




PINE DALE MINE ANNUAL REVIEW 2023

Prepared by Enhance Place Pty Ltd
22 February 2024

TITLE BLOCK

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
Environment Protection Licence Anniversary Date:	24 November
Water Licence Number:	10WA118780
Water Licence Holder:	Enhance Place Pty Ltd
Rehabilitation Management Plan Commencement Date:	1 July 2022
Forward Plan Anniversary Date:	30 June
Annual Review Start Date:	1 January 2023
Annual Review End Date:	31 December 2023
Annual Review Report Author:	Anh Hoang (RCA Australia)
<p>I, Graham Goodwin, certify that this audit report is a true and accurate record of the compliance status of Pine Dale Mine, for the period 1 January 2023 to 31 December 2023 and that I am authorised to make this statement on behalf of Enhance Place Pty Ltd.</p> <p><i>Note.</i></p> <p><i>a) The Annual Review is an 'environmental audit' for the purposes of section 9.39 of the Environmental Planning and Assessment Act 1979. Section 9.42 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 Tier 3 monetary penalty.</i></p> <p><i>b) 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 a fine of 200 penalty units or both).</i></p>	
Authorised Reporting Officer:	Graham Goodwin
Title:	Mining Engineering Manager
Signature:	
Date:	22 February 2024

STATEMENT OF COMPLIANCE

The Pine Dale Mine (PDM) Annual Review has been prepared to provide a summary of the performance of PDM operations during the period 1 January 2023 – 31 December 2023 (the reporting period).

This Annual Review 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 (Ref [1]).

A summary of the PDM compliance status during this reporting period is provided in **Table 1**. There were two (2) non-compliance during the 2023 reporting period and a description of the administrative non-compliance are provided in **Table 2**. The non-compliance status recorded during the reporting period has been ranked according to the risk included in **Table 3**.

Table 1 *Statement of compliance*

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

Table 2 *Non-Compliances*

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed in Annual Review
PA 10_0041	Condition 18	Air quality monitoring requirements of the Air Quality and Greenhouse Gas Management Plan	Non-compliant	Results from dust gauges D1, D2-D6, and PCB1-PCB3, PCB7 were collected two (2) days outside recommended (Ref [7]) exposure period. Did not comply to the Australian Standard.	Section 5.2
PA 10_0041	27 (c) Groundwater Management Plan	Groundwater monitoring requirements of Groundwater Management Plan.	Non-compliant	Yarraboldy Groundwater monitoring schedule unable to be adhered to due to the State Forest closure, safety risks accessing bores caused by bushfire damage and saturated ground, and overgrown vegetation obscuring bore location.	Section 6.2

Table 3 Compliance status Key for Table 2

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).

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

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 were below the air quality criteria stipulated in the Project Approval 10_0041 at all monitoring locations with the exception of the December 2023 results from dust gauge PCB1 which increased by more than NSW EPA threshold of 2g/m² from the November monitoring result. The majority of the PCB1 results are from combustible matter such as insects and other organic matter and not considered to indicate airborne particulates from soil disturbance works at PDM.
- There were no noise exceedances from mining activities recorded at privately owned properties during the reporting period.
- There were no surface water discharge events during the reporting period.
- The standing water level at onsite bore P6 and P7 were above the trigger levels throughout the reporting period which is consistent with expectations following above average rainfall during previous reporting periods.
- There were some intermittent exceedances of groundwater chemistry trigger values during the reporting period; however, these are considered to be primarily due to climatic influences (increased rainfall) and potential ingress of water into the underground workings outside of the control and influence of PDM.
- There were some intermittent exceedances of surface water trigger values during the reporting period; however, these are considered to be due to activities upstream of PDM and / or natural variation and not associated with activities undertaken by PDM during the reporting period.

During the reporting period, an assessment of rehabilitation areas was completed. Rehabilitation areas are generally stable in both the pasture and treed revegetation areas, whilst weed presence continues to be adequately controlled. It is recommended to continue weed management and monitoring of performance indicators over the 2024 reporting period. Installation of nesting boxes has also been recommended as per previous years, subject to trees being suitable size and age for the installation. Minor slumping at Transect 5 was identified and will be stabilised as recommended.

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ENVIRONMENTAL MONITORING SUMMARY REPORT

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PDM 2023 REHABILITATION MONITORING REPORT (REF [4])

1 INTRODUCTION

EnergyAustralia acquired Enhance Place Pty Ltd (Enhance Place) which owns and operates the Pine Dale Mine (PDM) in June 2012.

PDM 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). A locality plan is provided in **Plan 1, Appendix A**.

PDM is authorised by Project Approval (PA) 10_0041, dated 20 February 2011, granted by the former Department of Planning and Infrastructure, currently the Department of Planning, Housing and Infrastructure (DPHI), under section 75J of the Environmental Planning & Assessment Act 1979 (EP&A Act). The Project Approval provided for the extraction of up to 800,000 tonnes of Run of Mine (ROM) coal from the Yarraboldy Extension at PDM up to 31 December 2014 at a maximum rate of 350,000 tonnes per annum. Approved mining resources at PDM 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 (AR) has been generated to meet:

- The requirements of the NSW DPHI (Ref [1]), under the conditions of a development consent and/ or project approval.
- The routine reporting expectations of the NSW Resources Regulator.
- The annual reporting requirements of the Environment Protection Authority (EPA) under the conditions of the site Environmental Protection Licence 4911.

This Annual Review will be distributed to the following stakeholders:

- NSW DPHI – Compliance.
- Department of Regional NSW – Resources Regulator.
- NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) – Natural Resources Access Regulator.
- NSW Environment Protection Authority.
- Lithgow City Council.
- Community Consultative Committee (CCC) via the EnergyAustralia website (<https://www.energyaustralia.com.au/about-us/energy-generation/pine-dale-coal-mine/yarraboldy-stage-1>).

1.1 KEY PERSONNEL

The key personnel for environmental management at the PDM are listed in **Table 1-1**.

Table 1-1 Key Personnel and contact information

Contact Person	Position	Telephone	Email
Mr Graham Goodwin	Mining Engineering Manager	(02) 6354 8111	community@energyaustralia.com.au
Mr Mark Frewin	Coal Supply Lead	(02) 6354 8111	community@energyaustralia.com.au
Mr Ben Eastwood	NSW Environment Leader	(02) 6354 8111	community@energyaustralia.com.au

2 APPROVALS, LEASES AND LICENCES

PDM operates in accordance with a number of relevant licenses and approvals which are summarised in **Table 2-1**. The mining and exploration lease boundaries are shown in **Plan 2, Appendix A**.

Table 2-1 Pine Dale Mine Consents, Leases and Licences

Permit Type	Permit Number	Relevant Dates	Description
Project Approval	PA 10_0041	Granted 20 Feb 2011 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	Anniversary Date 24 November	EPL held by Enhance Place Pty Ltd.
Mining Lease	ML1578	Granted 5 November 2013	ML 1578 incorporates 69.4 hectares (ha) of land within the boundary of the PDM site.
Mining Lease	ML1664	Grouped under ML1578, 5 November 2013	ML 1664 incorporates 4.1ha of land within the boundary of the PDM site.
Mining Lease	ML1569	Grouped under ML1578, 5 November 2013	ML1569 incorporates 161ha of land with the Yarraboldy Extension and a portion of PDM.
Mining Lease	ML1637	Grouped under ML1578, 5 November 2013	ML1637 covers an area to the south of PDM for the purpose of proposed rail infrastructure.

Permit Type	Permit Number	Relevant Dates	Description
Exploration Mining Lease	EL7621	Granted 1 October 2010	EL 7621 incorporates 312ha of land within the northwestern 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 (6) six piezometers for monitoring groundwater levels and quality on the PDM site.
Bore Licence	10BL603588	Issued 17 December 2010	Issued by the DNR under Part 5 of the Water Act 1912 for the use of eight (8) piezometers for monitoring groundwater levels and quality on the Yarraboldy Extension.
Water Access Licence	WAL36480 (approval no 10WA118780)	Dated 1 July 2013 Expires 30 June 2026	This licence was issued by the (former) Department of Environment Climate Change and Water under Part 5 of the Water Act 1912 for interception and use of up to 200ML of groundwater per year from The Bong.

3 OPERATIONS SUMMARY

PDM was in care and maintenance during the reporting period, as such, no extractive mining operations were undertaken.

3.1 EXPLORATION

There were no exploration drilling activities carried out at PDM during the reporting period.

3.2 LAND PREPARATION

There were no land preparation activities carried out at PDM during the reporting period.

3.3 CONSTRUCTION

No construction work was undertaken at PDM during the reporting period.

3.4 MINING OPERATIONS

There were no mining activities undertaken at PDM during the reporting period: PDM is currently in care and maintenance. The production and waste summary for 2022, 2023 and forecast for 2024 is provided in **Table 3-1**.

Table 3-1 *Production Summary*

	Approved Limit	2022 Reporting Period (actual)	2023 Reporting Period (actual)	2024 Reporting Period (forecast)
Waste Rock / Overburden	NA	0	0	0
ROM Coal	800,000tonne (over life of mine)	0	0	0
Coarse Reject	NA	0	0	0
Fine Reject (Tailings)	NA	0	0	0
Saleable product	350,000tonne per annum	0	0	0

3.5 COAL PROCESSING

Due to the care and maintenance status of PDM, no coal was processed during the reporting period. The coal crushing plant was decommissioned at the completion of mining extraction in April 2014.

3.6 COAL TRANSPORTING

Due to the care and maintenance status of PDM, no product coal was required to be transported during the reporting period.

3.7 WASTE MANAGEMENT

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 programme. Minimal general waste is generated at PDM as the mine in care and maintenance.

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

3.8 PRODUCT STOCKPILES

All product stockpiles were decommissioned prior to the reporting period.

3.9 HAZARDOUS MATERIAL MANAGEMENT

There are no bulk oils stored on site and none were brought onto site during the reporting period. In the event hazardous materials are to be brought on site, they are to be accompanied by Safety Data Sheets (SDS).

3.10 FORECAST OPERATIONS

There are no operations forecast for PDM during 2024. The mine will continue to remain under care and maintenance.

4 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2022 Annual Review recommended:

- Weed management and fertilising as part of rehabilitation activities. Chemical control and fertilising have been undertaken (refer **Section 5.7**) and audited against relevant legislative requirements. The current status is considered satisfactory, and it continues to be monitored.
- Installation of nesting boxes once the treed area contains adequate structure to support nesting birds. No works were undertaken in relation to this in the 2023 reporting period as the trees remain too small following bushfire damage to accommodate them.

Relinquishment of successfully remediated Areas B, C and 8 (as confirmed by the 2018 SLR Rehabilitation and Completion Assessment report (Ref [2])) was intended to be undertaken during the 2023 reporting period.

There were no further specific actions (other than maintenance requirements) from the 2022 Annual Review.

5 ENVIRONMENTAL PERFORMANCE

PDM regards sound environmental performance and community liaison as integral components of its operations.

Environmental monitoring and management at PDM are governed by the requirements of PA 10_0041 and the supporting environmental assessment. The following management plans have been developed for PDM to minimise the potential risk to the surrounding environment.

- PDM Rehabilitation Management Plan, Ref [3]
- Aboriginal Heritage Management Plan.
- Air Quality and Greenhouse Gas Management Plan.
- Blast Management Plan.
- Bushfire Management Plan.
- Waste Management Plan.
- Water Management Plan.
- Noise Management Plan.
- Pollution Incident Response Management Plan.
- Pine Dale Mine Environmental Management Strategy.

These management plans are available on the EnergyAustralia website.

A summary of the environmental performance for noise and air quality monitoring is provided in **Table 5-1**. Applicable approval and Environmental Assessment criteria are also provided in **Table 5-1**. Detailed discussions of the environmental performance are presented further in this section.

Meteorological data is collected from the existing Mt. Piper Power Station (MPPS) weather station.

Table 5-1 Summary of Environmental Performance and assessment criteria

Aspect	Approval Criteria	Environment Assessment Prediction	Performance during 2023	Trends /Management Implications	Management Actions
Noise	NM1 – NM3 Daytime Criterion 42dB(A) L _{Aeq} (15minute) ^a	NM1 41 NM2 32 NM3 39 dB(A) L _{Aeq} (15minute)	NM1 Nil detected. NM2 Nil detected. NM3 Nil detected. dB(A) L _{Aeq} (15minute)	Not Applicable (NA) – no operational noise generated	Nil management actions required
	NM4 – NM6 Daytime Criterion 35dB(A) L _{Aeq} (15minute) ^a	NM4 34 NM6 <30 dB(A) L _{Aeq} (15minute)	NM4 Nil detected. NM5 Nil detected. NM6 Nil detected. dB(A) L _{Aeq} (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 1.2g/m ² /month deposited dust	Concentrations during previous five (5) years are considered consistent noting that there has been impact to the results from external factors (climate and bushfires in 2019 and 2020)	Maintain dust suppression measures as required
	Maximum increase in deposited dust 2g/m ² /month	Annual average increase of deposited dust 1.2g/m ² /month	Annual average change of -2.0 to 1.4/m ² /month deposited dust	Annual average dust levels are slightly lower than 2019 and 2020, generally consistent with 2021 and 2022 data.	Ensure dust suppression measures are efficiently utilised during extended dry periods, otherwise maintain current measures as required.

^a The A-weighted, equivalent continuous sound level in decibels measured across 15-minutes.

5.1 NOISE

Mining related noise impacts at PDM are managed in accordance with Schedule 3, Condition 1 of PA 10_0041, EPL 4911 and the Noise Management Plan. Noise emissions from PDM operations were monitored on a quarterly basis at six (6) locations surrounding PDM. Although PDM is currently in care and maintenance, rehabilitation maintenance activities and inspections were undertaken on the site during the 2023 reporting period. The noise monitoring locations are described as:

- NM1 – Noon Street, Blackman's Flat.
- NM2 – former Cherry residence, Blackman's Flat.

- NM3 – front of Barnes residence, east of Blackman’s Flat along the Castlereagh Highway.
- NM4 – North of View Street, Blackman’s Flat.
- NM5 – Fraser residence, Wolgan Road, Lidsdale.
- NM6 – Turek residence, Wolgan Road, Lidsdale.

The locations of these noise monitoring locations are shown in **Plan 3a**, located in **Appendix A**.

The operational noise assessment criteria are summarised in **Table 5-2**.

Table 5-2 *Noise Impact Assessment Criteria*

Location	Day ^a Period L _{Aeq} (15min), dB	Evening ^b Period L _{Aeq} (15min), dB
NM1	42	39
NM2	42	35
NM3	42	35
NM4	35	35
NM5	35	35
NM6	35	35

^a Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and public holidays.

^b Evening is defined as the period between 6pm and 10pm.

Attended noise monitoring was undertaken quarterly during the reporting period to assess any noise impacts from PDM against the relevant criteria detailed within EPL 4911 and PA 10_0041 (**Table 5-2**) on the following dates:

- Quarter 1 – January to March, monitoring conducted 16 & 17 March 2023.
- Quarter 2 – April to June, monitoring conducted 22 May 2023.
- Quarter 3 – July to September, monitoring conducted on 27 July 2023.
- Quarter 4 – October to December, monitoring conducted on 24 & 25 October 2023.

The measured L_{Aeq} 15 minutes noise contribution from PDM was below the noise assessment criteria for all 15-minute surveys at all noise monitoring locations measured during the reporting period. Similarly, the measured noise contribution from PDM was below the noise levels predicted in the Environmental Assessment (refer **Table 5-1**). Audible noise emanating from PDM operations have not been detected during noise surveys since the cessation of mining operations in April 2014.

Results for each noise monitoring survey during the 2023 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 generation by PDM.

5.2 AIR QUALITY

During care and maintenance, water for dust suppression is to be sourced from the onsite sediment basins.

Air quality at PDM 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.

The scope of air quality comprises five (5) depositional dust gauges (D1, D3, D4, D5 & D6) as shown on **Plan 3a, Appendix A**.

Four (4) additional dust gauges associated with the Purple Copper Butterfly (PCB) Monitoring Programme are located surrounding the Yarraboldy Extension. The PCB Monitoring Programme was prepared to address concerns raised by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (now Department of Agriculture, Fisheries and Forestry, DAFF). The PCB monitoring programme has been suspended as the decision relates to mining activities only, which have stopped at PDM and EnergyAustralia has notified the relevant Federal agency accordingly. EnergyAustralia has continued the dust monitoring for due diligence and to provide baseline data in the event that mining recommences.

Monitoring is undertaken by RCA Australia; a summary report data collected throughout the monitoring period is available in **Appendix B**.

5.2.1 DEPOSITIONAL DUST

All deposited dust results have been compared to the nominated annual average assessment criterion of 4.0g/m²/month, as stipulated in PA 10_0041. Depositional dust results for the reporting period showed an annual average insoluble solids range of 0.4g/m²/month to 1.2g/m²/month across the nine (9) dust gauges.

Comparative annual average depositional data for the previous five (5) year period is presented in **Table 5-3**. Depositional dust data are presented graphically in **Figure 5-1**.

An examination of the historical data (**Table 5-3**) indicates most dust monitoring locations show the 2023 annual averages slightly higher to those from 2022. The substantial decrease in the 2021 & 2022 annual averages deposited dust concentrations when compared to the 2019 & 2020 historical data is not considered to be due to a change in site activities at PDM as the mine has been in care and maintenance since 2014, rather it is considered to be influenced by the increased rainfall following prolonged dry conditions and associated correlation with dust storms and bushfires (observed during late 2019 and early 2020).

Table 5-3 *Depositional dust monitoring results*

Total insoluble solids (g/m ² per month)									
Date	D1	D3	D4	D5	D6	PCB1	PCB2	PCB3	PCB7
Jan-23	0.2	0.3	0.3	0.1	0.1	2.4	0.2	1.8	0.1
Feb-23	0.5	0.3	0.3	0.2	0.2	0.4	0.2	0.6	1.5
Mar-23	0.6	0.4	0.3	0.4	0.5	0.5	0.2	0.2	0.4
Apr-23	0.1	0.3	0.1	0.1	0.1	0.5	0.1	0.1	0.2
May-23	0.1	0.2	0.1	0.2	0.2	0.4	0.1	0.2	0.2
Jun-23	0.4	1.4	0.1	0.1	0.1	0.9	0.2	0.5	0.2
Jul-23	0.5	1.2	0.1	0.2	0.1	0.1	1.0	0.2	0.2
Aug-23	0.4	0.4	0.2	0.3	0.4	0.5	0.8	0.4	0.4
Sep-23	0.2	0.2	1.1	0.4	0.2	0.6	0.3	0.5	0.4
Oct-23	0.6	0.8	0.5	0.9	1.3	1.8	0.8	0.5	0.5
Nov-23	1.2	1.4	0.9	0.7	0.7	1.5	1.0	0.8	0.8
Dec-23	0.8	1.9	1.9	0.9	1.0	4.5	1.2	1.7	1.8
Annual Averages									
2019	1.3	1.5	1.6	1.3	1.2	1.6	1.4	1.1	1.4
2020	1.2	1.2	1.2	1.6	1.1	1.9	1.1	1.1	1.1
2021	0.5	1.0	0.3	0.4	0.6	0.7	0.4	0.4	0.2
2022	0.6	0.5	0.3	0.5	0.8	0.8	0.4	0.5	0.5
2023	0.5	0.7	0.5	0.4	0.4	1.2	0.5	0.6	0.6
Annual average assessment criterion: 4.0g/m²/month									

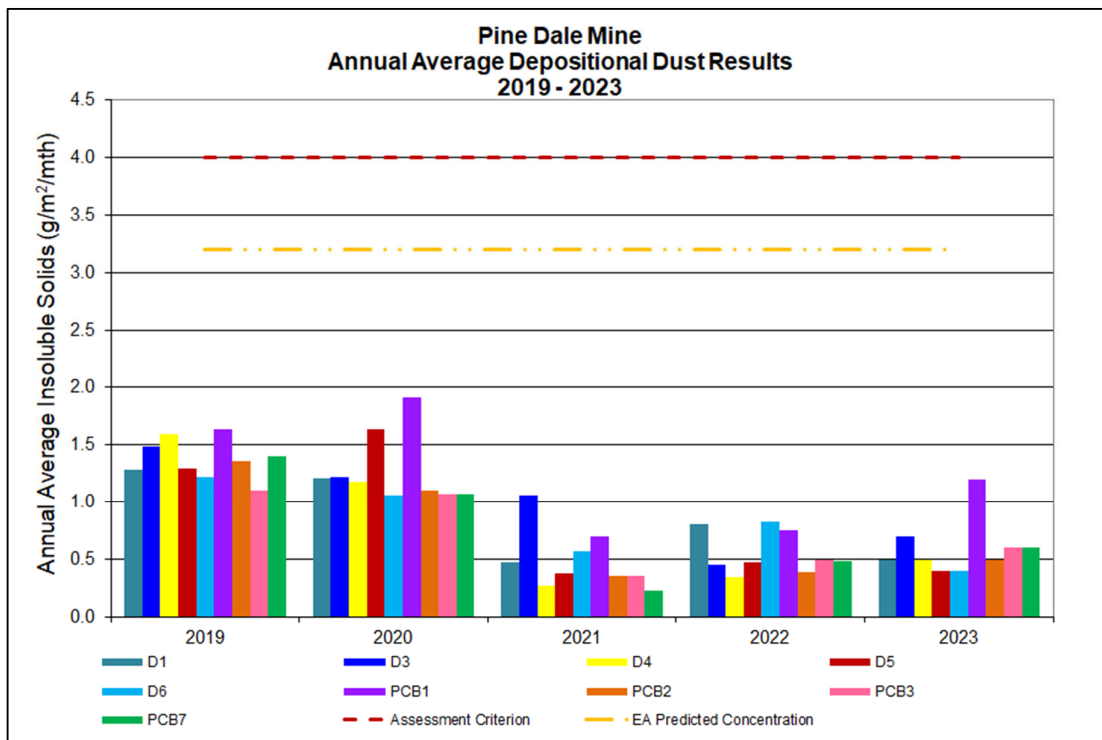


Figure 5-1 *Depositional dust data: 2019 – 2023*

The 2023 annual average deposited dust concentrations are shown to be significantly lower than the concentrations predicted in the site Environmental Assessment annual average criterion of 3.2g/m²/month annual average (refer **Table 5-1**), noting that the prediction was for an operational mine.

5.3 METEOROLOGICAL MONITORING

In accordance with Schedule 3, Condition 22 of PA 10_0041 and EPL 4911, data from the meteorological monitoring station situated at Mt. Piper Power Station (MPPS, located 3.2km to the west of PDM) is used to monitor conditions relating to revegetation and rehabilitation progress. Air temperature, wind direction, wind speed, solar radiation, sigma theta, rainfall, evapotranspiration and relative humidity data were collected from this station.

A summary of monthly meteorological conditions recorded during the 2023 reporting period are presented in the following sub-sections and in **Appendix B**.

The total annual rainfall and the minimum and maximum temperature at 2m from 2019 to 2023 are shown graphically in **Figure 5-2**.

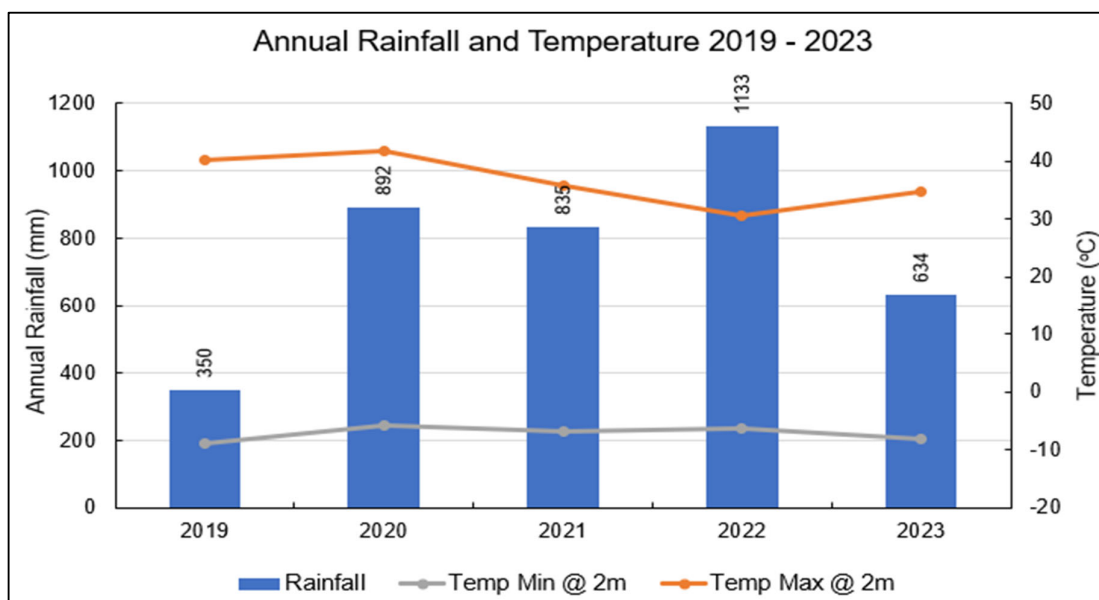


Figure 5-2 Annual Temperature and Rainfall Summary: 2019 – 2023

5.3.1 RAINFALL

PDM received 634mm of rainfall across 185 rainfall days during the 2023 reporting period. During the last five (5) years, there was a significant decrease in 2023 annual rainfall compared to the previous year (2022) and a lesser decrease from the preceding two (2) years (2020-2021) while rainfall during this reporting period was observed to be higher than that recorded in 2019 (**Figure 5-2**).

The Bureau of Meteorology (BoM) weather station located at Lithgow¹ (Birdwood Street) (approximately 16km from PDM), reported a long-term median² annual rainfall total (years 1889 – 2006) of 858.6mm. During the last five (5) years (**Figure 5-2**), 2020 and 2022 monitoring period are the only years that reported total rainfalls greater than the median (and the average). The 2019, 2021 and 2023 received below-median rainfall, with 2019 only reaching 42% of the median annual rainfall.

The monthly rainfall data for 2023 is summarised in **Table 5-4**.

5.3.2 TEMPERATURE

Temperature is monitored at two (2) heights (2 metres and 10 metres above the ground surface) to account for temperature inversions. The maximum temperatures recorded during the reporting period were 34.8°C at the 2m sensor and 33.9°C at the 10m sensor during March. The lowest temperatures were -8.1°C at 2m and -6.0°C at 10m in June.

A summary of monthly temperatures for 2023 is included in **Table 5-4**. A graphical presentation of annual temperature variations at 2m during the last five (5) years is presented in **Figure 5-2**.

5.3.3 WIND SPEED AND DIRECTION

Predominant wind direction at PDM during 2023 was observed to be primarily from the south-westerly quadrant with the exception in January where a south easterly direction was observed (refer **Table 5-4**).

The maximum wind speed measured at the site was 11.5m/s during July from a west-south-west direction.

Sigma theta data was measured continuously throughout the entire 2023 monitoring period.

A summary of monthly wind speed, predominant directions and sigma theta recordings in 2023 is included in **Table 5-4**.

5.3.4 RELATIVE HUMIDITY

Relative humidity was measured during the reporting period. The lowest humidity, at 9.0%, was recorded in May, while the highest humidity, reaching 99%, occurred in seven months in 2023. A summary of monthly humidity variations for 2023 is included in **Table 5-4**.

¹ Data for the Coerwull Station (14km from PDM) was not available at date of access (19/1/2024)

² The use of median value is specified as the preferred measure for 'typical' rainfall from a meteorological perspective as it reduces bias from extreme rainfall events.

Table 5-4 Pine Dale Mine Meteorological Monitoring Summary 2023

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	
Jan	108.6	108.6	16	18.0	6.7	31.9	17.7	8.1	30.9	25	1	101	79	18	99	2	0.2	6.4	SE
Feb	28.4	137	8	18.2	6.9	33.2	18.2	7.4	32.1	25	0	99	73	17	99	2	0.2	7.6	WSW
Mar	83.6	220.6	14	17.2	4.6	34.8	17.5	6.6	33.9	24	0	103	76	10	99	2	0.2	8.6	WSW
April	70.2	290.8	23	11.5	1.9	20.1	11.8	3.3	19.6	24	0	103	84	41	98	2	0.2	9.5	WSW
May	5.2	296	13	6.5	-5.3	18.2	7.2	-2.4	17.6	21	0	104	80	9	98	2	0.2	10.1	WSW
June	30	326	18	6.2	-8.1	17.2	6.8	-6.0	16.9	24	0	101	84	32	98	2	0.2	8.9	SW
July	23.6	349.6	20	5.6	-7.5	16.6	6.3	-4.9	16.0	23	0	103	84	18	98	2	0.2	11.5	WSW
Aug	44.4	394	22	7.4	-4.1	18.7	8.0	-1.6	18.5	23	0	102	80	17	98	2	0.2	9.7	WSW
Sept	22.4	416.4	13	10.0	-4.9	26.6	10.8	-2.9	26.2	23	0	103	68	15	99	2	0.2	9.3	SW
Oct	36.8	453.2	8	12.4	-0.9	28.2	12.8	0.7	27.3	23	0	102	62	12	99	3	0.2	9.5	SW
Nov	108.2	561.4	17	15.7	3.4	30.2	15.8	4.6	29.4	25	2	102	71	11	99	2	0.08	8.5	SW
Dec	72.9	634.3	13	16.3	6.3	24.1	16.4	7.4	23.4	20	2	91	79	26	99	2	0.08	6.4	WSW

TOTAL	634.3	185	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Minimum	5.2	8	--	-8.1	--	--	-6.0	--	--	0	--	--	--	9.0	--	--	0.08	--	--
Maximum	108.6	23	--	--	34.8	--	--	33.9	--	--	104	--	--	99	--	--	11.5	--	--

5.4 EROSION AND SEDIMENT

The erosion and sediment controls for PDM have been implemented to safeguard against soil loss and minimise potential water quality impacts. Erosion control structures have been installed around PDM 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 mine and surrounding hardstand areas.

Exposed areas which have been disturbed by previous mining operations 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 are pushed against the interface between the disturbed and undisturbed area creating a windrow where the potential for erosion impacts exist. Exposed areas 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 enable treatment prior to discharge into the underground workings. The management measures for the control of erosion described above are also put in place to increase batter and bench stability prior to establishment of permanent rehabilitation measures, where possible.

Erosion control structures at PDM are inspected on a monthly basis by the Mining Engineering Manager, particularly after significant rainfall events and repaired where necessary. Erosion and sediment control works which were undertaken during the reporting period comprised the inspection and maintenance of windrows and silt fencing to prevent potential surface water impacts and sediment entering Wangcol Creek.

5.5 CONTAMINATED AND POLLUTED LAND

There was no land identified as being contaminated or polluted during the reporting period. In the unlikely event that contaminated material is identified at the site, the remedial actions taken shall be those outlined in the PDM RMP (Ref [3]), whereby the affected material is either treated on-site or disposed of offsite by a licenced contractor.

5.6 THREATENED FLORA AND FAUNA

Measures for the management and mitigation of flora and fauna impacts at PDM and in the surrounding area are provided in the PDM RMP (Ref [3]).

5.6.1 PURPLE COPPER BUTTERFLY

The Purple Copper Butterfly (PCB), also known as the Bathurst Copper Butterfly, is listed as an endangered species under the *Biodiversity Conservation Act 2016* and vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*. The PCB and larvae have been identified adjacent to the eastern boundary of the PDM Yarraboldy Extension within an area of its habitat of native Blackthorn (*Bursaria spinosa subsp. Lasiophylla*).

PCB monitoring has been suspended until such times as when mining (or the "proposed action" as set out in the Referral 2011/6016) recommences with the agreement of DAFF in early November 2020. Monitoring at the four (4) deposition dust gauges associated with the PCB Monitoring Program has continued.

5.6.2 AUSTRAL TOADFLAX (*THESIUM AUSTRALE*)

Austral Toadflax is listed as vulnerable under the *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*. An erect to scrambling perennial herb, it occurs in small populations, parasitising a range of grass species, which at PDM 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 (3) patches located beyond the north-west crest of the Yarraboldy Stage 1 Extension pit.

A 2014 Species Management Plan completed in 2014 in consultation with the Department of Planning and Environment was 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.
- Control of priority weed infestations and feral animals.

The Gospers Mountain bushfire, which spread through Ben Bullen State Forest and PDM during December 2019 and January 2020, had burnt out the Austral Toadflax during the 2020 reporting period. The area is still recovering during the reporting period.

During the reporting period, care and maintenance operations did not encroach within the habitat area. Details regarding control of noxious weeds within and surrounding the habitat area for the reporting period is presented in **Section 5.7** and will continue to be undertaken in the next reporting period.

5.7 WEEDS AND FERAL ANIMALS

Weed and feral animal control activities at PDM are undertaken in accordance with the PDM RMP (Ref [3]). Weed control methods target four (4) priority weeds previously identified within PDM and the Yarraboldy Extension area, namely:

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

The PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) identified African Lovegrass (*Eragrostis curvula*) was the primary weed present at all rehabilitated pasture locations. The presence of weeds including African Lovegrass comprised <10% of the pasture sward and have been subjected to ongoing chemical control in accordance with legislation.

The PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) indicated there were no holes, burrows, scats or dens observed within and in the vicinity of the transects.

The control of weeds and feral animals will be undertaken on an ongoing basis as required and consistent with the PDM RMP (Ref [3]) to ensure species are managed accordingly.

5.8 BLASTING

As PDM is currently in care and maintenance, there were no blasting activities undertaken during the reporting period.

5.9 VISUAL AND 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.

5.10 ABORIGINAL HERITAGE

There were no artefacts of Aboriginal cultural heritage found at PDM during the reporting period.

5.11 NATURAL HERITAGE

No items or areas of natural heritage significance have been recorded or are considered to occur within the approved disturbance area at PDM.

5.12 SPONTANEOUS COMBUSTION

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

5.13 MINE SUBSIDENCE

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

5.14 BUSHFIRE

Bush fire control strategies for PDM are managed in accordance with Project Approval PA 10_0041 and the approved PDM 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 PDM to prevent the occurrence and spread of fire through proper maintenance of machinery and equipment, and the maintenance of access roads.

The PDM 2023 Rehabilitation Monitoring Report (Ref [4]), determined fuel loads within rehabilitation areas A, B, C and 8 were low and fuel hazard mitigation activities were not required. The internal access road within PDM provides a firebreak between Area A (refer **Plan 4, Appendix A**) and the PDM office and infrastructure to the south. The haul road provides a firebreak to the north of area A, and to the north and west of Areas B, C and 8 (refer **Plan 4, Appendix A**). Fire-fighting access roads were also considered to be adequate, with all access roads within rehabilitated areas maintained in good condition and suitable for the passage of Category 1 (vertical clearance of >4m and width of >2.8m) tankers.

During the 2023 reporting period there were no bush fire events at or in close proximity to PDM.

5.15 METHANE DRAINAGE AND VENTILATION

The underground workings at the PDM site were closed in 1986 and decommissioned over a period from 1987 to 1990. Methane levels are considered to be negligible at PDM.

5.16 PUBLIC SAFETY

No issues of public safety occurred during the reporting period. The entire perimeter of PDM 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, PDM has continued to be regularly monitored by mine personnel.

6 WATER MANAGEMENT

PDM lies within the Wangcol Creek (also known, and formerly referred to as, Neubeck’s Creek) catchment which is a sub-catchment of the Upper Coxs River catchment, which in turn is part of the Warragamba Catchment, administered by WaterNSW.

The runoff from the surrounding area flows to the Coxs River via Wangcol Creek (a perennial tributary) which runs into Blue Lake, a former open cut mining void. Wangcol 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 and/or natural seepage.

Water resources at PDM are managed in accordance with the Water Management Plan (WMP, Ref [5]) which was developed under the requirements of project approval PA 10_0041, 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 PDM into Wangcol 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 2, Appendix A**). The runoff from the north is captured in temporary sumps and used as dust suppression when required.

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

6.1 GROUNDWATER

Management of groundwater at PDM is undertaken in accordance with project approval PA 10_0041 and the PDM WMP. PDM has a water access licence (WAL36480) for the extraction and use of groundwater from the underground mine workings; and Bore Licences (10BL165933 & 10BL603588) for the monitoring of groundwater levels and quality. Results of groundwater monitoring are discussed in **Section 6.2**, with the complete results for the reporting period provided in **Appendix B**.

Review of groundwater extraction data is required to be undertaken by a qualified groundwater consultant in accordance with WAL36480 to validate the recorded data against groundwater predictions. As there was no measurable groundwater intercepted from the underground workings during the 2023 reporting period, no review was required.

6.2 GROUNDWATER MONITORING

The Groundwater Management Plan detailed within the Water Management Plan (WMP, Ref [5]) includes the monitoring of:

- Four (4) locations within PDM. Groundwater bores P6, Old Shaft and The Bong are located within the old Wallerawang Underground workings; whilst P7 is located within the Lithgow seam.
- Five (5) monitoring locations surrounding the Yarraboldy Extension. Monitoring bores A, D and E are located within the Middle River seam and bore C is within the Lithgow seam. Bore B is not a groundwater quality monitoring location and consists of a vibrating piezometer for the purposes of monitoring groundwater levels only.
 - It is noted that sampling of these locations has been historically limited due to unsafe access due to falling trees from a combination of wet conditions and remnant damage from the bushfire of November 2019 – January 2020. The National Parks and Wildlife Service formally closed access to the Gardens of Stone State Conservation Area on 14 October 2022.
- Two (2) locations at the former Enhance Place mine site (EP-PDH3 and EP-PDH4).

Monitoring locations are shown in **Plan 3a, Appendix A**. Groundwater field data and samples are collected by RCA Australia personnel and analysed at a NATA registered laboratory.

Monitoring during the reporting period was not in accordance with the WMP as per the following:

- Sampling from Old Shaft was discontinued after the February 2021 sampling round when an internal audit identified that the sampling posed a fall risk due to the requirement for an elevated position to collect samples and the absence of any formal attachment points for a harness required for working at heights.
- Sampling from bores within the Yarraboldy extension (Bores A, B, C, D and E) could not be undertaken in the first quarter due to the closure of the Gardens of Stone State Conservation Area. Bore C could not be located due to vegetation growth along the access track in the third quarter and Bore D could not be located in the second and third quarters for the same reason; both Bores were located in the fourth quarter after maintenance works. Monitoring of Bore E was unsuccessful in the second quarter due to falling trees and no further sampling attempt was made due to safety concerns.
 - Further the Bore C logger battery was flat when it was serviced in the second quarter and while the battery was replaced, the new battery was flat in the fourth quarter. This may be an issue with the replacement battery or may be indicative of a logger issue. The situation will be further considered in the 2024 monitoring period.
- EP-PDH3 and EP-PDH4 bores were decommissioned in the first quarter of the 2023 reporting period as part of the Enhance Place mining lease relinquishment.

Sampling was conducted at the onsite PDM bores (P6, P7) generally in accordance with the WMP (Ref [5]) undertaken on monthly basis for standing water level and physical water quality parameters, and on a quarterly basis for cations, anions and dissolved metals. The quarterly rounds were undertaken in February, May, August and November in this reporting period.

The Bong is an opening to the old underground workings and groundwater cannot be accessed as it is under pressure; historically samples of groundwater were collected by pumping water from the underground opening into the Water Cart Dam at PDM (location of Water Cart Dam is shown in **Plan 3a**). Water is not pumped into the Water Cart Dam during the care and maintenance period; thus, water quality at Water Cart Dam is now considered to be representative of surface water runoff and has been presented in **Section 6.4**.

6.2.1 GROUNDWATER ASSESSMENT CRITERIA

The approved groundwater trigger levels developed for PDM are detailed in the WMP in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041). The approved trigger levels are detailed in **Table 6-1**.

Table 6-1 *Approved Groundwater Assessment Criteria*

Groundwater Site	pH (range)	Electrical Conductivity (µS/cm)	SWL ^a Trigger (m, AHD)
P6	6.2 - 8.0	1180	887.90
P7	6.3 - 8.0	852	883.28
EP DDH7/GW (Site A)	6.5 - 8.0	326	954.40
EP DDH5/GW (Site B)	NA	NA	NA
EP PDH1/GW (Site C)*	6.9 - 8.0	490	889.25
EP DDH4/GW (Site D)**	6.8 - 8.0	608	940.61
<i>EP PDH7/GW (Site E)</i>	<i>5.5 - 8.0</i>	<i>151</i>	<i>938.43</i>

^a SWL: standing water level.

NA: Not applicable – No trigger value required for these locations.

Small, *italicised* text is not relevant to the 2023 reporting period due to access restrictions / change of scope as detailed in **Section 6.2**.

* Site C was accessible in the second and fourth quarters only.

** Site D was only accessible in the fourth quarter only.

Vibrating wire piezometers are installed within bores B, C and E at various target aquifers. A summary of the target aquifers and corresponding trigger levels for each bore location is shown in **Table 6-2**.

Table 6-2 *Approved Groundwater Trigger Levels (vibrating piezometers)*

Groundwater Site	Aquifer	SWL Trigger (m AHD)
Bore B (EP DDH5)	Sandstone	921.23
	Irondale	NA
	Lidsdale	899.23
	Lithgow	No trigger value
Bore C (EP HDD3)	Irondale	909.40
	Lithgow	No trigger value
	Lidsdale	891.78
	Marangaroo	889.76
Bore E (EP DDH6)	Irondale	884.67
	Lithgow	No trigger value

NA: no data, bore is depressurised (water level has dropped below sensor installation height)

Small text is not relevant to the 2023 reporting period due to access restrictions / change of scope as detailed in this Section.

The current approved assessment criteria detailed in **Table 6-1** was developed from groundwater quality data collected during the period January 2011 – December 2014. During the 2017 monitoring period, it was observed that intermittent exceedances of the approved trigger levels occurred. During the scheduled review of the WMP in 2017 revised trigger levels were proposed which were developed using the entire groundwater quality data set (2005 – 2017), as it was considered that using all available data would provide a robust data set which incorporated diverse climatic influences. These revised trigger levels were submitted to the Natural Resources Access Regulator (NRAR) (formerly Department of Industries – Water) for approval. NRAR recommended that an investigation be undertaken to determine the cause of the exceedances as a basis for the revision of trigger levels.

An investigation was undertaken, and the findings indicated that the likely cause of the decreasing pH trend observed in bore P6 and Old Shaft (which is now replaced by Wallerawang Underground) was acid mine drainage from historical underground workings (Ref [6]). The investigation recommended revised trigger levels which are summarised in **Table 6-3**.

Table 6-3 *Revised Groundwater Trigger Levels*

Monitoring location	P6	P7
pH trigger level ^a	5.6	6.3
Water Level (AHD) ^b	--	--

^a pH trigger level is exceeded if the pH drops below the nominated value.

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

-- remain unchanged from **Table 6-1**.

These values were submitted to the Department of Planning and Industry and a response was received in June 2020 that further work was required for the revised trigger levels to be accepted for use. At the time of writing this report, the revised trigger levels detailed in **Table 6-3** have been utilised alongside the approved trigger levels in **Table 6-1**.

6.2.2 GROUNDWATER QUALITY AND SWL

The full suite of groundwater results for the 2023 reporting period is presented in **Appendix B**.

6.2.2.1 ONSITE GROUNDWATER

The onsite groundwater standing water level (SWL) and rainfall for the period 2019 – 2023 is shown in **Figure 6-1** and are compared against the approved groundwater trigger levels.

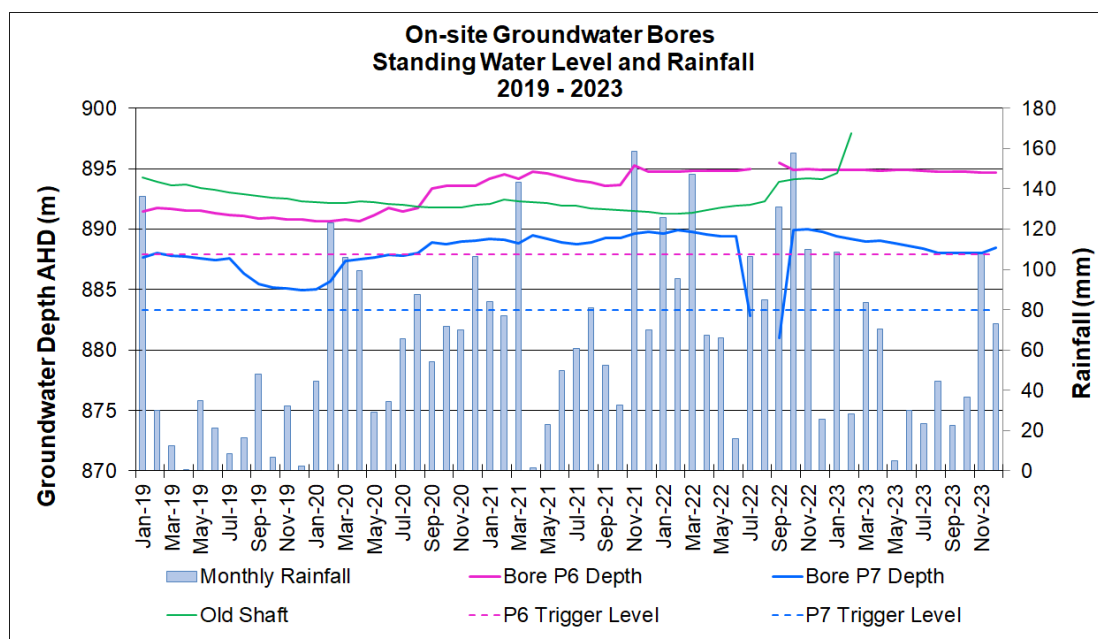


Figure 6-1 Onsite Groundwater Bores SWL and Rainfall 2019 – 2023

There were no instances of the SWL at bore P6 and bore P7 being below its approved trigger value (refer **Table 6-1**) during the 2023 reporting period.

Overall, the groundwater level in both bores P6 and P7 has fluctuated during the last five (5) years. This is considered to be due to changes in annual rainfall during the years (refer **Section 5.3**). The annual rainfall was significantly below average in 2019, approximately average in 2020 and 2021, significantly above average in 2022 and slightly below average in 2023. There have been no activities which have included groundwater extraction or injection undertaken at PDM since it was placed in care and maintenance. Furthermore, there is evidence of surface water ingress entering the old workings of the historic Wallerawang Underground mine as indicated by the development of a seep coming from an old adit of the historic Wallerawang Underground mine (refer **Section 6.3**) which was first identified in March 2021.

The pH of the onsite groundwater monitoring bores for the period 2019 – 2023 is shown in **Figure 6-2**. During the last five (5) years, fluctuations in pH are observable across both onsite groundwater sampling locations with pH values fluctuate between approximately 5.7 and 7.5 pH units.

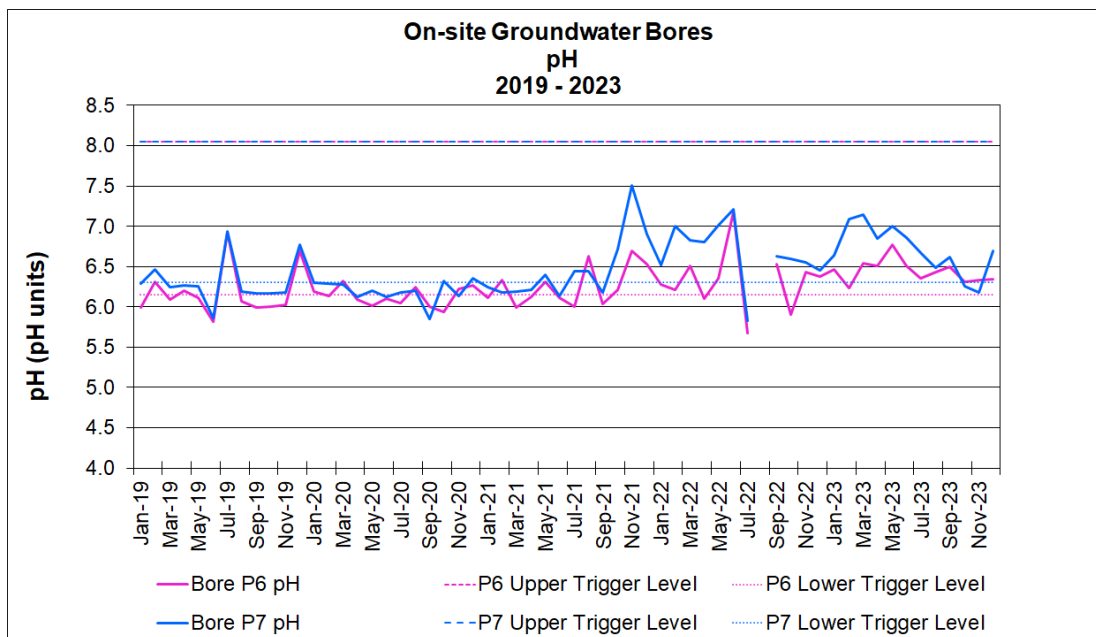


Figure 6-2 Onsite Groundwater Bores pH: 2019 – 2023

During the reporting period, pH at Bore P6 ranged from 6.23 to 6.77 and the pH at P7 ranged from 6.18 to 7.15. All P6 values were within the approved trigger range (refer **Table 6-1**); the October and November P7 values were slightly below the approved trigger range. All P6 values were within the revised trigger range whereas P7 October and November were slightly below the revised trigger range.

The electrical conductivity of the onsite groundwater monitoring bores for the period 2019 – 2023 is shown in **Figure 6-3**.

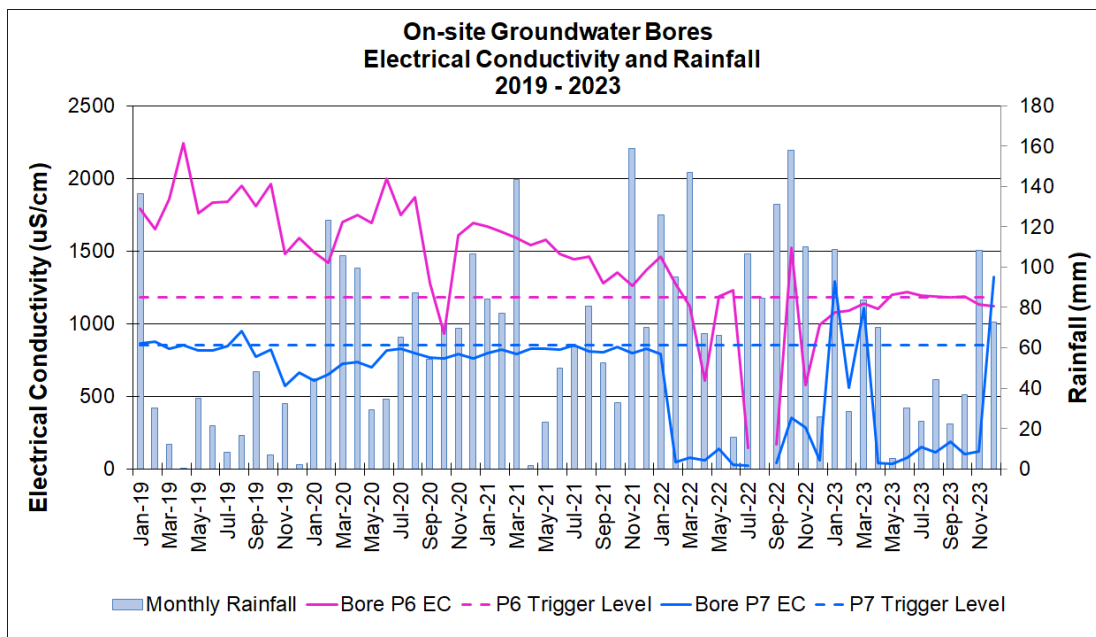


Figure 6-3 Onsite Groundwater Bores Electrical Conductivity: 2019 – 2023

The electrical conductivity fluctuates in bore P6 significantly throughout the 2019 – 2023 period (refer **Figure 6-3**) whereas this parameter was relatively stable in bore P7 until February 2022 at which time it dropped significantly and restabilised with the exception of January, March and December 2023 values. There were no activities undertaken at PDM which extracted or discharged water into the old Wallerawang Underground workings, as such, the factors causing the increase or decrease of the electrical conductivity are considered outside the control of PDM.

During the reporting period, electrical conductivity ranged from 1080 to 1220 μ S/cm at P6 and 36 to 1320 μ S/cm at P7. Five (5) of the P6 values were higher than the trigger level: May, June, July, August and October whereas the P7 values were higher than the trigger level on three (3) occasions (January, March and December). The revised trigger levels (refer **Table 6-3**) do not include electrical conductivity.

6.2.2.2 YARRABOLDY GROUNDWATER (OFFSITE)

As discussed in **Section 6.2** there were some limitations to the monitoring since 2019, including within the reporting period. Monthly standing water level measurements compared with rainfall for the last five (5) years are shown in **Figure 6-4** and the quarterly pH and electrical conductivity measurements for the same period are shown in **Figure 6-5** and **Figure 6-6**. The gaps in the graphs indicate that the bore was unable to be sampled because it was dry, or it was inaccessible.

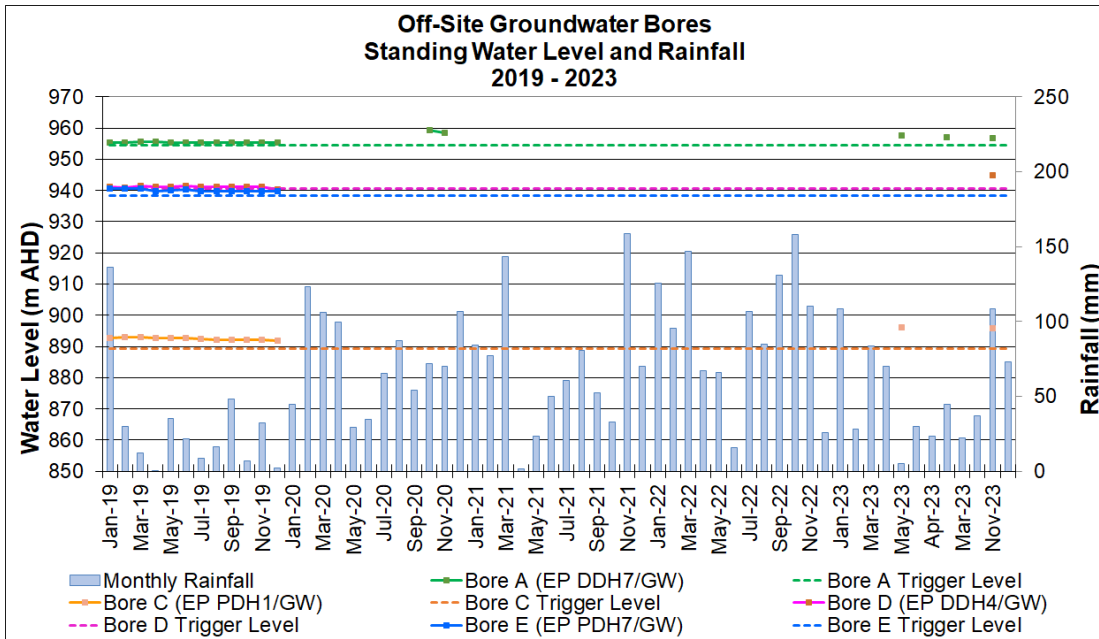


Figure 6-4 Yarraboldy Groundwater Bores Standing Water Level: 2019 – 2023

There is insufficient data to comment on the variation of standing water levels within the Yarraboldy groundwater bores during the reporting period with the exception of Bore A for which the three (3) results are relatively stable. All results are slightly higher than the data obtained in 2019 and all results are above the relevant trigger levels.

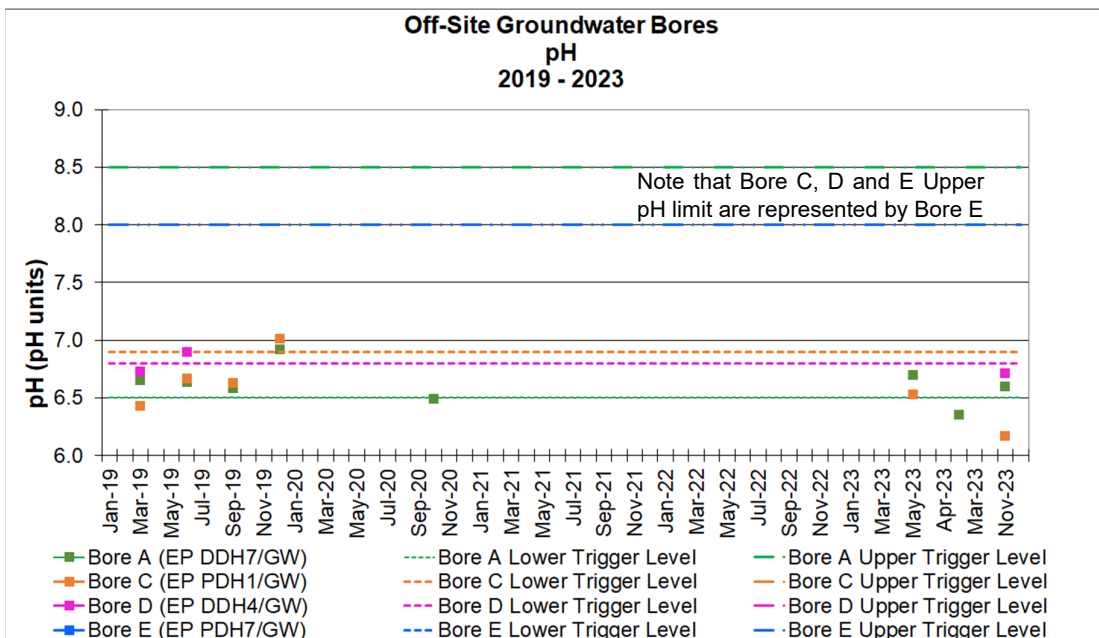


Figure 6-5 Yarraboldy Groundwater Bores pH: 2019 – 2023

There is insufficient data to comment on the variation of pH within the Yarraboldy groundwater bores during the reporting period with the exception of Bore A for which there was some variation with the August 2023 result below the trigger range. Both results for Bore C were below the approved trigger range as was the single result for Bore D. There were no activities undertaken at PDM which have the potential to impact the groundwater in the Yarraboldy area, as such, the factors causing the variation of pH are considered outside the control of PDM.

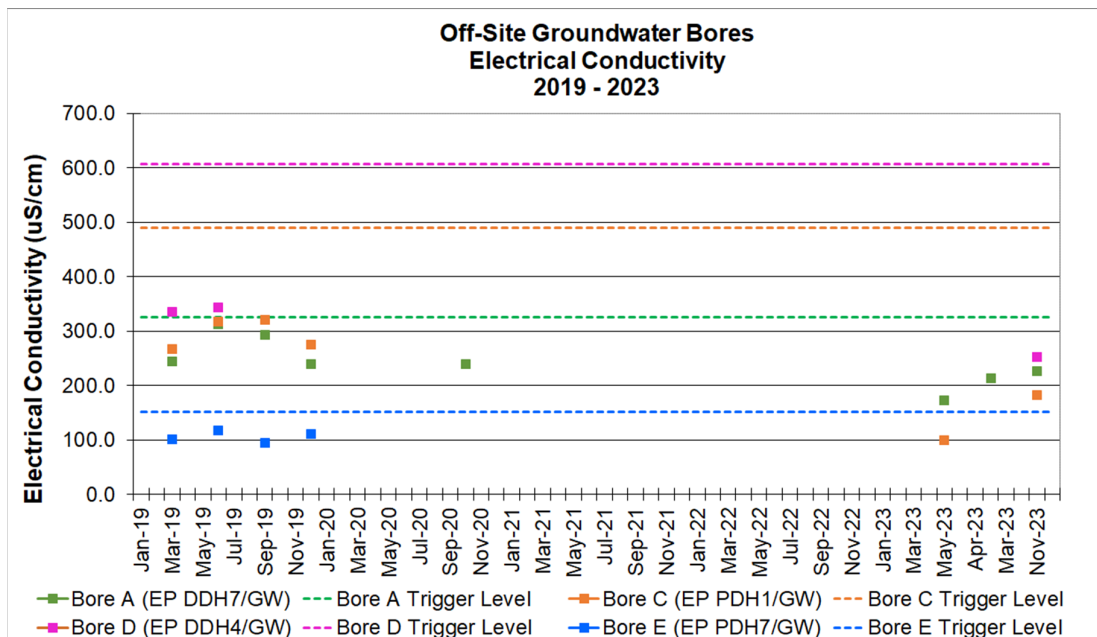


Figure 6-6 Yarraboldy Groundwater Bores Electrical Conductivity: 2017 – 2023

There is insufficient data to comment on the variation of electrical conductivity within the Yarraboldy groundwater bores during the reporting period with the exception of Bore A for which there was some variation; all results were well below the approved trigger value. There was a significant (85%) variation in the two (2) results from Bore C; these and the single result for Bore D were below the relevant approved trigger levels. Similar to pH, in the absence of any activities at PDM which have the potential to impact the groundwater in the Yarraboldy area, the factors causing the variation of pH are considered outside the control of PDM.

A groundwater level hydrograph for Bore B along with rainfall from 2019 to 2023 is shown in Figure 6-7 noting that there was no data available at Lithgow aquifer for Bore B since March 2022 due to a logger malfunction. A hydrograph for Bore C along with rainfall from 2019 to the point of battery failure (September 2022) is presented in Figure 6-8 noting that there may be some data captured between May and November 2023 which has not yet been downloaded. If captured, this data will be provided with the data from the 2024 monitoring period.

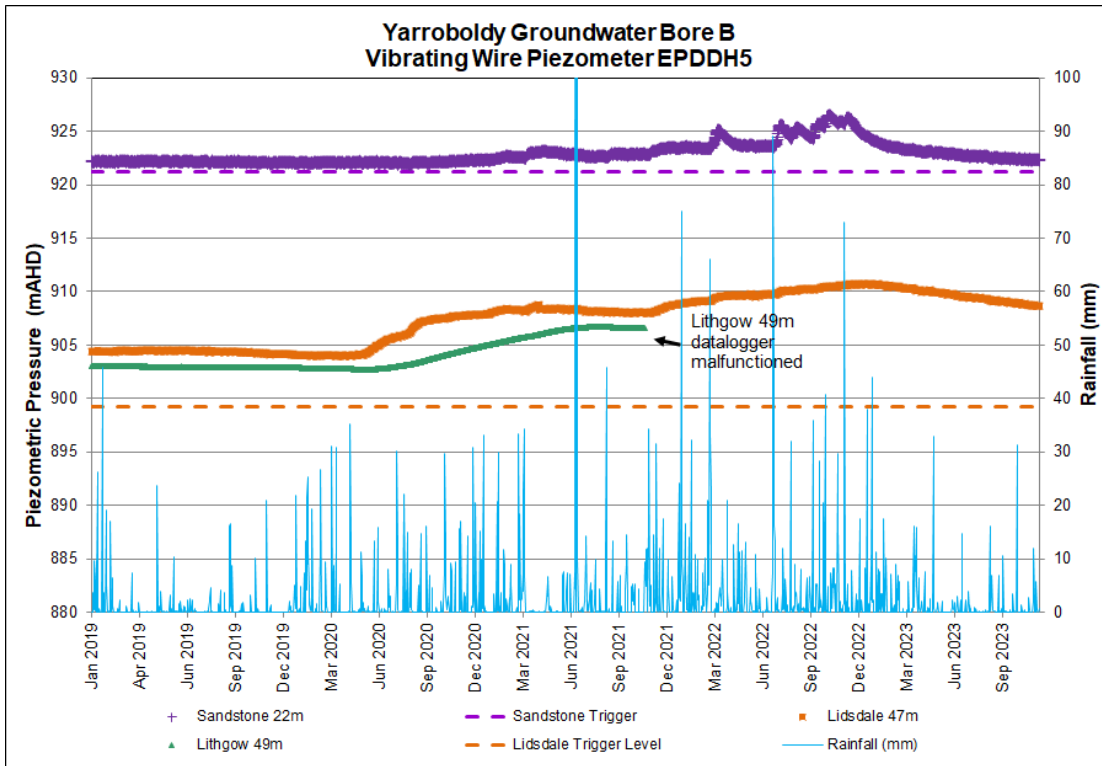


Figure 6-7 Yarroboldy Bore B Hydrograph and Rainfall 2019 – 2023

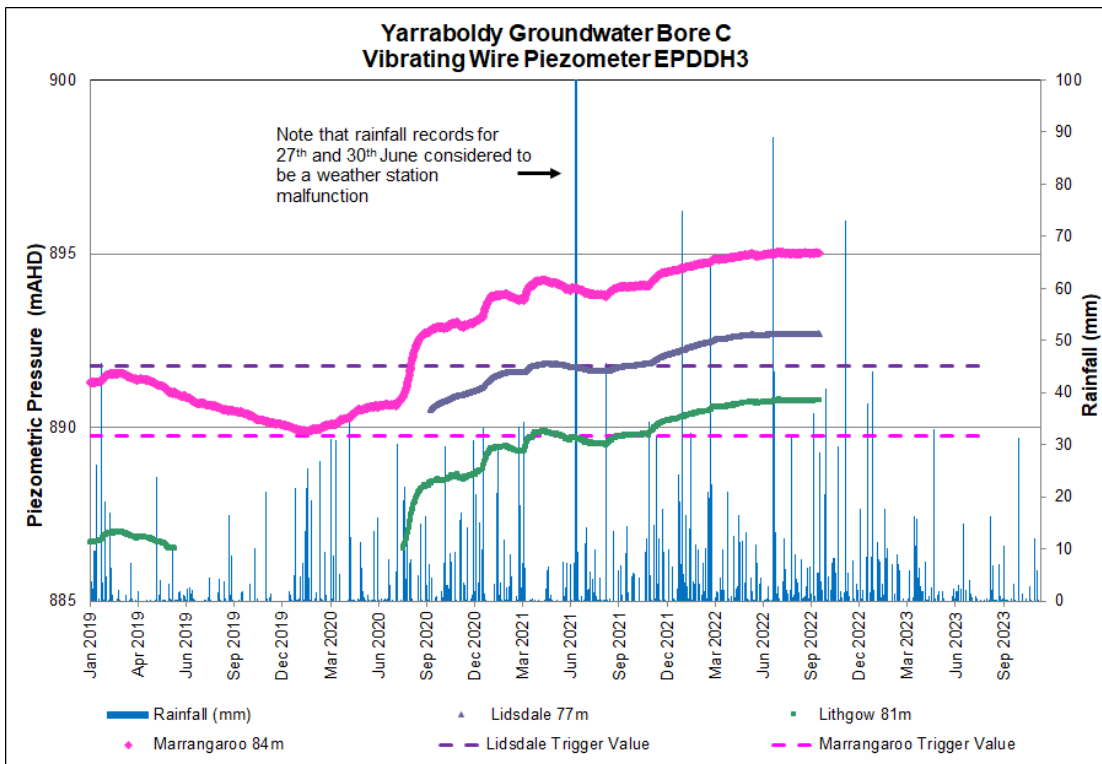


Figure 6-8 Yarroboldy Bore C Hydrograph and Rainfall 2019 – 2023

The groundwater levels at Bore B at the various aquifers have shown some variation in response to rainfall trends, however the response is generally minimal during the period January 2019 – May 2020. Following the decrease in rainfall during the 2023 reporting period, the Lidsdale and Sandstone seam show a decrease in water level. The water levels have not fallen below the groundwater trigger levels (refer **Figure 6-7**). There is no data available for the Irondale seam during the last five (5) years as the water level has fallen below the sensor height.

Data was collected from Bore C during January 2019 to September 2022 indicate an increase in groundwater levels considered to be due to increased rainfall (refer **Figure 6-8**). All aquifers indicate a similar response to rainfall; the Lidsdale aquifer has a slightly more level response to rainfall than the Marrangaroo and Lithgow aquifers.

6.2.2.3 ENHANCE PLACE GROUNDWATER

As discussed in **Section 6.2** these wells were decommissioned in the first quarter of the reporting period.

6.3 STORED WATER

There are no permanent water storage structures at the PDM. 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 enable treatment prior to draining into the underground workings.

6.4 SURFACE WATER MONITORING

Surface water quality at PDM is managed in accordance with the WMP (Ref [5]) and EPL 4911 and comprise a total of thirteen (13) surface water locations within and surrounding the mine site (see **Plan 3a, Appendix A**).

In accordance with EPL 4911 the following locations are required to be monitored at PDM on a quarterly basis for total suspended solids (TSS), sulphate and dissolved iron:

- EPL Point 2 – Upstream of confluence with Lamberts Gully.
- EPL Point 3 – 100m downstream of open cut area of PDM.
- EPL Point 14 – Cox's River downstream of Blue Lake.
- EPL Point 16 – a seep of underground water emanating from an adit associated with the historic Wallerawang Underground Mine which then enters the surface water system.

In accordance with EPL 4911 and in the event of a discharge to water, via PDM's licence discharge point (EPL Point 13), samples are required to be collected daily during discharge for electrical conductivity (EC), pH, and turbidity and weekly for dissolved iron, oil and grease, sulphate and total suspended solids. EPL Points 2, 3 and 14 are also required to be sampled daily for EC, pH and turbidity.

The WMP also details monitoring of a further seven (7) locations, S1 to S7. S1 and S3 to S7 are sampled on a monthly basis for analysis of pH, temperature, EC and turbidity plus a quarterly analysis suite comprising major ions, anions and filtered metals. No sample is collected at S2, monitoring comprises measurement of the water level on a monthly frequency. Monitoring at a further location, Wallerawang Downstream, was commenced after the issue of the WMP and is sampled on a monthly basis for analysis of pH, temperature, EC and turbidity plus a quarterly analysis suite comprising major ions, anions and filtered metals. The description of surface water monitoring sites is as follows:

- S1 is located within Wangcol Creek upstream of PDM operations (slightly downstream of EPL Point 2) and downstream of a water discharge point licensed to other parties (i.e., not associated with PDM operations).
- S2 is located in Wangcol Creek downstream of S1, the off-site water licensed discharge point and some of PDM operations.
- S3 is located within Wangcol Creek downstream of S1, PDM operations and the off-site water licensed discharge point.
 - Surface location S3 is the same location as EPL Point 3.
- S4 is located on Coxs River, upstream of the confluence of Wangcol Creek and does not receive water from PDM operations or the off-site water licensed discharge point.
- S5 is located within Blue Lake at the point of confluence with Coxs River.
- S6 is located within Wangcol Creek downstream of the PDM operations and the PDM licensed discharge point and just prior to the Creek's confluence with Blue Lake.
- S7 located within Coxs River, downstream of Blue Lake.
- Wallerawang Downstream, located downstream of the adit seepage (EPL Point 16).

The surface water monitoring locations are shown in **Plan 3a, Appendix A**.

During the reporting period, all surface water monitoring at PDM was undertaken in accordance with the surface water monitoring programme documented in the PDM WMP and EPL 4911.

Results of surface water monitoring are discussed in **Section 6.4.2** and also provided in **Appendix B**. As detailed in **Section 6.2**, samples from Water Cart Dam are considered representative of surface water and are presented in this Section.

The water quality entering Wangcol Creek from the off-site water licensed discharge is monitored voluntarily for the purposes of assessing trends within Wangcol Creek; samples are collected from the drainage line prior to the water entering Wangcol Creek within the PDM boundary.

6.4.1 SURFACE WATER ASSESSMENT CRITERIA

Concentration limits are specified in EPL 4911 for the licenced discharge point LDP13, whilst the remaining water monitoring locations only have water quality trigger levels stipulated in the site WMP (Ref [5]) – surface water section in accordance with Schedule 3, Condition 27(b) of the Project Approval (PA 10_0041). The current approved WMP trigger levels are presented in **Table 6-4**.

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

Table 6-4 PDM Approved Surface Water Trigger Levels

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	2325	30	10
S2	NA	NA	NA	NA
S3	6.4 – 8.0	2223	30	10
S4	7.3 – 8.0	957	30	10
S5	7.0 – 8.0	1013	30	10
S6	6.7 – 8.0	1941	30	10
S7	6.8 – 8.0	1007	30	10
The Bong (at Water Cart Dam)	5.8-8.0	1157	NA	NA
Wallerawang Downstream	NA	NA	NA	NA
EPL Point 2	7.1 – 8.0	2055	30	NA
EPL Point 3	6.4 – 8.0	2223	30	NA
EPL Point 13	6.5 – 8.0 ^a	NA	30 ^a	10 ^a
EPL Point 14	7.5 – 8.0	1166	30	NA
EPL Point 16	NA	NA	NA	NA

^a EPL concentration limit only applicable during discharge events.

EnergyAustralia commissioned an investigation of surface water quality at PDM which included identification of factors that influence surface water quality. This investigation was concluded in 2018 and, as a result, new surface water trigger levels were proposed. The investigation (Ref [6]) concluded that water quality monitored at EPL Point 2 and S1, which are located within Wangcol Creek, to be primarily influenced by the off-site licensed discharge point (not associated with PDM) located between EPL Point 2 and S1. The revised surface water trigger levels (Ref [6]) are shown in **Table 6-5**.

Table 6-5 Revised Surface Water Trigger Levels (Ref [6])

pH trigger level ^a	6.5 – 8.0
Electrical conductivity ($\mu\text{S}/\text{cm}$)	5592
Total suspended solids (mg/L)	25

^a pH trigger level is exceeded if the pH is outside the nominated range.

The trigger levels presented in **Table 6-5** are applicable to all PDM surface water monitoring sites, noting that EPL Point 2, S1 and S4 are not influenced by activities at PDM.

These values were submitted to the Department of Planning and Industry and a response was received in June 2020 that further work was required for the revised trigger levels to be accepted for use. At the time of writing this report, the revised trigger levels detailed in **Table 6-5** have been utilised alongside the approved trigger levels presented in **Table 6-4**.

No trigger levels are ascribed to the off-site water licensed discharge.

6.4.2 SURFACE WATER QUALITY

Surface water field data and samples are collected by RCA Australia personnel and analysed at a NATA registered laboratory.

6.4.2.1 EPA SURFACE WATER MONITORING

No discharge was made via PDM's licenced discharge point (LDP13) during the reporting period. As such, no samples were collected.

During the monitoring period, the four (4) surface water sampling locations specified in the EPL 4911 were monitored on a quarterly basis: February, May, August and November. EPL Point 14 was dry in November 2023 and no sample was collected.

There are no concentration limits stipulated in EPL 4911 for monitoring points 2, 3, 14 and 16 and results of surface water samples collected during the reporting period are compared against the approved surface water trigger levels (**Table 6-4**) from the WMP and the revised surface water trigger levels (**Table 6-5**) in **Appendix B** noting that as these were derived before the commencement of the seep which comprises EPL Point 16 that there are no approved trigger levels for that location and the comparison is with the revised trigger levels only.

pH was within the respective approved trigger value ranges for EPL Point 2 throughout the reporting period and for EPL Point 3 with the exception of the February result which was below the approved trigger range. All results of EPL Point 14 were below the approved trigger range during the reporting period. pH values were within the revised pH trigger range with the exception of EPL Point 3 February and EPL Point 16 February, August and November results.

The majority of the electrical conductivity results were above the approved trigger value in the reporting period; the EPL Point 2 May, EPL Point 3 February and the EPL Point 14 May results were compliant. Electrical conductivity was less than the revised surface water quality trigger value at all locations (EPL Point 2, 3, 14 and 16) during the reporting period.

Total suspended solids (TSS) concentrations were all below the approved trigger value except for the February result at EPL Point 14. This result and the November result from EPL Point 16 were above the revised trigger value.

The electrical conductivity and pH for the period 2019 – 2023 is shown in **Figure 6-9**; electrical conductivity and rainfall for the same period is shown in **Figure 6-10**.

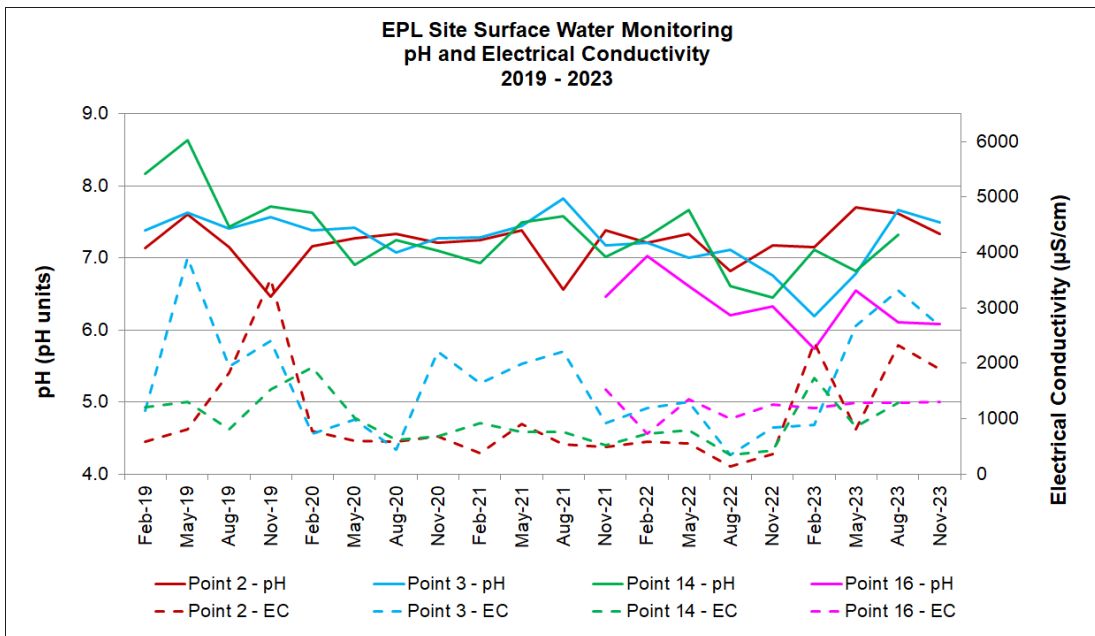


Figure 6-9 Surface water at EPL monitoring points: pH and Electrical Conductivity (2019 – 2023)

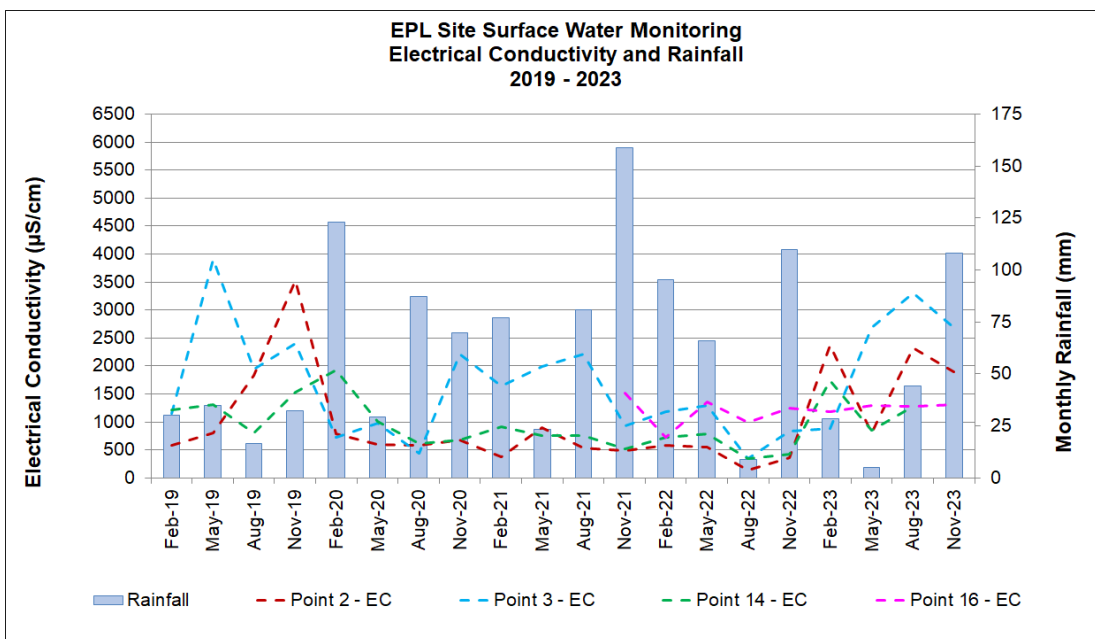


Figure 6-10 Surface water at EPL monitoring points: Rainfall and Electrical Conductivity (2019 – 2023)

During the 2019 – 2023 monitoring period, pH has remained generally stable at both EPL Point 2 and EPL Point 3 although with fluctuations. A decreasing trend was observed at both EPL Point 14 and EPL Point 16 with some fluctuations. The pH is generally neutral in the surface water samples and slightly acidic at EPL Point 16.

During the 2019 – 2023 monitoring period, electrical conductivity indicates a slight increasing trend at both EPL Point 2 and EPL Point 3 although with significant fluctuations. Electrical conductivity was generally stable at both EPL Point 14 and EPL Point 16 although with fluctuations, more significantly at EPL Point 14. The electrical conductivity is generally fresh with some concentrations representative of brackish water ($>1,500\mu\text{S}/\text{cm}$) at EPL Point 2, 3 and 14.

pH and electrical conductivity results of EPL Point 2 and EPL Point 3 are generally consistent during the 2019-2023 monitoring period however there are significant divergence of pH in November 2019, August 2021, February 2023 and May 2023, and of electrical conductivity in May 2019, November 2019, November 2020 through to May 2022, and February 2023 to November 2023. pH of EPL Point 14 do not correlate with either the results of EPL Point 2 or EPL Point 3, although there is some similarity. There does appear to be correlation between the electrical conductivity of EPL Point 2 and EPL Point 14 however it is not consistent.

Rainfall appears to have some influence on electrical conductivity during the 2019-2023 monitoring period however not consistently and the relationship is less obvious in the 2023 reporting period; there is no influence of rainfall to the electrical conductivity at EPL Point 16. As there are no mining activities being undertaken at PDM which may impact the surface water quality, the difference of results between EPL Point 2 and of EPL Point 3 are considered to be representative of the off-site water licensed discharge and localised natural influences between the two (2) sample points. The inconsistency in the correlation between EPL Point 2 and EPL Point 14 is considered to indicate that there are other influences to water quality at EPL Point 14 as would be expected downstream of Blue Lake and Coxs River

6.4.2.2 GENERAL SURFACE WATER MONITORING

During the monitoring period, the seven (7) surface water sampling locations were monitored on a monthly basis: all samples were collected with the exception of a sample from Water Cart Dam in August 2023 as it was dry.

Results of surface water samples collected during the reporting period are compared against the approved surface water trigger levels (**Table 6-4**) from the WMP and the revised surface water trigger levels (**Table 6-5**) in **Appendix B** noting that as these were derived before the commencement of the seep which comprises EPL Point 16 that there are no approved trigger levels for Wallerawang Downstream and the comparison is with the revised trigger levels only.

During the reporting period, pH was generally within the approved trigger levels (refer **Table 6-4**) with the exception of the seven (7) of the eighty-three (83) results noting an additional twelve (12) samples were collected from Wallerawang Downstream for which there are no approved trigger levels and the approved trigger levels are not considered relevant to Water Cart Dam in the absence of groundwater being pumped to it. In all but one result, the pH were below the approved trigger range; the S6 May result was higher than the approved trigger range. There were eight (8) results below the revised trigger range: S5 October, Water Cart Dam September-November and Wallerawang Downstream February, July, October and November. There were two (2) results above the revised trigger range: S6 October and Water Cart Dam May.

Electrical conductivity was higher than the relevant approved trigger levels in forty-three (43) of the eighty-three (83) results during the reporting period. For most locations the results above the trigger levels were sporadic or up to approximately 50% of the samples (S1, S3 and S5) however all but one of the S7 results (April) was in excess of the relevant approved trigger value. No results were in excess of the revised trigger value.

pH, and electrical conductivity along with rainfall for sampling locations within Wangcol Creek and the off-site water licensed discharge are presented in **Figure 6-11** and **Figure 6-12** below.

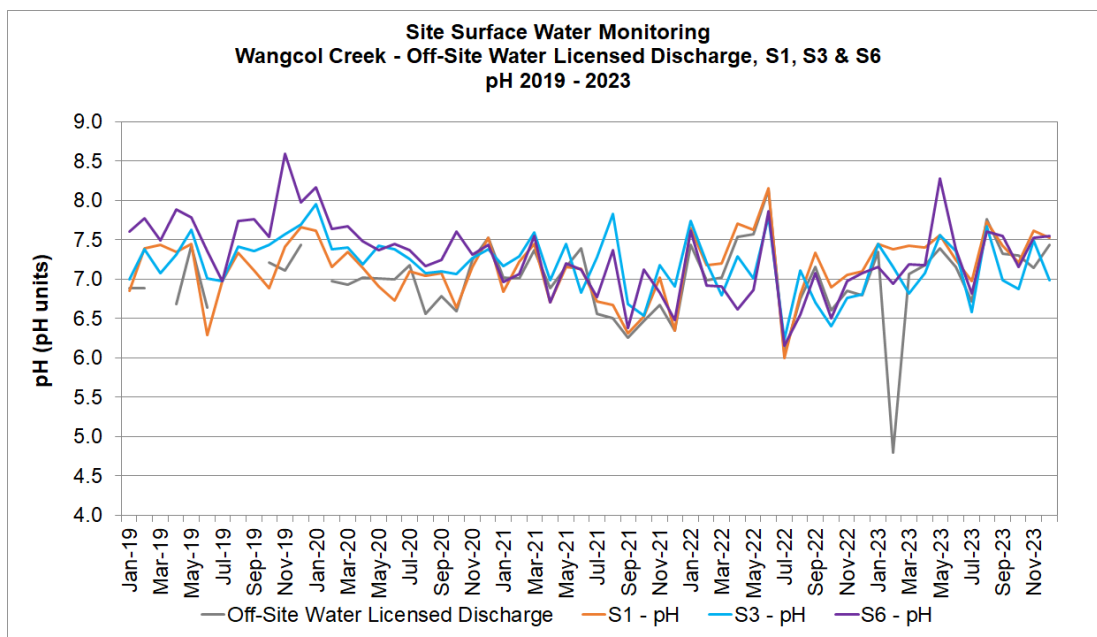


Figure 6-11 pH results at Wangcol Creek Sampling Locations S1, S3 and S6 2019 – 2023

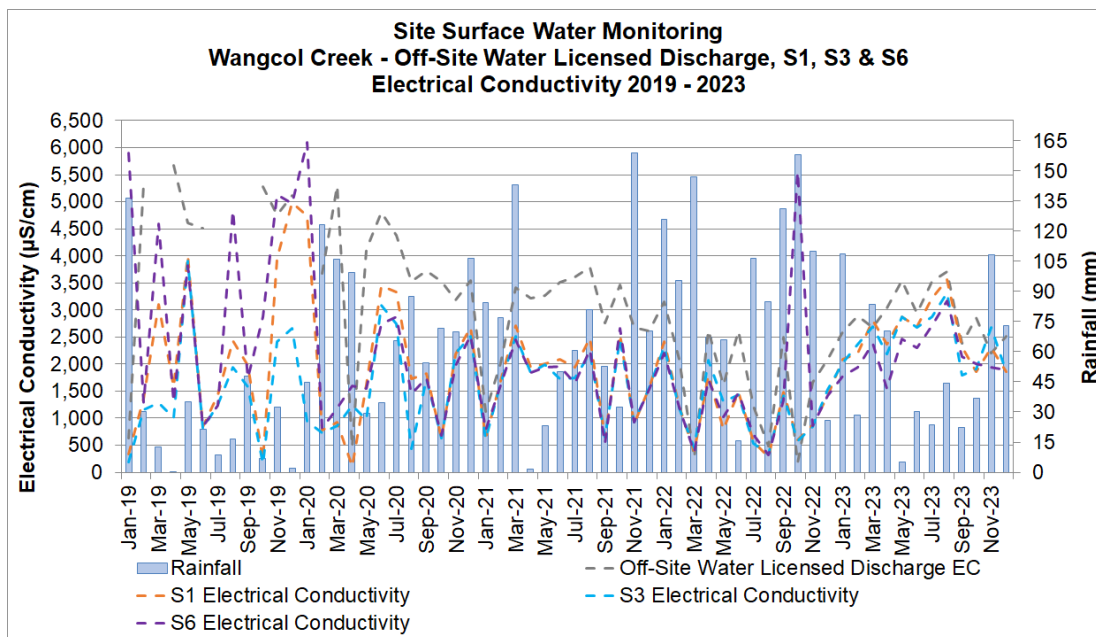


Figure 6-12 *Electrical Conductivity results at Wangcol Creek Sampling Locations S1, S3 and S6 2019 – 2023*

During the last five (5) years, pH in Wangcol Creek (refer **Figure 6-11**) are generally consistent between the upstream (S1) location and the downstream locations (S3 and S6) along with the off-site water licensed discharge. The off-site water licensed discharge and S1 are generally slightly more acidic in historical monitoring however have been more alkaline since late 2021 through to, and throughout the 2023 monitoring period. The February 2023 acidic spike in the off-site water licensed discharge was investigated the following day by contractors engaged by the responsible party and was unable to be replicated; the cause was ascribed to particles heavier than water which were characterised by the initial reading and sample however had dropped from the water column at the time of subsequent sampling. Overall, the pH trend is stable for all the monitoring locations (noting some large fluctuations).

Similarly, electrical conductivity (refer **Figure 6-12**) at S3 indicated occasional divergence prior to February 2020 however since then has indicated good correlation with the other results. The electrical conductivity of the off-site water licensed discharge is the highest of the data set on almost all occasions. Overall, the electrical conductivity trend is stable for all the monitoring locations noting some large fluctuations. The spike in electrical conductivity at S6 in October 2022 is not considered to be solely related to the off-site water licensed discharge as it is one month after, and almost double in concentrations. Rainfall appears to have some influence on electrical conductivity during the 2019-2023 monitoring period however not consistently and the relationship is less obvious in the 2023 reporting period. As such, while Wangcol Creek (S1, S3 and S6) is considered to be impacted by the off-site water licensed discharge, it is considered that sediment from the catchment is a potential contributor to electrical conductivity.

As water is being discharged by PDM to Wangcol Creek and there are no activities being undertaken which may contribute to erosion of soil it is not considered that the variation observed within Wangcol Creek is due to PDM activities.

pH, and electrical conductivity along with rainfall for sampling locations within Coxs River, including the quarterly results for EPL Point 14, are presented in **Figure 6-13** and **Figure 6-14** below.

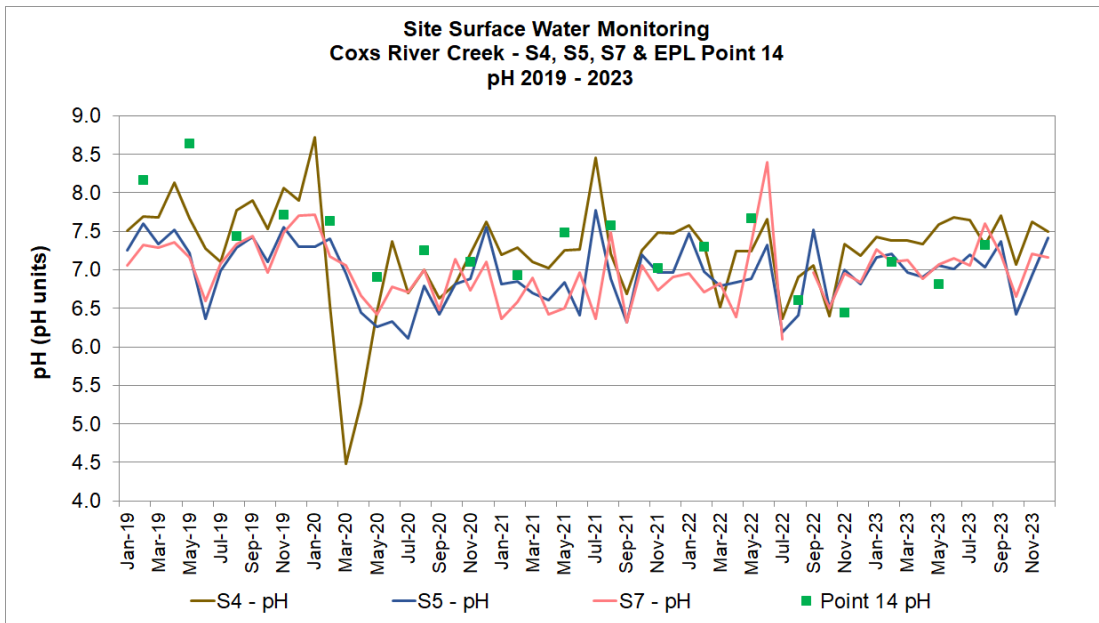


Figure 6-13 S4, S5, S7 and EPL Point 14 pH Results 2019 – 2023 (noting that EPL Point 14 was dry in November 2023 such that no sample was collected)

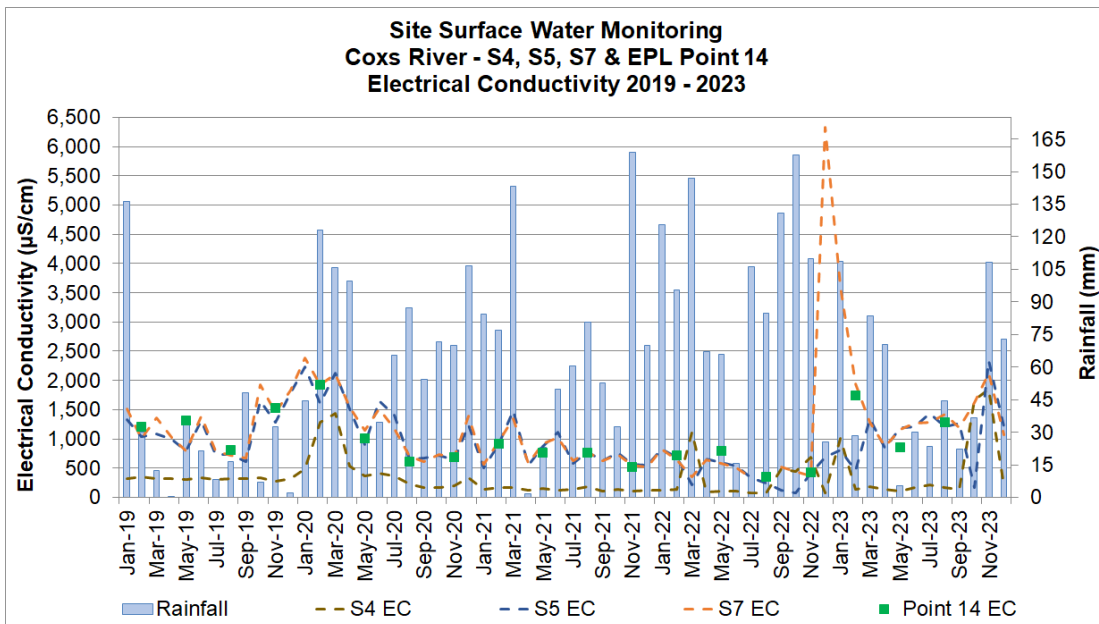


Figure 6-14 S4, S5, S7 and EPL Point 14 Electrical Conductivity Results & Rainfall 2019 – 2023 (noting that EPL Point 14 was dry in November 2023 such that no sample was collected)

During the last five (5) years, pH values in Coxs River (**Figure 6-13**) are higher (more alkaline) upstream of Blue Lake (i.e., S4) compared to those of S5 and S7 and overall similar to those in Wangcol Creek. There is good correlation between the three (3) sampling and overall, the pH trend is generally stable for all locations during the last five (5) years although there are some significant fluctuations. The cause of the significant spike in acidity at S4 in March 2020 is unknown however this location is upstream of the confluence with Wangcol Creek and as such does not receive any water from PDM and therefore the results are indicative of impacts from other areas of the catchment.

Electrical conductivity concentrations in Coxs River during the last five (5) years (refer **Figure 6-14**) is lower upstream of Blue Lake (i.e., S4) compared to those in S5 and S7; S5 and S7 are generally very well correlated with the exception of late 2022 and early 2023, and October 2023. The cause of the concentration spike at S4 in February and March 2020 is considered to be likely due to erosion of land burnt in the 2019 / 2020 bushfires and the decreasing trend from that point is considered likely due to revegetation of the catchment. The cause for the significant spike at S6 in December 2022 is unknown; it is almost $1,000\mu\text{S}/\text{cm}$ more and two (2) months later than that observed in Wangcol Creek (S6) and as such the concentrations are considered to be representative of overall conditions within the catchment.

The pH of EPL Point 14 does not appear to have significant correlation with any of the other surface water locations other than S7 which it is downstream of by approximately 1,500m. The pH has trended to more acid conditions over the 2019 – 2023 monitoring period which doesn't appear to be the case for any other sampling locations within Coxs River. Similarly, the electrical conductivity of EPL Point 14 appears to be best correlated with S7 and to a lesser extent S5; correlation with S4 is not obviously apparent however this is primarily due to the low variation in concentrations at S4 and the absence of results for EPL Point 14 at the time of spikes at S4 (March 2020, March 2022, October and November 2023). As such, while the flows from PDM and other upstream sources of Coxs River are considered to influence EPL Point 14, it is considered that there are also influences such as the intermittent creeks flowing to Coxs River downstream of S7. In the absence of any activities except those regarding care and maintenance the water quality impacts in Wangcol Creek are not considered to be related to PDM.

pH and electrical conductivity for Wallerawang Downstream and Water Cart Dam have been plotted with the quarterly results for Wallerawang Underground as presented in **Figure 6-15** and **Figure 6-16** below.

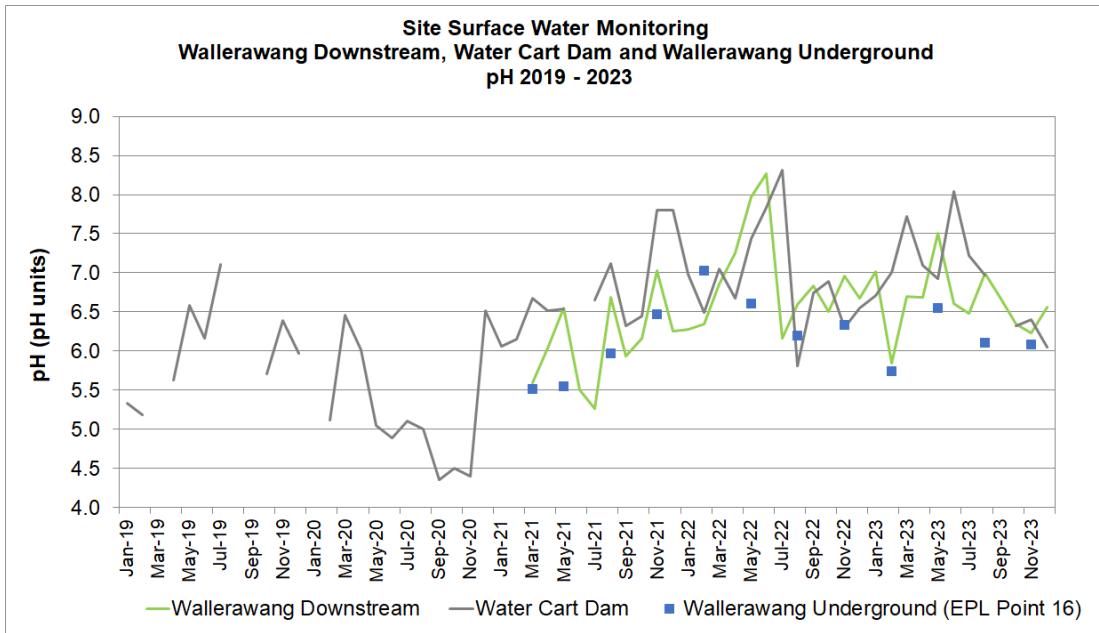


Figure 6-15 Wallerawang Downstream, Water Cart Dam and Wallerawang Underground pH Results 2019 - 2023 (noting that data gaps are when Water Cart Dam was dry and dates prior to the commencement of sampling at Wallerawang Downstream and Underground)

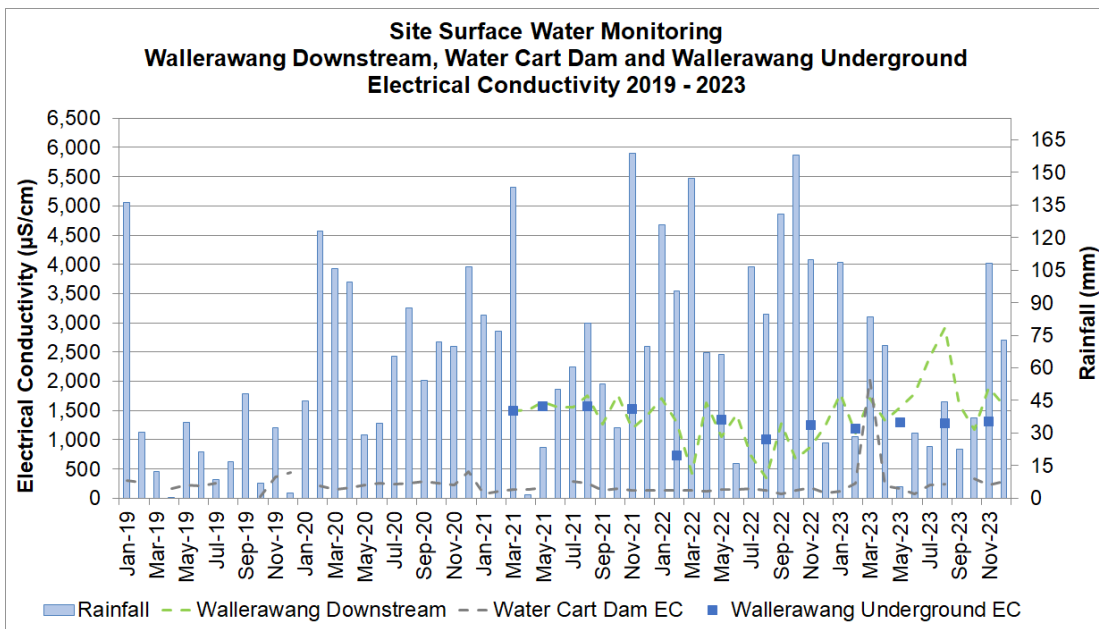


Figure 6-16 Wallerawang Downstream, Water Cart Dam and Wallerawang Underground Electrical Conductivity Results 2019 - 2023 (noting that data gaps are when Water Cart Dam was dry and dates prior to the commencement of sampling at Wallerawang Downstream and Underground)

During the last five (5) years (**Figure 6-15**), pH in Water Cart Dam has fluctuated towards a higher (more alkaline) value, presumed to be associated with the lessening influence from historically pumped groundwater from The Bong, although results during the reporting period have reverted back to slightly acidic. While there is some sporadic correlation between the results of Wallerawang Underground and Wallerawang Downstream, the absence of consistency is considered to indicate other influences to the pH of the Water Cart Dam.

Electrical conductivity has been representative of fresh water for the last five (5) years (**Figure 6-16**) with one spike into concentrations representative of brackish in March 2023. The concentrations are significant disparate to those of Wallerawang Downstream and Wallerawang Underground, which generally correlate with each other, such that other influences to the water quality of Water Cart Dam are considered to be present. The reason for the spike in concentrations in March 2023 at Water Cart Dam and of August 2023 in Wallerawang Downstream is not known however does not appear to be related to Wallerawang Underground, noting that this is sampled only once a quarter.

6.5 CHANNEL STABILITY AND STREAM HEALTH MONITORING

Channel stability and stream health monitoring of Wangcol Creek is conducted on a six-monthly basis in accordance with project approval PA 10_0041 and the WMP. Monitoring was conducted in March and September 2023. It is noted that additional inspections are undertaken on a voluntary basis each month.

Monitoring is conducted at four (4) monitoring points along Wangcol Creek (SH1, SH2, SH3 & SH3A) and one (1) location at Coxs River (SH5), which is downstream of Blue Lake (refer **Plan 3b, Appendix A**). An additional location at Blue Lake (SH4) is 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 ranks 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. The criteria and scoring methodology are based on the CSIRO Ephemeral Stream Assessment protocol (Ref [7]).

A baseline assessment of channel stability, stream health and vegetation health of Wangcol Creek and Coxs River undertaken in 2013 indicated the drainage lines were classified as 'potentially stabilising.'

Follow-up (six-monthly) assessments have been conducted at the same monitoring locations; results are presented **Figure 6-17**. Generally, the stability of all the locations have remained consistent or increased with the exception of decrease in classification based on a loss of vegetation in October 2019 presumed to be due to below average rainfall (drought conditions).

Location SH1 was considered 'potentially stabilising', locations SH2 and SH3 were considered 'stable', and SH5 was considered 'very stable' during the 2023 assessment, noting that the stability at SH3A is based on the presence of spray-concrete lining.

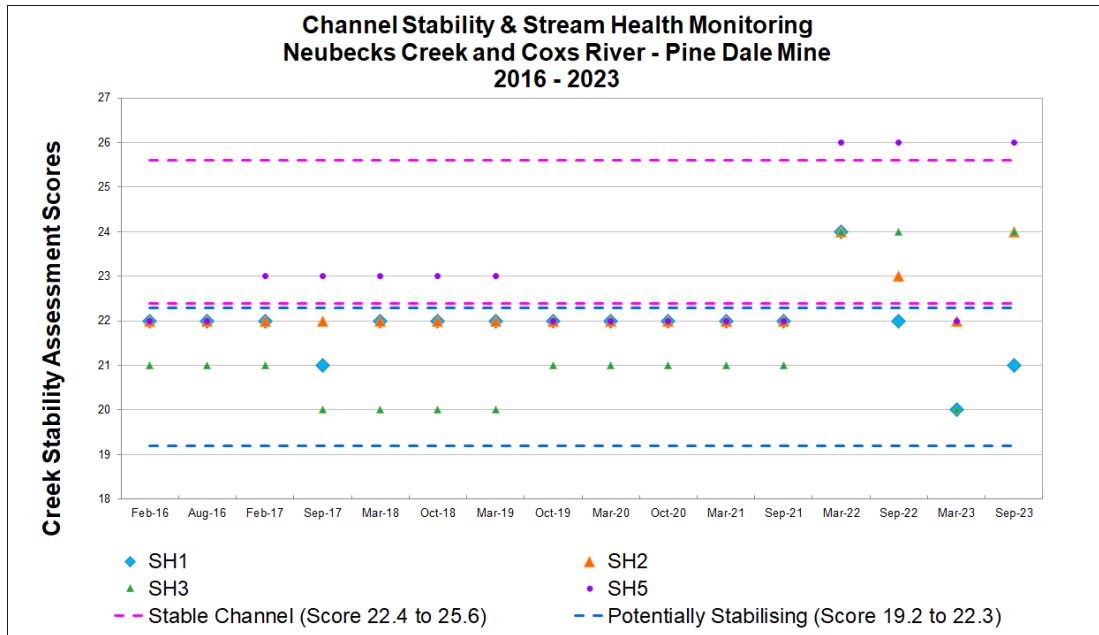


Figure 6-17 Channel Stability and Stream Health Scores during 2016 – 2023

Detailed results are presented in **Appendix B**.

7 REHABILITATION

Rehabilitation works at PDM are conducted in accordance with rehabilitation objectives in the approved PDM RMP (Ref [3]). Rehabilitation performance criteria documented in the PDM RMP define the performance indicators, measuring criteria, status and progress of rehabilitation at PDM.

PDM 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 the agreed post rehabilitation land use (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 mining recommences. The location of each rehabilitation domain is depicted in **Plan 4, Appendix A**.

A soil assessment and revised rehabilitation strategy was developed in 2014 by an agronomist (Ref [8]) and the recommendations were incorporated into the PDM RMP (Ref [3]).

The principal revegetation technique currently employed is direct seeding using native tree and shrub species for areas intended as 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.

Maintenance rehabilitation works undertaken within the reporting period comprised topsoiling and mulching of the eastern portion of ML1578 in February / March 2023. Photographs of the area as per 19 July 2023 are presented in **Photograph 7-1**.



Photograph 7-1 *Rehabilitated area within ML1578 looking east, July 2023.*

7.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

7.1.1 AGREED POST REHABILITATION LAND USE

Areas of privately owned land within PDM (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. The Rehabilitation domains are shown in **Plan 4, Appendix A**.

7.1.2 REHABILITATION STATUS SUMMARY

A summary of the rehabilitation status for the previous (2022), current (2023) and future (2024) reporting periods are presented in **Table 7-1**.

Table 7-1 *Rehabilitation Area Summary*

Mine Area Type	Area Affected/Rehabilitated (ha)		
	2022 reporting period (Actual)	2023 reporting period (Actual)	2024 reporting period (Forecast)
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	7	7	7
E. Completed Rehabilitation	25.4	25.4	25.4

A rehabilitation status survey is undertaken annually, and the monitoring report provides an overview of the rehabilitation status of PDM and recommendations for the improvement of rehabilitation outcomes in reference to the approved completion criteria. The survey comprises six (6) previously established monitoring transects: four (4) transects are located within rehabilitated pastures and two (2) transects are within treed rehabilitation areas. An additional two (2) transects exist as analogue sites in grazed pasture and undisturbed naturally vegetative areas to provide benchmarks against the pasture and treed rehabilitation areas.

The PDM 2023 Rehabilitation Monitoring Report (Ref [4]) is attached in **Appendix C** and Figure 1 of that report shows the location of the transects along with the results of the survey and comparative photographs.

The 2023 rehabilitation status as compared against the performance indicators and completion criteria as defined in the PDM RMP (Ref [3]) is reproduced from the PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) in **Table 7-2**.

Table 7-2 *Rehabilitation Status Summary: 2023*

Performance indicator	Completion Criteria	Current Status (2023 Reporting Period)
Feral animal and priority weed presence	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 priority weed control	Feral animals and priority weeds are controlled in accordance with legislation.	Satisfactory – continue to monitor.
Fuel loads	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	Adequate access for firefighting is maintained on rehabilitation areas.	Satisfactory – continue to monitor.
Habitat features	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	More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.	Complete.
	Native forest indicator species tree height and girth is within the range of analogue sites.	Ongoing – continue to monitor.
Soil loss	Net annual soil loss is comparable to analogue sites at year 10.	Complete.

Performance indicator	Completion Criteria	Current Status (2023 Reporting Period)
Erosion	There are no significant erosion features that compromise landform stability or public safety (including gullying or tunnelling).	Ongoing – minor slumping evident at transect 5.
Woodland birds present	Evidence of woodland birds utilising rehabilitation areas.	Complete.
Evidence of mammals	Evidence of target mammal species present in rehabilitation areas.	Complete.
Natural regeneration	Evidence of second generation of native forest indicator species from desired vegetation community.	Ongoing – continue to monitor.
	Evidence of natural regeneration of at least four (4) pasture species at year 5.	Complete.
Structure	Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.	Ongoing – continue to monitor.
Management inputs	Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.	Satisfactory – continue to monitor.
Rural land capability	Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	Complete.
	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.	Complete.
Species composition	Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix.	Complete.
	Approved pasture species mix is sown at the specified rate per hectare.	Complete.
Weed presence	Weeds including African Lovegrass to comprise <10% of the pasture sward.	Satisfactory – continue to monitor.
Ground cover	Ground cover (vegetation, leaf litter, mulch) >70% at year 5.	Complete.

7.1.3 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 was re-profiled in 2014, 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 was applied followed by mulch (refer **Photograph 7-2**).



Photograph 7-2 *Amenity Bund looking east following application of mulch and native mix 2015.*

During the reporting period, maintenance works was not required to be undertaken in the Yarraboldy Extension. No rehabilitation maintenance activities were undertaken. Current vegetative cover on the bund is shown in **Photograph 7-3**.



Photograph 7-3 *Amenity Bund looking northeast, January 2024*

7.1.4 AREA A REHABILITATION PERFORMANCE

Area A is a treed rehabilitation area located in the southern area of PDM, south-east of the Yarraboldy Extension (refer to **Plan 4, Appendix A**). During 2008, seeding was commenced in Area A (8 ha) and 1500 trees were 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.

Historical rehabilitation activities undertaken in Area A are presented in **Table 7-3**, along with the actions recommended in 2014 (Ref [8]) for improved rehabilitation and recommendations from the 2016 – 2022 annual rehabilitation surveys. Rehabilitation activities undertaken within the reporting period are also presented in **Table 7-3**.

Table 7-3 Recommended and Completed Rehabilitation Actions in Area A

Recommended Rehabilitation Actions - Area A		Actions Completed (2014 – 2022)	Undertaken in 2023
SLR Soil Assessment Report (Ref [8])	Continue control of Bidy Bush with current spot spraying regime.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes
	Continue with further application of mushroom compost, lime & gypsum (10:3:2 tonnes/ha).	Fertiliser and compost applied at recommended rates.	No – not required
	Increase potassium by application of Muriate of Potash or similar (0.25tonnes/ha).	Application of Muriate of Potash at recommended rate.	No – not required.
2014 Rehabilitation Monitoring Report (Ref [9])	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 re-sown 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 – trees unable to support boxes.
2015 Rehabilitation Monitoring Report (Ref [10])	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 – trees unable to support boxes.
	Re-apply a mixture of mushroom compost, lime and gypsum to treed rehabilitation areas as per the recommendations (Ref [8]) report.	Application of fertiliser and compost at recommended rates.	No – not required
	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 re-sown 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
	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 re-sown with locally sourced seed mix.	No – not required

Recommended Rehabilitation Actions - Area A		Actions Completed (2014 – 2022)	Undertaken in 2023
2016 Rehabilitation Monitoring Report (Ref [11])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	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 – trees unable to support boxes.
	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
2017 – 2022 Rehabilitation Monitoring Reports (Ref [12-17])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	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 – trees unable to support boxes.

The PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) indicated that the total living groundcover within the monitoring transects in Area A (transect 5 and transect 6) was altered compared to that observed during the 2022 survey. Total living cover within the transect 5 increased by more than 10% to >90%; there was a decrease in litter cover and bare surface however a corresponding increase in perennial living colour and annual living cover. The total living cover at transect 6 remained consistent with that of 2022 at 80% and there was no change in any of the four (4) contributing factors.

Comparative photographs are presented in **Appendix C**.

7.1.5 AREA B AND C REHABILITATION PERFORMANCE

Rehabilitation Areas B and C are located in the eastern area of PDM; the locations are shown in **Plan 4, Appendix A**. Area B and C cover an area of approximately 25ha in total 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 2018 SLR Rehabilitation and Completion Assessment report (Ref [2]) indicated that rehabilitation has been successfully completed in Area B and C and all completion criteria defined in the PDM RMP (Ref [3]) had been met.

Historical rehabilitation activities undertaken in Areas B and C are presented in **Table 7-4**, along with the actions recommended in 2014 (Ref [8]) for improved rehabilitation and recommendations from the 2016 – 2022 annual rehabilitation surveys. Rehabilitation activities undertaken within the reporting period are also presented in **Table 7-4**.

Table 7-4 Recommended and Completed Rehabilitation Actions in Area B and C

Recommended Rehabilitation Actions Area B & C		Actions Completed (2014 to 2022)	Undertaken in 2023
SLR Soil Assessment. Report, 2014 (Ref [8])	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule (Section 5.7).	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.	No – not required.
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha).	Fertiliser and compost applied at recommended rates.	No – not required.
2014 Rehabilitation Monitoring Report (Ref [9])	Continue to implement integrated weed management control methods for noxious weeds.	Weed spraying as per Weed Management Schedule (Section 6.7).	Yes
2015 Rehabilitation Monitoring Report (Ref [10])	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 (Ref [8]).	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 fertiliser and compost at recommended rates.	No – not required.
2016 Rehabilitation Monitoring Report (Ref [11])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No – not required
2017 Rehabilitation Monitoring Report (Ref [12])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes

Recommended Rehabilitation Actions Area B & C		Actions Completed (2014 to 2022)	Undertaken in 2023
2018 Rehabilitation. Monitoring Report (Ref [13])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes
	Repair soil cracking along contours in Area B (transect 3).	Cracking occurred in 2018; repair works undertaken in 2018.	No – not required
2019-2022 Rehabilitation Monitoring Report (Ref [14-17])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes

The PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) documented the following findings for Area B and C (transects 1, 2 and 3):

- Total living cover / Rehabilitated pasture surfaces in the three (3) transect areas support living groundcover of greater than 95%.
- Natural regeneration of groundcover species is evident across all the pasture rehabilitation areas.
- Target weed presence comprises African Lovegrass at <10% of the pasture sward.

Comparative photographs are presented in **Appendix C**.

7.1.6 AREA 8 REHABILITATION PERFORMANCE

Area 8 is a pasture rehabilitation area located in the south-eastern area of PDM, immediately south of Area B. The location of Area 8 is shown in **Plan 4, Appendix A**. The vegetation communities prior to mining include a mixture of cleared land, pasture, pines and eucalyptus. Seeding of Area 8 (10 ha) commenced in 2008, with a pasture mixture known as 'Coxs River Mix'.

The 2018 SLR Rehabilitation and Completion Assessment report (Ref [2]) indicated that rehabilitation has been successfully completed in Area 8 and all completion criteria defined in the PDM RMP (Ref [3]) have been met.

Historical rehabilitation activities undertaken in Area 8 are presented in **Table 7-5**, along with the actions recommended in 2014 (Ref [8]) for improved rehabilitation and recommendations from the 2016 – 2022 annual rehabilitation surveys. Rehabilitation activities undertaken within the reporting period are also presented in **Table 7-5**.

Table 7-5 Recommended and Completed Rehabilitation Actions in Area 8

Recommended Rehabilitation Actions Area 8		Actions Completed (2014 to 2022)	Undertaken in 2023
SLR Soil Assessment. Report, 2014 (Ref [8])	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule (Section 5.7).	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 – not required.
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha).	Fertiliser and compost applied at recommended rates.	No – not required.
2014 Rehabilitation Monitoring Report (Ref [9])	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 to treed rehabilitation area.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No – trees unable to support boxes.
2015 Rehabilitation Monitoring Report (Ref [10])	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 (Ref [8]).	Furrows created over the land, pasture seed mix applied, followed by fertiliser and compost.	No – not required.
	Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.	Application of fertiliser and compost at recommended rates.	No – not required
2016 Rehabilitation Monitoring Report (Ref [11])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No – not required
2017 – 2022 Rehab Monitoring Reports (Ref [12-17])	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 5.7).	Yes

The PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**) documented the following findings for Area 8 (transect 4):

- Total living cover / Rehabilitated pasture surfaces in the transect area supports living groundcover of greater than 95%.
- Natural regeneration of groundcover species is evident across all the pasture rehabilitation areas.
- Target weed presence comprises African Lovegrass at <10% of the pasture sward.

Comparative photographs are presented in **Appendix C**.

7.1.7 ADDITIONAL REHABILITATION MAINTENANCE WORKS

There were no additional rehabilitation or maintenance works undertaken or required to be undertaken during the reporting period.

7.1.8 RENOVATION / REMOVAL OF BUILDINGS

No buildings were renovated or removed during the reporting period.

7.1.9 REHABILITATION FORMAL SIGN OFF

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

7.1.10 REHABILITATION TRIALS AND RESEARCH

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

7.1.11 THREATS TO REHABILITATION SUCCESS

Significant threats to rehabilitation at PDM have been identified in the PDM RMP (Ref [3]). These threats and mitigation measures have been reproduced in **Table 7-6**. PDM successfully maintained the mitigation and management measures during the 2023 reporting period.

Table 7-6 Threats to Rehabilitation Success

Secondary Domains (Post Mining Land Use)	Potential Threat(s)	Mitigation & Management Measures
Infrastructure (A)	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 Management Structure (B)	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)	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
Rehabilitation - Native Forest (D)	Species diversity and density	Annual monitoring and supplementary tree planting and seeding as required
Rehabilitation – Pine Plantation (E)	Weed presence	Inspections and weed control (herbicide application).
	Drought	Drought tolerant species selection, timing seeding to coincide with appropriate soil moisture.
Rehabilitation Areas continued	Grazing	Restrict grazing particularly in early years to rehabilitated areas
	Bushfire	Maintain low fuel loads, emergency preparedness and response

Bushfire was the dominant threat during late 2019 and early January 2020; the PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix D**) indicated that fuel loads within all rehabilitation areas were low and fuel hazard mitigation activities were not required. Details regarding firefighting access tracks, fire breaks and emergency response measures are detailed in **Section 5.14**.

7.2 ACTIONS FOR THE 2024 REPORTING PERIOD

Maintenance and rehabilitation activities recommended in the PDM RMP (Ref [3]) will continue on areas not directly impacted by future mining operations throughout 2024 (sediment fences, fertilising, re-seeding, weed control etc), where required and as conditions allow.

As per the recommendations made in the PDM 2023 Rehabilitation Monitoring Report (Ref [4], **Appendix C**), further weed spraying is proposed as well as the installation of nesting boxes once the treed area contains adequate structure to support nesting birds. In addition, the minor slumping at transect 5 would be stabilised and monitored for further erosion.

The 2018 SLR Rehabilitation and Completion Assessment report (Ref [2]) confirms that rehabilitation has been successfully completed in Areas B, C and 8 and all completion criteria defined in the PDM RMP (Ref [3]) has been successfully achieved. As such PDM will further progress to relinquish rehabilitation responsibilities of Areas B, C and 8 during the 2024 reporting period.

8 COMMUNITY RELATIONS

8.1 ENVIRONMENTAL COMPLAINTS

All stakeholder and community complaints, enquiries and notifications regarding PDM 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 EnergyAustralia website. During the 2023 reporting period, there were no complaints received, enquiries or notifications received as summarised by **Table 8-1**.

Table 8-1 *Community Complaints, Incidents and Notifications*

Incident Type	Incidents Received 2023
Noise	0
Air Quality	0
Blasting	0
Traffic	0
Water	0
Other	0
Total Complaints Received	0
Enquiries/Notifications Received	0

No complaints, enquiries or notifications have been received during the last five (5) years (2019 – 2023): the last was a notification received in May 2018.

8.2 COMMUNITY

8.2.1 COMMUNITY CONSULTIVE COMMITTEE

PDM CCC commenced in January 2012 and comprises representatives from the local community and PDM. During 2017, the then Department of Planning and Environment approved an amalgamation of the PDM CCC and the regional EnergyAustralia CCC into one. The amalgamated CCC meets three (3) times per year to discuss matters relating to PDM and meeting minutes are made publicly available via the EnergyAustralia website. During the 2023 reporting period the CCC meetings were held on 18 April, 18 July and 5 December 2023.

8.2.2 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 Website³:

- EPL 4911.
- Environmental Assessment.
- Project Approval 10_0041.
- Environment Protection and Biodiversity Conservation Act 1999 Referral Decision 2011/6016.
- The Care and Maintenance Mining Operation Plan.
- Environmental Management Plans for Pine Dale Mine.
- AEMR Reports / Annual Review.
- Pollution Incident Response Management Plan.
- Independent Environmental Audits (refer **Section 9**).
- Community Consultative Committee minutes.
- Community Complaints (Enquiries & Notifications).
- Blasting information.
- Monthly Environmental Performance reports.

8.2.3 SOCIAL AND ECONOMIC CONTRIBUTIONS

PDM has contributed to the economy of the district and NSW by providing direct employment and indirect employment through the purchase of services and materials from regional suppliers. Coal supplies to Mount Piper Power Station provide competitively priced energy for the NSW electricity market which ultimately flows through to provide economic benefit to electricity consumers.

Additionally, EnergyAustralia undertakes a community grants programme which provides funding for local initiatives that will deliver sustainable benefits for the Lithgow region. The two (2) priority areas for funding are education and social inclusion. Details of the community grants programme is provided on the EnergyAustralia website³.

9 INDEPENDENT ENVIRONMENTAL AUDIT

There was no requirement within the Project Approval 10_0041 for an Independent Environmental Audit (IEA) to be conducted at PDM while PDM is in care and maintenance: as such none was undertaken during the 2023 reporting period.

³ <https://www.energyaustralia.com.au/about-us/community>

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 PDM are provided on the EnergyAustralia website.

As per the conditions of Project Approval 10_0041, no further IEA are required at PDM providing the care and maintenance status is maintained.

10 INCIDENTS AND NON-COMPLIANCES

During the 2023 reporting period, there were instances of non-compliance in relation to:

- The requirements of the Groundwater Management Plan:
 - The Old Shaft is no longer sampled as it is not safe to do so. Samples were collected from Wallerawang Underground as a suitable safe alternative site; the WMP (Ref [5]) will be updated accordingly to reflect this.
 - Sampling from some bores within the Yarraboldy extension (Bores A, B, C, D and E) could not be undertaken due to access and safety issues, and due to overgrown vegetation which meant bores could not be located.

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

The November samples for all dust gauges were collected two (2) days outside the recommended (Ref [7]) exposure period. The results from all gauges were below the criteria, and the December samples were collected within the correct exposure period such that it is not considered that there has been any significant impact to the monitoring results.

The December results for dust gauge PCB1 increased by more than the NSW EPA threshold of 2g/m² from the November monitoring result. The majority of the PCB1 results are from combustible matter such as insects and other organic matter and not considered to indicate airborne particulates related to activities at PDM.

There were several exceedances of the water quality triggers for surface water and groundwater during the reporting period. As discussed in **Section 6.3** exceedances of surface water triggers are considered to be due to upstream influences in Wangcol Creek and Coxs River outside of the control of PDM. As discussed in **Section 6.2.2** intermittent exceedances of the groundwater trigger levels are not considered to be due to activities undertaken by PDM, rather are due to external factors such as climate.

11 PROPOSED ACTIVITIES IN THE NEXT REPORTING PERIOD

The activities proposed for the 2024 reporting period are consistent with the PDM RMP (Ref [3]). Rehabilitation activities set out in the PDM RMP will be transitioned across into a new Rehabilitation Management Plan inclusive of Rehabilitation Objectives, Completion Criteria and Final Landform Plan. These will remain substantially consistent with that already set out in the PDM RMP. General maintenance will be undertaken at the site in addition to rehabilitation activities including weed management and fertilising as required.

11.1 MINING

All recoverable coal within the approved mining area was extracted during early 2014. No mining activities are proposed during 2024.

11.2 FUTURE MINING DEVELOPMENT

Subject to market conditions, in order to maintain supply of commercial coal to Mount Piper Power Station, Enhance Place may consider lodging an application with the DPHI to extend the existing mining operations. This will be subject to ongoing feasibility assessments associated with coal extraction within the existing authorisations.

11.3 DOCUMENT REVIEWS

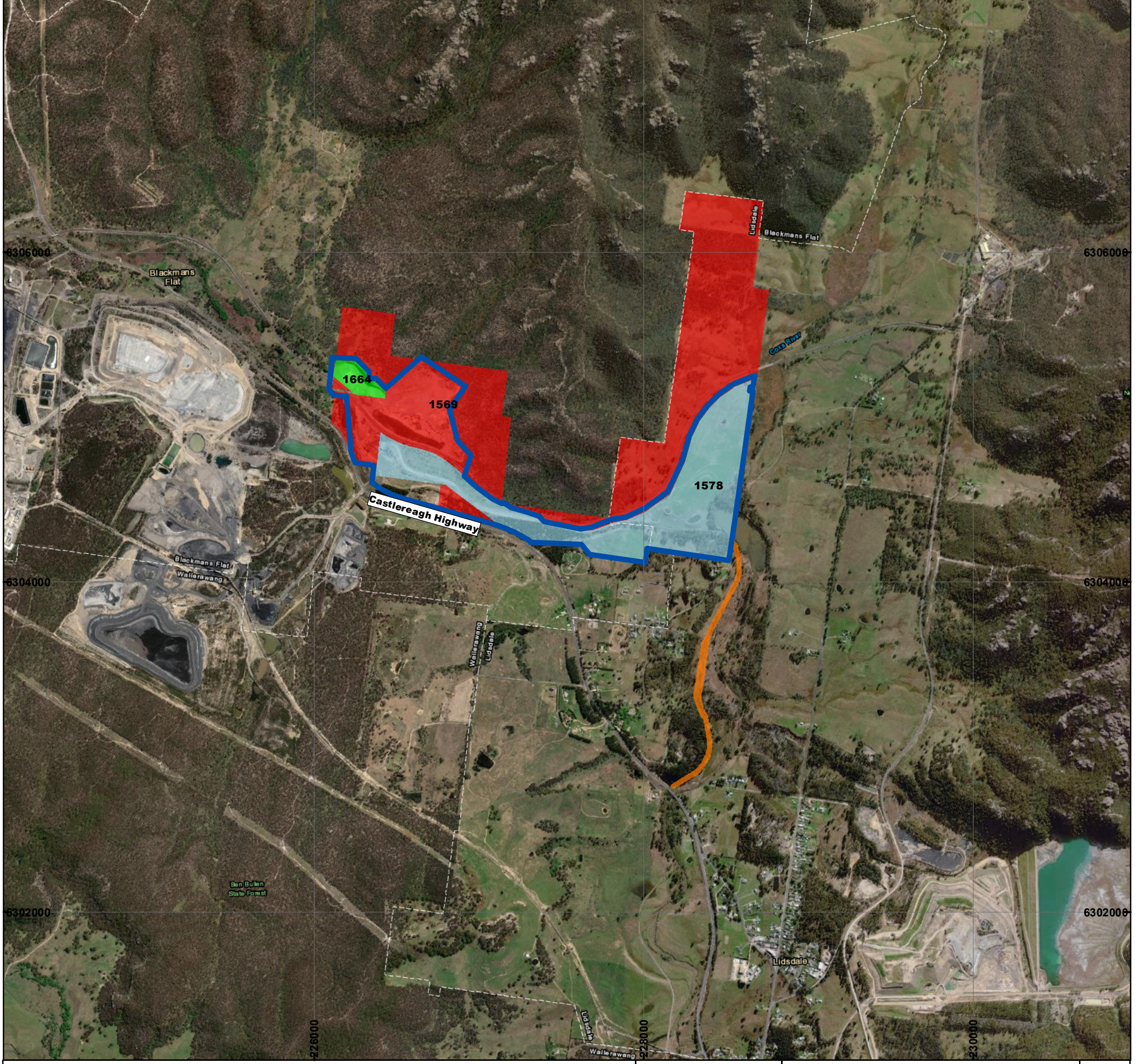
The PDM WMP (Ref [5]) is being reviewed for consistency with current arrangements.

REFERENCES

- [1] NSW Government, *Annual Review Guideline*, October 2015.
- [2] SLR, *Pine Dale Mine Rehabilitation Completion Assessment*, SLR ref 630.12362-R01, 2018.
- [3] EnergyAustralia, *Pine Dale Mine Rehabilitation Management Plan, July 2022*
- [4] FirstField Environmental, *Pine Dale Mine Rehabilitation Monitoring Report 2023*, September 2023.
- [5] Enhance Place Pty Limited, *Water Management Plan for the Pine Dale Coal Mine (Including the Yarraboldy Extension)*, August 2015.
- [6] GHD, *Pine Dale Groundwater and Surface Water Investigation Trigger Value Review Report*, September 2018.
- [7] CSIRO, *Ecosystem Function Analysis – Ephemeral Stream Assessment Protocol*.
- [8] SLR, *Soil Assessment and Recommendations for Rehabilitated Areas: Pine Dale Mine and Enhance Place*, November 2014.
- [9] FirstField Environmental, *Pine Dale Mine 2014 Rehabilitation Monitoring Report*, June 2014.
- [10] FirstField Environmental, *Pine Dale Mine 2015 Rehabilitation Monitoring Report*, November 2015.
- [11] FirstField Environmental, *Pine Dale Mine 2016 Rehabilitation Monitoring Report*, November 2016.
- [12] FirstField Environmental, *Pine Dale Mine 2017 Rehabilitation Monitoring Report*, October 2017.
- [13] FirstField Environmental, *Pine Dale Mine 2018 Rehabilitation Monitoring Report*, October 2018.
- [14] FirstField Environmental, *Pine Dale Mine 2019 Rehabilitation Monitoring Report*, October 2019.
- [15] FirstField Environmental, *Pine Dale Mine 2020 Rehabilitation Monitoring Report*, November 2020.
- [16] FirstField Environmental, *Pine Dale Mine Rehabilitation Monitoring Report 2021*, January 2022.
- [17] FirstField Environmental, *Pine Dale Mine Rehabilitation Monitoring Report 2022*, January 2023.

Appendix A

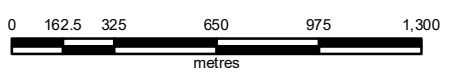
Site Plans



LEGEND
 Pine Dale Mine

Mine Lease Numbers
 1569
 1664
 1578
 1637

Note: Aerial taken from ArcGis Base Map,
 25 October 2021
 Coordinate System MGA Zone 56



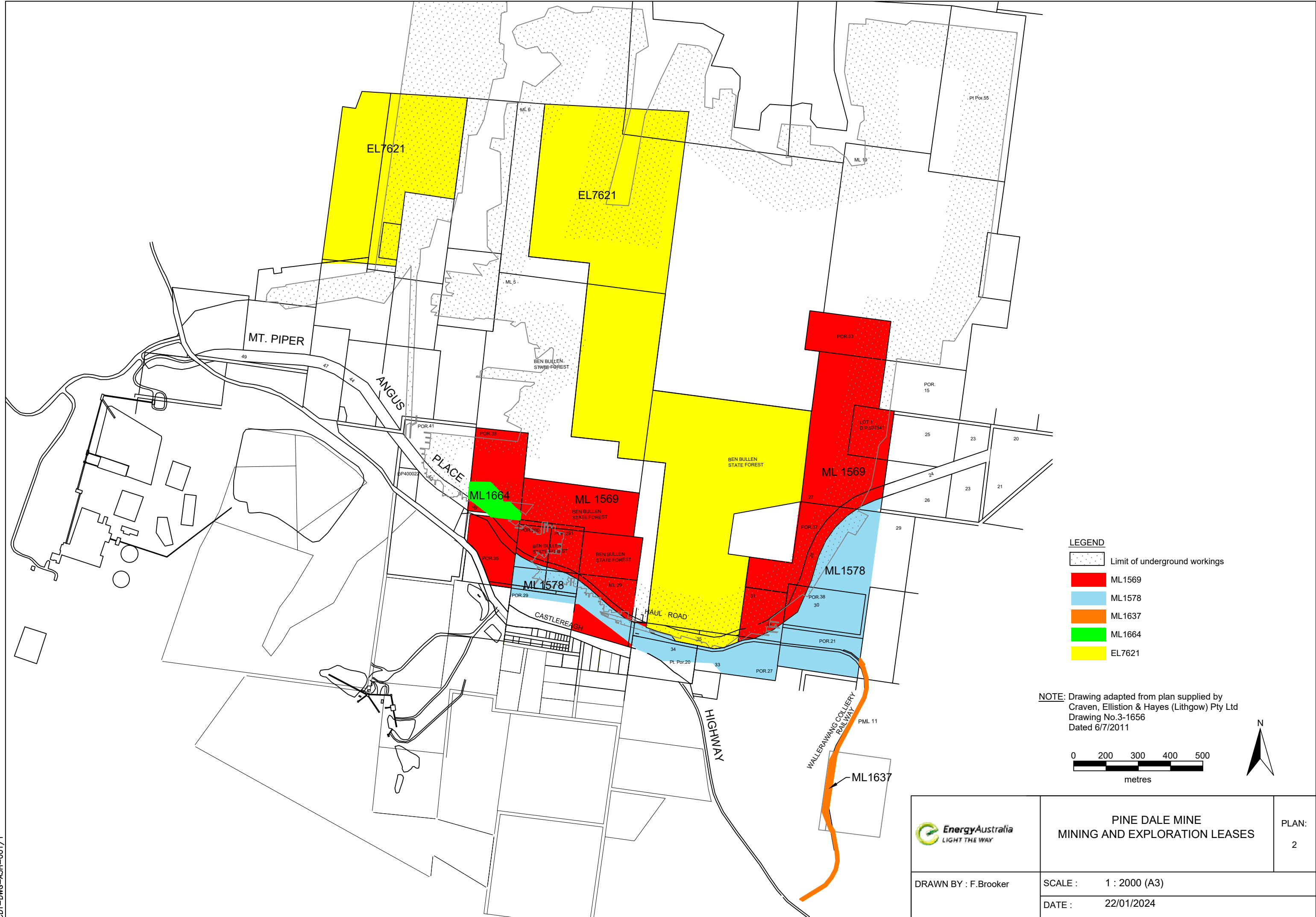
DRAWN BY : F.Brooker

**ENHANCE PLACE MINE
 REGIONAL LOCALITY PLAN**

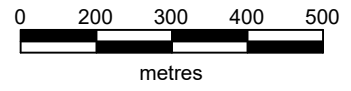
PLAN:
1


SCALE: 1:24,000 (A3)

DATE: 22/01/2024



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



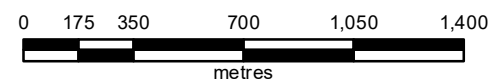
	PINE DALE MINE MINING AND EXPLORATION LEASES		PLAN: 2
	DRAWN BY : F.Brooker	SCALE : 1 : 2000 (A3)	DATE : 22/01/2024



LEGEND

- ▲ Noise monitoring location
- Depositional dust monitoring location
- Groundwater monitoring location
- Surface water monitoring location
- Historic High Volume Air Sampling Location
- Meteorological monitoring location (up until 10 November 2021)
- Meteorological monitoring location (from 10 November 2021)

Note: Aerial taken from ArcGis Base Map,
25 October 2021
Coordinate System MGA Zone 56



DRAWN BY : F. Brooker

**PINE DALE MINE
ENVIRONMENTAL MONITORING
LOCATION PLAN**

PLAN:
3a

SCALE: 1:24,000 (A3)

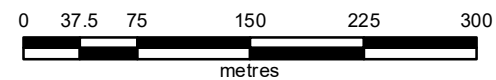
DATE: 22/01/2024



LEGEND

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

Note: Aerial taken from ArcGis Base Map,
25 October 2021
Coordinate System MGA Zone 56



DRAWN BY : F. Brooker

**PINE DALE MINE
ENVIRONMENTAL MONITORING
CHANNEL STABILITY, STREAM AND
VEGETATIVE HEALTH
MONITORING SITES**

PLAN:
3b

SCALE: 1:5,000 (A3)

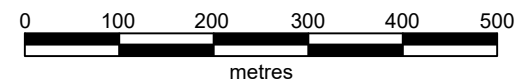
DATE: 22/01/2024

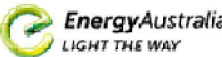


LEGEND

- 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, Elliston & Hayes (Lithgow) Pty Ltd
 Drawing No. PINE AEMR13
 Dated 31/12/2013



	PINE DALE MINE REHABILITATION DOMAINS DECEMBER 2018		PLAN: 4
	DRAWN BY : F. Brooker	SCALE: 1 : 8000 (A3)	DATE: 22/01/2024

Appendix B

Environmental Monitoring Summary Report

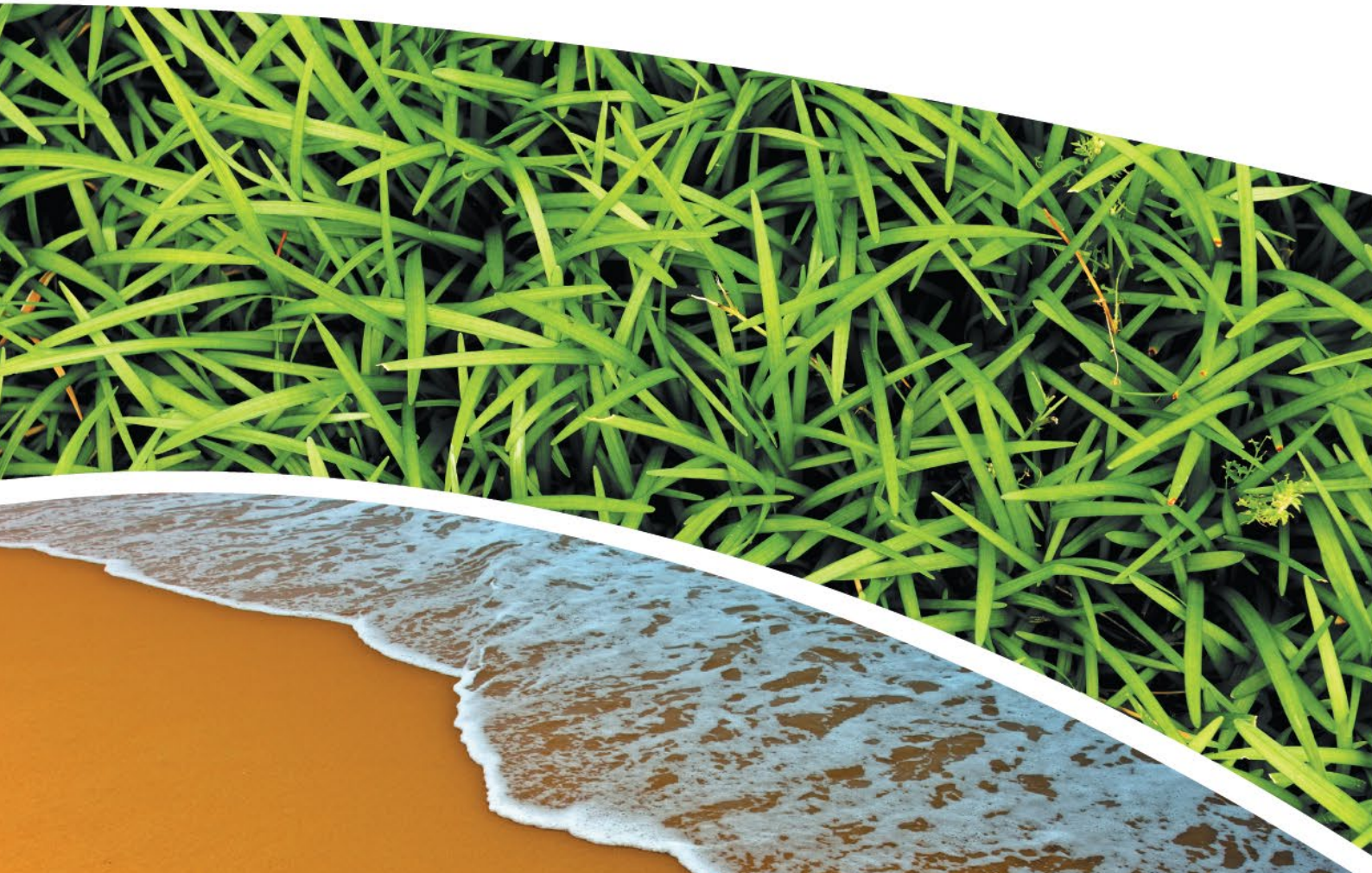
**ANNUAL REVIEW ENVIRONMENTAL SUMMARY 2023
PINE DALE MINE**

Prepared for ENHANCE PLACE PTY Limited

Prepared by RCA Australia

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FEBRUARY 2024



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16 February 2024

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Geotechnical Engineering

Engineering Geology

Environmental Engineering

Hydrogeology

Construction Materials Testing

Environmental Monitoring

Noise & Vibration

Occupational Hygiene

**ANNUAL REVIEW ENVIRONMENTAL SUMMARY 2023
COMPILED FOR PINE DALE MINE
JANUARY – DECEMBER 2023**

EXECUTIVE SUMMARY

Pine Dale Mine achieved an acceptable standard of environmental performance during the 2023 reporting period, as evidenced by the following:

- Air quality monitoring results recorded during the reporting period for depositional dust were below the Project Approval (PA 10_0041) and Environment Protection Licence limits in Blackmans Flat and other privately owned properties adjacent to the Mining Leases.
 - The December 2023 results for PCB1 represented an increase of more than the 2g/m² per month deposited matter from the November results and the results are not apparently related to only organic matter. However, as PDM has been in care and maintenance with no specific soil disturbance activities undertaken, the results are not considered indicative of impact from PDM.
- 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.
- Surface water and groundwater quality were assessed against the respective trigger levels that showed varied results which was generally consistent with previous years.
- There were no community complaints throughout the 2023 reporting period.

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Attachments

ATTACHMENT 1

DRAWING 1 - ENVIRONMENTAL MONITORING LOCATIONS

DRAWING 2 - STREAM HEALTH & CHANNEL STABILITY MONITORING LOCATIONS

1 INTRODUCTION

The following report provides a summary of monthly environmental monitoring data for Pine Dale Mine (PDM) for the period January – December 2023. The 2023 environmental summary data includes:

- Depositional dust monitoring.
- Groundwater monitoring.
- Surface water monitoring.
- Meteorological monitoring.
- Channel stability and stream health monitoring.
- Noise monitoring.

This report satisfies the requirements to monitor environmental parameters as presented in the PDM Environment Protection Licence (EPL 4911, Ref [1]) and Project Approval (PA 10_0041, (Ref [2]). Monitoring is also undertaken in general accordance with the PDM: Water Management Plan (Ref [3]); Air Quality and Greenhouse Gas Management Plan (Ref [4]; Purple Copper Butterfly Monitoring Programme (Ref [5]); and Noise Management Plan (Ref [6]).

A compliance assessment of each environmental monitoring parameter is made in accordance with the relevant assessment criteria outlined in EPL 4911 (Ref [1]), Project Approval (Ref [2]) and the PDM Management Plans (Ref [3] to [6]).

It is noted that quarterly reports have been issued with the monitoring data; this report is the only presentation of the October to December quarter for air quality, groundwater, surface water and meteorological data.

2 AIR QUALITY MONITORING

2.1 ASSESSMENT CRITERIA

The PDM Project Approval (Schedule 3 Condition 18, Ref [2]) and Air Quality and Greenhouse Gas Management Plan (Ref [4]) stipulates that dust emissions generated by the project must not cause additional exceedances of the long-term impact assessment criteria listed in **Table 1**.

Table 1 *Air Quality Assessment Criteria*

Pollutant	Average Period	Assessment Criteria	
		Maximum increase in deposited dust level	Maximum total deposited dust level
° Deposited dust	Annual	^b 2.0g/m ² .month	^a 4.0g/m ² .month

^a Total impact (incremental increase in concentrations due to the project plus background concentrations due to other sources)

^b Incremental impact (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 (Ref [7])

Criteria excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed to by the Director-General in consultation with Department of Planning and Environment (DPIE).

2.2 AIR MONITORING RESULTS

Depositional dust monitoring is undertaken at nine (9) locations across PDM.

A total of five (5) depositional dust gauges are monitored in accordance with EPL 4911 (Ref [1]) and the Air Quality and Greenhouse Gas Management Plan (Ref [4]). One (1) dust gauge is located within the settlement of Blackmans Flat (gauge D1) and one (1) is located to the east of Blackmans Flat (gauge D3). The remaining three (3) 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, Attachment 1**).

The remaining four (4) depositional dust gauges are monitored in accordance with the Purple Copper Butterfly Monitoring Programme (Ref [5]) assessing the level of dust present at each location to aid in the study of the Purple Copper Butterfly population. These gauges are: PCB1, PCB2, PCB3 and PCB7. Three (3) of the dust gauges were located within what was the major butterfly population to the east of the mine workings in the Yarraboldy Extension (PCB1, PCB2 and PCB3); whilst the fourth dust gauge (PCB7) is located to the south west of the butterfly habitat area (refer **Drawing 1, Attachment 1**).

Depositional dust summary results for the period January – December 2023 are shown in **Table 2 to Table 10**. Graphical presentations are shown in **Figures 1 and 2**. A discussion of results is presented in **Section 2.3**.

Table 2 *Depositional Dust Data Summary Dust Gauge D1 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.2	<u>0.05</u>	0.2
Feb-23	0.5	<u>0.05</u>	0.5
Mar-23	0.6	<u>0.05</u>	0.6
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.1	<u>0.05</u>	0.1
Jun-23	0.4	<u>0.05</u>	0.5
Jul-23	0.5	<u>0.05</u>	0.5
Aug-23	0.4	0.1	0.3
Sep-23	0.2	<u>0.05</u>	0.2
Oct-23	0.6	0.1	0.5
Nov-23	1.2	0.7	0.5
Dec-23	0.8	0.3	0.5
Annual Average	0.5	0.1	0.4

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 3 *Depositional Dust Data Summary Dust Gauge D3 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.3	0.1	0.2
Feb-23	0.3	0.2	0.1
Mar-23	0.4	0.2	0.2
Apr-23	0.3	0.1	0.2
May-23	0.2	<u>0.05</u>	0.2
Jun-23	1.4	0.7	0.7
Jul-23	1.2	0.5	0.7
Aug-23	0.4	0.2	0.2
Sep-23	0.2	<u>0.05</u>	0.2
Oct-23	0.8	0.1	0.6
Nov-23	1.4	0.8	0.6
Dec-23	1.9	1.2	0.7
Annual Average	0.7	0.4	0.4

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 4 *Depositional Dust Data Summary Gauge D4 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.3	<u>0.05</u>	0.3
Feb-23	0.3	<u>0.05</u>	0.3
Mar-23	0.3	<u>0.05</u>	0.3
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.1	<u>0.05</u>	0.1
Jun-23	0.1	<u>0.05</u>	0.1
Jul-23	0.1	<u>0.05</u>	0.1
Aug-23	0.2	0.1	0.1
Sep-23	1.1	0.3	0.8
Oct-23	0.5	<u>0.05</u>	0.5
Nov-23	0.9	0.5	0.4
Dec-23	1.9	0.9	1.0
Annual Average	0.5	0.2	0.3

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 5 *Depositional Dust Data Summary Gauge D5 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.1	<u>0.05</u>	0.1
Feb-23	0.2	<u>0.05</u>	0.2
Mar-23	0.4	0.1	0.4
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.2	<u>0.05</u>	0.2
Jun-23	0.1	<u>0.05</u>	0.3
Jul-23	0.2	<u>0.05</u>	0.2
Aug-23	0.3	0.2	0.1
Sep-23	0.4	0.1	0.3
Oct-23	0.9	0.4	0.5
Nov-23	0.7	0.4	0.3
Dec-23	0.9	0.4	0.5
Annual Average	0.4	0.2	0.3

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 6 *Depositional Dust Data Summary Gauge D6 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.1	<u>0.05</u>	0.1
Feb-23	0.2	<u>0.05</u>	0.2
Mar-23	0.5	0.2	0.3
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.2	<u>0.05</u>	0.2
Jun-23	0.1	<u>0.05</u>	0.2
Jul-23	0.1	<u>0.05</u>	0.1
Aug-23	0.4	0.3	0.1
Sep-23	0.2	<u>0.05</u>	0.2
Oct-23	1.3	0.5	0.8
Nov-23	0.7	0.4	0.3
Dec-23	1.0	0.7	0.3
Annual Average	0.4	0.2	0.2

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 7 *Depositional Dust Data Summary Gauge PCB1 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	2.4	<u>0.05</u>	2.4
Feb-23	0.4	<u>0.05</u>	0.4
Mar-23	0.5	<u>0.05</u>	0.5
Apr-23	0.5	<u>0.05</u>	0.5
May-23	0.4	<u>0.05</u>	0.4
Jun-23	0.9	0.3	0.6
Jul-23	0.1	<u>0.05</u>	0.1
Aug-23	0.5	0.1	0.4
Sep-23	0.6	0.1	0.5
Oct-23	1.8	0.4	1.4
Nov-23	1.5	0.5	1.0
Dec-23	4.5	1.4	3.1
Annual Average	1.2	0.3	0.9

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 8 *Depositional Dust Data Summary Gauge PCB2 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.2	<u>0.05</u>	0.2
Feb-23	0.2	<u>0.05</u>	0.2
Mar-23	0.2	<u>0.05</u>	0.3
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.1	<u>0.05</u>	0.1
Jun-23	0.2	0.1	0.1
Jul-23	1.0	<u>0.05</u>	1.0
Aug-23	0.8	0.3	0.5
Sep-23	0.3	0.1	0.2
Oct-23	0.8	0.1	0.7
Nov-23	1.0	0.4	0.6
Dec-23	1.2	0.3	0.9
Annual Average	0.5	0.1	0.4

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 9 *Depositional Dust Data Summary Gauge PCB3 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	1.8	<u>0.05</u>	1.8
Feb-23	0.6	<u>0.05</u>	0.6
Mar-23	0.2	<u>0.05</u>	0.2
Apr-23	0.1	<u>0.05</u>	0.1
May-23	0.2	<u>0.05</u>	0.2
Jun-23	0.5	0.1	0.4
Jul-23	0.2	<u>0.05</u>	0.2
Aug-23	0.4	0.1	0.3
Sep-23	0.5	0.1	0.4
Oct-23	0.5	<u>0.05</u>	0.5
Nov-23	0.8	0.4	0.4
Dec-23	1.7	0.4	1.3
Annual Average	0.6	0.1	0.5

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

Table 10 *Depositional Dust Data Summary Gauge PCB7 January – December 2023*

Month	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-23	0.1	<u>0.05</u>	0.1
Feb-23	1.5	<u>0.05</u>	1.5
Mar-23	0.4	0.1	0.3
Apr-23	0.2	<u>0.05</u>	0.2
May-23	0.2	<u>0.05</u>	0.2
Jun-23	0.2	<u>0.05</u>	0.2
Jul-23	0.2	<u>0.05</u>	0.2
Aug-23	0.4	0.1	0.3
Sep-23	0.4	0.1	0.3
Oct-23	0.5	<u>0.05</u>	0.5
Nov-23	0.8	0.3	0.5
Dec-23	1.8	0.7	1.1
Annual Average	0.6	0.1	0.5

Small & underline – Where results are less than the detection limit, half of the detection limit has been used in statistical calculations.

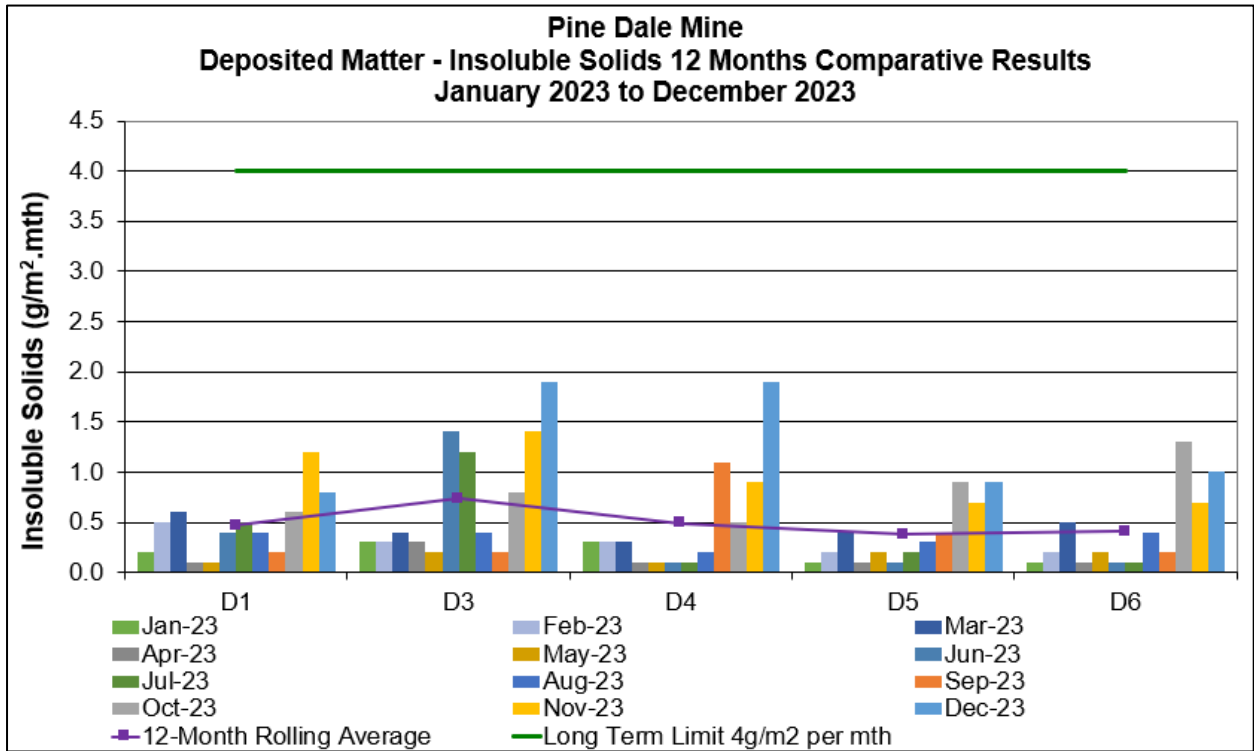


Figure 1 Depositional Dust Results – Gauges D1 & D3 to D6

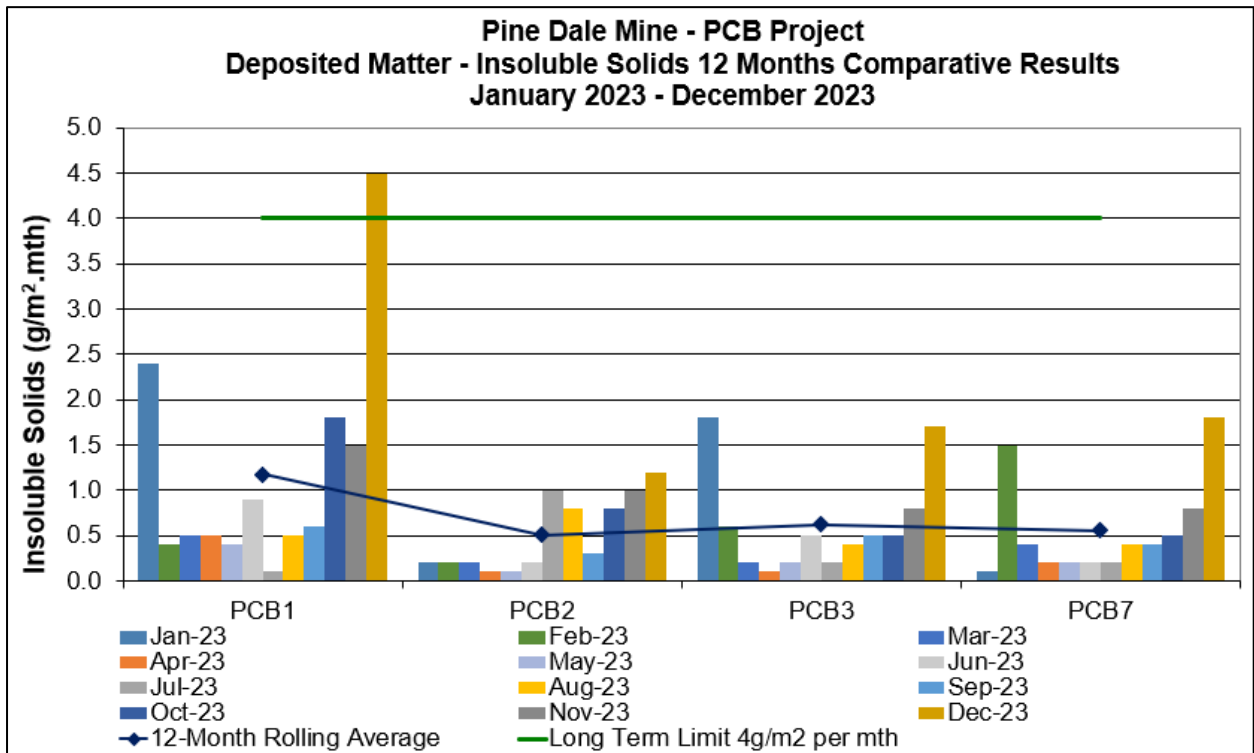


Figure 2 Depositional Dust Results – Gauges PCB1 to PCB3 & PCB7

2.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS

The average insoluble solids within depositional dust gauges D1 and D3 to D6 for the period January – December 2023 range from 0.4g/m² per month to 0.7g/m² per month. These results are well below the long-term assessment criteria detailed in **Table 1**. The highest result, 1.9g/m² per month, was recorded in December at D3 and D4. The results (refer **Table 3** and **Table 4**) indicates that a significant portion of insoluble solids (63% at D3 and ~ 50% at D4) was ash which is considered to be related to dust particles. It is noted that were no reported physical activities undertaken at Pine Dale Mine which may have generated high dust levels however the particulates may be sourced from the site itself.

The average insoluble solids within depositional dust gauges PCB1, PCB2, PCB3 and PCB7 for the period January – December 2023 range from 0.5g/m² per month to 1.2g/m² per month. These results are well below the long-term assessment criteria detailed in **Table 1**, noting that as the dust gauges are located in a bushland setting under the canopy of tall trees and therefore do not conform to the siting requirements of AS/NZS 3580.1.1 (Ref [8]) the criteria are not strictly applicable. The highest result, 4.5g/m² per month, was recorded in December at PCB1 and is discussed below.

It is noted that the dust gauges were collected after a thirty-four (34) day exposure in November which is two (2) days longer than the recommended (Ref [7]) exposure period. The results do not appear to have been unduly impacted and the exposure period for the following month was within the recommended timeframe. As such, it is not considered that the late collection of samples has had a significant impact on the dust monitoring.

A review of historical data captured over the previous five (5) years including the 2023 monitoring period indicate there were seven (7) instances where the dust gauges D1 and D3 to D6, and four (4) instances where dust gauges PCB1, PCB2, PCB3 and PCB7 showed results which were greater than the allowable maximum annual average increase of 2.0g/m² per month deposited matter **Table 1**. One (1) result within the 2023 monitoring period was identified as below:

- PCB1 increased 3.0g/m² per month from the November to the December monitoring result. The majority of the insoluble solids result (~69%, refer **Table 7**) was from combustible matter such as insects and other organic matter and the photograph of the dust gauge bottle, **Figure 3** below, indicates the presence of multiple insects. As such this result is not considered to represent elevated dust particulates. Given the absence of any soil disturbance works at PDM it is not considered that the source of the particulates is from PDM activities; however, the particulates may be sourced from the site itself.

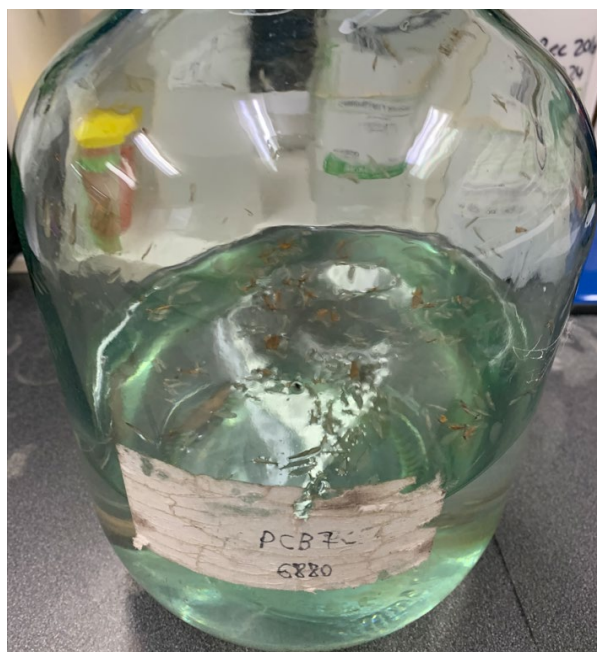


Figure 3 PCB7 Dust Gauge from December 2023

All results, including the result at PCB1, are within the historical ranges of results available to RCA (from December 2005 for DDG gauges and July 2011 for PCB gauges).

3 GROUNDWATER QUALITY MONITORING

Groundwater monitoring is undertaken at PDM to monitor for any potential impacts on local groundwater due to past mining operations. The intended monitoring scope in accordance with the Water Management Plan (Ref [3]) comprises:

- Four (4) locations within the mine site; seven (7) locations surrounding the Yarraboldy Extension area comprising four (4) sampling wells and three (3) vibrating wire piezometer wells.
 - The scope of sampling at the Yarraboldy bores was reduced to a quarterly download of Bore B only following the Gospers Mountain bushfire during late 2019 / early 2020 as detailed in the 2020 Annual Review Environmental Summary Report.
- Two (2) locations at the former Enhance Place Mine site.

Groundwater monitoring is not a requirement of EPL 4911 (refer **Drawing 1, Attachment 1**).

Sampling from one of the in-site locations, Old Shaft, was discontinued in 2021 following an internal audit which identified that the sampling posed a fall risk due to the requirement for an elevated position to collect samples and the absence of any formal attachment points for a harness required for working at heights.

Sampling of another of the on-site locations, an opening to the Old Wallerawang underground workings known as The Bong, is conducted from Water Cart Dam. Groundwater from The Bong was historically pumped into the Water Cart Dam however during care and maintenance, water is no longer pumped into the Water Cart Dam and therefore water quality from the Water Cart Dam is now considered to be representative of surface water runoff rather than groundwater quality. Thus, any results reported in excess of the trigger levels at the Bong are not considered indicative of impacts to groundwater and results are presented in **Section 4**.

Sampling from the two (2) locations (bores PDH3 & PDH4) at the former Enhance Place was discontinued in 2022 as part of the Enhance Place mining lease relinquishment. These wells were decommissioned in 2023 and no sampling has been undertaken in the monitoring period.

3.1 GROUNDWATER ASSESSMENT CRITERIA

Site specific trigger levels for standing water level (SWL) and water quality parameters pH and electrical conductivity were developed for PDM are stipulated in the Water Management Plan (Ref [3]) which is in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041). The groundwater trigger levels (Ref [3]) are shown in **Table 11**: compliance with these trigger levels is not an EPL requirement.

Table 11 Groundwater Trigger Levels

Bore	pH (range)	Electrical Conductivity ($\mu\text{S}/\text{cm}$)	SWL Trigger (m, AHD)
P6	6.2 - 8.0	1,180	887.90
P7	6.3 - 8.0	852	883.28
EP DDH4/GW (Bore D)	6.8 - 8.0	608	940.61
EP DDH7/GW (Bore A)	6.5 - 8.0	326	954.40
EP PDH1/GW Bore C)	6.9 - 8.0	490	889.25
EP PDH7/GW (Bore E)	5.5 - 8.0	151	938.43

NA – no trigger level required for these locations.

Trigger levels for Old Shaft, PDH3 and PDH4 not presented in the absence of sampling in the monitoring period.

Trigger levels for The Bong are presented in **Table 18**.

It is noted that an investigation (Ref [9]) derived revised site-specific pH trigger levels as per **Table 12** below and recommended the removal of electrical conductivity as a trigger level.

Table 12 Revised Groundwater Trigger Levels (Ref [9])

Monitoring location	P6	P7
pH trigger level ^a	5.6	6.3
Water Level (AHD) ^b	--	--

^a pH trigger level is exceeded if the pH is outside the nominated range

^b Water level trigger level is exceeded if the water level is below the nominated level

These values were submitted to the Department of Planning and Industry and a response was received in June 2020 that further work was required for the revised trigger levels to be accepted for use. At the time of writing this report, the revised trigger levels detailed in **Table 12** have been utilised alongside the approved trigger levels in **Table 11**.

3.2 GROUNDWATER MONITORING DATA SUMMARY

Samples were collected from P6 and P7 each month during the January – December 2023 monitoring period.

Sampling from bores within the Yarraboldy extension (Bores A, B, C, D and E) could not be undertaken in the first quarter due to the closure (in October 2022) of the Gardens of Stone State Conservation Area. Bore C could not be located due to vegetation growth along the access track in the third quarter (August 2023) and Bore D could not be located in the second and third quarters (May and August 2023) for the same reason; both Bores were located in the fourth quarter (November 2023) after maintenance works. No data was able to be retrieved from Bore C during the monitoring period however as the logger batteries were flat at time of both download attempts, noting that battery replacement was undertaken in the second quarter (May 2023). Monitoring of Bore E was unsuccessful in the second quarter (February 2023) due to falling trees and no further sampling attempt was made in the reporting period due to safety concerns.

Groundwater summary results for the period January – December 2023 are shown in **Table 13** to **Table 17**. Graphical presentations of standing water levels, pH and electrical conductivity in on-site bores are shown in **Figure 4** and **Figure 5**.

Table 13 Groundwater Monitoring Bore P6 Results January – December 2023

Location	Site Bore P6												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	07/02/23	09/03/23	05/04/23	08/05/23	09/06/23	07/07/23	08/08/23	07/09/23	05/10/23	08/11/23	07/12/23	
Time Sampled	9:45	9:56	9:39	15:30	10:37	10:35	9:52	10:30	9:59	9:23	9:43	9:39	
Standing Water Level (m)	22.72	22.72	22.73	22.77	22.73	22.74	22.76	22.82	22.85	22.87	22.92	22.94	
Standpipe Height (m)	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
Relative Water Level (m)	22.06	22.06	22.07	22.11	22.07	22.08	22.10	22.16	22.19	22.21	22.26	22.28	
Water Level AHD (m)	894.89	894.89	894.88	894.84	894.88	894.87	894.85	894.79	894.76	894.74	894.69	894.67	887.90 [#]
Temperature (°C)	17.6	17.8	15.3	17.9	13.56	13.54	9.6	14.3	15.3	12.9	17.1	18.15	
pH	6.47	6.23	6.54	6.51	6.77	6.51	6.36	6.43	6.50	6.31	6.33	6.34	6.2 to 8.0*
Conductivity (µS/cm)	1080	1090	1140	1100	1200	1220	1196	1190	1180	1190	1130	1121	1180
Turbidity (NTU)	32	26	50	72	63	56	79	63	71	107	54	37	
Dissolved Oxygen (mg/L)	2.3	1.0	2.0	2.6	1.4	3.4	3.1	3.9	3.8	2.8	<1	5.6	
TSS (mg/L)	61	47	60	60	28	24	26	33	9	61	90	56	
Oil & Grease (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Bicarbonate Alkalinity (mg/L)	133	144	150	152	149	152	152	97	134	135	124	125	
Total Alkalinity (mg/L)	133	144	150	152	149	152	152	97	134	135	124	125	
Sulphate (mg/L)	409	420	387	410	388	427	415	448	420	419	490	441	
Chloride (mg/L)	34	40	34	34	37	32	34	35	52	31	59	42	
Calcium (mg/L)	99	98	107	104	126	99	117	118	112	112	114	110	
Magnesium (mg/L)	46	48	51	50	43	45	52	52	50	47	52	50	
Sodium (mg/L)	52	48	47	48	42	43	49	48	50	45	45	48	
Potassium (mg/L)	22	22	23	23	22	21	25	22	22	23	22	21	
Cobalt (dissolved, mg/L)	0.032	0.008	0.008	0.008	0.006	0.004	0.004	0.003	0.005	0.007	0.006	0.006	
Manganese (dissolved, mg/L)	1.73	1.98	1.82	1.76	1.76	1.76	1.92	2	2	1.93	1.95	1.94	
Nickel (dissolved, mg/L)	0.052	0.015	0.016	0.019	0.013	0.01	0.012	0.01	0.012	0.012	0.011	0.014	
Zinc (dissolved, mg/L)	0.044	0.012	0.033	0.029	0.068	0.032	0.037	0.019	0.068	0.071	0.033	0.058	
Iron (dissolved, mg/L)	16.7	14.6	12.1	<0.05	7.03	11.1	10.4	10	8.92	11.8	15.7	14.4	

Shaded Cells – Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level

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

Table 14 Groundwater Monitoring Bore P7 Results January – December 2023

Location	Site Bore P7												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	10:35	10:52	10:31	16:40	11:39	11:25	10:38	11:34	10:44	10:00	10:48	10:30	
Standing Water Level (m)	5.03	5.21	5.44	5.40	5.61	5.87	6.09	6.40	6.46	6.45	6.45	5.98	
Standpipe Height (m)	0.05	0.03	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Relative Water Level (m)	4.98	5.18	5.39	5.35	5.55	5.82	6.04	6.35	6.41	6.40	6.40	5.93	
Water Level AHD (m)	889.42	889.22	889.01	889.05	888.85	888.58	888.36	888.05	887.99	888.00	888.00	888.47	883.28 [#]
Temperature (°C)	17.1	20.0	15.3	16.6	13.6	13.0	12.4	14.0	14.6	12.7	17.1	17.6	
pH (pH units)	6.64	7.09	7.15	6.85	7.00	6.86	6.67	6.49	6.62	6.26	6.18	6.70	6.3 to 8.0*
Conductivity (µS/cm)	1290	560	1110	42	35.8	76	149	115	190	102	118	1320	852
Bicarbonate Alkalinity (mg/L)	--	16	--	--	6	--	--	30	--	--	27	--	
Total Alkalinity (mg/L)	--	16	--	--	6	--	--	30	--	--	27	--	
Sulphate (mg/L)	--	<1	--	--	<1	--	--	<1	--	--	10	--	
Chloride (mg/L)	--	4	--	--	2	--	--	7	--	--	8	--	
Calcium (mg/L)	--	2	--	--	2	--	--	3	--	--	3	--	
Magnesium (mg/L)	--	1	--	--	<1	--	--	2	--	--	2	--	
Sodium (mg/L)	--	2	--	--	1	--	--	4	--	--	5	--	
Potassium (mg/L)	--	2	--	--	3	--	--	11	--	--	11	--	
Iron (dissolved, mg/L)	--	1.64	--	--	0.46	--	--	2.6	--	--	0.68	--	

Shaded Cells – Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level

-- Indicates no analysis for compound required.

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

Table 15 Groundwater Monitoring Bore A (EP DDH7/GW) Results January – December 2023

Location	Off-Site Bore A (EP DDH7/GW)												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month					8/05/23			8/08/23			8/11/23		
Date Sampled					15:22			12:25			13:40		
Time Sampled					66.91			67.45			67.80		
Standing Water Level (m)					0.75			0.75			0.75		
Standpipe Height (m)					66.16			66.70			67.05		
Relative Water Level (m)					957.64			957.10			956.75		954.40#
Water level AHD (m)					11.7			16			18.8		
Temperature (°C)					6.7			6.35			6.6		6.5 to 8.0
pH					173			214			227		326
Conductivity (µS/cm)					11.7			11.7			109		
TDS (mg/L)					74			82			72		
Bicarbonate Alkalinity (mg/L)					74			82			72		
Total Alkalinity (mg/L CaCO ₃)					13			10			10		
Sulphate (mg/L)	Sampling not required	Access not permitted	Sampling not required	Sampling not required	7	Sampling not required	Sampling not required	8	Sampling not required	Sampling not required	7	Sampling not required	
Chloride (mg/L)					16			18			18		
Calcium (mg/L)					6			7			7		
Magnesium (mg/L)					5			7			8		
Sodium (mg/L)					11			14			13		
Potassium (mg/L)					<0.001			<0.001			<0.001		
Arsenic (dissolved, mg/L)					<0.0001			<0.0001			<0.0001		
Cadmium (dissolved, mg/L)					<0.001			<0.001			<0.001		
Chromium (dissolved, mg/L)					0.002			<0.001			<0.001		
Copper (dissolved, mg/L)					<0.001			<0.001			<0.001		
Lead (dissolved, mg/L)					0.001			<0.001			<0.001		
Nickel (dissolved, mg/L)					0.058			0.032			0.045		
Zinc (dissolved, mg/L)					<0.05			<0.05			<0.05		
Iron (dissolved, mg/L)													

Shaded Cells – Indicates results 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 16 Groundwater Monitoring Bore C (EP PDH1/GW) Results January – December 2023

Location	Off-Site Bore C (EP PDH1/GW)												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month													
Date Sampled					8/05/23						15/11/23		
Time Sampled					13:56						9:45		
Standing Water Level (m)					72.23						72.47		
Standpipe Height (m)					0.74						0.74		
Relative Water Level (m)					71.49						71.73		
Water level AHD (m)					896.01						895.77		889.25#
Temperature (°C)					15						23.8		
pH					6.53						6.17		6.9 to 8.0
Conductivity (µS/cm)					99						183		490
TDS (mg/L)					58						65		
Bicarbonate Alkalinity (mg/L)					43						49		
Total Alkalinity (mg/L CaCO ₃)					43						49		
Sulphate (mg/L)	Sampling not required	Access not permitted	Sampling not required	Sampling not required	12	Sampling not required	Sampling not required	Bore could not be located on overgrown track	Sampling not required	Sampling not required	11	Sampling not required	
Chloride (mg/L)					14						11		
Calcium (mg/L)					10						12		
Magnesium (mg/L)					4						4		
Sodium (mg/L)					10						8		
Potassium (mg/L)					6						6		
Arsenic (dissolved, mg/L)					<0.001						<0.001		
Cadmium (dissolved, mg/L)					0.0001						<0.0001		
Chromium (dissolved, mg/L)					<0.001						<0.001		
Copper (dissolved, mg/L)					0.001						0.001		
Lead (dissolved, mg/L)					<0.001						<0.001		
Nickel (dissolved, mg/L)					0.002						0.002		
Zinc (dissolved, mg/L)					0.047						0.043		
Iron (dissolved, mg/L)					<0.05						<0.05		

Shaded Cells – 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.

--- Indicates no sampling required

Table 17 Groundwater Monitoring Bore D (EP DDH4/GW) Results January – December 2023

Location	Off-Site Bore D (EP DDH4/GW)												Trigger Level		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Sampling Month														15/11/23	
Date Sampled														10:15	
Time Sampled														34.33	
Standing Water Level (m)														0.71	
Standpipe Height (m)														33.62	
Relative Water Level (m)														944.88	940.61#
Water level AHD (m)														21.5	
Temperature (°C)														6.71	6.8 to 8.0
pH														253	608
Conductivity (µS/cm)														168	
TDS (mg/L)														113	
Bicarbonate Alkalinity (mg/L)														113	
Total Alkalinity (mg/L CaCO ₃)														14	
Sulphate (mg/L)	Sampling not required	Access not permitted	Sampling not required	Sampling not required	Bore could not be located on overgrown track	Sampling not required	Sampling not required	Bore could not be located on overgrown track	Sampling not required	Sampling not required	Sampling not required	Sampling not required	Sampling not required	11	
Chloride (mg/L)														5	
Calcium (mg/L)														1	
Magnesium (mg/L)														48	
Sodium (mg/L)														7	
Potassium (mg/L)														<0.001	
Arsenic (dissolved, mg/L)														<0.0001	
Cadmium (dissolved, mg/L)														<0.001	
Chromium (dissolved, mg/L)														<0.001	
Copper (dissolved, mg/L)														<0.001	
Lead (dissolved, mg/L)														<0.001	
Nickel (dissolved, mg/L)														<0.001	
Zinc (dissolved, mg/L)														0.034	
Iron (dissolved, mg/L)														<0.05	

Shaded Cells – Indicates results 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.

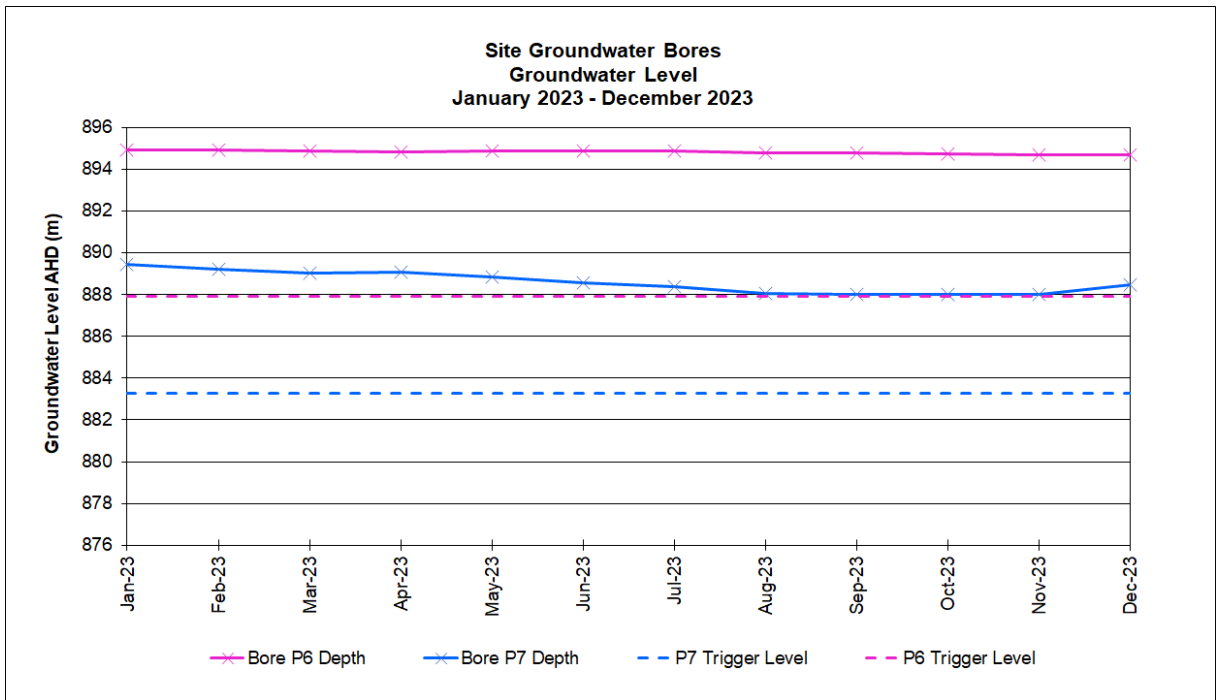


Figure 4 Onsite Groundwater Standing Water Level 2023

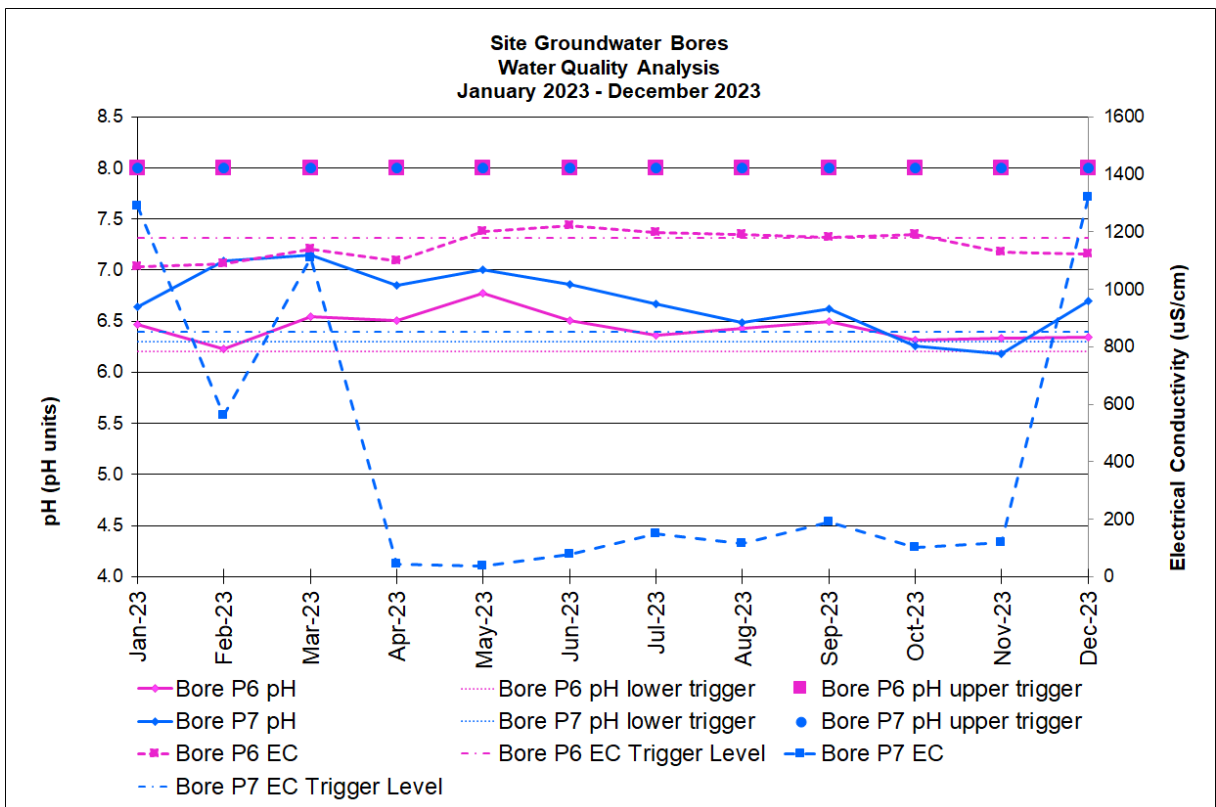


Figure 5 Onsite Groundwater pH and Electrical Conductivity 2023

3.3 REVIEW & INTERPRETATION OF GROUND WATER MONITORING

3.3.1 SITE GROUNDWATER BORES

The standing water level at P6 was generally consistent while there was a slight decrease in water level in P7 over the majority the monitoring period and a slight increase in the later part of the monitoring period. All water levels were above the relevant trigger levels at the monitoring locations in 2023 (refer **Figure 4**).

pH values within the on-site bores (refer **Figure 5**) slightly fluctuated during the monitoring period in which P6 had an amplitude of 0.54pH units whereas P7 had an amplitude of 0.97pH units. The pH values were generally within the site-specific pH trigger levels with the exception of two (2) instances at P7 (October and November), noting that reported concentrations are rounded to one decimal place when comparing to the site-specific trigger levels, which were more acidic than the approved trigger range.

The electrical conductivity in P6 showed a slight increasing trend whereas there was a significant fluctuation at P7 throughout the reporting period (refer **Figure 5**). The electrical conductivity at bore P7 dropped significantly to 42 μ S/cm in April and then generally stabilised until November before increasing significantly to 1,320 μ S/cm in December. It is noted that the January 2024 results indicate reversion to low electrical conductivity at P7 (133 μ S/cm). The water from both bores is considered to be 'fresh' based on the electrical conductivity. The electrical conductivity was higher than the P6 approved trigger level on five (5) occasions: May, June, July, August and October whereas that in P7 was above the approved trigger level in January, March and December.

For the purpose of completeness, RCA notes the following with regards to the revised trigger levels (**Table 12**):

- The pH at Bore P6 is within the trigger level range for all twelve (12) monitoring events.
- The pH trigger levels for Bore P7 remains unchanged, thus the pH remained outside the pH trigger level range for three (3) of the twelve (12) monitoring events.

Concentrations of analytes in P6 and P7 recorded in the reporting period were compared to historical data:

- Turbidity and total suspended solids at P6 throughout the reporting period were within the historical ranges.
- Oil and Grease was not detected in P6 in any of the monitoring events in 2023 consistent with the majority of the historical range.
- Alkalinity at P6 was higher than the historical range in all months except August; all alkalinity at P7 was within the historical range.
- Sulphate and chloride at P6 and P7 were within the relevant historical ranges.
- Calcium, magnesium, sodium and potassium were within the relevant historical ranges at both P6 and P7, noting that the concentrations previously decreased by an order of magnitude in P7 in 2022.
- Cobalt, manganese, nickel and zinc concentrations were within the relevant historical ranges at P6.
- Iron concentrations are within the relevant historical ranges.

A Piper Plot is presented in **Figure 6** below to demonstrate the change in water chemistry between the monitoring period and the historical data.

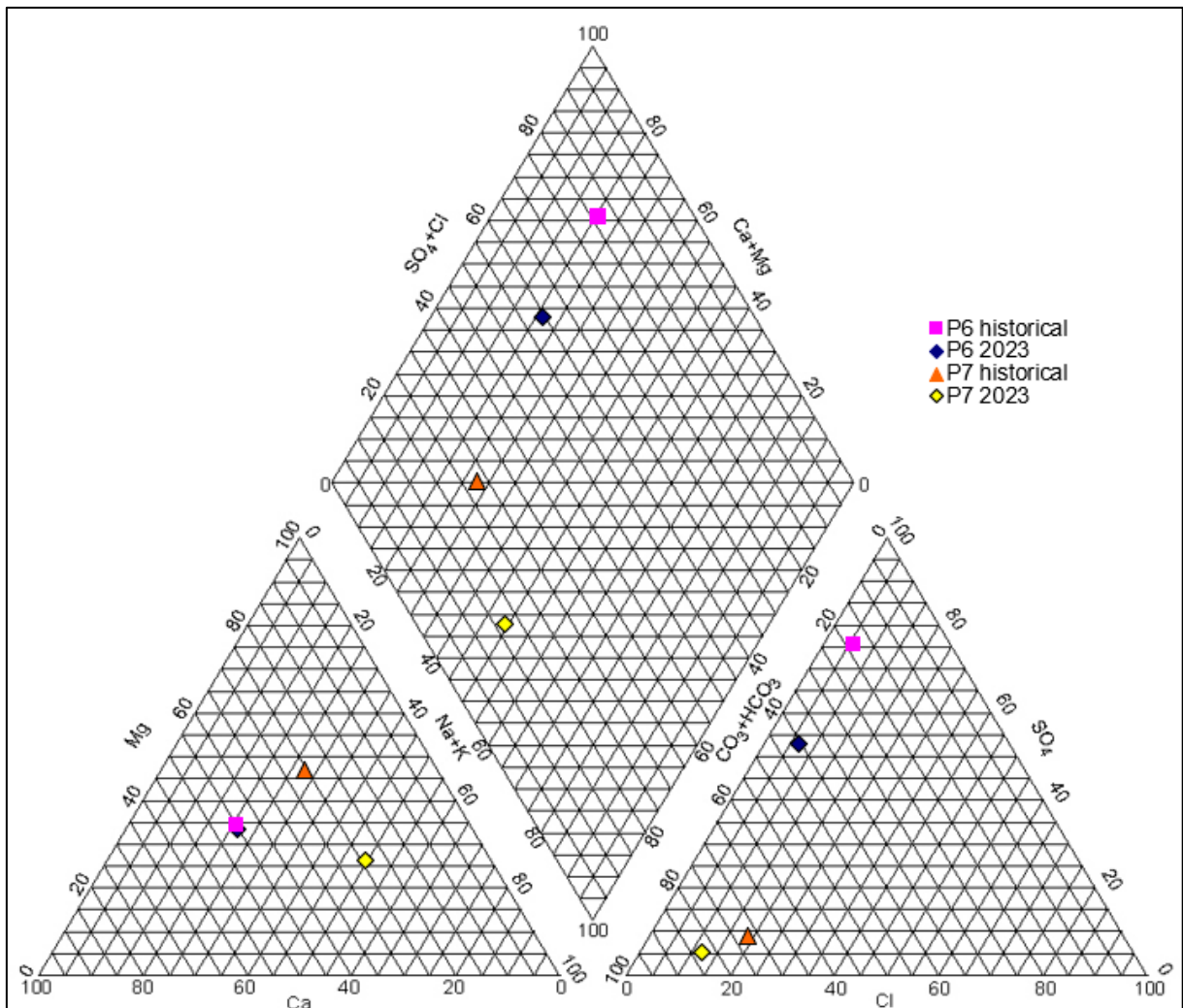


Figure 6 Piper Plot comparing results of 2023 monitoring to historical data

Based on the above **Figure 6** alterations were observed in the chemistry of P6 and P7 in comparison to historical data. The magnitude of these changes varies depending on the specific cation/anion involved. It is noted that, due to the absence of any excavation, injection of water or extraction of water at PDM, that the change in groundwater level and chemistry is not considered likely to be as a result of activities at PDM.

3.3.2 OFF-SITE GROUNDWATER BORES

The water level within Bore A, Bore C and Bore D are generally shown (refer **Figure 7**) to be above their respective water level and there is an increasing trend for all the bores in the last five (5) years based on the available data.

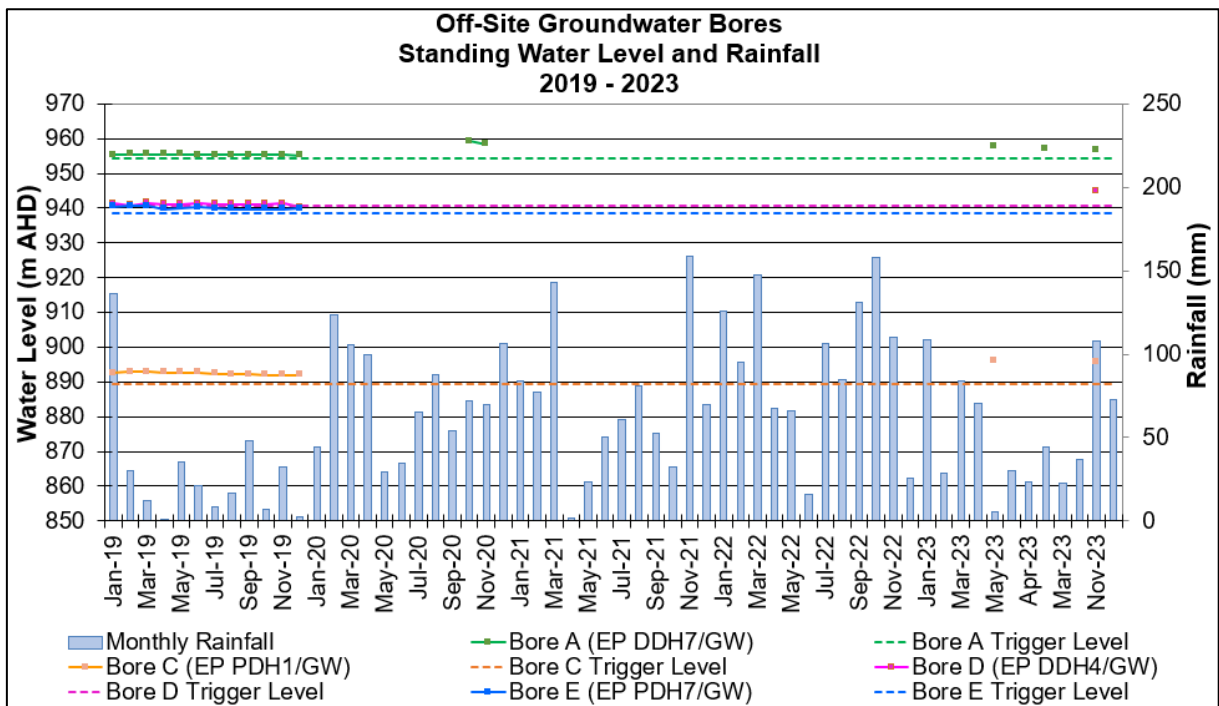


Figure 7 Standing water level and rainfall 2019 – 2023

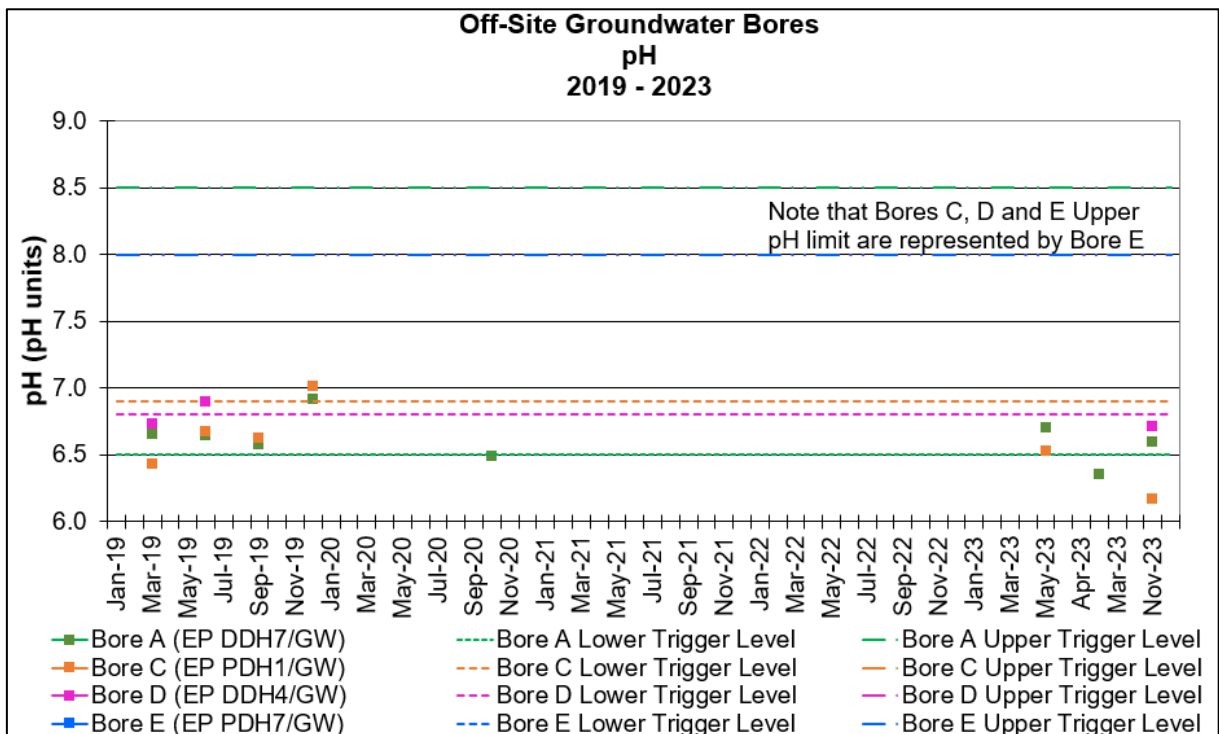


Figure 8 pH in off-site groundwater bores 2019 – 2023

The groundwater samples collected from off-site bores during the reporting period are generally outside the respective pH trigger level ranges (Figure 8), as below:

- Bore A was below the lower pH trigger level during one (1) of the three (3) water quality monitoring events.

- Bore C was below the lower pH trigger level in both water quality monitoring events (May and November).
- Bore D was below the lower pH trigger level during the only one (1) monitoring event (November).

Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2023 monitoring period (**Figure 10**).

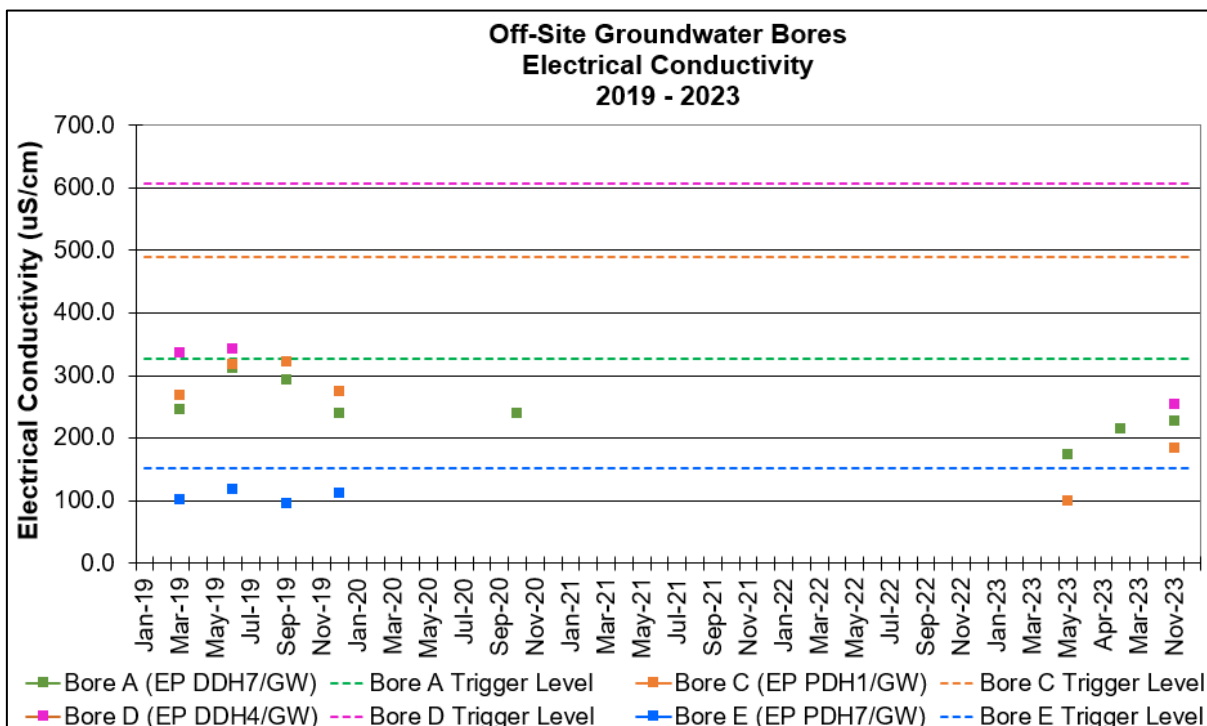


Figure 9 Electrical conductivity in off-site groundwater bores 2019 – 2023

4 SURFACE WATER QUALITY MONITORING

The purpose of surface water monitoring is to ensure that any impact of the mining operations on surface water bodies and streams can be identified, and to demonstrate compliance with relevant legislative requirements.

Surface water monitoring for the Pine Dale Mine is undertaken in accordance with the EPL 4911 (Ref [1]) and the Water Management Plan (Ref [3]) at twelve (12) monitoring locations within and surrounding the mine site (refer **Drawing 1, Attachment 1**). Frequency is on a quarterly and monthly basis for routine samples depending on location and in accordance with the EPL 4911 (Ref [1]) and Water Management Plan (Ref [3]).

EPL 4911 (Ref [1]) specifies sampling to be undertaken daily or weekly from EPL Point 13 during discharge with daily samples analysed for pH, electrical conductivity and turbidity, and weekly samples analysed for filterable (dissolved) iron, oil and grease, sulphate and total suspended solids.

EPL 4911 (Ref [1]) specifies quarterly surface water monitoring is to be undertaken at four (4) surface water monitoring locations:

- EPL Point 2: ambient water monitoring point.

- EPL Point 3: ambient water monitoring point.
- EPL Point 14: ambient water monitoring point.
- EPL Point 16: ambient water monitoring point.

The PDM Water Management Plan (Ref [3]) stipulates quarterly monitoring of EPL Point 2, 3, 14 is to include analysis for pH, electrical conductivity, turbidity, total suspended solids, sulphate and filterable (dissolved) iron.

The PDM Water Management Plan (Ref [3]) also stipulates the water level of Wangcol Creek (referred to as Neubecks Creek in the Plan) is measured (at S2) on a monthly frequency, and monthly monitoring of a further six (6) monitoring locations:

- S1 is located within Wangcol Creek upstream of PDM operations (slightly downstream of EPL Point 2).
- S3 which is the same location as EPL Point 3.
- S4 is located on Coxs River, upstream of the confluence of Wangcol Creek and does not receive water from PDM operations.
- S5 is located within Blue Lake which receives flow from Wangcol Creek and Coxs River.
- S6 is located within Wangcol Creek; downstream of S1 and PDM operations.
- S7 located within Coxs River, downstream of Wangcol Creek.

A further point, Wallerawang Downstream, has been included in the monitoring since the commencement of monitoring at EPL Point 16.

Analysis at locations S1, and locations S3-S7 is stipulated in the PDM Water Quality Management Plan (Ref [3]) to include pH electrical conductivity, turbidity, dissolved oxygen, total suspended solids, oil & grease, bicarbonate and total alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium and filterable (dissolved) metals (cobalt, manganese, nickel, zinc, iron). Sampling at Wallerawang Downstream post-dates the WMP such that there are no stipulations with regards to analysis; analysis is undertaken consistent with the other locations.

4.1 SURFACE WATER ASSESSMENT CRITERIA

EPL 4911 stipulates maximum concentrations limits applicable to EPL Point 13 discharge events for pH, oil and grease, and total suspended solids. No concentration limits are detailed in EPL 4911 for any other analytes at EPL Point 13, or any analytes at the other locations (EPL Points 2, 3, 14 and 16).

Site specific trigger levels for pH and electrical conductivity are stipulated in the PDM Water Management Plan (Ref [3]) in accordance with Schedule 3, Condition 27(c) of the Project Approval (Pa 10_0041) except for EPL Point 16 and Wallerawang Downstream for which monitoring postdates the Plan and have not yet had site specific triggers derived. Trigger levels for oil and grease and total suspended solids are not site specific and are uniform across all surface water sites except for Water Cart Dam (refer **Section 3**). Compliance with these trigger levels, refer **Table 18**, is not an EPL requirement.

It is noted that an investigation (Ref [9]) derived revised site-specific pH trigger levels as per **Table 19**. The investigation indicated that surface water sites EPL Point 2, S1 and S4 are considered appropriate background sites for the purpose of assessing influences of PDM on water quality.

Table 18 *Surface Water Trigger Levels*

Surface Water Site	pH (range)	Electrical Conductivity (mS/cm)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
EPL Point 2	7.1 – 8.0	2055	30	NA
EPL Point 3	6.4 – 8.0	2223	30	NA
EPL Point 13	6.5 – 8.0 ^a	NA	30 ^a	10
EPL Point 14	7.5 – 8.0	1166	30	NA
EPL Point 16	NA	NA	30	NA
S1	6.2 – 8.0	2325	30	10
S2	NA	NA	NA	NA
S3	6.4 – 8.0	2223	30	10
S4	7.3 – 8.0	957	30	10
S5	7.0 – 8.0	1013	30	10
S6	6.7 – 8.0	1941	30	10
S7	6.8 – 8.0	1007	30	10
The Bong (at SW location)	5.8 - 8.0	1,157	NA	NA

NA – no trigger level required for these locations.

^arefers to maximum concentration limits applicable during discharge events as detailed in EPL 4911 section L2.

Table 19 *Revised Surface Water Trigger Levels (Ref [9])*

pH trigger level ^a	6.5 – 8.0
Electrical conductivity (µS/cm)	5592
TSS (mg/L)	25

^a pH trigger level is exceeded if the pH is outside the nominated range.

These values were submitted to the Department of Planning and Industry and a response was received in June 2020 that further work was required for the revised trigger levels to be accepted for use. At the time of writing this report, the revised trigger levels detailed in **Table 19** have been utilised alongside the approved trigger levels in **Table 18**.

4.2 SURFACE WATER MONITORING DATA SUMMARY

Four (4) quarterly surface water monitoring events were conducted at EPL Point 2, 3, 14 and 16: February, May, August and November 2023. It is noted that two (2) sampling events were conducted in November as there were some delays during the first day of fieldwork such that all EPL quarterly samples were not collected. All EPL samples were collected on the second fieldwork day to ensure consistency.

No monitoring was undertaken at EPL Point 13 during the reporting period in the absence of discharge during the 2023 monitoring period.

Twelve (12) monthly surface water monitoring events were conducted at S1 – S7, Wallerawang Downstream and Water Cart Dam during the January to December 2023 monitoring period. There was no Water Cart Dam sample in August 2023 as the Dam was dry.

Surface water summary results for the period January – December 2023 are shown in **Table 20** to **Table 32**. Graphical presentations are shown in **Figure 10** to **Figure 16**.

Table 20 Surface Water Monitoring Location EPL Point 2 Results 2023

Location	EPL Point 2				Trigger Level
	Feb	May	Aug	Nov	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	7/02/2023	8/05/2023	8/08/2023	15/11/2023	
Time Sampled	09:20	12:17	10:03	11:45	
pH (pH units)	7.15	7.71	7.62	7.34	7.1 – 8.0
Conductivity ($\mu\text{S}/\text{cm}$)	2370	810	2320	1900	2055
Sulphate (mg/L)	264	258	866	706	
Iron filterable (mg/L)	0.06	0.07	0.15	0.2	
TSS (mg/L)	<5	5	<5	23	30
Turbidity (NTU)	3.5	1.9	4.4	1.5	

Shaded Cells – Indicates results are outside of the nominated Trigger Level

Table 21 Surface Water Monitoring Location EPL Point 3 Results 2023

Location	EPL Point 3				Trigger Level
	Feb	May	Aug	Nov	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	7/02/2023	8/05/2023	8/08/2023	15/11/2023	
Time Sampled	08:33	10:09	08:40	10:55	
pH (pH units)	6.19	6.78	7.67	7.49	6.4 – 8.0
Conductivity ($\mu\text{S}/\text{cm}$)	885	2680	3310	2680	2223
Sulphate (mg/L)	913	935	1550	1180	
Iron filterable (mg/L)	0.11	0.35	0.17	0.07	
TSS (mg/L)	5	7	<5	16	30
Turbidity (NTU)	4.7	6.5	5.8	<1	

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

Table 22 Surface Water Monitoring Location EPL Point 14 Results 2023

Location	EPL Point 14				Trigger Level
	Feb	May	Aug	Nov	
Sampling Month					
Date Sampled	7/02/2023	8/05/2023	8/08/2023	15/11/2023	
Time Sampled	11:22	16:02	08:20	11:58	
pH (pH units)	7.11	6.82	7.32	--	7.45 – 8.0
Conductivity (µS/cm)	1740	849	1280	--	1166
Sulphate (mg/L)	293	339	527	--	
Iron filterable (mg/L)	<0.05	<0.05	0.06	--	
TSS (mg/L)	44	6	<5	--	30
Turbidity (NTU)	6.7	9.6	4.7	--	

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

-- Indicates no sample was collected: location was dry.

Table 23 Surface Water Monitoring Location EPL Point 16 Results 2023

Location	EPL Point 14				Trigger Level
	Feb	May	Aug	Nov	
Sampling Month					
Date Sampled	7/02/2023	8/05/2023	8/08/2023	15/11/2023	
Time Sampled	09:40	10:22	10:18	11:05	
pH (pH units)	5.74	6.55	6.11	6.08	NA
Conductivity (µS/cm)	1190	1290	1280	1310	NA
Sulphate (mg/L)	533	531	565	538	
Iron filterable (mg/L)	24	7.73	2.82	23.7	
TSS (mg/L)	10	14	24	54	NA
Turbidity (NTU)	2.8	2.8	13.9	29.1	

NA: Trigger levels are not applicable in this monitoring location.

Table 24 Surface Water Monitoring Location S1 Results 2023

Location	Surface Water S1												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	9:28	9:18	9:21	15:10	12:11	9:41	9:31	10:08	9:39	9:07	8:38	9:20	
Temperature (°C)	18.9	20.0	16.2	19	10	11	8	10	8	11	15	21	
pH	7.45	7.38	7.42	7.40	7.56	7.25	6.97	7.73	7.42	7.21	7.61	7.52	6.2 – 8.0*
Conductivity (µS/cm)	2090	2200	2810	2360	2870	2695	3220	3560	2310	1860	2300	1860	2325
Turbidity (NTU)	4.1	4.2	6.0	1.7	4.6	1.7	6.6	6.5	1.4	96.7	<1	13.9	
Dissolved Oxygen (mg/L)	--	5.80	--	--	9.57	--	--	8.00	--	--	7.80	--	
TSS (mg/L)	--	<5	--	--	10.00	--	--	<5	--	--	54.00	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	108	--	--	112	--	--	127	--	--	90	--	
Total Alkalinity (mg/L)	--	108	--	--	112	--	--	127	--	--	90	--	
Sulphate (mg/L)	--	896	--	--	1150	--	--	1590	--	--	956	--	
Chloride (mg/L)	--	138	--	--	175	--	--	234	--	--	198	--	
Calcium (mg/L)	--	85	--	--	132	--	--	153	--	--	97	--	
Magnesium (mg/L)	--	73	--	--	82	--	--	121	--	--	88	--	
Sodium (mg/L)	--	287	--	--	324	--	--	493	--	--	303	--	
Potassium (mg/L)	--	25	--	--	29	--	--	42	--	--	20	--	
Cobalt (dissolved, mg/L)	--	0.002	--	--	0.008	--	--	0.017	--	--	0.001	--	
Manganese (dissolved, mg/L)	--	0.359	--	--	0.651	--	--	0.986	--	--	0.461	--	
Nickel (dissolved, mg/L)	--	0.113	--	--	0.17	--	--	0.246	--	--	0.144	--	
Zinc (dissolved, mg/L)	--	0.027	--	--	0.07	--	--	0.064	--	--	0.018	--	
Iron (dissolved, mg/L)	--	<0.05	--	--	<0.05	--	--	<0.05	--	--	<0.05	--	

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 25 Surface Water Monitoring Location S2 Results 2023

Location	Surface Water Site S2											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Date Sampled	10/01/2023	7/02/2023	9/03/2023	5/04/2023	8/05/2023	9/06/2023	7/07/2023	8/08/2023	7/09/2023	5/10/2023	8/11/2023	7/12/2023
Time Sampled	8:45	8:40	8:40	14:45	10:18	9:50	8:50	8:41	8:57	8:29	8:17	8:43
Depth to Surface from Top of Rail Bridge (m)	3.74	3.75	3.76	3.71	3.75	3.76	3.74	3.73	3.8	3.64	3.76	3.73

Table 26 Surface Water Monitoring Location S3 Results 2023

Location	Surface Water S3												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	15/11/23	7/12/23	
Time Sampled	8:41	8:33	8:40	14:40	10:09	9:47	8:42	8:40	8:54	8:25	10:55	8:41	
Temperature (°C)	18.3	20.4	15.0	20.1	9.6	11.0	8.5	10.4	8.4	10.5	19.7	19.8	
pH	7.45	7.15	6.82	7.08	7.56	7.36	6.58	7.67	6.99	6.87	7.49	6.99	6.4 – 8.0*
Conductivity (µS/cm)	2030	2370	2700	2180	2870	2670	2870	3310	1800	1910	2680	1860	2223
Turbidity (NTU)	4.9	4.7	2.7	1.8	6.5	3.0	6.4	5.8	3.6	82.4	<1	13.7	
Dissolved Oxygen (mg/L)	--	7.8	--	--	11.0	--	--	8.20	--	--	8.40	--	
TSS (mg/L)	--	5	--	--	7	--	--	<5	--	--	16	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	121	--	--	<1	--	--	120	--	--	66	--	
Total Alkalinity (mg/L)	--	121	--	--	<1	--	--	120	--	--	66	--	
Sulphate (mg/L)	--	913	--	--	935	--	--	1550	--	--	724	--	
Chloride (mg/L)	--	135	--	--	159	--	--	209	--	--	160	--	
Calcium (mg/L)	--	85	--	--	130	--	--	150	--	--	79	--	
Magnesium (mg/L)	--	72	--	--	80	--	--	119	--	--	68	--	
Sodium (mg/L)	--	283	--	--	317	--	--	480	--	--	231	--	
Potassium (mg/L)	--	25	--	--	29	--	--	40	--	--	16	--	
Cobalt (dissolved, mg/L)	--	0.004	--	--	0.010	--	--	0.018	--	--	0.007	--	
Manganese (dissolved, mg/L)	--	0.523	--	--	0.910	--	--	1.1	--	--	1.14	--	
Nickel (dissolved, mg/L)	--	0.112	--	--	0.167	--	--	0.244	--	--	0.117	--	
Zinc (dissolved, mg/L)	--	0.033	--	--	0.047	--	--	0.074	--	--	0.056	--	
Iron (dissolved, mg/L)	--	0.110	--	--	0.350	--	--	0.17	--	--	<0.05	--	

Shaded Cells – Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 27 Surface Water Monitoring Location S4 Results 2023

Location	Surface Water S4												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	10:21	10:32	10:20	16:05	11:15	11:04	10:25	11:15	10:23	9:51	10:15	10:11	
Temperature (°C)	18.7	19.5	17	17.5	6.53	7.9	6.64	11.14	10.24	10.6	19	23.5	
pH	7.43	7.38	7.38	7.34	7.59	7.68	7.65	7.32	7.7	7.07	7.62	7.5	7.3 – 8.0*
Conductivity (µS/cm)	1010	139	186	135	103	175	220	164	141	1670	1850	191	957
Turbidity (NTU)	25.5	20.4	55.2	26.6	8.1	9.6	8.3	5.9	4.4	31.0	17.7	33.9	
Dissolved Oxygen (mg/L)	--	4.6	--	--	8.1	--	--	7.6	--	--	6.9	--	
TSS (mg/L)	--	<5	--	--	9	--	--	10	--	--	18	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	57	--	--	27	--	--	32	--	--	80	--	
Total Alkalinity (mg/L)	--	57	--	--	27	--	--	32	--	--	80	--	
Sulphate (mg/L)	--	2	--	--	14	--	--	11	--	--	13	--	
Chloride (mg/L)	--	6	--	--	11	--	--	10	--	--	13	--	
Calcium (mg/L)	--	6	--	--	6	--	--	5	--	--	12	--	
Magnesium (mg/L)	--	4	--	--	4	--	--	4	--	--	8	--	
Sodium (mg/L)	--	9	--	--	9	--	--	11	--	--	19	--	
Potassium (mg/L)	--	3	--	--	6	--	--	6	--	--	10	--	
Cobalt (dissolved, mg/L)	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	
Manganese (dissolved, mg/L)	--	0.115	--	--	0.02	--	--	0.021	--	--	0.359	--	
Nickel (dissolved, mg/L)	--	0.001	--	--	<0.001	--	--	<0.001	--	--	0.002	--	
Zinc (dissolved, mg/L)	--	0.027	--	--	0.014	--	--	0.008	--	--	0.025	--	
Iron (dissolved, mg/L)	--	0.25	--	--	0.1	--	--	0.15	--	--	0.69	--	

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 28 Surface Water Monitoring Location S5 Results 2023

Location	Surface Water S5												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	10:15	10:27	10:14	16:10	11:23	11:08	10:20	11:05	10:20	9:46	10:22	10:05	
Temperature (°C)	22.3	20.6	18.4	18.7	11.4	9.3	7.9	12.1	14.1	13.4	19.9	22.3	
pH	7.16	7.21	6.96	6.91	7.06	7.01	7.20	7.03	7.37	6.42	6.93	7.42	7.0 – 8.0*
Conductivity (µS/cm)	808	463	1350	835	1190	1205	1435	1213	1270	165	2340	1210	1013
Turbidity (NTU)	23.1	15.5	17.2	11.1	22.9	14.0	15.1	13.3	4.5	33.0	3.7	49.2	
Dissolved Oxygen (mg/L)	--	5.3	--	--	5.6	--	--	8.3	--	--	7.9	--	
TSS (mg/L)	--	<5	--	--	6	--	--	8	--	--	82	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	67	--	--	62	--	--	70	--	--	72	--	
Total Alkalinity (mg/L)	--	67	--	--	62	--	--	70	--	--	72	--	
Sulphate (mg/L)	--	393	--	--	442	--	--	520	--	--	689	--	
Chloride (mg/L)	--	46	--	--	66	--	--	79	--	--	128	--	
Calcium (mg/L)	--	42	--	--	69	--	--	64	--	--	93	--	
Magnesium (mg/L)	--	32	--	--	39	--	--	46	--	--	67	--	
Sodium (mg/L)	--	101	--	--	115	--	--	142	--	--	225	--	
Potassium (mg/L)	--	11	--	--	19	--	--	16	--	--	24	--	
Cobalt (dissolved, mg/L)	--	0.004	--	--	0.014	--	--	0.014	--	--	0.008	--	
Manganese (dissolved, mg/L)	--	0.456	--	--	0.958	--	--	0.948	--	--	0.788	--	
Nickel (dissolved, mg/L)	--	0.047	--	--	0.082	--	--	0.092	--	--	0.126	--	
Zinc (dissolved, mg/L)	--	0.039	--	--	0.059	--	--	0.045	--	--	0.083	--	
Iron (dissolved, mg/L)	--	<0.05	--	--	<0.05	--	--	<0.05	--	--	<0.05	--	

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 29 Surface Water Monitoring Location S6 Results 2023

Location	Surface Water S6												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	10:10	10:23	10:09	15:58	11:06	10:58	10:13	10:56	10:17	9:40	9:59	9:59	
Temperature (°C)	19.5	20.4	15.4	19.1	9.0	9.6	8.1	11.0	12.9	11.5	17.6	21.1	
pH	7.16	6.94	7.19	7.18	8.28	7.38	6.82	7.60	7.55	7.16	7.53	7.55	6.7 – 8.0*
Conductivity (µS/cm)	1770	1940	2380	1550	2470	2294	2710	3170	2130	2000	1940	1890	1941
Turbidity (NTU)	<1	3.1	3.2	2.7		10.5	10.1	5.7	4.1	67.5	2.0	3.7	
Dissolved Oxygen (mg/L)	--	6.2	--	--	8.4	--	--	9.2	--	--	8.8	--	
TSS (mg/L)	--	<5	--	--	21	--	--	<5	--	--	30	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	103	--	--	104	--	--	160	--	--	77	--	
Total Alkalinity (mg/L)	--	103	--	--	104	--	--	160	--	--	77	--	
Sulphate (mg/L)	--	812	--	--	926	--	--	1500	--	--	791	--	
Chloride (mg/L)	--	116	--	--	168	--	--	209	--	--	180	--	
Calcium (mg/L)	--	85	--	--	130	--	--	147	--	--	102	--	
Magnesium (mg/L)	--	66	--	--	77	--	--	115	--	--	80	--	
Sodium (mg/L)	--	239	--	--	276	--	--	460	--	--	257	--	
Potassium (mg/L)	--	22	--	--	26	--	--	39	--	--	20	--	
Cobalt (dissolved, mg/L)	--	0.008	--	--	0.014	--	--	0.014	--	--	0.006	--	
Manganese (dissolved, mg/L)	--	0.634	--	--	0.946	--	--	0.927	--	--	0.596	--	
Nickel (dissolved, mg/L)	--	0.101	--	--	0.155	--	--	0.217	--	--	0.14	--	
Zinc (dissolved, mg/L)	--	0.067	--	--	0.056	--	--	0.05	--	--	0.047	--	
Iron (dissolved, mg/L)	--	<0.05	--	--	0.26	--	--	<0.05	--	--	<0.05	--	

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 30 Surface Water Monitoring Location S7 Results 2023

Location	Surface Water S7												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	10:30	10:45	10:27	16:20	11:33	11:21	10:32	11:20	10:34	9:55	10:42	10:17	
Temperature (°C)	19.3	22	17.4	19.2	9.68	9	7.2	11.01	12.4	12.6	18.1	22.7	
pH	7.27	7.11	7.13	6.89	7.07	7.15	7.06	7.6	7.2	6.65	7.21	7.16	6.8 – 8.0*
Conductivity (µS/cm)	3610	1940	1290	865	1160	1265	1287	1420	1190	1620	2130	1070	1007
Turbidity (NTU)	14.6	833	13.0	6.3	8.9	11.2	11.6	6.9	3.0	15.8	2.2	19.0	
Dissolved Oxygen (mg/L)	--	6.3	--	--	6.6	--	--	9.1	--	--	9.2	--	
TSS (mg/L)	--	<5	--	--	8	--	--	<5	--	--	39	--	30
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5	--	10
Bicarbonate Alkalinity (mg/L)	--	71	--	--	63	--	--	75	--	--	82	--	
Total Alkalinity (mg/L)	--	71	--	--	63	--	--	75	--	--	82	--	
Sulphate (mg/L)	--	352	--	--	432	--	--	586	--	--	779	--	
Chloride (mg/L)	--	45	--	--	64	--	--	86	--	--	127	--	
Calcium (mg/L)	--	39	--	--	67	--	--	72	--	--	92	--	
Magnesium (mg/L)	--	30	--	--	37	--	--	51	--	--	65	--	
Sodium (mg/L)	--	92	--	--	109	--	--	160	--	--	217	--	
Potassium (mg/L)	--	10	--	--	18	--	--	18	--	--	23	--	
Cobalt (dissolved, mg/L)	--	0.002	--	--	0.006	--	--	0.012	--	--	0.011	--	
Manganese (dissolved, mg/L)	--	0.402	--	--	0.636	--	--	1.060	--	--	1.360	--	
Nickel (dissolved, mg/L)	--	0.042	--	--	0.075	--	--	0.103	--	--	0.122	--	
Zinc (dissolved, mg/L)	--	0.025	--	--	0.050	--	--	0.044	--	--	0.038	--	
Iron (dissolved, mg/L)	--	0.05	--	--	0.07	--	--	0.10	--	--	0.05	--	

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required during particular period.

Table 31 Surface Water Monitoring Location Wallerawang Downstream Results 2023

Location	Surface Water Wallerawang Downstream												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	9:40	9:40	9:31	15:25	10:30	10:30	9:43	10:22	9:50	9:16	10:57	9:29	
Temperature (°C)	18.9	19.7	16.0	21.3	10.4	11.1	8.8	12.0	12.6	12.2	16.4	19.5	
pH	7.02	5.84	6.70	6.69	7.51	6.61	6.48	6.99	6.69	6.35	6.23	6.56	NA
Conductivity (µS/cm)	1780	1120	1710	1330	1560	1790	2420	2910	1600	1170	1900	1580	NA
Turbidity (NTU)	27.1	25.0	1.9	12.6	5.6	7.5	11.0	15.0	6.0	43.1	2.8	10.3	
Oil & Grease (mg/L)	--	<5	--	--	<5	--	--	<5	--	--	<5		NA
Bicarbonate Alkalinity (mg/L)	--	70	--	--	48	--	--	138	--	--	72	--	--
Total Alkalinity (mg/L)	--	70	--	--	48	--	--	138	--	--	72	--	--
Sulphate (mg/L)	--	728	--	--	639	--	--	855	--	--	685	--	--
Chloride (mg/L)	--	81	--	--	67	--	--	113	--	--	155	--	--
Calcium (mg/L)	--	90	--	--	133	--	--	129	--	--	94	--	--
Magnesium (mg/L)	--	60	--	--	54	--	--	80	--	--	72	--	--
Sodium (mg/L)	--	173	--	--	102	--	--	220	--	--	224	--	--
Potassium (mg/L)	--	20	--	--	19	--	--	29	--	--	18	--	--
Cobalt (dissolved, mg/L)	--	0.032	--	--	0.060	--	--	0.026	--	--	0.011	--	--
Manganese (dissolved, mg/L)	--	1.200	--	--	1.780	--	--	1.29	--	--	0.939	--	--
Nickel (dissolved, mg/L)	--	0.120	--	--	0.137	--	--	0.206	--	--	0.127	--	--
Zinc (dissolved, mg/L)	--	0.155	--	--	0.227	--	--	0.076	--	--	0.051	--	--
Iron (dissolved, mg/L)	--	3.29	--	--	6.02	--	--	4.09	--	--	<0.05	--	--

NA: Trigger levels are not applicable in this monitoring location.

-- Indicates no analysis for compound required during particular period.

Table 32 Surface Water Monitoring Location 'The Bong' Results January – December 2023

Location	The Bong												Trigger Level
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	10/01/23	7/02/23	9/03/23	5/04/23	8/05/23	9/06/23	7/07/23	8/08/23	7/09/23	5/10/23	8/11/23	7/12/23	
Time Sampled	08:54	08:47	08:49	14:50	12:24	09:56	08:57	08:46	09:06	08:36	08:33	8:54	
Temperature (°C)	17.2	20.1	13.0	20.7	9.5	7.7	6.4	Dry	6.6	9.5	15.0	20.6	
pH	7.01	7.72	7.10	6.93	8.04	7.22	6.97		6.32	6.40	6.05	6.68	5.8 – 8.0*
Conductivity (µS/cm)	256	2030	207	169	72	231	248		340	220	286	1140	1157
Turbidity (NTU)	14.8	17.7	52.8	7.7	8.1	182.0	37.1		4.1	245.0	23.0	36.1	
Bicarbonate Alkalinity (mg/L)	--	24	--	--	12	--	--		--	--	3	--	
Total Alkalinity (mg/L)	--	24	--	--	12	--	--		--	--	3	--	
Sulphate (mg/L)	--	28	--	--	36	--	--		--	--	109	--	
Chloride (mg/L)	--	<1	--	--	2.00	--	--		--	--	2.00	--	
Calcium (mg/L)	--	12	--	--	13	--	--		--	--	26	--	
Magnesium (mg/L)	--	4	--	--	4	--	--		--	--	8	--	
Sodium (mg/L)	--	2	--	--	2	--	--		--	--	5	--	
Potassium (mg/L)	--	3	--	--	3	--	--		--	--	4	--	
Arsenic (dissolved, mg/L)	--	0.001	--	--	<0.001	--	--		--	--	<0.001	--	
Cadmium (dissolved, mg/L)	--	<0.0001	--	--	<0.0001	--	--		--	--	<0.0001	--	
Chromium (dissolved, mg/L)	--	<0.001	--	--	<0.001	--	--		--	--	<0.001	--	
Copper (dissolved, mg/L)	--	<0.001	--	--	<0.001	--	--		--	--	<0.001	--	
Lead (dissolved, mg/L)	--	<0.001	--	--	<0.001	--	--		--	--	<0.001	--	
Nickel (dissolved, mg/L)	--	0.002	--	--	0.001	--	--		--	--	0.024	--	
Zinc (dissolved, mg/L)	--	0.013	--	--	0.021	--	--		--	--	0.061	--	
Iron (dissolved, mg/L)	--	0.34	--	--	<0.05	--	--	--	--	<0.05	--		

Shaded Cells - Indicates results are outside of the nominated trigger level.

* Results are rounded to 1 decimal place when comparing to trigger level.

-- Indicates no analysis for compound required

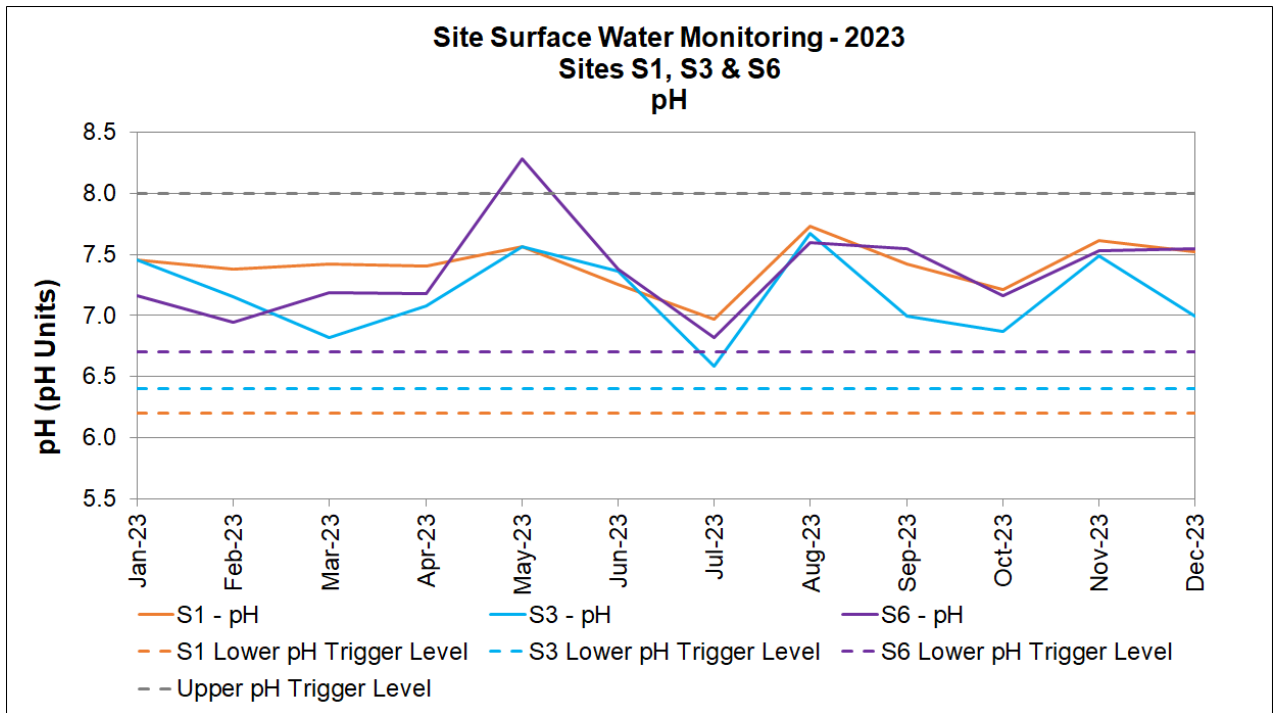


Figure 10 Site Surface Water S1, S3 & S6 pH Results 2023

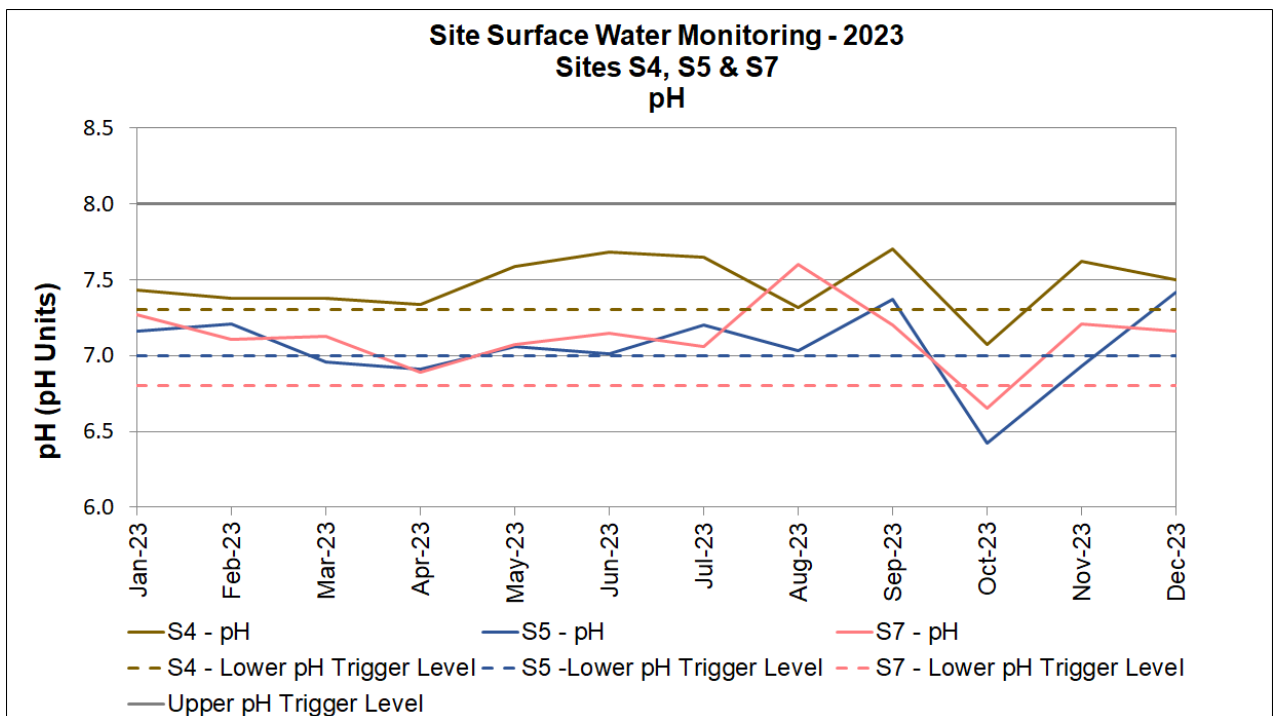


Figure 11 Site Surface Water S4, S5 & S7 pH Results 2023

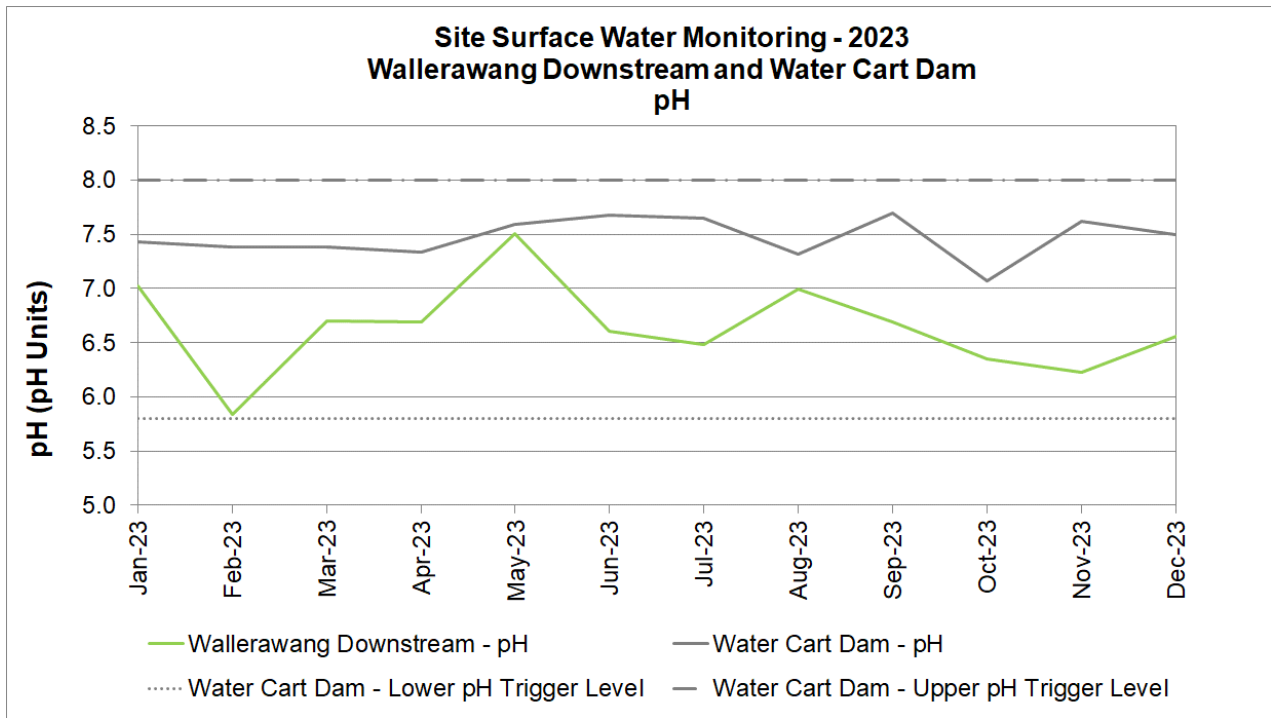


Figure 12 Wallerawang Downstream and Water Cart Dam pH Results 2023

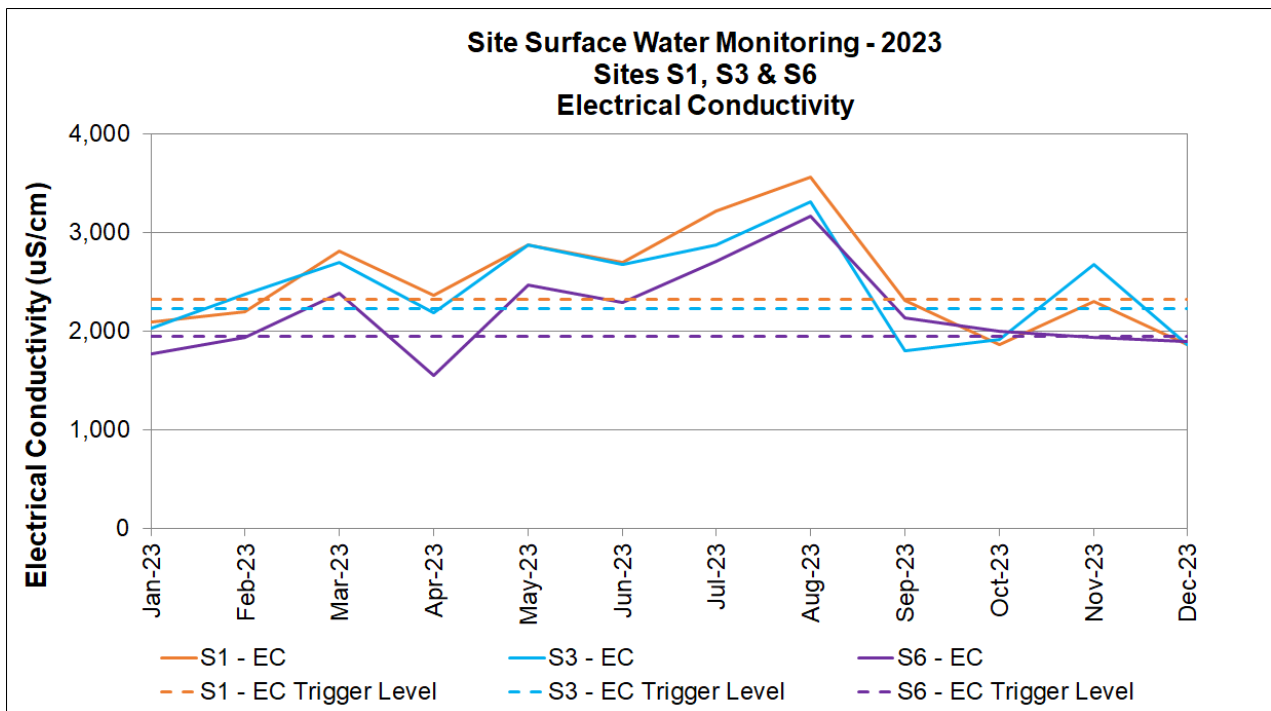


Figure 13 Site Surface Water S1, S3 & S6 Electrical Conductivity Results 2023

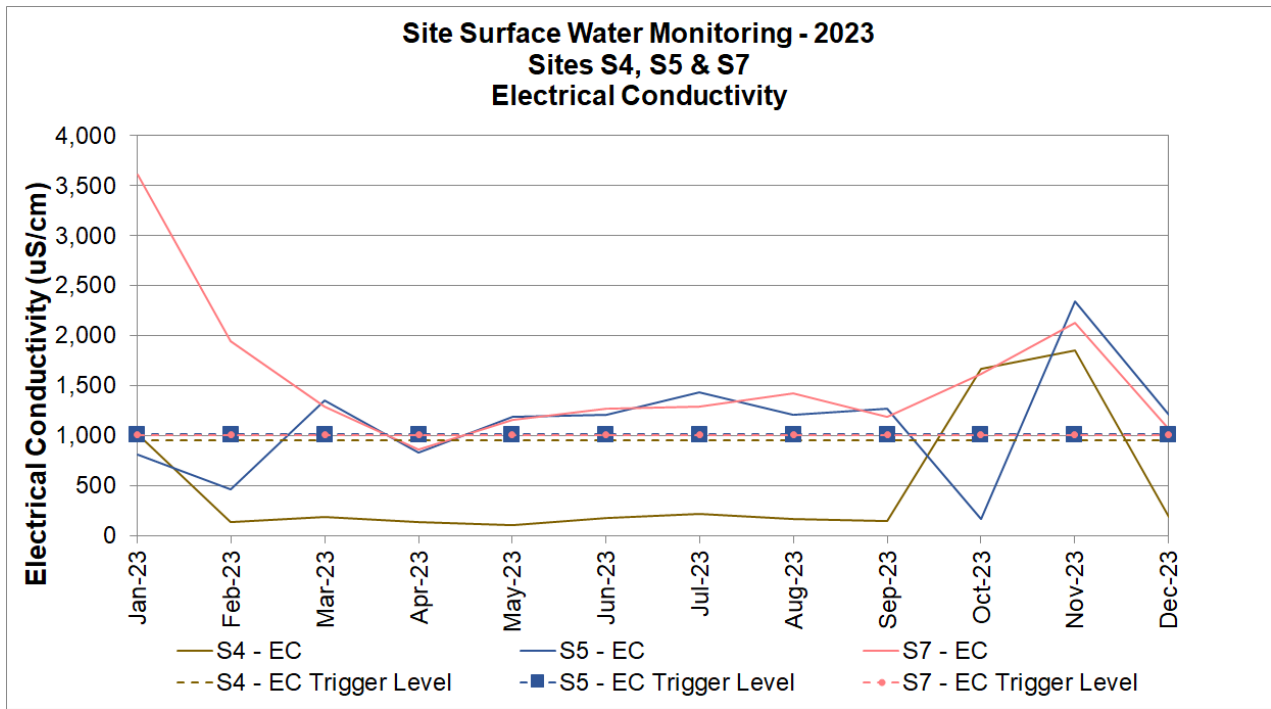


Figure 14 Site Surface Water S4, S5 & S7 Electrical Conductivity Results 2023

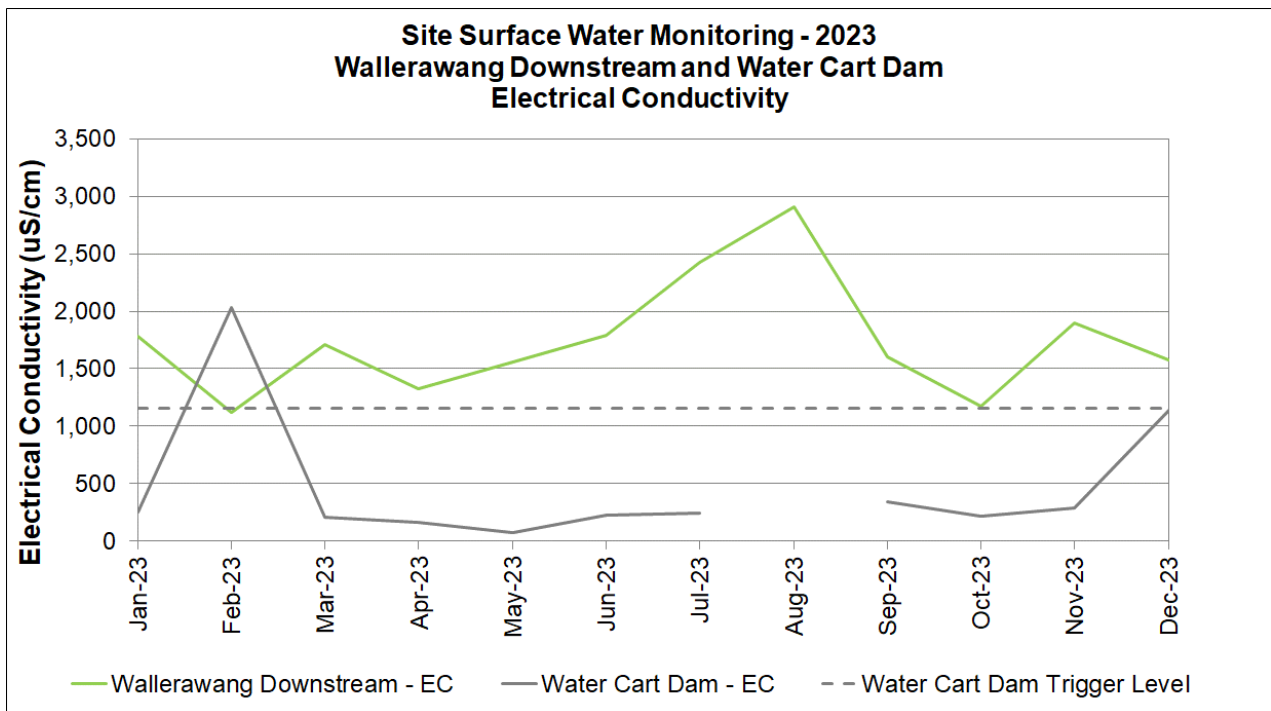


Figure 15 The Bong and Wallerawang Downstream Electrical Conductivity Results 2023 (a gap in August 2023 due to dry conditions at The Bong)

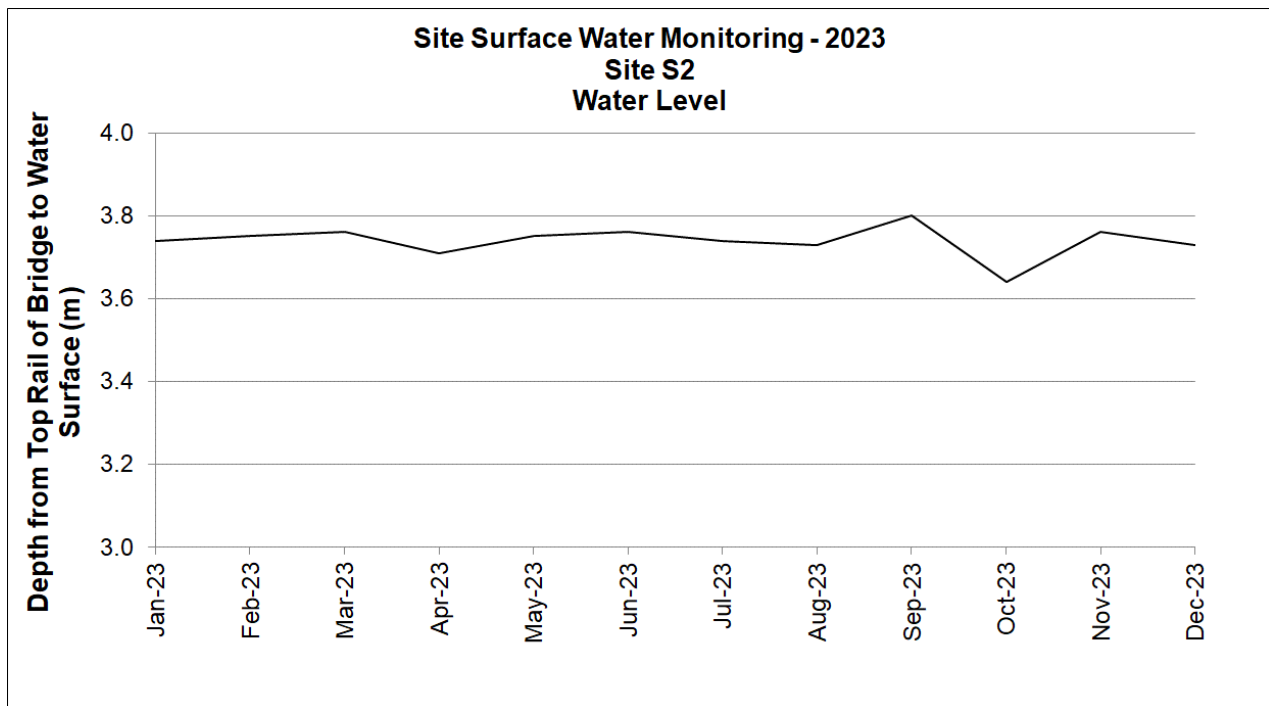


Figure 16 Site Surface Water S2 – 2023 Water Level

4.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS

4.3.1 EPL SURFACE WATER

The results of the water quality monitoring were generally within the respective water quality trigger level range with the exception of the following:

- pH
 - The EPL Point 3 February 2023 result was below the approved lower trigger level.
 - The EPL Point 14 February, May and August results were below the approved lower trigger level.
- Electrical conductivity
 - The EPL Point 2 February and August 2023 results were above the approved trigger level.
 - The EPL Point 3 May, August and November 2023 results were above the approved trigger level.
 - The EPL Point 14 February and August 2023 results were above the approved trigger level.
- Total suspended solids (TSS)
 - The EPL Point 14 February 2023 result was above the trigger level.

For the purpose of completeness, RCA notes the following with regards to the revised trigger level (refer **Table 19**):

- The EPL Point 3 February and the EPL Point 16 February, August and November results were below the revised lower trigger level.

- All electrical conductivity results were below the revised trigger level.
- The EPL Point 14 February and the EPL Point 16 November total suspended solids results are above the revised trigger level.

4.3.2 SITE SURFACE WATER

During the 2023 monitoring period, pH was intermittently outside the site-specific trigger level ranges at:

- S4 for the October monitoring round only; the pH was below the lower trigger level.
- S5 for three (3) of the monitoring events; the pH was below the lower trigger level for the April, October and November monitoring rounds.
- S6 for the May monitoring round only; the pH was above the upper trigger level.
- S7 for the October monitoring round only; the pH was below the lower trigger level.

During the 2023 monitoring period, electrical conductivity was intermittently above the site-specific trigger levels at:

- S1 for six (6) consecutive monitoring events (March to August).
- S3 for seven (7) monitoring events (February to March, May to August, and November).
- S4 for three (3) monitoring events (January, October and November).
- S5 for eight (8) monitoring events (March, May to September, November and December).
- S6 for seven (7) monitoring events (March, and May to October).
- S7 with the exception of April.
- Water Cart Dam for February only

Oil and grease concentrations were below the trigger level in all sampling locations throughout the 2023 monitoring period.

Total suspended solids values at all the monitoring locations were below the trigger level with the exception of the November monitoring round for S1, S5 and S7.

For the purpose of completeness, RCA notes the following with regards to the revised trigger levels (refer **Table 19**):

- The pH results for S5 in October, Wallerawang Downstream in February, October and November, and Water Cart Dam in September, October and November were below the lower trigger level.
- The pH result for S6 in October was above the upper trigger level.
- The electrical conductivity was below the relevant trigger levels for all locations.
- TSS was above the revised trigger level at S1, S5, S6 and S7 for the November monitoring event.

The variation of electrical conductivity with rainfall is presented in **Figure 17**: while electrical conductivity theoretically increases in response to decreased rainfall, some results were significantly higher than the majority of results in a month of significant rainfall. As such it is considered that there are other contributions to the salinity of the water, potentially including sediment which is eroded by rainfall from the catchment.

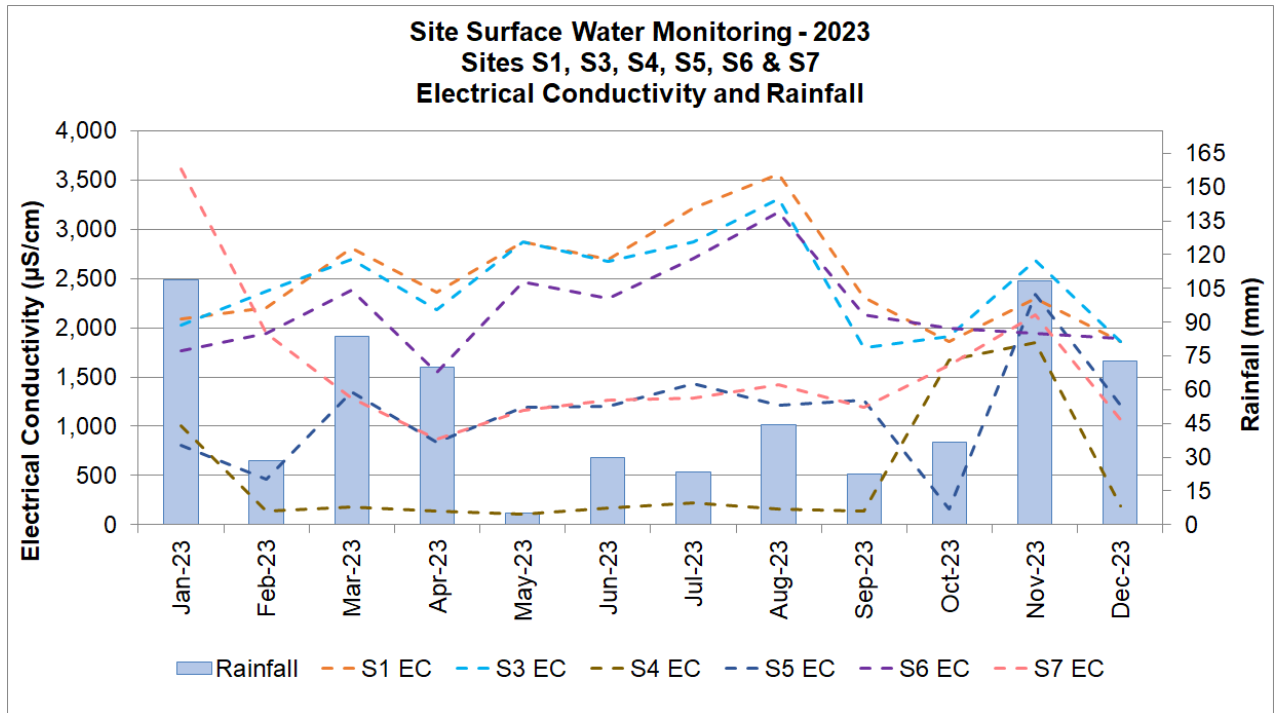


Figure 17 Site Surface Water Electrical Conductivity and Monthly Rainfall

5 METEOROLOGICAL MONITORING

The meteorological monitoring requirements of EPL 4911 (Ref [1]) are presented in **Table 33**.

Table 33 *EPL Meteorological Monitoring Requirements*

Parameter	Units of Measure	Frequency	Averaging Period
Rainfall	mm	Continuous	15 minute
Air temperature	°C	Continuous	1.0 hour
Sigma theta	°	Continuous	15 minute
Relative humidity	%	Continuous	1.0 hour
Wind direction	°	Continuous	15 minute
Wind speed	m/s	Continuous	15 minute

5.1 METEOROLOGICAL MONITORING DATA SUMMARY

Meteorological monitoring was undertaken via the monitoring station at Mt Piper Power Station in accordance with the EPL 4911.

The station presents data for rainfall, temperature at 2m height, temperature at 10m height, sigma theta, humidity, wind speed, wind direction and satisfies the requirements as per **Table 33**. The station does record additional data (pressure, solar radiation, evapotranspiration) which is not considered relevant to this report and is therefore not presented.

The completeness of the data set is presented in **Table 34** and a summary of the weather data recorded for the period January to December 2023 is presented in **Table 35**.

Table 34 *Completeness (%) of Weather Station Data Capture*

Month	Rainfall	Air Temperature		Sigma Theta	Relative Humidity	Wind Direction	Wind Speed
		2m	10m				
January	100	100	99.9	100	100	83.7	83.7
February	99.7	99.7	99.7	99.7	99.7	99.7	100
March	99.8	99.8	99.8	99.8	99.8	99.8	100
April	100	100	100	100	100	100	100
May	93.8	93.8	93.7	93.8	93.7	93.8	100
June	99.8	99.8	99.7	99.8	99.8	99.8	100
July	100	100	99.9	100	99.9	100	100
August	100	100	100	100	100	100	100
September	100	100	100	100	100	100	100
October	99.9	99.9	99.9	99.9	99.9	99.9	100
November	99.1	93.9	99.1	93.9	83.9	93.9	100
December	100	100	100	99.9	99.9	99.9	100

Table 35 Meteorological Monitoring Summary Data 2023

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	
Jan	108.6	108.6	16	18.0	6.7	31.9	17.7	8.1	30.9	25	1	101	79	18	99	2	0.2	6.4	SE
Feb	28.4	137	8	18.2	6.9	33.2	18.2	7.4	32.1	25	0	99	73	17	99	2	0.2	7.6	WSW
Mar	83.6	220.6	14	17.2	4.6	34.8	17.5	6.6	33.9	24	0	103	76	10	99	2	0.2	8.6	WSW
April	70.2	290.8	23	11.5	1.9	20.1	11.8	3.3	19.6	24	0	103	84	41	98	2	0.2	9.5	WSW
May	5.2	296	13	6.5	-5.3	18.2	7.2	-2.4	17.6	21	0	104	80	9	98	2	0.2	10.1	WSW
June	30	326	18	6.2	-8.1	17.2	6.8	-6.0	16.9	24	0	101	84	32	98	2	0.2	8.9	SW
July	23.6	349.6	20	5.6	-7.5	16.6	6.3	-4.9	16.0	23	0	103	84	18	98	2	0.2	11.5	WSW
Aug	44.4	394	22	7.4	-4.1	18.7	8.0	-1.6	18.5	23	0	102	80	17	98	2	0.2	9.7	WSW
Sept	22.4	416.4	13	10.0	-4.9	26.6	10.8	-2.9	26.2	23	0	103	68	15	99	2	0.2	9.3	SW
Oct	36.8	453.2	8	12.4	-0.9	28.2	12.8	0.7	27.3	23	0	102	62	12	99	3	0.2	9.5	SW
Nov	108.2	561.4	17	15.7	3.4	30.2	15.8	4.6	29.4	25	2	102	71	11	99	2	0.08	8.5	SW
Dec	72.9	634.3	13	16.3	6.3	24.1	16.4	7.4	23.4	20	2	91	79	26	99	2	0.08	6.4	WSW
TOTAL		634.3	185	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Minimum		5.2	8	--	-8.1	--	--	-6.0	--	--	0	--	--	9.0	--	--	0.08	--	--
Maximum		108.6	23	--	--	34.8	--	--	33.9	--	--	104	--	--	99	--	--	11.5	--

5.2 REVIEW OF METEOROLOGICAL MONITORING RESULTS

Rainfall was recorded across 185 days during the 2023 monitoring period.

The total rainfall recorded by the meteorological monitoring was 634mm, higher than rainfall recorded during 2019 (350mm) but lower than those in 2020 to 2022 (892, 835 and 1133mm respectively).

The maximum temperatures recorded during the reporting period were 34.8°C at the 2m sensor and 33.9°C at the 10m sensor during March. The lowest temperatures were both in July: -8.1°C at the 2m sensor and -6.0°C at the 10m sensor during June.

Predominant wind directions at the PDM during 2023 was observed to be primarily from the south-westerly quadrant.

6 STREAM HEALTH & CHANNEL STABILITY MONITORING

6.1 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 PDM. 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 Wangcol Creek, the Blue Lake and Coxs River.

A Channel Stability and Stream Health Monitoring programme is outlined in Section 4.6.5 of the PDM Water Management Plan (Ref [3]) for the purpose of monitoring channel stability and stream health and vegetation health of Wangcol Creek. In addition to the requirements of the Channel Stability and Stream Health Monitoring programme, the water bodies of Blue Lake and Coxs River have also been included in the monitoring programme, to satisfy the conditions outlined in the Project Approval (Ref [2]).

Routine six-monthly assessments of Wangcol Creek, Blue Lake and Coxs River were undertaken in March and September 2023 in accordance with the Channel Stability and Stream Health Monitoring programme. The performance criteria utilised for the stream health assessment of each monitoring point is derived from the CSIRO Ephemeral Stream Assessment protocol (Ref [10]) which is reproduced in **Table 36**.

Results of the routine six-monthly assessments are presented in **Table 37** to **Table 40**. The locations of stream health monitoring sites are presented in **Drawing 2, Appendix 1**.

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. Results of this monthly monitoring indicate no evidence of erosion, newly exposed soils, or vegetation disturbance.

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 (Ref [10]), which has been developed for streams and drainage lines. Nevertheless, the Blue Lake is still included in monthly erosion and vegetation disturbance observation inspections.

Table 36 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 37 Classification of Different Drainage Line State – Site SH1

Activity		Rating 9 March	Rating 7 September	Explanation of Rating
Vegetation	On Drainage Line Floor	1	2	1 – Little or no vegetation growing on drainage line floor. 2 – Any vegetation present is annual or short lived; partial burial of plants by recently deposited sediment evident.
	On Drainage Line Walls	3	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 Section	3	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width > depth.
	Longitudinal Morphology of Drainage Line	3	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	2	2	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	2	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	2	Steep bank, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	4	Dense grassland: low inflow rate, mostly diffuse.
2023 Overall Scores				
Classification of Drainage Line		20/32 63%	21/32 66%	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 38 Classification of Different Drainage Line State – Site SH2

Activity		Rating 9 March	Rating 7 September	Explanation of Rating
Vegetation	On Drainage Line Floor	1	2	1 – Little or no vegetation growing on drainage line floor. 2 – Any vegetation present is annual or short lived; partial burial of plants by recently deposited sediment evident.
	On Drainage Line Walls	3	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 Section	3	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width > depth.
	Longitudinal Morphology of Drainage Line	3	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	3	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	3	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	2	Steep bank, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	5	Dense grassland: low inflow rate, mostly diffuse.
2023 Overall Scores				
Classification of Drainage Line		22/32 69%	24/32 75%	69% – Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future. 75% – Drainage is considered stable.

Table 39 Classification of Different Drainage Line State – Site SH3

Activity		Rating 6 June	Rating 6 September	Explanation of Rating
Vegetation	On Drainage Line Floor	1	2	1 – Little or no vegetation growing on drainage line floor.
				2 – Any vegetation present is annual or short lived; partial burial of plants by recently deposited sediment evident.
	On Drainage Line Walls	2	3	2 – Any vegetation present is annual or short-lived: partial burial of plants by recently deposited sediment evident
				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 Section	2	3	2 – Actively eroding: slight undercutting, near vertical walls fans also eroding: depth = width
				3 – Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width > depth.
	Longitudinal Morphology of Drainage Line	3	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	3	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	3	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	2	Steep bank, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	5	Woodland with dense litter; very low, diffuse inflow rates.
2023 Overall Scores				
Classification of Drainage Line		20/32 63%	24/32 75%	63% – Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
				75% – Drainage line is considered stable.

Table 40 Classification of Different Drainage Line State – Site SH5

Activity		Rating 7 March	Rating 6 September	Explanation of Rating
Vegetation	On Drainage Line Floor	3	2	2 – Some vegetation growing on drainage line floor.
				3 – Dense perennial plant cover, similar to vegetation on the bank of the drainage line: characteristic wetland species composition: no observable plant
	On Drainage Line Walls	2	3	2 – Any vegetation present is annual or short-lived: partial burial of plants by recently deposited sediment evident
				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 Section	3	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width > depth.
	Longitudinal Morphology of Drainage Line	3	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	2	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	4	3 – Materials that slake and/or disperse are exposed on less than 0.3 metre of wall height.
				4 – Materials that do not slake or disperse are exposed on wall surface.
Bank Edge	Shape of Stream Bordering Slopes	3	4	Moderately sloped bank, 6 – 10°.
	Nature of Lateral Flow Regulation	3	4	3 – Sparse grassland/woodland with bare soil bank lip: moderate flow rate, some highly focused inflow locations.
				4 – Dense grassland: low inflow rate, mostly diffuse.
2023 Overall Scores				
Classification of Drainage Line		22/32 69%	26/32 81%	69% – Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
				81% – Drainage line is very stable.

6.2 REVIEW & INTERPRETATION OF STREAM HEALTH MONITORING RESULTS

The routine six-monthly assessment of channel stability, stream health and vegetation health of the Wangcol Creek monitoring locations (SH1, SH2, and SH3) at PDM indicates the drainage line classification is 'stable' at SH2 and SH3 while it is considered 'potentially stabilising' at SH1. The drainage line at location SH3a is considered stable as this section of the creek is lined with spray concrete.

An assessment of the Coxs River monitoring site (SH5) indicated the drainage line has significantly improved from 'potentially stabilising' in March to 'very stable' conditions in September.

The CSIRO Ephemeral Stream Assessment protocol Ref [10]) does not indicate either specific ongoing monitoring or rehabilitation works are required for the stable systems. Ongoing monitoring is required for the potentially stabilising systems.

7 NOISE MONITORING

Noise monitoring is undertaken in accordance with Project Approval (Ref [2]) conditions and the PDM Noise Management Plan (Ref [6]) on a quarterly basis. There is no specific requirement for monitoring in the EPL 4911 (Ref [1]) although limits are set (refer **Section 7.1**).

The purpose of noise monitoring is to ensure that any impact of operations on the surrounding sensitive receivers can be identified; and to show compliance with relevant legislative requirements.

As PDM is currently in care and maintenance, rehabilitation activities are considered to be the primary noise source.

7.1 NOISE ASSESSMENT CRITERIA

The conditional requirements within EPL 4911 (Ref [1]), Project Approval 10_0041 (Schedule 3, Condition 1, Ref [2]) are presented in **Table 41**.

Table 41 Noise Assessment Criteria (Ref [1] and [2])

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

Noise survey locations are presented in **Drawing 1, Appendix 1**.

7.2 NOISE MONITORING DATA SUMMARY

Quarterly attended noise surveys of PDM for the 2023 monitoring period were undertaken during the care and maintenance stage of the site on the following dates:

- Quarter 1 – January to March, monitoring conducted 16 & 17 March 2023.
- Quarter 2 – April to June, monitoring conducted 22 May 2023.
- Quarter 3 – July to September, monitoring conducted on 27 July 2023.
- Quarter 4 – October to December, monitoring conducted on 24 & 25 October 2023.

The conditions and operations during noise surveys were considered to be representative of those undertaken on a normal daily basis.

Monitoring comprised two (2) consecutive 15-minute surveys conducted at each of the six (6) monitoring locations. Measurements were recorded in free field conditions with a Class 1 sound level meter (SLM) attached to a tripod at a height of 1.5 metres above the ground. A handheld calibrator was used to check the calibration of the SLM in between all measurement locations. All calibration checks were within the acceptable range of $94 \text{ dB} \pm 0.5$.

Results of attended noise surveys carried out during the 2023 monitoring period are presented in **Table 42** to **Table 45**. Meteorological conditions recorded during each noise survey are presented in **Table 46**; the 10m data has been sourced from the meteorological data (refer **Section 5**) subsequent to the completion of the noise surveys with the exception of the October monitoring which was sourced from the onsite automatic weather station.

Table 42 *Attended Noise Survey – Quarter 1, March 2023*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	LA10 15min	LA90 15min				
17/03/23	08:00	NM 1	61	65	51	NIL	42	61	Pine Dale Mine NIL* Road Traffic 50 to 73 dBA Birds 46 to 50 dBA
17/03/23	08:15	NM 1	62	66	50	NIL	42	62	Pine Dale Mine NIL* Road Traffic 50 to 73 dBA Birds 46 to 50 dBA
17/03/23	08:45	NM 2	51	55	40	NIL	42	51	Pine Dale Mine NIL* Road Traffic 47 to 63 dBA Birds 35 to 62 dBA
17/03/23	09:00	NM 2	49	53	39	NIL	42	49	Pine Dale Mine NIL* Road Traffic 47 to 61 dBA Birds 35 to 56 dBA
17/03/23	09:20	NM 3	64	68	51	NIL	42	64	Pine Dale Mine NIL* Road Traffic 54 to 77 dBA Birds 45 to 59 dBA
17/03/23	09:35	NM 3	65	69	53	NIL	42	65	Pine Dale Mine NIL* Road Traffic 54 to 77 dBA Birds 47 to 64 dBA
17/03/23	10:00	NM 4	45	48	42	NIL	35	45	Pine Dale Mine NIL* Birds 40 to 56dBA Distant Traffic 40 to 42 dBA
17/03/23	10:15	NM4	46	48	42	NIL	35	45	Pine Dale Mine NIL* Birds 40 to 57dBA Distant Traffic 40 to 42 dBA
16/03/23	12:15	NM 5	61	50	41	NIL	35	61	Pine Dale Mine NIL* Cars pass by 50 to 87 dBA Birds & Insects 40 to 55 dBA
16/03/23	12:30	NM 5	56	55	41	NIL	35	56	Pine Dale Mine NIL* Cars pass by 50 to 78 dBA Birds & Insects 37 to 55dBA Wind gusts 55 to 60 dBA

Table 42 *Continued*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	LA10 15min	LA90 15min				
16/03/23	11:42	NM 6	56	50	44	NIL	35	56	Pine Dale Mine NIL* Cars pass by 50 to 77 dBA Birds & Insects 43 – 60 dBA
16/03/23	11:57	NM 6	59	51	45	NIL	35	59	Pine Dale Mine NIL* Cars pass by 53 to 83dBA Birds & Insects 43 to 58 dBA

* Nil – Noise source not audible during survey session

Table 43 *Attended Noise Survey – Quarter 2, May 2023*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min				
22/05/2023	12:39	NM1	52	56	36	NIL	42	52	Pine Dale Mine NIL* Road Traffic 50 to 64 dBA Birds 32 to 53 dBA
22/05/2023	12:54	NM 1	53	57	37	NIL	42	53	Pine Dale Mine NIL* Road Traffic 50 to 68 dBA Birds 34 to 53 dBA
22/05/2023	13:13	NM2	47	51	38	NIL	42	47	Pine Dale Mine NIL* Road Traffic 47 to 56 dBA Birds 35 to 49 dBA
22/05/2023	13:28	NM 2	49	53	39	NIL	42	49	Pine Dale Mine NIL* Road Traffic 45 to 58 dBA Birds 35 to 63 dBA
22/05/2023	13:46	NM3	63	67	48	NIL	42	63	Pine Dale Mine NIL* Road Traffic 47 to 76 dBA Birds 41 to 50 dBA
22/05/2023	14:01	NM3	62	66	48	NIL	42	62	Pine Dale Mine NIL* Road Traffic 50 to 71 dBA Local Road Traffic 54 to 74 dBA Birds 42 to 50 dBA
22/05/2023	14:24	NM4	39	42	35	NIL	35	39	Pine Dale Mine NIL* Birds 32 to 49 dBA Distant Traffic 33 to 42 dBA
22/05/2023	14:38	NM4	38	40	35	NIL	35	38	Pine Dale Mine NIL* Birds 33 to 48dBA Distant Traffic 40 to 42 dBA
22/05/2023	15:38	NM5	61	50	30	NIL	35	61	Pine Dale Mine NIL* Cars pass by 50 to 83 dBA Birds & Insects 27 to 46 dBA
22/05/2023	15:53	NM 5	61	51	32	NIL	35	61	Pine Dale Mine NIL* Cars pass by 50 to 82 dBA Birds & Insects 30 to 53dBA Cattle in paddock 46 to 55 dBA

Table 43 *Continued*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min				
22/05/2023	15:05	NM6	58	53	39	NIL	35	58	Pine Dale Mine NIL* Cars pass by 50 to 79 dBA Birds & Insects 36 – 54 dBA
22/05/2023	15:20	NM 6	59	54	38	NIL	35	59	Pine Dale Mine NIL* Cars pass by 52 to 79 dBA Birds & Insects 36 to 50 dBA

* Nil – Noise source not audible during survey session

Table 44 *Attended Noise Survey – Quarter 3, July 2023*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min				
27/07/2023	08:05	NM1	56	59	47	NIL	42	56	Pine Dale Mine NIL* Road Traffic 50 to 65 dBA
27/07/2023	08:20	NM 1	56	59	48	NIL	42	56	Pine Dale Mine NIL* Road Traffic 50 to 71 dBA
27/07/2023	08:40	NM2	53	57	46	NIL	42	53	Pine Dale Mine NIL* Road Traffic 50 to 65 dBA Birds 45 to 52 dBA
27/07/2023	08:55	NM 2	52	56	45	NIL	42	52	Pine Dale Mine NIL* Road Traffic 50 to 63 dBA Birds 43 to 52 dBA
27/07/2023	09:15	NM3	62	66	48	NIL	42	62	Pine Dale Mine NIL* Road Traffic 47 to 76 dBA Distant Road 43 to 53 dBA
27/07/2023	09:30	NM3	62	66	45	NIL	42	62	Pine Dale Mine NIL* Road Traffic 50 to 71 dBA Local Road Traffic 54 to 78 dBA
27/07/2023	10:00	NM4	44	42	32	NIL	35	44	Pine Dale Mine NIL* Birds 32 to 56 dBA Distant Traffic 33 to 42 dBA
27/07/2023	10:15	NM4	42	41	34	NIL	35	42	Pine Dale Mine NIL* Birds 33 to 56 dBA Distant Traffic 34 to 42 dBA
27/07/2023	11:20	NM5	58	43	34	NIL	35	58	Pine Dale Mine NIL* Cars pass by 50 to 82 dBA Distant Traffic 36 to 46 dBA Birds & Insects 34 to 46 dBA
27/07/2023	11:35	NM 5	60	48	36	NIL	35	60	Pine Dale Mine NIL* Cars pass by 50 to 83 dBA Distant Traffic 38 to 53 dBA Birds & Insects 35 to 48dBA

Table 44 *Continued*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min				
27/07/2023	10:45	NM6	53	44	33	NIL	35	53	Pine Dale Mine NIL* Cars pass by 60 to 80 dBA Birds & Insects 45 to 53 dBA Distant Traffic 37 to 54 dBA
27/07/2023	11:00	NM 6	63	55	33	NIL	35	63	Pine Dale Mine NIL* Cars pass by 62 to 87 dBA Birds & Insects 37 to 46 dBA Distant Traffic 32 to 42 dBA

* Nil – Noise source not audible during survey session

Table 45 *Attended Noise Survey – Quarter 4, October 2023*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	LA10 15min	LA90 15min				
24/10/2023	15:02	NM1	58	61	48	NIL	42	58	Pine Dale Mine NIL* Road Traffic 55 to 74 dBA Birds 50 to 53 dBA
24/10/2023	15:17	NM 1	55	58	45	NIL	42	55	Pine Dale Mine NIL* Road Traffic 55 to 67 dBA Birds 48 to 53 dBA
24/10/2023	15:51	NM2	50	54	41	NIL	42	50	Pine Dale Mine NIL* Road Traffic 49 to 59 dBA Birds 46 to 52 dBA
24/10/2023	16:06	NM 2	51	53	43	NIL	42	51	Pine Dale Mine NIL* Road Traffic 53 to 69 dBA Birds 46 to 52 dBA
24/10/2023	16:28	NM3	61	63	45	NIL	42	61	Pine Dale Mine NIL* Road Traffic 57 to 76 dBA Birds 48 to 54 dBA
24/10/2023	16:43	NM3	58	62	44	NIL	42	58	Pine Dale Mine NIL* Road Traffic 56 to 74 dBA Birds 47 to 54 dBA
25/10/2023	08:08	NM4	45	44	36	NIL	35	45	Pine Dale Mine NIL* Birds 44 to 62 dBA Distant Traffic 33 to 41 dBA
25/10/2023	08:23	NM4	43	43	35	NIL	35	43	Pine Dale Mine NIL* Birds 45 to 61 dBA Distant Traffic 33 to 39 dBA
25/10/2023	09:00	NM5	59	51	33	NIL	35	59	Pine Dale Mine NIL* Cars pass by 54 to 81 dBA Birds 39 to 46 dBA
25/10/2023	09:15	NM 5	59	49	32	NIL	35	59	Pine Dale Mine NIL* Cars pass by 54 to 80 dBA Birds 39 to 46 dBA

Table 45 *Continued*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine L _{Aeq} 15min Contribution	Pine Dale Mine L _{Aeq} 15min Limit	Road traffic, birds and other L _{Aeq} 15min Contribution	Noise Sources & Level Ranges (Min to Max) dB(A)
			L _{Aeq} 15min	L _{A10} 15min	L _{A90} 15min				
25/10/2023	09:35	NM6	55	44	34	NIL	35	55	Pine Dale Mine NIL* Cars pass by 54 to 79 dBA Birds 39 to 48 dBA
25/10/2023	09:50	NM 6	58	46	34	NIL	35	58	Pine Dale Mine NIL* Cars pass by 54 to 80 dBA Birds 39 to 48 dBA

* Nil – Noise source not audible during survey session

Table 46 Meteorological Conditions during Attended Noise Surveys

Survey Date	Start Time	Location	Temp at 10m (°C)	Average Wind Speed (m/s)	Average Wind Direction (degrees)
16/03/2023	12:15	NM5	28	2-3	270
16/03/2023	11:42	NM6	27	2-3	270
17/03/2023	08:00	NM1	8	0-1	270
17/03/2023	08:45	NM2	12	0-1	270
17/03/2023	09:20	NM3	20	0-1	270
17/03/2023	10:00	NM4	23	1-2	270
22/05/2023	12:54	NM1	17	1-2	200
22/05/2023	13:13	NM2	17	1-2	228
22/05/2023	13:46	NM3	16	2-3	239
22/05/2023	14:24	NM4	15	3-4	222
22/05/2023	15:38	NM5	16	1-2	230
22/05/2023	15:05	NM6	16	2-3	233
27/07/2023	08:05	NM1	1	0.2	215
27/07/2023	08:40	NM2	6	0.7	42
27/07/2023	09:15	NM3	10	1.5	353
27/07/2023	10:00	NM4	11	1.7	23
27/07/2023	11:20	NM5	13	3.5	252
27/07/2023	10:45	NM6	12	3.6	261
24/10/2023	15:02	NM1	28	4-5	327
24/10/2023	15:51	NM2	28	3-4	302
24/10/2023	16:28	NM3	27	4-5	292
25/10/2023	08:08	NM4	25	2-3	251
25/10/2023	09:00	NM5	25	3-4	243
25/10/2023	09:35	NM6	26	2-3	250

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".

7.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS

7.3.1 FIRST QUARTER 2023

Attended noise surveys for the January to March 2023 quarter were undertaken on 16 & 17 March at six (6) PDM noise monitoring locations. During the surveys, no activities were observed at the mine, with no traffic observed to be using the privately-owned Angus Place haul road located within PDM.

The surveys showed that road traffic along Castlereagh Highway was typically the dominant noise source with bird calls and distant traffic contributing to the acoustic environment.

There were no audible noise contributions from PDM at the six (6) noise monitoring locations.

7.3.2 SECOND QUARTER 2023

Attended noise surveys for the April to June 2023 quarter were undertaken on 22 May. During the surveys, no activities were observed at the mine, with no traffic observed to be using the privately-owned Angus Place haul road located within PDM.

The surveys showed that road traffic along Castlereagh Highway was typically the dominant noise source with bird calls and distant traffic contributing to the acoustic environment.

There were no audible noise contributions from PDM at the six (6) noise monitoring locations.

7.3.3 THIRD QUARTER 2023

Attended noise surveys for the July to September 2023 quarter were undertaken on the 27 July. During the surveys, no activities were observed at the mine, with no traffic observed to be using the privately-owned Angus Place haul road located within PDM.

The surveys showed that road traffic along Castlereagh Highway was typically the dominant noise source with bird calls and distant traffic contributing to the acoustic environment.

There were no audible noise contributions from PDM at the six (6) noise monitoring locations.

7.3.4 FOURTH QUARTER 2023

Attended noise surveys for the October to December 2023 quarter were undertaken on the 24 & 25 October. During the surveys, no activities were observed at the mine, with no traffic observed to be using the privately-owned Angus Place haul road located within PDM.

The surveys showed that road traffic along Castlereagh Highway was typically the dominant noise source with bird calls and distant traffic contributing to the acoustic environment.

There were no audible noise contributions from PDM at the six (6) noise monitoring locations.

7.3.5 OVERALL ASSESSMENT FOR 2023

The assessable sound levels from PDM were below the assessment criteria at the six (6) locations during the 2023 monitoring period.

It is a requirement under AS 1055 that the noise surveys also document levels of ambient sound resulting from non PDM sources; these are represented by the "Overall" $L_{Aeq\ 15\ minute}$ noise levels (refer **Table 42** to **Table 45**). In the surveys conducted for PDM, traffic from the Castlereagh Highway was observed to be the dominant noise source with natural sounds and more distant traffic significant contributors to the acoustic environment.

8 BLAST MONITORING

8.1 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 Environment Protection License (EPL 4911) are presented in **Table 47**.

Table 47 *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%

8.2 BLASTING OPERATIONS MONITORING DATA SUMMARY

Throughout the 2023 monitoring period there were no blast events conducted at the site as a result of the mine being in care and maintenance.

9 LIMITATIONS

This report has been prepared for Enhance Place Pty Limited in accordance with an agreement with RCA Australia (RCA). 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 sole use of Enhance Place Pty Limited. The report may not contain sufficient information for purposes of other uses or for parties other than Enhance Place Pty Limited. 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 Australia.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including analyte concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully

RCA AUSTRALIA



Dr. Anh Hoang
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- [8] Standards Australia, *AS/NZS 3580.1.1:2007: Methods for sampling and analysis of ambient air: Guide to siting air monitoring equipment*, 2007.
- [9] GHD, *Pine Dale Groundwater and Surface Water Investigation Trigger Value Review Report*, September 2018.
- [10] CSIRO, *Ecosystem Function Analysis – Ephemeral Stream Assessment*.

GLOSSARY

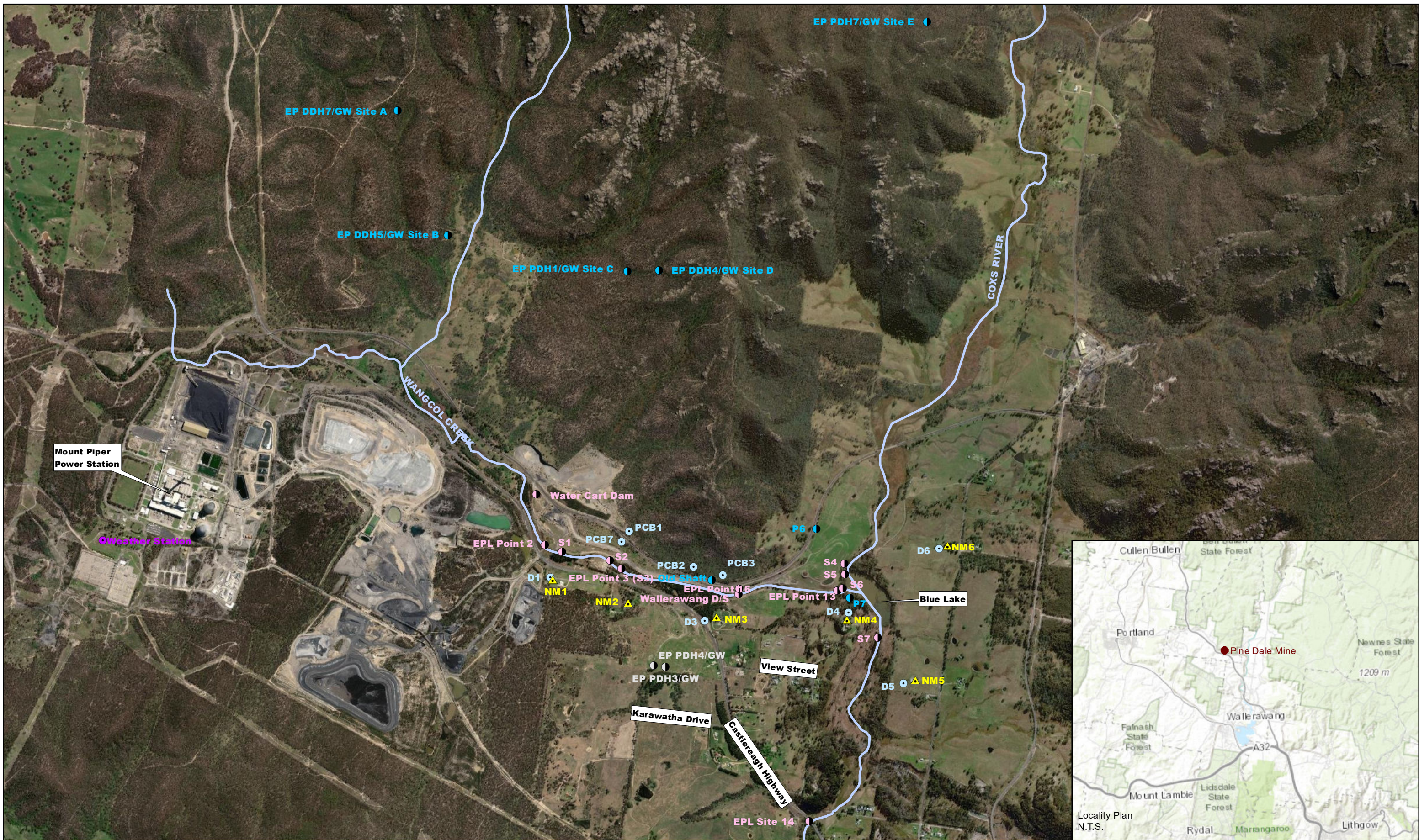
AHD	Australian height datum, based on a mean sea level.
dB	Unit of sound pressure level

DPIE	Department of Planning and Environment – formerly known as Department of Planning, Industry and Environment (2019 – 2023), Department of Planning and Environment (2014 – 2019), Department of Industry (2015 – 2019) and the Office of Environment and Heritage (OEH, 2011 – 2019).
EPL	Environment Protection Licence
kg	kilogram, 1000 gram.
L _{A90}	Average A-weighted minimum noise level in a measurement period
L _{Aeq}	Average acoustic energy over the duration of the measurement, represented using the A-weighting filter.
L _{Aeqmax}	Maximum A-weighted noise level in a measurement period.
mg	milligram, 1/1000 gram.
NSW EPA	NSW Environment Protection Authority.
NTU	Nephelometric Turbidity Units: unit for the measurement of turbidity.
PDM	Pine Dale Mine
µg	microgram, 1/1000 milligram.
<u>Chemical Compounds</u>	
EC	Electrical conductivity: a measure of the ability of a solution to conduct electricity.
PM ₁₀	particulate matter less than or equal to 10 micrometres.
TSP	Total suspended Particulates
TSS	Total suspended solids.
Turbidity	Cloudiness of fluid

Attachment 1

Drawing 1 - Environmental Monitoring Locations

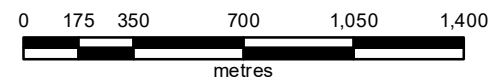
Drawing 2 - Stream Health & Channel Stability
Monitoring Locations



LEGEND

- ▲ Noise monitoring location
- Depositional dust monitoring location
- Groundwater monitoring location
- Surface water monitoring location
- Groundwater monitoring prior to 2023
- Meteorological monitoring location (from 10 November 2021)

Note: Aerial taken from ArcGis Base Map, 25 October 2021



PINE DALE MINE ENVIRONMENTAL MONITORING LOCATION PLAN

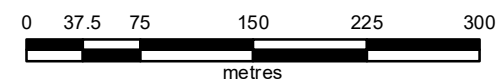
CLIENT	Enhance Place Pty Ltd	RCA Ref	6880-1899-App. B
DRAWN BY	FB	SCALE	1:24,000 (A3)
APPROVED BY	FB	DATE	22/01/2024
		DRAWING	1
		REV	0
		OFFICE	NEWCASTLE



LEGEND

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

Note: Aerial taken from ArcGis Base Map, 25 October 2021



**PINE DALE MINE
CHANNEL STABILITY, STREAM AND
VEGETATIVE HEALTH MONITORING SITES**

CLIENT	Enhance Place	RCA Ref	6880-1899-App. B	
DRAWN BY	FB	SCALE	1:5,000 (A3)	DRAWING 2 REV 0
APPROVED BY	FB	DATE	22/01/2024	OFFICE NEWCASTLE

Appendix C

PDM 2023 Rehabilitation Monitoring Report
(Ref [4])



Pine Dale Mine Rehabilitation Monitoring Report 2023

Report prepared by First Field Environmental Pty Ltd
on behalf of EnergyAustralia

22 September 2023

Revision history		
Version	Date	Author
Version 1	22 September 2023	Michelle Evans

Cover image: Pasture adjacent to transect 1

This report has been prepared by First Field Environmental Pty Ltd 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, 15 km north of Lithgow on the northern side of Castlereagh Highway. The property is approximately 3 km 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, 2019) 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, 2019).

Table 1 Performance indicators and completion criteria

Performance indicator	Completion criteria
Feral animal and priority weed presence	Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use.
Feral animal and priority weed control	Feral animals and priority weeds are controlled in accordance with legislation.
Fuel loads	Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan.
Access	Adequate access for fire-fighting is maintained on rehabilitation areas.
Habitat features	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	More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.
	Native forest indicator species tree height and girth is within the range of analogue sites.
Soil loss	Net annual soil loss is comparable to analogue sites at year 10.

Performance indicator	Completion criteria
Erosion	There are no significant erosion features that compromise landform stability or public safety (including gullyng or tunneling).
Woodland birds present	Evidence of woodland birds utilising rehabilitation areas.
Evidence of mammals	Evidence of target mammal species presence in rehabilitation areas.
Natural regeneration	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	Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.
Management inputs	Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.
Rural land capability	Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).
Species composition	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	Weeds including African Lovegrass to comprise <10% of the pasture sward.
Ground cover	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, 2019)

3. Weather conditions

The three months leading up to the survey were warmer than average temperatures (over a 5-year period of observations). The area received significantly lower than average rainfall in the three months leading up to the survey with winter rainfall of 95.2 mm compared with the average of 149.8 mm (over a 15-year period of observations) in the months of June to August (Bureau of Meteorology 2023).

Table 2 Maximum temperature (°C) recorded June-September

Month	6 year average	2023 average
June	11.6	12.6
July	11.9	13.7
August	13.0	15.7
September	16.0	-

Source: Bureau of Meteorology 2023 (Marrangaroo (Defence))

Table 3 Rainfall (mm) recorded June-September

Month	15 year average	2022 average
June	49.16	29.0
July	47.7	21.0
August	53.0	45.2
September	54.4	-

Source: Bureau of Meteorology 2023 (Lidsdale (Maddox Lane))

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 2019) 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

-  Transect lines
-  Tree rehabilitation site
-  Pine Dale Mine

0 250 500 m



Pindale Mine Rehabilitation Monitoring Report

Drawing No: A1		Prepared for Enhanced Place Mine
Date: 26/9/2019	Drawing Size: A4	This figure may be based on third party data or data which has not been verified by first field Environmental and it may not be to scale, unless expressly agreed otherwise this figure is intended as a guide only and first field Environmental does not warrant its accuracy.
Drawn By: Andrew Evers	Reviewed By: Michelle Evers	
Coordinate System: GDA2020 MGA Zone 56 EPSG:28356		

Figure 1 Monitoring locations

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 2019) 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 2019). 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.

Priority weeds - The location and extent of priority weeds as declared for the Central Tablelands Region (Central Tablelands Local Land Services 2019) 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 priority 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 4 September 2023 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

The presence and extent of active surface erosion within transect areas is recorded in Appendix A. There are no significant erosion features that compromise landform stability or public safety (including gullying or tunnelling) within the pasture rehabilitation areas. A sink hole was observed adjacent to Transect 5 (Figure 2).



Figure 2 Sink hole adjacent to Transect 5

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 was evident at the pasture or treed analogue sites.

5.2 Soil loss

Estimated annual soil loss at rehabilitated transects is summarised in Table 4. Note that soil loss in transect 3 is affected by increased slope. Current tonnes per hectare soil loss in transect 3 is considered acceptable. Full calculations are provided in Appendix C.

Table 4 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	0.36 t/ha	0.36 t/ha	0.00 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 were established with a mix of ~70% perennial grasses and ~20% annual legumes consistent with species composition at the analogue pasture site. Examples of analogue pasture and rehabilitated pasture at Area C are shown in Figure 3 and Figure 4.



Figure 3 Pasture composition at analogue site

Figure 4 Pasture composition Area C

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

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 were 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.

In 2019 the treed analogue site was characterised by a canopy to 14 m height with 20% canopy cover over a sparse shrubby mid-storey to 3 m height and isolated shrubs to 1.5 m height in the understorey. Groundcover consisted of grasses and herbs with a cover of >95%.

The treed analogue site was affected by fire in 2020 which resulted in the loss of groundcover, shrubby understorey and canopy. Natural regeneration is occurring and is characterized by an increase in shrubby vegetation and juvenile tree growth evident in Figure 5.



Figure 5 Natural regeneration of the treed analogue site

Rehabilitation of the treed rehabilitation areas aims to achieve structural complexity and species diversity comparable to established forest and they have therefore been compared to 2019 data from the treed analogue site.

Canopy cover is sparse in treed rehabilitation areas. A sparse mid-storey of isolated juvenile trees and shrubs exists over a sparse, low, shrubby understorey. Groundcover is a 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 – Annual living cover at transect 5 has increased to 20%, from ~10% in 2022 while % perennial groundcover has remained stable. Both % of litter cover and bare soil have decreased.

Total living cover at transect 6 of 80% has not changed from 2022. Non-living cover consists of 10% litter cover and 10% bare surface.

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 60% of native tree and shrub species recorded within the treed analogue site in 2023 are actively growing in the treed rehabilitation areas.

Natural regeneration of treed rehabilitation areas - There is some evidence of second-generation native forest indicator tree or shrub species on treed rehabilitation areas.

5.4 Evidence of fauna and habitat features

Habitat features – Nesting boxes have not been installed in treed rehabilitation areas. Habitat features were previously installed and were evident in treed rehabilitation areas prior to 2020. These included timber and rock pile clusters. The 2020 bushfire reduced the amount of mulch and fallen timber at transects 5 and 6.

Fauna – Macropod scats and tracks were evident throughout the property. Native woodland birds were observed landing within the treed vegetation areas. Native bird activity was evident on inspection of the treed analogue site and included Laughing Kookaburras and specialist forest species. Magpies were observed on the ground within pasture areas A, B and C.

5.5 Feral animals and weeds

Feral animal and weed species presence and abundance is not considered likely to adversely impact the intended final land use. Feral animals and priority 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 –No holes, burrows, scats or dens were observed.

Priority and targeted weed species – Priority weeds observed during field survey are listed in Table 5.

Table 5 Feral animal and priority weed presence

Common name <i>Species name</i>	Location	Treatment
African lovegrass <i>Eragrostis curvula</i>	All pasture locations	All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

The presence of African lovegrass was noted at all rehabilitated pasture locations and occurred across less than 10% of the pasture area. These outbreaks have been subjected to ongoing chemical control.

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 the former Wallerawang Power Station site, 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 >4 m and a width of >2.8 m (*Policy No. 2/2007 Fire Trails* (Bush Fire Coordinating Committee 2007)).

5.7 Rural land capability assessment

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 6 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 >500 mm			
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 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 >100 cm			
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 priority 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 7.

Table 7 Status of completion criteria

Performance indicator	Completion criteria	Status
Feral animal and priority weed presence	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 priority weed control	Feral animals and priority weeds are controlled in accordance with legislation.	Satisfactory – Continue to monitor
Fuel loads	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	Adequate access for firefighting is maintained on rehabilitation areas.	Satisfactory – Continue to monitor
Habitat features	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. 	Ongoing – nesting boxes to be installed once trees are established.
Vegetation health	More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.	Complete
	Native forest indicator species tree height and girth is within the range of analogue sites.	Ongoing – continue to monitor
Soil loss	Net annual soil loss is comparable to analogue sites at year 10.	Complete
Erosion	There are no significant erosion features that compromise landform stability or public safety (including gullying or tunneling).	Ongoing – sink hole evident at transect 5.
Woodland birds present	Evidence of woodland birds utilising rehabilitation areas.	Complete
Evidence of mammals	Evidence of target mammal species presence in rehabilitation areas.	Complete

Performance indicator	Completion criteria	Status
Natural regeneration	Evidence of second generation of native forest indicator species from desired vegetation community.	Ongoing – continue to monitor
	Evidence of natural regeneration of at least four pasture species at year 5.	Complete
Structure	Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.	Ongoing – continue to monitor
Management inputs	Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.	Satisfactory – Continue to monitor
Rural land capability	Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	Complete
Species composition	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.	Complete
	Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix.	Complete
	Approved pasture species mix is sown at the specified rate per hectare.	Complete
Weed presence	Weeds including African lovegrass to comprise <10% of the pasture sward.	Satisfactory – Continue to monitor
Ground cover	Ground cover (vegetation, leaf litter, mulch) >70% at year 5.	Complete

7. Key findings

- Rainfall preceding the September survey was lower than the mean annual rainfall for the area.
- Feral animal and weed control are satisfactory and are to continue to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- Fuel loads and access are satisfactory and are to continue to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- Nesting boxes are not installed in or adjacent to the treed rehabilitation areas.
- A sink hole was observed at transect 5.
- Vegetation health in treed areas is satisfactory and is to continue to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- African Lovegrass is present. The extent of establishment is to be monitored and the species is to be controlled to within less than 10% of the pasture sward.

- The treed analogue area located near Pine Dale Mine was affected by bushfire in 2020. 2019 survey data was utilised as a comparison to 2023 treed rehabilitation conditions.

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 2019).

- Continue to monitor performance indicators;
- Continue to spot-spray outbreaks of African Lovegrass;
- Stabilise the sink hole at transect 5 and monitor for further erosion and
- Install nesting boxes once the treed rehabilitation areas contain adequate structure to support nesting woodland birds.

9. References

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Appendix A

Survey data 2023

Pasture analogue site (Pine Dale Mine) 2023	
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	
Total living cover	>95%
Annual living cover	20%
Perennial living cover	75%
Litter cover	-
Bare surface	<5%

Transect 1 Pasture rehabilitation area 2023								
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	>40 herbs and grasses identified, dominated by exotic species.							
Cover classification	% cover at each observation							
	September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover	95%	90%	90%	90%	90%	>90%	>90%	>95%
Annual living cover	47.5%	40%	40%	40%	20%	20%	20%	20%
Perennial living cover	47.5%	50%	50%	50%	70%	70%	70%	75%
Litter cover	-	<10%	10%	-	-	-	-	-
Bare surface	5%	<10%	10%	10%	10%	<10%	<10%	<5%
Target weed presence								
African Lovegrass (<i>Eragrostis curvula</i>)	<10%							

Transect 2 Pasture rehabilitation area 2023									
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		>45 herbs and grasses identified, dominated by exotic species.							
Cover classification		% cover at each observation							
		September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover		90%	90%	90%	90%	90%	>90%	>90%	>95%
Annual living cover		42%	40%	40%	40%	20%	20%	20%	20%
Perennial living cover		48%	50%	50%	50%	70%	70%	70%	75%
Litter cover		-	<10%	10%	-	-	-	-	-
Bare surface		10%	<10%	10%	10%	10%	<10%	<10%	<5%
Target weed presence									
African Lovegrass (<i>Eragrostis curvula</i>)		<10%							

Transect 3 Pasture rehabilitation area 2023								
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		>40 herbs and grasses recorded, dominated by exotic species.						
Cover classification	% cover at each observation							
	September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover	90%	90%	90%	90%	90%	>90%	>90%	>95%
Annual living cover	46%	40%	40%	40%	20%	20%	20%	20%
Perennial living cover	44%	50%	50%	50%	70%	70%	70%	75%
Litter cover	-	<10%	10%	-	-	-	-	-
Bare surface	10%	<10%	10%	10%	10%	<10%	<10%	<5%
Target weed presence								
African Lovegrass (<i>Eragrostis curvula</i>)		<10%						

Transect 4 Pasture rehabilitation area 2023									
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 and exotic grasses and broadleaf herbs.							
Species richness		>40 herbs and grasses recorded, dominated by exotic species.							
Cover classification		% cover at each observation							
		September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover		90%	90%	90%	90%	>90%	>90%	Not assessed due to inaccessibility	>95%
Annual living cover		42%	30%	30%	40%	20%	20%		20%
Perennial living cover		48%	60%	60%	50%	70%	70%		75%
Litter cover		-	<10%	10%	-	-	-		-
Bare surface		10%	<10%	10%	10%	10%	<10%		<5%
Target weed presence									
African Lovegrass (<i>Eragrostis curvula</i>)		<10%							

Transect 5 Treed rehabilitation area 2023								
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 observed.							
Surface drainage impediments	No significant drainage impediments.							
Vegetation								
Vegetation structure	Sparse tree layer to 3 m height with juvenile trees and sparse mixed native shrub species. Sparse shrub layer consists of native species and juvenile trees to 2 m height. Groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.							
Species richness	Groundcover dominated by exotic grasses. >40 species recorded.							
Cover classification	% cover at each observation							
	September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover	75%	70%	70%	70%	80%	80%	80%	>90%
Annual living cover	12%	10%	10%	10%	10%	20%	10%	20%
Perennial living cover	63%	60%	60%	60%	60%	60%	70%	70%
Litter cover	10%	10%	10%	15%	10%	-	10%	5%
Bare surface	15%	20%	20%	15%	10%	20%	10%	<5%
Target weed presence								
None observed.								

Transect 6 Treed rehabilitation area 2023								
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 5 m height with juvenile trees and sparse mixed native shrub species. Sparse shrub layer consists of native species and juvenile trees to 3 m height. Groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.					
Species richness			Groundcover dominated by exotic grasses. >35 species recorded.					
Cover classification			% cover at each observation					
	September 2016	September 2017	September 2018	September 2019	September 2020	November 2021	November 2022	September 2023
Total living cover	80%	80%	70%	70%	80%	>90%	80%	80%
Annual living cover	12%	10%	10%	10%	10%	20%	20%	20%
Perennial living cover	68%	70%	60%	60%	70%	70%	60%	60%
Litter cover	10%	10%	10%	15%	10%	-	10%	10%
Bare surface	10%	10%	20%	15%	10%	<10%	10%	10%
Target weed presence								
None observed.								

Treed analogue site (transect 7) 2023	
Easting	Northing
226801	6305097
226838	6305039
Landform and soils	
Slope	Transect located along contour of mid slope gently inclining to the north.
Erosion	Minor wind erosion observed on exposed soils.
Cracking soils	Not observed.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Open canopy to 12 m height. Dense shrub layer including juvenile tree species. Groundcover dominated by native grasses with sparse native herbs.
Species richness	>20 species observed.
Cover classification	
Total living cover	>95%
Annual living cover	<5%
Perennial living cover	>90%
Litter cover	10%
Bare surface	<5%
Target weed presence	
None observed.	

Appendix B

Vegetation assessment of treed areas

Vegetation assessment treed areas 2023

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	2019 treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>10	>15	>25
Trees	Sparse. To 3 m height.	Sparse. To 5 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.	>14 species, 1-3 m height, 10% cover
Groundcover	90% cover. Mix of exotic grasses, native and exotic herbs.	80% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>25	>20	<5
Recruitment	Observed.	Observed.	Observed.
Organic litter	Thin, sparse.	Thin, sparse.	Well-developed to 2 cm depth.
Logs	Large logs placed along contours on upper slope. Some burned.	Large logs placed along contours on upper slope.	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2022

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	2019 treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>5	>10	>25
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.	>14 species, 1-3 m height, 10% cover
Groundcover	80% cover. Mix of exotic grasses, native and exotic herbs.	80% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>25	>25	<5
Recruitment	Observed.	Observed.	Observed.
Organic litter	Thin, sparse.	Thin, sparse.	Well-developed to 2 cm depth.
Logs	Large logs placed along contours on upper slope. Some burned.	Large logs placed along contours on upper slope.	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2021

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	2019 treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>5	>10	>25
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.	>14 species, 1-3 m height, 10% cover
Groundcover	80% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. >90% cover.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>5	>10	<5
Recruitment	Observed.	Observed.	Observed.
Organic litter	Thin, sparse.	Thin, sparse.	Well-developed to 2 cm depth.
Logs	Large logs placed along contours on upper slope. Some burned.	Large logs placed along contours on upper slope.	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2020

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	>5	>10	>20
Trees	Sparse. To 3 m height.	Sparse. To 3 m height.	>5 species, 12-14 m height. No significant canopy cover not assessable due to recent fire.
Understorey	Sparse, to 2 m height. Includes juvenile Eucalyptus and Acacia species.	Sparse, to 3 m height. Includes juvenile Eucalyptus and Acacia species.	Sparse. <10 species, 1-3 m height, No significant cover due to recent fire.
Groundcover	90% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 90% cover.	70% cover. Mixed native herbs and grasses.
Non-native species	>5	>10	<5
Recruitment	Observed.	Observed.	Regeneration observed.
Organic litter	Thin, sparse.	Thin, sparse.	Thin, sparse.
Logs	Large logs placed along contours on upper slope. Some burned.	Large logs placed along contours on upper slope.	Sparse fallen timber from burned trees.

Vegetation assessment treed areas 2019

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	>10	>15	>25
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.	>14 species, 1-3 m height, 10% cover
Groundcover	80% 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.	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2018

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.	>14 species, 1-3 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.	>10 fallen logs of >20 cm diameter present along transect.

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

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, 5 m slope length			0.34 8% gradient, 5 m slope length	0.09 1% gradient, 5 m slope length	0.89 20% gradient, 5 m slope length		0.52 12% gradient, 5 m slope length
Cover and management factor (C)	0.01 No appreciable canopy cover, 80-95% grassy groundcover					0.01 25% canopy cover of tall weeds or short brush, 80-95% grassy groundcover	0.01 25% canopy cover of tall weeds or short brush, 80-95% grassy groundcover	0.00 50% canopy cover of appreciable brush, 80-95% grassy groundcover
Erosion control practice factor (P)	1.3 Compacted					1.2 Consistent with trackwalking along contour		1.2 Consistent with trackwalking along contour
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	0.36 t/ha	0.36 t/ha	0.00 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 baileyana</i>					✓	✓	✓
<i>Acacia dealbata</i> subsp. <i>dealbata</i>					✓	✓	✓
<i>Acacia nana</i>					✓	✓	
<i>Acacia parramattensis</i>						✓	
<i>Acacia parvipinnula</i>					✓	✓	✓
<i>Acacia rubida</i>					✓	✓	✓
<i>Acacia</i> sp.					✓	✓	
<i>Acacia spectabilis</i>						✓	✓
<i>Amaranthus</i> sp.	✓	✓	✓	✓			
<i>Anagalis arvensis</i>	✓	✓	✓	✓			
<i>Brassica</i> spp.	✓	✓	✓	✓	✓	✓	
<i>Bursaria spinosa</i> subsp. <i>lasiophylla</i>					✓	✓	✓
<i>Cassinia arcuata</i>					✓	✓	
<i>Chenopodium</i> sp.						✓	
<i>Chloris truncata</i>	✓	✓	✓	✓	✓	✓	
<i>Cirsium vulgare</i>	✓	✓	✓	✓	✓	✓	
<i>Conyza bonariensis</i>	✓	✓	✓	✓	✓	✓	
<i>Cortaderia</i> sp.						✓	
<i>Cymbonotis</i> sp.					✓	✓	
<i>Cyperus eragrostis</i>		✓			✓		
<i>Dactylis glomerata</i>	✓	✓	✓	✓			
<i>Daviesia alata</i>					✓		
<i>Eragrostis</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Eucalyptus aggregata</i>					✓		

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Eucalyptus bensonii</i>							✓
<i>Eucalyptus cypellocarpa</i>						✓	
<i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i>							✓
<i>Eucalyptus dealbata</i>						✓	
<i>Eucalyptus dives</i>					✓	✓	✓
<i>Eucalyptus macrorhyncha</i> subsp. <i>cannonii</i>							✓
<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>							✓
<i>Eucalyptus melliodora</i>						✓	
<i>Eucalyptus pauciflora</i>					✓	✓	
<i>Eucalyptus pulverulenta</i>						✓	
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>						✓	✓
<i>Eucalyptus rubida</i> subsp. <i>rubida</i>							✓
<i>Eucalyptus</i> sp.					✓	✓	✓
<i>Euphorbia</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Festuca</i> sp.	✓	✓	✓	✓			
<i>Gamochaeta</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Geranium molle</i> var. <i>molle</i>	✓	✓	✓	✓	✓		
<i>Gnaphalium sphaericum</i>	✓	✓	✓	✓	✓		
<i>Hypochaeris radicata</i>	✓	✓	✓	✓	✓	✓	
<i>Juncus</i> spp.		✓		✓	✓		
<i>Lepidium</i> sp.	✓	✓	✓	✓			
<i>Leucopogon</i> sp.							✓
<i>Lissanthe strigosa</i> subsp. <i>strigosa</i>							✓

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Lolium perenne</i>	✓	✓	✓	✓			
<i>Malva neglecta</i>	✓	✓	✓	✓			
<i>Malva</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Medicago</i> sp.	✓	✓	✓	✓			
<i>Modiola carolina</i>	✓	✓	✓	✓	✓	✓	
<i>Oxalis corniculata</i>	✓	✓	✓	✓	✓	✓	
<i>Oxalis</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Paspalum</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Pattersonia</i> sp.	✓	✓	✓	✓			
<i>Persoonia</i> sp.							✓
<i>Phalaris</i> sp.	✓	✓	✓	✓			
<i>Plantago lanceolata</i>	✓	✓	✓	✓	✓	✓	
<i>Poa annua</i>	✓	✓	✓	✓	✓		
<i>Poa</i> spp.	✓	✓	✓	✓	✓	✓	✓
<i>Portulaca oleracea</i>		✓	✓	✓	✓	✓	
<i>Ranunculus</i> sp.	✓	✓	✓	✓	✓		
<i>Romulea minutiflora</i>	✓	✓	✓	✓			
<i>Rorippa</i> sp.	✓	✓	✓	✓			
<i>Rumex acetosella</i>	✓	✓	✓	✓	✓	✓	
<i>Solanum</i> sp.	✓	✓	✓	✓	✓	✓	
<i>Sonchus oleraceus</i>	✓	✓	✓	✓	✓	✓	
<i>Stellaria media</i>	✓	✓	✓	✓	✓	✓	
<i>Taraxacum officinale</i>	✓	✓	✓	✓			
<i>Themeda australis</i>					✓	✓	✓

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Trifolium arvense</i>	✓	✓	✓	✓	✓	✓	
<i>Trifolium campestre</i>	✓	✓	✓	✓	✓	✓	
<i>Trifolium pratense</i>	✓	✓	✓	✓	✓	✓	
<i>Trifolium repens</i>	✓	✓	✓		✓	✓	
<i>Trifolium subterraneum</i>	✓	✓	✓				
<i>Vulpia</i> sp.	✓	✓	✓				

Appendix E

Photo point monitoring to 2023



Transect 1 looking south 2014



Transect 1 looking south 2015



Transect 1 looking south 2016



Transect 1 looking south 2017



Transect 1 looking south 2018



Transect 1 looking south 2019



Transect 1 looking south 2020



Transect 1 looking east 2021 note that the transect 1 photo-monitoring point was inaccessible to the presence of livestock



Transect 1 looking south 2022



Transect 1 looking south 2023



Transect 2 looking southeast 2014



Transect 2 looking southeast 2015



Transect 2 looking southeast 2016



Transect 2 looking southeast 2017



Transect 2 looking southeast 2018



Transect 2 looking southeast 2019



Transect 2 looking southeast 2020



Transect 2 looking southeast 2021



Transect 2 looking southeast 2022



Transect 2 looking southeast 2023



Transect 3 looking southwest 2014



Transect 3 looking southwest 2015



Transect 3 looking southwest 2016



Transect 3 looking southwest 2017



Transect 3 looking southwest 2018



Transect 3 looking southwest 2019



Transect 3 looking southwest 2020



Transect 3 looking south 2021



Transect 3 looking south 2022



Transect 3 looking south 2023



Transect 4 looking west 2014



Transect 4 looking west 2015



Transect 4 looking west 2016



Transect 4 looking west 2017



Transect 4 looking west 2018



Transect 4 looking west 2019



Transect 4 looking west 2020



Transect 4 looking west 2021



Adjacent to Transect 4 looking south-west 2022



Transect 4 looking west 2023



Transect 5 looking west 2014



Transect 5 looking west 2015



Transect 5 looking west 2016



Transect 5 looking west 2017



Transect 5 looking west 2018



Transect 5 looking west 2019



Transect 5 looking west 2020



Transect 5 looking west 2021



Transect 5 looking west 2022



Transect 5 looking west 2023



Transect 6 looking east 2014



Transect 6 looking east 2015



Transect 6 looking east 2016



Transect 6 looking east 2017



Transect 6 looking east 2018



Transect 6 looking east 2019



Transect 6 looking east 2020



Transect 6 looking east 2021



Transect 6 looking east 2022



Transect 6 looking east 2023



Transect 7 looking east 2014



Transect 7 looking east 2015



Transect 7 looking east 2016



Transect 7 looking east 2017



Transect 7 looking east 2018



Transect 7 looking east 2019



Transect 7 looking east 2020

Note that Transect 7 was inaccessible in 2021 and 2022



Looking towards Transect 7 2022



Transect 7 looking east 2023



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



Quadrat 1 September 2018



Quadrat 1 September 2019



Quadrat 1 September 2020



Quadrat 1 November 2021

Note that Quadrat 1 was inaccessible in 2022



Quadrat 1 November 2023