



PINE DALE MINE


ANNUAL REVIEW

2017

Prepared by: Enhance Place Pty Ltd
February 2018

Revision 1.0 – 21 February 2018

TITLE

Name of Operation:	Pine Dale Mine
Name of Operator:	Enhance Place Pty Limited
Project Approval Number:	10_0041
Project Approval Holder:	Enhance Place Pty Limited
Mining Lease Numbers:	ML1569, ML1578, ML1664, ML1637
Mining Lease Holder:	Enhance Place Pty Limited
Water Licence Number:	10WA118780
Water Licence Holder:	Enhance Place Pty Limited
MOP Commencement Date	12 April 2017
MOP Completion Date	12 April 2019
Annual Review Start Date:	1 January 2017
Annual Review End Date:	31 December 2017
Annual Review Report Author:	Karen Tripp (RCA Australia)
<p>I, Ben Eastwood, certify that this audit report is a true and accurate record of the compliance status of Pine Dale Mine, for the period 1 January 2017 to 31 December 2017 and that I am authorised to make this statement on behalf of Enhance Place Pty Ltd.</p> <p><i>Note.</i></p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Authorised Reporting Officer:	Ben Eastwood
Title:	NSW Environment Leader
Signature:	
Date:	27. 2. 2018

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1 STATEMENT OF COMPLIANCE

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 Review (formerly the AEMR) has been prepared pursuant to Schedule 5, Condition 3 of the Project Approval 10_0041, and in accordance with the *Annual Review Guideline* developed by the NSW Department of Planning and Environment (October 2015).

A summary of the Pine Dale Mine compliance achieved during this reporting period is provided in **Table 1**, below. Any non-compliance during the reporting period is provided in **Table 2**, with a key of the compliance provided in **Table 3**.

Table 1
Statement of Compliance During 2017 Reporting Period

Approval No.	Were all conditions of the approval complied with?
PA 10_0041	YES
EPL 4911	YES
ML1569	YES
ML1578	YES
ML1664	YES
ML1637	YES
10WA118780	YES

Table 2
Details of Non-Compliance during 2017 Reporting Period

Relevant Approval	Condition No.	Summary of Condition.	Compliance Status	Comment	Where addressed in Annual Report
PA 10_0041	NA	NA	NA	NA	NA
EPL 4911	NA	NA	NA	NA	NA
ML1569	NA	NA	NA	NA	NA
ML1578	NA	NA	NA	NA	NA
ML1664	NA	NA	NA	NA	NA
ML1637	NA	NA	NA	NA	NA
10WA118780	NA	NA	NA	NA	NA

Table 3
Compliance Status Key

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur.
Low	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).

An acceptable standard of environmental performance was achieved 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 (PM₁₀) were below the NSW Environmental Protection Authority (EPA) assessment criteria in Blackmans Flat and other privately owned properties adjacent to Pine Dale Mine;
- There were no noise exceedances from mining activities recorded at privately owned properties recorded during the reporting period;
- There were no surface water discharge events during the reporting period;
- Water monitoring results were compliant with Environment Protection Licence 4911.

During the reporting period, an assessment of rehabilitation areas was completed (refer **Appendix C**). Rehabilitation areas are generally stable in both the pasture and treed revegetation areas, whilst weed presence continues to be adequately controlled. In the 2018 reporting period, it is recommended to continue weed management and the monitoring of performance indicators.

2 INTRODUCTION

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. EA acquired the Pine Dale Mine in June 2012.

Pine Dale Mine is located at Blackmans Flat in NSW, 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. A locality plan is provided in **Plan 1, Appendix A**.

The Pine Dale Mine operates under Project Approval (PA) 10_0041, dated 20 February 2011, granted by the Department of Planning and Infrastructure (DP&I) under section 75J of the Environmental Planning & Assessment Act 1979 (EP&A Act). The project approval provides for the extraction of up to 800,000 tonnes (t) of Run of Mine (ROM) from the Yarraboldy Extension at Pine Dale Mine through to 31 December 2014 at a maximum rate of 350,000 tonnes per annum (tpa).

Additionally, the Mine is also bound by the conditions of several mining leases and a water licence.

Approved mining resources at the Pine Dale Mine were exhausted in March 2014. From April 2014 the mine was placed under care and maintenance, with only rehabilitation activities undertaken intermittently at the site from this time.

This Annual Review (formerly AEMR) details the environmental performance of the Pine Dale Mine in accordance with Schedule 5, Condition 3 of Project Approval (PA) 10_0041; Mining Leases ML1569, ML1578, ML1664 and ML1637; and water licence number 10WA118780 (refer **Table 5**). The assessment of compliance status covers the 2017 reporting period which runs from 1 January 2017 to 31 December 2017.

The format of this report is presented in accordance with the *Annual Review Guideline* dated 2015 as developed by the NSW Department of Planning and Environment. The following report has been generated to meet:

- the Annual Review requirements of the Department of Planning and Environment under the conditions of a development consent or project approval;
- the Annual Environmental Management Report (AEMR) requirements of the Division of Resources & Energy under the conditions of a mining lease;
- the routine reporting expectations of DPI Lands & Water; and
- the Annual Reporting requirements of the Environmental Protection Authority under the conditions of the site Environmental Protection Licence.

This report is distributed to the following stakeholders:

- NSW Department of Planning & Environment (DPE);
- NSW Department of Industry - Resources and Energy (DRE);
- NSW Department of Industry - Water (DPI Lands & Water);
- Environment Protection Authority (EPA);
- Lithgow City Council (LCC); and
- Pine Dale Mine Community Consultative Committee (CCC).

2.1 KEY PERSONNEL

The key personnel responsible for environmental management at the Pine Dale Mine are listed in **Table 4**.

Table 4
Key Contacts

Contact Person	Position	Telephone
Mr Graham Goodwin	Mining Engineering Manager	(02) 6355 7893
Mr Mark Frewin	Commercial Manager	(02) 6355 7893
Mr Ben Eastwood	NSW Environment Leader	(02) 6355 7893

3 APPROVALS, LEASES AND LICENCES

Pine Dale Mine operates in accordance with relevant licenses and approvals which are summarised in **Table 5**.

Table 5
Pine Dale Mine Consents, Leases and Licences

Permit Type	Permit Number	Relevant Dates	Description
Project Approval	PA 10_0041	Granted 20 Feb 2012 Expired 31 Dec 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.
Referral Decision	2011/6016	Date of Decision 20 October 2011	Issued by Department of Sustainability, Environment, Water, Population and Communities under section 75 & 77A of the EPBC Act 1999; to avoid impact on Purple Copper Butterfly & Austral toadflax (<i>Thesium australe</i>).
Environment Protection Licence	EPL 4911	Review Due Date 29 Aug 2018	EPL held by Enhance Place Pty Ltd
Mining Lease	ML1578	Granted 5 November 2013	ML 1578 incorporates 69.4ha of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML1664	Grouped under ML1578, 5 Nov 2013	ML 1664 incorporates 4.1 Hectares of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML 1569	Grouped under ML1578, 5 Nov 2013	ML1569 incorporates 161 hectares of land with which the Yarraboldy Extension and a portion of Pine Dale Coal Mine.
Mining Lease	ML1637	Grouped under ML1578, 5 Nov 2013	ML1637 covers an area to the south of Pine Dale Mine for the purpose of proposed rail infrastructure.
Exploration Mining Lease	EL7621	Granted 1 October 2010	EL 7621 incorporates 312 Hectares of land within the north western and central parts of the Wallerawang Colliery.
Bore Licence	10BL165933	Issued 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 on the Pine Dale Mine site.
Bore Licence	10BL603588	Issued 17 December 2010	Issued by the Department of Natural Resources (DNR) under Part 5 of the Water Act 1912 for the use of eight piezometers for monitoring groundwater levels and quality on the Yarraboldy extension site.
Water Access Licence	WAL36480 (approval no 10WA118780)	Dated 1 July 2013 Expires 30 June 2026	This licence was issued by DECCW – NOW under Part 5 of the <i>Water Act 1912</i> for interception and use of up to 200ML of groundwater per year from The Bong.
Flood Control Works Licence	10CW801601 (approval no 10FW119292)	Dated 21 Sept 2015 Expires 21 Sep 2017	Issued by the DNR under Part 8 of the <i>Water Act 1912</i> for the construction of noise/flood bunding along the boundaries of Mining Areas A, B and C.

4 OPERATIONS SUMMARY

4.1 EXPLORATION

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

4.2 LAND PREPARATION

During the reporting period, there was no land preparation activities carried out at Pine Dale Mine.

4.3 CONSTRUCTION

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

4.4 MINING

During the reporting period there were no mining activities occurring at the Pine Dale Mine. The production and waste volumes during the reporting period are summarised in **Table 6**.

Table 6
Production and Waste Summary

	Approved Limit	Previous Reporting Period (actual)	This Reporting Period (actual)	Next Reporting Period (forecast)
Waste Rock / Overburden	NA	0	0	0
ROM Coal	800,000 t (over life of mine)	0	0	0
Coarse Reject	NA	0	0	0
Fine Reject (Tailings)	NA	0	0	0
Saleable product	350,000 t/year	0	0	0

4.5 COAL PROCESSING

At the completion of mining extraction in April 2014 the coal crushing plant was decommissioned.

4.6 COAL TRANSPORTING

Due to the care and maintenance status, no product coal was transported during the 2017 reporting period.

4.7 WASTE MANAGEMENT

Hydrocarbon based materials were stored or kept at the site in accordance with the currently approved Environmental Management Strategy and Waste Management Plan. Waste hydrocarbon materials were transported from the site by a licenced contractor.

General waste bins are kept at the site office for the collection of putrescible waste. These bins are inspected and emptied as part of the regular inspection and maintenance program for the site.

Sewage management facilities were maintained at the site during the reporting term with regular inspections and pump outs undertaken as required.

4.8 PRODUCT STOCKPILES

As the mine entered into care and maintenance in early 2014, the product stockpiles were decommissioned prior to the 2017 reporting period.

4.9 HAZARDOUS MATERIALS MANAGEMENT

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.

4.10 OTHER INFRASTRUCTURE MANAGEMENT

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

4.11 FORECAST OPERATIONS

There are no operations forecast at the Pine Dale Mine during the next reporting period. The mine will continue to remain under care and maintenance.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

A letter of acceptance for the 2016 Annual Review (AEMR) was received from DPE on the 3rd March 2017. Actions required by DPE, and where they have been addressed in the 2017 Annual Review are provided in **Table 7**.

Table 7
Actions Required from 2016 Annual Review

Item	Action Required from 2016 Annual Review	Requested By	Action Taken	Where Discussed in Annual Review
1	<i>Complaints – the Department requests that a comparison of complaints received for the last five years is provided in future Annual Reviews.</i>	DPE	The complaints register presented details the complaints and /or the nature of the communications received over the previous five year period.	Section 9.1
Notation 1	<i>Section 10 of the Annual Review contains incorrect text and no update is provided on the close out of actions from the Independent Environmental Audit (IEA). An update has been provided in the IEA action plan on the website; however, this has not been included in the Annual Review. It is requested that this text is corrected and the IEA action update is included in the Annual Review prior to uploading onto the EnergyAustralia website.</i>	DPE	The text in Section 10 was corrected and updated to include the completion table from the IEA Action Plan. A revised version (Revision 1.0) of the Annual Review was forwarded to all stakeholders on 14 March 2017. This version is also available on the EnergyAustralia website.	Appendix D

Item	Action Required from 2016 Annual Review	Requested By	Action Taken	Where Discussed in Annual Review
Notation 2	<i>The link on the website to view documents required in accordance with Condition 10 of Schedule 5 of the approval is labelled 'NSW EPA Reports'. It is requested that this is updated to reflect that documents as required by the approval and Department are accessible using the link.</i>	DPE	The website link to view documents required in accordance with Condition 10 of Schedule 5 of the approval was renamed as 'Annual Reviews / AEMRs', whilst a separate link was provided for 'EPA Reports'. These changes were made on 15 March 2017.	Appendix D
Request a)	Response requested by 31 March 2017 – <i>what management actions, if any, can be implemented to move stream health for Neubeck's Creek from 'potentially stabilising' to 'stable channel'.</i>	DPE	A letter response was provided to the Department on 24 March 2017 detailing the management actions implemented to maintain and improve the health of Neubeck's Creek.	Appendix D
Request b)	Response requested by 31 March 2017 – <i>is there a timeframe by which the bridge allowing access to Bore E is to be repaired? It is noted that Bore E has been inaccessible since March 2016 and failure to monitor at this location is a non-compliance with the management plan.</i>	DPE	A letter response was provided to the Department on 24 March 2017 detailing the actions taken regarding access to Bore E. Sampling and data downloads at the Bore E site were resumed on a monthly basis from March 2017.	Appendix D

6 ENVIRONMENTAL PERFORMANCE

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

Environmental monitoring and management at Pine Dale Mine is governed by the requirements of Project Approval PA10_0041 and supporting Environmental Assessment. The following management plans have been developed for the Pine Dale Mine to minimise the potential risk to the surrounding environment.

- Mining Operations Plan
- Aboriginal Heritage Management Plan
- Air Quality and Greenhouse Gas Management Plan
- Blast Management Plan
- Bushfire Management Plan
- Purple Copper Butterfly Monitoring & Management Plan
- Waste Management Plan
- Water Management Plan
- Noise Management Plan
- Pollution Incident Response Management Plan

These management plans are displayed on the Pine Dale Mine website.

A summary of the environmental performance for noise monitoring and air quality monitoring is provided in **Table 8**. Detailed discussions of other key environmental performance indicators are presented further in this Section.

Table 8
Environmental Performance

Aspect	Approval Criteria	EA Prediction	Performance during 2017	Trends /Management Implications	Management Actions
Noise	NM1 – NM3 Daytime Criteria 42dB(A) LAeq(15minute)	NM1 41 NM2 32 NM3 39 dB(A) LAeq(15minute)	NM1 Nil detected NM2 Nil detected NM3 Nil detected dB(A) LAeq(15minute)	NA – no operational noise generated	Nil management actions required
	NM4 – NM6 Daytime Criteria 35dB(A) LAeq(15minute)	NM4 34 NM6 <30 dB(A) LAeq(15minute)	NM4 Nil detected NM5 Nil detected NM6 Nil detected dB(A) LAeq(15minute)	NA – no operational noise generated	Nil management actions required
Air Quality: Depositional Dust	Maximum total deposited dust 4g/m ² /month	Annual average of 3.2g/m ² /month deposited dust	Annual average range of 0.4 to 0.8g/m ² /month deposited dust	Annual average dust levels consistent with previous years	Maintain dust suppression measures as required
	Maximum increase in deposited dust 2g/m ² /month	Annual average increase of 1.2g/m ² /month deposited dust	Annual average change of -0.6 to 0.4g/m ² /month deposited dust	Annual average dust levels consistent with previous years	Maintain dust suppression measures as required
Air Quality: High Volume Air Sampling	TSP Annual Average 90 µg/m ³	TSP Annual Average 45 µg/m ³	TSP Annual Average 19.6 µg/m ³	Annual average TSP levels consistent with previous years	Maintain dust suppression measures as required
	PM10 Annual Average 25 µg/m ³	PM10 Annual Average 18 µg/m ³	PM10 Annual Average 9.5 µg/m ³	Annual average PM10 levels consistent with previous years	Maintain dust suppression measures as required
	PM10 24hr Average Max 50 µg/m ³	PM10 24hr Average Max 45.7 µg/m ³	Max PM10 24hr Average result 46 µg/m ³	Max 24hr PM10 levels consistent with EA prediction	Maintain dust suppression measures as required

6.1 NOISE

Mining related noise impacts at Pine Dale Mine are managed in accordance with Schedule 3, Condition 1 of 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 Australia (see **Plan 2 & 4**). These locations included:

- NM1 – the Green residence, Blackman’s flat;
- NM2 – the Cherry residence, Blackman’s flat;
- NM3 – front of Barnes residence, 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 LAeq (15 minute) at three of the six monitoring locations (NM1 to NM3); and a noise assessment criteria of 35dB LAeq (15 minute) applies at the remaining three monitoring locations (NM4 to NM6). During construction and removal of the amenity bund the noise assessment criteria is 46dB LAeq (15 minute) at receptors NM1, NM2 and NM3.

Attended noise monitoring was undertaken routinely during the 2017 reporting period to assess any noise impacts from Pine Dale Mine against relevant criteria detailed within PA 10_0041 and EPL 4911. Quarterly monitoring was undertaken as follows:

- Quarter 1 – January to March; monitoring conducted 9 January 2017
- Quarter 2 – April to June; monitoring conducted 11 May 2017
- Quarter 3 – July to September; monitoring conducted 11 July 2017
- Quarter 4 – October to December monitoring conducted 10 October 2017

Although the mine is currently in care and maintenance, rehabilitation activities facilitating the use of mobile plant was conducted at the site during the 2017 reporting period. The measured LAeq 15min noise contribution from the Pine Dale Mine was below the noise assessment criteria for all 15-minute surveys at all noise monitoring locations measured during the 2017 reporting period. Similarly, the measured noise contribution from Pine Dale Mine was also below the noise levels predicted in the Environmental Assessment. Audible noise emanating from the Pine Dale Mine has not been detected during noise monitoring surveys since the cessation of mining operations in April 2014.

Results for each noise survey during the 2017 reporting period are presented in full in **Appendix B**.

During the reporting period, no environmental performance or management measures were required to be implemented at the site in respect to noise generated by the site.

6.2 AIR QUALITY

Air quality management is a priority at the Pine Dale Mine. During care and maintenance, water for dust suppression was sourced from the onsite sediment basins.

Air quality at Pine Dale Mine is managed in accordance with Schedule 3, Condition 18 of PA 10_0041, EPL 4911 and the approved Air Quality and Greenhouse Gas Management Plan. Air quality is monitored at eleven locations including ten depositional dust gauges (DDG) and one high volume air sampling (HVAS) site which monitors Total Suspended Particulates (TSP) and particulates less than 10µm (PM₁₀) (refer **Plan 2 & 4, Appendix A**). Monitoring is performed by RCA Laboratories – Environmental and a summary report on data collected throughout the reporting period is available in **Appendix B**.

6.2.1 DEPOSITIONAL DUST

Depositional Dust results for the period January – December 2017 show an annual average insoluble solid range of 0.4 g/m² per month to 0.9 g/m² per month for all dust gauges. These results fall well below the nominated annual average assessment criteria of 4.0 g/m² per month, as stipulated in the project approval (PA 10_0041).

Comparative annual average depositional dust data for the previous five year period is presented in **Table 9**, with data presented graphically in **Figure 1**.

An examination of the historical data indicates a slight decrease in the depositional dust concentrations at the site during the period 2013 to 2017. Operations at the mine ceased during April 2014, with a reduction in depositional dust concentrations reflected during the Care and Maintenance phase (2015 to 2017). All depositional dust results are shown to be lower than the concentrations predicted in the site Environmental Assessment (predicted annual average of 3.2g/m²/month deposited dust).

Figure 1
Historical Depositional Dust Data

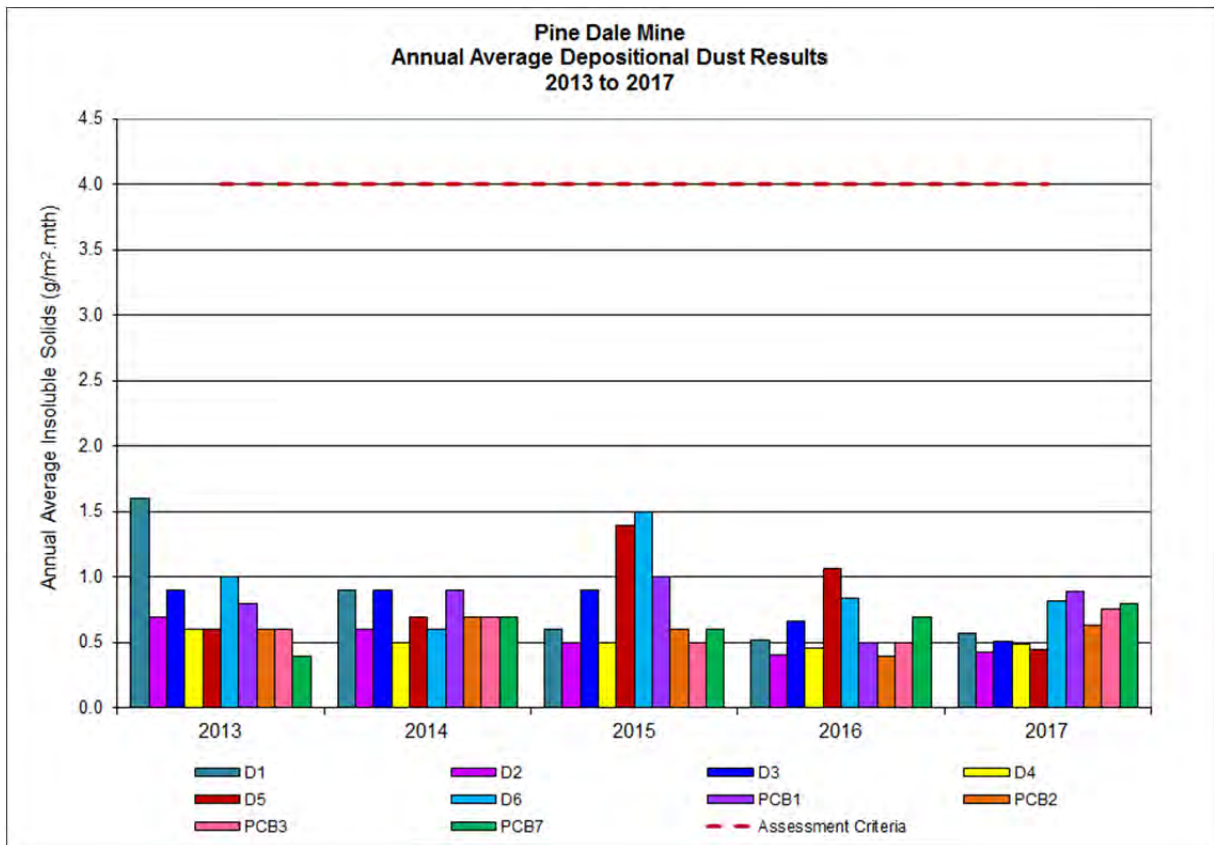


Table 9
Depositional Dust Monitoring Results

Date	Total Insoluble Solids (g/m ² .month)									
	Dust Gauge ID									
	D1	D2	D3	D4	D5	D6	PCB1	PCB2	PCB3	PCB7
Jan-17	0.9	0.5	0.4	0.7	0.6	<u>0.05</u>	0.8	1.0	2.2	1.3
Feb-17	0.8	0.2	0.9	1.0	0.7	2.8	2.5	0.8	1.5	1.3
Mar-17	0.7	0.6	0.9	0.9	0.6	1.0	1.0	0.8	0.5	0.6
Apr-17	0.2	0.4	0.2	0.5	0.2	2.8	0.8	0.4	0.3	0.7
May-17	0.3	0.2	0.5	0.3	0.5	0.5	0.4	0.1	0.4	0.6
Jun-17	0.4	0.1	0.1	0.2	0.2	0.2	0.5	0.1	0.4	0.2
Jul-17	0.3	0.2	0.1	0.2	0.2	0.3	0.1	0.3	0.4	0.2
Aug-17	0.5	0.4	0.5	0.2	0.4	0.4	0.8	0.4	0.5	2.3
Sep-17	0.6	0.5	0.2	0.3	0.5	0.6	1.3	1.2	0.8	0.5
Oct-17	1.0	1.0	1.0	0.9	0.8	0.7	0.8	0.8	1.0	0.9
Nov-17	0.4	0.4	0.4	0.1	0.3	0.4	0.8	0.9	0.3	0.8
Dec-17	0.8	0.6	0.9	0.6	0.4	0.1	0.9	0.8	0.8	0.7
Annual Averages										
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
2015	0.6	0.5	0.9	0.5	1.4	1.5	1.0	0.6	0.5	0.6
2016	0.5	0.4	0.7	0.5	1.1	0.8	0.5	0.4	0.5	0.7
2017	0.6	0.4	0.5	0.5	0.5	0.8	0.9	0.6	0.8	0.8
PA Annual Average Assessment Criteria	4.0 g/m².month									

Notes:

Underlined results indicate result is less than detection limits, half the PQL has been reported.

6.2.2 HIGH VOLUME AIR SAMPLING

Annual average PM₁₀ and TSP monitoring results are summarised in **Table 10**. Detailed data analysis is presented in **Appendix B**. During the 2017 reporting period, all PM₁₀ 24-hour average results recorded were below the 50 micrograms per cubic metre (µg/m³) assessment criteria nominated in PA 10_0041. The highest PM₁₀ result recorded during 2017 was 46 µg/m³ on 24th April 2017. The annual average PM₁₀ result recorded in 2017 was 10 µg/m³, which is below the long term 25µg/m³ annual average assessment criteria. The highest TSP result recorded for 2017 was 66 µg/m³ on 11th February 2017. The annual average TSP result recorded during 2017 was 20 µg/m³, which is below the 90µg/m³ assessment criteria. Both the TSP and PM₁₀ annual average concentrations continue to remain below the concentrations predicted in the Environmental Assessment. The long-term average annual PM₁₀ and TSP levels are all within the nominated assessment criteria.

Results also demonstrate consistent PM₁₀ and TSP levels were recorded at the site throughout the 2013 to 2017 monitoring period (see **Table 10** and **Figure 2**). The PM₁₀ and TSP particulate concentrations observed in 2013 are slightly higher than those recorded during 2014 to 2017. This is most likely attributed to the commencement of mining in 2012, bushfires and the low rainfall received at the site during the 2013 monitoring period. There has been a notable decrease in concentrations throughout 2014 to 2016; this is likely due to the higher rainfall recorded during 2015 and 2016, and the cessation of mining activities in April 2014. The PM₁₀ and TSP particulate concentrations recorded during 2017 are slightly higher than the previous year, however, the rainfall recorded during 2017 was the lowest recorded at the site since 2007 (refer Section 6.3.1).

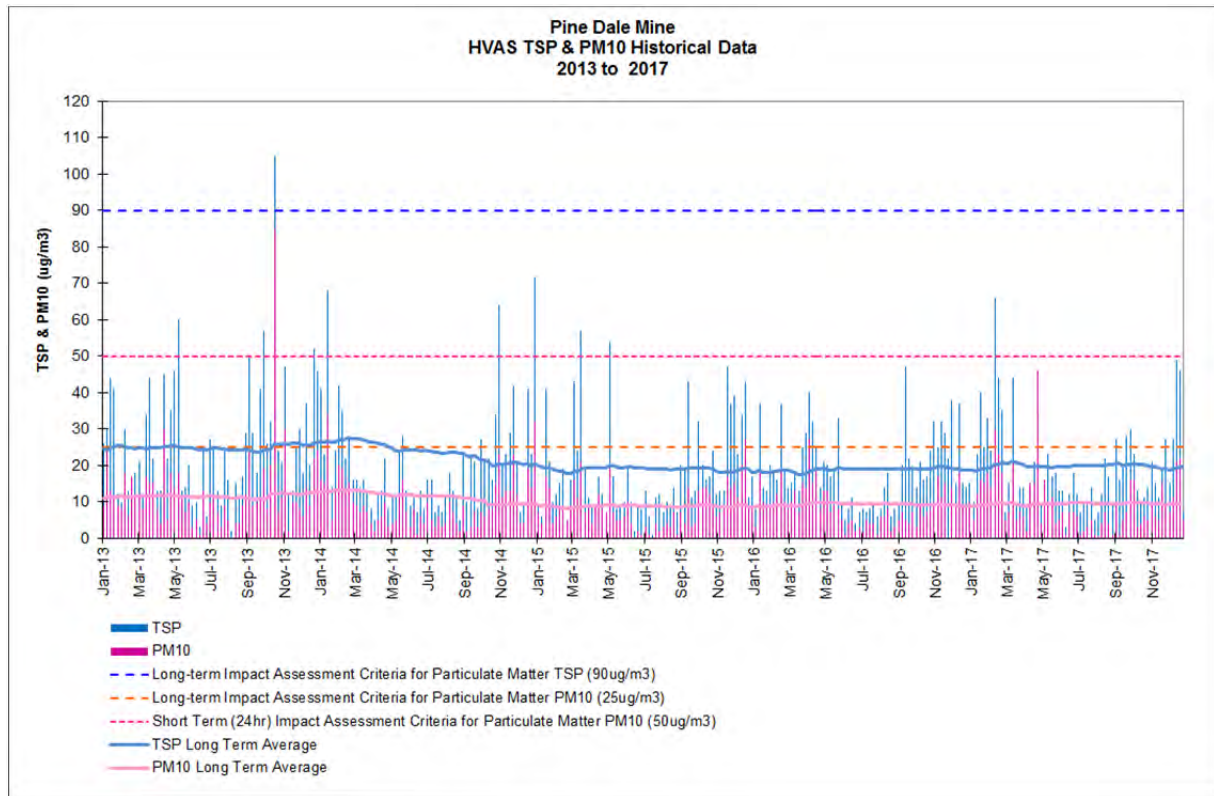
Table 10
PM₁₀ and TSP Summary

	Particulate Matter <10µm (µg/m ³)	TSP (µg/m ³)
Maximum 24h Average result 2013	85*	n/a
Maximum 24h Average result 2014	34	n/a
Maximum 24h Average result 2015	27	n/a
Maximum 24h Average result 2016	27	n/a
Maximum 24h Average result 2017	46	n/a
PM ₁₀ 24h Assessment Criteria **	50	Not Required
Annual Average 2013	13	26
Annual Average 2014	10	20
Annual Average 2015	8	18
Annual Average 2016	9	19
Annual Average 2017	10	20
Annual Average Assessment Criteria**	30	90

* Result influenced by external sources (bushfires) outside of the control of the project.

**Air Quality Assessment Criteria listed in project approval PA 10_0041.

Figure 2
Historical HVAS Data



During the reporting period no additional environmental management measures were required to be implemented at the site in respect to depositional dust monitoring and high volume air sampling.

The existing air quality monitoring program and dust management practices will continue to be implemented throughout 2018. All air quality monitoring units will continue to be regularly calibrated and audited to ensure compliance with the appropriate Australian Standard.

6.3 METEOROLOGICAL MONITORING

In accordance with Schedule 3, Condition 22 of PA 10_0041 and EPL 4911, Pine Dale Mine operates a meteorological monitoring station measuring air temperature, wind direction, wind speed, solar radiation, sigma theta, rainfall, evapotranspiration and relative humidity. A summary of monthly meteorological conditions recorded during the 2017 reporting period are presented in the following sections and **Appendix B**.

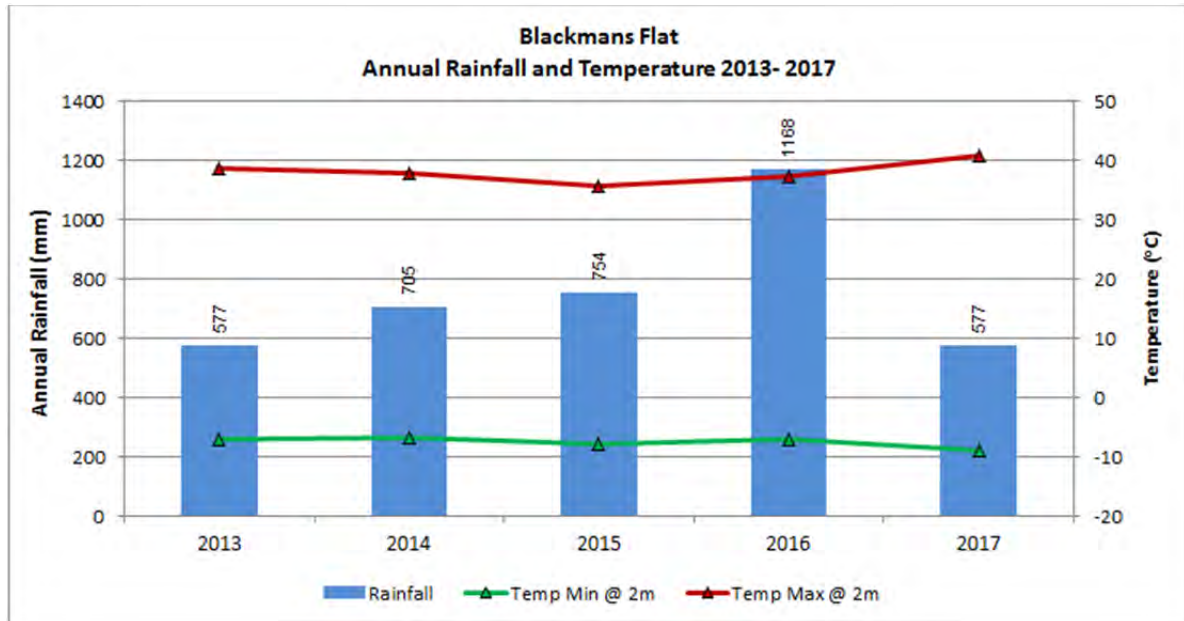
6.3.1 RAINFALL

Pine Dale Mine received 577 mm of rainfall and experienced 130 rainfall days during the 2017 reporting period. Rainfall during this reporting period was observed to be considerably lower than rainfall recorded in 2016 (1167.6 mm and 147 rainfall days) and 2015 (756.2 mm and 144 rainfall days). The monthly rainfall data for 2017 is summarised in **Table 11**. A graphical presentation of annual rainfall during the previous 5 years is presented in **Figure 3**.

6.3.2 TEMPERATURE

Temperature is monitored at two heights (2 metres and 10 metres) to account for temperature inversions. The maximum temperature recorded during the reporting period was 40.7°C at 2m and 38.9°C at the 10m sensor, during February. The lowest temperature occurred in July, with a recording of -8.9°C at both 2m and 10m. A summary of monthly temperatures for 2017 is included in **Table 11**. A graphical presentation of annual temperature variations during the previous 5 years is presented in **Figure 3**.

Figure 3
Annual Temperature & Rainfall Summary



6.3.3 WIND SPEED, DIRECTION & SIGMA THETA

Recordings of wind parameters are monitored from the stations' 10 metre mast. Predominant wind directions at the site in 2017 were observed to be from the west to north-west, and the south easterly quadrant, however wind directions were shown to fluctuate on a seasonal basis. The predominant wind direction during summer was observed to be from the north-west and from the south-east during autumn. During both winter and spring the wind was predominantly recorded from the west-north-west.

The maximum wind speed measured at the site was 19.1m/s in February 2017 from a west-north-westerly direction. Sigma theta data was measured continuously throughout the entire 2017 monitoring period. A summary of monthly wind speed, predominant directions and sigma theta recordings in 2017 is included in **Table 11**.

6.3.4 RELATIVE HUMIDITY

Relative humidity was measured in the 2017 monitoring period. The maximum humidity recorded at the site was 99.0% during October. A summary of monthly humidity variations for 2017 is included in **Table 11**.

Table 11
Pine Dale Mine Meteorological Station Summary 2017

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	37.4	37.4	12	22.1	10.9	37.9	21.4	10.9	36.1	32.6	0	102.1	65.6	9.4	95.8	1.8	0	13.64	SSE/ NW
February	14.4	51.8	6	21.4	1.8	40.7	20.7	1.7	38.9	32.1	0	100	60.6	12.6	95.1	1.6	0	19.05	SE
March	167.8	219.6	21	17.6	5.4	31.3	17.2	5.7	28.8	32.4	0	101.3	77.8	16.4	97.5	1.4	0	13.74	SE
April	36.2	255.8	10	11.5	-1.5	23.7	11.2	-1.4	22.3	29.0	0	103.1	76.3	25.2	96.0	1.1	0	14.43	SE
May	41.4	297.2	9	8.1	-5.7	21	8.0	-5.5	19.2	27.4	0	101.7	78.7	16.8	97.1	1.0	0	12.58	WNW
June	23.0	320.2	16	5.7	-6.7	18.7	5.7	-6.6	16.8	25.9	0	102.4	82.1	30.0	97.4	0.9	0	11.29	SE/ WNW
July	13.6	333.8	10	4.5	-8.9	20.2	4.7	-8.9	19.2	18.1	0	101.7	69.7	3.2	96.4	1.7	0	14.78	WNW
August	31.6	365.4	10	5.8	-5.8	19.3	5.8	-5.8	18.5	21.1	0	100.9	66.0	15.8	95.4	2.0	0	16.76	WNW
September	4.0	369.4	3	9.5	-7	29.7	9.3	-6.8	28.4	21.1	0	102.6	53.9	9.1	93.7	2.2	0	18.33	WNW
October	82.8	452.2	9	14.4	-1.9	29.8	13.9	-1.9	27.9	28.6	0	100.9	65.4	15.6	99.0	1.5	0	16.58	WNW
November	42.6	494.8	12	15.3	0.7	30.9	14.8	0.9	28.8	36.8	0	103.6	67.6	18.9	96.1	1.2	0	14.17	ESE
December	82.2	577.0	11	19.9	6.9	35.2	19.4	6.8	33.2	30.8	0	102.1	64.2	12.4	96.0	1.5	0	12.82	WNW
TOTAL	577	-	129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4	-	3	-	-8.9	-	-	-8.9	-	-	0	-	-	3.2	-	-	0	-	-
Maximum	167.8	-	21	-	-	40.7	-	-	38.9	-	-	103.6	-	-	99	-	-	19.05	-

6.4 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 through 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 2017 reporting period included:

- The inspection and maintenance of windrows and silt fencing to prevent potential surface water impacts and sediment entering Neubeck's Creek;
- Repair of surface cracking from soil settling in the Yarraboldy extension area (May 2017);
- Repair of drainage lines and erosion control structures in Area A from runoff during storm event (June 2017);

The effectiveness of the erosion and sediment control structures at Pine Dale Mine was demonstrated by their performance during a high rainfall event recorded in March 2017 (167.8mm).

6.5 CONTAMINATED POLLUTED LAND

There was no land identified as being contaminated or polluted during the reporting period.

6.6 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 Care and Maintenance MOP and the Flora and Fauna Management Plan.

6.6.1 PURPLE COPPER BUTTERFLY

The Purple Copper Butterfly (PCB), also known as the Bathurst Copper Butterfly, is listed as an Endangered species under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999*, and 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 PCB, the following mitigation measures have been implemented:

- a) maintenance of fencing and earth bunds around known PCB habitat;
- b) mining activity not occurring within 200m of the main habitat area between September through to the end February, when the flying season of the adult and larvae stages of the PCB were apparent as determined by an independent ecologist; and
- c) implementation of further management and mitigation measures in accordance with Project Approval PA 10_0041 and Particular Manner Decision 2011/6016.

A PCB Monitoring Program has been implemented to monitor potential indirect impacts from extractive mining activities (particularly 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 PCB with monitoring being undertaken by ecologists from Ecological Australia Pty Ltd.

Two field surveys were conducted during the 2017 reporting period in accordance with the Commonwealth Department of Environment (DoE) Notification of Referral Decision measure, as follows:

- February 2017 - field survey of the Purple Copper Butterfly (PCB) within and adjacent to the locations identified in the Notification of Referral Decision to determine the completion of the larval stage.
- September 2017 - weekly survey for the PCB within monitoring locations identified in the Notification of Referral Decision, to determine whether the adult feeding stage of PCB lifecycle had commenced.

A review of the survey data recorded during the period 2013 to 2017 indicates the Pine Dale Mine has had minimal impact upon the life cycles of the Purple Copper Butterfly.

The monitoring program will be reviewed following the completion of the current season of monitoring, in line with the mine's current care and maintenance status.

Results of the ecologist field monitoring are provided in **Table 12**.

Data collected from dust gauges located within the butterfly habitat area is provided within **Appendix B**.

Table 12
Purple Copper Butterfly Field Survey Summary

Monitoring season	Purpose of field survey	Date of field surveys	Survey results	Conclusion	Response	
2013-2014	To confirm commencement of PCB larval feeding season	5 September 2013	No larvae or evidence of larvae identified; eight adult PCB identified	Due to evidence of adult PCB, precautionary approach taken that PCB larval feeding season has commenced.	No mining activities to occur within 200m of PCB main habitat area.	
		13 September 2013	No larvae or evidence of larvae identified; one adult PCB identified			
	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 11-12 March 2014	No larvae identified	The PCB in larvae form is no longer coming to the surface		Mining activities can recommence within 200m of PCB main habitat area.
2014-2015	To confirm commencement of PCB larval feeding season	5 September 2014	No larvae or evidence of larvae identified; no adult PCB 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 PCB main habitat area.	
		12 September 2014	No larvae or evidence of larvae identified; >36 adult PCB identified			
	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 5 - 6 March 2015	No larvae identified	Larvae have commenced pupation and are no longer active. Larvae stage is complete. The PCB is not expected to reappear above ground until Aug/Sept.		Mining activities can recommence within 200m of PCB main habitat area.
	To confirm commencement of PCB larval feeding season	4 September 2015	No larvae identified; five adult PCB 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 PCB main habitat area.
2015-2016	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 22/23 February 2016	No larvae identified; no attendant ants observed near targeted plants.	No larvae detected indicate PCB larvae have commenced pupation and are no longer active. Larvae stage is complete. PCB not expected to reappear until Aug / Sep.	Mining activities can recommence within 200m of PCB main habitat area.	
	To confirm commencement of PCB larval feeding season	29 August 2016	Numerous adult PCB observed; no larvae observed.	Lack of active larvae observed indicates PCB breeding season had only recently	No mining activities to occur within 200m of PCB main habitat	

Monitoring season	Purpose of field survey	Date of field surveys	Survey results	Conclusion	Response
				commenced.	area.
2016-2017	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening of 27 February 2017	No larvae identified on any plants; attendant ants were observed on two plants at site PCB1 and PCB2.	No larvae detected in survey area indicating PCB larvae have commenced pupation and are no longer active. Larvae stage is complete. PCB not expected to re-appear until late August / early September.	Mining activities can recommence within 200m of PCB main habitat area.
	To confirm commencement of PCB larval feeding season	31 August 2017	Abundant adult PCB observed; no larvae observed.	Absence of larvae observed indicates PCB breeding season had only recently commenced.	No mining activities to occur within 200m of PCB main habitat area.

6.6.2 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 re-sprouts 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 a 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 (e.g. tape) when operating in close proximity to the Austral toadflax buffer area; and,
- Control of noxious weed infestations and feral animals.

During the reporting period, mining activity did not encroach within the habitat area (refer **Appendix C**). Control of noxious weeds within and surrounding the habitat area will continue to be undertaken in the next reporting period.

As the mine is currently in care and maintenance, there were no environmental performance or management issues in relation to impacts upon the sites' vulnerable species, the Purple Copper Butterfly and Austral Toadflax.

6.7 WEEDS

Weed control activities at Pine Dale Mine are undertaken in accordance with the Care and Maintenance MOP. 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*).

Weed inspections were undertaken on a regular basis with a large portion of weed problems on the mine's property being sprayed during the reporting period. Active weed control was undertaken during the reporting period in accordance with the following schedule:

- African Love Grass - sprayed in summer (Dec 2016, Jan & Feb 2017) and Spring (Sep, Oct & Nov 2017).
- Blackberry - sprayed in summer (Dec 2016, Jan & Feb 2017) and Spring (Nov 2017).
- Briar Rose - sprayed in summer (Dec 2016, Jan & Feb 2017) and Spring (Oct, Nov 2017).
- St John's Wort - sprayed in summer (Dec 2016) and Spring (Nov 2017).

The Pine Dale Mine Rehabilitation Monitoring Report (FirstField Environmental, **Appendix C**) indicated some outbreaks of African lovegrass were present at three of the pasture rehabilitation areas; however, these outbreaks had been controlled and were not observed to be growing or producing seeds. The report also found the method of African lovegrass control was consistent with legislative requirements.

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

6.8 BLASTING

As the mine is currently in care and maintenance, there were no blasting activities undertaken at the site during the 2017 reporting period.

6.9 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.

6.10 ABORIGINAL HERITAGE

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

6.11 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.

6.12 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, all coal stockpiles have been decommissioned.

6.13 MINE SUBSIDENCE

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

6.14 HYDROCARBON CONTAMINATION

There were no reported incidents of hydrocarbon contamination at Pine Dale Mine during the reporting period. In the unlikely event that contaminated land is identified at the site, the remedial actions taken shall be those outlined in the MOP, whereby the affected material is either treated on-site or disposed of off-site by a licenced contractor.

6.15 BUSHFIRE

Bush fire control strategies for Pine Dale Mine are managed in accordance with Project Approval PA 10_0041 and 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.

6.16 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.

6.17 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. Continuation of the control of trespassing during the reporting period has occurred through routine inspection, monitoring, upgrades and repairs of fencing structures. During the care and maintenance term, the site has continued to be regularly monitored by mine personnel.

6.18 OTHER ISSUES AND RISKS

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

7 WATER MANAGEMENT

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 Water NSW.

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.

Water resources at the Pine Dale Mine are managed in accordance with the Water Management Plan which was developed under the requirements of project approval PA 10_0041, Environmental Protection Licence (EPL 4911), respective groundwater bore licences, the water access licence (WAL 36480) and Water Supply Works Approval 10WA118780.

The water management system has been designed as a closed loop system, with all clean water diverted around the mining site where practicable. 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's disturbed areas is generally to the south and southeast following the natural topography for treatment prior to free draining into the underground workings (see **Plan 4**). The runoff from the north is captured in temporary sumps and used as dust suppression when required.

7.1 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 draining into the underground workings.

7.2 SURFACE WATER

During the reporting period, all surface water monitoring at the Pine Dale Mine was undertaken in accordance with the Surface Water Monitoring Program documented in the Pine Dale Mine Water Management Plan, and EPL 4911. Details of the locations, frequency and sampling methods for surface water monitoring are presented in **Table 13** and **14**. The parameters analysed were consistent with the requirements of the Water Management Plan and EPL 4911. Results of surface water monitoring are discussed in **Section 7.3.2** and at **Appendix B**.

No discharge of waters via the licenced discharge point (LDP13) occurred during the reporting period.

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

7.3 SURFACE WATER MONITORING

Surface water quality at Pine Dale Mine is managed in accordance with the Water Management Plan and the site EPL. Sampling is conducted at a total of eleven locations

within and surrounding the mine site. Surface water data is collected by RCA Laboratories and analysed at a NATA registered laboratory.

In accordance with EPL 4911 the following points are required to be monitored at Pine Dale Mine on a quarterly basis for pH, EC, turbidity, TSS, oil & grease, sulfate and dissolved iron; Point 2 – Upstream of EnergyAustralia flow gauge; Point 3 – 100m downstream of bridge near site office; and Point 14 – Cox’s River downstream of Blue Lake. Licenced discharge point LDP13 is required to be sampled for pH, EC and turbidity daily during discharge.

A further seven locations, S1 to S7 are monitored in accordance with the site Water Management Plan. Monitoring is conducted on a monthly basis for pH, temperature, EC and turbidity, with an additional quarterly suite comprising major ions, anions and filtered metals. The locations of monitoring points are indicated on **Plan 2 & 4** in **Appendix A**.

7.3.1 SURFACE WATER CONCENTRATION LIMITS AND TRIGGER LEVELS

Concentration limits are specified in EPL 4911 for the licenced discharge point LDP13, whilst the remaining water monitoring locations have water quality trigger values stipulated in the sites’ Surface Water Management Plan in accordance with Schedule 3, Condition 27(b) of the Project Approval (PA 10_0041). Water quality trigger values were reviewed in September 2017, with approval sought from DPI Lands & Water in a letter dated 19 September 2017 (attached in **Appendix D**). To date, a response has not yet been received from DPI Lands & Water. For the purposes of this Annual Review report, the water quality trigger values updated in September 2017 have been used to assess the surface water and groundwater quality of samples collected at the Pine Dale Mine during 2017. These values are presented in **Table 13**.

The Surface Water Management Plan details the protocol for the investigation, notification, and mitigation of any identified adverse impacts on surface water quality. The Surface Water Management Plan also provides impact assessment criteria, including trigger levels for investigating any potentially adverse surface water impacts.

Table 13
WMP & EPL Surface Water Trigger Values & Limits

Surface Water Site	pH (range)	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
S1	6.2 – 8.0	2570	30	10
S2	NA	NA	NA	NA
S3	6.4 – 8.0	2454	30	10
S4	7.3 – 8.0	957	30	10
S5	6.9 – 8.0	1244	30	10
S6	6.7 – 8.0	2501	30	10
S7	6.8 – 8.0	1283	30	10
EPA Point 2	6.9 – 8.0	2398	30	NA
EPA Point 3	6.4 – 8.0	2454	30	NA
EPA Point 13	6.5 – 8.0*	NA	30*	10*

EPA Point 14	7.5 – 8.0	1207	30	NA
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* EPL Concentration Limit (daily during discharge)

7.3.2 SURFACE WATER QUALITY

7.3.2.1 EPL Surface Water Monitoring

During the 2017 monitoring period, four quarterly EPL surface water monitoring events were conducted. These events were conducted during February, May, August and November 2017. Monitoring Point 2 and Point 3 are ambient surface water monitoring points on Neubeck's Creek; whilst 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 concentration limits for monitoring Points 2, 3 and 14.

Surface water samples collected for EPL compliance during the 2017 period show water quality analysis results are generally compliant with the concentration limits specified by the Water Management Plan.

- Monitoring Point 2 exhibited pH concentrations which were found to be lower than the adopted trigger level range on one occasion (May 2017). A preliminary investigation found that this was not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- Point 14 was shown to be above the adopted pH trigger range on each monitoring occasion in 2017 (Feb, May, Aug and Nov). A preliminary investigation found that this was not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- Monitoring Point 2, Point 3 and Point 14 were intermittently shown to be greater than the adopted EC trigger values throughout 2017. This occurred at Point 2 in Feb and May; at Point 3 in Feb, May and Nov; and at Point 14 in May, Aug and Nov. A preliminary investigation found that this was not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- All EPL monitoring locations were in compliance with the total suspended solids (TSS) trigger value of 30 mg/L during each of the monitoring events.
- There was no controlled surface water discharge from licensed discharge monitoring Point 13 during the 2017 reporting period. Therefore, the EPL 4911 limits were not exceeded.
- The intermittent pH and EC concentrations outside the trigger values suggest influences from other land uses and may be reflective of low rainfall conditions recorded at the site during 2017. There is no indication that activities at Pine Dale Mine contributed to the exceedances of the trigger levels.

During the 2017 monitoring period, EC was generally shown to decrease at Point 2 and Point 3 (with the exception of Nov 2017) and remain consistent at Point 14, whilst pH was observed to be reasonably consistent at each monitoring location. Examination of the historical data set indicates the pH concentrations at all three EPL monitoring points has remained relatively consistent, whilst the EC is shown to fluctuate at Point 2 and particularly

Point 3 (Nov 2017). It should be noted that Point 2 is located on the upper reaches of Neubeck’s Creek and is subject to very low to nil flow during dry periods. This can influence water quality in Neubeck’s Creek.

The EC at Point 14 is shown to remain fairly consistent over the five year period. Results of monitoring during the previous five (5) years are presented graphically in **Figure 4**.

A comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels, with periods of higher EC measured during months with less rainfall (Aug 2013; May 2014; Feb & May 2016; and Feb & Aug 2017). Due to the variability of sample collection times throughout the month across the five year period, and the variability of rainfall days throughout the month some lag time may appear on the graphical presentation (refer **Figure 5**).

The full suite of surface water monitoring results for Environmental Protection Licence compliance for the 2017 period are presented in **Appendix B**.

Figure 4
EPL Surface Water Historical Results

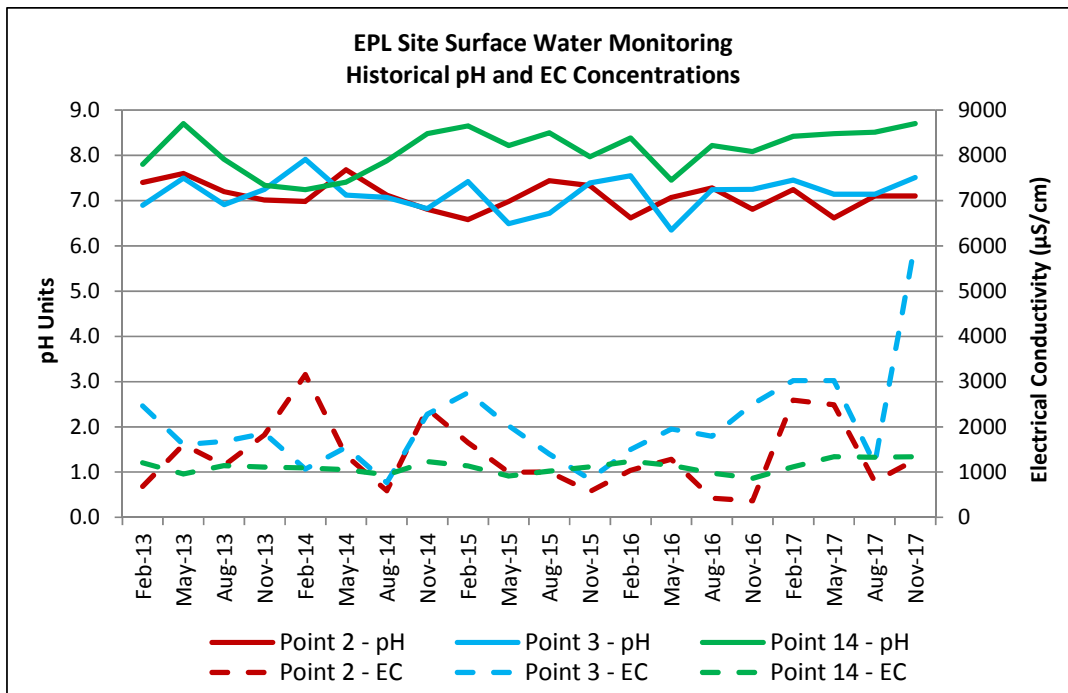
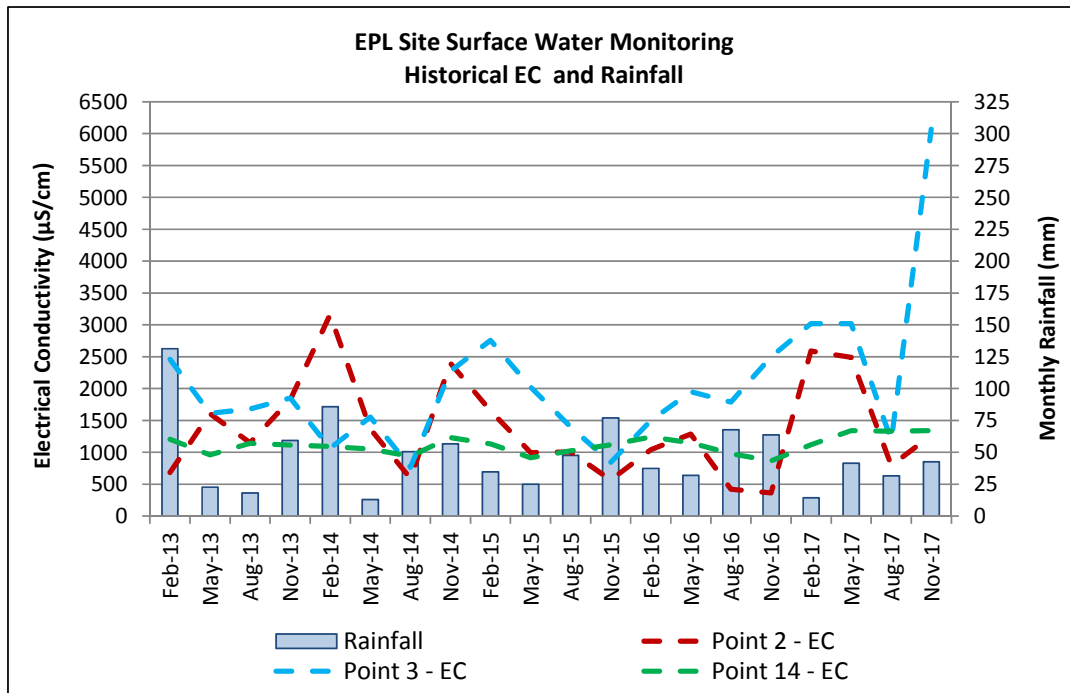


Figure 5
EPL Surface Water Historical Results and Rainfall



7.3.2.2 WMP Surface Water Monitoring

Site surface water samples associated with the Water Management Plan were collected monthly during the 2017 monitoring period. Site surface water samples S1 to S7 are generally shown to be consistent over the duration of the monitoring period.

- pH results recorded at monitoring sites S1 to S7 are shown to be relatively stable throughout the 2017 sampling period.
- S3, S6 and S7 were within the trigger range of pH for the duration of 2017.
- pH was recorded below the site specific lower trigger levels at S1 (Dec) S5 (May & Jun). A preliminary investigation has indicated that the pH results below the trigger levels were not due to, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- S4 exhibited a fluctuating pH range (7.3 to 8.2) with seven results slightly above the upper trigger level of 8.0 pH units (Mar, May, Jul, Aug, Sep, Oct & Nov). A preliminary investigation has indicated that the pH results slightly above the trigger level was not due to, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- EC was observed to fluctuate across the Neubeck's Creek sampling sites (S1, S3 and S6) however the fluctuations were consistent at each sampling location along the creek.
- S1, S3 and S6 reported EC levels above their respective trigger levels during February, March, May, June, October and November 2017. Additionally, S1 was also shown to be above the EC trigger in January and September and S3 in January. A preliminary

investigation has indicated that the elevated EC results were not due to, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.

- EC at monitoring locations S4, S5 and S7 were observed to be relatively stable, with consistency shown between the Blue lake (S5) samples and the Cox's River samples downstream of Blue Lake (S7).
- S4 reported conductivity concentrations below the respective trigger level throughout the 2017 monitoring period.
- S5 exceeded the electrical conductivity levels throughout the entire 2017 monitoring period, with the exception of the February sampling round. A preliminary investigation has indicated that this was not due to, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- S7 exceeded the electrical conductivity levels throughout the 2017 monitoring period, with the exception of the September sampling round. A preliminary investigation has indicated that this was not due to, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- All monitoring locations exhibited results below the total suspended solids trigger level and the oil and grease trigger level.
- The water level of Neubeck's Creek at monitoring location S2 was stable throughout the duration of the monitoring period.
- The intermittent pH and EC results outside of the trigger values suggests the results may be influenced by other land uses and may be reflective of low rainfall conditions recorded at the site during 2017. There is no indication that activities undertaken at Pine Dale Mine during the 2017 monitoring period contributed to the results outside of the trigger values.

An examination of historical data collected over the previous five (5) years indicates fluctuations in both the pH and EC concentrations; however, the fluctuations are consistent between the Neubeck's Creek samples (S1, S3, S6), and the Blue Lake and Cox's River samples (S4, S5 & S7). Historical results showing the last five (5) years of key analysis parameters are presented graphically in **Figures 6** and **Figure 7**.

When these fluctuations are compared against the monthly rainfall received at the site a correlation is evident, particularly with the EC concentration. During periods of low rainfall (Jan 2014; Feb to Mar 2015; Apr 2016; and Feb, Apr and Sept 2017) concentrations of EC are shown to increase at the site. It should be noted that due to the variability of sample collection times throughout the month over the five year period, and the variability of rainfall days throughout the month, some lag time may be evident on the graphical presentation (refer **Figure 8** and **Figure 9**).

The full 2017 dataset of surface water monitoring results for Water Management Plan compliance are presented in **Appendix B**.

Figure 6
WMP S1, S3 & S6 Historical pH Results

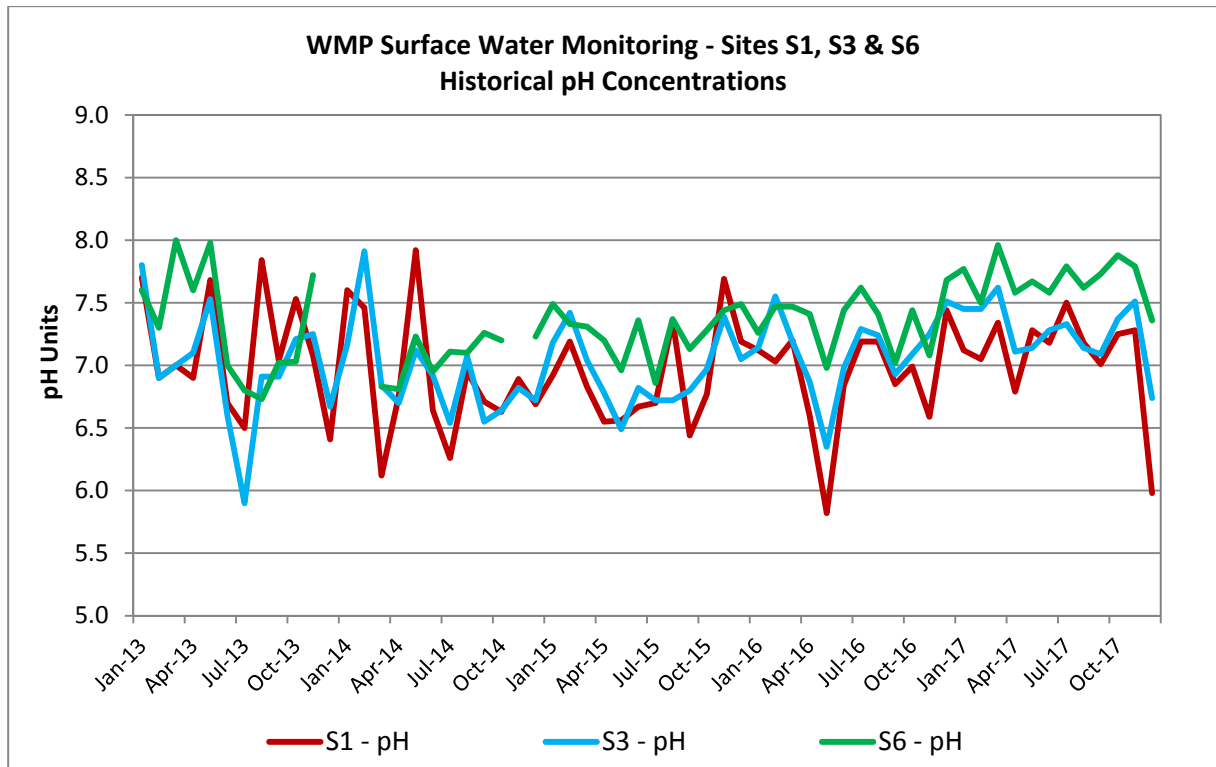


Figure 7
WMP S4, S5 & S6 Historical pH Results

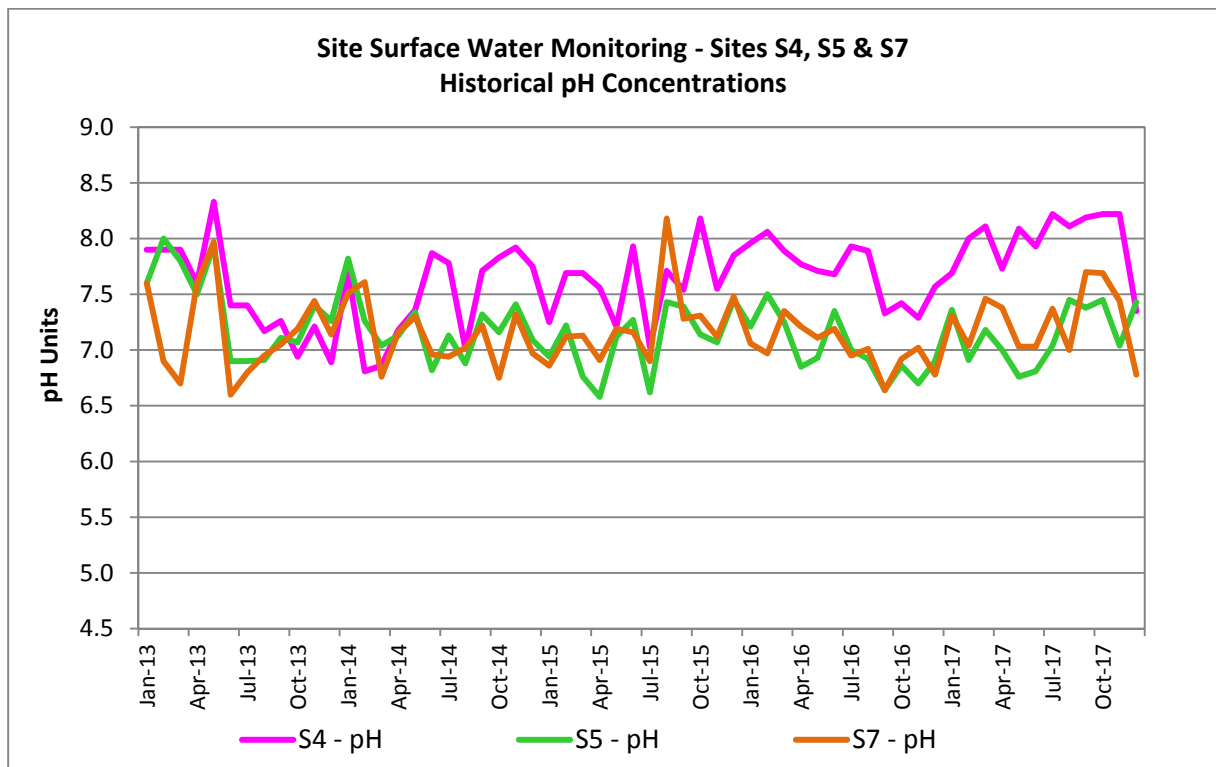


Figure 8
WMP S1, S3 & S6 Historical EC Results & Rainfall

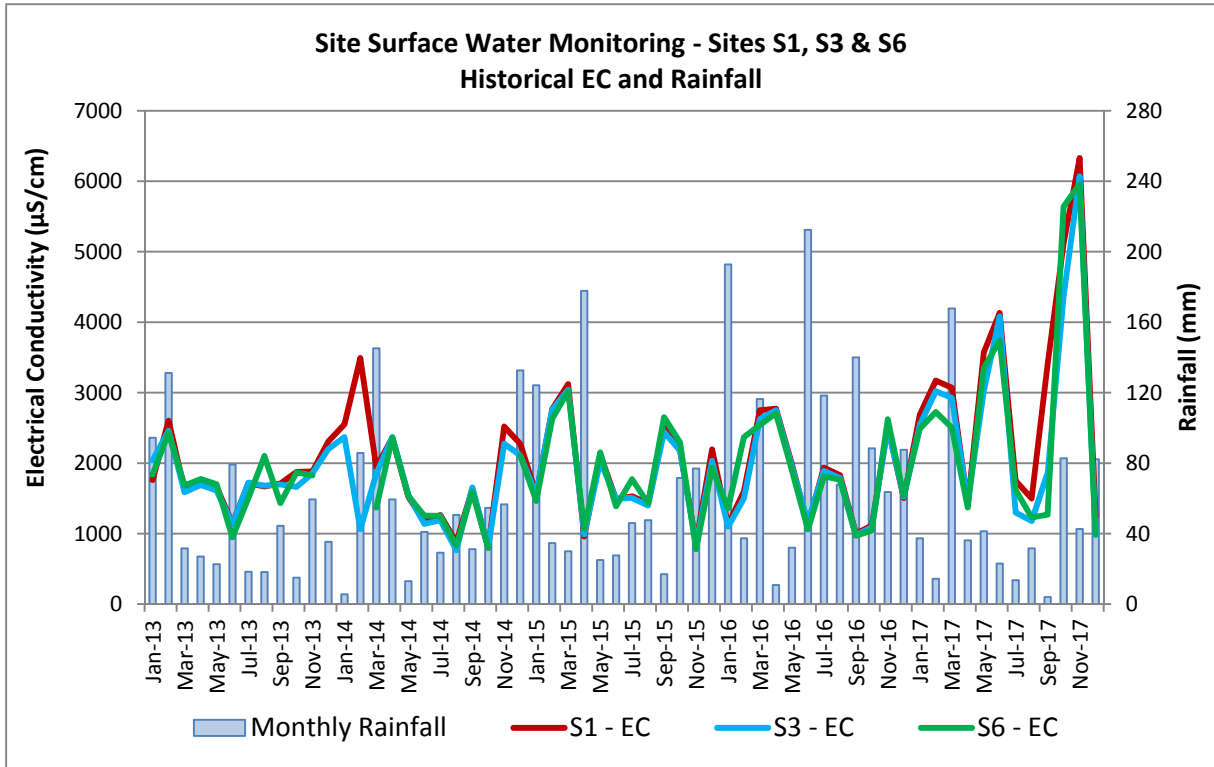
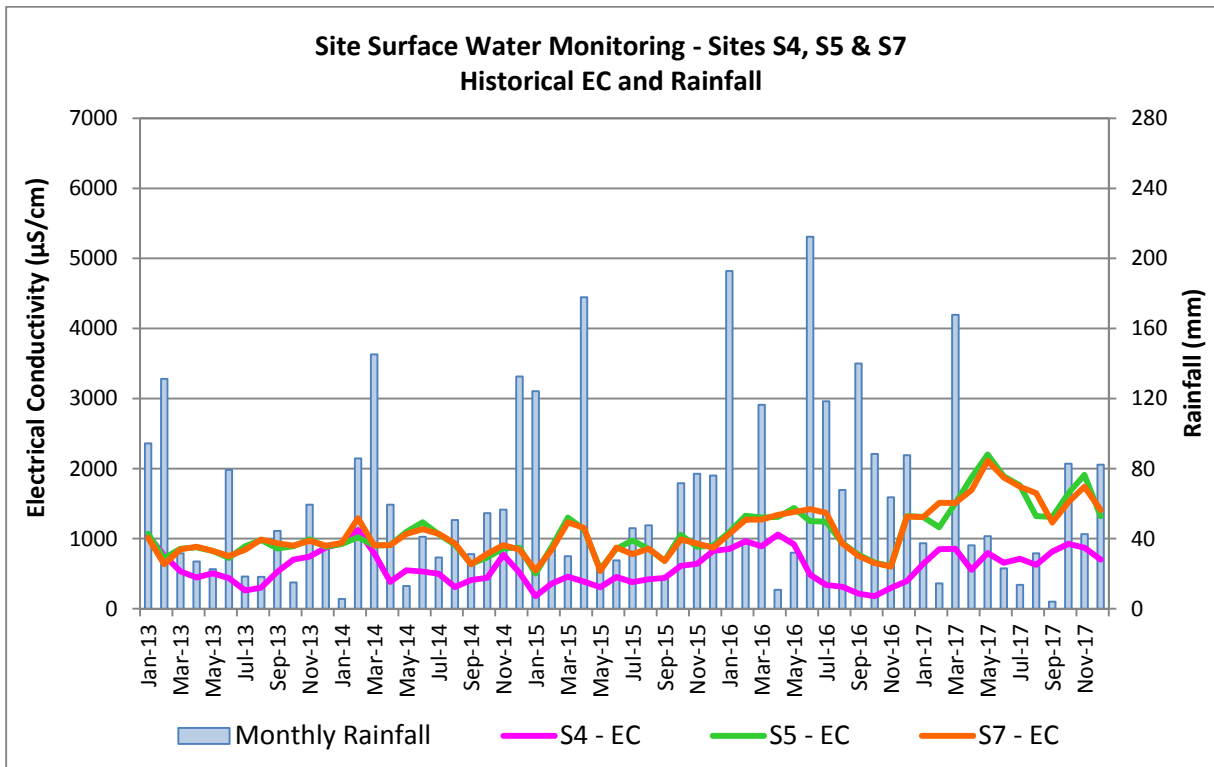


Figure 9
WMP S4, S5 & S6 Historical EC Results & Rainfall



7.4 CHANNEL STABILITY & STREAM HEALTH MONITORING

Channel stability and stream health monitoring of Neubeck's Creek is conducted on a six monthly basis in accordance with project approval PA 10_0041 and the Water Management Plan. Monitoring was conducted in February and September 2017.

Monitoring is conducted at three monitoring points along Neubeck's Creek (SH1, SH2 & SH3A) and one location at Cox's River (SH5), downstream of Blue Lake (refer **Plan 2**). Two additional locations at Blue Lake (SH4) and the concrete lined section of Neubeck's Creek (SH3A) are also included to allow for visual observation of the condition of the water bodies.

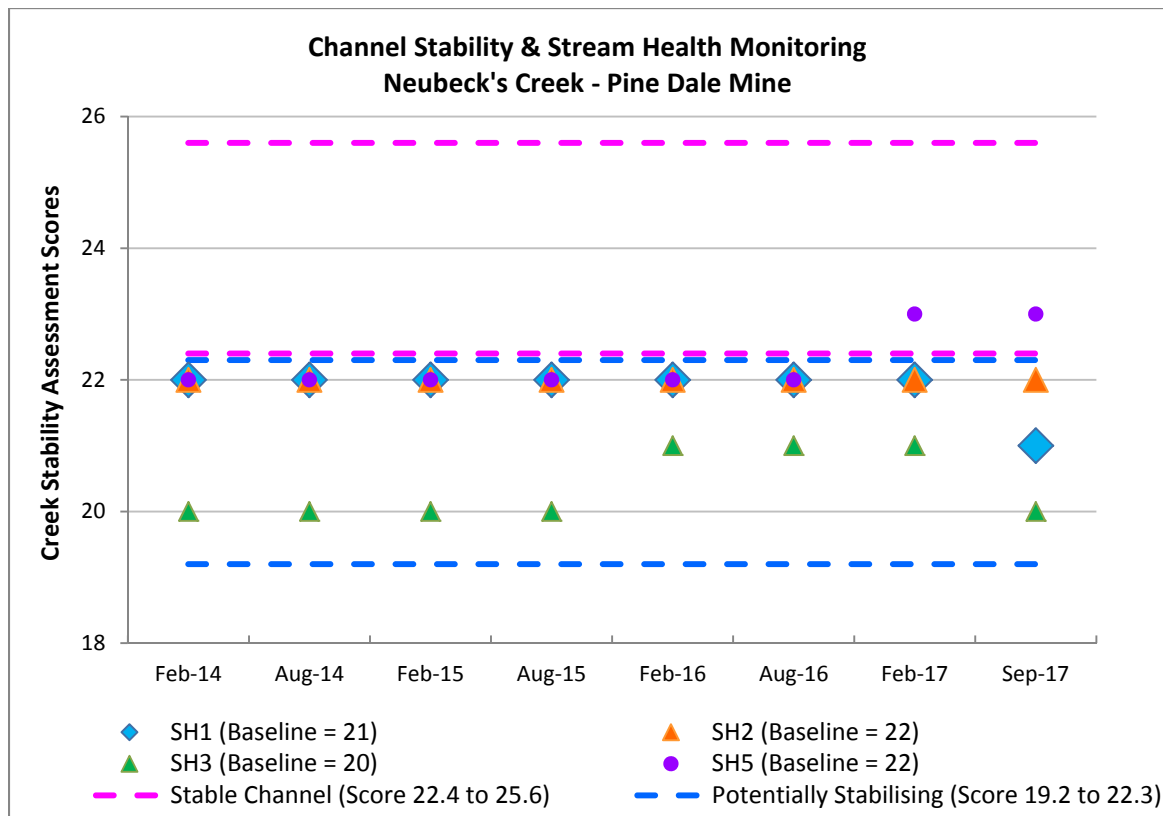
The monitoring involves an observational survey which provides a description of the locations and dimensions of erosive features. Indicators then produce a rating based on a scoring system. The combined total score of the indicators then rank each monitoring location from very actively eroding through to very stable. This assessment enables determinations to be made as to whether the section of creek has changed over time from the classification derived during the original baseline survey.

A Baseline Assessment of channel stability, stream health and vegetation health of Neubeck's Creek and Cox's River undertaken in 2013 indicated the drainage lines were classified as "Potentially Stabilizing".

Follow-up (six-monthly) assessments were conducted at the same monitoring locations during February and August 2014, 2015, 2016 and 2017. Results of the follow-up assessments undertaken during 2014 to 2016 indicated there had been no major change to the Neubeck's Creek and Cox's River drainage lines, with each monitoring location classified as "Potentially Stabilizing".

Monitoring during the 2017 reporting period again indicates no major change to the Neubeck's Creek drainage lines, with each monitoring location again classified as "Potentially Stabilizing" (refer **Figure 10**). During the 2017 monitoring period, the Cox's River drainage line showed a slight improvement in the particle size of materials on the drainage line floor, classifying this location as 'Stable'. Detailed results are presented in **Appendix B**.

Figure 10
Channel Stability and Stream Health Results



7.5 GROUNDWATER

Management of groundwater at the Pine Dale Mine is undertaken in accordance with project approval PA 10_0041 and the approved Groundwater Management Plan (documented within the site Water Management Plan, August 2015). Groundwater monitoring is not a requirement of EPL 4911. The mine also has approval for a water access licence (WAL36480) for the interception and use of groundwater from the underground workings; and Bore Licences (10BL165933 & 10BL603588) for the monitoring of groundwater levels and quality. Results of groundwater monitoring are discussed in **Section 7.6.2**, with a full dataset provided in **Appendix B**.

There was no measurable groundwater intercepted from the underground workings during the 2017 reporting period. As such, a review of groundwater extraction data by a qualified groundwater consultant to validate the recorded data against the groundwater model predictions (in accordance with WAL36480) was not required.

7.6 GROUNDWATER MONITORING

Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the *Groundwater Monitoring Program* documented in the *Water Management Plan*. Sampling is conducted at a total of four locations within the mine site; a further seven locations surrounding the Yarraboldy Extension area (four sampling wells & three vibrating wire piezometer wells); and two locations at the former Enhance Place Mine Site (refer **Plan 2 & 4, Appendix 1**). Sampling is conducted monthly at the site bores (Old Shaft, P6, P7 and The

Bong) for standing water level and physical water quality parameters, and on a quarterly basis for cations, anions and dissolved metals. Bores within the Yarraboldy extension (Bores A, B, C & D) are sampled on a monthly basis for standing water level and on a quarterly basis for the extended analysis suite. The Enhance Place bores are sampled monthly for standing water level only. All parameters analysed are consistent with the requirements of the Water Management Plan. Groundwater data is collected by RCA Laboratories and analysed at a NATA registered laboratory.

It should be noted that The Bong is an opening to the old underground workings. Water from The Bong is sampled from a surface water location (water cart dam) where it is pumped to, on an as required basis.

7.6.1 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) were reviewed in September 2017. The adopted trigger level values are detailed in **Table 14**.

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.

Table 14
Groundwater Trigger Values & Levels

Groundwater Site	pH (range)	Electrical Conductivity (µS/cm)	SWL Trigger (m, AHD)
P6	6.2 - 8.0	1201	882.25
P7	6.2 - 8.0	852	882.31
EP DDH4/GW (Bore D)	6.7 - 8.0	608	940.61
EP DDH7/GW (Bore A)	6.5 - 8.5	894	954.00
EP PDH1/GW Bore C)	6.7 - 8.0	490	889.25
EP PDH3/GW (Enhance)	NA	NA	891.06
EP PDH4/GW (Enhance)	NA	NA	890.95
EP PDH7/GW (Bore E)	5.5 - 8.0	151	938.43
Old ventilation shaft	6.1 - 8.0	1100	887.84
The Bong (at SW location)	5.8 - 8.0	1157	NA

7.6.2 GROUNDWATER WATER QUALITY

7.6.2.1 Site Groundwater Monitoring

Groundwater samples collected from the on-site groundwater bores during 2017 have generally shown water quality to be consistent throughout the monitoring period. However some fluctuations were observed where key water monitoring parameters pH and EC were intermittently recorded outside of the trigger level ranges.

- EC concentrations recorded at the Old Shaft were greater than the conductivity trigger level throughout the entire 2017 monitoring period except during February and March, while the pH was recorded outside of the trigger criterion range for the duration of the monitoring period, except during April 2017.
- pH at Bore P6 dropped below the lower pH trigger level during four of the twelve monitoring events (Jan, May, Sept & Dec), whilst, similar to the Old Shaft, the EC concentrations were greater than the higher trigger level throughout the entire 2017 monitoring period, except during February and March.
- pH at Bore P7 was compliant with the trigger level range during the entire 2017 monitoring period, whilst the EC was greater than the trigger level during April, June, October and November.
- The Bong showed three monitoring events (Feb, Nov & Dec 2017) where the pH was below the lower trigger level. EC was shown to comply with the trigger level for the entire 2017 period.
- Trigger levels for standing water level were shown to be compliant for the entire monitoring period at all site bores.
- A decreasing trend in standing water level was observed at all site bores during 2017.
- A preliminary investigation suggests that the pH and EC intermittently recorded outside the trigger value criterion was not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period. There were no soil disturbances or water discharges at the Pine Dale Mine site; and it is likely that the pH and EC results are reflective of the low rainfall conditions recorded at the site during 2017. There is a possibility that the pH and EC results are impacted by historic underground mine workings.

In accordance with the site's Water Management Plan, continued pH and EC values outside the groundwater quality triggers will act as a prompt for further investigation into correlations between the data trends, land use and climatic conditions. An internal investigative report was compiled at the end of the 2015 monitoring period to examine the concentrations outside the trigger level criteria range at the Old Shaft sampling well. The outcome of this investigation indicated that the elevated electrical conductivity concentrations were most likely attributed to the below average rainfall observed since 2013. It was also considered that the water levels within the Old Shaft were adjusting as a result of the cessation of water extraction from the Wallerawang underground workings during the Care and Maintenance phase. It is considered that the findings of the investigation are still likely attributing to the exceedances observed during this monitoring period, and these factors could be related to the elevated electrical conductivity reported within the other site bores (P6 and P7).

In support of this, the predictions of the Environmental Assessment during the decommissioning phase (similar to Care & Maintenance phase) state 'following subsequent recovery and rising of the water table within the old Wallerawang Colliery underground void, development of acid water may then result, with a lowering of pH and the precipitation of

iron". The increase in acidity of the groundwater; however, is considered to be only short term until the groundwater levels reach equilibrium.

An examination of the historical data set shows consistency between the fluctuations of pH and EC within site groundwater bores P6, P7 and Old Shaft. Over the previous five (5) year period, a slight decreasing trend in pH is observed in bores P6, P7 and Old Shaft, whilst the EC shows a steadily increasing trend in bore P6 and Old Shaft. The EC concentration has remained consistent at bore P7 over the previous five (5) years. Results of monitoring during the previous five (5) years are presented graphically in **Figure 11** and **Figure 12**.

In accordance with the site's Water Management Plan, a comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels across all site bores, including The Bong samples. Following periods of low rainfall (July 2013 to January 2014; September 2015; April 2016; February, July and September 2017) concentrations of EC are shown to increase at all four sites (refer **Figure 12**).

Standing water levels are observed to be consistent over the period January 2013 to May 2016, with an increase observed during the remainder of the 2016 reporting period. A steady decrease in standing water level occurred throughout 2017, with the exception of a slight increase after the large rainfall event in May 2017. It should be noted that due to the variability of sample collection times throughout the month over the five year period, the variability of rainfall days throughout the month, and the rate of groundwater recharge, some lag time may be evident on the graphical presentation (refer **Figure 13**).

The full suite of groundwater results for the 2017 monitoring period are presented in **Appendix B**.

Figure 11
Site Groundwater Bores Historical pH Results

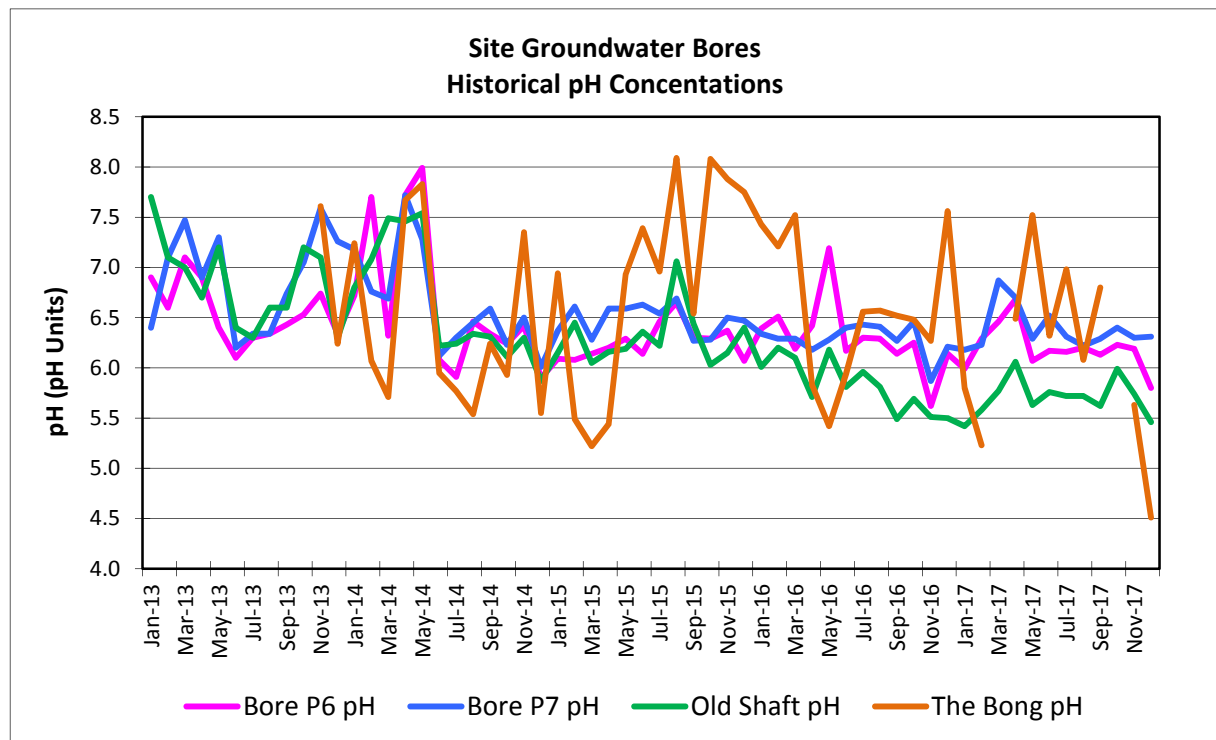


Figure 12
Site Groundwater Bores Historical EC Results & Rainfall

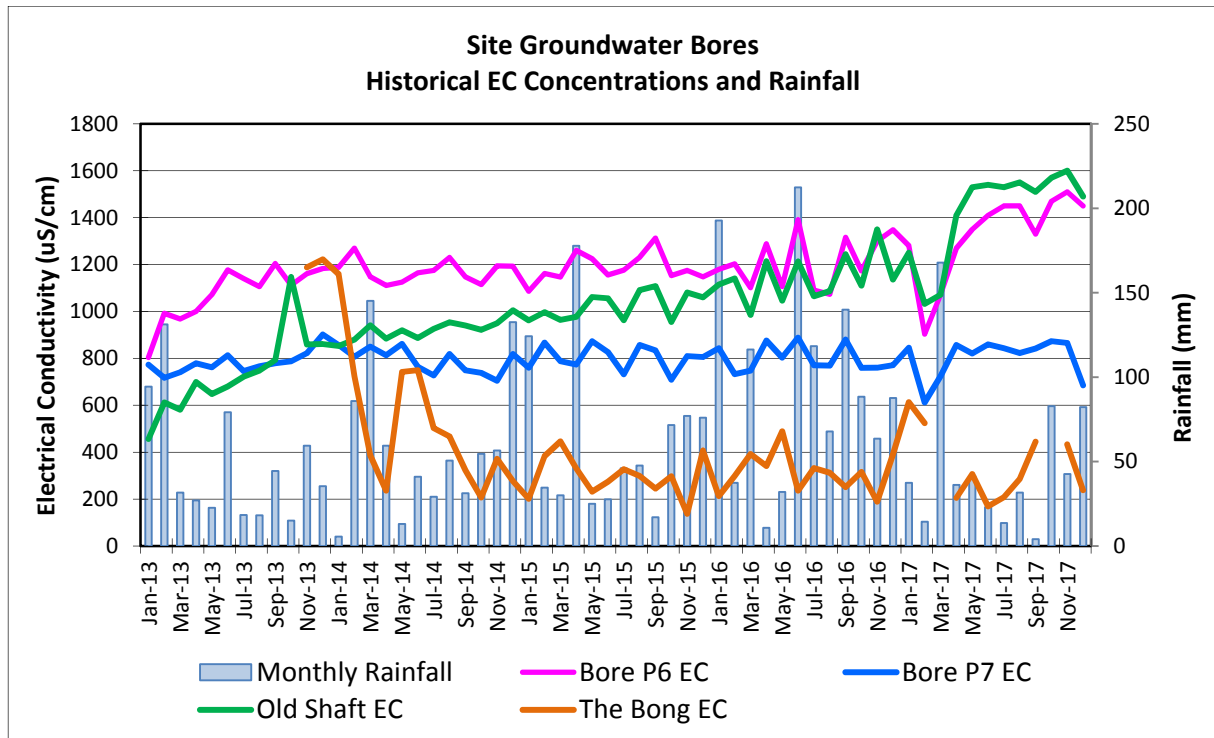
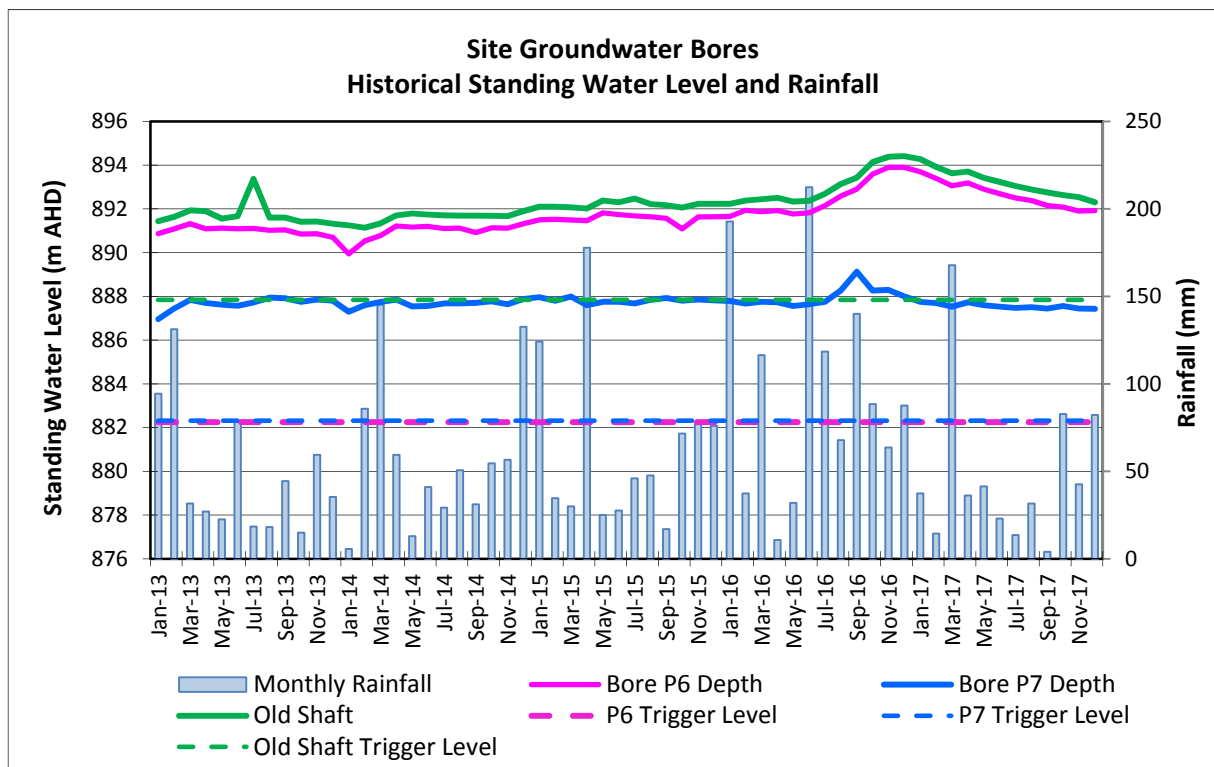


Figure 13
Site Groundwater Bores Historical SWL & Rainfall



7.6.2.2 Yarraboldy Groundwater Monitoring

The results of quarterly water quality monitoring within the Yarraboldy (off-site) groundwater bores for pH, EC and standing water level are generally shown to be consistent throughout the 2017 monitoring period, with the exception of Bore A, which shows a marked decrease in EC during the 2017 monitoring round.

Groundwater samples collected from off-site bores were shown to be compliant with the respective key trigger levels with the following exceptions:

- pH at Bore C during March, June, September and December 2017 was below the lower trigger value. A preliminary investigation has found that these slightly lower pH results were not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- pH at Bore D was below the lower trigger value during March and December 2017; A preliminary investigation has found that these slightly lower pH results were not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- Electrical conductivity concentrations were below the respective conductivity trigger levels for all off-site bores during the 2017 monitoring period, with the exception of Bore A during March. A preliminary investigation has found that the EC concentration above the trigger level was not caused by, or related to activities undertaken at Pine Dale Mine during the 2017 monitoring period.
- The logger units associated with vibrating wire piezometers installed in Bore B and Bore C exhibited connectivity and download issues during the 2017 monitoring period. The logger units in these bores have since been replaced (February 2018). The decommissioned loggers have been sent to the manufacturer in an effort to obtain the unloaded water level data which they contain.
- Standing water levels recorded both manually and via the vibrating wire piezometers was shown to be compliant with the respective water level triggers for each monitoring bore.
- The predictions of the Environmental Assessment during the decommissioning phase (similar to Care & Maintenance phase) indicate a lowering of pH in the groundwater bores is to be expected over the short term until the groundwater levels reach equilibrium. The pH results below the trigger range are likely due to these groundwater levels adjusting; there were no activities undertaken at Pine Dale Mine during the 2017 monitoring period that could cause a decrease of the pH. Similarly, there were no activities undertaken at Pine Dale Mine that could have caused the EC results to be above the trigger level.

An examination of the historical data set shows consistency between the fluctuations of pH within groundwater Bores A, C and D, whilst the variation of pH in Bore E is more amplified. A decreasing pH trend is observed in Bores C, D and E, whilst Bore A shows a slight increase over the previous five (5) year period. Historical electrical conductivity data show a slow decreasing trend over the previous five (5) years, with the exception of Bore A, which shows a marked increase during the last quarter of 2016, then a decreasing trend throughout 2017.

Results of monitoring during the previous five (5) years are presented graphically in **Figures 14 and 15**.

A comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels across all off-site bores, except for an anomaly observed at Bore A during the last quarter of 2016 (refer **Figure 16**). During periods of low rainfall (Sept 2013; Sept 2014; Sept 2015; Nov 2016 & Sept 2017) concentrations of EC are shown to increase at the site. Standing water levels are observed to be consistent over the previous five (5) year period, with intermittent increases and decreases observed as a result of rainfall infiltration. It should be noted that due to the variability of sample collection times throughout the month over the five year period, the variability of rainfall days throughout the month, and the rate of groundwater recharge, some lag time may be evident on the graphical presentation (refer **Figure 16** to **Figure 19**). The full suite of groundwater results for the 2017 monitoring period are presented in **Appendix B**.

Figure 14
Off-Site Groundwater Bores Historical pH Results

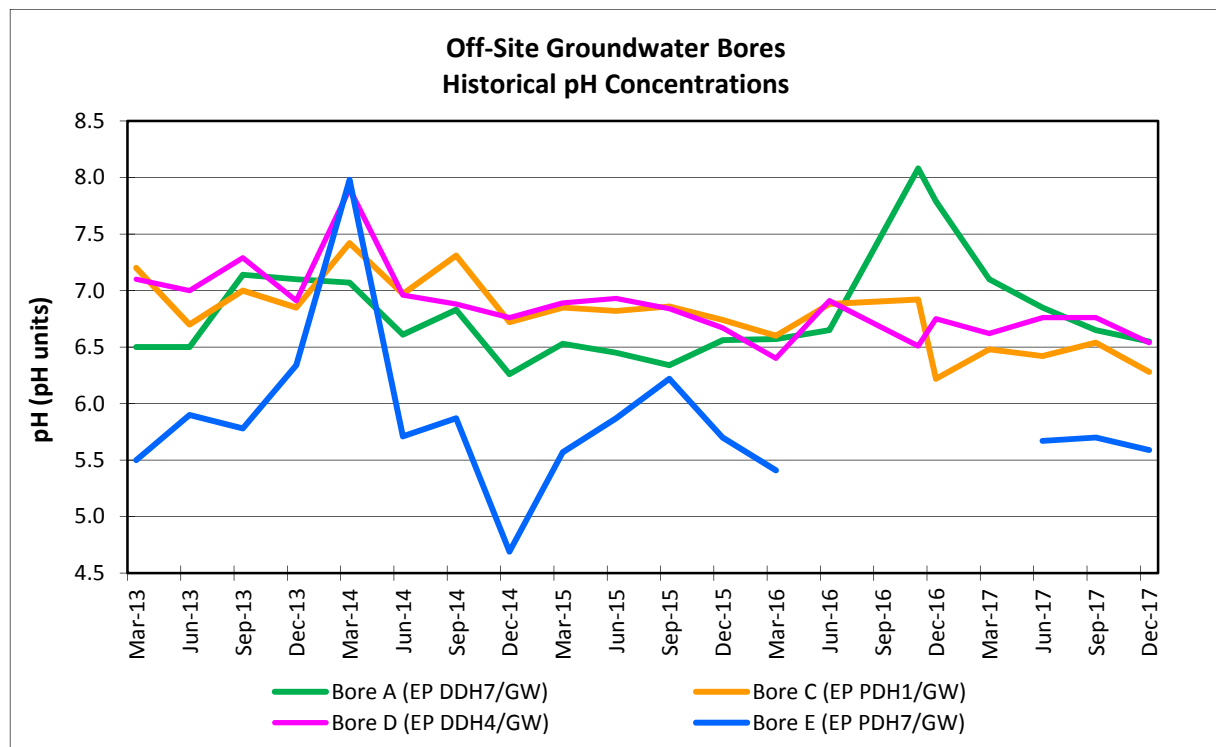


Figure 15
Off-Site Groundwater Bores Historical EC Results & Rainfall

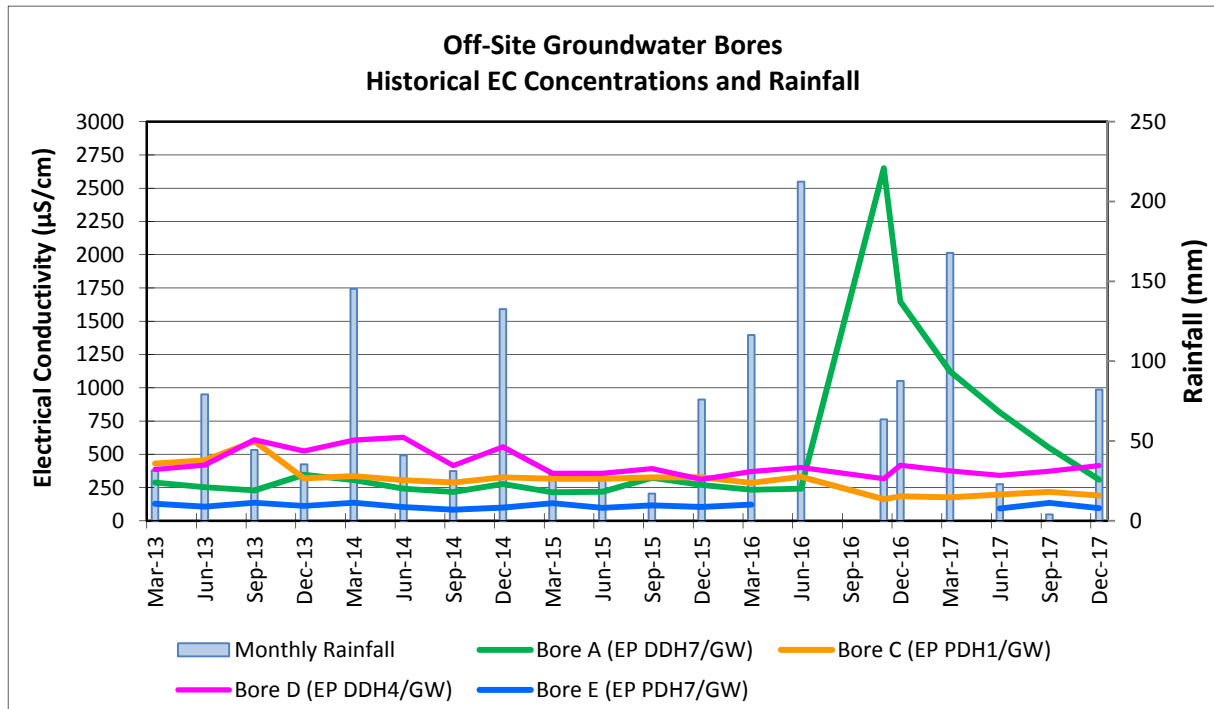


Figure 16
Off-Site Groundwater Bores Historical SWL & Rainfall

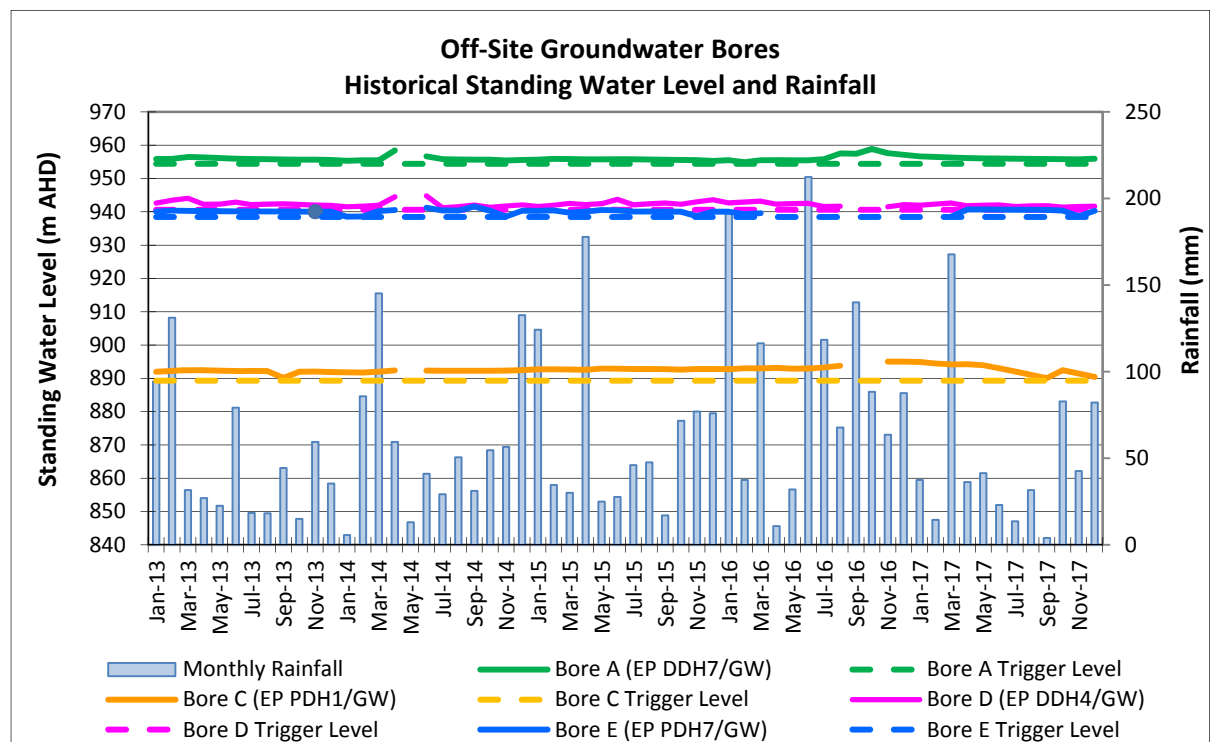


Figure 17
Off-Site Bore B-VWP Historical SWL & Rainfall

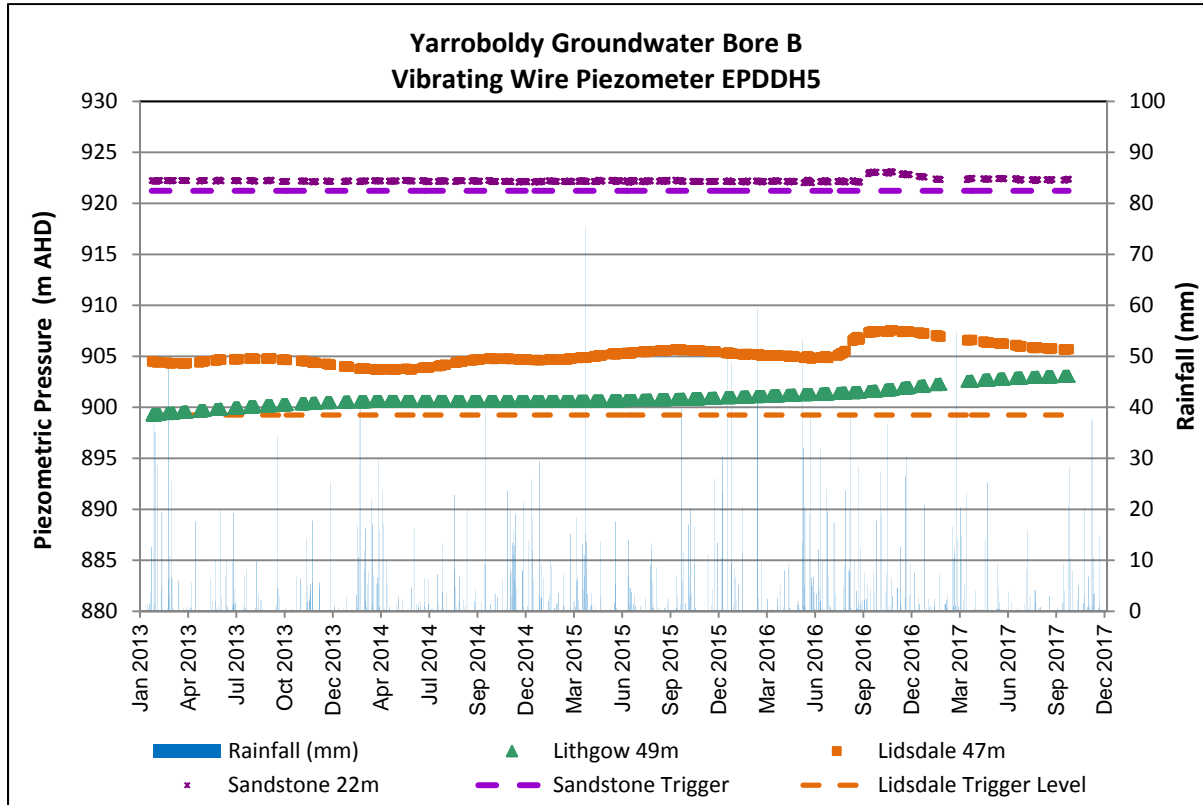


Figure 18
Off-Site Bore C-VWP Historical SWL & Rainfall

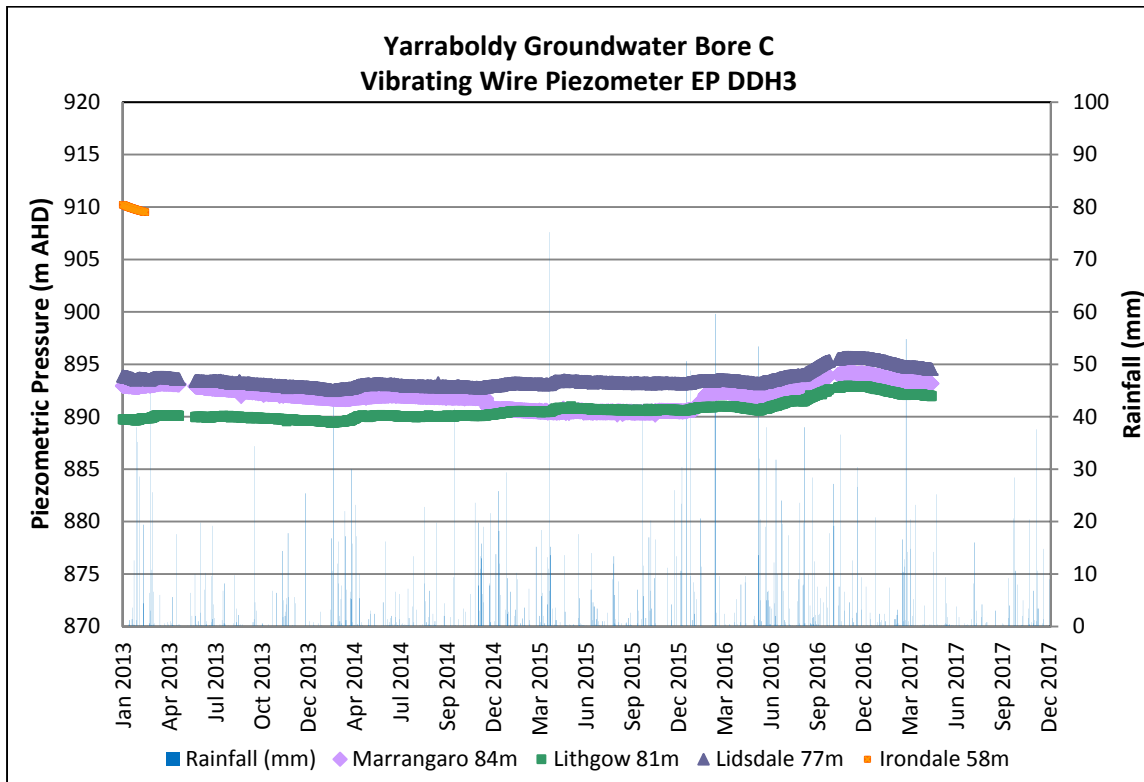
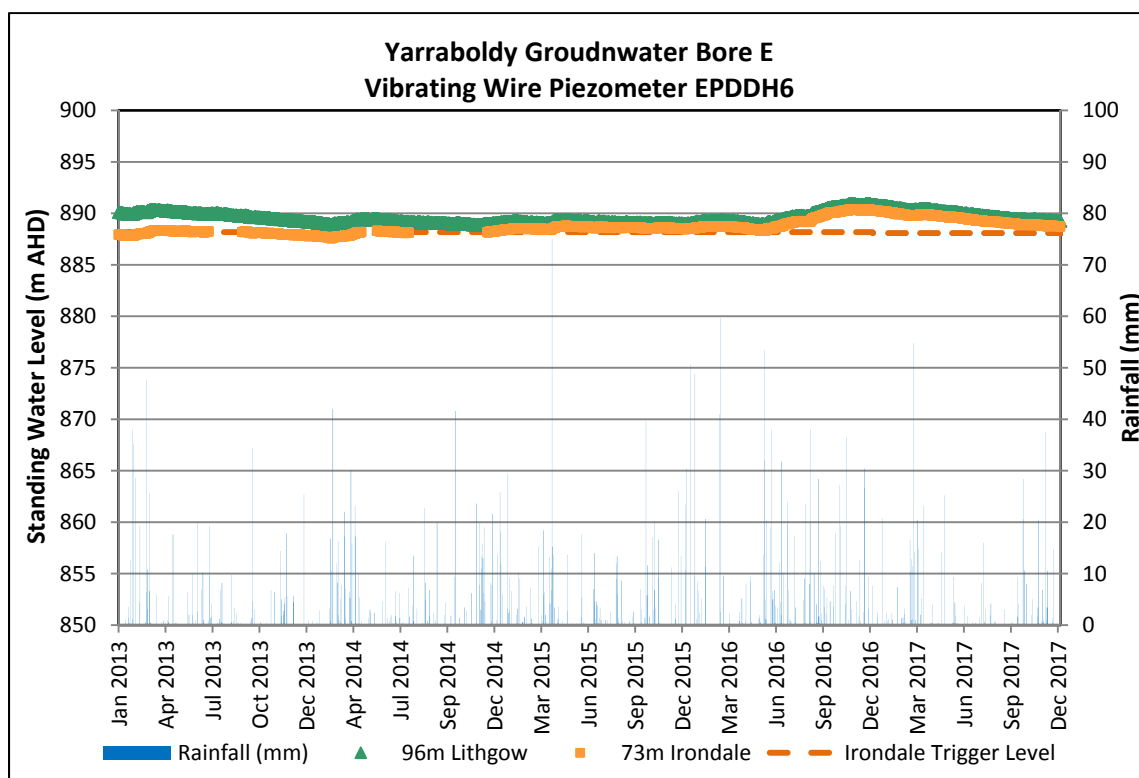


Figure 19
Off-Site Bore E-VWP Historical SWL & Rainfall



Note: Bore E was inaccessible during the period April to December 2016 due to an access bridge closure in the State Forest.

7.6.2.3 Enhance Place Groundwater Level Monitoring

The two monitoring bores located at the former Enhance Place mine generally exhibited standing water levels which were stable throughout the 2017 monitoring period, with a slight decrease in water levels observed in September 2017 when rainfall was low. Water levels recorded were shown to be compliant with the respective standing water level triggers at both bores during the 2017 monitoring period.

A detailed summary of The Enhance Place groundwater bore standing water levels can be found in **Appendix B**.

8 REHABILITATION

Rehabilitation works at Pine Dale Mine are conducted in accordance with rehabilitation objectives in the approved Care and Maintenance MOP. Rehabilitation performance criteria documented in the MOP define the performance indicators, measuring criteria, status and progress of rehabilitation at the mine.

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 domain is depicted in **Plan 3, 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.

8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

8.1.1 AGREED POST REHABILITATION LAND USE

Areas of privately owned land within the Pine Dale Mine (Area B, C & 8) have been returned to pasture for agricultural purposes, including grazing, as per the approved rehabilitation strategy and landholder preferences.

The principal aim for the final land use of the Yarraboldy Extension rehabilitation area (including Area A) is for native vegetation conservation and for the use of Forests NSW.

8.1.2 REHABILITATION STATUS SUMMARY

A summary of the rehabilitation area status for the current and previous reporting period is presented in **Table 15** along with forecasts for the 2018 reporting period.

A Rehabilitation Monitoring Report was commissioned by FirstField Environmental (2017) which provides an overview of the rehabilitation status at the site and recommendations for the improvement of rehabilitation outcomes in reference to the approved completion criteria. A summary of the rehabilitation status for the 2017 reporting period compared to the MOP performance indicators and completion criteria are presented in **Table 16**.

Table 15
Rehabilitation Area Summary

Mine Area Type	Area Affected/Rehabilitated (ha)		
	Previous Reporting Period (Actual) 2016	This Reporting Period (Actual) 2017	Next Reporting Period (Forecast) 2018
A. Total Mine Footprint	98.1	98.1	98.1
B. Total Active Disturbance	56.8	56.8	56.8
C. Land Being Prepared for Rehabilitation	0	0	0
D. Land Under Active Rehabilitation	32	32	32
E. Completed Rehabilitation	0	0	0

Table 16
Rehabilitation Status Summary

Performance indicator	Completion Criteria	Current Status (2017 Reporting Period)
Feral animal and noxious weed presence	<ul style="list-style-type: none"> Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use. 	Satisfactory – continue to monitor
Feral animal and noxious weed control	<ul style="list-style-type: none"> Feral animals and noxious weeds are controlled in accordance with legislation. 	Satisfactory – continue to monitor
Fuel loads	<ul style="list-style-type: none"> Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan. 	Satisfactory – continue to monitor
Access	<ul style="list-style-type: none"> Adequate access for firefighting is maintained on rehabilitation areas. 	Satisfactory – continue to monitor
Habitat features	<ul style="list-style-type: none"> Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehab areas - Rock pile clusters. 	Ongoing - nesting boxes to be installed once trees are established
Vegetation health	<ul style="list-style-type: none"> More than 75% of native forest indicator species are assessed to be healthy and growing at year 5. 	Ongoing – continue to monitor
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites. 	Ongoing – continue to monitor
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10. 	Ongoing – continue to monitor
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gulying or tunnelling). 	Satisfactory – continue to monitor
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas. 	Satisfactory
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species present in rehabilitation areas. 	Satisfactory
Natural regeneration	<ul style="list-style-type: none"> Evidence of second generation of native forest indicator species from desired vegetation community. Evidence of natural regeneration of at least four pasture species at year 5. 	Ongoing – continue to monitor
Structure	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites. 	Ongoing – continue to monitor
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites. 	Ongoing – continue to monitor
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing). 	Satisfactory – continue to monitor

Performance indicator	Completion Criteria	Current Status (2017 Reporting Period)
Species composition	<ul style="list-style-type: none"> Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix. Approved pasture species mix is sown at the specified rate per hectare. 	Satisfactory
Weed presence	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward. 	Satisfactory – continue to monitor
Ground cover	<ul style="list-style-type: none"> Ground cover (vegetation, leaf litter, mulch) >70% at year 5. 	Satisfactory – continue to monitor

8.1.3 YARRABOLDY EXTENSION REHABILITATION PERFORMANCE

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

The amenity bund located along the southern boundary of the Yarraboldy Extension has been re-profiled with the southern batter having a gradient of 18° to minimise erosion and enhance establishment of seedlings. Following the application and tilling of topsoil, a native species grass and tree species seed mix has been applied followed by mulch (refer **Plate 1**).

During the reporting period, rehabilitation maintenance works were undertaken in the Yarraboldy Extension. These works comprised of:

- Treatment of surface cracking on slopes in May 2017 by ripping and tilling (refer **Plate 2 & 3**).
- Drainage line repair and installation of hay bales to reduce flow velocity, June 2017 (refer **Plate 4**).

Growth of vegetation on the bund during the 2017 reporting period is shown in **Plate 5 & 6**.



Plate 1 Amenity bund – application of mulch & native seed mix (2015)



Plate 2 Surface cracking on slope in Yarraboldy Extension area, May 2017.



Plate 3 Repair of surface cracking in Yarraboldy Extension area, May 2017.



Plate 4 Repair of drainage line in Yarraboldy Extension area, June 2017.



Plate 5 Amenity Bund - Yarraboldy Extension area, December 2017.



Plate 6 Amenity Bund - Yarraboldy Extension area, December 2017.

8.1.4 AREA A REHABILITATION PERFORMANCE

Seeding of Area A (8 ha) commenced in 2008, with 1500 trees planted. In 2010 an additional 400 trees were planted. Further direct seeding and application of an organic mulch layer and lime occurred in October 2013; however, drought conditions late in 2013 limited the outcomes of this work.

A revised rehabilitation strategy was developed in 2014, incorporating recommendations from an agronomist (SLR, 2014 report) for input within the Care and Maintenance MOP. Annual rehabilitation monitoring reports (FirstField Environmental, 2014 - 2017) also provide recommendations for the improvement of rehabilitation within Area A. The recommendations included in these reports are summarised in **Table 17**. The rehabilitation activities undertaken in Area A during the reporting period are also presented in this table.

Table 17
Recommended and Completed Rehabilitation Actions in Area A

Recommended Rehabilitation Actions - Area A		Actions Completed (2014 to 2016)	Undertaken in 2017
Soil Assess. Report, 2014	Continue control of Bidy Bush with current spot spraying regime	Weed spraying as per Weed Man. Schedule (Section 6.7)	Yes
	Continue with further application of mushroom compost, lime & gypsum (10:3:2 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
	Increase potassium by application of Muriate of Potash or similar (0.25tonnes/ha)	Application of Muriate of Potash at recommended rate.	Yes
Rehabilitation Monitoring Report, 2014	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels	Coarse woody debris placed along contours above rills to reduce runoff rate and volume.	No – not required
	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses	Exposed surfaces ripped and reseeded with locally sourced seed mix.	No – not required
	Install nesting boxes in close proximity treed rehabilitation area	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
Rehabilitation Monitoring Report, 2015	Install nesting boxes in or adjacent to treed rehabilitation areas.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
	Re-apply a mixture of mushroom compost, lime and gypsum to treed rehabilitation areas as per the recommendations of SLR (2014) report.	Application of fertilizer and compost at recommended rates.	Yes
	Increase canopy cover of tall herbs and shrubs at treed rehabilitation Area A to 75% with 80% groundcover of grasses and broadleaf herbs.	Exposed surfaces ripped and reseeded with fast growing herbs and grasses.	No – not required
	Concentrate tube stock planting in benches of treed rehabilitation areas to take advantage of run-on from banks.	Tree planting undertaken in addition to direct seeding.	No – not required
	Place additional coarse woody debris along contours above rills to reduce runoff rate and volume at treed rehabilitation areas.	Woody mulch placed along contours above rills to reduce runoff rate and volume	No – not required

Recommended Rehabilitation Actions - Area A		Actions Completed (2014 to 2016)	Undertaken in 2017
Rehabilitation Monitoring Report, 2016	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Install nesting boxes in or adjacent to treed rehabilitation areas.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
	Place additional coarse woody debris along contours above rills to reduce runoff rate and volume at treed rehabilitation areas.	Woody mulch placed along contours above rills to reduce runoff rate and volume	No – not required
Rehab Monitoring Report, 2017	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Install nesting boxes in or adjacent to treed rehabilitation areas.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No

The Pine Dale Mine Rehabilitation Monitoring Report for 2017 (refer **Appendix C**) indicated the living groundcover within the monitoring transects in Area A had decreased slightly from 75% in 2016 to 70% in 2017 at Transect 5; whilst the living groundcover at Transect 6 remained stable at 80%.



Plate 7 Area A – Vegetation cover, December 2017

8.1.5 AREA B AND C REHABILITATION PERFORMANCE

Rehabilitation Areas B and C cover an area of approximately 25 ha and have been rehabilitated as pasture. 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.

The rehabilitation activities undertaken in Areas B and C during the reporting period are presented in Table 18, along with the actions recommended for improved rehabilitation of Areas A and B, as presented in the *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR 2014) and the *Pine Dale Mine Rehabilitation Monitoring Reports* (FirstField Environmental, 2014 - 2017).

Table 18
Recommended and Completed Rehabilitation Actions in Areas B & C

Recommended Rehabilitation Actions – Area B & C		Actions Completed (2014 to 2016)	Undertaken in 2017
Soil Assessment Report, 2014	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Ripping with a plough to create furrows, followed by application of pasture seed mix	Furrows created along pasture poor areas and contour banks, seed, fertiliser & compost applied	No – not required
	Application of Muriate of Potash (0.25tonnes/ha) and Di-ammonium phosphate 0.20 tonnes/ha)	MAP and DAP applied at recommended rates.	Yes
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
Rehab. Monitoring Report, 2014	Continue to implement integrated weed management control methods for noxious weeds.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
Rehabilitation Monitoring Report, 2015	Rip along contours of poorly established pasture rehabilitation areas and re-sow pasture mix and fertiliser. Cover with a mixture of mushroom compost, lime and gypsum as per the recommendations of SLR (2014) report.	Poorly established pasture areas and drainage lines mechanically ripped prior to re-sowing with pasture species	No – not required
	Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.	Application of fertilizer and compost at recommended rates.	Yes (Plate 9)
Rehab. Monitoring Report, 2016	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No – not required
Rehab. Monitoring Report, 2017	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes

During the reporting period, rehabilitation maintenance works were undertaken in Area B & B. These works comprised of:

- Removal of rocks and a fallen tree from the Area B pasture, May 2017.
- Application of fertilizer and compost to Area B & C pastures, July 2017 (refer **Plate 8**).

The 2017 Rehabilitation Monitoring Report documented the following findings for rehabilitation Areas B & C:

- Groundcover in pasture rehabilitation areas is stable at 90% (**Plate 9 & 10**).
- African Lovegrass comprises <10% of pasture sward.
- Rehabilitated pasture areas are consistent with Soil and Land Capability Class V land and are suitable for grazing.

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



Plate 8 Area B & C – Application of fertilizer and compost, July 2017



Plate 9 Area B & C – Pasture growth, December 2017



Plate 10 Area B & C – Pasture growth, December 2017

8.1.6 AREA 8 REHABILITATION PERFORMANCE

Seeding of area 8 (10 ha) 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.

The rehabilitation activities undertaken in Area 8 during the reporting period are presented in **Table 19**, along with the actions recommended for improved rehabilitation of Areas A and B, as presented in the *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR 2014) and the *Pine Dale Mine Rehabilitation Monitoring Reports* (FirstField Environmental, 2014 - 2017).

Table 19
Recommended and Completed Rehabilitation Actions in Area 8

Recommended Rehabilitation Actions – Area 8		Actions Completed (2014 to 2016)	Undertaken in 2017
Soil Assessment Report, 2014	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule	Yes
	Ripping with a plough to create furrows, followed by application of pasture seed mix	Furrows created along poorly vegetated areas followed by direct seeding	No – not required
	Application of Muriate of Potash (0.25tonnes/ha) and Di-ammonium phosphate 0.20 tonnes/ha)	MAP and DAP applied at recommended rates.	No
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
Rehabilitation Monitoring Report, 2014	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels	Drainage lines re-shaped with rock placement in erosion channels	No, not required
	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses	Exposed areas re-sown with pasture seed mix.	No – not required
	Install nesting boxes in close proximity treed rehabilitation area	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
Rehabilitation Monitoring Report, 2015	Rip along contours of poorly established pasture rehabilitation areas and re-sow pasture mix and fertiliser. Cover with a mixture of mushroom compost, lime and gypsum as per the recommendations of SLR (2014) report.	Furrows created over the land, pasture seed mix applied, followed by fertiliser and compost	No
	Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.	Application of fertilizer and compost at recommended rates.	No – not required
Rehabilitation Monitoring Report, 2016	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No

Recommended Rehabilitation Actions – Area 8		Actions Completed (2014 to 2016)	Undertaken in 2017
Rehab. Monitoring Report, 2017	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes

The 2017 Rehabilitation Monitoring Report (refer **Appendix C**) indicated Transect 4, in the eastern portion of Area 8 had 90% groundcover, which is consistent with the previous reporting period (2016). African Lovegrass was reported as comprising <10% of the pasture sward (refer **Plate 11**).



Plate 11 Area 8 – Pasture growth / ground coverage, January 2017

8.1.7 ADDITIONAL REHABILITATION MAINTENANCE WORKS

During the 2017 reporting period additional maintenance activities were conducted on rehabilitated lands in the form of erosion control works and the maintenance of sedimentation fencing in and around the rehabilitated areas.

8.1.8 RENOVATION / REMOVAL OF BUILDINGS

There were no buildings removed or constructed during the 2017 reporting period.

8.1.9 REHABILITATION FORMAL SIGN OFF

There were no areas of rehabilitation which acquired formal sign off from DRE during the reporting period.

8.1.10 REHABILITATION TRIALS AND RESEARCH

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

8.1.11 THREATS TO REHABILITATION SUCCESS

Significant threats to rehabilitation at the Pine Dale Mine have been identified in the Care and Maintenance MOP. These threats and the proposed mitigation and management measures are summarised in **Table 20**.

Table 20
Threats to Rehabilitation Success

Secondary Domains (Post Mining Land Use)	Potential Threat(s)	Mitigation & Management Measures
Infrastructure (A) Water Management Structure (B)	Engineering design failure	Any infrastructure remaining in place post mining would be inspected and approved by a suitably qualified person (if required) and agreed by relevant stakeholders.
	Water damage (erosion, flooding etc.)	Infrastructure and water management structures would be constructed in accordance with relevant guidelines and to ensure erosion and damage from floods is minimised.
Rehabilitation - Pasture (C) Rehabilitation - Native Forest (D) Rehabilitation – Pine Plantation (E)	Adverse soil chemistry	Soil testing and amelioration
	Erosion	Design to relevant guidelines, regular maintenance as required
	Seed germination failure	Seed treatment, soil amelioration, annual monitoring
	Species diversity and density	Annual monitoring and supplementary tree planting and seeding as required
	Weed presence	Inspections and weed control (herbicide application).
	Drought	Drought tolerant species selection, timing seeding to coincide with appropriate soil moisture.
	Grazing	Restrict grazing particularly in early years to rehabilitated areas
	Bushfire	Maintain low fuel loads, emergency preparedness and response

8.2 ACTIONS FOR THE NEXT REPORTING PERIOD

During the 2017 reporting period rehabilitation activities were undertaken on areas that will not be directly impacted by any future mining operations at the Pine Dale Mine. Maintenance and rehabilitation activities recommended in the Care and Maintenance MOP will continue on these areas throughout 2018 (sediment fences, fertilizing, re-seeding, weed control etc).

As per the recommendations made in the Rehabilitation Monitoring Report (**Appendix C**), further weed spraying is proposed in addition to the installation of nesting boxes once the treed area contains adequate structure to support nesting birds.

During the 2018 reporting period, Pine Dale Mine will seek to engage an independent

consultant to develop a final Rehabilitation and Completion Assessment report for the partial relinquishment of the mining lease covering Areas B & C. This report will determine if the rehabilitation completion criteria for Area B & C have been met and the landform and land use is comparable to adjacent lands.

9 COMMUNITY RELATIONS

9.1 ENVIRONMENTAL COMPLAINTS, INCIDENTS & NOTIFICATIONS

All stakeholder and community complaints, enquiries and notifications regarding the Pine Dale Mine are documented, with appropriate actions taken as soon as possible to determine the likely cause of the incident and all possible corrective actions to resolve the problem and prevent its recurrence. Complaints, enquiries and notifications are recorded and retained at the site office in addition to monthly publication on the Pine Dale Mine website.

During the previous (2016) reporting period, the complaints register was updated to better reflect the nature of the communications received. The nature of the communication is now listed as an Enquiry, Notification or Complaint. The term 'complaint number' was also replaced with *Item Number*. Details of the complaints received during the previous 5 years are presented in **Table 22**.

During the 2017 reporting period, two complaints were recorded (**Table 21**). In the first instance the complainant called EnergyAustralia (Mount Piper Power Station) on February 28th stating the Minutes of the December 2015 Community Consultative Committee (CCC) meeting were not able to be viewed on the website. It was also noted by the complainant that the minutes from the June and December 2016 meetings were still shown in a draft format. The problems with website links may have occurred due to the upgrading of the website in preparation for the re-branding of EnergyAustralia. On March 1st the minutes of the June & December 2016 CCC meetings were revised from Draft to Final versions and the website link to the December 2015 minutes was restored.

The second complaint occurred on 26th May when a representative from Pine Dale Mine called the complainant to inform him that remediation works were planned to take place at the mine in an area adjacent to the complainant's residential boundary. The complainant indicated he did not want any remediation works to occur near his property boundary. A note was made to discuss the issue with the complainant at the next CCC meeting; however, the complainant resigned his position from the CCC.

Table 21
Community Complaints, Incidents & Notifications

Incident Type	Incidents Received 2017
Noise	0
Air Quality	0
Blasting	0
Traffic	0
Water	0
Other	2
Total Complaints Received	2
Enquiries/Notifications Received	0

Table 22
Historical Community Complaints, Incidents & Notifications

Complainant	Item No.	Date Received	Nature (Enquiry / Notification or Complaint)	Issue(s)	Comment on nature of complaint in relation to approved parametric limits	Corrective Action Required? Y/N	Response / Action	
							Y/N	Date Completed
7	002-17	26/05/17	Notification	Operations adjacent to Private Property	Notification from neighbouring resident that he did not want remediation activities occurring near his residential boundary.	Yes	Yes	10/11/17
6	001-17	28/02/17	Complaint	CCC Minutes on EA Website	Minutes of December 2015 CCC meeting were not able to be viewed on the website due to a problem with the link. The June and December 2016 minutes and the December 2015 minutes (when visible) were still shown in Draft format.	Yes	Yes	1/03/17
7	002-16	23/12/16	Complaint	Operations adjacent to Private Property	Energy Australia received an email from the office of the Member for Bathurst regarding a complaint they had received from a neighbouring PDM resident regarding rehabilitation activities undertaken at the mine during December within close proximity to the residential boundary without prior notification to the resident.	No	Yes	12/01/17
6	001-16	28/04/16	Complaint	Community Consultation	Email to DRE indicating lack of community consultation concerning renewal of Exploration Licence EL7621.	No	Yes	6/05/16
7	004-15	14/12/15	Enquiry / Notification	Trespassing	Notification regarding a trespasser entering the PDM property with the intention of going to Blue Lake. Complainant noticed the man and asked him to leave the site. Complainant also expressed concern over the potential impact of trespassers on their property.	Yes	Yes	15/12/15
7	003-15	28/10/15	Enquiry	Dust	Enquiry regarding dust generation during application of lime for PDM rehabilitation program	No	NA	NA
6	002-15	26/06/15	Enquiry	Noise	Letter regarding concerns of noise emissions from the proposed Pine Dale mine extension	No	Yes	3/07/15
7	001-15	9/04/15	Enquiry / Notification	Access	Enquiry regarding noise monitoring being undertaken within the Pine Dale Mine site (within 50m of Barnes' residential boundary) without prior notification to the resident.	Yes	Yes	9/04/15
6	002-14	28/02/14	Complaint	Various	Complaint received via DTRIS regarding rehabilitation and land use. Written response provided to DTRIS. Issue has been resolved.	No	Yes	5/03/14

Complainant	Item No.	Date Received	Nature (Enquiry / Notification or Complaint)	Issue(s)	Comment on nature of complaint in relation to approved parametric limits	Corrective Action Required? Y/N	Response / Action	
							Y/N	Date Completed
7	001-14	5/02/14	Complaint	Noise	Complaint regarding noise which started around Christmas Eve from the security patrol company caused by reversing beeper. Issue has been resolved.	Yes	Yes	6/02/14
1	013-13	17/07/13	Complaint	Blast	Complaint regarding blast. PDM was compliant with blast limits. Requested blasting results information, which was subsequently hand delivered by G. Goodwin.	No	Yes	17/07/13
2	012-13	21/06/13	Complaint	Blast	Complaint regarding blast. PDM was compliant with blast limits.	No	NA	NA
2	011-13	16/05/13	Complaint	Blast	Complaint regarding blast. Enquired why it went off a few minutes early. PDM was compliant with blast limits.	No	NA	NA
1	009-13	11/04/13	Complaint	Blast, Noise & Dust	Complaint regarding blast, noise and dust. PDM was compliant with blast limits.	No	NA	NA
2	010-13	11/04/13	Complaint	Blast, Noise & Dust	Complaint regarding blast, noise and dust. PDM was compliant with blast limits. Blast design reviewed. Noise logger placed at residence.	No	Yes	22/04/13
1	008-13	21/02/13	Complaint	Blast	Complaint regarding blast. PDM was compliant with blast limits.	No	NA	NA
2	006-13	31/01/13	Complaint	Blast	Complaint regarding the Blast. PDM was compliant with blast limits. Request for neighbours to get a paper copy of CCC meeting minutes.	Yes	Yes	31/01/13
1	007-13	31/01/13	Complaint	Blast	Complaint regarding blast. PDM was compliant with blast limits.	No	NA	NA
1	005-13	25/01/13	Complaint	Noise	Complaint about squeaky noise from the pit, possibly a dozer. Dozer moved to a lower location to reduce noise levels.	Yes	Yes	25/01/13
1	003-13	17/01/13	Complaint	Noise	Complaint about squeaky noise from the pit, possibly a dozer. Dozer moved to a lower location to reduce noise levels.	Yes	Yes	17/01/13
2	004-13	17/01/13	Complaint	Blast	Compliant with timing of blast. Thought it was not scheduled until the following week.	No	NA	NA
1	002-13	10/01/13	Complaint	Noise	Complaint about squeaky noise from the pit, possibly a dozer. Dozer moved to a lower location to reduce noise levels.	Yes	Yes	10/01/13
3	001-13	8/01/13	Complaint	Dust	Complaint regarding dust. Truck movements moved from top dump to bottom dump, water cart utilized.	Yes	Yes	8/01/13

9.2 COMMUNITY LIAISON

9.2.1 COMMUNITY CONSULTATIVE COMMITTEE

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.

During the reporting period a Community Consultative Committee (CCC) meeting was held on the 6th July 2017. In late 2017, a merger of the Pine Dale CCC with a wider regional EnergyAustralia CCC group (incorporating the Mt Piper Power Station and the Wallerawang Power Station) was approved by the Department of Planning. The second CCC meeting scheduled for December 2017 was then deferred until the first quarter of 2018, during which time the new Chair appointed to the merged committee by the DPE would actively recruit members for the new CCC.

9.2.2 WEBSITE INFORMATION

A website has been established 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; and EPL 4911. Copies of the following documents are made publicly available on the EnergyAustralia Website:

- EPL 4911;
- Environmental Assessment;
- Project Approval 10_0041;
- EPBC Act Referral Decision 2011/6016;
- The Care and Maintenance Mining Operation Plan;
- Environmental Management Plans for Pine Dale Mine;
- AEMR Reports / Annual Review;
- PIRMP;
- Independent Environmental Audits;
- Community Consultative Committee minutes;
- Community Complaints (Enquiries & Notifications);
- Blasting information; and
- Monthly Environmental Performance reports

9.2.3 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.

10 INDEPENDENT ENVIRONMENTAL AUDIT

There was no requirement for an Independent Environmental Audit (IEA) to be conducted at the Pine Dale Mine during the 2017 reporting period.

The last IEA was undertaken in August 2014. Copies of the audit report, the audit Action Plan and the auditor's recommendations and proposed actions by Pine Dale Mine are provided on the company website.

All of the non-compliances identified and recommendations made in the IEA Action Plan have been completed (refer **Table 23**).

As per the conditions of Project Approval 10_0041, no further IEA's are required at the Pine Dale Mine.

Table 23
Independent Environmental Audit Action Plan

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 3.27 (c)	<p>c) a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> i. groundwater assessment criteria, including trigger levels for investigating and potentially adverse groundwater impacts; ii. a program to monitor: <ul style="list-style-type: none"> i. groundwater inflows to the open cut mining operation ii. the impacts of the project on; <ul style="list-style-type: none"> - baseflows to Neubecks Creek; - any groundwater bores on privately owned land; and iii. a program to validate the groundwater model for the project, and calibrate it to site specific conditions; and iv. a plan to respond to any exceedances of the performance criteria, and offset the loss of any baseflow to Neubecks Creek caused by the project. 	<p>The previous IEA (URS, 2013, p.A-18) identified that this condition was non-compliant on the basis that the Bushfire Management Plan was not approved by State Forests by the end of April 2011. The Bushfire Management Plan has not been developed to the satisfaction of State Forests and has not been updated to reflect the Site response for a care and maintenance situation, as opposed to a mining operation.</p>	<p>Preparation – Compliant (2013)</p> <p>Implementation – Non-compliant</p> <p>Repeat Recommendation 2013/IEA/009 Consult with NOW, OEH and DPE to review water quality trigger values and based on the consultation update and implement the WMP (incorporating the GWMP).</p>	<p>Unforeseen delays in the progress of the Pine Dale Mine Stage 2 Extension Project application has caused delays in the review and updates of existing management plans. Enhance Place intends to review relevant Environmental Management plans in light of the site being held in care and maintenance for an extended period.</p>	<p>Completed in September 2015</p>
PA 10_0041, Condition 3.52	<p>By the end of April 2011, the Proponent shall prepare and implement a Bushfire Management Plan for the site, to the satisfaction of the State Forest in consultation with the local Rural Fire Service.</p>	<p>The previous IEA (URS, 2013, p.A-18) identified that this condition was non-compliant on the basis that the Bushfire Management Plan was not approved by State Forests by the end of April 2011. The Bushfire Management Plan has not been developed to the satisfaction of State Forests and has not been updated to reflect the Site response for a care and maintenance situation, as opposed to a mining operation.</p>	<p>Non-compliant 2014IEA/022 Recommendation Update the Bushfire Management Plan with respect to the Site being on care and maintenance. Ensure State Forests and the local RFS have involvement in the update of the Plan and confirm satisfaction of the plan from State Forests.</p>	<p>Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.</p>	<p>Completed in September 2015</p>

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 5.1	Environmental Management Strategy Refer to Appendix A for full Condition requirements.	<i>Pine Dale has been found non-compliant with this Condition as a number of key revisions and updates have not occurred to the Environmental Management Strategy during the audit period.</i>	<i>Preparation – Compliant (2013) Implementation – Non-compliant 2014/IEA/011 Recommendation Update the Environmental Management Strategy and relevant figures and plans to reflect current monitoring programs and reports as well as explain and reflect that the Site has moved from operational activities to a care and maintenance status and that controls as detailed in the strategy and plans will remain relevant.</i>	Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.	Completed in September 2015
PA 10_0041, Condition 5.4	Revision of Strategies, Plans and Programs Refer to Appendix A for full Condition requirements.	<i>This Condition was found non-compliant in accordance with Condition 5.4(c) as strategies, plans and programs were not updated following submission of the previous IEA (URS, 2013).</i>	Non-compliant 2014/IEA/012 Recommendation <i>Strategies, plans, and programs should be reviewed and revised to reflect recommendations provided in the previous Independent Environmental Audit report and to reflect the care and maintenance status of the Site.</i>	Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.	Completed in September 2015
PA 10_0041, Condition 5.8	Independent Environmental Audit Refer to Appendix A for full Condition requirements.	<i>Pine Dale was found non-compliant with this Condition due to timing of the 2014 independent environmental audit as the audit was not commenced until August 2014 as compared to the condition requirement of June 2014.</i>	Non-compliant (due to timing)	Noted, no further action required.	Completed

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
ML 1569, Condition 2	Mining, Rehabilitation, Environmental Management Process (MREMP) - Mining Operations Plan (MOP) Refer to Appendix A for full Condition requirements.	Refer to ML 1664, Condition 3(a). This condition was found to be non-compliant given the MOP expired on 28 February 2014 whilst mining operations were continuing (the Site went into care and maintenance in April 2014) and the draft Care and Maintenance MOP was yet to be formally approved at the time of writing this report.	Refer to ML 1664, Condition 3(a). Non-compliant (due to expiration of previous MOP and no approval of draft C&M MOP) 2014/IEA/018 Recommendation Prepare and implement a plan identifying detailed rehabilitation measures for the entire length of Neubecks Creek.	A draft C&M MOP was submitted to DRE in March 2014. DRE responded in May 2014 seeking clarifications which rely on external advice. The required external expert assessment and advice has been received. Enhance Place has been actively working on the preparation of a robust rehabilitation strategy to meet DRE requirements. A revised C&M MOP has been submitted to DRE for approval. A rehabilitation program for Neubecks Creek has been included in the C&M MOP submitted to DRE.	C&M MOP Completed in December 2014
ML 1569, Condition 3(a)	Mining Operations Plan Mining operations must not be carried out otherwise than in accordance with a Mining Operations Plan (MOP) which has been approved by the Director-General.	This condition was found to be non-compliant given the MOP expired on 28 February 2014 whilst mining operations were continuing (the Site went into care and maintenance in April 2014). Pine Dale has been consulting with DTRIS-DRE concerning the requirements for the draft Care and Maintenance Mining Operations Plan / Rehabilitation Management Plan since April 2014 and was in the process of actioning DTRIS-DRE requests for the draft MOP at the time of the audit with a view to approval by the end of 2014. Therefore DTRIS-DRE are aware of the situation with respect to the status of the MOP.	Non-compliant (due to expiration of previous MOP and no approval of draft C&M MOP)	See above comment	Completed December 2014

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
ML 1569, Condition 3(e)	A MOP ceases to have effect 7 years after date of approval or other such period as identified by the Director-General.	<i>This condition was found to be non-compliant given the 2011 MOP expired in February 2014 and a replacement MOP was in the process of being prepared but had not formally been approved.</i>	Non-compliant	See above comment	Completed December 2014

11 INCIDENTS AND NON COMPLIANCES

During the 2017 reporting period there were no instances of non-compliance in relation to the project approval, mining leases, or the water access licence.

There were no reportable incidents, official cautions, warning letters, penalty notices or prosecution proceedings by any regulatory body during the reporting period.

There were several exceedances of the water quality triggers for groundwater during the reporting period. However, as the mine has been under Care and Maintenance for the previous two years, it is considered these exceedances observed in the groundwater quality were not attributed to any operations occurring at the site. It is likely it is a reflection of rainfall variability and the long term recovery and return to equilibrium after the cessation of site operations.

The exceedances observed in surface water quality are considered to be due to rainfall variability at the site.

12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

The activities proposed for the 2018 reporting period are consistent with the Care & Maintenance MOP. General maintenance will be undertaken at the site in addition to rehabilitation activities including weed management, fertilizing and re-seeding as required.

12.1 MINING

All recoverable coal within the approved mining area was extracted during early 2014. No mining activities are proposed during the 2018 monitoring period.

12.2 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. A request to update the *Secretary's Environmental Assessment Requirements (SEARs)* was lodged by the Company in late 2016. Engagement with regulators and other key stakeholders will continue to be undertaken throughout 2018 as appropriate.

12.3 DOCUMENT REVIEWS

During the 2017 reporting period the Pine Dale Mine Care & Maintenance MOP was scheduled for review. An application to extend the C&M MOP for a further 2 years was approved by the DPE in April 2017. As such, no document reviews are forecast for the 2018 reporting period.

13 REFERENCES

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

FirstField Environmental (2014) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

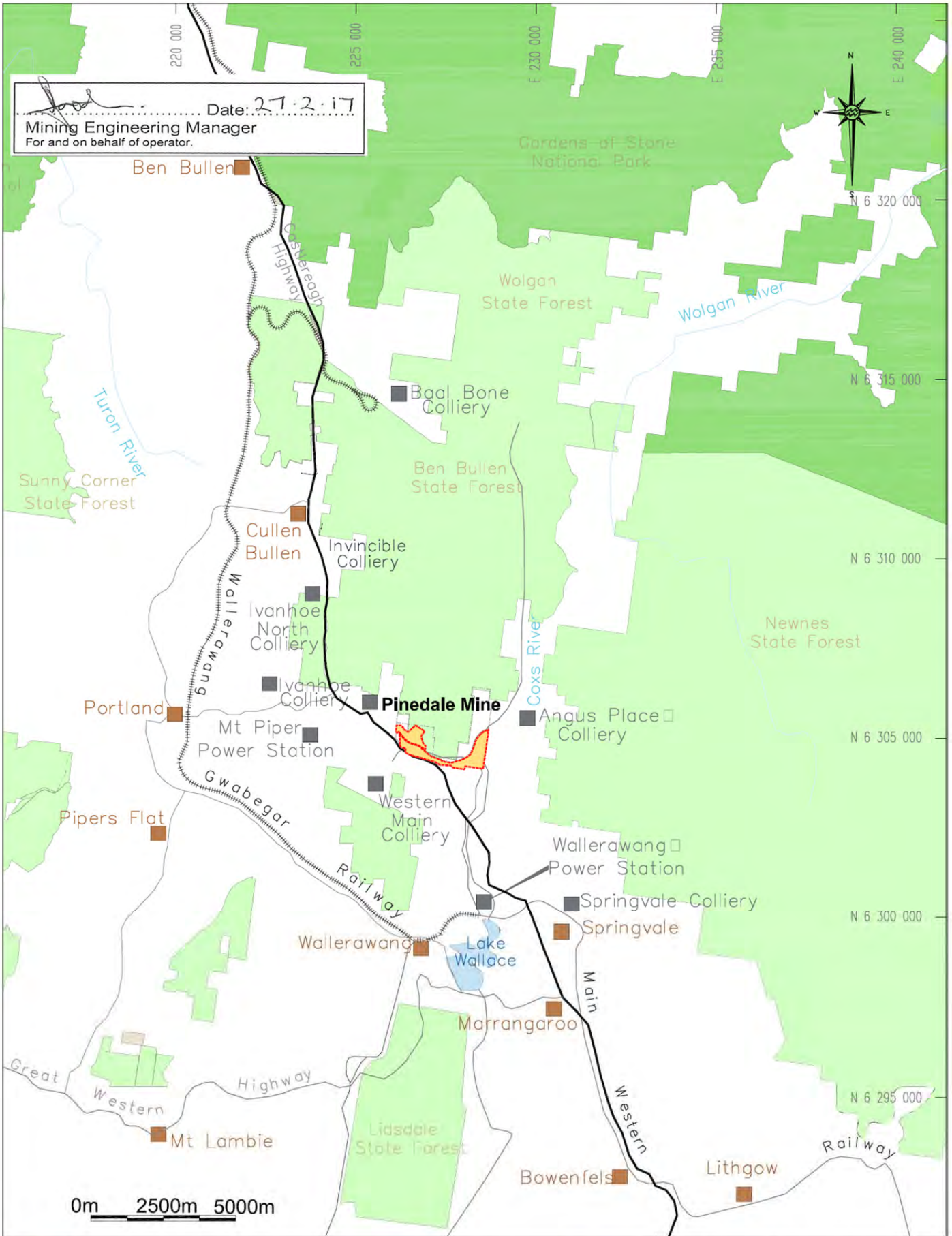
FirstField Environmental (2015) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

FirstField Environmental (2016) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

FirstField Environmental (2017) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

APPENDIX A

SITE PLANS 2017




 Date: 27.2.17
 Mining Engineering Manager
 For and on behalf of operator.

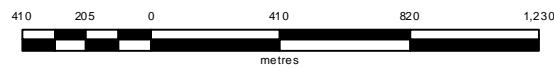
LEGEND	
	Pinedale Mine
	State Forest
	National Park
	Pinedale Mining Authority
	Castlereagh Highway
	Railway Line



Pine Dale Mine Regional Locality				Plant: 1
Drawn By: K Tripp	Date: 6/02/18	Drawing No.: 23.4.11.6.1	Revision: C	MGA Zone 56



- Legend**
- Noise Monitoring Location
 - Depositional Dust Monitoring Location
 - Groundwater Monitoring Location
 - High Volume Air Sampling Location
 - Meteorological Monitoring Location
 - Surface Water Monitoring Location



**PINE DALE MINE
CURRENT
ENVIRONMENTAL MONITORING LOCATIONS**

CLIENT Pine Dale Mine		PROJECT No 6880-1755
DRAWN BY KT	SCALE 1:24,000 (A3)	DRAWING No Plan 2a
APPROVED BY KT	DATE 06/02/2018	OFFICE NEWCASTLE



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



Aerial image taken from Google Earth, 23 May 2006



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

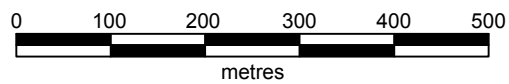
CLIENT	Pine Dale Mine			RCA Ref	6880-1755	
DRAWN BY	KT	SCALE	1 : 5000 (A3)	DRAWING No	Plan 2b	REV 0
APPROVED BY	KT	DATE	06/02/2018	OFFICE	NEWCASTLE	

CDT-DWG-A3H-001/1



LEGEND

- Yarraboldy Extension Area (21.9ha)
- Rehabilitation Area - Native Forest (7.1ha)
- Rehabilitation Area - Pasture (25.4ha)
- Dams
- Bund Wall
- Road

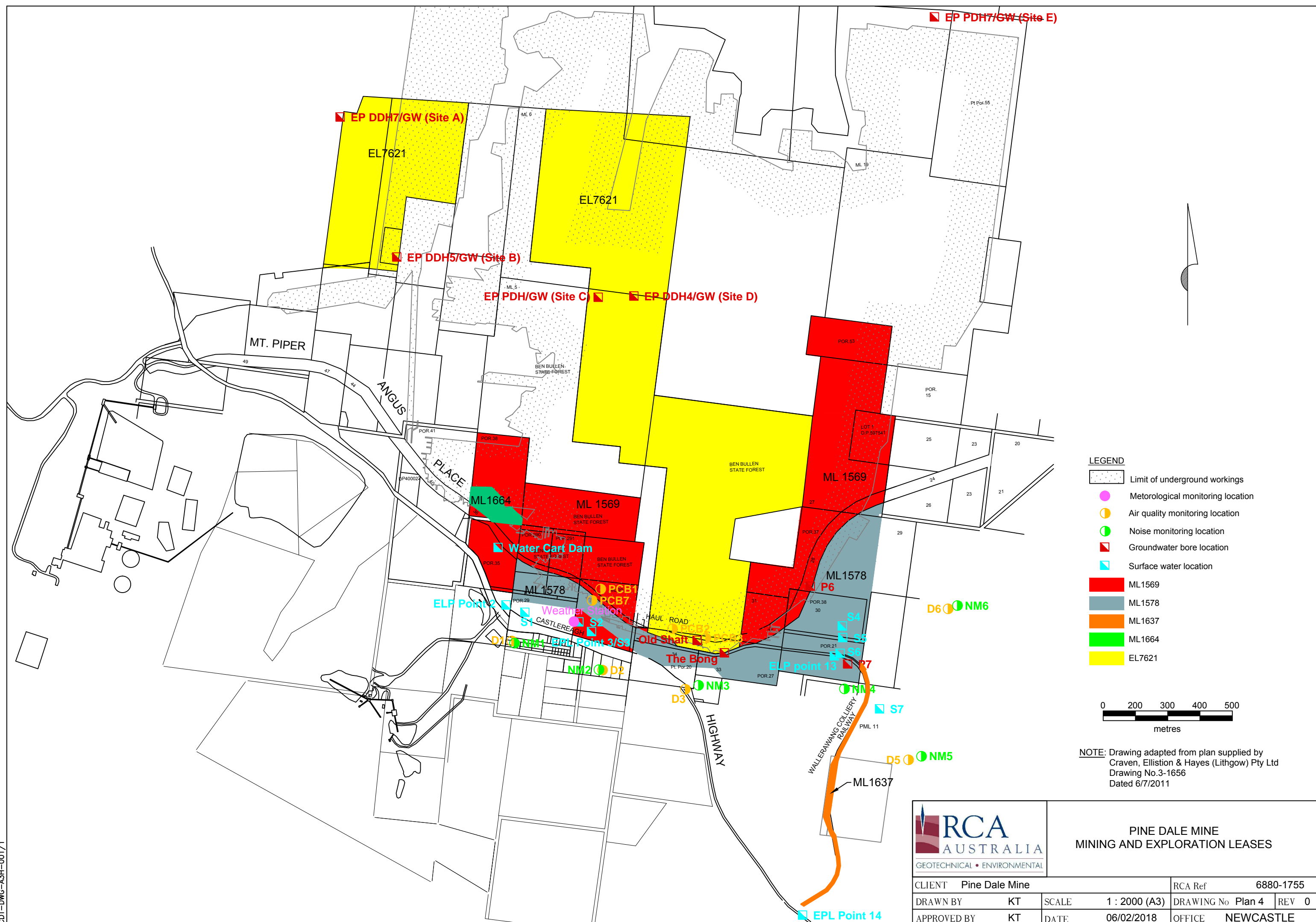


NOTE: Drawing adapted from plan supplied by Craven, Ellistion & Hayes (Lithgow) Pty Ltd
 Drawing No. PINE AEMR13
 Dated 31/12/2013

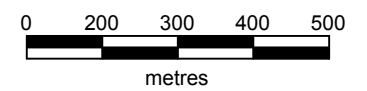


 GEOTECHNICAL • ENVIRONMENTAL		PINE DALE MINE REHABILITATION DOMAINS DECEMBER 2017					
		CLIENT	Pine Dale Mine	RCA Ref	6880-1755		
DRAWN BY	KT	SCALE	1 : 8000 (A3)	DRAWING No	Plan 3	REV	0
APPROVED BY	KT	DATE	06/02/2018	OFFICE	NEWCASTLE		

CDT-DWG-A3H-001/1



- LEGEND**
- Limit of underground workings
 - Meteorological monitoring location
 - Air quality monitoring location
 - Noise monitoring location
 - Groundwater bore location
 - Surface water location
 - ML 1569
 - ML 1578
 - ML 1637
 - ML 1664
 - EL 7621



NOTE: Drawing adapted from plan supplied by Craven, Ellistion & Hayes (Lithgow) Pty Ltd Drawing No.3-1656 Dated 6/7/2011



PINE DALE MINE MINING AND EXPLORATION LEASES

CLIENT	Pine Dale Mine		RCA Ref	6880-1755	
DRAWN BY	KT	SCALE	1 : 2000 (A3)	DRAWING No	Plan 4
APPROVED BY	KT	DATE	06/02/2018	OFFICE	NEWCASTLE
				REV	0

CDT-DWG-A3H-001/1

APPENDIX B

ENVIRONMENTAL MONITORING SUMMARY REPORT



AEMR SUMMARY REPORT COMPILED FOR PINE DALE MINE

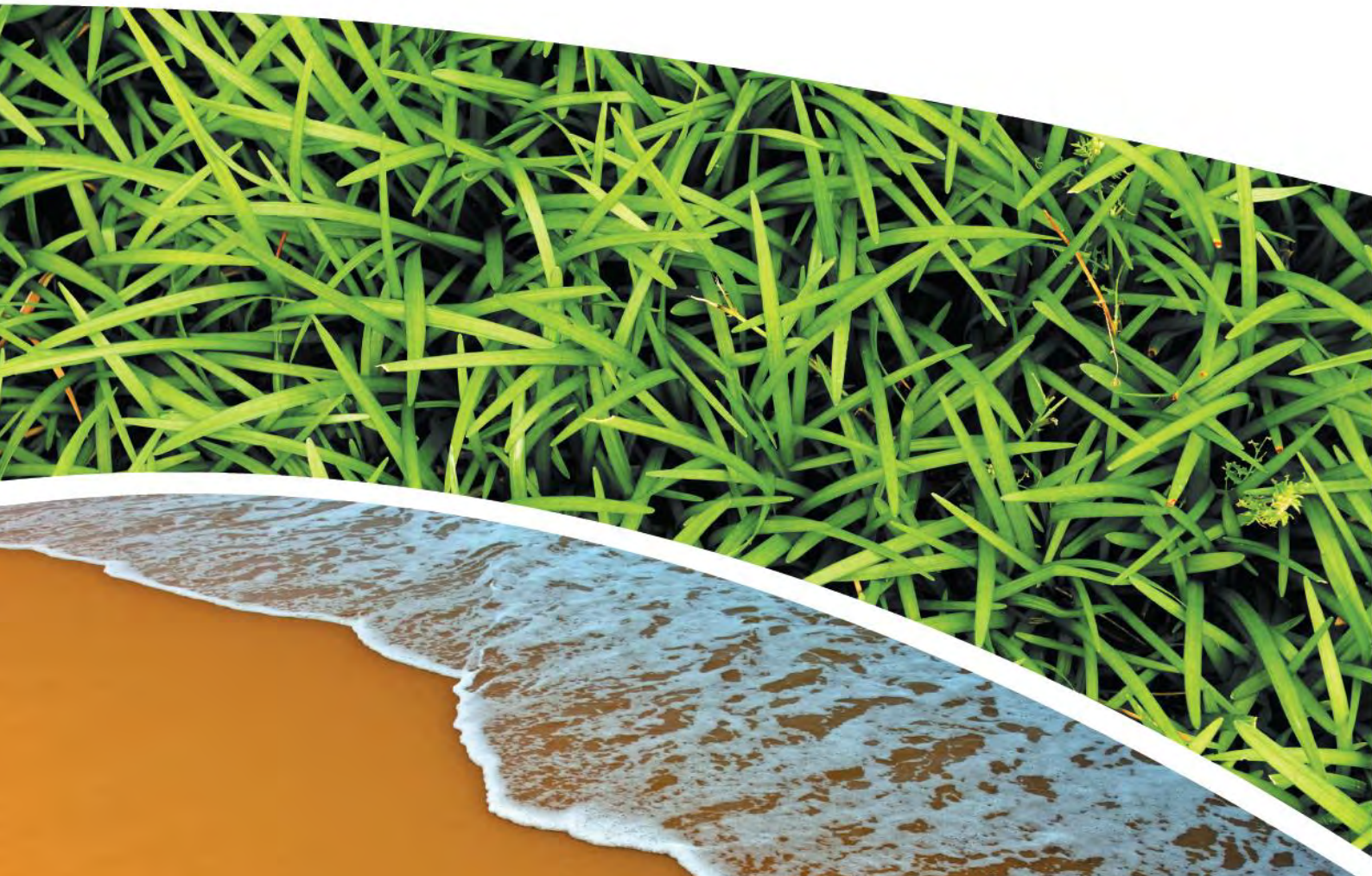
**Environmental Performance Monitoring
January – December 2017**

Pine Dale Mine

RCA Australia

RCA ref 6880-1755a/0

6 February 2018



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DOCUMENT STATUS						
Rev No	Comment	Author	Reviewer	Approved for Issue (Project Manager)		
				Name	Signature	Date
/0	Final	Katy Shaw	Karen Tripp	K Tripp		8.02.2018

DOCUMENT DISTRIBUTION				
Rev No	Copies	Format	Issued to	Date
/0	1	Electronic (email)	Pine Dale Mine – Graham Goodwin; Mark Frewin; Ben Eastwood; Alicia de Vos	8.02.2018
/0	1	Electronic report	RCA – job archive	8.02.2018



RCA-LE ref 6880-1755a/0



6 February 2018

Pine Dale Mine
PO Box 202
WALLERAWANG NSW 2845

Attention: Mr Graham Goodwin

**ANNUAL SUMMARY REPORT
COMPILED FOR PINE DALE MINE
DETAILING ENVIRONMENTAL PERFORMANCE MONITORING
JANUARY – DECEMBER 2017**

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APPENDIX

APPENDIX 1

ENVIRONMENTAL MONITORING LOCATIONS

STREAM HEALTH & CHANNEL STABILITY MONITORING LOCATIONS

1 EXECUTIVE SUMMARY

Pine Dale Mine achieved an acceptable standard of environmental performance during the 2017 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 (PM₁₀) were below the Project Approval (PA 10_0041) and 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;
- 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 2017. Summary data is comprised of High Volume Air Samples (TSP & PM₁₀), Depositional Dust, Surface Water, Groundwater, Channel Stability and Stream Health Monitoring; and Noise 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*; the *Air Quality and Greenhouse Gas Management Plan*; *Purple Copper Butterfly Monitoring Programme*; and the *Noise 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).

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 **Tables 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 25µg/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 (EPL 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 2017 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D1	0.9	0.4	0.5
Feb-17	D1	0.8	0.4	0.4
Mar-17	D1	0.7	0.4	0.3
Apr-17	D1	0.2	0.05*	0.2
May-17	D1	0.3	0.2	0.1
Jun-17	D1	0.4	0.2	0.2
Jul-17	D1	0.3	0.05*	0.3
Aug-17	D1	0.5	0.2	0.3
Sep-17	D1	0.6	0.3	0.3
Oct-17	D1	1.0	0.6	0.4
Nov-17	D1	0.4	0.05*	0.4
Dec-17	D1	0.8	0.4	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 5 *Depositional Dust Data Summary Gauge D2 Jan – Dec 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D2	0.5	0.1	0.4
Feb-17	D2	0.2	0.05*	0.2
Mar-17	D2	0.6	0.4	0.2
Apr-17	D2	0.4	0.1	0.3
May-17	D2	0.2	0.1	0.1
Jun-17	D2	0.1	0.05*	0.1
Jul-17	D2	0.2	0.1	0.1
Aug-17	D2	0.4	0.1	0.3
Sep-17	D2	0.5	0.2	0.3
Oct-17	D2	1.0	0.7	0.3
Nov-17	D2	0.4	0.2	0.2
Dec-17	D2	0.6	0.3	0.3
ANNUAL AVERAGE		0.4	0.2	0.2

* 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D3	0.4	0.1	0.3
Feb-17	D3	0.9	0.5	0.4
Mar-17	D3	0.9	0.6	0.3
Apr-17	D3	0.2	0.05*	0.2
May-17	D3	0.5	0.3	0.2
Jun-17	D3	0.1	0.05*	0.1
Jul-17	D3	0.1	0.05*	0.1
Aug-17	D3	0.5	0.3	0.2
Sep-17	D3	0.2	0.05*	0.2
Oct-17	D3	1.0	0.6	0.4
Nov-17	D3	0.4	0.1	0.3
Dec-17	D3	0.9	0.6	0.3
ANNUAL AVERAGE		0.5	0.3	0.2

* 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D4	0.7	0.1	0.6
Feb-17	D4	1.0	0.4	0.6
Mar-17	D4	0.9	0.4	0.5
Apr-17	D4	0.5	0.1	0.4
May-17	D4	0.3	0.05*	0.3
Jun-17	D4	0.2	0.05*	0.2
Jul-17	D4	0.2	0.1	0.1
Aug-17	D4	0.2	0.1	0.1
Sep-17	D4	0.3	0.1	0.2
Oct-17	D4	0.9	0.7	0.2
Nov-17	D4	0.1	0.05*	0.1
Dec-17	D4	0.6	0.1	0.5
ANNUAL AVERAGE		0.5	0.2	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 8 *Depositional Dust Data Summary Gauge D5 Jan – Dec 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D5	0.6	0.3	0.3
Feb-17	D5	0.7	0.4	0.3
Mar-17	D5	0.6	0.4	0.2
Apr-17	D5	0.2	0.05*	0.2
May-17	D5	0.5	0.3	0.2
Jun-17	D5	0.2	0.05*	0.2
Jul-17	D5	0.2	0.05*	0.2
Aug-17	D5	0.4	0.2	0.2
Sep-17	D5	0.5	0.3	0.2
Oct-17	D5	0.8	0.5	0.3
Nov-17	D5	0.3	0.1	0.2
Dec-17	D5	0.4	0.1	0.3
ANNUAL AVERAGE		0.5	0.3	0.2

* 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	D6	0.05*	0.05*	0.05*
Feb-17	D6	2.8	1.4	1.4
Mar-17	D6	1.0	0.6	0.4
Apr-17	D6	2.8	0.7	2.1
May-17	D6	0.5	0.3	0.2
Jun-17	D6	0.2	0.05*	0.2
Jul-17	D6	0.3	0.1	0.2
Aug-17	D6	0.4	0.3	0.1
Sep-17	D6	0.6	0.4	0.2
Oct-17	D6	0.7	0.5	0.2
Nov-17	D6	0.4	0.2	0.2
Dec-17	D6	0.1	0.05*	0.1
ANNUAL AVERAGE		0.8	0.4	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 10 *Depositional Dust Data Summary Gauge PCB1 Jan – Dec 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	PCB1	0.8	0.1	0.7
Feb-17	PCB1	2.5	0.7	1.8
Mar-17	PCB1	1	0.4	0.6
Apr-17	PCB1	0.8	0.1	0.7
May-17	PCB1	0.4	0.1	0.3
Jun-17	PCB1	0.5	0.1	0.4
Jul-17	PCB1	0.1	0.05*	0.1
Aug-17	PCB1	0.8	0.3	0.5
Sep-17	PCB1	1.3	0.4	0.9
Oct-17	PCB1	0.8	0.4	0.4
Nov-17	PCB1	0.8	0.2	0.6
Dec-17	PCB1	0.9	0.2	0.7
ANNUAL AVERAGE		0.9	0.3	0.6

* 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	PCB2	1	0.1	0.9
Feb-17	PCB2	0.8	0.1	0.7
Mar-17	PCB2	0.8	0.2	0.6
Apr-17	PCB2	0.4	0.05*	0.4
May-17	PCB2	0.1	0.05*	0.1
Jun-17	PCB2	0.1	0.05*	0.1
Jul-17	PCB2	0.3	0.05*	0.3
Aug-17	PCB2	0.4	0.2	0.2
Sep-17	PCB2	1.2	0.4	0.8
Oct-17	PCB2	0.8	0.5	0.3
Nov-17	PCB2	0.9	0.2	0.7
Dec-17	PCB2	0.8	0.1	0.7
ANNUAL AVERAGE		0.6	0.2	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 12 *Depositional Dust Data Summary Gauge PCB3 Jan – Dec 2017*

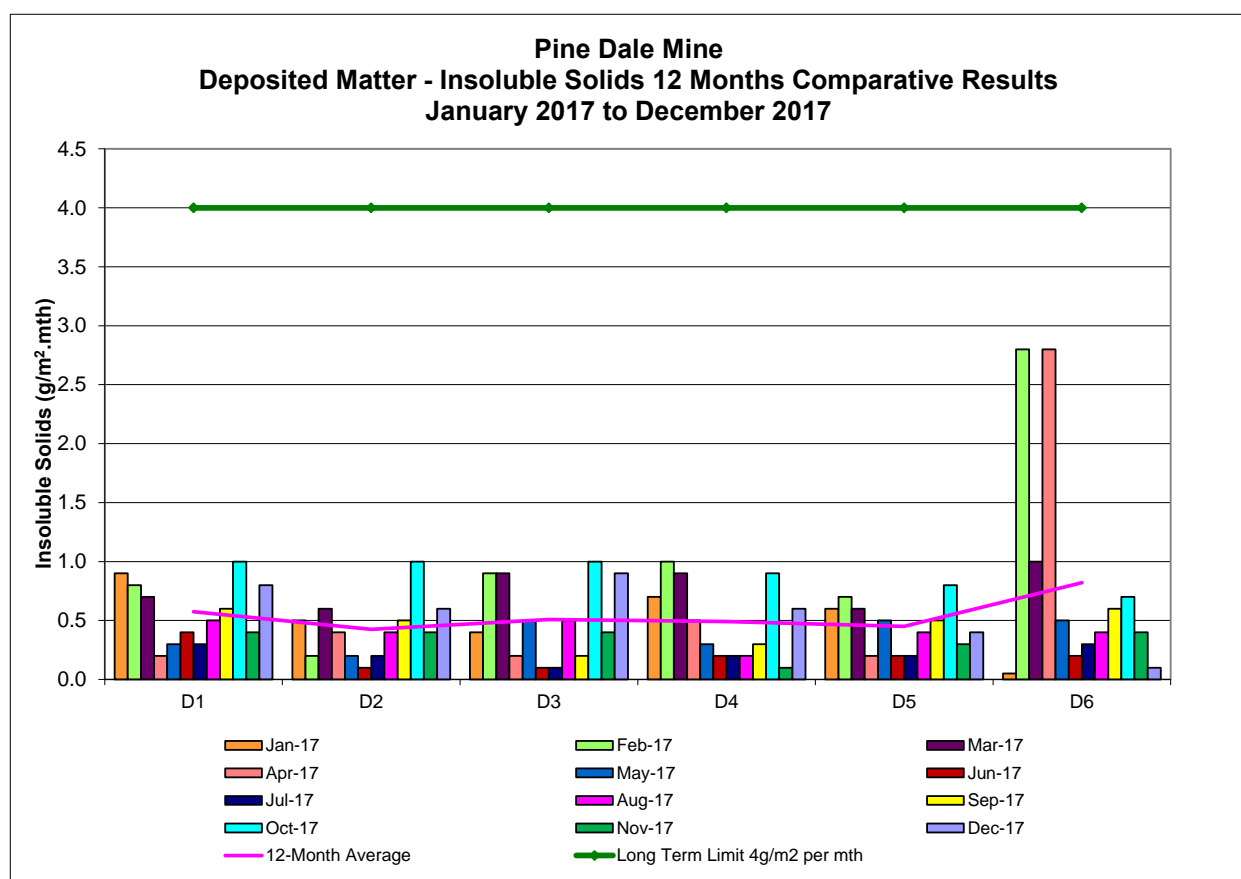
Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	PCB3	2.2	0.2	2
Feb-17	PCB3	1.5	0.2	1.3
Mar-17	PCB3	0.5	0.1	0.4
Apr-17	PCB3	0.3	0.05*	0.3
May-17	PCB3	0.4	0.2	0.2
Jun-17	PCB3	0.4	0.1	0.3
Jul-17	PCB3	0.4	0.05*	0.4
Aug-17	PCB3	0.5	0.2	0.3
Sep-17	PCB3	0.8	0.2	0.6
Oct-17	PCB3	1	0.5	0.5
Nov-17	PCB3	0.3	0.05*	0.3
Dec-17	PCB3	0.8	0.2	0.6
ANNUAL AVERAGE		0.8	0.2	0.6

* 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 2017*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-17	PCB7	1.3	0.3	1.0
Feb-17	PCB7	1.3	0.3	1.0
Mar-17	PCB7	0.6	0.2	0.4
Apr-17	PCB7	0.7	0.1	0.6
May-17	PCB7	0.6	0.2	0.4
Jun-17	PCB7	0.2	0.05*	0.2
Jul-17	PCB7	0.2	0.05*	0.2
Aug-17	PCB7	2.3	1.4	0.9
Sep-17	PCB7	0.5	0.3	0.2
Oct-17	PCB7	0.9	0.5	0.4
Nov-17	PCB7	0.8	0.3	0.5
Dec-17	PCB7	0.7	0.2	0.5
ANNUAL AVERAGE		0.8	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.

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

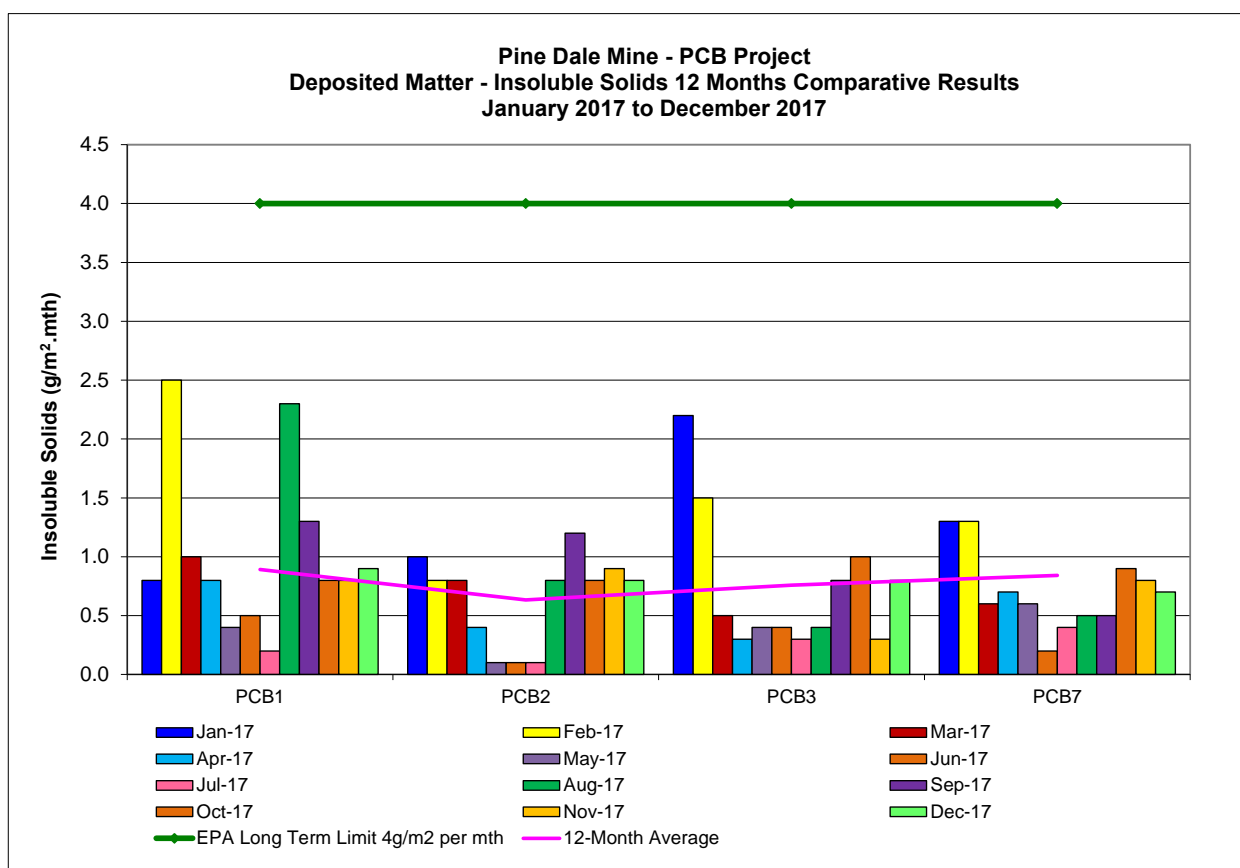


Figure 2 *Depositional Dust Results – Gauges PCB1-3 & PCB7*

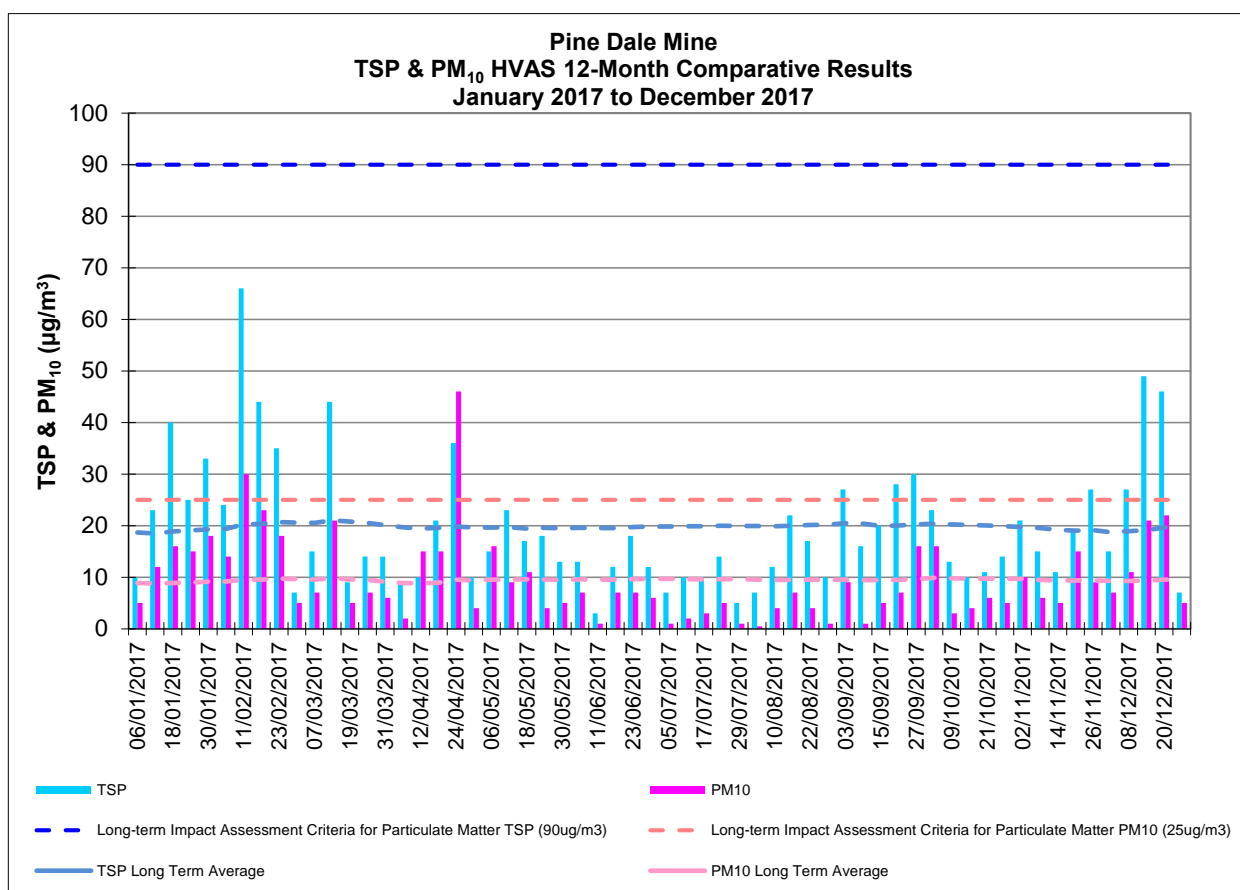
3.2 AIR MONITORING RESULTS – HVAS PARTICULATE MATTER DATA SUMMARY

Pine Dale Coal Mine monitors Total Particulate Matter less than 10 μ m (PM₁₀) 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 PM₁₀ 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 2017 are shown in **Table 14**. Graphical presentations are shown in **Figure 3**.

Table 14 *HVAS Particulate Matter Summary Jan – Dec 2017*

Run Date	HVAS TSP ($\mu\text{g}/\text{m}^3$)	HVAS PM ₁₀ ($\mu\text{g}/\text{m}^3$)	Run Date	HVAS TSP ($\mu\text{g}/\text{m}^3$)	HVAS PM ₁₀ ($\mu\text{g}/\text{m}^3$)
06-Jan-17	10	5	05-Jul-17	7	1
12-Jan-17	23	12	11-Jul-17	10	2
18-Jan-17	40	16	17-Jul-17	10	3
24-Jan-17	25	15	23-Jul-17	14	5
30-Jan-17	33	18	29-Jul-17	5	1
05-Feb-17	24	14	04-Aug-17	7	<1
11-Feb-17	66	30	10-Aug-17	12	4
17-Feb-17	44	23	16-Aug-17	22	7
23-Feb-17	35	18	22-Aug-17	17	4
01-Mar-17	7	5	28-Aug-17	10	1
07-Mar-17	15	7	03-Sep-17	27	9
13-Mar-17	44	21	09-Sep-17	16	1
19-Mar-17	9	5	15-Sep-17	20	5
25-Mar-17	14	7	21-Sep-17	28	7
31-Mar-17	14	6	27-Sep-17	30	16
06-Apr-17	9	2	03-Oct-17	23	16
12-Apr-17	10	15	09-Oct-17	13	3
18-Apr-17	21	15	15-Oct-17	10	4
24-Apr-17	36	46	21-Oct-17	11	6
30-Apr-17	10	4	27-Oct-17	14	5
06-May-17	15	16	02-Nov-17	21	10
12-May-17	23	9	08-Nov-17	15	6
18-May-17	17	11	14-Nov-17	11	5
24-May-17	18	4	20-Nov-17	19	15
30-May-17	13	5	26-Nov-17	27	9
05-Jun-17	13	7	02-Dec-17	15	7
11-Jun-17	3	1	08-Dec-17	27	11
17-Jun-17	12	7	14-Dec-17	49	21
23-Jun-17	18	7	20-Dec-17	46	22
29-Jun-17	12	6	26-Dec-17	7	5
Annual Average				19.6	9.5



3.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS

3.3.1 DEPOSITIONAL DUST RESULTS

Depositional Dust results for the period January – December 2017 show an average insoluble solids range of 0.4g/m² per month to 0.8g/m² per month for dust gauges D1 to D6. These results fall well below the nominated annual average assessment criteria of 4.0g/m² per month, as stipulated in the *Air Quality Monitoring Program*.

A review of historical data captured over the previous five years indicate during the 2017 period there were no instances where the dust gauges showed results which were greater than the maximum annual average increase of 2g/m² per month deposited matter, as stipulated in the site's Air Quality Monitoring Program.

It is noted that dust gauges PCB1, PCB2, PCB3 and PCB7 are located in a bushland setting under the canopy of tall trees and as such, these gauges do not conform to the siting requirements of AS/NZS 35801.1 (2007). The purpose of these gauges is to determine the level of dust present at each location to aid in the 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 2017 show an average result of 19.6µg/m³, which is well below the nominated annual average assessment criterion of 90µg/m³ for total suspended particulates. During the reporting period the TSP HVAS recorded 100% data capture, with sampling undertaken in accordance with AS/NZS 3580.9.3, with two exceptions. On 23 July 2017 and 2 November 2017, the TSP HVAS

run time was outside of the 24 ±1 hour sampling period stipulated in AS/NZS 3580.9.3, with sampling conducted for 14.4 hours and 33.9 hours respectively.

Similarly, the HVAS particulate matter results less than 10µm (PM₁₀) also show results within the required *Air Quality Monitoring Program* assessment criteria. The average PM₁₀ result was 9.5µg/m³, which is below the annual average PM₁₀ assessment criteria of 25µg/m³. All HVAS results were below the OEHL 24 hour maximum assessment criteria of 50µg/m³ with the maximum concentration reported during 2017 being 46µg/m³ on 24 April 2017.

During the reporting period the PM₁₀ HVAS recorded 100% data capture. Sampling during 2017 was undertaken in accordance with AS/NZS 3580.9.6, with the exception of the run on 6 April 2017 where the PM₁₀ sampler ran for 44 hours; which was outside of the 24±1 hour period stipulated in AS/NZS 3580.9.6.

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. Site specific Trigger Values for Standing Water Level (SWL) and water quality parameters pH and Electrical Conductivity were 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). The groundwater trigger values are shown in **Table 15**.

Table 15 Groundwater Trigger Levels¹

Bore	pH (range)	Electrical Conductivity (µS/cm)	SWL Trigger (m, AHD)
P6	6.2 - 8.0	1201	882.25
P7	6.2 - 8.0	852	882.31
EP DDH4/GW (Bore D)	6.7 - 8.0	608	940.61
EP DDH7/GW (Bore A)	6.5 - 8.5	894	954.00
EP PDH1/GW (Bore C)	6.7 - 8.0	490	889.25
EP PDH3/GW (Enhance)	NA	NA	891.06
EP PDH4/GW (Enhance)	NA	NA	890.95
EP PDH7/GW (Bore E)	5.5 - 8.0	151	938.43
Old ventilation shaft	6.1 - 8.0	1100	887.84
The Bong (at SW location)	5.8 - 8.0	1157	NA

NA – no trigger value required for these locations.

¹ It is noted that a revised set of trigger values were submitted to the Department of Primary Industries Water (DPI Water) in September 2017, however a response has yet to be provided to Enhanced Place Pty Ltd. The revised trigger values are assumed to be accepted, however, and have therefore been used for this summary report.

4.2 GROUNDWATER MONITORING DATA SUMMARY

Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the *Groundwater Monitoring Program* and the *Water Management Plan*. Sampling is conducted at a total of three locations within the mine site; a further seven locations surrounding the Yarraboldy Extension area (4 sampling wells & 3 vibrating wire piezometer wells); 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 2017 are shown in **Tables 16 to 25**. Graphical presentations of standing water levels are shown in **Figures 4 to 6**.

Table 16 Groundwater Monitoring Bore P6 Results Jan - Dec 2017

Location	Site Bore P6													
Sample Number	01176880009	02176880011	03176880009	04176880009	05176880011	06176880009	07176880009	08176880011	09176880009	10176880009	11176880011	12176880009	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17		
Time Sampled	10:30	8:28	17:16	12:52	14:16	17:07	12:37	16:08	9:08	16:25	13:09	14:33		
Standing Water Level (m)	24.20	24.51	24.84	24.71	25.00	25.20	25.40	25.52	25.74	25.82	26.00	25.93		
Standpipe Height (m)	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 Water Level (m)	23.25	23.56	23.89	23.76	24.05	24.25	24.45	24.57	24.79	24.87	25.05	24.98		
Water Level AHD (m)#	893.70	893.39	893.06	893.19	892.90	892.70	892.50	892.38	892.16	892.08	891.90	891.97		882.25
Temperature (°C)	16.0	16.5	16.0	15.0	16.1	15.0	15.0	13.6	14.0	12.0	16.0	16.5		
pH	5.99	6.29	6.46	6.68	6.07	6.17	6.16	6.20	6.13	6.23	6.19	5.80		6.2 to 8.0
Conductivity (µS/cm)	1281	903	1071	1270	1350	1410	1450	1450	1330	1470	1510	1450		1201
Turbidity (NTU)	23	13	8	28	35	69	44	45	96	166	66	81		
Dissolved Oxygen (mg/L)	3.9	5.0	5.2	3.9	4.1	3.2	2.8	5.6	2.7	5.4	<2	4.0		
TSS (mg/L)	48	52	32	54	38	58	57	39	89	74	58	69		
Oil & Grease (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		
Bicarbonate Alkalinity (mg/L)	56	45	57	82	68	61	82	84	86	79	71	65		
Total Alkalinity (mg/L)	56	45	57	82	68	61	82	84	86	79	71	65		
Sulphate (mg/L)	697	586	604	483	502	556	558	672	497	500	663	693		
Chloride (mg/L)	34	31	36	33	30	30	30	33	30	35	33	36		
Calcium (mg/L)	140	119	129	118	118	128	118	123	124	135	134	148		
Magnesium (mg/L)	62	64	61	55	59	57	57	55	56	54	62	59		
Sodium (mg/L)	58	58	53	49	48	48	50	48	52	46	53	51		
Potassium (mg/L)	20	21	18	18	18	18	18	18	20	19	19	18		
Cobalt (dissolved) (mg/L)	0.066	0.067	0.059	0.058	0.063	0.068	0.071	0.072	0.076	0.08	0.081	0.089		
Manganese (dissolved) (mg/L)	2.75	2.5	2.58	2.4	2.4	2.58	2.66	2.5	2.6	2.99	2.72	3.07		
Nickel (dissolved) (mg/L)	0.116	0.115	0.091	0.086	0.101	0.1	0.106	0.109	0.113	0.121	0.127	0.15		
Zinc (dissolved) (mg/L)	0.119	0.13	0.013	0.15	0.144	0.193	0.052	0.039	0.035	0.09	0.064	0.054		
Iron (dissolved) (mg/L)	36.1	30	36.1	25.9	24	24.6	34.1	30.7	34.2	36.6	35.8	46.6		

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 17 Groundwater Monitoring Bore P7 Results Jan - Dec 2017

Location	Site Bore P7												Trigger Levels
	01176880010	02176880012	03176880010	04176880010	05176880012	06176880010	07176880010	08176880012	09176880010	10176880010	11176880012	12176880010	
Sample Number	01176880010	02176880012	03176880010	04176880010	05176880012	06176880010	07176880010	08176880012	09176880010	10176880010	11176880012	12176880010	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	9/01/17	9/02/17	9/03/17	10/04/17	11/05/17	8/06/17	10/07/17	10/08/17	08/09/17	9/10/17	8/11/17	11/12/17	
Time Sampled	13:04	9:20	17:52	13:42	15:07	12:45	13:19	16:50	11:18	17:05	14:00	15:40	
Standing Water Level (m)	7.65	7.71	7.87	7.67	7.80	7.87	7.93	7.90	7.96	7.84	7.96	7.92	
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 Water Level (m)	6.65	6.71	6.87	6.67	6.80	6.87	6.93	6.90	6.96	6.84	6.96	6.92	
Water Level AHD (m)#	887.75	887.69	887.53	887.73	887.60	887.53	887.47	887.50	887.44	887.56	887.44	887.48	882.31
Temperature (°C)	16.0	16.0	16.0	15.5	15.8	16.0	15.0	14.2	14.5	16.0	16.0	16.5	
pH (pH units)	6.18	6.23	6.87	6.70	6.29	6.52	6.31	6.22	6.29	6.40	6.30	6.31	6.2 to 8.0
Conductivity (µS/cm)	845	612	724	<i>857</i>	821	<i>860</i>	843	823	842	<i>873</i>	<i>866</i>	685	852
Bicarbonate Alkalinity (mg/L)	---	212	---	---	198	---	---	222	---	---	214	---	
Total Alkalinity (mg/L)	---	212	---	---	198	---	---	222	---	---	214	---	
Sulphate (mg/L)	---	101	---	---	115	---	---	61	---	---	61	---	
Chloride (mg/L)	---	62	---	---	78	---	---	90	---	---	108	---	
Calcium (mg/L)	---	41	---	---	46	---	---	44	---	---	45	---	
Magnesium (mg/L)	---	56	---	---	44	---	---	47	---	---	48	---	
Sodium (mg/L)	---	51	---	---	42	---	---	45	---	---	49	---	
Potassium (mg/L)	---	8	---	---	8	---	---	7	---	---	8	---	
Iron (dissolved) (mg/L)	---	<0.05	---	---	<0.05	---	---	0.08	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 18 Groundwater Monitoring Bore Old Shaft Results Jan - Dec 2017

Location	Site Bore 'Old Shaft'													
Sample Number	1176880013	02176880015	03176880013	04176880013	05176880015	06176880013	07176880013	08176880015	09176880013	10176880013	11176880015	12176880013	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17		
Time Sampled	12:22	7:58	17:06	12:40	12:15	16:20	12:18	15:01	17:27	16:09	12:36	14:00		
Standing Water Level (m)	10.46	10.82	11.11	11.03	11.32	11.50	11.70	11.85	11.98	12.11	12.2	14.24		
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 Water Level (m)	8.76	9.12	9.41	9.33	9.62	9.80	10.00	10.15	10.28	10.41	10.50	12.54		
Water Level AHD (m)#	894.28	893.92	893.63	893.71	893.42	893.24	893.04	892.89	892.76	892.63	892.54	890.5		887.84
Temperature (°C)	18.0	16.5	18.0	14.8	15.5	17.2	16.0	15.7	12.0	17.0	17.0	19.2		
pH	5.42	5.58	5.77	6.06	5.63	5.76	5.72	5.72	5.62	5.99	5.74	5.46		6.1 to 8.0
Conductivity (µS/cm)	1251	1032	1071	1410	1530	1540	1530	1550	1510	1570	1600	1490	1100	
Turbidity (NTU)	37	25	14	42	35	119	121	78	73	326	48	1000		
Dissolved Oxygen (mg/L)	---	4.2	---	---	3.8	---	---	4.6	---	---	<2	---		
TSS (mg/L)	---	49	---	---	33	---	---	39	---	---	39	---		
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---		
Bicarbonate Alkalinity (mg/L)	---	32	---	---	42	---	---	39	---	---	214	---		
Total Alkalinity (mg/L)	---	32	---	---	42	---	---	39	---	---	214	---		
Sulphate (mg/L)	---	675	---	---	613	---	---	701	---	---	819	---		
Chloride (mg/L)	---	29	---	---	27	---	---	29	---	---	27	---		
Calcium (mg/L)	---	124	---	---	142	---	---	140	---	---	154	---		
Magnesium (mg/L)	---	68	---	---	59	---	---	62	---	---	69	---		
Sodium (mg/L)	---	52	---	---	43	---	---	45	---	---	49	---		
Potassium (mg/L)	---	18	---	---	19	---	---	18	---	---	20	---		
Cobalt (dissolved) (mg/L)	---	0.151	---	---	0.149	---	---	0.15	---	---	0.141	---		
Manganese (dissolved) (mg/L)	---	2.95	---	---	3.38	---	---	3.24	---	---	3.48	---		
Nickel (dissolved) (mg/L)	---	0.236	---	---	0.239	---	---	0.236	---	---	0.229	---		
Zinc (dissolved) (mg/L)	---	0.648	---	---	0.492	---	---	0.446	---	---	0.427	---		
Iron (dissolved) (mg/L)	---	21	---	---	20	---	---	19.1	---	---	26.4	---		

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 19 Groundwater Monitoring Location 'The Bong' Results Jan – Dec 2017

Location	Surface Water The Bong												Trigger Levels
Sample Number	01176880001	02176880001	03176880001	04176880001	05176880001	06176880001	07176880001	08176880001	09176880001	10176880001	11176880001	12176880001	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	10:12	8:05	Dry	12:47	12:33	16:33	12:28	15:20	8:55	Dry	12:46	14:15	
Temperature (°C)	27.0	20.0		12.5	15.0	12.0	11.0	15.5	8.5		17.8	26.5	
pH	5.80	5.23		6.49	7.52	6.32	6.98	6.08	6.80		5.63	4.51	5.8 – 8.0
Conductivity (µS/cm)	613	524		205	307	169	208	286	445		433	238	1157
Turbidity (NTU)	78	32		112	53	186	299	38	107		34	18	
Bicarbonate Alkalinity (mg/L)	---	<1		---	<1	---	---	<1	---		<1	---	
Total Alkalinity (mg/L)	---	<1		---	<1	---	---	<1	---		<1	---	
Sulphate (mg/L)	---	218		---	115	---	---	104	---		185	---	
Chloride (mg/L)	---	6		---	3	---	---	2	---		3	---	
Calcium (mg/L)	---	45		---	24	---	---	28	---		40	---	
Magnesium (mg/L)	---	24		---	9	---	---	10	---		15	---	
Sodium (mg/L)	---	13		---	5	---	---	4	---		5	---	
Potassium (mg/L)	---	10		---	5	---	---	4	---		6	---	
Arsenic (dissolved) (mg/L)	---	<0.001		---	<0.001	---	---	<0.001	---		<0.001	---	
Cadmium (dissolved) (mg/L)	---	<0.0001		---	<0.0001	---	---	0.0002	---		0.0004	---	
Chromium (dissolved) (mg/L)	---	<0.001		---	<0.001	---	---	<0.001	---		<0.001	---	
Copper (dissolved) (mg/L)	---	<0.001		---	<0.001	---	---	<0.001	---		0.001	---	
Lead (dissolved) (mg/L)	---	<0.001		---	<0.001	---	---	<0.001	---		<0.001	---	
Nickel (dissolved) (mg/L)	---	0.019		---	0.011	---	---	0.028	---		0.054	---	
Zinc (dissolved) (mg/L)	---	0.018		---	0.016	---	---	0.048	---		0.081	---	
Iron (dissolved) (mg/L)	---	0.93	---	<0.05	---	---	<0.05	---	<0.05	---			

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 20 Groundwater Monitoring Bore A (EP DDH7/GW) Results Jan - Dec 2017

Location	Off-Site Bore A (EP DDH7/GW)												
Sample Number	01176880014	02176880016	03176880014	04176880016	05176880016	06176880014	07176880014	08176880016	09176880014	10176880014	11176880016	12176880014	Trigger Levels
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	09/01/17	10/02/17	09/03/16	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17	
Standing Water Level (m)	67.88	68.08	68.3	68.41	68.5	68.57	68.63	68.66	68.73	68.77	68.82	68.64	
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	0.75	
Relative Water Level (m)	67.13	67.33	67.55	67.66	67.75	67.82	67.88	67.91	67.98	68.02	68.07	67.89	
Water level AHD (m)#	956.67	956.47	956.25	956.14	956.05	955.98	955.92	955.89	955.82	955.78	955.73	955.91	
pH	---	---	7.10	---	---	6.85	---	---	6.65	---	---	6.55	6.5 to 8.0
Conductivity (µS/cm)	---	---	1122	---	---	816	---	---	547	---	---	309	894
Temperature (°C)	---	---	21.0	---	---	15.8	---	---	15.0	---	---	18.0	
TDS (mg/L)	---	---	355	---	---	223	---	---	196	---	---	156	
Bicarbonate Alkalinity (mg/L)	---	---	553	---	---	321	---	---	220	---	---	154	
Total Alkalinity (mg/L CaCO ₃)	---	---	553	---	---	321	---	---	220	---	---	154	
Sulphate (mg/L)	---	---	1	---	---	1	---	---	1	---	---	2	
Chloride (mg/L)	---	---	56	---	---	32	---	---	16	---	---	12	
Calcium (mg/L)	---	---	38	---	---	130	---	---	17	---	---	17	
Magnesium (mg/L)	---	---	15	---	---	62	---	---	8	---	---	7	
Sodium (mg/L)	---	---	32	---	---	53	---	---	14	---	---	8	
Potassium (mg/L)	---	---	40	---	---	19	---	---	26	---	---	15	
Arsenic (dissolved) (mg/L)	---	---	0.002	---	---	0.001	---	---	<0.001	---	---	<0.001	
Cadmium (dissolved) (mg/L)	---	---	<0.0001	---	---	<0.0001	---	---	<0.0001	---	---	<0.0001	
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Copper (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Nickel (dissolved) (mg/L)	---	---	0.002	---	---	0.11	---	---	0.004	---	---	0.003	
Zinc (dissolved) (mg/L)	---	---	<0.005	---	---	0.202	---	---	<0.005	---	---	0.008	
Iron (dissolved) (mg/L)	---	---	0.56	---	---	27.4	---	---	3.48	---	---	3.85	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 21 Groundwater Monitoring Bore C (EP PDH1/GW) Results Jan - Dec 2017

Location	Off-Site Bore C (EP PDH1/GW)												Trigger Levels
	01176880016	02176880018	03176880016	04176880018	05176880018	06176880016	07176880016	08176880018	09176880016	10176880016	11176880018	12176880016	
Sample Number	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17	
Date Sampled	73.36	73.77	74.06	74.02	74.29	74.46	74.65	74.80	74.94	75.08	75.16	75.21	
Standing Water Level (m)	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	
Standpipe Height (m)	72.62	73.03	73.32	73.28	73.55	74.46	75.46	76.46	77.46	75.08	76.08	77.08	
Relative Water Level (m)	894.88	894.47	894.18	894.22	893.95	893.04	892.04	891.04	890.04	892.42	891.42	890.42	889.25
Water level AHD (m)#	---	---	6.48	---	---	6.42	---	---	6.54	---	---	6.28	6.7 to 8.0
pH	---	---	176	---	---	197	---	---	217	---	---	190	490
Conductivity (µS/cm)	---	---	19.5	---	---	15.6	---	---	15.5	---	---	20.8	
Temperature (°C)	---	---	140	---	---	133	---	---	152	---	---	147	
TDS (mg/L)	---	---	56	---	---	69	---	---	97	---	---	104	
Bicarbonate Alkalinity (mg/L)	---	---	56	---	---	69	---	---	97	---	---	104	
Total Alkalinity (mg/L CaCO ₃)	---	---	8	---	---	5	---	---	4	---	---	4	
Sulphate (mg/L)	---	---	11	---	---	6	---	---	6	---	---	6	
Chloride (mg/L)	---	---	14	---	---	18	---	---	19	---	---	22	
Calcium (mg/L)	---	---	5	---	---	6	---	---	6	---	---	6	
Magnesium (mg/L)	---	---	7	---	---	7	---	---	7	---	---	6	
Sodium (mg/L)	---	---	5	---	---	6	---	---	7	---	---	7	
Potassium (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Arsenic (dissolved) (mg/L)	---	---	0.0002	---	---	<0.0001	---	---	<0.0001	---	---	<0.0001	
Cadmium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Copper (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Nickel (dissolved) (mg/L)	---	---	0.004	---	---	0.002	---	---	0.001	---	---	0.003	
Zinc (dissolved) (mg/L)	---	---	0.038	---	---	0.023	---	---	0.022	---	---	0.033	
Iron (dissolved) (mg/L)	---	---	<0.05	---	---	<0.05	---	---	0.06	---	---	<0.05	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 22 Groundwater Monitoring Bore D (EP DDH4/GW) Results Jan - Dec 2017

Location	Off-Site Bore D (EP DDH4/GW)												Trigger Levels
Sample Number	01176880017	021766880019	03176880017	041766880019	05176880019	06176880017	07176880017	08176880019	09176880017	10176880017	11176880019	12176880017	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17	
Standing Water Level (m)	37.26	36.87	36.58	37.40	37.26	37.16	37.60	37.45	37.40	37.79	37.67	37.57	
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	0.71	
Relative Water Level (m)	36.55	36.16	35.87	36.69	36.55	36.45	36.89	36.74	36.69	37.08	36.96	36.86	
Water level AHD (m)#	941.95	942.34	942.63	941.81	941.95	942.05	941.61	941.76	941.81	941.42	941.54	941.64	940.61
pH	---	---	6.62	---	---	6.76	---	---	6.76	---	---	6.54	6.7 to 8.0
Conductivity (µS/cm)	---	---	375	---	---	342	---	---	373	---	---	415	608
Temperature (°C)	---	---	20.5	---	---	15.8	---	---	14.0	---	---	21.5	
TDS (mg/L)	---	---	254	---	---	230	---	---	284	---	---	350	
Bicarbonate Alkalinity (mg/L)	---	---	142	---	---	120	---	---	149	---	---	209	
Total Alkalinity (mg/L)	---	---	142	---	---	120	---	---	149	---	---	209	
Sulphate (mg/L)	---	---	32	---	---	19	---	---	24	---	---	27	
Chloride (mg/L)	---	---	15	---	---	12	---	---	12	---	---	15	
Calcium (mg/L)	---	---	5	---	---	4	---	---	5	---	---	8	
Magnesium (mg/L)	---	---	1	---	---	1	---	---	2	---	---	2	
Sodium (mg/L)	---	---	76	---	---	65	---	---	85	---	---	92	
Potassium (mg/L)	---	---	5	---	---	5	---	---	6	---	---	7	
Arsenic (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Cadmium (dissolved) (mg/L)	---	---	0.0001	---	---	<0.0001	---	---	<0.0001	---	---	<0.0001	
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Copper (dissolved) (mg/L)	---	---	0.003	---	---	<0.001	---	---	<0.001	---	---	0.006	
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Nickel (dissolved) (mg/L)	---	---	0.004	---	---	0.006	---	---	0.006	---	---	0.006	
Zinc (dissolved) (mg/L)	---	---	0.08	---	---	0.067	---	---	0.102	---	---	0.049	
Iron (dissolved) (mg/L)	---	---	<0.05	---	---	0.08	---	---	0.25	---	---	0.09	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 23 Groundwater Monitoring Bore E (EP PDH7/GW) Results Jan - Dec 2017

Location	Off-Site Bore E (EP PDH7/GW)													
Sample Number	01176880018	02176880020	03176880018	04176880018	0517688020	06176880018	07176880018	08176880020	09176880018	10176880018	11176880020	12176880018	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled			10/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17		
Standing Water Level (m)			17.07	14.94	14.95	15.00	15.03	15.03	15.09	15.26	17.00	15.3		
Standpipe Height (m)			0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73		
Relative Water Level (m)			16.34	14.21	14.22	14.27	14.30	14.30	14.36	14.53	16.27	14.57		
Water level AHD (m)#			938.56	940.69	940.68	940.63	940.60	940.60	940.54	940.37	938.63	940.33		938.43
pH			---	---	---	5.67	---	---	5.70	---	---	5.59		5.5 to 8.0
Conductivity (µS/cm)			---	---	---	93	---	---	135	---	---	95		151
Temperature (°C)			---	---	---	15.0	---	---	13.0	---	---	19.0		
TDS (mg/L)			---	---	---	92	---	---	78	---	---	60		
Bicarbonate Alkalinity (mg/L)			---	---	---	17	---	---	22	---	---	20		
Total Alkalinity (mg/L)			---	---	---	17	---	---	22	---	---	20		
Sulphate (mg/L)			---	---	---	7	---	---	6	---	---	4		
Chloride (mg/L)			---	---	---	8	---	---	8	---	---	9		
Calcium (mg/L)			---	---	---	1	---	---	1	---	---	2		
Magnesium (mg/L)			---	---	---	3	---	---	2	---	---	2		
Sodium (mg/L)			---	---	---	10	---	---	7	---	---	7		
Potassium (mg/L)			---	---	---	6	---	---	5	---	---	4		
Arsenic (dissolved) (mg/L)			---	---	---	<0.001	---	---	<0.001	---	---	<0.001		
Cadmium (dissolved) (mg/L)			---	---	---	<0.0001	---	---	<0.0001	---	---	0.0007		
Chromium (dissolved) (mg/L)			---	---	---	<0.001	---	---	<0.001	---	---	<0.001		
Copper (dissolved) (mg/L)			---	---	---	<0.001	---	---	<0.001	---	---	0.199		
Lead (dissolved) (mg/L)			---	---	---	<0.001	---	---	<0.001	---	---	0.007		
Nickel (dissolved) (mg/L)			---	---	---	0.006	---	---	<0.001	---	---	0.003		
Zinc (dissolved) (mg/L)			---	---	---	0.041	---	---	0.008	---	---	0.141		
Iron (dissolved) (mg/L)			---	---	---	1.56	---	---	0.16	---	---	10.8		

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 24 Groundwater Monitoring Bore - EP PDH3/GW Results Jan - Dec 2017

Location	Enhance Place Bore EP PDH3/GW												Trigger Level	
Sample Number	01176880011	02176880013	03176880011	04176880011	05176880013	06176880011	07176880011	08176880011	09176880011	10176880011	11176880013	12176880012		Inaccessible
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	09/01/17	09/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17		
Standing Water Level (m)	23.77	23.75	23.78	23.77	23.77	23.78	23.79	23.79	23.90	23.84	23.76	Inaccessible		
Standpipe Height	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72			
Relative Water Level (m)	23.05	23.03	23.06	23.05	23.05	23.06	23.07	23.07	23.18	23.12	23.04			
Water Level AHD (m)#	892.95	892.97	892.94	892.95	892.95	892.94	892.93	892.93	892.82	892.88	892.96		891.06	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 25 Groundwater Monitoring Bore - EP PDH4/GW Results Jan - Dec 2017

Location	Enhance Place Bore EP PDH4/GW												Trigger Level	
Sample Number	01176880012	02176880014	03176880012	04176880012	05176880014	06176880012	07176880012	08176880012	09176880012	10176880012	11176880014	12176880012		Inaccessible
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	09/01/17	09/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	07/09/17	09/10/17	08/11/17	11/12/17		
Standing Water Level (m)	23.22	23.25	23.27	23.25	23.26	23.25	23.27	23.27	23.31	23.33	23.3	Inaccessible		
Standpipe Height	0.2	0.2	0.2	0.1	0.2	0.15	0.2	0.2	0.1	0.2	0.2			
Relative Water Level (m)	23.02	23.05	23.07	23.05	23.06	23.05	23.07	23.07	23.11	23.13	23.10			
Water Level AHD (m)#	893.06	893.03	893.01	893.03	893.02	893.03	893.01	893.01	892.97	892.95	892.98		890.95	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

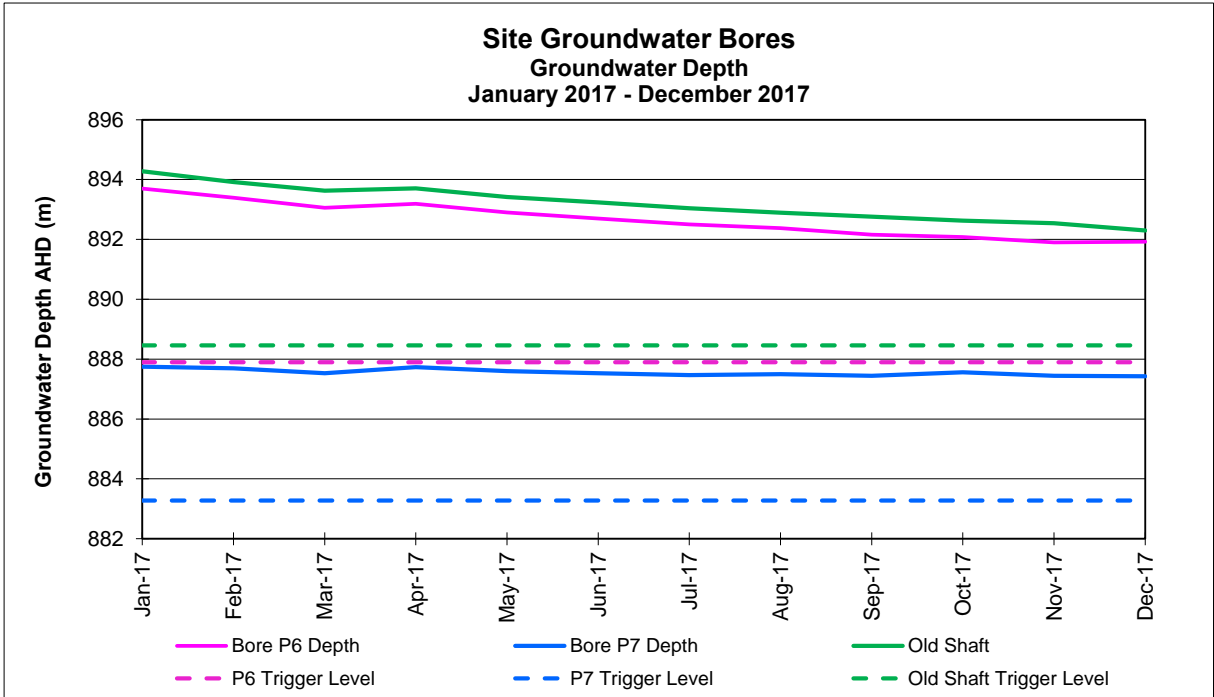


Figure 4 Onsite Groundwater Monitoring Bore Depths 2017

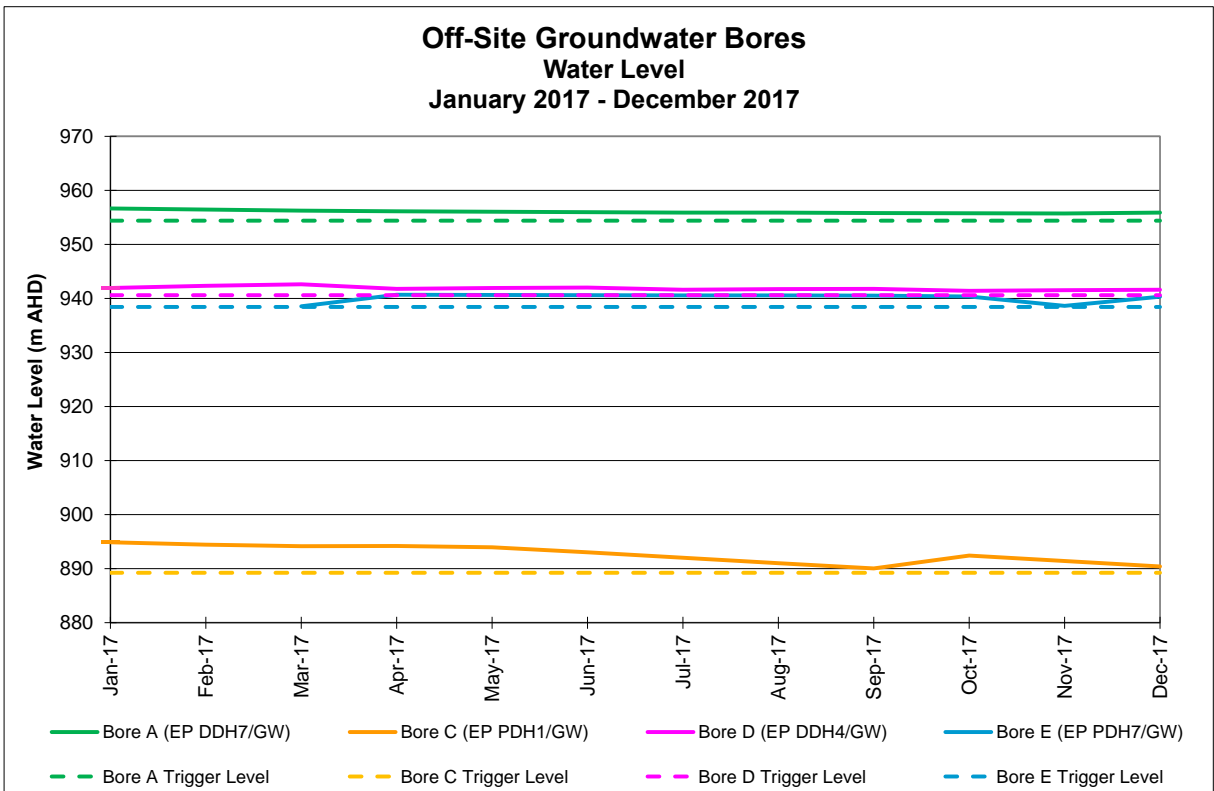


Figure 5 Off-Site Groundwater Monitoring Bore Depths 2017

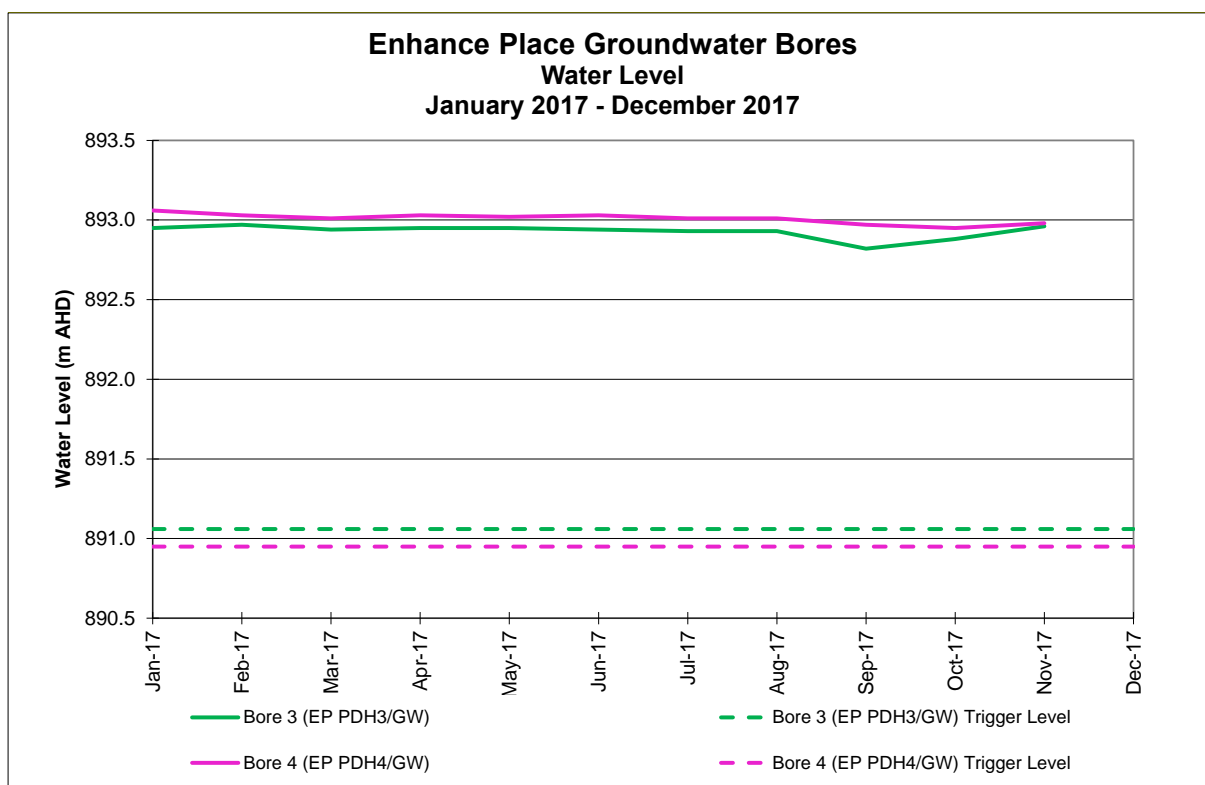


Figure 6 Enhance Place Groundwater Monitoring Bore Depth 2017

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 2017 period generally show water quality results which are consistent throughout the monitoring period. There were no instances during the 2017 monitoring period where the groundwater levels dropped below their respective water level triggers, although the depth to the water table at P6 and Old Shaft has been decreasing during the reporting period.

The pH within the site bores was shown to drop below the lower pH trigger level criterion intermittently throughout the 2017 monitoring period. The pH at Bore P6 ranged between 5.8 and 6.7 pH units (when results are rounded to one decimal place). The pH at Bore P6 dropped below the lower pH trigger level (6.2 pH units) during four of the twelve monitoring events. The pH at Bore P7 ranged between 6.2 and 6.9 pH units and was within the pH trigger level range during all of the twelve monitoring events. The pH at Old Shaft was below the lower pH trigger value of 6.1 pH units eleven of the twelve monitoring events in 2017, with pH levels varying between 5.4 pH units and 6.1 pH units. During 2017 there were no instances where the upper pH trigger levels (8.0 pH units) was exceeded at any of the onsite groundwater bores. The pH at the Bong ranged between 4.5 and 7.5 pH units during 2017, with three of the 2017 monitoring events reporting a pH concentration below the lower pH trigger level of 5.8 pH units. There were two instances where the monitoring location was dry at the time of sampling, March and October 2017.

The electrical conductivity levels at the site bores have also intermittently exceeded their respective conductivity trigger levels throughout the January – December 2017 monitoring period with the exception of the Bong which was compliant throughout the year. Bore P6 exceeded the conductivity trigger level of 1201 μ S/cm during ten monitoring events, with the

maximum concentration of 1510 μ S/cm reported in November 2017. P7 exceeded its site specific trigger level of 852 μ S/cm during four monitoring events, with the greatest concentration (873 μ S/cm) observed in October 2017. The Old Shaft exceeded the 1100 μ S/cm trigger level on ten occasions throughout the 2017 monitoring period. The maximum concentration was reported in November 2017 (1600 μ S/cm).

Following exceedances at the Old Shaft sampling well and in accordance with the site's Water Management Plan, an internal investigative report was compiled following the end of the 2015 monitoring period (Ref [1]). It is considered that the findings of the investigation are still likely attributing to the exceedances observed during 2017; with the annual rainfall observed at the site's meteorological station recording 568.8mm. This amount is considerably lower than the rainfall received during the previous 2016 reporting (1168mm) and is also lower than the Lithgow BOM stations' median rainfall².

During the 2017 reporting period Enhanced Place Pty Ltd (managers of Pine Dale Mine) undertook a review of the site water monitoring data in accordance with the Water Management Plan (WMP). Subsequent to the review, Enhanced Place Pty Ltd has written to the Department of Primary Industries – Water for approval to revise the site specific trigger values by using all historical data (up to twelve years) as opposed to four years' of data. At the time of writing, approval had yet to be granted however the report has been prepared with the understanding that approval will be obtained without comment.

4.3.2 OFF-SITE GROUNDWATER BORES

The results of water quality monitoring within the off-site groundwater bores are generally shown to be compliant with their respective water quality trigger levels. Groundwater samples collected from off-site bores are shown to be compliant with the respective pH trigger levels at Bores A and E. Bore C was below the lower pH trigger value during each of the quarterly sampling events, whilst Bore D was non-compliant in March and December 2017. During one sampling event in March 2017 the water level at Bore E was too low to obtain a sample.

Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2017 monitoring period with the exception of Bore A during March 2017.

All off-site bores exhibited standing water levels which were consistent throughout the 2017 monitoring period and compliant with their respective trigger levels.

Inclement weather damaged the bridge required to access Bore E in 2016 and therefore the site was inaccessible in January and February 2017 until the bridge had been repaired.

4.3.3 ENHANCE PLACE GROUNDWATER BORES

The two monitoring bores located at the former Enhance Place mine generally exhibited stable standing water levels throughout the 2017 monitoring period. The water level in Bore 3 (EP PDH3) did dip in September 2017. Standing water levels at Bore 3 (EP PDH3) fluctuated by 0.15m through the year, whilst Bore 4 (EP PDH4) fluctuated by 0.11m. Neither of the Enhanced Place bores was accessible in December 2017 due to livestock.

² The BOM Australia consider the median to be the preferred measure of typical rainfall due to the high variability of daily rainfall that could be skewed by extreme weather events if the mean was used. The data used in the Lithgow BOM Station at Birdwood Street statistics is based on the rainfall recorded between 1889 and 2006.

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. Site specific Trigger values for water quality parameters pH and electrical conductivity were developed for 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). Trigger values for oil and grease and total suspended solids are not site specific and are uniform across all surface water sites. Surface water assessment criteria are presented in **Table 26**.

Table 26 EPL Surface Water Assessment Criteria

Surface Water Site	pH (range)	Electrical Conductivity ($\mu\text{S}/\text{cm}$)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
S1	6.2 – 8.0	2570	30	10
S2	NA	NA	NA	NA
S3	6.4 – 8.0	2454	30	10
S4	7.3 – 8.0	957	30	10
S5	6.9 – 8.0	1244	30	10
S6	6.7 – 8.0	2501	30	10
S7	6.8 – 8.0	1283	30	10
EPA Point 2	6.9 – 8.0	2398	30	NA
EPA Point 3	6.4 – 8.0	2223	30	NA
EPA Point 13	6.5 – 8.0	NA	30	10
EPA Point 14	7.5 – 8.0	1207	30	NA

NA – no trigger value required for these locations.

5.2 SURFACE WATER MONITORING DATA SUMMARY

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

During the period January to December 2017, monitoring was undertaken on a monthly and quarterly basis for routine samples associated with the *Water Management Plan* and site EPL.

No samples were collected at EPL Point 13 (discharge to concrete lined section of Neubeck's creek), as there was no discharge from the mine during the 2017 monitoring period.

Surface water summary results for the period January – December 2017 are shown in **Tables 27 to 37**. Graphical presentations are shown in **Figures 7 to 11**.

Table 27 Surface Water Monitoring Location EPL Point 2 Results 2017

Location	EPL Point 2				Trigger Values
Sample No	02176880009	05176880009	08176880009	11176880009	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	10/02/2017	11/05/2017	10/08/2017	08/11/2017	
Time Sampled	08:21	12:42	15:30	13:00	
pH (pH units)	7.24	<i>6.62</i>	7.10	7.1	6.9 – 8.0
Conductivity (µS/cm)	<i>2588</i>	<i>2490</i>	795	1270	2398
TSS (mg/L)	<5	<5	<5	<5	30
Sulphate (mg/L)	1820	522	204	434	
Iron filterable (mg/L)	0.11	1.12	0.05	0.07	
Turbidity (NTU)	3	6	4	3	

Shaded Cells & Italics - Indicates results (when rounded to one decimal place) are outside of the nominated Trigger Level.

Table 28 Surface Water Monitoring Location EPL Point 3 Results 2017

Location	EPL Point 3				Trigger Values
Sample No	02176880004	05176880004	08176880004	11176880004	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	10/02/2017	11/05/2017	10/08/2017	08/11/2017	
Time Sampled	09:45	12:51	13:43	14:17	
pH (pH units)	7.45	7.14	7.14	7.51	6.4 – 8.0
Conductivity (µS/cm)	<i>3020</i>	<i>3020</i>	1180	<i>6070</i>	2223
TSS (mg/L)	<5	13	7	<5	30
Sulphate (mg/L)	1770	1240	420	2800	
Iron filterable (mg/L)	0.07	2.5	0.99	0.2	
Turbidity (NTU)	3	4	8	6	

Shaded Cells & Italics - Indicates results (when rounded to one decimal place) are outside of the nominated Trigger Level.

Table 29 Surface Water Monitoring Location EPL Point 14 Results 2017

Location	EPL Point 14				Trigger Values
Sample No	02176880010	05176880010	08176880010	11176880010	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	9/02/2017	11/05/2017	10/08/2017	8/11/2017	
Time Sampled	17:25	10:15	10:22	10:30	
pH (pH units)	<i>8.42</i>	<i>8.48</i>	<i>8.51</i>	<i>8.7</i>	7.5 – 8.0
Conductivity (µS/cm)	1120	<i>1340</i>	<i>1330</i>	<i>1340</i>	1207
TSS (mg/L)	9	<5	7	<5	30
Sulphate (mg/L)	127	114	86	67	
Iron filterable (mg/L)	<0.5	<0.5	<0.5	<0.5	
Turbidity (NTU)	4	7	18	9	

Shaded Cells & Italics - Indicates results (when rounded to one decimal place) are outside of the nominated Trigger Level

Table 30 Surface Water Monitoring Location S1 Results 2017

Location	Surface Water S1												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880002	02176880002	03176880002	04176880002	05176880002	06176880002	07176880002	08176880002	09176880002	10176880002	11176880002	12176880002	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	10:15	8:16	15:33	12:49	12:38	16:37	12:32	12:32	9:00	16:15	12:54	14:22	
Temperature (°C)	21.0	21.0	19.0	13.0	8.5	11.1	5.0	6.5	6.5	17.5	16.0	19.5	
pH	7.12	7.05	7.34	6.79	7.28	7.18	7.50	7.18	7.01	7.25	7.28	5.98	6.2 – 8.0
Conductivity (µS/cm)	2684	3170	3070	1410	3570	4130	1750	1500	3410	5120	6330	1240	2570
TSS (mg/L)	---	<5	---	---	<5	---	---	9	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	4	2	3	9	1	8	3	1	7	10	6	76	
Dissolved Oxygen (mg/L)	---	7.9	---	---	9.5	---	---	10.0	---	---	8.0	---	
Bicarbonate Alkalinity (mg/L)	---	93	---	---	81	---	---	56	---	---	81	---	
Total Alkalinity (mg/L)	---	93	---	---	81	---	---	56	---	---	81	---	
Sulphate (mg/L)	---	1810	---	---	1370	---	---	486	---	---	2750	---	
Chloride (mg/L)	---	319	---	---	270	---	---	86	---	---	470	---	
Calcium (mg/L)	---	207	---	---	177	---	---	72	---	---	276	---	
Magnesium (mg/L)	---	163	---	---	138	---	---	54	---	---	226	---	
Sodium (mg/L)	---	548	---	---	401	---	---	134	---	---	801	---	
Potassium (mg/L)	---	45	---	---	28	---	---	11	---	---	58	---	
Cobalt (dissolved) (mg/L)	---	0.020	---	---	0.009	---	---	0.003	---	---	0.037	---	
Manganese(dissolved) (mg/L)	---	1.880	---	---	2.59	---	---	0.684	---	---	2.55	---	
Nickel (dissolved) (mg/L)	---	0.264	---	---	0.152	---	---	0.04	---	---	0.411	---	
Zinc (dissolved) (mg/L)	---	0.089	---	---	0.047	---	---	0.038	---	---	0.118	---	
Iron (dissolved) (mg/L)	---	0.070	---	---	0.53	---	---	0.21	---	---	0.09	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 31 *Surface Water Monitoring Location S2 Results 2017*

Location	Surface Water Site S2											
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sample Number	01176880003	02176880003	03176880003	04176880003	05176880003	06176880003	07176880003	08176880003	09176880003	10176880003	11176880003	12176880003
Date Sampled	9/01/17	10/02/17	9/03/17	10/04/17	11/05/17	8/06/17	10/07/17	10/08/17	8/09/17	9/10/17	8/11/17	11/12/17
Time Sampled	10:00	6:47	15:27	13:50	11:02	16:45	11:04	13:45	11:36	15:12	11:20	11:38
Depth to Surface from Top of Rail Bridge (m)	3.74	3.72	3.76	3.71	3.77	3.75	3.76	3.77	3.77	3.76	3.74	3.77

Table 32 Surface Water Monitoring Location S3 Results 2017

Location	Surface Water S3												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880004	02176880004	03176880004	04176880004	05176880004	06176880004	07176880004	08176880004	09176880004	10176880004	11176880004	12176880004	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	14:01	9:45	15:25	13:52	12:51	17:20	11:00	13:43	11:34	15:10	14:17	11:45	
Temperature (°C)	26.0	23.5	19.0	12.5	11.5	11.0	7.0	10.8	9.8	22.0	18.2	22.5	
pH	7.45	7.45	7.62	7.11	7.14	7.28	7.33	7.14	7.09	7.37	7.51	6.74	6.4 – 8.0
Conductivity (µS/cm)	<i>2542</i>	<i>3020</i>	<i>2926</i>	1450	<i>3020</i>	<i>4080</i>	1300	1180	1860	<i>4370</i>	<i>6070</i>	980	2454
TSS (mg/L)	---	<5	---	---	13	---	---	7	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	3	3	4	9	4	10	5	8	11	6	6	6	
Dissolved Oxygen (mg/L)	---	9.2	---	---	10.7	---	---	9.5	---	---	9.0	---	
Bicarbonate Alkalinity (mg/L)	---	90	---	---	46	---	---	43	---	---	76	---	
Total Alkalinity (mg/L)	---	90	---	---	46	---	---	43	---	---	76	---	
Sulphate (mg/L)	---	1770	---	---	1240	---	---	420	---	---	2800	---	
Chloride (mg/L)	---	314	---	---	216	---	---	70	---	---	445	---	
Calcium (mg/L)	---	208	---	---	154	---	---	62	---	---	268	---	
Magnesium (mg/L)	---	164	---	---	107	---	---	45	---	---	219	---	
Sodium (mg/L)	---	548	---	---	299	---	---	111	---	---	773	---	
Potassium (mg/L)	---	45	---	---	24	---	---	9	---	---	55	---	
Cobalt (dissolved) (mg/L)	---	0.02	---	---	0.022	---	---	0.01	---	---	0.037	---	
Manganese(dissolved) (mg/L)	---	1.88	---	---	3.48	---	---	1.36	---	---	2.68	---	
Nickel (dissolved) (mg/L)	---	0.263	---	---	0.144	---	---	0.044	---	---	0.394	---	
Zinc (dissolved) (mg/L)	---	0.049	---	---	0.097	---	---	0.036	---	---	0.096	---	
Iron (dissolved) (mg/L)	---	0.07	---	---	2.5	---	---	0.99	---	---	0.2	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 33 Surface Water Monitoring Location S4 Results 2017

Location	Surface Water S4												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880005	02176880005	03176880005	04176880005	05176880005	06176880005	07176880005	08176880005	09176880005	10176880005	11176880005	12176880005	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	13:57	9:29	17:46	13:40	15:10	11:20	13:15	16:35	11:19	16:55	14:05	15:27	
Temperature (°C)	23.0	27.0	19.0	10.0	10.8	8.5	5.0	9.8	9.5	17.5	15.5	20.5	
pH	7.69	8.00	<i>8.11</i>	7.73	<i>8.09</i>	7.93	<i>8.22</i>	<i>8.11</i>	<i>8.19</i>	<i>8.22</i>	<i>8.22</i>	7.35	7.3 – 8.0
Conductivity (µS/cm)	640	848	854	555	795	656	713	625	815	925	870	701	957
TSS (mg/L)	---	11	---	---	<5	---	---	<5	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	26	21	18	20	3	12	4	6	11	21	19	14	
Dissolved Oxygen (mg/L)	---	5.9	---	---	10.3	---	---	11.3	---	---	8.0	---	
Bicarbonate Alkalinity (mg/L)	---	506	---	---	384	---	---	308	---	---	445	---	
Total Alkalinity (mg/L)	---	520	---	---	414	---	---	309	---	---	465	---	
Sulphate (mg/L)	---	<1	---	---	14	---	---	17	---	---	4	---	
Chloride (mg/L)	---	4	---	---	7	---	---	10	---	---	7	---	
Calcium (mg/L)	---	16	---	---	14	---	---	12	---	---	19	---	
Magnesium (mg/L)	---	16	---	---	13	---	---	10	---	---	16	---	
Sodium (mg/L)	---	169	---	---	145	---	---	108	---	---	150	---	
Potassium (mg/L)	---	30	---	---	25	---	---	22	---	---	28	---	
Cobalt (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Manganese(dissolved) (mg/L)	---	0.048	---	---	0.016	---	---	0.006	---	---	0.024	---	
Nickel (dissolved) (mg/L)	---	0.002	---	---	<0.001	---	---	<0.001	---	---	0.001	---	
Zinc (dissolved) (mg/L)	---	<0.005	---	---	<0.005	---	---	<0.005	---	---	<0.005	---	
Iron (dissolved) (mg/L)	---	0.5	---	---	0.16	---	---	0.12	---	---	0.53	---	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 34 Surface Water Monitoring Location S5 Results 2017

Location	Surface Water S5												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880006	02176880006	03176880006	04176880006	05176880006	06176880006	07176880006	08176880006	09176880006	10176880006	11176880006	12176880006	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	13:00	9:24	17:50	13:45	15:15	11:40	13:20	16:42	11:22	17:00	14:00	15:29	
Temperature (°C)	27.0	25.0	19.0	15.5	15.0	7.5	9.0	10.7	10.0	19.5	16.5	27.5	
pH	7.36	6.91	7.18	7.00	<i>6.76</i>	<i>6.81</i>	7.04	7.45	7.38	7.45	7.04	7.43	6.9 – 8.0
Conductivity (µS/cm)	<i>1309</i>	1163	<i>1505</i>	<i>1870</i>	<i>2200</i>	<i>1890</i>	<i>1760</i>	<i>1320</i>	<i>1310</i>	<i>1650</i>	<i>1910</i>	<i>1320</i>	1244
TSS (mg/L)	---	<5	---	---	5	---	---	9	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	4	3	9	16	17	23	19	20	19	10	11	20	
Dissolved Oxygen (mg/L)	---	7.9	---	---	6.9	---	---	9.8	---	---	8.0	---	
Bicarbonate Alkalinity (mg/L)	---	101	---	---	103	---	---	165	---	---	147	---	
Total Alkalinity (mg/L)	---	101	---	---	103	---	---	165	---	---	147	---	
Sulphate (mg/L)	---	782	---	---	761	---	---	433	---	---	668	---	
Chloride (mg/L)	---	127	---	---	128	---	---	60	---	---	76	---	
Calcium (mg/L)	---	109	---	---	106	---	---	67	---	---	93	---	
Magnesium (mg/L)	---	85	---	---	72	---	---	45	---	---	64	---	
Sodium (mg/L)	---	243	---	---	202	---	---	145	---	---	194	---	
Potassium (mg/L)	---	25	---	---	24	---	---	20	---	---	23	---	
Cobalt (dissolved) (mg/L)	---	0.022	---	---	0.029	---	---	0.017	---	---	0.018	---	
Manganese(dissolved) (mg/L)	---	1.6	---	---	2.11	---	---	1.08	---	---	1.47	---	
Nickel (dissolved) (mg/L)	---	0.135	---	---	0.137	---	---	0.081	---	---	0.111	---	
Zinc (dissolved) (mg/L)	---	0.086	---	---	0.111	---	---	0.048	---	---	0.074	---	
Iron (dissolved) (mg/L)	---	<0.05	---	---	0.1	---	---	<0.05	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 35 Surface Water Monitoring Location S6 Results 2017

Location	Surface Water S6												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880007	02176880007	03176880007	04176880007	05176880007	06176880007	07176880007	08176880007	09176880007	10176880007	11176880007	12176880007	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	13:45	9:18	17:53	13:34	15:00	12:00	13:10	16:25	11:24	16:57	13:50	15:31	
Temperature (°C)	26.0	21.5	19.0	12.2	15.4	8.5	7.0	11.5	13.0	21.5	16.0	28.0	
pH	7.77	7.50	7.96	7.58	7.67	7.58	7.79	7.62	7.73	7.88	7.79	7.36	6.7 – 8.0
Conductivity (µS/cm)	2488	<i>2725</i>	<i>2504</i>	1370	<i>3350</i>	<i>3740</i>	1620	1230	1270	<i>5640</i>	<i>5960</i>	990	2501
TSS (mg/L)	---	<5	---	---	11	---	---	5	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	2	2	2	8	3	6	1	2	6	3	4	5	
Dissolved Oxygen (mg/L)	---	8.5	---	---	11.3	---	---	11.0	---	---	10.0	---	
Bicarbonate Alkalinity (mg/L)	---	88	---	---	51	---	---	42	---	---	72	---	
Total Alkalinity (mg/L)	---	88	---	---	51	---	---	42	---	---	72	---	
Sulphate (mg/L)	---	1700	---	---	1320	---	---	443	---	---	2560	---	
Chloride (mg/L)	---	310	---	---	252	---	---	74	---	---	435	---	
Calcium (mg/L)	---	202	---	---	168	---	---	66	---	---	262	---	
Magnesium (mg/L)	---	163	---	---	124	---	---	47	---	---	214	---	
Sodium (mg/L)	---	554	---	---	371	---	---	118	---	---	749	---	
Potassium (mg/L)	---	45	---	---	30	---	---	10	---	---	54	---	
Cobalt (dissolved) (mg/L)	---	0.009	---	---	0.01	---	---	0.006	---	---	0.018	---	
Manganese(dissolved) (mg/L)	---	1.03	---	---	1.69	---	---	0.849	---	---	1.61	---	
Nickel (dissolved) (mg/L)	---	0.2	---	---	0.151	---	---	0.04	---	---	0.318	---	
Zinc (dissolved) (mg/L)	---	0.02	---	---	0.033	---	---	0.019	---	---	0.037	---	
Iron (dissolved) (mg/L)	---	<0.05	---	---	<0.05	---	---	<0.05	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

Table 36 Surface Water Monitoring Location S7 Results 2017

Location	Surface Water S7												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01176880008	02176880008	03176880008	04176880008	05176880008	06176880008	07176880008	08176880008	09176880008	10176880008	11176880008	12176880008	
Date Sampled	09/01/17	10/02/17	09/03/17	10/04/17	11/05/17	08/06/17	10/07/17	10/08/17	08/09/17	09/10/17	08/11/17	11/12/17	
Time Sampled	13:32	9:05	17:38	13:20	14:43	12:20	13:06	16:20	10:50	16:50	13:40	15:08	
Temperature (°C)	26.0	25.0	19.5	13.5	11.0	10.0	7.0	11.6	10.5	19.0	17.0	25.5	
pH	7.31	7.04	7.46	7.38	7.03	7.03	7.37	7.00	7.70	7.69	7.44	6.78	6.8 – 8.0
Conductivity (µS/cm)	<i>1307</i>	<i>1511</i>	<i>1508</i>	<i>1690</i>	<i>2110</i>	<i>1870</i>	<i>1740</i>	<i>1650</i>	1230	<i>1520</i>	<i>1740</i>	<i>1410</i>	1283
TSS (mg/L)	---	<5	---	---	6	---	---	3	---	---	<5	---	30
Oil & Grease (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	10
Turbidity (NTU)	2	2	3	2	4	10	6	7	12	7	6	38	
Dissolved Oxygen (mg/L)	---	6.5	---	---	8.3	---	---	10.1	---	---	5.0	---	
Bicarbonate Alkalinity (mg/L)	---	115	---	---	108	---	---	158	---	---	182	---	
Total Alkalinity (mg/L)	---	115	---	---	108	---	---	158	---	---	182	---	
Sulphate (mg/L)	---	749	---	---	749	---	---	446	---	---	567	---	
Chloride (mg/L)	---	122	---	---	124	---	---	63	---	---	69	---	
Calcium (mg/L)	---	96	---	---	107	---	---	70	---	---	82	---	
Magnesium (mg/L)	---	77	---	---	71	---	---	47	---	---	57	---	
Sodium (mg/L)	---	224	---	---	197	---	---	146	---	---	178	---	
Potassium (mg/L)	---	24	---	---	24	---	---	20	---	---	22	---	
Cobalt (dissolved) (mg/L)	---	<0.001	---	---	0.004	---	---	0.004	---	---	0.003	---	
Manganese(dissolved) (mg/L)	---	0.828	---	---	0.831	---	---	0.454	---	---	1.160	---	
Nickel (dissolved) (mg/L)	---	0.06	---	---	0.086	---	---	0.052	---	---	0.065	---	
Zinc (dissolved) (mg/L)	---	0.007	---	---	0.025	---	---	0.014	---	---	0.015	---	
Iron (dissolved) (mg/L)	---	0.06	---	---	0.13	---	---	0.10	---	---	0.14	---	

Shaded Cells & Italics - Indicates results (rounded to one decimal place) are outside of the nominated Trigger Level.

--- Indicates no sampling required during particular period.

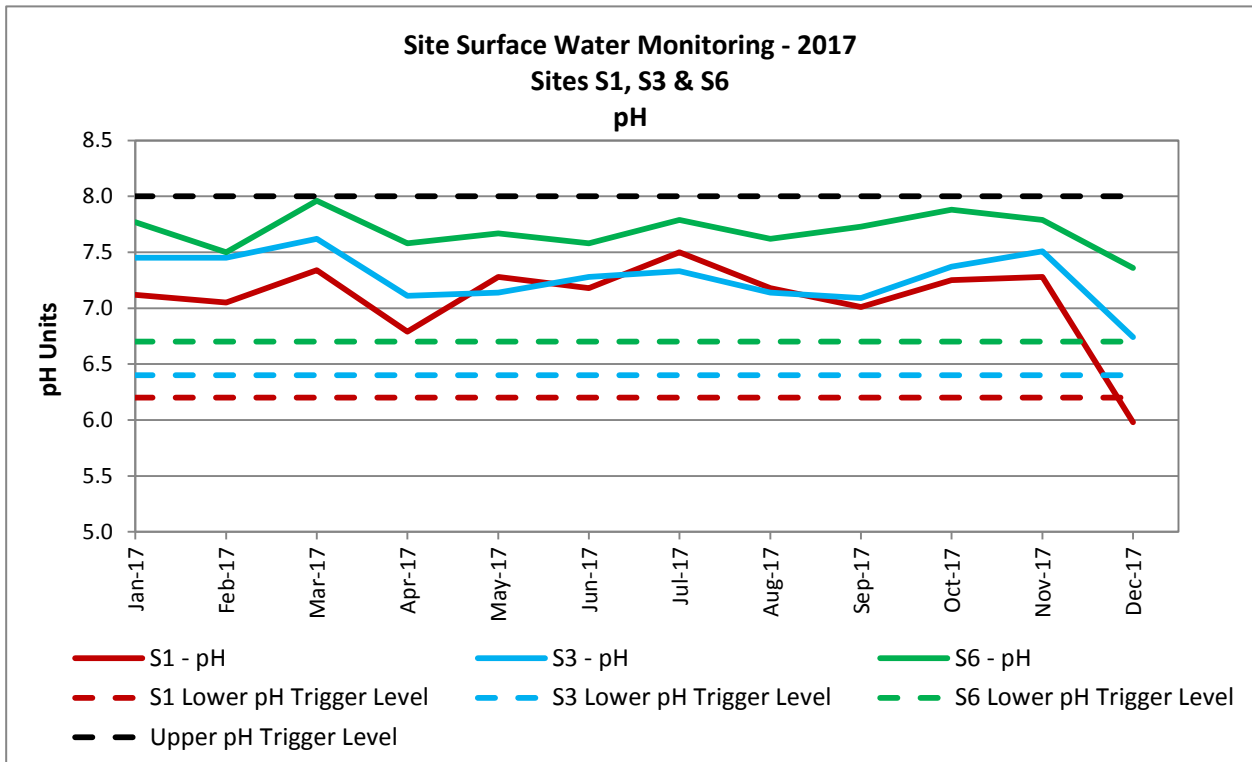


Figure 7 Site Surface Water S1, S3 & S6 pH Results 2017

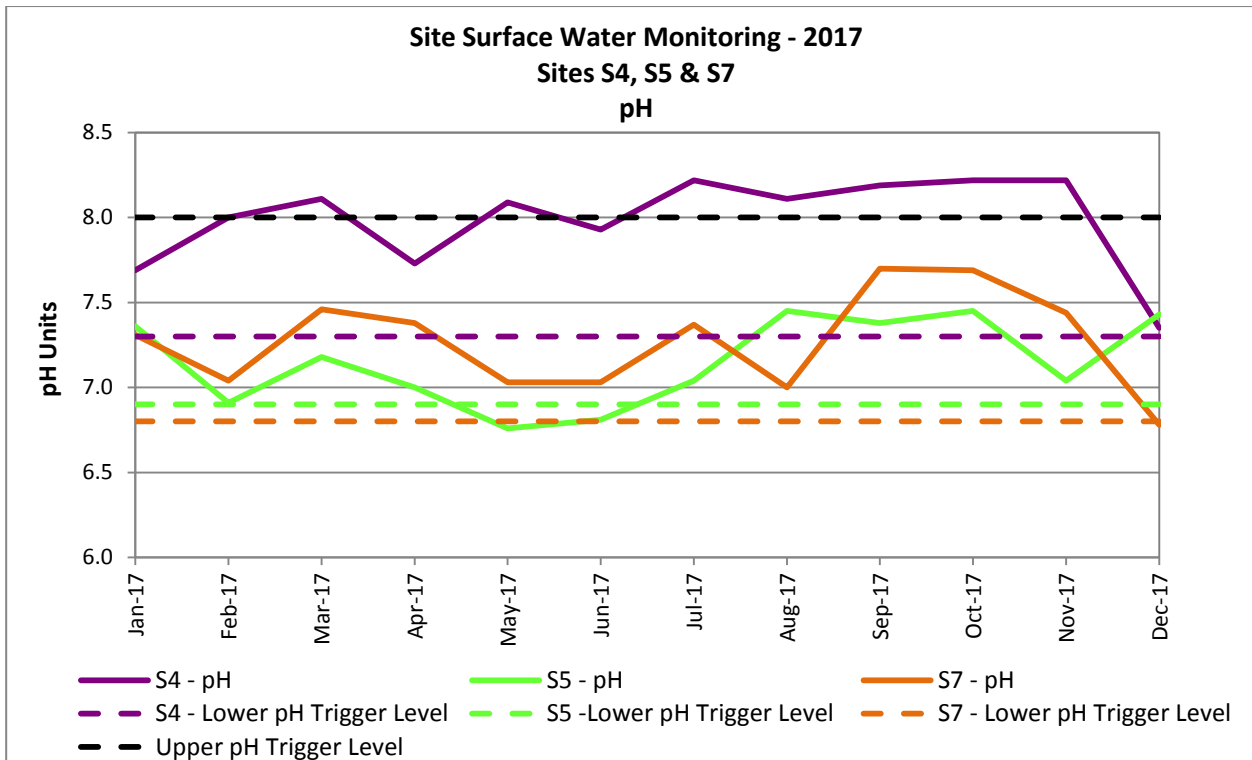


Figure 8 Site Surface Water S4, S5 & S7 pH Results 2017

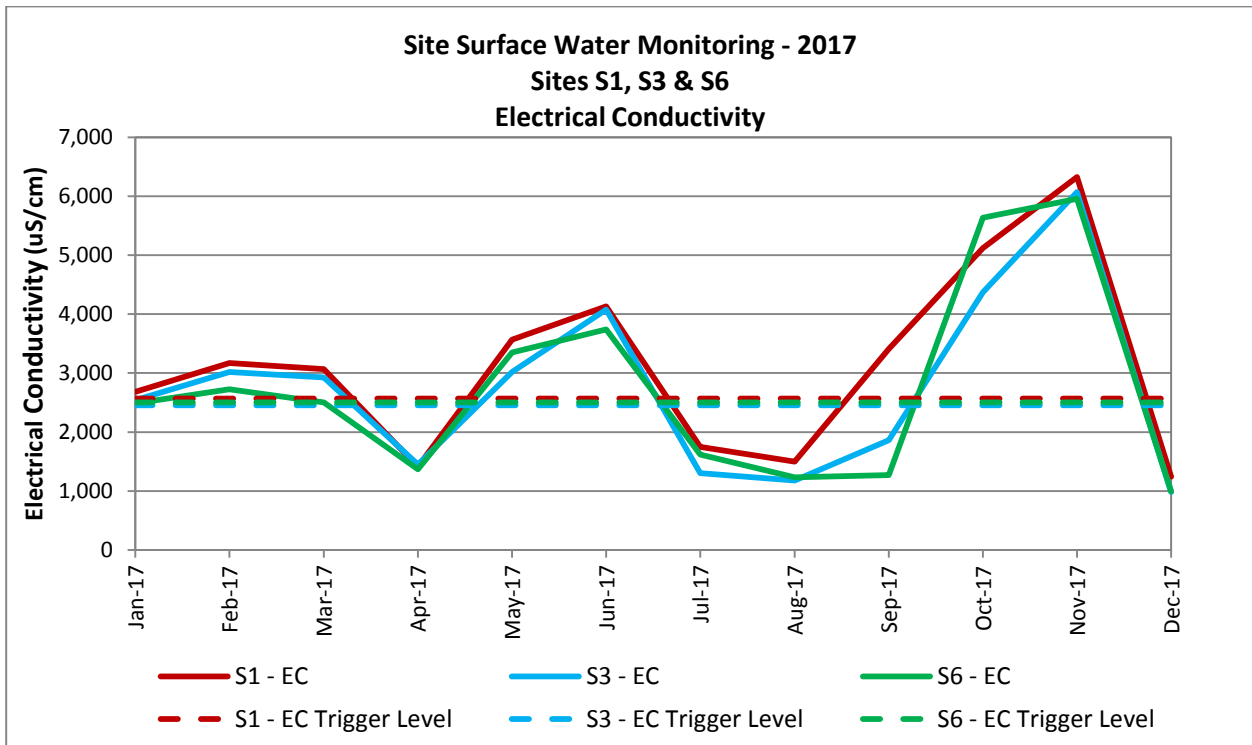


Figure 9 Site Surface Water S1, S3 & S6 Electrical Conductivity Results 2017

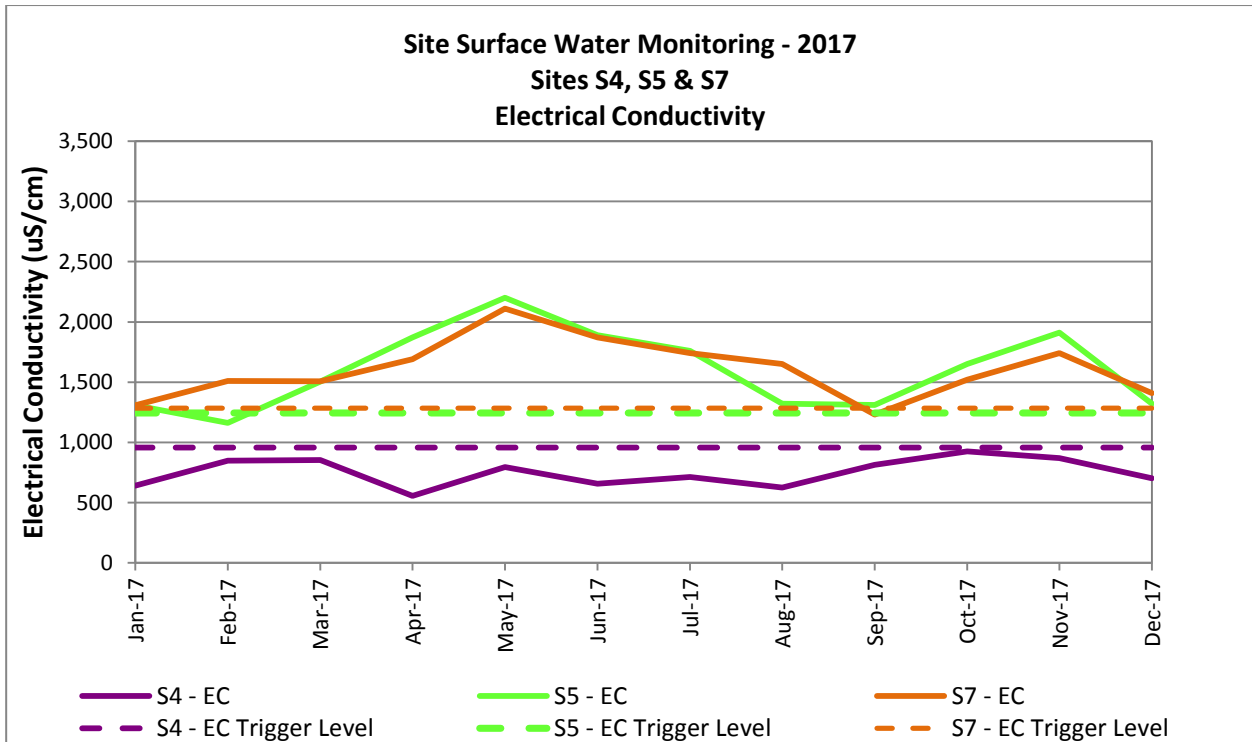


Figure 10 Site Surface Water S4, S5 & S7 Electrical Conductivity Results 2017

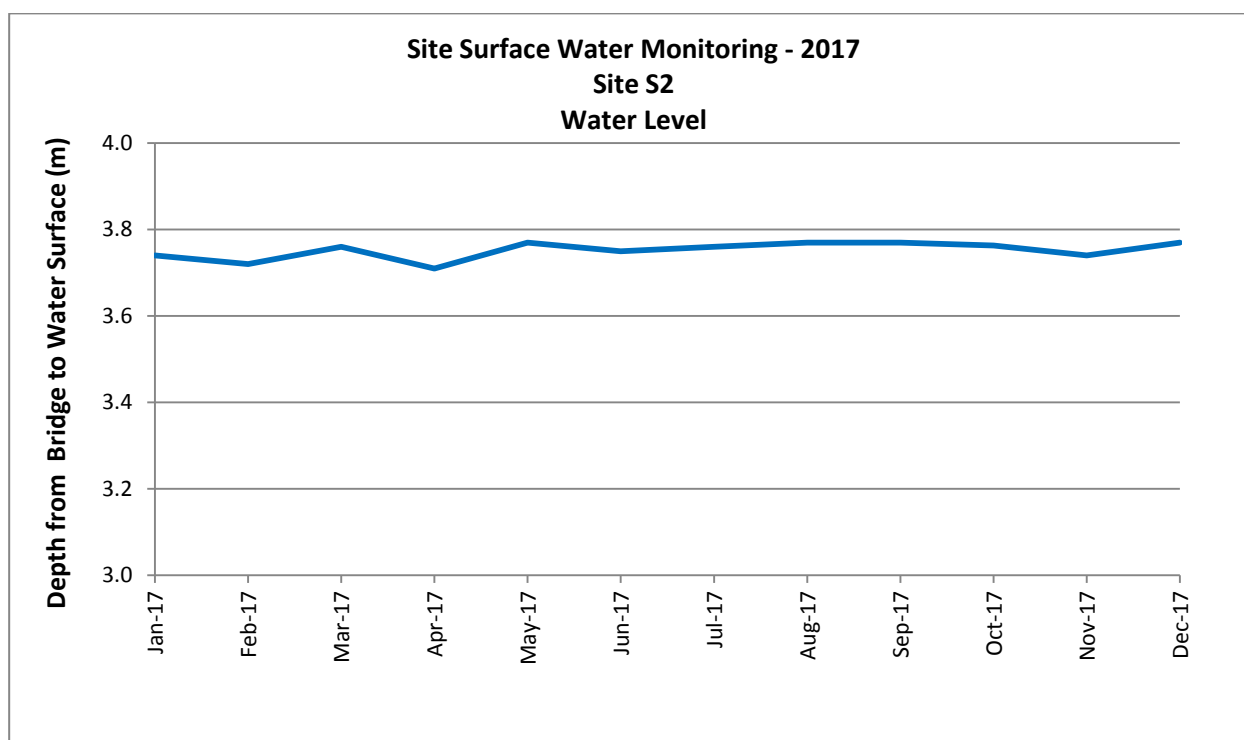


Figure 11 Site Surface Water S2 - Water Level 2017

5.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS

5.3.1 EPL SURFACE WATERS

During the 2017 monitoring period, four quarterly EPL surface water monitoring events were conducted. These events were conducted during February, May, August and November 2017. The results of the water quality monitoring at the EPL surface water sites are generally compliant with their respective water quality trigger levels. All EPL locations were in compliance with the total suspended solids (TSS) trigger value of 30mg/L, whilst EPL 3 was compliant with the trigger range for pH during all of the monitoring events. The pH at surface water site EPL 2 was below the lower pH trigger level (6.9 pH units) during the May 2017 monitoring event. The pH at surface water site EPL 14 was above of the pH trigger range of 8.0 pH units during all of the monitoring events in 2017. The electrical conductivity at site EPL 3 exceeded the trigger level (2454 μ S/cm) during the February, May and November 2017 monitoring events, whilst site EPL 2 exceeded the trigger level (2398 μ S/cm) during February and May. Site EPL 14 exceeded the electrical conductivity trigger level (1207 μ S/cm) during all monitoring events except for February 2017.

Monitoring at EPL Point 13 was not undertaken during the 2017 monitoring period as there was no surface water discharge from the site into Neubeck's Creek.

5.3.2 SITE SURFACE WATERS

Site surface water samples were collected monthly during the January to December 2017 monitoring period.

During the 2017 monitoring period, S3, S6 and S7 were within their respective pH trigger ranges for all samples collected throughout the year. The pH concentration was below the site specific

lower trigger levels at S1 in December 2017, S5 in May and June 2017. The pH recorded at S4 during 2017 was shown to be above the upper pH limit (8.0 pH units) during seven of the twelve sampling rounds (Mar, May, Jul, Aug, Sept, Oct & Nov).

Surface water site S1 reported electrical conductivity levels above the trigger level during each monitoring event in 2017 except for April, July, August and December. Similarly, surface water site S3 reported electrical conductivity levels above the trigger level during all monitoring events in 2017 except for April, July, August, September and December. Surface water site S4 was shown to be compliant with the electrical conductivity trigger level throughout the entire 2017 reporting period; whilst S5 reported conductivity levels above the trigger level during all sampling events except for February. Surface water site S7 exceeded the conductivity trigger level during all sampling events except for September; while site S6 exceeded the electrical conductivity trigger level in February, March, May, June October and November 2017.

Overall, during the 2017 monitoring period conductivity levels are generally shown to fluctuate in accordance with the amount of rainfall received at the site (refer Figure 12). The water monitoring locations in Neubeck's Creek (surface water sites S1, S3 and S6) show consistency in their conductivity and pH concentrations recorded throughout the 2017 monitoring period. Similarly, surface water sites S5 and S7, which are collected at Blue Lake, and downstream Cox's River, show a similar pattern in fluctuating conductivity and pH levels throughout the 2017 monitoring period.

The water level at surface water site S2 remained relatively stable throughout the 2017 monitoring period.

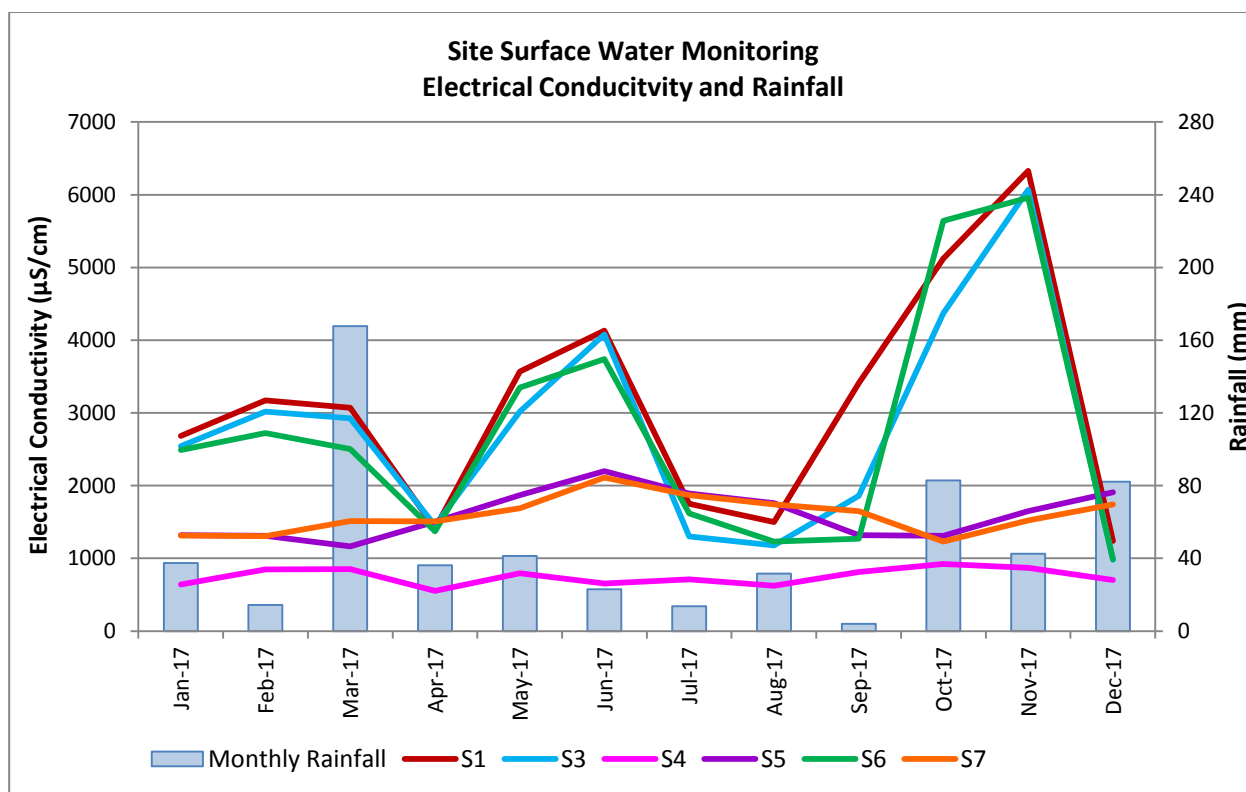


Figure 12 Site Surface Water EC and Monthly Rainfall

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 37**.

Table 37 *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

6.2 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 2017 are summarised in **Table 38**. Windrose plots for the 2017 period are presented in **Figures 13** and **14**.

Table 38 Meteorological Monitoring Summary Data 2017

Month (2017)	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	37.4	37.4	12	22.1	10.9	37.9	21.4	10.9	36.1	32.6	0	102.1	65.6	9.4	95.8	1.8	0	13.64	SSE/ NW
February	14.4	51.8	6	21.4	1.8	40.7	20.7	1.7	38.9	32.1	0	100	60.6	12.6	95.1	1.6	0	19.05	SE
March	167.8	219.6	21	17.6	5.4	31.3	17.2	5.7	28.8	32.4	0	101.3	77.8	16.4	97.5	1.4	0	13.74	SE
April	36.2	255.8	10	11.5	-1.5	23.7	11.2	-1.4	22.3	29.0	0	103.1	76.3	25.2	96	1.1	0	14.43	SE
May	41.4	297.2	9	8.1	-5.7	21	8.0	-5.5	19.2	27.4	0	101.7	78.7	16.8	97.1	1.0	0	12.58	WNW
June	23.0	320.2	16	5.7	-6.7	18.7	5.7	-6.6	16.8	25.9	0	102.4	82.1	30	97.4	0.9	0	11.29	SE/ WNW
July	13.6	333.8	10	4.5	-8.9	20.2	4.7	-8.9	19.2	18.1	0	101.7	69.7	3.2	96.4	1.7	0	14.78	WNW
August	31.6	365.4	10	5.8	-5.8	19.3	5.8	-5.8	18.5	21.1	0	100.9	66.0	15.8	95.4	2.0	0	16.76	WNW
September	4.0	369.4	3	9.5	-7	29.7	9.3	-6.8	28.4	21.1	0	102.6	53.9	9.1	93.7	2.2	0	18.33	WNW
October	82.8	452.2	9	14.4	-1.9	29.8	13.9	-1.9	27.9	28.6	0	100.9	65.4	15.6	99	1.5	0	16.58	WNW
November	42.6	494.8	12	15.3	0.7	30.9	14.8	0.9	28.8	36.8	0	103.6	67.6	18.9	96.1	1.2	0	14.17	ESE
December	82.2	577.0	11	19.9	6.9	35.2	19.4	6.8	33.2	30.8	0	102.1	64.2	12.4	96	1.5	0	12.82	WNW
TOTAL	577	-	129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4	-	3	-	-8.9	-	-	-8.9	-	-	0	-	-	3.2	-	-	0	-	-
Maximum	167.8	-	21	-	-	40.7	-	-	38.9	-	-	103.6	-	-	99	-	-	19.05	-

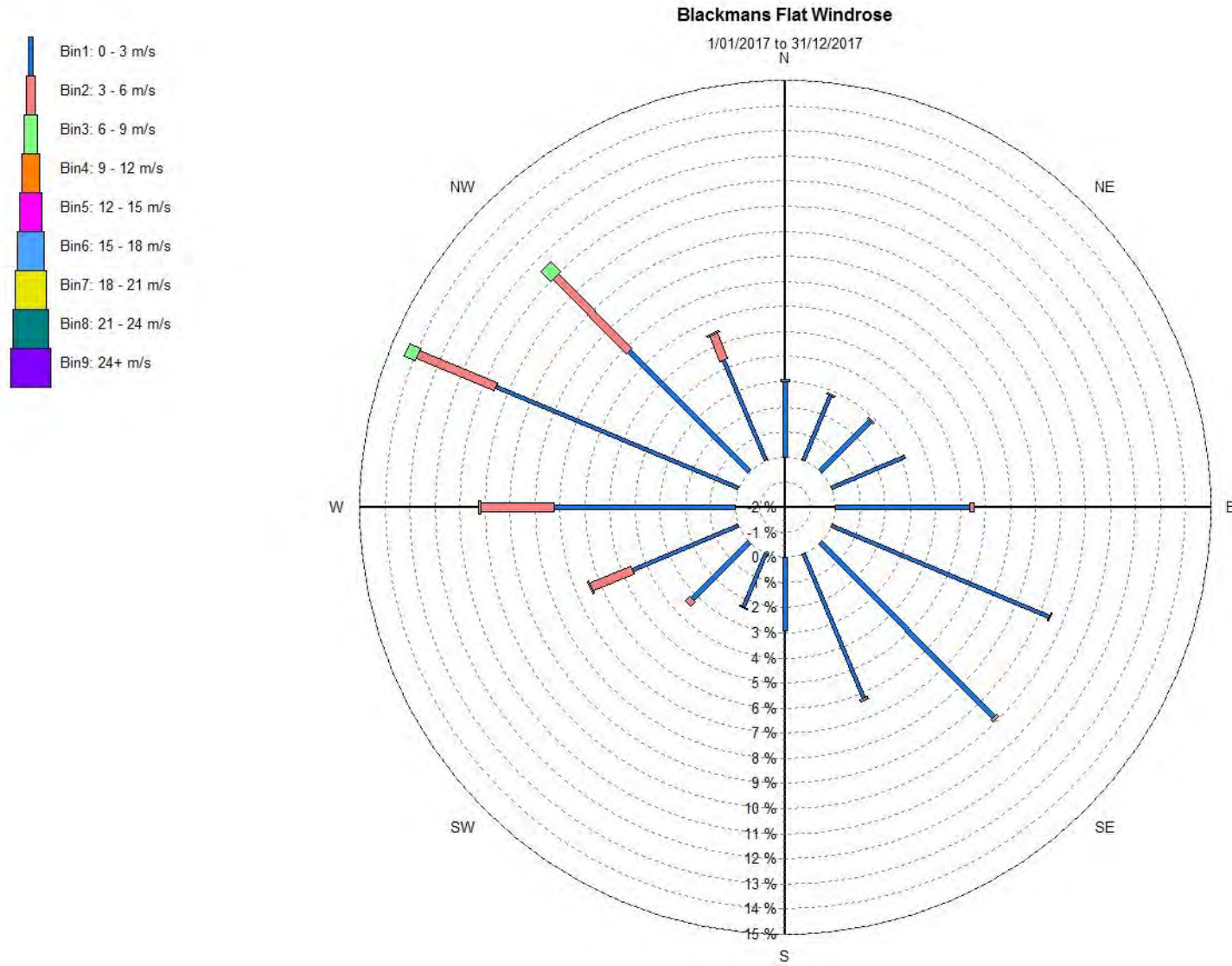


Figure 13 Pine Dale Mine Windrose Plot - 2017

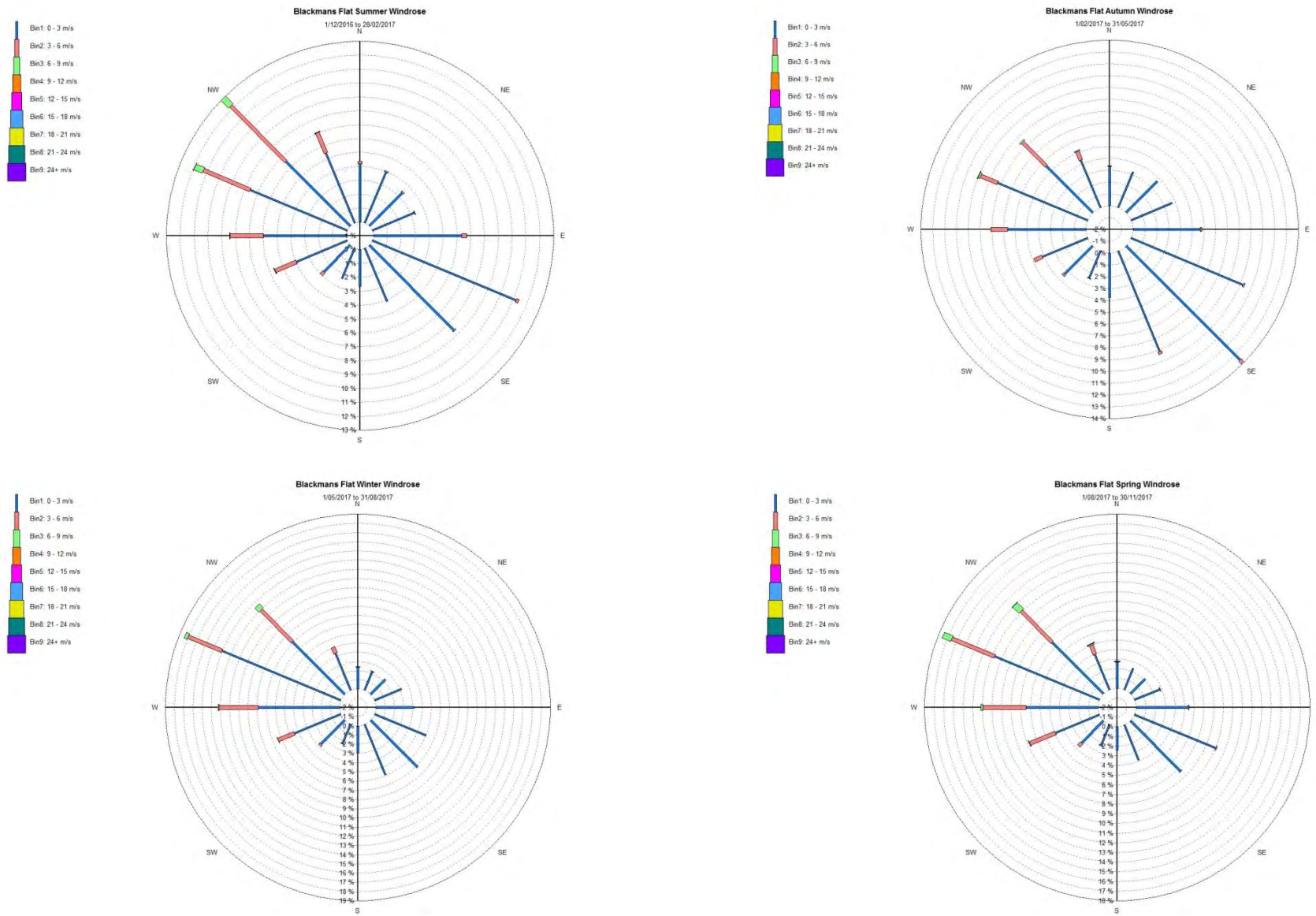


Figure 14 Pine Dale Mine Seasonal Windrose Plots - 2017

6.3 REVIEW OF METEOROLOGICAL MONITORING RESULTS

Pine Dale Mine received 568.8mm of rainfall and experienced 129 rainfall days during the 2017 reporting period. Rainfall during this period was observed to be less than half of the rainfall recorded during 2016 (1167.6mm and 147 rainfall days) and was the lowest amount received since 2006. The maximum 2m and 10m temperatures recorded during the reporting period was 40.7°C and 38.9°C respectively and was observed in February 2017. The lowest temperature was observed during July with -8.9°C recorded at both 2m and 10m. Predominant wind directions at the site during 2017 were observed to be from the north-west during summer, south easterly during autumn and from the west-north-west during both winter and spring. The maximum wind speed measured at the site was 19.0m/s on the 12 February from a west-north-westerly direction.

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 Neubeck's 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 Neubeck's Creek to ensure mining operations do not have an adverse effect upon the Neubeck's 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 Neubeck's Creek, Blue Lake and Cox's River were undertaken in February and September 2017 (refer RCA Reports 6880-1759, Feb 2017; and 6880-1760, Sept 2017 respectively).

Visual assessments and photographic documentation of each site are also undertaken on a monthly basis detailing evidence of erosion, newly exposed soils, and vegetation disturbance [refer to monitoring field sheets presented in **Appendix 2**]. Results of the routine six-monthly assessments are presented in **Tables 40 to 44**. The location of Stream Health monitoring sites are presented in **Drawing 2, Appendix 1**.

A stream health assessment of the Blue Lake site was not undertaken, as the site does not fit the requirements of the *Ephemeral 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 39**.

Table 39 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 40 Classification of Different Drainage Line State – Site SH1

Location:		SH1	
Assessment Date:		10/02/2017 & 08/09/2017	
Activity		Rating	Explanation of Rating
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	2	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 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	3	Gently slopes bank/ floodplain, laterally extensive, <5°
	Nature of Lateral Flow Regulation	4	Sparse grassland/ woodland with bare soil bank lip. Moderate flow rate, some highly focused inflow locations.
Classification of Drainage Line September 2017 survey		Score 21/32 66%	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 2017 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 41 Classification of Different Drainage Line State – Site SH2

Location:		SH2	
Assessment Date:		10/02/2017 & 08/09/2017	
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, 5-10°
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line September 2017 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 2017 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 42 Classification of Different Drainage Line State – Site SH3

Location:		SH3	
Assessment Date:		10/02/2017 08/09/2017	
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	Actively eroding. Slight undercutting, near vertical walls, alluvial fans also eroding. Depth=width.
	Longitudinal Morphology of Drainage Line	2	Flat with a cohesive fine 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 metre of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	Steep bank, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line September 2017 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 2017 survey		66%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 43 *Classification of Different Drainage Line State – Site SH3A*

Location:		SH3A	
Assessment Date:		10/02/2017 & 08/09/2017	
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 Section	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, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	3	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line		NA	Drainage line is considered stable due to spray-concrete lining.

Table 44 *Classification of Different Drainage Line State – Site SH5*

Location:		SH5	
Assessment Date:		10/02/2017 & 08/09/2017	
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	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 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 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°
	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 September 2017 survey		Total Score 23/32 72%	Drainage line is stable. This site SH5 has remained stable.
Comparative Survey Results			
Classification of Drainage Line February 2017 survey		72%	Drainage line is stable. This site SH5 has moved from a potentially stabilizing to a more stable form.

7.2 REVIEW & INTERPRETATION OF STREAM HEALTH MONITORING RESULTS

The routine six-monthly assessment of channel stability, stream health and vegetation health of the Neubeck's Creek monitoring locations (SH1, SH2, SH3 and SH3A) at Pine Dale Mine indicates the drainage line is classified as potentially stabilizing at locations SH1, SH2 and SH3. The drainage line at location SH3a is considered stable. An assessment of the Cox's River monitoring site (SH5) indicated the drainage line is also considered stable.

The CSIRO *Ephemeral Stream Assessment* protocol indicates ongoing monitoring of both Neubeck's 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 2017. 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. The conditional requirements within Project Approval 10_0041 (Schedule 3, Condition 1) and Environmental Protection License (EPL 4911) are presented in **Table 45**.

Table 45 *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 and 14		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 2017 period:

- Quarter 1 – January to March, monitoring conducted 9 January 2017.
- Quarter 2 – April to June, monitoring conducted 11 May 2017.
- Quarter 3 – July to September, monitoring conducted on 11 July 2017.
- Quarter 4 – October to December, monitoring conducted on 10 October 2017.

The aim of the attended noise survey is to record any impact of operational noise on the surrounding community. Two consecutive 15-minute surveys are conducted at each of the six monitoring locations. Results of attended noise surveys carried out during the 2017 monitoring period are presented in **Tables 46 to 49**. Meteorological conditions recorded during each noise survey are presented in **Table 50**. Noise survey locations are presented in **Drawing 1, Appendix 1**.

Table 46 *Attended Noise Survey – Quarter 1, January 2017*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine LAeq 15min Contribution	Pine Dale Mine LAeq 15min Limit	Road Traffic LAeq 15min Contribution	Birds & Other LAeq 15min Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			LAeq 15min	LA10 15min	LA90 15min						
9 January 2017	09:23:22	NM 1	48.3	51.2	39.9	NIL	42	47.8	39.3	Pine Dale Mine Road Traffic Birds & Other	NIL* 39 to 63 35 to 58
9 January 2017	09:38:22	NM 1	49.0	52.3	41.3	NIL	42	48.5	39.7	Pine Dale Mine Road Traffic Birds & Other	NIL* 38 to 64 35 to 60
9 January 2017	10:11:41	NM 2	49.1	52.9	38.4	NIL	42	50.7	38.9	Pine Dale Mine Road Traffic Birds & Other	NIL* 38 to 62 33 to 55
9 January 2017	10:26:41	NM 2	49.4	53.2	35.9	NIL	42	51.3	39.7	Pine Dale Mine Road Traffic Birds & Other	NIL* 36 to 63 31 to 59
9 January 2017	12:40:23	NM 3	40.8	43.7	33.6	NIL	42	39.4	35.1	Pine Dale Mine Road Traffic Birds & Other	NIL* 32 to 54 28 to 54
9 January 2017	12:55:23	NM 3	38.2	41.0	31.3	NIL	42	37.2	31.1	Pine Dale Mine Road Traffic Birds & Other	NIL* 29 to 50 29 to 46
9 January 2017	13:24:31	NM 4	38.3	37.3	<30	NIL	35	<30	38.1	Pine Dale Mine Road Traffic Birds & Other	NIL* 26 to 46 24 to 70
9 January 2017	13:39:31	NM 4	36.5	38.2	<30	NIL	35	<30	35.8	Pine Dale Mine Road Traffic Birds & Other	NIL* 28 to 53 26 to 55
9 January 2017	16:07:38	NM 5	44.9	47.5	39.9	NIL	35	42.6	41.2	Pine Dale Mine Road Traffic Birds & Other	NIL* 40 to 59 37 to 54
9 January 2017	16:22:38	NM 5	42.7	44.3	38.7	NIL	35	36.4	41.5	Pine Dale Mine Road Traffic Birds & Other	NIL* 37 to 58 36 to 57
9 January 2017	17:25:57	NM 6	41.2	43.4	32.0	NIL	35	32.9	40.5	Pine Dale Mine Road Traffic Birds & Other	NIL* 33 to 61 29 to 59
9 January 2017	17:40:57	NM 6	36.2	38.8	<30	NIL	35	31.3	34.5	Pine Dale Mine Road Traffic Birds & Other	NIL* 27 to 56 25 to 53

* Nil – Noise source not audible during survey session

Table 47 *Attended Noise Survey – Quarter 2, May 2017*

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	Birds & Other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)	
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min					Pine Dale Mine	Road Traffic
11 May 2017	07:14	NM 1	57.0	60.5	48.7	NIL	42	58.3	45.3	Pine Dale Mine Road Traffic Birds & Other	NIL* 47 to 65 44 to 56
11 May 2017	07:29	NM 1	56.5	60.1	46.3	NIL	42	58.1	43.8	Pine Dale Mine Road Traffic Birds & Other	NIL* 45 to 69 42 to 59
11 May 2017	07:51	NM 2	52.4	56.1	44.0	NIL	42	52.2	37.5	Pine Dale Mine Road Traffic Birds & Other	NIL* 40 to 62 40 to 55
11 May 2017	08:06	NM 2	53.9	57.2	46.9	NIL	42	53.8	39.2	Pine Dale Mine Road Traffic Birds & Other	NIL* 43 to 65 42 to 53
11 May 2017	09:29	NM 3	52.5	53.0	41.8	NIL	42	51.8	43.6	Pine Dale Mine Road Traffic Birds & Other	NIL* 39 to 71 38 to 63
11 May 2017	09:44	NM 3	48.9	50.9	41.0	NIL	42	47.7	42.9	Pine Dale Mine Road Traffic Birds & Other	NIL* 39 to 68 38 to 59
11 May 2017	08:39	NM 4	45.5	48.4	39.9	NIL	35	43.8	40.4	Pine Dale Mine Road Traffic Birds & Other	NIL* 39 to 56 36 to 50
11 May 2017	08:54	NM 4	43.5	45.7	39.3	NIL	35	41.2	39.7	Pine Dale Mine Road Traffic Birds & Other	NIL* 38 to 53 37 to 59
11 May 2017	10:22	NM 5	40.0	42.1	35.8	NIL	35	38.4	34.6	Pine Dale Mine Road Traffic Birds & Other	NIL* 33 to 51 34 to 54
11 May 2017	10:37	NM 5	42.3	43.5	33.4	NIL	35	35.7	41.2	Pine Dale Mine Road Traffic Birds & Other	NIL* 31 to 56 30 to 60
11 May 2017	11:00	NM 6	38.8	40.0	31.2	NIL	35	30.9	45.1	Pine Dale Mine Road Traffic Birds & Other	NIL* 30 to 54 29 to 57
11 May 2017	11:15	NM 6	45.8	45.3	32.0	NIL	35	38.0	37.8	Pine Dale Mine Road Traffic Birds & Other	NIL* 32 to 67 28 to 58

* Nil – Noise source not audible during survey session

Table 48 *Attended Noise Survey – Quarter 3, July 2017*

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	Birds & Other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)	
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min						
11 July 2017	10:12	NM 1	48.6	51.3	35.1	NIL	42	48.4	34.8	Pine Dale Mine Road Traffic Birds & Other	NIL* 37 to 67 31 to 57
11 July 2017	10:27	NM 1	47.8	50.3	38.3	NIL	42	47.6	35.0	Pine Dale Mine Road Traffic Birds & Other	NIL* 39 to 60 33 to 46
11 July 2017	10:59	NM 2	51.0	55.6	37.4	NIL	42	50.6	36.2	Pine Dale Mine Road Traffic Birds & Other	NIL* 35 to 62 33 to 56
11 July 2017	11:14	NM 2	50.9	55.3	32.8	NIL	42	50.8	32.0	Pine Dale Mine Road Traffic Birds & Other	NIL* 33 to 62 28 to 55
11 July 2017	11:44	NM 3	38.5	42.2	29.5	NIL	42	37.9	29.9	Pine Dale Mine Road Traffic Birds & Other	NIL* 30 to 55 26 to 45
11 July 2017	11:59	NM 3	39.2	42.0	28.6	NIL	42	38.3	31.9	Pine Dale Mine Road Traffic Birds & Other	NIL* 28 to 53 24 to 57
11 July 2017	12:45	NM 4	37.7	40.1	33.0	NIL	35	34.1	35.3	Pine Dale Mine Road Traffic Birds & Other	NIL* 32 to 51 29 to 59
11 July 2017	13:00	NM 4	41.8	43.4	33.5	NIL	35	33.1	57.4	Pine Dale Mine Road Traffic Birds & Other	NIL* 31 to 47 30 to 57
11 July 2017	13:35	NM 5	35.0	36.8	29.8	NIL	35	29.7	33.5	Pine Dale Mine Road Traffic Birds & Other	NIL* 29 to 56 27 to 63
11 July 2017	13:50	NM 5	34.7	36.9	30.3	NIL	35	31.0	32.3	Pine Dale Mine Road Traffic Birds & Other	NIL* 28 to 52 29 to 54
11 July 2017	14:32	NM 6	39.5	42.1	29.7	NIL	35	37.9	34.3	Pine Dale Mine Road Traffic Birds & Other	NIL* 29 to 62 26 to 49
11 July 2017	14:47	NM 6	47.0	47.1	31.4	NIL	35	41.4	45.6	Pine Dale Mine Road Traffic Birds & Other	NIL* 32 to 57 27 to 73

* Nil – Noise source not audible during survey session

Table 49 *Attended Noise Survey – Quarter 4, October 2017*

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	Birds & 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						
10 October 2017	10:36	NM 1	57.2	61.8	40.4	NIL	42	57.2	35.9	Pine Dale Mine NIL* Road Traffic 41 to 68 Birds & Other 36 to 52	
10 October 2017	10:51	NM 1	55.0	58.6	41.6	NIL	42	55.0	33.9	Pine Dale Mine NIL* Road Traffic 39 to 68 Birds & Other 37 to 54	
10 October 2017	10:00	NM 2	51.9	55.8	38.0	NIL	42	51.7	39.7	Pine Dale Mine NIL* Road Traffic 36 to 64 Birds & Other 34 to 61	
10 October 2017	11:15	NM 2	52.6	56.4	34.9	NIL	42	52.5	35.1	Pine Dale Mine NIL* Road Traffic 35 to 70 Birds & Other 30 to 54	
10 October 2017	09:27	NM 3	46.7	50.5	34.0	NIL	42	46.2	36.6	Pine Dale Mine NIL* Road Traffic 38 to 60 Birds & Other 28 to 54	
10 October 2017	09:42	NM 3	47.4	35.2	51.2	NIL	42	47.1	36.3	Pine Dale Mine NIL* Road Traffic 37 to 60 Birds & Other 30 to 57	
10 October 2017	13:19	NM 4	36.3	36.1	30.5	NIL	35	34.5	31.7	Pine Dale Mine NIL* Road Traffic 29 to 55 Birds & Other 27 to 43	
10 October 2017	13:34	NM 4	36.9	37.2	29.1	NIL	35	35.6	31.2	Pine Dale Mine NIL* Road Traffic 29 to 54 Birds & Other 26 to 46	
10 October 2017	11:17	NM 5	39.1	42.3	32.1	NIL	35	35.5	36.5	Pine Dale Mine NIL* Road Traffic 33 to 55 Birds & Other 29 to 56	
10 October 2017	11:32	NM 5	40.3	43.2	34.6	NIL	35	37.1	37.4	Pine Dale Mine NIL* Road Traffic 33 to 54 Birds & Other 31 to 59	
10 October 2017	12:37	NM 6	35.2	37.9	30.1	NIL	35	30.7	33.2	Pine Dale Mine NIL* Road Traffic 30 to 48 Birds & Other 28 to 50	
10 October 2017	12:52	NM 6	36.1	38.9	29.6	NIL	35	33.5	32.6	Pine Dale Mine NIL* Road Traffic 31 to 51 Birds & Other 28 to 48	

* Nil – Noise source not audible during survey session

Table 50 Meteorological Conditions during Attended Noise Surveys

Survey Date	Start Time	Location	Cloud (octa)	Temp at 10m (°C)	Wind Speed At Microphone Position	Wind Speed Range at Height of 10m (m/s)	Wind Direction
9 January 2017	09:23	NM 1	0	24	0 – 1.0	0 – 5.4	S-SW
9 January 2017	10:12	NM 2	0	28	0 – 1.8	0 – 3.7	SW
9 January 2017	12:40	NM 3	3	34	0 – 2.0	0 – 5.1	NE-SW changing
9 January 2017	13:25	NM 4	5	35	0 – 2.0	0 – 3.8	SE
9 January 2017	16:08	NM 5	7	27	1.0 – 3.0	0 – 2.3	S-SE
9 January 2017	17:26	NM 6	8	24	0 – 2.9	0 – 3.5	SE
11 May 2017	07:14	NM 1	0	-3.1	0	0	N/A
11 May 2017	07:51	NM 2	0	3.6	0	0	N/A
11 May 2017	09:29	NM 3	0	11.1	0	0.59	ENE
11 May 2017	08:39	NM 4	0	6.5	0	0.45	ENE
11 May 2017	10:22	NM 5	0	13.9	<0.5	1.63	SSE
11 May 2017	11:00	NM 6	0	14.6	2.0	2.1	SSE
11 July 2017	10:12	NM 1	0	7.6	0-2.5	2.1	SE
11 July 2017	10:59	NM 2	0	9.1	0-2.0	2.2	SE
11 July 2017	11:44	NM 3	0	10.3	0-0.5	1.7	S
11 July 2017	12:45	NM 4	0	11.0	0-3.0	1.8	S
11 July 2017	13:35	NM 5	0	11.1	0-2.7	1.7	S
11 July 2017	14:32	NM 6	0	11.6	0-2.7	1.5	SSE
10 October 2017	10:36	NM 1	5	17.8	0-2.3	1.7	W
10 October 2017	10:00	NM 2	4	16.4	0-1.0	2.0	W
10 October 2017	09:27	NM 3	6	15.9	0-1.0	2.2	W
10 October 2017	13:19	NM 4	3	20.1	0	2.7	NW-W
10 October 2017	11:17	NM 5	5	18.1	0-3.0	2.3	NW-N
10 October 2017	12:37	NM 6	3	20.4	0-2.8	1.2	NW-NE

Note: The Industrial Noise Policy states "Wind can also create extraneous noise on noise-monitoring equipment; an upper limit of 5 m/s at the microphone position is commonly applied during noise measurement to reduce this effect"

8.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS

Attended noise surveys of the Pine Dale mine for the 2017 monitoring period were undertaken when the mine was in care and maintenance. The conditions and operations during noise surveys were considered to be representative of those undertaken on a normal daily basis during the care and maintenance period.

Time based source coding was used during the attended noise surveys to record the overall noise levels and identify the sound sources that contribute to the sound environment at each of the six noise monitoring locations. Sound sources audible during the attended surveys were classified into three categories, 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 survey data using the sound level meter manufacturer's proprietary software. The software analysis determines the overall L_{Aeq} and L_n statistical values for the entire survey, as well as identifying the individual sound sources that were coded during the attended surveys and shows the energy average contribution and L_{min} and L_{max} values, for each source, for each of the 15 minute survey periods.

8.3.1 FIRST QUARTER 2017

Attended noise surveys of the Pine Dale mine operations for the January to March 2017 quarter were undertaken on the 9th January 2017. During the surveys the mine was observed to be non-operational and in a state of care and maintenance.

The surveys conducted for this assessment period showed nil $L_{Aeq, 15min}$ noise contributions from the Pinedale Mine at all noise monitoring locations, NM1 through NM6.

Wind was blowing from Pine Dale Mine (Source to Receiver) at NM 5 and 6 which would have resulted in slightly increased received Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

The surveys conducted at NM 1, NM 2 and NM3 showed that Road Traffic was the dominant noise source with Bird Calls intermittently contributing to the acoustic climate. The surveys conducted at NM 3 and NM 6 showed that Bird calls were the dominant noise source with Road Traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 5 showed that Road Traffic and Bird calls contributed evenly to the acoustic climate.

8.3.2 SECOND QUARTER 2017

Attended noise surveys of the Pine Dale mine operations for the April to June 2017 quarter were undertaken on the 11th May 2017. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road.

The surveys conducted for this assessment period showed nil $L_{Aeq, 15min}$ noise contributions from the Pinedale Mine at all noise monitoring locations, NM1 through NM6.

Wind was blowing from Pine Dale Mine (Source to Receiver) at NM 6 which would have resulted in slightly increased received Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

The surveys conducted at NM 1, NM 2 and NM3 showed that Road Traffic was the dominant noise source with Bird Calls intermittently contributing to the acoustic climate. The surveys conducted at NM6 showed that Bird calls were the dominant noise source with Road Traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 4 and NM 5 showed that Road Traffic and Bird calls contributed evenly to the acoustic climate.

8.3.3 THIRD QUARTER 2017

Attended noise surveys of the Pine Dale mine operations for the July to September 2017 quarter were undertaken on the 11th July 2017. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road.

There was nil $L_{Aeq, 15min}$ noise contribution measured from the Pine Dale Mine, at any noise monitoring location during this period.

Wind was not blowing from Pine Dale Mine (Source to Receiver) at any of survey locations at the time of measurement, reducing the potential for slightly increased received Sound Pressure Levels from Pine Dale Mine workings, if present.

The surveys conducted at NM 1, NM 2 and NM3 showed that Road Traffic was the dominant noise source with Bird Calls intermittently contributing to the acoustic climate. The surveys conducted at NM 4 showed that Bird calls were the dominant noise source with Road Traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 5 and NM 6 showed that Road Traffic and Bird calls contributed evenly to the acoustic climate.

8.3.4 FOURTH QUARTER 2017

Attended noise surveys of the Pine Dale mine operations for the October to December 2017 quarter were undertaken on the 10th of October 2017. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road.

All surveys conducted for this assessment period showed that there was nil noise contribution from the Pinedale Mine at any of the noise monitoring locations, NM1 through NM6.

The surveys conducted at NM 1, NM 2 and NM3 showed that Road Traffic was the dominant noise source with Bird Calls intermittently contributing to the acoustic climate. The surveys conducted at NM 4 showed that Road Traffic was the slightly dominant noise source with Bird noise intermittently contributing to the acoustic climate. The surveys conducted at NM 5 and NM 6 indicate that Road Traffic and Bird calls were the significant noise sources.

8.3.5 OVERALL ASSESSMENT FOR 2017

The assessable sound levels from Pine Dale Mine were below the assessment criteria during all survey 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 the 2017 period, traffic and natural sounds, which are represented by the "Overall" LAeq (15 minute) noise levels set out in **Tables 46 to 49**, were observed to be a significant contributor to the acoustic climate.

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 51**.

Table 51 *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

Throughout the 2017 monitoring period there were nil blast events conducted at the site as a result of the mine continuing to operate under Care and Maintenance.

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



Katy Shaw
Environmental Scientist
Robert Carr and Associates trading as
RCA Australia

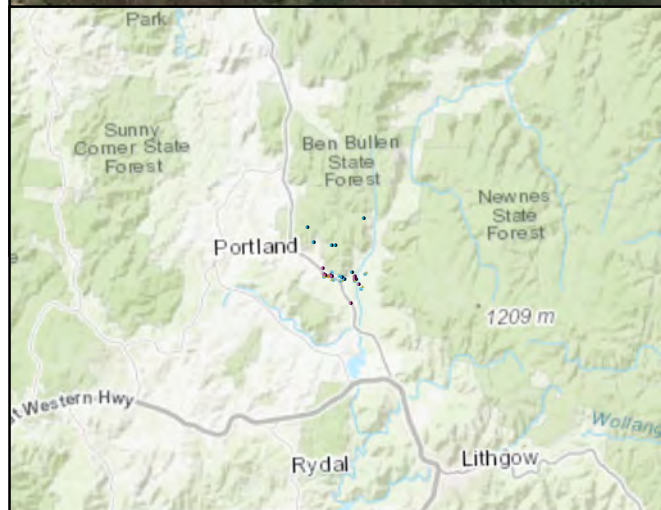


Karen Tripp
Senior Environmental Scientist / Hygienist
Robert Carr and Associates trading as
RCA Australia

Appendix 1

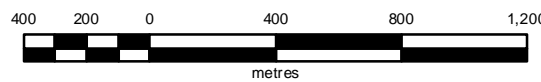
Drawing 1 - Environmental Monitoring Locations

Drawing 2 - Stream Health & Channel Stability Monitoring Locations



Legend

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



**PINE DALE MINE
CURRENT
ENVIRONMENTAL MONITORING LOCATIONS**

CLIENT	Pine Dale Mine	RCA Ref	6880-1755a/0
DRAWN BY	KS	SCALE	1:24,000 (A3)
APPROVED BY	KT	DATE	8/01/2018
		OFFICE	NEWCASTLE



Mine Office

Castlereagh

Highway

View Street

Clean Water Diversion

SH1

SH2

SH3

LDP13

SH3a

SH4

SH5

LEGEND

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



Aerial image taken from Google Earth, 23 May 2006



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

CLIENT	Pine Dale Mine		RCA Ref	6880-1755a/0	
DRAWN BY	KS	SCALE	1 : 5000 (A3)	DRAWING No	2
APPROVED BY	KT	DATE	8/1/2018	OFFICE	NEWCASTLE
				REV	0

CDT-DWG-A3H-001/1

APPENDIX C

2017 REHABILITATION MONITORING REPORT



Pine Dale Mine Rehabilitation Monitoring Report 2017

Report prepared by First Field Environmental
on behalf of EnergyAustralia

6 October 2017

Revision history

Version	Date	Author
Draft	22 September 2017	Michelle Evans
Final	6 October 2017	Michelle Evans

This report has been prepared by First Field Environmental for EnergyAustralia. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

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1. Introduction

Pine Dale Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km north of Lithgow on the northern side of Castlereagh Highway. The property is approximately 3km 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* (Enhance Place Pty Ltd, 2014) 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 in rehabilitation in regard to agreed performance indicators and completion criteria. Recommendations are made in areas that could be improved.

2. Performance indicators

Table 1 identifies the performance indicators and completion criteria for Pine Dale Mine as determined by the *Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd, 2014).

Table 1 Performance indicators and completion criteria

Performance indicator	Completion criteria
Feral animal and noxious weed presence	<ul style="list-style-type: none"> • Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use.
Feral animal and noxious weed control	<ul style="list-style-type: none"> • Feral animals and noxious weeds are controlled in accordance with legislation.
Fuel loads	<ul style="list-style-type: none"> • Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan.
Access	<ul style="list-style-type: none"> • Adequate access for fire-fighting is maintained on rehabilitation areas.
Habitat features	<ul style="list-style-type: none"> • Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters.
Vegetation health	<ul style="list-style-type: none"> • More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.

Performance indicator	Completion criteria
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites.
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10.
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gullyng or tunneling).
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas.
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species presence in rehabilitation areas.
Natural regeneration	<ul style="list-style-type: none"> Evidence of second generation of native forest indicator species from desired vegetation community. Evidence of natural regeneration of at least four pasture species at year 5.
Structure	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).
Species composition	<ul style="list-style-type: none"> Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. Vegetation within the treed rehabilitation areas are established in accordance with the approved species mix. Approved pasture species mix is sown at the specified rate per hectare.
Weed presence	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward.
Ground cover	<ul style="list-style-type: none"> Ground cover (vegetation, leaf litter, mulch) >70% at year 5.

Source: *Care and Maintenance Mining Operations Plan for Pine Dale Mine* (Enhance Place Pty Ltd, 2014)

3. Weather conditions

Winter of 2017 was characterised by sustained warmer weather. Average monthly rainfall leading up to the survey was variable, with June and July being unusually dry receiving significantly lower rainfall than the statistical average for that month.

The area received light rain (between 2 and 6 mm per day) during the week leading up to the survey work on the 25th of August (Bureau of Meteorology 2017).

Table 2 presents regional rainfall data for the period commencing 2010.

The area received light rain (between 2 and 6 mm per day) during the week leading up to the survey work on the 25th of August (Bureau of Meteorology 2017).

Table 2 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) January 2011 - August 2017

Year	Average	2011	2012	2013	2014	2015	2016	2017
Month								
January	77.6	63	48.2	87.4	9.2	156.2	142.0	37.2
February	76.8	68.2	173.8	149	85	21.2	28.8	12.2
March	101.9	78	187	43.2	155	39.4	69.6	141.4
April	47.2	23.8	31.6	26.8	63	158.2	6.2	21.2
May	29.2	42.4	40.6	23.6	14	25.2	26.0	32.6
June	65.6	41.2	70.6	87	43.2	24.8	173.4	19.6
July	36.4	18.2	48.8	19.6	25.6	44.6	91.4	6.6
August	42.0	54.8	23.2	22.4	56.4	43.8	52.2	41.8
September	52.2	65.4	40.4	44	35.2	9.8	118.6	-
October	42.5	36.8	16.6	20.8	51.6	58.0	71.4	-
November	70.7	158	39	68.6	36.8	63.6	58.4	-
December	81.8	86	61.2	38.4	160.4	58.6	86.4	-
Annual	762.1	735.8	781	630.8	735.4	703.4	924.4	-

Source: Bureau of Meteorology (2017)

4. Survey methodology

4.1 Rehabilitation monitoring

Monitoring locations - Previous studies have seen the establishment of six monitoring transects; four transects are located within rehabilitated pastures while the remaining two transects are within treed rehabilitation areas. Additional transects exist as analogue sites in grazed pasture and an undisturbed naturally vegetated area of the property to provide benchmarks against which the pasture and treed rehabilitation areas are assessed. Monitoring locations are shown in Figure 1.

Photopoint monitoring - Coordinates for each transect and analogue site are provided in Appendix A. Each transect area contains previously established photo monitoring points. Photos taken from these points enable a visual comparison to photos from previous surveys and are provided in Appendix E.

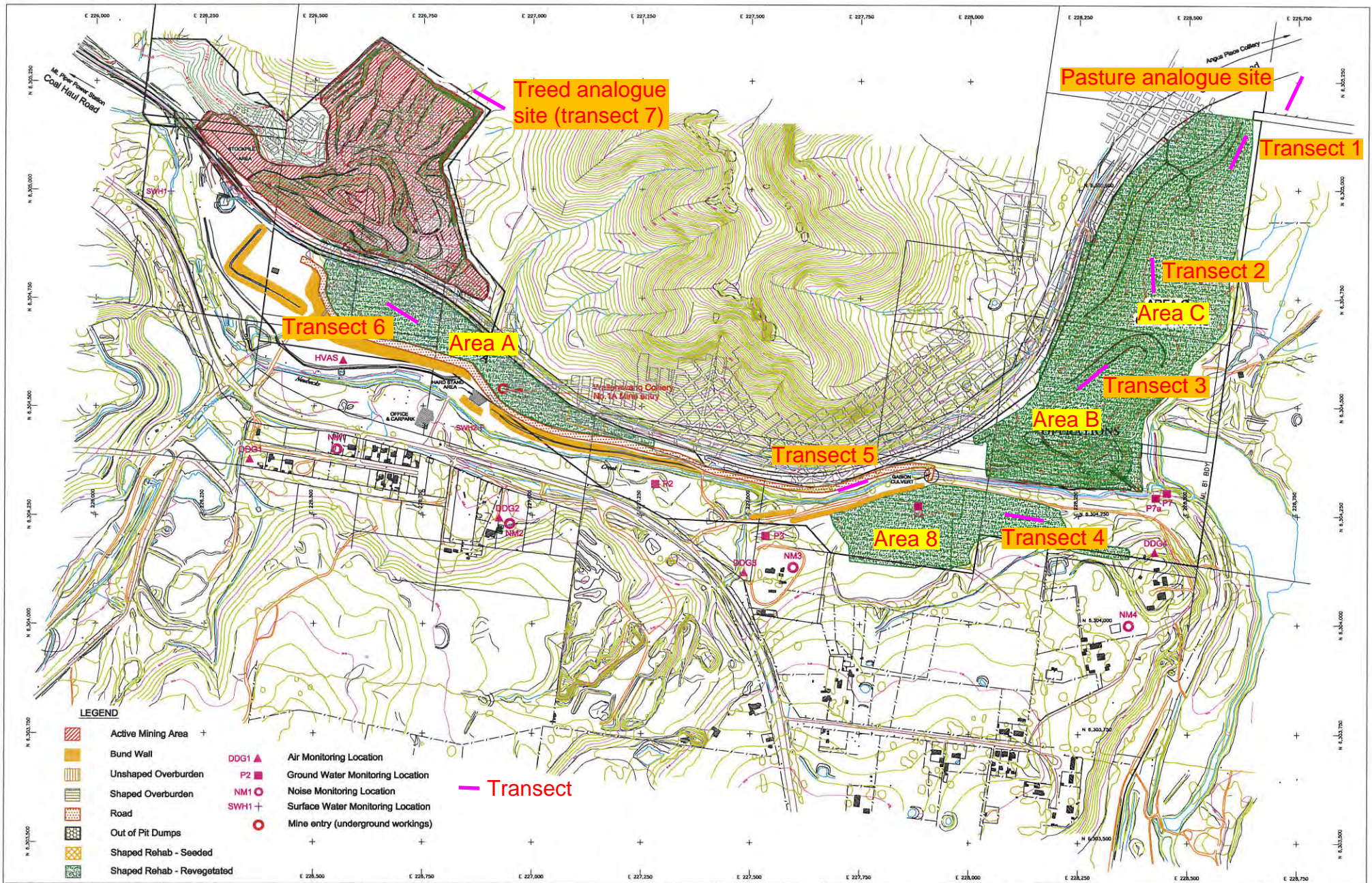
4.2 Erosion and sedimentation

Evidence of erosion and sedimentation along and within the vicinity of each transect has been determined in accordance with *Best Practice Erosion and Sediment Control* (IECA 2006).

4.3 Soil loss

The *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014) recommends that net soil loss be determined in accordance with the *Ecosystem Function Analysis* (CSIRO 2008). This method has been found to be inadequate for determining soil loss in comparison with the widely used *RUSLE* (IEAC Australasia 2012).

An estimation of soil loss at each transect site has been calculated using the *Revised Universal Soil Loss Equation* (RUSLE) (IEAC Australasia 2012). Values used for these calculations are presented in Appendix C.



LEGEND

- Active Mining Area
- Bund Wall
- Unshaped Overburden
- Shaped Overburden
- Road
- Out of Pit Dumps
- Shaped Rehab - Seeded
- Shaped Rehab - Revegetated
- DDG1 ▲ Air Monitoring Location
- P2 ■ Ground Water Monitoring Location
- NM1 ○ Noise Monitoring Location
- SWH1 + Surface Water Monitoring Location
- Mine entry (underground workings)

— Transect

NOTES:



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DATE	31-12-12
AMENDED	
SURVEYOR	AERIAL PHOTO/TE/TH
DRAWN	K.L.F.
CHECKED	

PINEDALE MINE
AEMR PLAN
END DECEMBER 2012

SCALE - 1 : 4000 (A1 Sheet)

DWG No
PINE-AEMR12

4.4 Vegetation assessment

Pasture rehabilitation areas – Cox’s River seed mix was sown in 2010-2011 at Areas B, C and Area 8 at the following rates:

- 40% Fescue (*Festuca spp.*)
- 25% Cocksfoot (*Dactylis glomerata*)
- 20% Subterranean clover (*Trifolium subterranean*)
- 6% Perennial rye grass (*Lolium perene*)
- 5% White clover (*Trifolium repens*)
- 4% Phalaris (*Phalaris aquatica*)

The proportion of perennial grasses and annual legumes currently in evidence at pasture transects has been recorded and compared with the proportion at which these species were initially sown.

Tree rehabilitation areas – The *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014) recommends that vegetation structure be determined in accordance with the *Ecosystem Function Analysis* (CSIRO 2008). This method does not adequately enable the identification of all completion criteria as required by the *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014). Vegetation health, natural regeneration, structure and species composition have instead been determined in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO 2009).

4.5 Evidence of fauna and habitat features

Fauna - Evidence of woodland birds and native fauna utilising rehabilitated areas has been recorded through the observation of scats and tracks and sightings.

Habitat features - The presence of nesting boxes, crushed timber piles and rock pile clusters within the rehabilitation areas is noted.

4.6 Pest animal and weed survey

Pest animal presence - Evidence of feral animal presence across the rehabilitation areas has been determined through scat and trail identification.

Noxious weeds - The location and extent of noxious weeds (as declared for the Upper Macquarie County Council area (NSW DPI, 2017) have been recorded. Target weed species, particularly African Lovegrass were identified in accordance with field guides and botanical keys.

4.7 Fuel loads and fire-fighting access

Fuel loads - Fuel loads within and adjacent to rehabilitation areas have been assessed in accordance with the *Overall Fuel Hazard Assessment Guide* (Department of Sustainability 2010).

Fire-fighting access - Access trails within rehabilitated areas have been assessed in accordance with *Policy No. 2/2007 Fire Trails* (Bush Fire Coordinating Committee 2007).

4.8 Rural land capability assessment

Pasture rehabilitation areas have been assessed in accordance with the *Land and Soil Capability Assessment* (OEH 2007).

4.9 Management input assessment

Land management activities - Land management and soil amelioration activities conducted in the past year have been identified through discussions with the land manager.

Feral animal and weed management - Evidence of feral animal and noxious weed control activities have been sought from the land manager and audited against relevant legislative requirements.

5. Field survey results

Field survey was conducted on 25th August 2017 by a qualified ecologist. The survey revisited six transects representing rehabilitated pasture and treed areas as well as pasture and treed analogue sites.

5.1 Erosion and sedimentation

There are no significant erosion features that compromise landform stability or public safety (including gullying or tunneling) within the rehabilitation areas. The presence and extent of active surface erosion within transect areas is recorded in Appendix A.

Pasture rehabilitation areas - The pasture rehabilitation areas support evidence of minor wind erosion where groundcover is poorly established or absent.

Treed rehabilitation areas - Minor wind and rill erosion is occurring at treed rehabilitation areas.

Analogue sites - No active erosion is evident at the pasture and treed analogue sites.

5.2 Soil loss

Rehabilitation activities commenced less than 10 years ago, and it is not yet possible to determine whether net soil loss is comparable to analogue sites at year 10. Estimated annual soil loss at rehabilitated transects is summarised in Table 3. Full calculations are provided in Appendix C.

Table 3 Estimated soil loss due to erosion

Estimated annual soil loss t/ha	Pasture analogue site	Transect 1 (pasture)	Transect 2 (pasture)	Transect 3 (pasture)	Transect 4 (pasture)	Transect 5 (treed)	Transect 6 (treed)	Treed analogue site (transect 7)
	0.09 t/ha	0.09 t/ha	0.09 t/ha	0.18 t/ha	0.03 t/ha	1.46 t/ha	0.36 t/ha	0.0 t/ha

5.3 Vegetation assessment

Flora species identified along and within the vicinity of transects are listed in Appendix D.

Species composition at pasture rehabilitation areas – Pasture rehabilitation areas are established with a mix of 70% perennial grasses and 20% annual legumes and are representative of species composition at the analogue pasture site. An example of transect 1, 2 and 3 pasture is shown in Figure 2 and Figure 3.



Figure 2 Typical pasture composition of transects 1, 2 and 3



Figure 3 Pasture composition representative of transect 4

Groundcover at pasture rehabilitation areas – Rehabilitated pasture surfaces in each of the transect areas support living groundcover of approximately 90%.

Areas currently exist within each pasture rehabilitation area where groundcover is sparse or absent. It is estimated that these areas account for less than 10% of each pasture area.

Natural regeneration at pasture rehabilitation areas – Natural regeneration of groundcover species is evident across all the pasture rehabilitation areas.

Species composition at treed rehabilitation areas – Treed rehabilitation areas are established in accordance with an approved species mix representing local native species.

Structure of vegetation at treed rehabilitation areas – Structural layers of vegetation at treed rehabilitation areas are not comparable to those of the treed analogue site.

The treed analogue site is characterised by a canopy to 12m height with 40% canopy cover over a sparse shrubby mid-storey to 3m height and isolated shrubs to 1.5m height in the understorey. Groundcover consists of grasses and herbs with a cover of >95% (Figure 4).



Figure 4 Vegetation structure of treed analogue site (transect 7)



Figure 5 Transect 6 vegetation structure

Canopy cover is absent in treed rehabilitation areas. A sparse mid-storey of isolated juvenile trees and shrubs exists over a sparse, low, shrubby understorey (seen in Figure 6). Groundcover is a sparse mix of broadleaf herbs and grasses. Changes in vegetation structure over time (as shown in Appendix B) are not considered significant.

Groundcover at treed rehabilitation areas – Transect 5 supports a total living groundcover of 70%. Total living cover within the transect 5 area has fluctuated from 90% in 2014, 50% in 2015 and 75% cover in 2017. Annual cover has decreased slowly from 20% in 2015 to 10% in 2017, while perennial living cover has increased from 30% to 60% in the same period. Litter cover appears to be stable at 10% and the area of bare surface along the transect has decreased from 40% in 2015 to 20% in 2017.

Groundcover at transect 6 is 80%. Total living cover has fluctuated from 90% in 2014 to 70% in 2015 and 80% in 2016 and 2017. Annual and perennial living cover is generally stable at around 10% for annual cover and 70% for perennial cover. Litter cover has been stable at 10% from 2015 to 2017 and bare surface has decreased from 20% in 2015 to 10% in 2016 and 2017.

See Appendix E for a visual comparison of cover at 2014 and 2017.

Vegetation health at treed rehabilitation areas – Native forest indicator species are those that occur both in treed rehabilitation areas and the treed analogue site and provide an opportunity for comparison of growth between natural and rehabilitation conditions. Indicator species include native trees, shrubs and groundcovers.

More than 20% of native species recorded within the treed analogue site are actively growing in the treed rehabilitation areas. These species are dominated by trees and shrubs and it is expected that groundcovers and herbaceous species will be able to colonise the treed rehabilitation areas once sufficient canopy cover is established.

It is difficult to determine whether native forest indicator tree species on treed rehabilitation areas are within the height and girth measurements of trees on the treed analogue site. While there is evidence of recruitment on the treed analogue site it is not possible to determine whether the age of juvenile trees is comparable to those establishing on the treed rehabilitation areas.

Natural regeneration of treed rehabilitation areas - There is no evidence of second generation native forest indicator tree or shrub species on treed rehabilitation areas; however natural regeneration of groundcover species is evident.

5.4 Evidence of fauna and habitat features

Field surveys recorded evidence of woodland birds utilising rehabilitation areas. Habitat features are installed on native forest rehabilitation areas including crushed timber rock pile clusters. Nesting boxes have not been installed in treed rehabilitation areas.

Fauna – Macropod, wombat, fox and rabbit scats and tracks were evident throughout the property. Evidence of foraging was observed as shallow diggings in both pasture and treed rehabilitation areas. Logs within the treed analogue and rehabilitation areas showed evidence of scratching. The remains of a rabbit kill were observed within Transect 6.

Native woodland birds were observed landing on trees and foraging within mulch in each of the treed vegetation areas and in the treed analogue site. Generalist birds including Currawong, Magpie and Noisy Miner were observed on the ground within pasture areas A and B and Area 8.

Habitat features – Crushed timber piles and rock pile clusters were observed within the treed rehabilitation areas of transects 5 and 6. Habitat features at the treed analogue site include fallen trees and scattered piles of fallen vegetation (visible in Figure 6).



Figure 6 An active burrow in an equipment storage area

5.5 Feral animals and weeds

Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use. Feral animals and noxious weeds are controlled in accordance with legislation. Weeds including African Lovegrass comprise <10% of the pasture sward. The presence or evidence of pests and weeds within and in the vicinity of each transect is recorded in Appendix A.

Pest animal presence – Rabbit and fox scats were observed across the property. Rabbit and fox numbers are considered low and do not require population reduction measures.

The European rabbit and European red fox are declared pests under the Local Land Services Act 2013. Rabbit and fox density is considered low, with some evidence of shallow soil scraping and scats across each of the monitoring locations. No holes, burrows or dens were observed.

Noxious and targeted weed species – Noxious weeds observed during field survey are listed in Table 4.

Table 4 Feral animal and noxious weed presence

Common name <i>Species name</i>	Location	Treatment
European Red Fox <i>Vulpes vulpes</i>	All locations	Landholders are obliged to control populations on their land.
European rabbit <i>Oryctolagus cuniculus</i>		
African Lovegrass <i>Eragrostis curvula</i>	Transects 1, 2, 3 and 4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continually inhibits its reproduction. Not notifiable.

The presence of African Lovegrass was noted at transects 1, 2, 3 and 4 and occurred across less than 10% of the pasture area. These outbreaks have been subjected to ongoing chemical control and were not observed to be growing or producing seed.

5.6 Fuel loads and fire-fighting access

Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan, and adequate access for firefighting is maintained on rehabilitation areas.

Fuel loads – Fuel loads within Areas A, B and C and Area 8 are low and fuel hazard mitigation activities are not required at this time.

Firebreaks - The internal road provides a mineral earth firebreak between Area A and Pine Dale Mine infrastructure to the south, while the Coal Haul Road provides a mineral earth firebreak immediately to the north of Area A. The Coal Haul Road and internal road provide a mineral earth firebreak to the north and west of Areas B and C and Area 8. Private grazing land is located immediately adjacent to the east and south of Areas B and C and Area 8. The majority of this interface supports mature Pine and Eucalypt trees which would provide a barrier to wind-borne embers spreading to private grazing land during a fire event.

Fire-fighting access - Access to each of the rehabilitation areas is considered to be adequate. The Coal Haul Road is a private road located immediately to the north of Areas A, B and C and Area 8 and allows movement from within Wallerawang Power Station, through Pine Dale Mine and to Mount Piper Power Station. An internal road is located immediately to the south of Areas A and B and to the north of Area 8. This road connects to Castlereagh Highway through the administration area of Pine Dale Mine. Area C is accessible by following the internal road through Area B. All access roads within rehabilitated areas are maintained in good condition and are suitable for the passage of Category 1 tankers, having a vertical clearance of >4m and a width of >2.8m (*Policy No. 2/2007 Fire Trails* (Bush Fire Coordinating Committee 2007)).

5.7 Rural land capability assessment

Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).

Pasture rehabilitation areas are assessed as being Land and Soil Capability Class V and are suitable for grazing. The limiting factors for land use are generally related to wind erosion hazard. Note that the area of transect 4 is also subject to soil acidification hazard due to soil texture (Table 5).

Table 5 Rural land capability assessment of pasture areas

Class	Transect 1	Transect 2	Transect 3	Transect 4
Water erosion hazard class	2 1 - <3% slope	3 3 - <10% slope	4 10 - <20% slope, no gully erosion present	2 1 - <3% slope
Wind erosion hazard class	5 Moderate wind erodibility class of surface soil, high winds erosive power, high exposure to wind, average annual rainfall >500mm			
Soil structural decline class	4 Fragile light textured soil - hardsetting			
Soil acidification hazard class	4 Very low texture /buffering capacity, pH 6.7 – 7.5 (CaCl ₂)			5

Class	Transect 1	Transect 2	Transect 3	Transect 4
				Very low texture /buffering capacity, pH 4.0 – 4.7 (CaCl ₂)
Salinity hazard class	1	Moderate to high recharge potential, low discharge potential, low salt store		
Waterlogging hazard class	2	0 – 0.25 months typical waterlogging duration, moderately well drained soils		
Shallow soils and rockiness hazard class	1	Nil rocky outcrop, soil depth >100cm		
Mass movement hazard class	1	No mass movement present		

5.8 Management input assessment

Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.

Control of noxious and targeted weed species has been undertaken across all rehabilitation areas as required and in accordance with the recommendations of the *Pine Dale Mine Rehabilitation Monitoring Report 2014* (First Field Environmental 2014).

6. Rehabilitation status

The status of performance indicators and completion criteria are summarised in Table 6.

Table 6 Status of completion criteria

Performance indicator	Completion criteria	Status
Feral animal and noxious weed presence	<ul style="list-style-type: none"> Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Feral animal and noxious weed control	<ul style="list-style-type: none"> Feral animals and noxious weeds are controlled in accordance with legislation. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Fuel loads	<ul style="list-style-type: none"> Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Access	<ul style="list-style-type: none"> Adequate access for firefighting is maintained on rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Habitat features	<ul style="list-style-type: none"> Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters. 	<ul style="list-style-type: none"> Ongoing - nesting boxes to be installed once trees are established

Performance indicator	Completion criteria	Status
Vegetation health	<ul style="list-style-type: none"> More than 75% of native forest indicator species are assessed to be healthy and growing at year 5. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gullying or tunneling). 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species presence in rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Natural regeneration	<ul style="list-style-type: none"> Evidence of second generation of native forest indicator species from desired vegetation community. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
	<ul style="list-style-type: none"> Evidence of natural regeneration of at least four pasture species at year 5. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Structure	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing). 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Species composition	<ul style="list-style-type: none"> Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix. Approved pasture species mix is sown at the specified rate per hectare. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Weed presence	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Ground cover	<ul style="list-style-type: none"> Ground cover (vegetation, leaf litter, mulch) >70% at year 5. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor

7. Key findings

General

- Estimated soil loss in each of the transect areas is considered acceptable. Heightened soil loss calculated for the treed rehabilitation areas is consistent with the structural complexity differences between the rehabilitation and analogue sites.

Treed rehabilitation areas

- Nesting boxes are not installed in or adjacent to the treed rehabilitation areas.
- There is no evidence of second generation establishment at treed rehabilitation areas.
- Structural vegetation layers at treed rehabilitation areas are not comparable to the vegetation structure at the treed analogue site.

8. 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 Mining Operations Plan* (Enhance Place Pty Ltd 2014).

- Continue to monitor performance indicators, in particular:
- Continue to spot-spray outbreaks of African Lovegrass; and
- Install nesting boxes once the treed rehabilitation areas contain adequate structure to support nesting woodland birds.

9. References

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- OEH (2007) *Land and Soil Capability Assessment*, Office of Environment and Heritage, NSW
- SLR (2014) *Soil Assessment and Recommendations for Rehabilitation Areas*, NSW

Appendix A

Survey data 2017

Pasture analogue site	
Easting	Northing
228300	6304880
228317	6304925
Landform and soils	
Slope	1 - <3% slope inclining to the northwest.
Erosion	Not observed.
Cracking soils	Not observed.
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 2015	
Total living cover	>90%
Annual living cover	40%
Perennial living cover	50%
Litter cover	<10%
Bare surface	-

Transect 1 Pasture rehabilitation area

Easting		Northing		
228621		6305093		
228594		6305048		
Landform and soils				
Slope	Transect located along a contour. 1 - <3% slope inclining to the northwest.			
Erosion	Minor wind erosion observed on exposed soils.			
Cracking soils	Not observed.			
Surface drainage impediments	No significant drainage impediments.			
Vegetation				
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.			
Species richness	>30 herbs and grasses identified, dominated by exotic species.			
Cover classification	% cover at each observation			
	April 2014	September 2015	September 2016	September 2017
Total living cover	90%	80%	95%	90%
Annual living cover	-	40%	47.5%	40%
Perennial living cover	-	50%	47.5%	50%
Litter cover	10%	-	-	<10%
Bare surface	-	20%	5%	<10%
Target weed presence				
African Lovegrass (<i>Eragrostis curvula</i>)	<10%			

Transect 2 Pasture rehabilitation area

Easting		Northing		
228454		6304718		
228400		6304744		
Landform and soils				
Slope	Transect located along a contour. 3 - <10% slope inclining to the west.			
Erosion	Minor wind erosion observed on exposed soils.			
Cracking soils	Not observed.			
Surface drainage impediments	No significant drainage impediments.			
Vegetation				
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.			
Species richness	>30 herbs and grasses identified, dominated by exotic species.			
Cover classification	% cover at each observation			
	April 2014	September 2015	September 2016	September 2017
Total living cover	90%	80%	90%	90%
Annual living cover	-	40%	42%	40%
Perennial living cover	-	50%	48%	50%
Litter cover	10%	-	-	<10%
Bare surface	-	20%	10%	<10%
Target weed presence				
African Lovegrass (<i>Eragrostis curvula</i>)	<10%			

Transect 3 Pasture rehabilitation area					
Easting		Northing			
228267		6304532			
228306		6304560			
Landform and soils					
Slope		Transect located along a contour. 10 - <20% slope declining to the northwest.			
Erosion		Minor wind erosion observed on exposed soils.			
Cracking soils		Not observed.			
Surface drainage impediments		No significant drainage impediments.			
Vegetation					
Vegetation structure		Groundcover of mixed native and exotic grasses and broadleaf herbs.			
Species richness		>30 herbs and grasses recorded, dominated by exotic species.			
Cover classification		% cover at each observation			
		April 2014	September 2015	September 2016	September 2017
Total living cover		90%	80%	90%	90%
Annual living cover		-	40%	46%	40%
Perennial living cover		-	50%	44%	50%
Litter cover		10%	-	-	<10%
Bare surface		-	20%	10%	<10%
Target weed presence					
African Lovegrass (<i>Eragrostis curvula</i>)		<10%			

Transect 4 Pasture rehabilitation area				
Easting		Northing		
228318		6304224		
228249		6304227		
Landform and soils				
Slope	Transect located along a contour. 1 - <3% slope declining to the west.			
Erosion	Minor wind erosion observed on exposed soils.			
Cracking soils	Not observed.			
Surface drainage impediments	No significant drainage impediments.			
Vegetation				
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.			
Species richness	Diverse groundcover with >30 exotic herb and grass species recorded.			
Cover classification	% cover at each observation			
	April 2014	September 2015	September 2016	September 2017
Total living cover	90%	80%	90%	90%
Annual living cover	-	40%	42%	30%
Perennial living cover	-	50%	48%	60%
Litter cover	10%	-	-	<10%
Bare surface	-	20%	10%	<10%
Target weed presence				
African Lovegrass (<i>Eragrostis curvula</i>)	<10%			

Transect 5 Treed rehabilitation area					
Easting		Northing			
227846		6304272			
227787		6304251			
Landform and soils					
Slope		Transect located along contour of mid slope inclining 10-20% to the north.			
Erosion		Minor wind and rill erosion observed on exposed soils.			
Cracking soils		Not present.			
Surface drainage impediments		No significant drainage impediments.			
Vegetation					
Vegetation structure		Sparse tree layer to 3m height with scattered juvenile trees and sparse mixed native shrub species. Dense groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.			
Species richness		Shrub layer is dominated by native species and juvenile trees. Groundcover dominated by exotic broadleaf herbs and grasses. >15 species recorded.			
Cover classification		% cover at each observation			
		April 2014	September 2015	September 2016	September 2017
Total living cover		90%	50%	75%	70%
Annual living cover		-	20%	12%	10%
Perennial living cover		-	30%	63%	60%
Litter cover		10%	10%	10%	10%
Bare surface		-	40%	15%	20%
Target weed presence					
None observed.					

Transect 6 Treed rehabilitation area				
Easting		Northing		
226604		6304724		
226647		6304706		
Landform and soils				
Slope	Transect located along contour of mid slope inclining 10-20% to the northeast.			
Erosion	Minor wind and rill erosion observed on exposed soils.			
Cracking soils	Not observed.			
Surface drainage impediments	No significant drainage impediments.			
Vegetation				
Vegetation structure	Sparse tree layer to 3m height with scattered juvenile trees and sparse mixed native shrub species. Moderately dense groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.			
Species richness	Shrub layer is dominated by native species and juvenile trees. Groundcover dominated by exotic broadleaf herbs and grasses. >15 species recorded.			
Cover classification	% cover at each observation			
	April 2014	September 2015	September 2016	September 2017
Total living cover	90%	70%	80%	80%
Annual living cover	-	10%	12%	10%
Perennial living cover	-	60%	68%	70%
Litter cover	10%	10%	10%	10%
Bare surface	-	20%	10%	10%
Target weed presence				
None observed.				

Treed analogue site (transect 7)	
Easting	Northing
226801	6305097
226838	6305039
Landform and soils	
Slope	Transect located along contour of mid slope gently inclining to the north.
Erosion	No erosion observed.
Cracking soils	Not observed.
Surface drainage impediments	No drainage impediments.
Vegetation	
Vegetation structure	Eucalyptus dominated canopy to 12m high with a canopy cover of 40%. Sparser shrub layer to 3m height with isolated shrubs to 1.5m height. >90% groundcover to 0.5m height, dominated by native grasses with mixed native herbs.
Species richness	More than 10 tree species, dominated by <i>Eucalyptus</i> spp. Shrub layer of >9 native species. Diverse groundcover dominated by <i>Poa</i> spp. with mixed native herbs.
Cover classification	
Total living cover	90%
Annual living cover	10%
Perennial living cover	80%
Litter cover	10%
Bare surface	-
Target weed presence	
None observed.	

Appendix B

Vegetation assessment of treed areas

Vegetation assessment treed areas 2017

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	Treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	Sparse. To 3 m height.	Sparse. To 3 m height.	>10 species, 12-14 m height. 20% canopy cover.
Understorey	Sparse, to 2 m height. Includes juvenile Eucalyptus and Acacia species.	Sparse, to 3 m height. Includes juvenile Eucalyptus and Acacia species.	>9 species, 1-2 m height, 10% cover
Groundcover	70% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 80% cover.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>10	>10	<5
Recruitment	Not observed.	Not observed.	Observed.
Organic litter	Very sparse layer of mulch remaining.	Very sparse layer of mulch remaining.	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.

Vegetation assessment treed areas 2016

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	Treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	Sparse. To 3 m height.	Sparse. To 3 m height.	>10 species, 12-14 m height. 20% canopy cover.
Understorey	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species.	Sparse, to 3 m height. Juvenile Eucalyptus and Acacia species.	>9 species, 1-2 m height, 10% cover
Groundcover	75% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 80% cover.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>15	>13, including <i>Senecio madagascariensis</i> .	<10
Recruitment	Not observed.	Not observed.	Present
Organic litter	Very sparse layer of mulch remaining.	Very sparse layer of mulch remaining.	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.

Vegetation assessment treed areas 2015

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	Treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	Sparse. To 3 m height.	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. <i>Cassinia arcuata</i> .	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. <i>Cassinia arcuata</i> .	>7 species, 1-2 m height, 10% cover
Groundcover	<40%. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 20% cover.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>10, including <i>Rubus fruticosus</i> .	>10	<10
Recruitment	Not observed.	Not observed.	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.

Vegetation assessment treed areas 2014

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	Treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	Sparse. To 3m height.	Sparse. To 3m height.	>5 species, 12-14 m height. 40% canopy cover.
Understorey	Sparse. Juvenile Eucalyptus spp. present with Acacia shrubs.	Sparse. Juvenile Eucalyptus spp. present with Acacia shrubs.	>7 species, 1.5 - 3 m height, 35% cover
Groundcover	Sparse. Mix of exotic grasses, native and exotic herbs.	Sparse. Mix of exotic grasses, native and exotic herbs.	70% cover. Dominated by <i>Poa</i> spp. with mixed native herbs.
Non-native species	>10	>10	<10
Recruitment	Not observed.	Not observed.	Present
Organic litter	Thin mulch present.	Thin mulch present.	Well-developed to >2cm 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 C

Estimation of annual soil loss in pastures

Annual soil loss factors	Pasture analogue site	Transect 1 (pasture)	Transect 2 (pasture)	Transect 3 (pasture)	Transect 4 (pasture)	Transect 5 (treed)	Transect 6 (treed)	Treed analogue site (transect 7)
Annual rainfall erosivity factor (R)	1365 Bathurst							
Soil erodibility factor (K)	0.03 Sandy loam /fine sandy loam			0.025 Sandy clay-loam			0.03 Sandy loam /fine sandy loam	
Topographic factor (LS)	0.17 3% gradient, 5m slope length		0.34 8% gradient, 5m slope length	0.09 1% gradient, 5m slope length	0.89 20% gradient, 5m slope length		0.52 12% gradient, 5m slope length	
Cover and management factor (C)	0.01 No appreciable canopy cover, 80-95% grassy groundcover				0.04 25% canopy cover of tall weeds or short brush, 60-80% grassy groundcover	0.01 25% canopy cover of tall weeds or short brush, 80-95% grassy groundcover	0.00 Consistent with 75% canopy cover of trees and 95% grassy groundcover	
Erosion control practice factor (P)	1.3 Compacted					1.2 Consistent with trackwalking along contour		1.3 Compacted
Annual soil loss due to erosion (A)	0.09 t/ha	0.09 t/ha	0.09 t/ha	0.18 t/ha	0.03 t/ha	1.46 t/ha	0.36 t/ha	0.0 t/ha

Appendix D

Species list

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Acacia dealbata</i> subsp. <i>dealbata</i>					X	X	X
<i>Acacia nana</i>					X	X	
<i>Acacia rubida</i>					X	X	X
<i>Acacia</i> sp.					X	X	X
<i>Acacia ulcifolia</i>							X
<i>Ajuga australis</i>							X
<i>Amaranthus</i> sp.	X	X	X	X	X	X	
<i>Brassica juncea</i>	X	X	X	X	X	X	
<i>Bursaria spinosa</i> subsp. <i>lasiophylla</i>					X	X	X
<i>Calandrinia calytrata</i>							X
<i>Cirsium vulgare</i>	X	X	X	X			
<i>Conyza bonariensis</i>	X	X	X	X	X	X	
<i>Crassula</i> sp.					X		
<i>Dactylis glomerata</i>	X	X	X	X			
<i>Desmodium varians</i>							X
<i>Dillwynia phyllicoides</i>							X
<i>Eragrostis</i> sp.	X	X	X	X			
<i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i>							X
<i>Eucalyptus dives</i>					X	X	X
<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>							X
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>						X	
<i>Eucalyptus rubida</i> subsp. <i>rubida</i>							X

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Festuca arundinacea</i>	X	X	X	X			
<i>Festuca</i> sp.	X	X	X	X			
<i>Gamochaeta</i> sp.	X	X	X	X			
<i>Geranium</i> sp.				X			X
<i>Gompholobium huegelii</i>							X
<i>Goodenia hederacea</i>							X
<i>Hibbertia aspera</i> subsp. <i>aspera</i>							X
<i>Hibbertia obtusifolia</i>							X
<i>Hypochaeris radicata</i>	X	X	X	X	X	X	
<i>Juncus</i> spp.		X					
<i>Leucopogon</i> sp.							X
<i>Lissanthe strigose</i> subsp. <i>subulata</i>							X
<i>Lomandra filiformis</i>							X
<i>Medicago</i> sp.	X	X	X	X			
<i>Oxalis corniculata</i>	X	X	X				
<i>Paspalum</i> sp.				X	X		
<i>Persoonia laurina</i>							X
<i>Phalaris aquatica</i>	X	X	X	X			
<i>Pinus</i> sp.							X
<i>Plantago lanceolata</i>	X	X	X	X	X	X	
<i>Poa annua</i>	X	X	X	X			X
<i>Poa labillardierei</i>							X
<i>Poa</i> spp.	X	X	X	X	X	X	X
<i>Ranunculus lappaceus</i>							X

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Ranunculus sp.</i>	X	X	X	X	X	X	
<i>Rumex acetosella</i>	X	X			X	X	
<i>Sonchus oleraceus</i>	X	X	X	X			
<i>Taraxacum officinale</i>				X			
<i>Themeda australis</i>							X
<i>Trifolium arvense</i>	X	X	X	X			
<i>Trifolium repens</i>	X	X	X	X			
<i>Trifolium subterraneum</i>	X	X	X	X			
<i>Veronica calycina</i>							X
<i>Vicia sp.</i>					X	X	
<i>Vulpia sp.</i>	X	X	X	X			

Appendix E

Photopoint monitoring to 2017



Transect 1 looking south 2014



Transect 1 looking south 2015



Transect 1 looking south 2016



Transect 1 looking south 2017



Transect 2 looking southeast 2014



Transect 2 looking southeast 2015



Transect 2 looking southeast 2016



Transect 2 looking southeast 2017



Transect 3 looking southwest 2014



Transect 3 looking southwest 2015



Transect 3 looking southwest 2016



Transect 3 looking southwest 2017



Transect 4 looking west 2014



Transect 4 looking west 2015



Transect 4 looking west 2016



Transect 4 looking west 2017



Transect 5 looking west 2014



Transect 5 looking west 2015



Transect 5 looking west 2016



Transect 5 looking west 2017



Transect 6 looking east 2014



Transect 6 looking east 2015



Transect 6 looking east 2016



Transect 6 looking east 2017



Transect 7 looking east 2014



Transect 7 looking east 2015



Transect 7 looking east 2016



Transect 7 looking east 2017



Quadrat 1 February 2010 (Cunningham 2012)



Quadrat 1 September 2011 (Cunningham 2012)



Quadrat 1 November 2012 (Cunningham 2012)



Quadrat 1 April 2014



Quadrat 1 September 2015



Quadrat 1 September 2016



Quadrat 1 September 2017

APPENDIX D

DEPARTMENT OF PLANNING & ENVIRONMENT CORRESPONDENCE

Enhance Place Pty Ltd
Operators of Enhance Place & Pine Dale Open Cut Coal Mines

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Mine office:

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24 March 2017

Chris Schultz

Senior Compliance Officer

Department of Planning & Environment, Resource Assessments & Compliance
Level 2, Block G, 84 Crown St, Wollongong NSW 2500

Dear Chris,

Pine Dale Mine (Project Approval 10_0041)
Annual Review – Enhance Place Response to the Department

I refer to your letter dated 8 March 2017 regarding the Pine Dale Mine Annual Review report for the period 1 January 2016 to 31 December 2016, submitted to the Department of Planning and Environment (the Department) on 1 March 2017. Please find below our responses to the questions raised by the Department and additional information as requested.

Notation by the Department	Enhance Place Response
<p>1) Section 10 of the Annual Review contains incorrect text and no update is provided on the close out of actions from the Independent Environmental Audit (IEA). An update has been provided in the IEA action plan on the website, however this has not been included in the Annual Review. It is requested that this text is corrected and the IEA action update is included in the Annual Review prior to uploading onto the EnergyAustralia website.</p>	<p>The text in Section 10 has been corrected and updated to include the completion table from the IEA Action Plan. A revised version (Revision 1.0) was forwarded to all stakeholders on 14 March 2017. This version will also be uploaded on the EnergyAustralia website.</p>
<p>2) The link on the website to view documents required in accordance with Condition 10 of Schedule 5 of the approval is labelled 'NSW EPA Reports'. It is requested that this is updated to reflect that documents as required by the approval and Department are accessible using the link.</p>	<p>The website link to view documents required in accordance with Condition 10 of Schedule 5 of the approval has been renamed as 'Annual Reviews / AEMRs', whilst a separate link is now provided for 'EPA Reports'. These changes were made on 15 March 2017.</p>

Notation by the Department	Enhance Place Response
<p>a) <i>what management actions, if any, can be implemented to move stream health for Neubeck's Creek from 'potentially stabilising' to 'stable channel'</i></p>	<p>Pine Dale Mine adopted the CSIRO Ephemeral Stream Assessment method as the Performance Criteria for the ongoing 6-monthly surveys. A baseline survey classification of Neubeck's Creek was undertaken in August and October 2013. At present, all monitored sections of Neubeck's Creek are classified as 'potentially stabilising' indicating no change from baseline monitoring. The CSIRO recommends: <i>'ongoing monitoring of Neubeck's Creek is required, while rehabilitation works are not needed in the immediate future'</i>.</p> <p>Pine Dale Mine will continue to monitor the channel stability and stream health of Neubeck's Creek. A number of management actions have been implemented to maintain and improve the health of Neubeck's Creek; this includes some supplementary tree planting, maintaining existing vegetation, removal of problematic material from the channel and the construction of earthen berms to direct sediment laden water from access roads away from the creek. These management measures have proven effective in maintaining the stability and health of Neubeck's Creek over the years. In accordance with the CSIRO guidelines no further rehabilitation works will be undertaken in the immediate future. Any additional works would likely involve the removal of the existing approved haul road which is not proposed at this time.</p>
<p>b) <i>is there a timeframe by which the bridge allowing access to Bore I is to be repaired? It is noted that Bore E has been inaccessible since March 2016 and failure to monitor at this location is a non-compliance with the management plan.</i></p>	<p>An inspection of the bridge was undertaken on 10 March 2017. The barricades and warning signage had been removed from the bridge and evidence of vehicle usage of the bridge was observed. Sampling was conducted at Bore E and the VW Piezometer was downloaded. An examination of the data indicated there was 100% data capture between 5 May 2016 and 10 March 2017 (refer Attachment 1). Data downloads and standing water level measurements from Bore E will be resumed on a monthly basis, in addition to quarterly water quality sampling.</p>
<p><i>The Department requests that a comparison of complaints received for the last five years is provided in future Annual Reviews.</i></p>	<p>Noted</p>

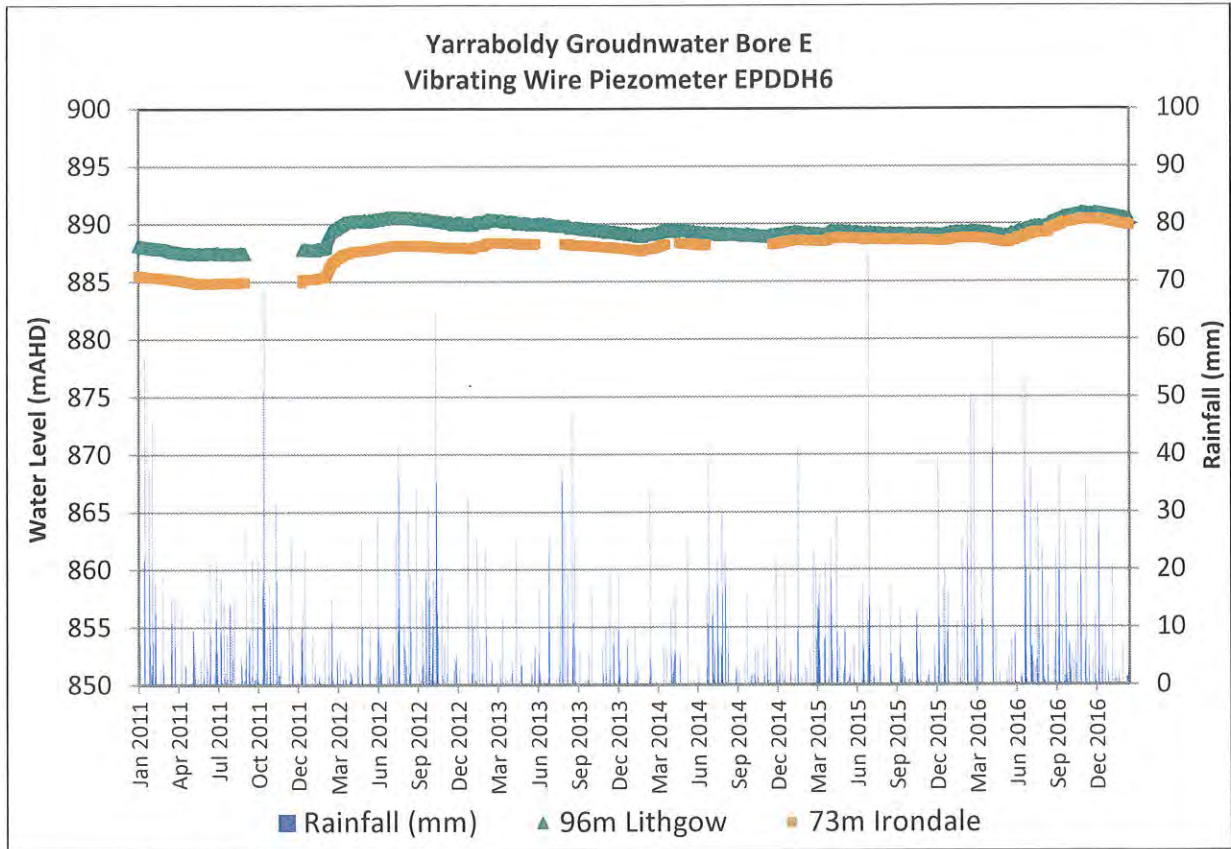
Please contact me if you have any questions relating to the above on 6359 0600, or at graham.goodwin@energyaustralia.com.au.

Yours Sincerely,



Graham Goodwin
Mining Engineering Manager
Enhance Place Pty Ltd

Attachment 1 Data capture from Bore E VW Piezometer – January 2011 to March 2017



Enhance Place Pty Ltd
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19 September 2017

Tim Baker
Department of Primary Industries Water
Level 10 Macquarie Tower
Locked Bag 5123
Parramatta NSW 2124

Via email: water.referrals@dpi.nsw.gov.au
tim.baker@dpi.nsw.gov.au

Dear Tim,

Pine Dale Mine – Water Management Plan
Approval of water quality and water level trigger values

Background

Pine Dale Mine is managed by Enhance Place Pty Ltd which is a subsidiary company of EnergyAustralia NSW. Pine Dale Mine is managed in accordance with Project Approval 10_0001, granted by the Minister of the Department of Planning and environment in 2011. Pine Dale Mine is currently in care and maintenance following approved mineable reserves being exhausted in March 2014.

A review of the Pine Dale Mine Water Management Plan (WMP) and site water monitoring data was completed in April 2015 to develop water quality and level trigger values. The proposed trigger values related to the surface and groundwater monitoring network described in the WMP. These trigger levels were based on four years of data from 2011 to 2014. These trigger values were accepted by the Department of Primary Industries - Water in August 2015.

Enhance Place Pty Ltd has undertaken a scheduled review of site water monitoring data in accordance with the Pine Dale Mine Water Management Plan (WMP). It was noted that the current trigger levels only consider four years of data and not the entire data set for each monitoring point which covers up to 12 years of monitoring data for some points. As such Enhance Place Pty Ltd propose to use the entire monitoring data set for each monitoring

point rather than limiting it to four years which is currently the case. This will provide robust trigger values which are representative of site conditions. The use of the entire historical dataset will provide a more accurate representation of the water quality conditions present at the site, thereby increasing the validity of the trigger levels defined.

Enhance Place seeks approval from the Department of Primary Industries - Water for the revised trigger values provided in **Tables 1, 2 and 3** to be incorporated within the updated Water Management Plan.

Requirement to undertake a review

The *Pine Dale Mine Water Management Plan* (Approved August 2015), which forms part of the MOP requires Pine Dale to:

- Review the assessment criteria (trigger levels) to ensure that the most appropriate criteria are being applied.

It is noted that the review of the site water trigger values and monitoring frequency would also satisfy Schedule 5, Condition 2(h) of Project Approval 10_0041 to undertake periodic review of the site Management Plans.

Existing surface and groundwater monitoring network

Existing water monitoring is completed in accordance with the site WMP and EPL4911. This comprises 10 groundwater monitoring locations and 11 surface water monitoring locations (monitoring locations depicted in **Drawing 1**, attached).

Surface water monitoring is primarily focused around Neubeck's Creek which has historically been subject to realignments. Upstream of the Pine Dale Mine surface monitoring network along Neubeck's Creek lies the NSW Office of Water gauging station 212055, whilst Centennial Coal Services LDP006 discharges to an upstream tributary of Neubeck's Creek in-between Pine Dale Mine monitoring location "EPL Site 2" and "S1", downstream of gauging station 212054.

Water data used in the review

This review was based on the entire Pine Dale water monitoring dataset collected from the surface and groundwater monitoring network, which dates from December 2005 to present. This comprised of:

- Groundwater data collected during the period December 2005 to July 2011 in accordance with the Groundwater Monitoring Plan (October 2005);
- Surface and groundwater data collected during the period January 2011 to July 2013 in accordance with the Baseline Water Monitoring Plan (July 2011); and,
- Routine surface water and groundwater monitoring conducted during the period February 2009 to May 2017 in accordance with the Water Management Plans (July 2011 & August 2015) and the site Environmental Protection Licence (EPL 4911).

Trigger Level Review Methodology

The following section outlines the methodology used to review the water quality and water level triggers as per the Pine Dale Mine Water Management Plan (August 2015).

The methodology used during this review is consistent with that used in the previous review of water quality and water level triggers, which was accepted by the Department of Primary Industries – Water (DPI-Water) in August 2015. The review methodology previously accepted incorporated the use of:

- The 90th percentile statistical value for determining a site specific upper EC limit.
- The 20th percentile statistical value for determining a site specific lower pH trigger level, with an upper pH trigger level of 8.0 pH units.
- The minimum reported baseline water level (AHD) minus 10% of the saturated aquifer thickness, to determine site specific groundwater level triggers.

A summary of the current surface water and groundwater trigger levels (approved in 2015) and the proposed trigger levels derived during this review (highlighted values), using the entire data set, are provided in **Table 1** and **Table 2**. The complete water quality data set for the period December 2005 to May 2017 is provided in an attached spreadsheet format (file PDM 2017 Trigger Level Review Water Data.xls).

Table 1
Surface Water Quality Trigger Level Review - Summary

Surface Water Site ID	pH					Electrical Conductivity				
	Maximum Range Reported	20th Percentile	90th Percentile	Existing 2015 Trigger Level	Proposed 2017 Trigger levels	Maximum Range Reported	90th Percentile	Existing 2015 Trigger Level (uS/cm2)	Proposed 2017 Trigger Level (uS/cm2)	
S1	5.00 - 9.80	6.25	7.51	6.2 - 8.0	6.2 - 8.0	438 - 3570	2570	2325	2570	
S3	5.79 - 8.00	6.50	7.49	6.4 - 8.0	6.4 - 8.0	288 - 3140	2454	2223	2454	
S4	6.70 - 8.50	7.36	8.22	7.3 - 8.0	7.3 - 8.0	178 - 1380	940	957	957	
S5	6.58 - 8.30	6.91	7.93	7.0 - 8.0	6.9 - 8.0	376 - 2200	1244	1013	1244	
S6	5.60 - 8.20	6.84	7.79	6.7 - 8.0	6.7 - 8.0	467 - 4460	2501	1941	2501	
S7	6.10 - 8.18	6.87	7.70	6.8 - 8.0	6.8 - 8.0	380 - 3290	1283	1007	1283	
The Bong	5.14 - 8.09	5.79	7.65	5.8 - 8.0	5.8 - 8.0	137 - 1222	1145	1157	1157	
EPA Point 2	6.62 - 8.10	6.98	7.61	7.1 - 8.0	6.9 - 8.0	295 - 3160	2398	2055	2398	
EPA Point 14	7.10 - 8.70	7.50	8.48	7.5 - 8.0	7.5 - 8.0	368 - 1340	1207	1166	1207	

Note: **Italic** indicates a change in trigger level since last (2015) review.

Table 2
Groundwater Quality Trigger Level Review - Summary

Groundwater Site ID	pH					Electrical Conductivity				
	Maximum Range Reported	20th Percentile	90th Percentile	Existing 2015 Trigger Level	Proposed 2017 Trigger levels	Maximum Range Reported	90th Percentile	Existing 2015 Trigger Level (uS/cm2)	Proposed 2017 Trigger Level (uS/cm2)	
Bore P6	5.62 - 8.16	6.19	7.05	6.2 - 8.0	6.2 - 8.0	172 - 1391	1201	1180	1201	
Bore P7	5.87 - 8.39	6.20	7.04	6.3 - 8.0	6.2 - 8.0	550 - 1020	845	852	852	
Old Shaft	5.42 - 8.09	6.10	7.48	6.3 - 8.0	6.1 - 8.0	142 - 1530	1100	908	1100	
Bore A	6.20 - 8.08	6.50	7.43	6.5 - 8.0	6.5 - 8.0	214 - 2650	894	326	894	
Bore C	6.22 - 7.90	6.72	7.38	6.9 - 8.0	6.7 - 8.0	162 - 598	474	490	490	
Bore D	6.40 - 7.90	6.72	7.41	6.8 - 8.0	6.7 - 8.0	312 - 627	598	608	608	
Bore E	4.69 - 7.98	5.50	6.34	5.5 - 8.0	5.5 - 8.0	83 - 238	147	151	151	

Note: **Italic** indicates a change in trigger level since last (2015) review.

A summary of groundwater level data from the groundwater monitoring bores and vibrating wire piezometers are provided in **Table 3**, whilst a complete data set of groundwater logger levels are also included in spreadsheet format (file PDM 2017 Trigger Level Review Water Data.xls and PDM Groundwater VW Piezometer 2011-2017 Data).

Table 3
Groundwater Level Review - Summary

Vibrating Wire Piezometers	Groundwater Level				
	Aquifer Screened	10% of Saturated Aquifer Thickness	Minimum Water Level Reported (m AHD)	Existing 2015 Trigger Level (m AHD)	Proposed 2017 Trigger Level (m AHD)
EP DDH5 Bore B	22m Sandstone	0.00	921.80	921.23	921.23
	30m Irondale	0.20	NA*	NA*	NA*
	47m Lidsdale	0.20	899.43	899.23	899.23
EP HHD3 Bore C	58m Irondale	0.10	909.51	909.40	909.41
	77m Lidsdale	0.17	891.95	891.78	891.78
	84m Marangaroo	0.70	890.18	889.76	889.48
EP DDH6 Bore E	73m Irondale	0.10	888.17	884.67	888.07
Bore P6	Underground workings (Lithgow/Lidsdale Seam)	0.20	882.45	887.90	882.25
Bore P7	Lithgow Seam	1.72	884.03	883.28	882.31
Old Shaft	Mine Void	0.20	888.04	888.46	887.84
Bore A	Middle River Seam	0.90	954.90	954.40	954.00
Bore C	Lithgow Seam	0.15	889.40	889.25	889.25
Bore D	Middle River Seam	0.50	941.11	940.61	940.61
Bore E	Middle River Seam	0.12	938.55	938.43	938.43
EP PDH3/GW Enhance Bore	Lithgow Seam	1.72	892.78	891.06	891.06
EP PDH4/GW Enhance Bore	Goaf / Lithgow Seam	1.72	892.67	890.95	890.95

* ND – No Data. Bore is depressurised (water level has dropped below bore sensor installation height).

Bold Italics indicates a change in trigger level since last (2015) review.

Summary

As per the requirements of the Pine Dale Mine Water Management Plan, a periodic review of the current water quality triggers and groundwater level triggers has recently been undertaken. This review utilised the entire water quality monitoring dataset for the Pine Dale Mine, spanning the period December 2005 to present. These reviews were conducted using the same methodologies previously approved by DPI-Water during the last periodic review undertaken in 2015. As per the recommendations of DPI-Water and the ANZECC guidelines, the review was undertaken on data obtained from each individual monitoring location in order to refine the site specific trigger values.

Pine Dale Mine seeks approval from DPI-Water for the proposed trigger values presented in **Tables 1, 2 and 3** be incorporated within the updated WMP. The updated WMP will provide water quality and level triggers that are relative to the local environment and allow Pine Dale Mine to continue to effectively manage site waters to minimise potential environmental impacts during the Care and Maintenance period.

Please do not hesitate to contact me if you have any questions relating to the above on phone 02 6354 8102 or email ben.eastwood@energyaustraliansw.com.au

Regards,

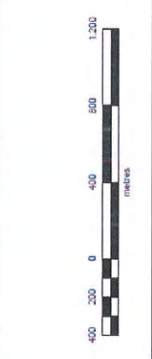


Graham Goodwin
Mining Engineering Manager



Legend

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



RCA AUSTRALIA
 GEOTECHNICAL • ENVIRONMENTAL
 CLIENT: Pine Dale Mine
 DRAWN BY: NS
 APPROVED BY: NT

PINE DALE MINE CURRENT ENVIRONMENTAL MONITORING LOCATIONS	
PROJECT No	6880-1726a
SCALE	1:24 000 (A3)
DATE	16/01/2017
DRAWING No	1
OFFICE	NEWCASTLE