Whitehaven

Reporting date: 31 March 2026
Submitted via email to epbcmonitoring@dcceew.gov.au

Environmental Event Report

Narrabri Underground Mine Stage 3 Extension Project

Application number:	EPBC 2019/8427
Licensee/Proponent:	Narrabri Coal Operations Pty Ltd Locked Bag 1002 Narrabri NSW 2390
Licensed Premises/Land:	Narrabri Coal Operations (NCO) 10 Kurrajong Creek Road Baan Baa NSW 2390

a) **Summary of the incident;**

Quarterly groundwater monitoring was completed in accordance with the Water Management Plan[1] (**the plan**); monitoring results for several locations (Table 1) have exceeded the groundwater impact assessment criteria listed in the plan. NCO have complied with the plan requirements and enacted the Trigger Action Response Plan (**TARP**). The TARP lists the following response when monitoring indicates an exceedance of water level and/or quality triggers:

- *Implement incident notification measures.*
    - Notification to NSW Department of Planning, Housing and Infrastructure (DPHI), and the Australian Government DCCEEW was completed on: 11 February 2026.
- *Engage a suitably qualified hydrogeologist to undertake an assessment and report on any identified changes/likely causes and recommendations.*
    - Results from monitoring bores with reported exceedance of trigger levels were provided to Australasian Groundwater & Environmental Consultants Pty Ltd (**AGE**) to undertake a hydrogeological review. The investigation report is provided as Attachment A.

Table 1: Summary of groundwater monitoring trigger value exceedances

Sample Date	Bore ID	Coordinates (MGA55)	Formation	Trigger Type	Trigger Value	Q1 2026 Monitoring Result
3/2/2026	P10	774066; 6616447	Napperby	Water Level	270.9mAHD [3]	262.67mAHD
				Water Quality- EC	9426 µS/cm [3]	13450 µS/cm
6/2/2026	P29	778541; 6619978	Napperby	Water Quality- EC	11337 µS/cm [3]	19260 µS/cm
6/2/2026	P32	778993; 6620335	Napperby	Water Quality- EC	2938 µS/cm [3]	3920 µS/cm

[1] Narrabri Mine- Water Management Plan LW203-206

Sample Date	Bore ID	Coordinates (MGA55)	Formation	Trigger Type	Trigger Value	Q1 2026 Monitoring Result
3/2/2026	P39A	782024; 6620076	Watermark	Water Quality- EC	5970 µS/cm [1]	6890 µS/cm
3/2/2026	P39B	782018; 6620077	Tullamullen Alluvium	Water Quality- EC	6546 µS/cm [3]	11360 µS/cm
2/2/2026	P53	776995; 6620655	Garrawilla	Water Quality- EC	1169 µS/cm [2]	2041 µS/cm
4/2/2026	P7	768998; 6624338	Pilliga Sandstone	Water Quality- pH	pH minimum - 6.0	5.14 pH

[1] ANZG (2018) livestock drinking water (beef cattle)
[2] Tier 1- bore specific 80th percentile
[3] Tier 2- bore specific 95th percentile

b) **Outcomes of an investigation, including identification of the cause of the incident**

AGE was requested to undertake an assessment of the exceedances and report on any identified changes/likely causes and recommendations. The investigation report is attached:

- *Narrabri Coal Mine- Hydrogeological Review of Monitoring Bore Exceedances Q1 2026*

Conclusions and recommendations for individual exceedances are contained within the attached report. A summary of findings and recommendations for further work are included in Table 2. This includes recommendations from the 2024 Annual Review that states that bores with repeated exceedances should consider the following:

- does the conclusion that changes are associated with climatic events remain true; and
- has a new adjusted baseline been established, if so, a review of the baseline data and trigger levels is recommended.
  - New trigger levels have been recommended for several bores (Table 2). The Water Management Plan has been revised to include the new trigger levels; submitted to NSW DPHI for approval on 12 December 2025.

For bores with no current recommendation for further work monitoring should continue with data reviewed quarterly to determine if bore has reached equilibrium or any other changes are noticeable.

Overall, the review indicated that the GWMP was followed and that the exceedances have not resulted in potential risk of environmental impacts to sensitive receptors.

Table 2: Summary of exceedances and recommendations for further work (Table 8.1 in attached AGE report)

Bore ID	Formation	Exceedance	Likely cause	New baseline / triggers established	Further work required
P7	Pilliga	pH	Natural variability of formation	No	Consider aquifer specific trigger
P10	Napperby	EC	Natural variations / major climate event	No	Remove from list of triggers and use as information only
P29	Napperby	EC	Saturation of unsaturated zone	N/A	No
P32	Napperby	EC	Saturation of unsaturated zone	N/A	No
P39A	Watermark	EC	Natural variations / major climate event / seepage from nearby dams	Tier 1 7,710 µS/cm Tier 2 8,031 µS/cm	Update triggers and sample groundwater quality from nearby bores
P39B	Alluvium	EC	Natural variations / major climate event / seepage from nearby dams	Tier 1 13,662 µS/cm Tier 2 14,198 µS/cm	Update triggers and sample groundwater quality from nearby bores
P53	Garrawilla	EC	Mixing with other groundwater and/or infiltration of water from REA	N/A	Review major ions and groundwater types against nearby SB3

c) **Details of the corrective actions that have been, or will be, implemented to address the incident and prevent recurrence;**

- New trigger levels have been recommended for several bores (Table 2). The Water Management Plan has been revised to include the new trigger levels; submitted to NSW DPHI for approval on 12 December 2025 and is currently under assessment.
- The recommendation associated with monitoring bore P53 for additional analysis of major ions will be completed and assessed against Q2 2026 groundwater monitoring results.

The outcomes of these actions will be summarised within the 2026 Annual Review to be submitted no later than 31 March 2027 (required under condition E11 of SSD-10269) and in the annual report detailing the outcomes of the water monitoring program (required under Condition 13 of EPBC 2019/8427).

d) **Details of compliance with requirements of the relevant management plan pertinent to the incident**

Water Management Plan- Groundwater Monitoring Program		
Section / Requirement	**Comments**	**Compliant**
4.2 Groundwater monitoring program Monitoring type- Standpipes Quarterly field EC and pH	All required groundwater monitoring wells are sampled quarterly in accordance with groundwater monitoring program.	Yes
5. Trigger Action Response Plan	NCO have initiated the required response for a Level 2 TARP trigger.	Yes

Level 2- Routine monitoring indicates water quality exceeds the EC trigger value over three consecutive monitoring events.		
6. Incidents and non-compliance As soon as practicable after becoming aware of an exceedance of performance criteria notify DPHI and provide a detailed report within 7 days.	As per table 5.1 TARP - Engage a suitably qualified hydrogeologist to undertake an assessment and report on any identified changes/likely causes and recommendations. - Implement reasonable and feasible remediation measures in accordance with hydrogeologist recommendations and in consultation with DPHI. NCO became aware of the exceedance of performance criteria on 10 February 2026 and provided incident notification on 11 February 2026. A hydrogeologist was engaged to undertake an assessment. There are no remediation measures recommended by the hydrogeologist. Recommendations have been provided in Table 2.	Yes

e) **Details of any communication with other stakeholders regarding the incident.**

Due to the generally high naturally occurring groundwater salinity in the area, there is limited existing groundwater abstraction in the immediate mining area other than for coal mine dewatering. No vulnerable receptors or active stock/irrigation bores are in the immediate area and therefore no immediate action is required outside of further investigation and monitoring.

The outcomes of the investigation and attached report have been provided to NSW DPHI.

Reported by:

Brent Baker
Environmental Manager

ATTACHMENT A

Narrabri Coal Mine - Hydrogeological Review of Monitoring Bore Exceedances Q1 2026, Australasian Groundwater & Environmental Consultants

Australasian Groundwater & Environmental Consultants

31 March 2026

Narrabri Coal Mine
Kamilaroi Highway
Narrabri NSW 2390

Attention: Brent Baker
via email: BrentBaker@whitehavencoal.com.au

Dear Brent,

Narrabri Coal Mine – Hydrogeological Review of Monitoring Bore Exceedances Q1 2026

1 Introduction

Narrabri Coal Operations Pty Ltd (NCOPL) routinely monitor groundwater levels and quality above and surrounding the Narrabri Coal Mine. Groundwater monitoring campaigns are conducted in accordance with the site Water Management Plan (WMP) [1]. Monitoring results have been reviewed against the 2024 revision of the WMP, which has been updated with water level and quality trigger criteria that align with the approved Extraction Plan for Long Wall (LW) 203-206 WMP[2]. Groundwater drawdown trigger levels are based on the latest revision of the site groundwater model[3]. As shown in Figure 2.1 water levels and quality are monitored by a network of standpipe monitoring bores and vibrating wire piezometers (VWPs). Data collected at these monitoring locations is reviewed quarterly by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) on behalf of NCOPL.

The Narrabri WMP includes Trigger Action Response Plans (TARP) for managing changes in groundwater levels and quality, and defines groundwater level and quality triggers. For water levels and bores where water is unsuitable for stock and irrigation, a two-tiered trigger system is used:

- Tier 1 trigger provides a method for assessing a gradual change in groundwater quality over the medium term; and
- Tier 2 trigger is intended to detect an event related change over the short term.

As indicated in sections 2 and 3, bores P10, P29, P32, P39A, P39B, P53 were identified as exceeding their Tier 2 water quality electrical conductivity (EC) trigger for three consecutive recordings, while P7 exceeded pH trigger lower level and P10 also exceeded water level trigger. As per the TARP, further review was required. AGE was commissioned by NCOPL to undertake this review of exceedances for Q1 2026 (reporting period).

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[1] Narrabri Coal Operations (2022) Stage 3 Groundwater Management Plan, revision date 01 December 2022.

[2] Narrabri Coal Operations (2025) Narrabri Mine Extraction plan water management plan LW203 – LW206, revision date 24 January 2025.

[3] AGE Consultants (2024) Narrabri Coal Mine Groundwater Model – Re-calibration Stage 2 MOD 7 v 01.01.

Brisbane (Head Office) Level 2, 15 Mallon Street Bowen Hills QLD 4006 t: (07) 3257 2055
Adelaide Office 13, 62 Queen Street Glenunga SA 5064 t: (07) 3257 2055
Newcastle 4 Hudson Street Hamilton NSW 2303 t: (02) 4962 2091
Perth 46B Angove Street North Perth WA 6006 t: (08) 6383 9970
Townsville Unit 1, 60 Ingham Road West End QLD 4810 t: (07) 4413 2020

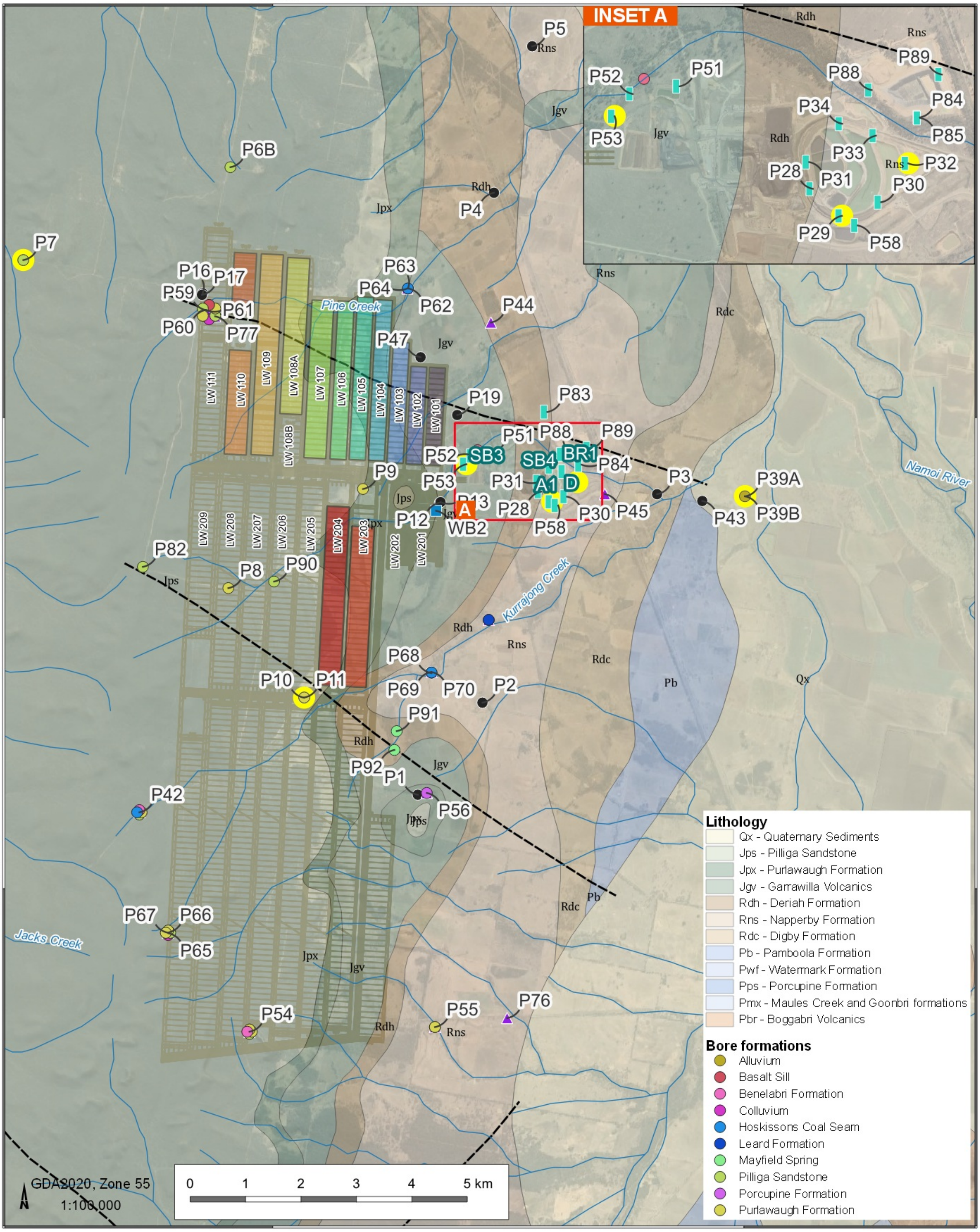
2 Reporting period exceedance bore descriptions

Details of bores with recorded exceedances for the reporting period (RP), including locations, installation depths, screened intervals and formations are listed in Table 2.1, bore locations are shown in Figure 2.1 and Figure 2.2. Further information on the trigger levels and exceedances is listed in Table 3.1, Table 3.2 and Table 3.3.

Table 2.1 Reporting period exceedance bore descriptions

Bore ID	Easting (GDA2020)	Northing (GDA2020)	Total depth (m bgl)	Screen interval (m bgl)	Target formation	Exceedance
P7	768998	6624340	90	78-90	Pilliga Sandstone	Water quality - pH
P10	774064	6616445	130	118-130	Napperby Formation	Water quality - EC Water level
P29*	778542	6619979	25	19-25	Napperby Formation	Water quality - EC
P32*	778993	6620335	15	9-14	Napperby Formation	Water quality - EC
P39A	782024	6620078	80	72-80	Watermark Formation	Water quality - EC
P39B	782019	6620079	32	15-30	Tulla Mullen Alluvium	Water quality - EC
P53*	776995	6620657	24	18-21	Garrawilla Volcanics	Water quality - EC

Notes: Coordinates are in GDA2020.
m bgl - metres below ground level.
*seepage monitoring bores.



LEGEND

- - - Faults

Drainage

Drainage

Minor

Planned underground mine workings

Monitoring Bores

Standpipe

Standpipe - seepage detection

Production - stock and domestic

VWP

Bores with exceedances

LW101, LW102, LW103, LW104, LW105, LW106, LW107, LW108, LW109, LW110, LW110A, LW111, LW203, LW204

Narrabri Mine Quarterly and Annual Reporting 2025 - 2026 (NAR5027.001)

Groundwater Monitoring Network

AGE

DATE 13/03/2026

FIGURE No: 2.1

Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
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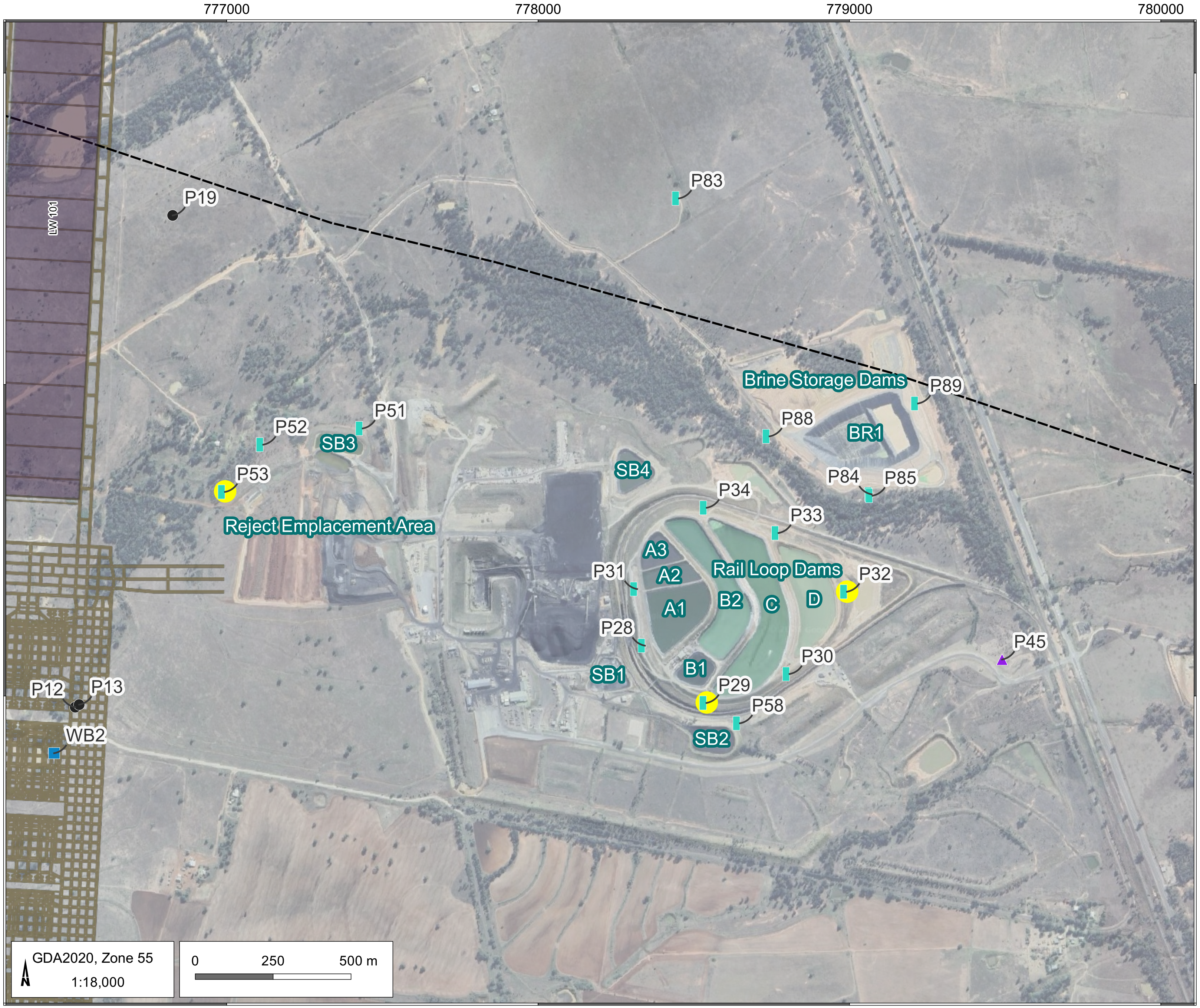

LEGEND

Underground mine workings
GunnedahCFnth100Fault_MGAz56

Monitoring Bores
- Standpipe
- Standpipe - seepage detection
- Production - stock and domestic
- VWP
- Bores with exceedances

Narrabri Mine Quarterly and Annual Reporting 2025-2026 (NAR5027.001)

Surface water storage and monitoring network

AGE

DATE
13/03/2026

FIGURE No:
2.2

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3 Reporting period trigger exceedances

Water quality (EC) triggers are defined in the WMP and extraction plans. For datasets with non-normal distribution, a rolling median is calculated from the eight most recent data points and plotted on a time series chart (control chart) and a two-tiered trigger approach is used. Two triggers are then identified as follows:

- Tier 1 – where the rolling EC median[4] exceeds the 80th percentile of long-term data; and
- Tier 2 – where three consecutive EC exceedances of the 95th percentile of the long-term data occur. If this occurs, the TARP (Level 2) will be initiated.

Bores with three consecutive exceedances of their listed EC trigger level are outlined in Table 3.1, pH exceedances in Table 3.2 and water level exceedances in Table 3.3.

Table 3.1 Bores with reportable EC exceedances

Bore ID	Formation	EC trigger (µS/cm)		Three consecutive exceedances (µS/cm)	EC Trend (previous 12 months – between Q1 2025 and Q1 2026)
		Tier 1	Tier 2		
P10	Napperby	8,894	9,426	13,820 (Aug 2025) 14,680 (Nov 2025) 13,450 (Feb 2026)	Overall decreasing trend with short term fluctuations from 15,120 to 13,450 µS/cm
P29*	Napperby	9,732	11,337	17,540 (Aug 2025) 19,590 (Nov 2025) 19,260 (Feb 2026)	Overall increasing trend with short term fluctuations from ~13,000 to ~19,000 µS/cm
P32*	Napperby	2,170	2,938	3,500 (Aug 2025) 3,640 (Nov 2025) 3,920 (Feb 2026)	Increasing trend with EC increasing from 1,902 to 3,920 µS/cm
P39A	Watermark	5,970		7,580 (Aug 2025) 7,020 (Nov 2025) 6,890 (Feb 2026)	Decreasing from 7,700 to 6,890 µS/cm
P39B	Tulla Mullen Alluvium	6,546		11,040 (Aug 2025) 12,090 (Nov 2025) 11,360 (Feb 2026)	Overall decreasing trend with short term fluctuations 14,360 and 11,360 µS/cm
P53*	Garrawilla	1,107	1,169	1,733 (Aug 2025) 2,041 (Nov 2025) 1,154 (Feb 2026)	Large fluctuations ranging up to approximately 1000 µS/cm

Note: *Seepage monitoring bores.

Table 3.2 Bores with reportable pH exceedances

Bore ID	Formation	pH (lower) (pH units)	pH (upper) (pH units)	Three consecutive exceedances (pH)	pH Trend (previous 12 months)
P7	Pilliga	6.0	8.5	5.01 (Aug 2025) 5.08 (Nov 2025) 5.14 (Feb 2026)	Increasing from 5.01 and 5.14

[4] For datasets with non-normal distribution, a rolling median is calculated from the eight most recent data points and plotted on a time series chart.

Table 3.3 Bores with reportable water level exceedances

Bore ID	Formation	Tier 1 (m AHD)	Tier 2 (m AHD)	Three consecutive exceedances (m AHD)	Water level trend (previous 12 months)
P10	Napperby	275.2	270.9	270.3 (Aug 2025) 265.1 (Nov 2025) 262.7 (Feb 2026)	Declining

4 Climate

Monthly rainfall and evaporation totals obtained from Scientific Information for Landowners (SILO) (DES, 2025)[5] are plotted in Figure 4.1 from 2008 to 2026 to capture climate variations prior to the onset of baseline data. Rainfall and evaporation trends show seasonal fluctuations, with rainfall generally highest from November to March. A period of reduced rainfall occurred between 2017 and the end of 2019, coinciding with increased evaporation. This was followed by a wetter period from 2020 to 2023, characterised by increased rainfall and reduced evaporation. From 2023 to the present, rainfall has again declined, while evaporation shows an increasing trend.

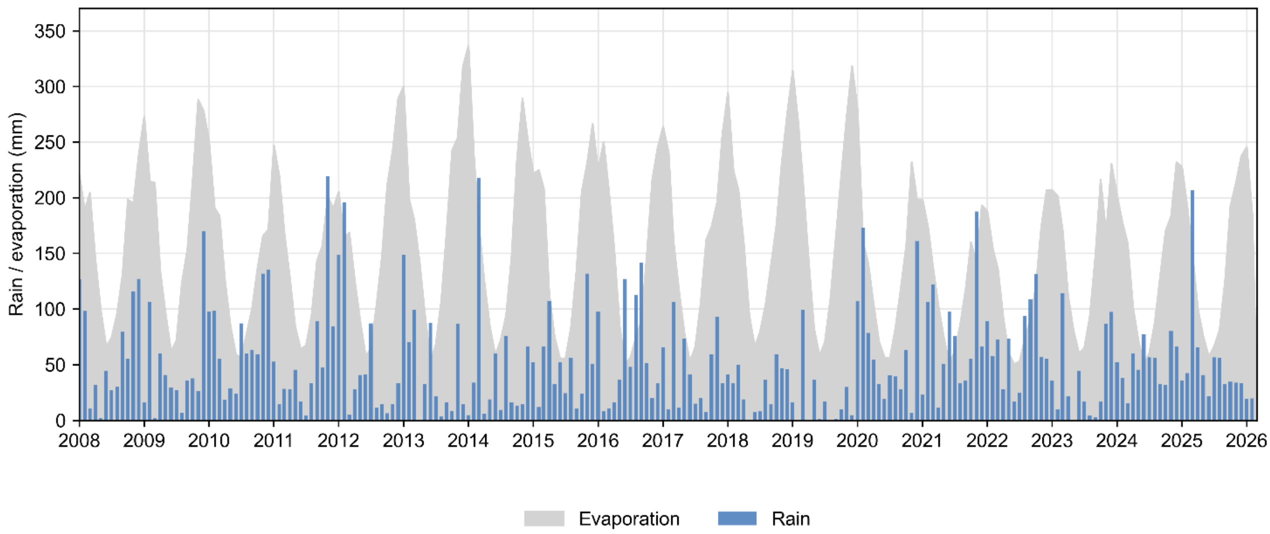

Figure 4.1 Monthly rainfall and evaporation 2008 to 2026

Cumulative rainfall departure (CRD) is calculated to place recent rainfall years into a historical context. The CRD is calculated by subtracting the long-term average monthly rainfall from the actual monthly rainfall, providing a monthly departure from the average. A rising slope in the CRD indicates periods of above-average rainfall, and a falling slope indicates below-average rainfall. CRD for the site is shown in Figure 4.2 using historical rainfall data obtained from the SILO website.

From 2017 to the end of 2019 a falling slope is recorded which coincides with the Tinderbox Drought, the driest three-year period on record for the region. Following this drought the region experienced a period of above average rainfall from early 2020 to 2023. Since then, rainfall fluctuations show similar trends to those experienced before the tinderbox drought (2008 to 2017).

[5] Department of Environment and Science. 2025. SILO Australian climate data from 1889 to yesterday, Downloaded from https://www.longpaddock.qld.gov.au/silo/ on 11 March 2026.

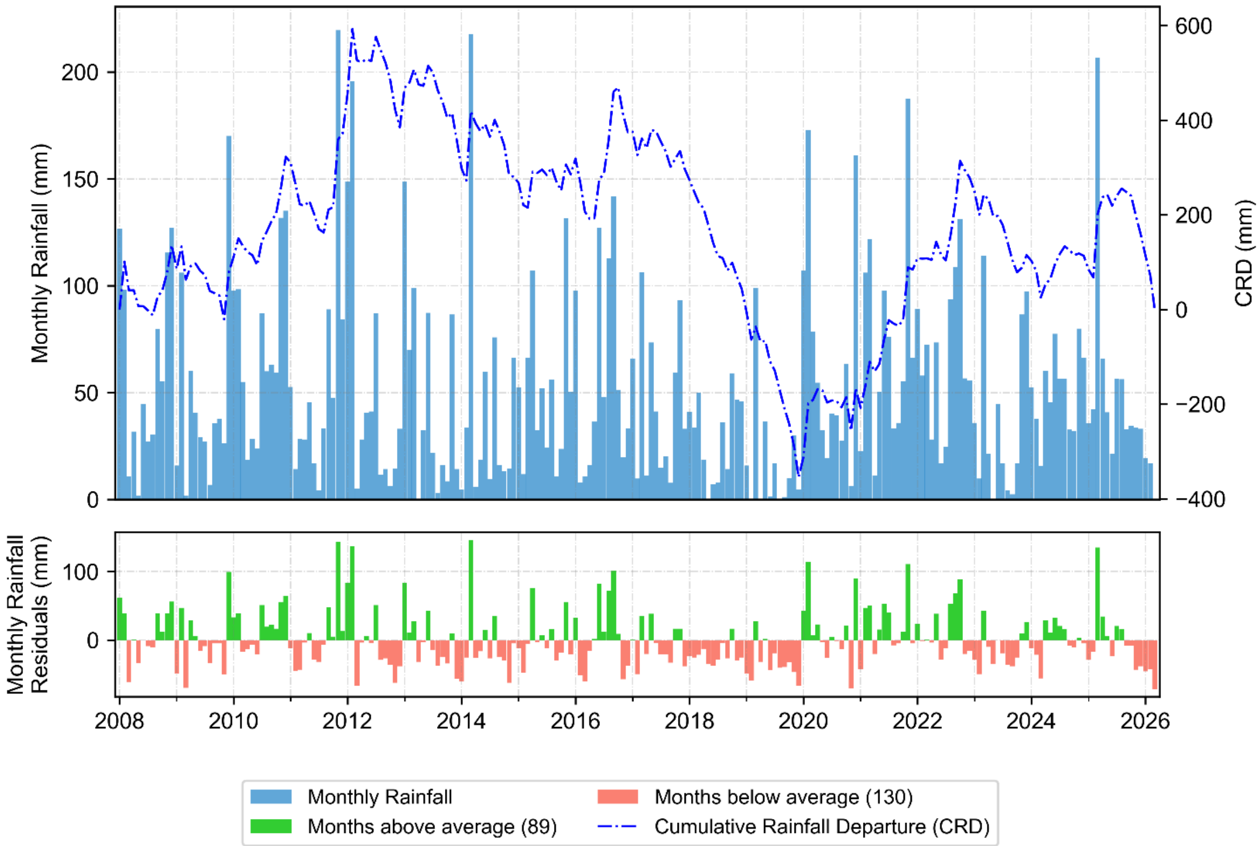

Figure 4.2 Cumulative rainfall departure and monthly rainfall from January 2008 to March 2026

5 Hydrogeological conceptual model

The Narrabri Mine is located within the Mullaley Sub-basin, which forms part of the larger Gunnedah Basin. The western half of the mining lease is also located on the eastern margin of the Surat Basin. Generally, the Surat and Gunnedah Basin stratigraphic units are characterised by a dip to the west at an angle of less than 10 degrees and outcrops along the Namoi River valley. The main stratigraphic units occurring in the vicinity of the Narrabri Mine are illustrated in Figure 5.1 and include the following:

- Quaternary alluvium consisting of unconsolidated clays, silts, sands, and gravels associated with the Namoi River and its tributaries;
- Surat Basin units including;
  - Jurassic Pilliga Sandstone, Purlawaugh Formation and Garrawilla Volcanics.
- Gunnedah Basin Units including;
  - Triassic Napperby Formation and Digby Formation; and
  - Permian Hoskissons Coal Seam, Arkarula Formation, Watermark Formation and Pamboola Formation.

Bores with recorded exceedances reviewed in this report are located within the Tulla Mullen alluvium (tributary of the Namoi River), Pilliga Sandstone, Purlawaugh Formation Garrawilla Volcanics, Watermark Formation, and Napperby Formation.

The Pilliga Sandstone is the youngest consolidated formation in the project area, and ranges in thickness from 0 to 120 m at the far western reach of the project area. The sandstone is predominantly a well sorted, fine to coarse grained quartz sandstone in medium cross beds (AGE, 2020).

The Purlawaugh Formation underlies the Pilliga Sandstone, which is a productive aquifer; and the former is typically comprised of fine grain lithic to labile sandstone and siltstone. The formation is reported to have a lower hydraulic conductivity than the Pilliga Sandstone and acts as an aquitard. The Purlawaugh Formation unconformably overlies the Garrawilla Volcanics, which was eroded by the deposition of the overlying sediments.

The Purlawaugh Formation unconformably overlies the Garrawilla Volcanics, a layer of alkali basalt rocks, trachytes and interbedded pyroclastis. The volcanics form the basal unit of the Surat Basin in the area and unconformably overlie the Triassic formations of the Gunnedah Basin.

The Napperby Formation is comprised of an upwards coarsening sequence of siltstone and sandstone laminate, interbedded with quartzose sandstone beds. The upper part of the Napperby Formation, above the Napperby Sill, has a higher proportion of sandstone. The Napperby Formation is generally unweathered rock with low permeability and is not a productive aquifer.

The Watermark formation consists of a fining-up sequence of intensely bioturbated silty sandstone to siltstone/claystone laminite with marine fossils, overlain by finely laminated siltstone/claystone, then a coarsening-up sequence (Australian Stratigraphic Units Database, 2023).

Recharge to the hydrostratigraphic units occurs through diffuse rainfall recharge as well as limited seepage through the non-perennial Kurrajong Creek and its tributaries when flowing. No aquifer discharge related to baseflow occurs near the mining area as groundwater levels are generally deep and well below the channels of the highly ephemeral creeks. Accordingly, no alluvium is present along these creeks, and they are either entirely disconnected (or possibly only very occasionally connected) to the Namoi Alluvium.

Two water sources dominate the mine area, the Gunnedah-Oxley Basin (GOB) Murray Darling Basin (MDB) Groundwater Source and the Great Artesian Basin (GAB) Southern Recharge Groundwater Source. The GOB MDB groundwater source covers an outcrop area of 1,128,000 hectares and comprises the Permian and Triassic rocks associated with the Gunnedah Basin and the younger Jurassic and Cretaceous rocks associated with the Oxley Basin. The GAB Southern Recharge Groundwater Source includes Cretaceous, Jurassic and Tertiary aged rocks including alluvial sediments and the outcropping Pilliga Sandstone.

Two high-productivity aquifers are located within the region: the Namoi River alluvium to the east and the Pilliga Sandstone to the west (Figure 5.1), all other formations are either considered aquitards or non-productive aquifers.

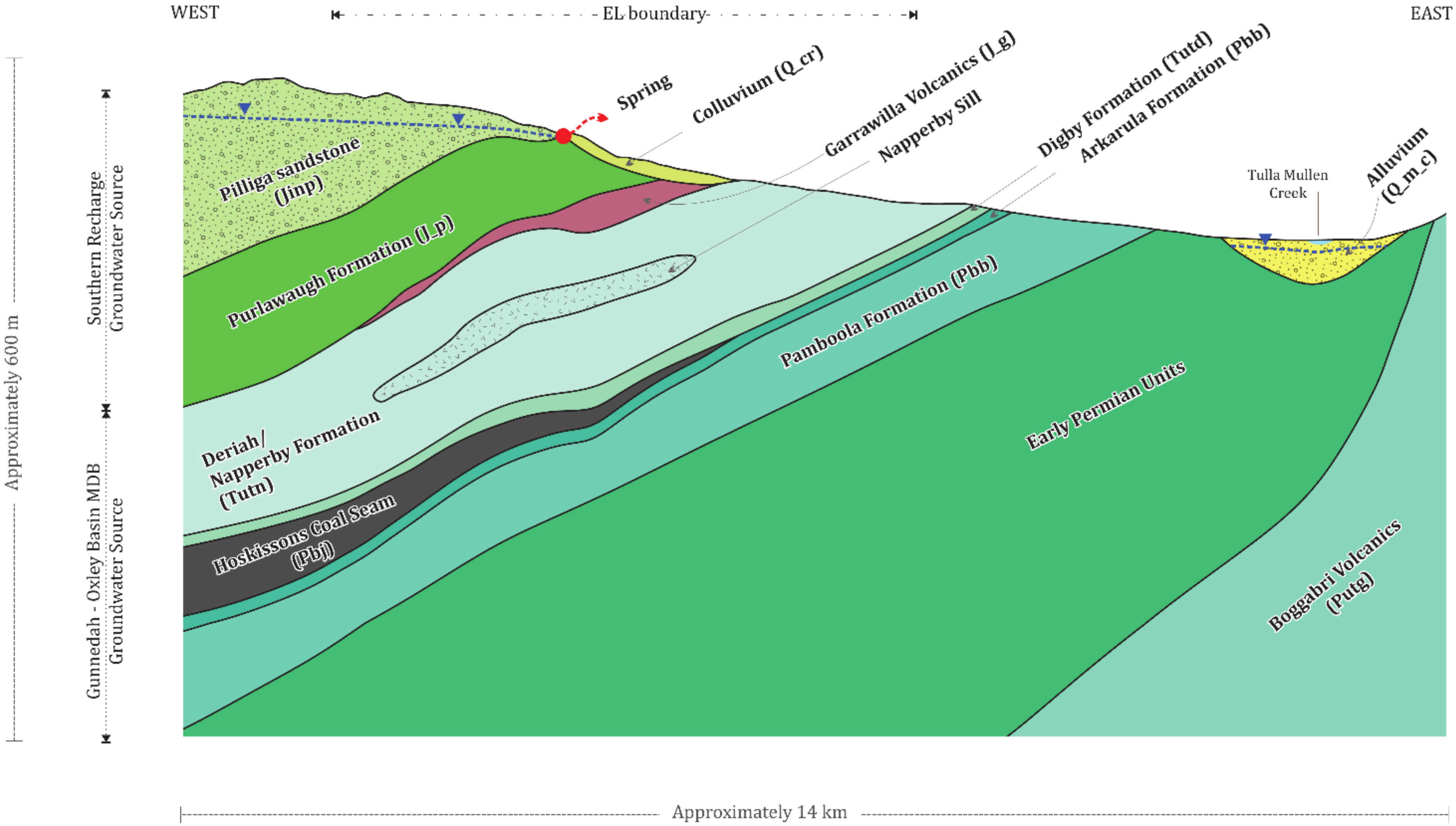

Figure 5.1 Conceptual geological cross section (AGE, 2020)[6]

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[6] Australasian Groundwater & Environmental Consultants (AGE) (October 2020). Groundwater Assessment Narrabri Mine Stage 3 Extension Project. Prepared for Narrabri Coal Operations Pty Ltd.

6 Mining progression and infrastructure

Mining at NCO commenced in June 2012 with longwall (LW) 101 (Figure 2.1) and progressed west, in April 2023 the 100 series longwalls were completed. The 200 series commenced in June 2023 with LW 203. Mining progression is outlined in Table 6.1.

A set of water storage dams, the Rail Loop dams (RLDs) are located next to the Coal Handling and Processing Plant (CHPP) (inset Figure 2.1 and Figure 2.2). Typically, water stored in dams D and B1 is fresh (low salinity), water in dams A1, A2, A3, SB1, SB2, SB3 and SB4 are brackish while water quality in dams B2, C and BR1 are saline. Dam D receives water from the Namoi River pump station and the water supply bore.

Table 6.1 Progression of longwall mining

Longwall	Start Date	Completion Date
Longwall 101	6 June 2012	1 June 2013
Longwall 102	22 July 2013	20 January 2014
Longwall 103	3 March 2014	20 October 2014
Longwall 104	1 December 2014	4 August 2015
Longwall 105	10 September 2015	16 May 2016
Longwall 106	20 June 2016	10 March 2017
Longwall 107	19 April 2017	22 July 2018
Longwall 108	16 September 2018	17 November 2019
Longwall 109	6 January 2020	7 November 2021
Longwall 110A	22 December 2020	15 June 2022
Longwall 110B	21 July 2022	17 April 2023
Longwall 203	05 June 2023	12 April 2025
Longwall 204	14 June 2025	28 July 2026*
Longwall 205	11 September 2026*	23 September 2027*
Longwall 206	8 November 2027*	22 October 2028*

Note: *planned extraction.

7 Review of monitoring data

Potential causes of changes in groundwater quality at and around coal mines are both natural and anthropogenic, and typically include:

1. **natural**: a reduction in recharge (causing less dilution) or an increase in evaporation (causing more concentration) or increase in recharge (causing mobilisation of salts) due to climate factors; and/or
2. **anthropogenic/natural**: seepage from surface sources of water that have salinity elevated above groundwater levels and likely connected to aquifer systems directly or indirectly through lagged recharge; and/or
3. **anthropogenic**: groundwater mixing with groundwater from adjacent areas of hydrostratigraphic units due to permitted mine dewatering and/or third-party groundwater users (e.g. irrigation) that may cause changes or reversals in hydraulic gradient; and/or
4. **anthropogenic**: geochemical solute release due to oxidation and acid-rock drainage.

To determine the possible causes of water quality and level exceedances for the reporting period, this review encompasses the following tasks:

- undertake a first-order data review to identify any unexpected outliers or data errors;
- review results against baseline monitoring for the bore and against historical trends (if available);
- compare with trends in nearby bores within the same aquifer;
- investigate links to operational activities and external influences (e.g. climatic data) including:
  - natural climate factors;
  - from surface sources;
  - mining induced seepage or mixing; and
  - solute release.
- assess potential risk of environmental impacts to sensitive receptors; and
- review the current monitoring regime and asses if further work or monitoring is required.

7.1 Tulla Mullen alluvium bores

7.1.1 P39B - water quality - EC exceedance

Bore P39B is located approximately 6 kilometres (km) east of mining between Tulla Mullen and Kurrajong creeks and is screened from 15 to 30 meters (m) below ground level (bgl). The bore is co-located with bore P39A installed in the Watermark formation from 72 to 78 m bgl. P39B was installed in mid-2016, just prior to the onset of the Tinderbox Drought. From installation to 2021 water levels decreased (about 0.5 to 1 m) while EC increased with some fluctuations (Figure 7.1). From 2021 to 2026, groundwater levels increased by approximately 2.25 m. Over the same period, EC values also increased, although with marked temporal fluctuations. Figure 7.1 presents the EC values measured both in the field and in the laboratory. The most recent measurements, recorded in February 2026 (11,360 µS/cm for Field EC and 11,700 µS/cm for laboratory EC), have reduced in comparison to the EC of 12,090 µS/cm recorded in November 2025, supporting the fluctuating EC trend.

Groundwater levels recorded at P39A (Watermark) and P39B (Alluvium) (Figure 7.2) have historically remained at similar levels with a slight upwards gradient from the Watermark Formation to the alluvium being recorded prior to 2022. From 2022 onwards, during which groundwater levels were recovering, the hydraulic gradient changed to a downwards gradient from the alluvial bore to the Watermark Formation bore.

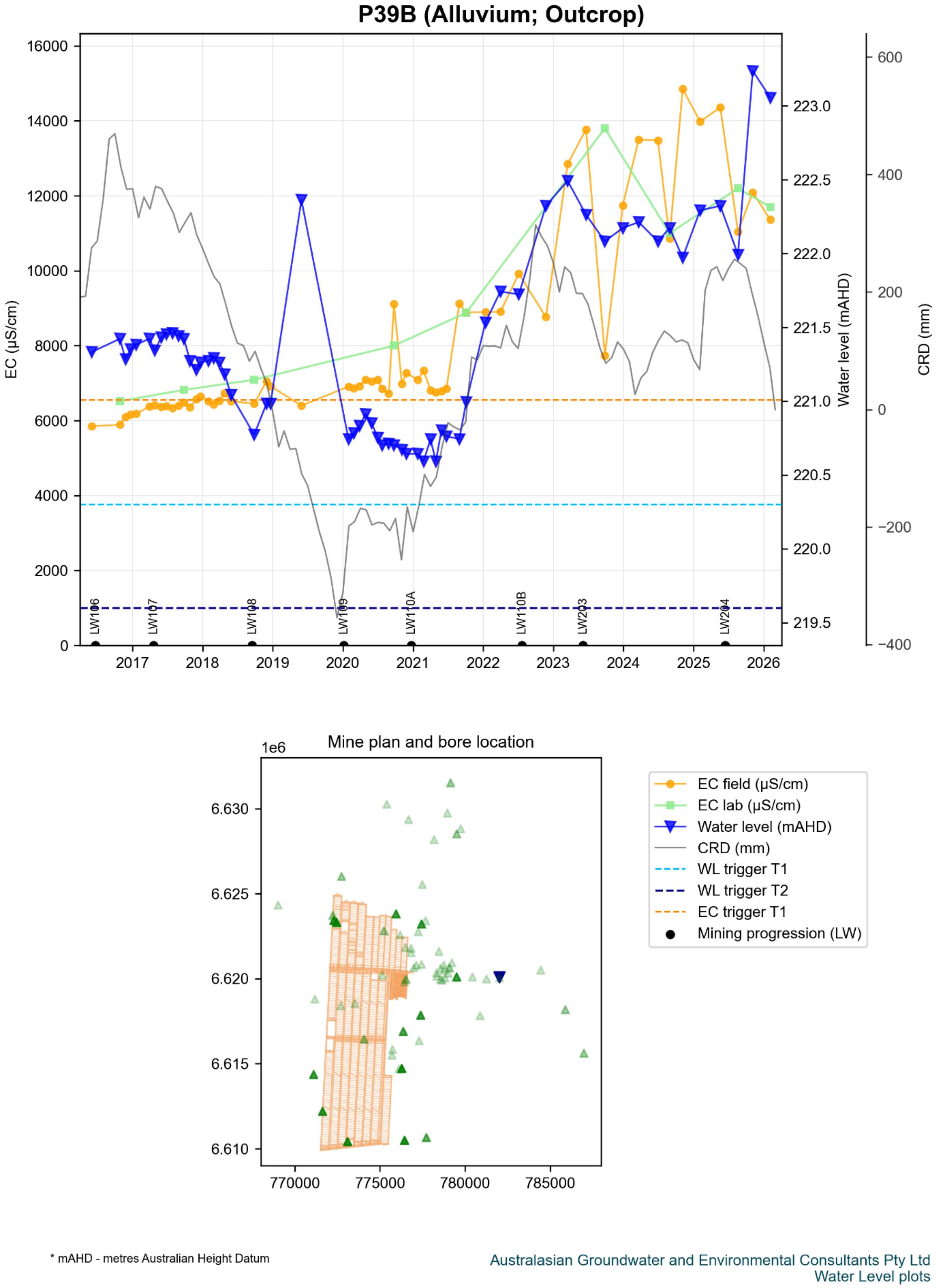

Figure 7.1 P39B EC field and laboratory measurements plotted with water levels

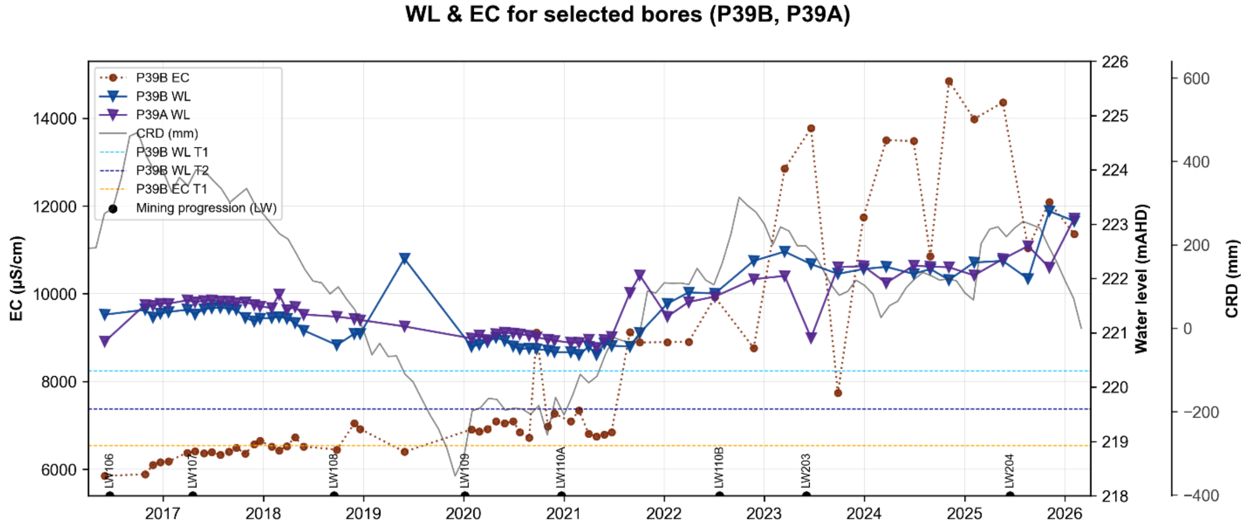

Figure 7.2 P39A and P39B groundwater elevations with P39A EC

Major and minor ion chemistry indicates that water sampled at bore P39B sampled from the Tulla Mullen Alluvium, plots as sodium–chloride (Na–Cl) type groundwater (Figure 7.3). This composition is similar to groundwater samples from the Watermark Formation (bores P43 and P39A) and the Pamboola Formation (bore P3).

In contrast, other Namoi Alluvium groundwater monitoring bores located further to the east (WB7) and southeast (WB5a and WB5b) of P39B exhibit different hydrochemical characteristics. The major ion composition at these locations is characterised by a greater relative contribution of calcium (Ca) compared to sodium and potassium (Na–K). Accordingly, groundwater samples from the Namoi Alluvium predominantly display a calcium–bicarbonate ($Ca–HCO_3$) or mixed hydrochemical facies.

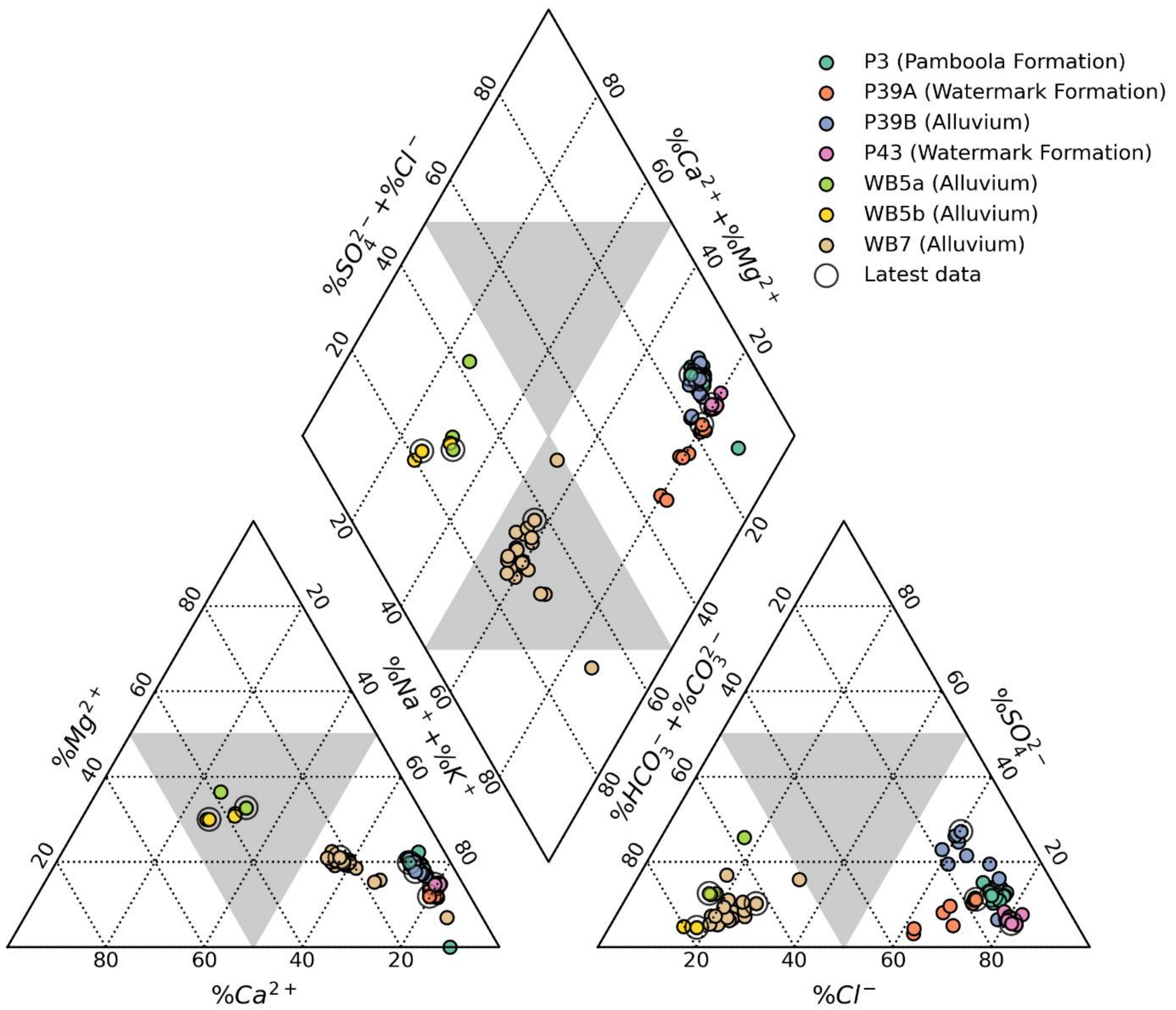

Figure 7.3 Piper Diagram of P39B and proximal bores

7.1.1.1 Natural climate factors

P39B is installed within sediments associated with Tulla Mullen Creek, which comprises a laterally unconfined, continuous channel characterised by low sinuosity (relatively straight planform) and a predominantly fine-grained channel bed. Groundwater levels at the bore range from approximately 4.9 m bgl to 7.6 m bgl.

Although rainfall conditions remained above average from the end of the Tinderbox Drought through to mid-2022, as shown on the hydrograph in Figure 7.1, groundwater levels did not begin to recover until early 2021. The approximately two-year lag between the cessation of drought conditions and the onset of groundwater recovery is interpreted to reflect slow recharge and infiltration processes associated with the fine-grained sediments of the Tulla Mullen Creek alluvium.

The most pronounced groundwater level response occurred between mid-2021 and 2023, when water levels rose from approximately 7.5 m bgl to 5.7 m bgl over a period of approximately 23 months. This interval also corresponds to the most rapid change in EC, increasing from 6,790 µS/cm to 12,850 µS/cm over the same period. This is one of two distinct periods of increasing EC evident in the monitoring record. The other comprises a gradual increase in EC coinciding with declining groundwater levels during the drought period, likely reflecting reduced recharge and dilution, resulting in concentration of dissolved salts.

During the recovery phase, after the drought, the rate of increase in EC has been higher. This response is interpreted to reflect mobilisation of salts that accumulated in the soil profile and shallow subsurface during the prolonged hot and dry conditions of the drought, which were subsequently flushed into the groundwater system as recharge increased and water levels recovered.

7.1.1.2 Seepage from surface sources

A review of Digital Earth Australia (DEA) water observations[7] for the area surrounding the bores (Figure 7.4) shows little to no surface water present during the Tinderbox drought (2019). In 2020 and 2021 surface water was observed in 20 to 30% of observations. DEA images show an increase in persistent surface water post-drought with several surface water bodies present that were not present during the drought.

No surface water quality data are available for Tulla Mullen Creek or nearby dams; therefore, the potential contribution of seepage from these surface water bodies as a source of elevated EC cannot be confirmed. Nevertheless, the presence of persistent surface water features following the drought suggests that seepage from surface water sources is likely to contribute to recharge of the shallow groundwater system. The dam located approximately 250 m to the west and upgradient of the P39 bores should be sampled to assess the hydrochemical facies of the water and potential recharge to the bores.

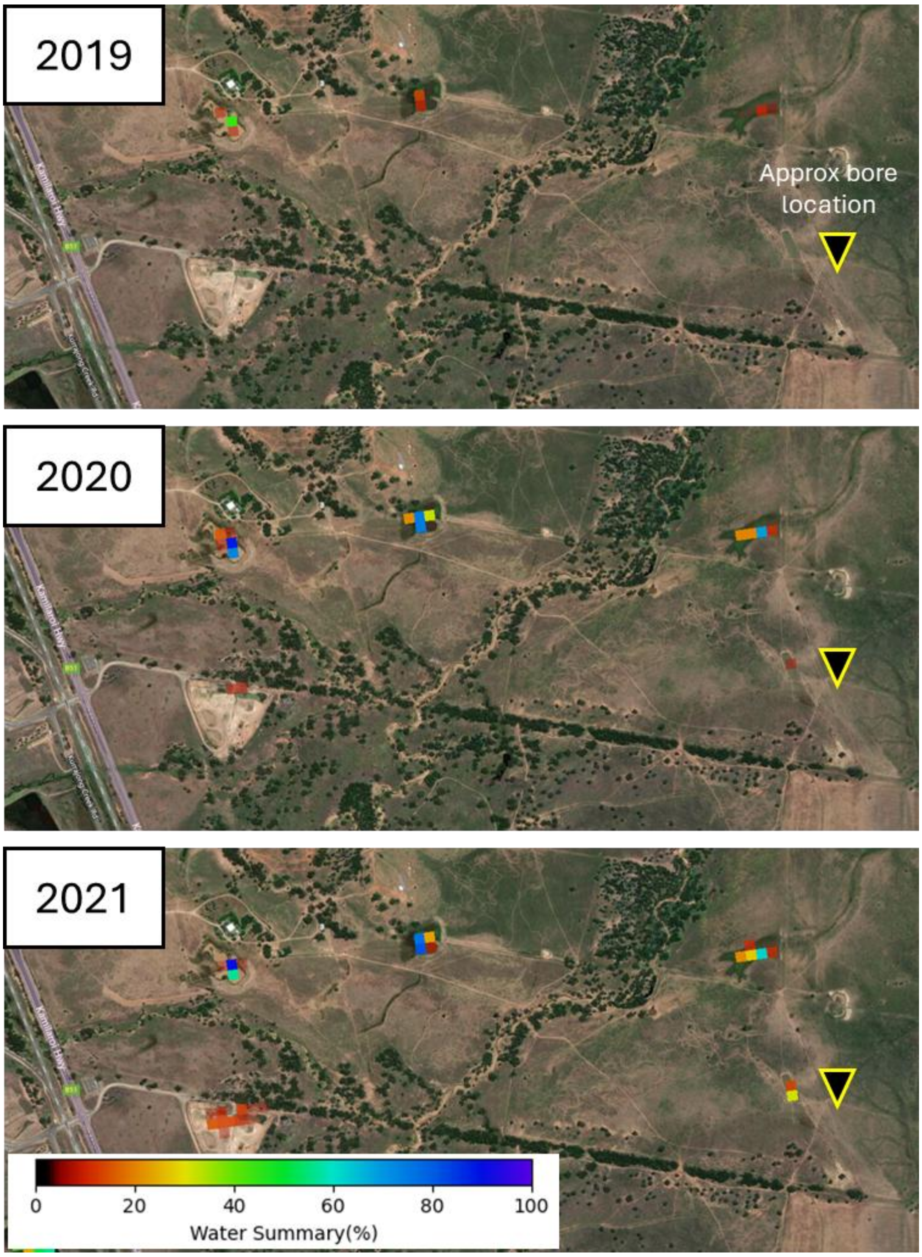

Figure 7.4 DEA water observations

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[7] The DEA Annual Water Observation Statistic is a set of calendar year statistical summaries of the DEA Water Observations product that combines satellite observations, that occur within each calendar year from 1986 to present, into summary products that help the understanding of surface water across Australia.

7.1.1.3 Mining-induced mixing

Groundwater levels recorded at bores P3 (Pamboola), P43 (Watermark), P39A (Watermark) and P39B (Alluvium) either remain stable (P3 and P43) or fluctuate with changes in rainfall (P39A and B). The lack of mining-induced depressurisation indicates that there is likely limited interconnectivity between the alluvium and the deeper coal seams and that mining-induced mixing is not a likely cause of elevated EC.

7.1.1.4 Solute release

The bores are located approximately 3 km to the east of the rail loop dams and 7 km from active underground mining; lateral migration of solutes through the westerly dipping formations from the dam complex is considered unlikely. Bores located between the dam complex and bore P39B do not show a similar increasing EC trend.

7.1.2 Conclusion and recommendations

Trends observed in the EC and groundwater level data indicate that the likely cause of EC increases is due to two significant climate events: the Tinderbox Drought from 2017 to 2020 and the subsequent period of increased rainfall from 2020 to late 2022. The steady increase in EC observed during the Tinderbox Drought is likely due to reduced recharge from rainfall and diminished contributions from the Kurrajong and Tulla Mullen Creeks. Following the drought, as groundwater levels began to recover, EC values rose more sharply and exhibited greater fluctuations. This post-drought increase in salinity is potentially attributed to accumulation and concentration of salts (as a result of preceding dry spells and associated high evapouration) seeping from near-surface strata in the unsaturated zone to deeper strata within the saturated zone, driven by increased recharge.

Given the natural causes of these mechanisms, no immediate action is required.

7.1.3 Potential impacts

Increases in EC are a likely result of long-term natural conditions, with no mining-induced impacts likely. Before the increase in EC in 2021 background EC measurements ranged from 6,000 to 7,000 µS/cm with values now ranging from 8,000 µS/cm to 14,000 µS/cm. Background salinity indicates saline water; however, within the acceptable ranges for most livestock e.g. TDS of 4,000 to 5,000 mg/L (2,680 µS/cm to 3,350 µS/cm) for cattle and 4,000 to 10,000 mg/L (2,680 µS/cm to 6,700 µS/cm) for sheep[8]. If this groundwater is used for livestock watering, the increase in salinity may result in loss of production and a decline in livestock condition and health.

7.2 Pilliga Sandstone Bores

The Pilliga Sandstone monitoring bores at NCOPL are all situated on the eastern edge of the western dipping formation. The existence and thickness of the formation may differ from what has been inferred, and saturated conditions within the Pilliga have been found to be highly localised and not specifically related to depth.

7.2.1 P7 - water quality - pH exceedance

Bore P7, screened from 78 m bgl to 90 m bgl in the Pilliga Sandstone, has recorded stable water levels and EC measurements for the past 5 years. From mid-2020 pH levels have decreased and have dropped below the minimum pH threshold of 6 (Figure 7.5). Laboratory (lab) pH measurements declined between 2022 and 2024. From 2024 to 2026, pH shows an increasing trend, although values persist to remain below the minimum pH threshold of 6; however, they are more consistent with historical trends. A report prepared by CSIRO for the Gas Industry Social and Environmental Research Alliance (GISERA) discusses distinct spatial zonation within the Pilliga Sandstone (Raiber et al 2022). Based on the work of Raiber et al 2022 the characteristics of the Pilliga sandstone within this zone include low EC (less than150 µS/cm), low pH (less than 6) and generally low major ion concentrations.

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[8] ANZG. 2023. Livestock drinking water guidelines. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra.

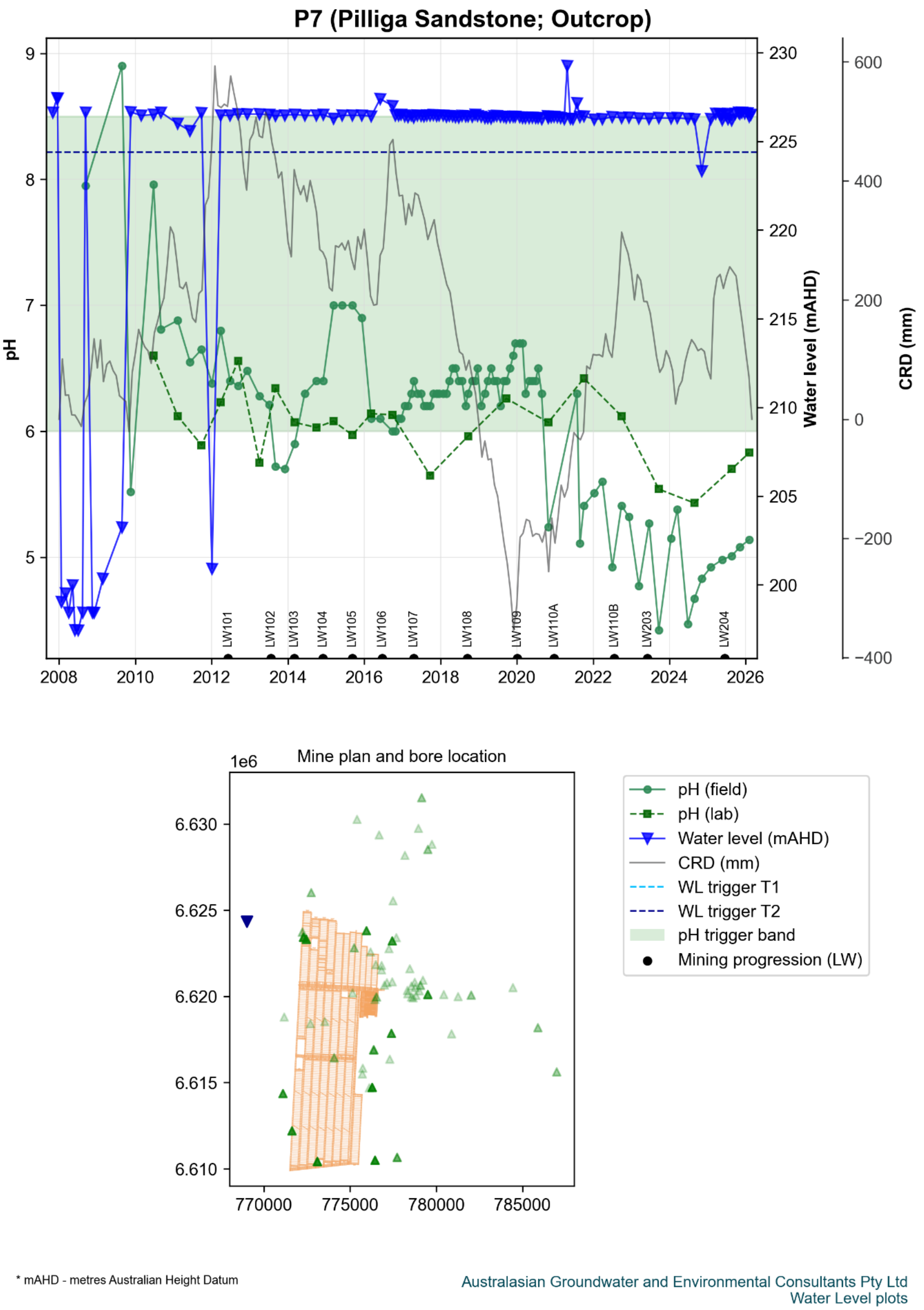


Figure 7.5 P7 pH field and laboratory measurements plotted with water levels

7.2.1.1 Natural climate factors

The decrease in pH coincides with the end of the Tinderbox Drought; however, no changes in water levels or EC are recorded at the same time. The increase in precipitation provides a possible source of acidity.

Changes in pH are likely due to natural fluctuations; however, further monitoring is required to confirm this. There appears to be drift/error in the field measurements, laboratory measurements do not record similar drift and fluctuations.

7.2.1.2 Seepage from surface sources

No surface water is located near this bore therefore seepage from surface sources is unlikely.

7.2.1.3 Mining-induced mixing

Groundwater chemistry recorded at bore P7 plots as a sodium-chloride (Na-Cl) type water (Figure 7.6), a linear mixing trend in the anions is visible with a relative increase in bicarbonate. The linear mixing trend does not coincide with the decreasing field pH trend.

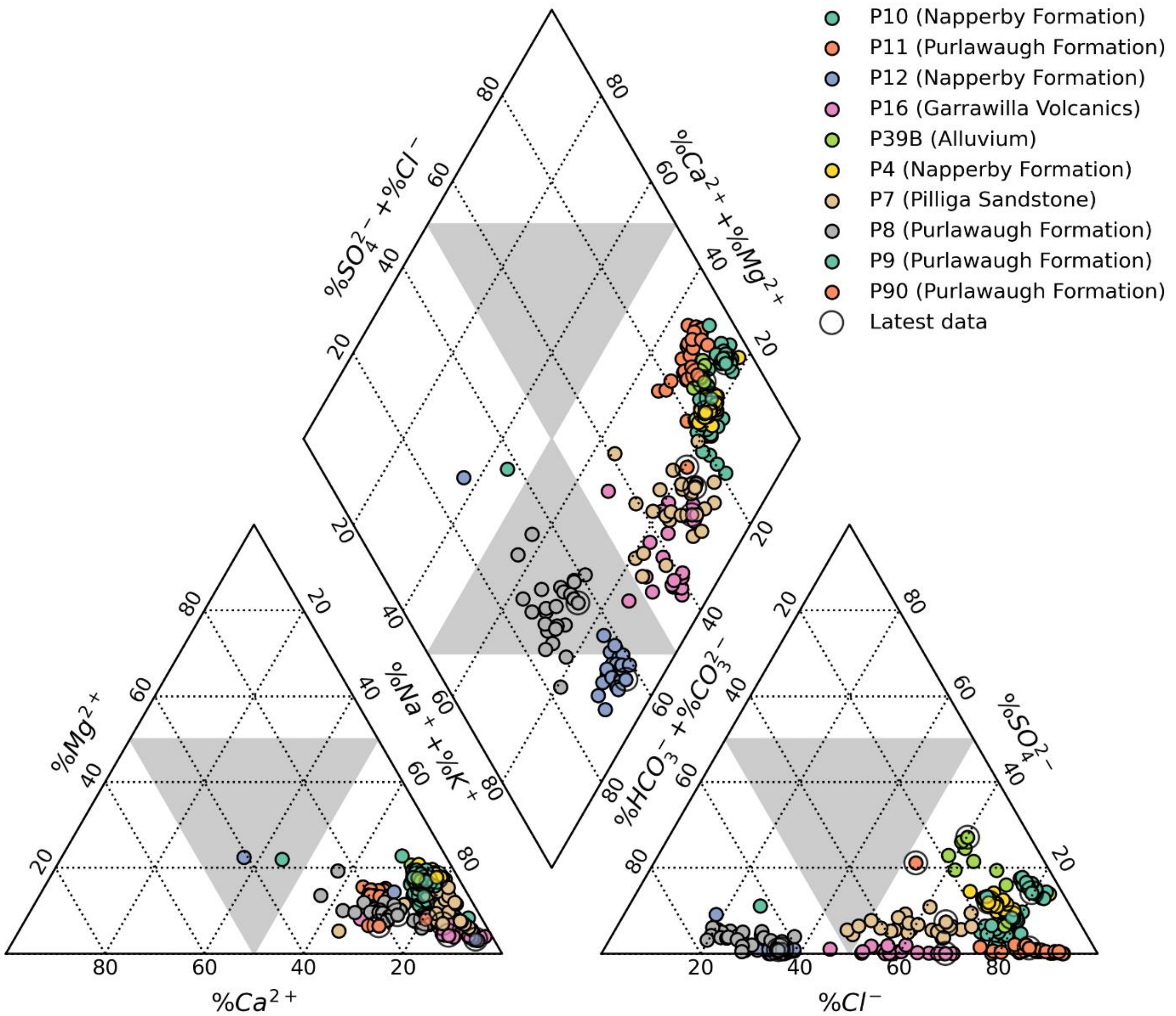


Figure 7.6 P7 and surrounding bores Piper Plot

7.2.1.4 Solute release

Pilliga Sandstone is not predicted to have significant impacts from mining in part due to the presence of multiple formations between the Hoskissons Coal Seam and the Pilliga Sandstone including the Digby Conglomerate, Napperby Formation (low permeability), Garrawilla Volcanics and Purlawaugh Formation (aquitard) (AGE, 2020). Groundwater samples collected underground from LW203 (located approximately 7.6 km southeast of P7) records pH from 5.3 to 7.7.

7.2.2 Conclusion and recommendations

Groundwater within the Pilliga at P7 has a low baseline pH, and subsequent decreases in pH trigger the lower trigger level (pH 6.0). Multiple monitoring bores within the mining area have also recorded a decreasing pH trend with associated variable fluctuations. Sensor drift for field equipment is a possible means for the decreasing field trend; however, in most cases have an associated decreasing pH recorded in laboratory measurements, indicating that the decreasing trend is real. The timing of the decreasing pH across the site with the end of the Tinderbox drought indicates causes are likely attributable to increased recharge. Historical pH of the Pilliga Sandstone is variable across the formation and is often lower than 6 and as such the recently recorded low pH are within this range. Work completed by (Rabier et al, 2022) support the low pH range identified in this area.

7.2.3 Potential impacts

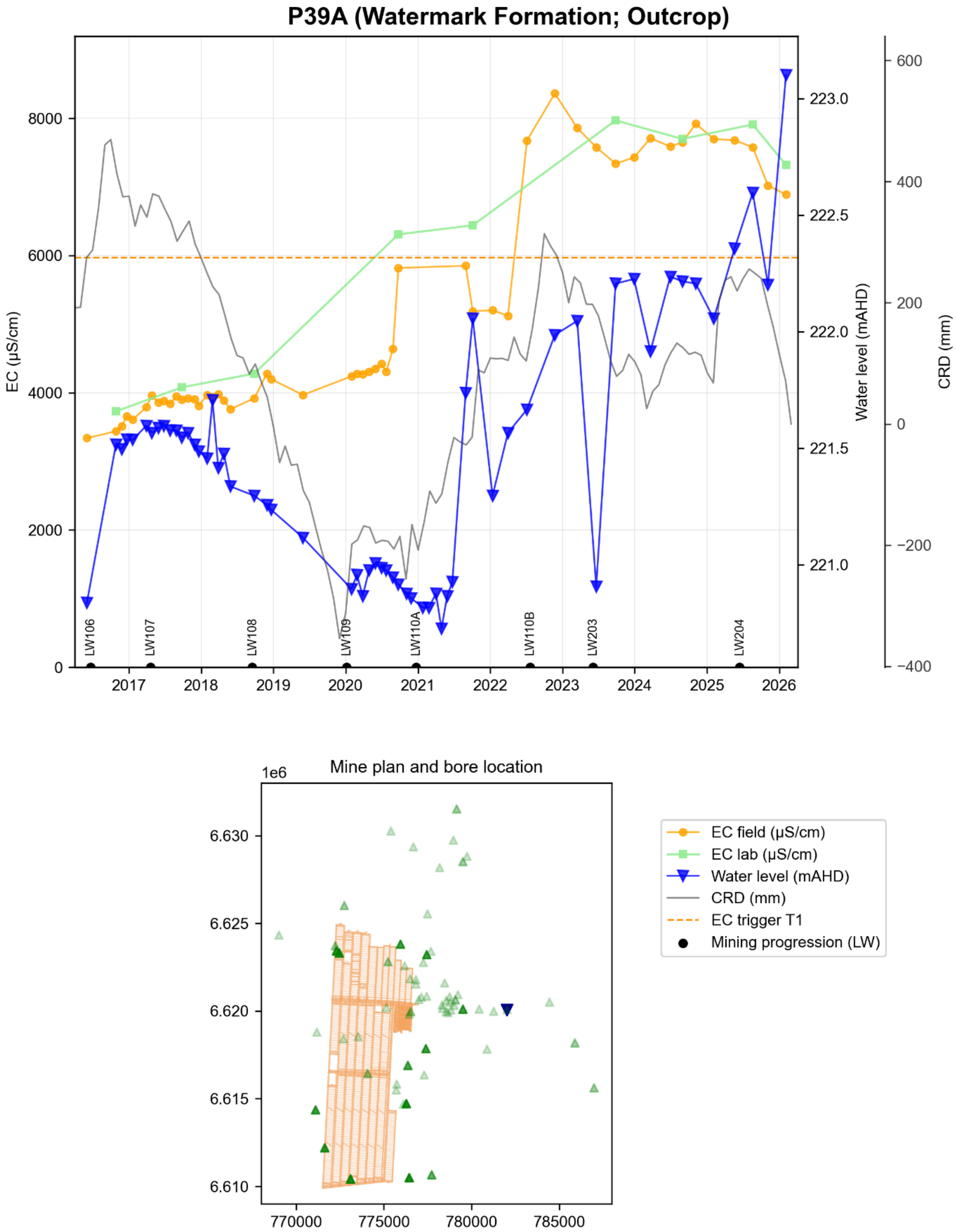
Hydrochemical studies conducted by Raiber et al[9]found that water of the Pilliga Sandstone often records pH lower than 6. Hierarchical cluster analysis (HCA) identified a cluster predominantly comprising bores sampled within the Pilliga region, exhibiting an average pH of 5.9. Considering the naturally low pH and baseline conditions, further reductions in pH are not anticipated to exert a significant impact on the groundwater system and would likely be driven by natural causes.

7.3 Watermark Formation Bores

7.3.1 P39A - water quality - EC exceedance

Bore P39A is installed approximately 6 km east of mining between Tulla Mullen and Kurrajong Creeks from 72 to 78 m bgl. The bore was installed just prior to the Tinderbox Drought and as with bore P39B demonstrates a lag from the end of the Tinderbox Drought to groundwater level recovery, as groundwater levels commenced recovering the EC values show a sharp increase with large (~3,000 µS/cm) fluctuations (Figure 7.7).

[9] Raiber, M., Martinez, J., Suckow, A., Deslandes, A., & Gerber, C. 2022. Assessment of the influence of geological structures on aquifer connectivity in the Pilliga Forest, NSW – an integrated hydrogeological, geophysical, hydrochemical and environmental tracer approach. A technical report from GSIRO to GISERA.



* mAHD - metres Australian Height Datum

Australasian Groundwater and Environmental Consultants Pty Ltd
Water Level plots

Figure 7.7 P39A EC field and laboratory measurements plotted with water levels

7.3.1.1 Natural climate factors

As with bore P39B (Tulla Mullen alluvium) changes in EC are marked by two distinct periods, the first a steady increase in EC observed during the Tinderbox Drought which is likely due to reduced recharge from rainfall and diminished contributions from the Kurrajong and Tulla Mullen Creeks. As with P39B, following the drought, as groundwater levels began to recover, EC values rose more sharply and exhibited greater fluctuations. This post-drought increase is attributed to the mobilisation of salts that had accumulated in the unsaturated zone during the dry period.

Water levels recorded at P39B (Tulla Mullen Alluvium) and P39A (Watermark Formation) are similar, have similar fluctuations in EC trends, the natural climate factors influencing P39B appear to also be influencing groundwater quality and level recorded at P39A.

7.3.1.2 Seepage from surface sources

Nearby surface water storage may contribute to elevated salinity; however, no surface water quality is available to cross reference.

7.3.1.3 Mining-induced mixing

No mixing trends are identified with other nearby formations, water type plots as Na-Cl type (Figure 7.3).

7.3.1.4 Solute release

The bore is located approximately 7 km east of active mining and 3 km east of rail loop dams; as such, solute release from these sources is unlikely without observable trends in bores located nearby.

7.3.2 Conclusion and recommendations

Mechanisms for change with the Watermark bores appear to be the same as with other formations experiencing EC exceedances. Groundwater EC trends are similar to those recorded in the Napperby Formation, as such, recommendations are the same as for Napperby Formation which include continued monitoring followed by a review of EC baseline once bores have reached a new equilibrium and further sampling of surface water quality in nearby farm dams.

7.3.3 Potential impacts

EC measurements at bores P43 and P39A indicate the presence of naturally saline groundwater. As such, further increases in salinity are unlikely to result in significant impacts to the system.

7.4 Napperby Formation Bores

Three Napperby Formation bores have exceeded water quality (EC) triggers, these are shown together in Figure 7.8 and are further discussed in the sections below.

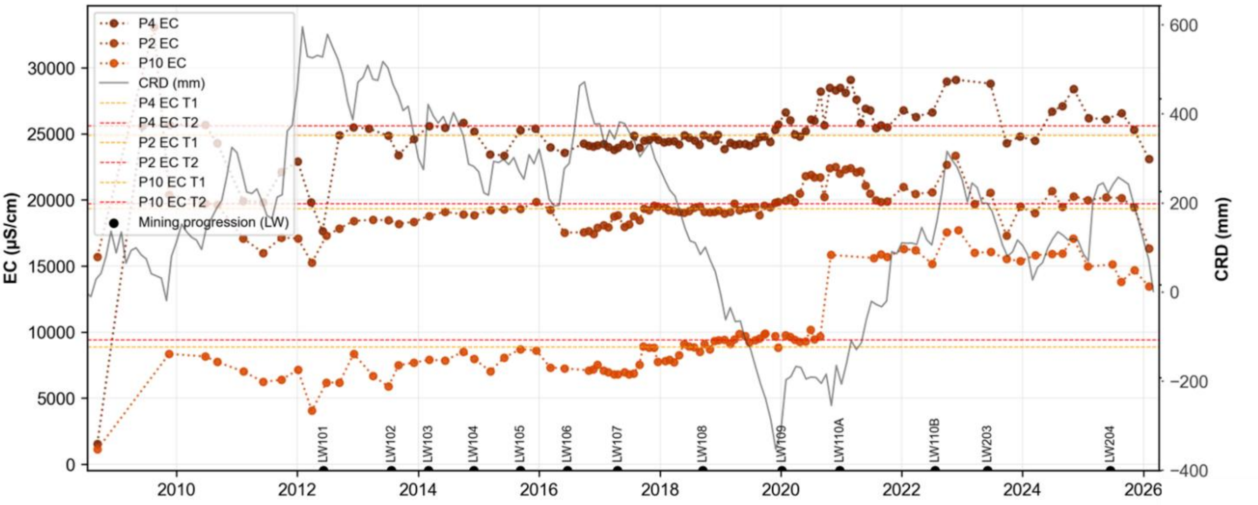
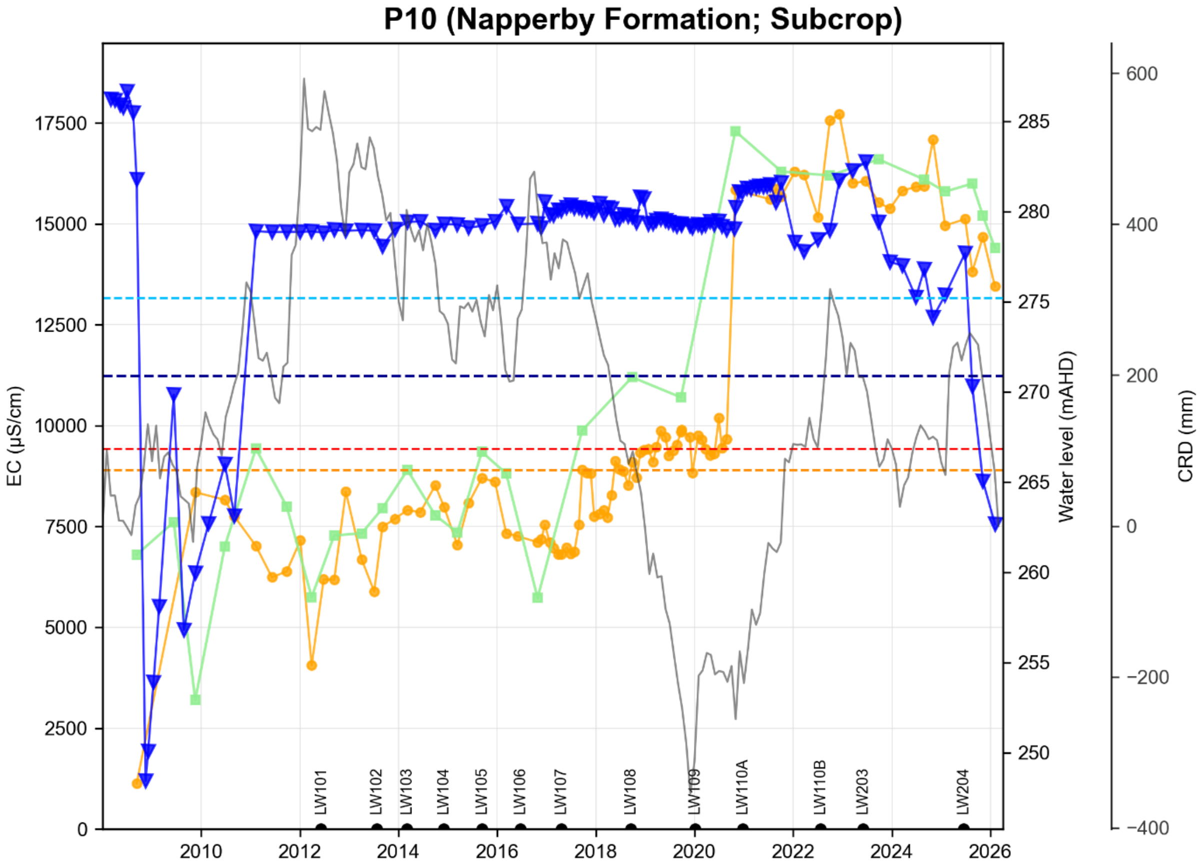
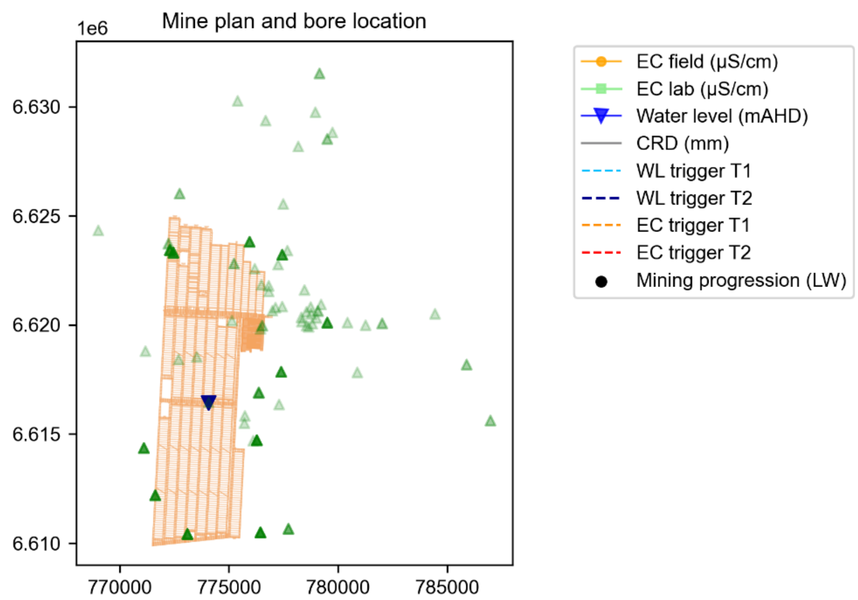


Figure 7.8 Napperby Formation bores EC comparison

7.4.1 P10 - water quality - EC exceedance and water level

Bore P10 is located south of planned LW 205 and north of Kurrajong Creek; the bore is installed in the Napperby Formation from 118 m bgl to 130 m bgl and is immediately adjacent to bore P11, which is installed in the shallower Purlawaugh Formation at 44 m bgl to 50 m bgl. Groundwater EC values are naturally high in the Napperby Formation at P10 (Figure 7.9), having fluctuated between 4,000 µS/cm and 8,000 µS/cm from 2010 (installation pre-mining) to 2017. In 2017, P10 groundwater EC values began to steadily increase from 7,000 µS/cm to 10,000 µS/cm. In late 2021, EC values increased more rapidly, reaching a maximum of 17,715 µS/cm in 2024. Since then, EC has remained elevated, although a decreasing trend is evident. The most recent measurement, recorded in February 2026, was 13,450 µS/cm.





* mAHD - metres Australian Height Datum

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Water Level plots

Figure 7.9 P10 EC field and laboratory measurements plotted with water levels

7.4.1.1 Natural climate factors

The gradual EC increase recorded between 2017 and 2020 is possibly associated with a reduction in recharge from precipitation and freshwater recharge from Kurrajong Creek during the Tinderbox Drought. However, with P10 being a deep bore, and the groundwater being naturally saline, immediate responses to a reduction in current recharge are only one possibility for the change in EC. In October 2020, just prior to the commencement of mining LW110A (December 2020) the groundwater levels recorded at P10 increased by 1.2 m from 279.0 m AHD to 280.2 m AHD at the same time EC increased from 9,670 µS/cm to 15,841 µS/cm.

7.4.1.2 Seepage from surface sources

Nearby surface water testing at Kurrajong Creek shows no increases in groundwater salinity or possible contribution to changes in the underlying groundwater. In addition, there are no other surface sources adjacent to P10; therefore, this potential cause is dismissed.

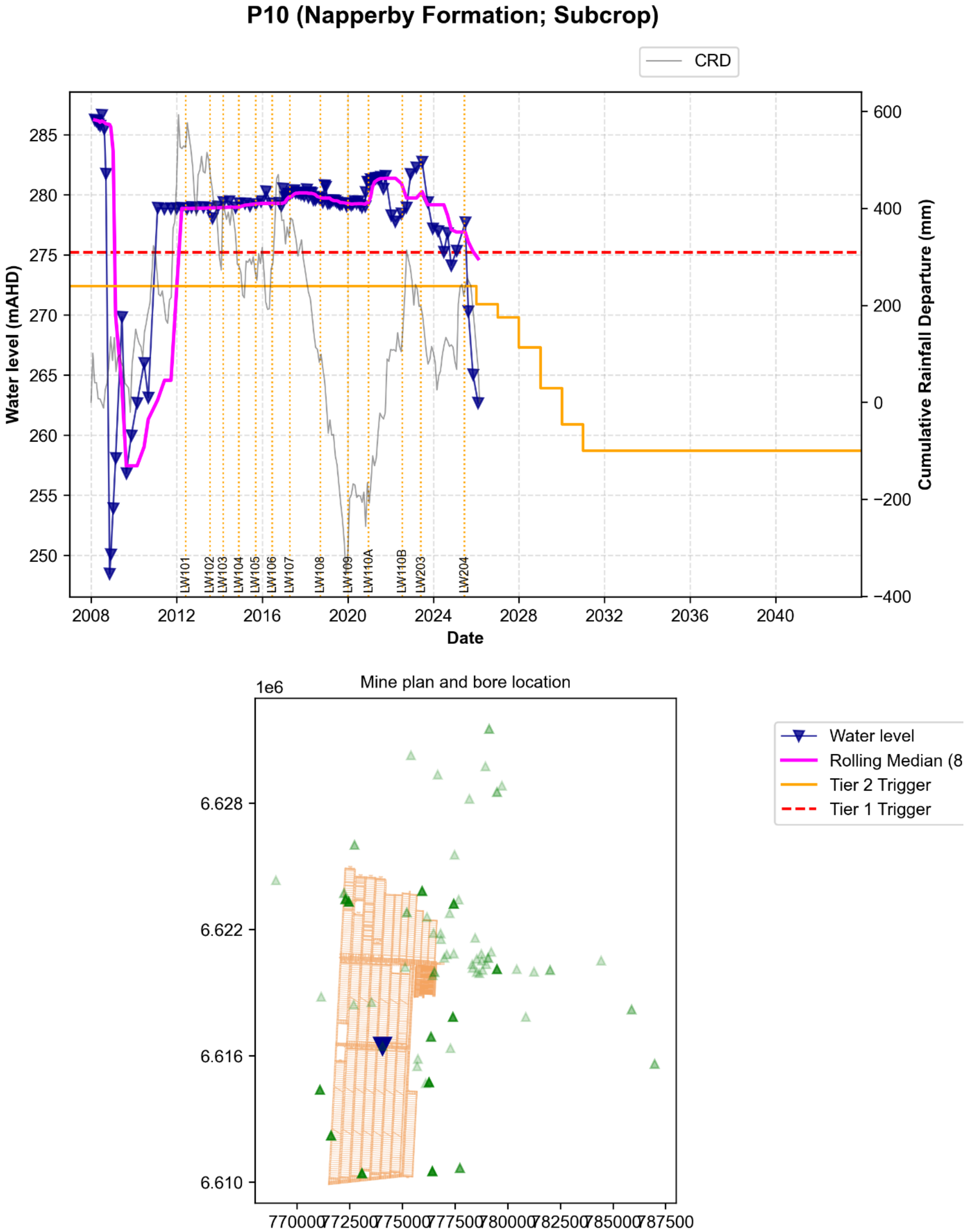
7.4.1.3 Mining-induced mixing

Groundwater levels have fluctuated at P10 since 2020, when EC changed significantly (Figure 7.9). In addition, in January 2017 the vertical hydraulic gradient between P10 (deep) and P11 (shallow) switched from downward to upward. Therefore, changes or reversals in hydraulic gradient could be causing groundwater mixing that has resulted in EC changes.

Chemical analysis of water from P10 indicates a Na-Cl type water chemistry (Figure 7.6) throughout its record. Changes in chemistry over time could provide insight into the source of the higher EC water at P10. Ion-ion ratio plots indicate a decrease in the bicarbonate (HCO3) to chloride (Cl) mass ratio (Figure 7.11), with a concurrent increase in the calcium (Ca) + magnesium (mg) to sodium (Na) mass ratio (Figure 7.12). This indicates that the water at P10 is becoming more Na-Cl dominated with time.

Bore P2, located 3.2 km to the east of P10, also plots as a Na-Cl type, indicating that this is a typical water composition for that formation. In addition, the EC at P2 is ~20,000 µS/cm, which means there is naturally saline water in the formation that is greater than the Tier 2 value at P10. Therefore, the exceedance at P10 could be the result of groundwater mixing within the Napperby Formation.

Mining of LW204 commenced in June 2025, the decreasing groundwater trend commenced at this time as expected based on groundwater modelling. In October 2024 drilling of the Western Shaft commenced at this point drawdown appears to have decreased at a faster rate than previously modelled. The drilling and installation of the Western Shaft was not included in the numerical modelling. Groundwater decline is associated with mining LW204 with the faster than expected decline likely due to the installation of the Western Shaft.



* mAHD - metres Australian Height Datum

Australasian Groundwater and Environmental Consultants Pty Ltd
Water Level plots

Figure 7.10 Groundwater drawdown at P10 with predicted modelled drawdown

7.4.1.4 Solute release

Mine rock drainage in coal mine settings is typically associated with an increase in sulfate (SO_4) concentration, as reduced SO_4 becomes oxidised because of dewatering. However, SO_4 concentration can increase due to evaporation or other natural causes. One metric of SO_4 release that distinguishes oxidation from evaporative concentration is the SO_4-Cl mass ratio. If this ratio does not increase above background concentrations, it indicates that sulfide oxidation is less likely to be the cause of groundwater quality changes. This is the case at P10, where the SO_4-Cl mass ratio has increased from about 0.10 in 2010 to about 0.18 in 2023 (Figure 7.13), but has remained well below the baseline value, which is approximately 0.23 to 0.43 in bore P8, and approximately 0.21 to 0.32 in bore P9. In addition, the hydraulic gradient at P10 indicates flow toward the mining zone, indicating that there is no viable pathway for solutes to reach P10, if they were being produced.

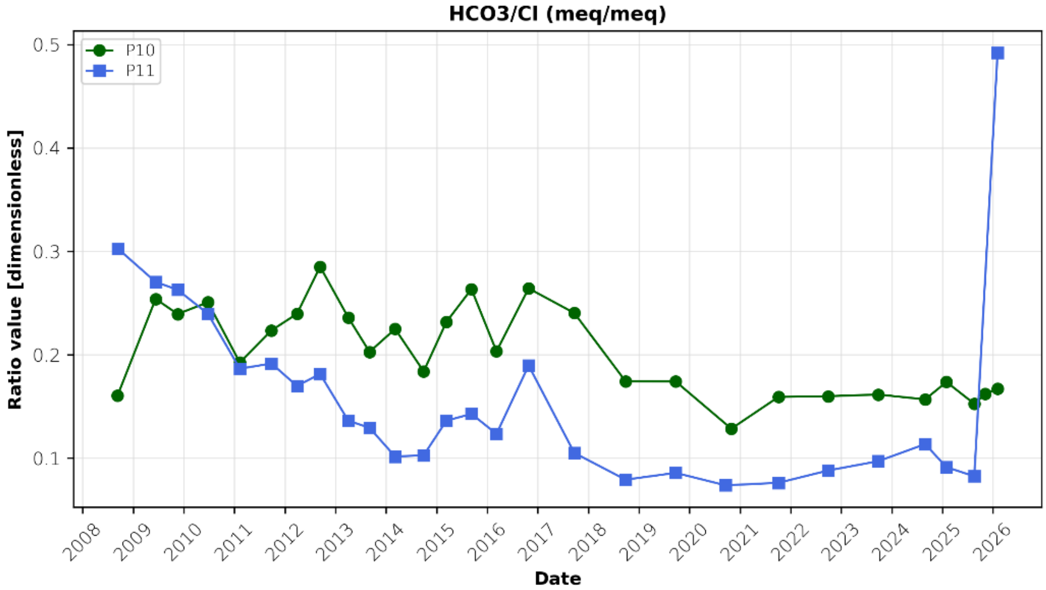


Figure 7.11 P10 and P11 HCO3/Cl ratio

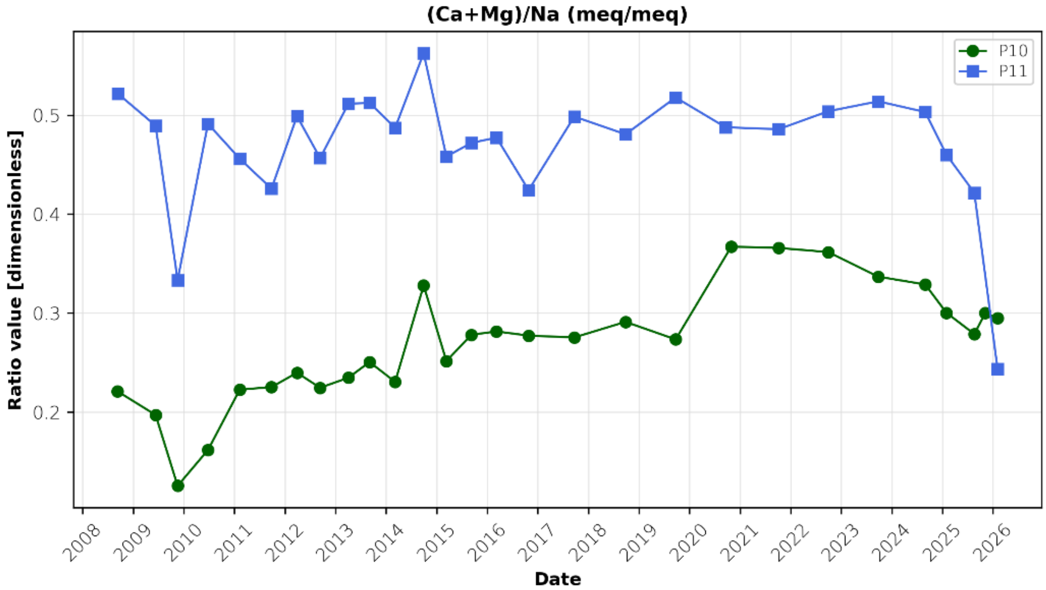


Figure 7.12 P10 and P11 Ca+Mg/Na ratios

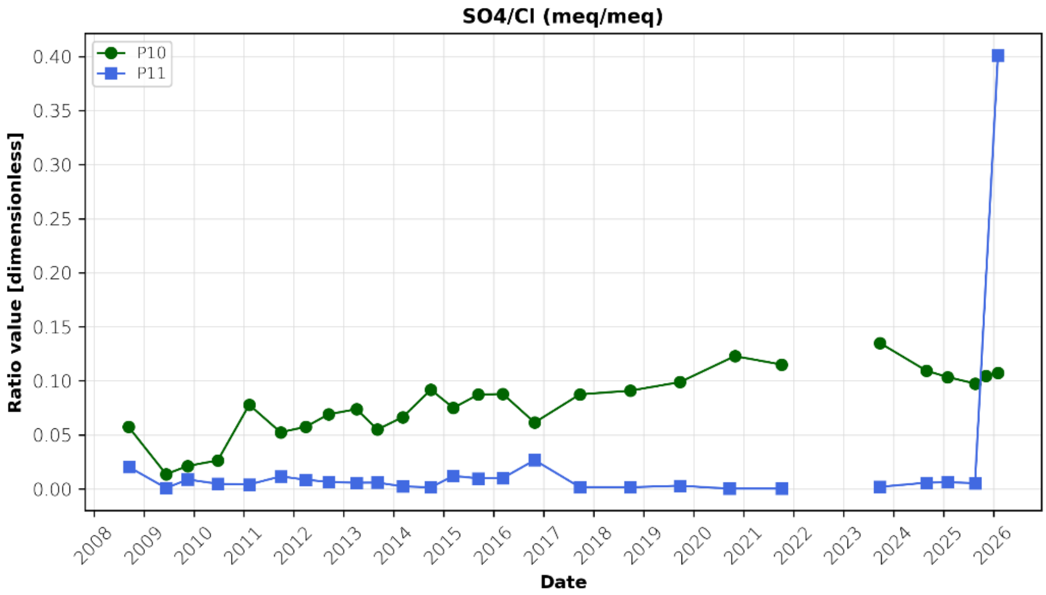


Figure 7.13 P10 and P11 SO4/Cl ratios

7.4.2 Conclusion and recommendations

Groundwater EC observed values within Napperby Formation bore P10 have been historically high. EC increases, as response to the Tinderbox Drought, in P10 (118 m bgl to 130 m bgl) indicates that changes in salinity are a natural response to the mobilisation of salts after the end of the drought. The delayed response is associated with the tight Napperby Formation and depths for recharge to reach the bore depths. Recent groundwater declining trend indicates that the bore is connected with mining and drawdown is associated with mining LW204.

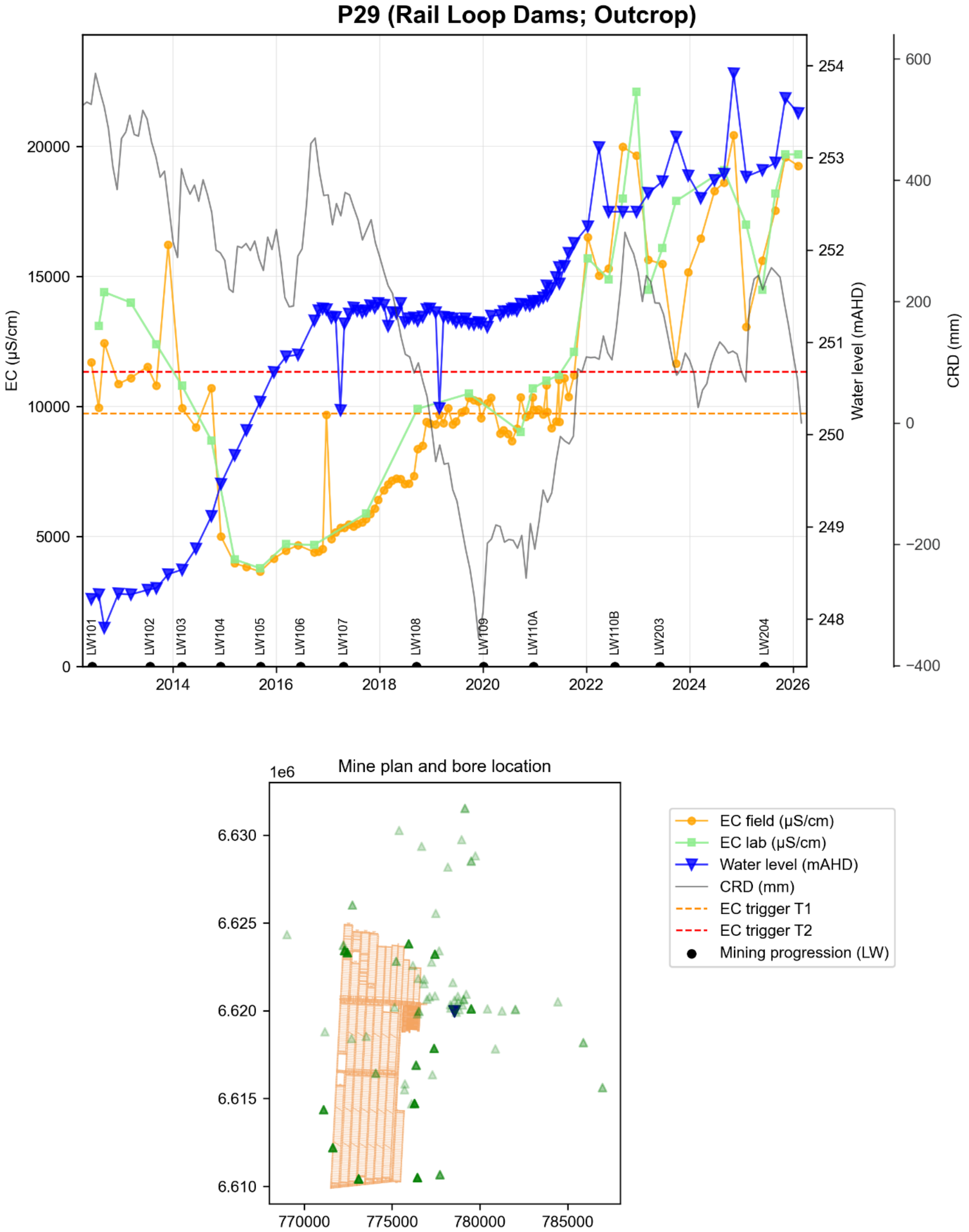
7.4.3 Potential impacts

Salinity in groundwater within the Napperby Formation is naturally high therefore values resulting in EC elevations are unlikely to cause impacts to any sensitive environmental receptors or groundwater users.

7.5 Seepage Monitoring

7.5.1 P29 - water quality - EC exceedance

Bore P29 is a seepage monitoring bore located south of the Rail Loop Dams (RLD) (Figure 2.2), the bore is screened in the Napperby Formation from 19 m bgl to 25 m bgl. The monitoring bore was installed in 2012 when the dams were constructed. EC values initially declined after installation to mid-2015. Since 2015 values have fluctuated with an overall increase concurrent with an increase in water levels (Figure 7.14).



* mAHD - metres Australian Height Datum

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Water Level plots

Figure 7.14 P29 EC field and laboratory measurements plotted with water levels

7.5.1.1 Natural climate factors

Other RLD seepage monitoring bores installed in the Napperby Formation (Figure 7.15) do not follow similar EC trends of P29. P30, located about 280 m to the east of P29 and adjacent to storage Dams D and C shows a declining EC trend (Figure 7.15), with EC decreasing from 20,800 µS/cm in February 2025 to 14,910 in February 2026. The minimal correlation between bores and rainfall trends indicates natural climate variations are unlikely causing increasing trends in EC.

Bores P31 and P32 show a stable, low EC trend with minor fluctuations, consistent with variations in average rainfall.

Soil samples were collected in January 2025 to determine if saturation of previously unsaturated soils is a possible cause for increased salinity. Sample S1 was collected from the top 1 m of soil next to bore P29, sample S2 was collected south of BR1. Sodium Adsorption Ratio (SAR) is a measure of the relative concentration of sodium compared to calcium and magnesium in soil solution. When the SAR is high, the water can increase the exchangeable sodium percentage (ESP) of the soil. Sample S1 had a SAR range of4.94 to 7.47 while SAR for sample S2 ranged from 0.54 to 1.99. SAR of 6 to 8 is considered medium sodium hazard while less than 3 is considered ideal. Given the higher SAR in soils near P29 the elevated EC could be attributed to mobilisation of salts and minerals present in the previously unsaturated soils.

7.5.1.2 Seepage from surface sources

As stated above, the high EC values at P29 and the changes over time indicate seepage from the RLDs as a possible cause of changes. Dams B2 and C have average EC values exceeding 20,000 µS/cm and are a viable source of the increased EC at P29.

The major ion water quality data from bore P29 and other seepage monitoring bores are plotted in Figure 7.16. Major ions of recent P29 samples plots as a Na-Cl type water; whereas water from the dams B1, A1 and C plot as a Na-HCO_3 type. A linear mixing trend towards Na-HCO_3 types has been identified in historical data, the reasons for this is unknown.

The dam water is alkaline (Figure 7.16), having a pH consistently over 8, and often over 9. From 2012 until late 2021 pH measured at P29 ranged from 7.1 to 8.8, since EC began increasing over its trigger in November 2021 pH has commenced declining from approximately 8 to 6.5. Although this could indicate that the influences acting on water at P29 is not seepage from nearby dams this does not consider any buffering properties of the soil.

Overall, the net increases in EC and water level at P29 since before chemical changes occurred in 2015 indicate that seepage from the RLD complex has affected the bore. Some influence of Dam C is suspected due to the similarity of the EC with recent P29 observations; however, addition of sodium-chloride (and all major ions except bicarbonate and potassium) has occurred from a source other than Dam C, which is bicarbonate dominated. These salts could be from the subsurface, but other sources cannot be ruled out.

7.5.1.3 Mining-induced mixing

Mixing with groundwater from adjacent hydrostratigraphic units as a result of changes in hydraulic gradients is not considered a plausible cause of the increased EC observed at P29. This is supported by recorded increases in groundwater levels, which indicate that depressurisation associated with nearby mining activities has not occurred.Solute release

The proximity of P29 to the RLDs and the comparative distance to mining indicates solute release from mining as the lesser likely source.

7.5.2 Conclusion and recommendations

Water levels in bore P29 show an increasing trend that does not align with climate fluctuations indicating that water is likely from alternative sources than recharge from rainfall. Although a linear mixing trend has been identified in historical data, recent assessment of major ions indicate no mixing trends with the nearest high salinity Dam C; therefore, increasing water levels are not likely due to seepage from Dam C. Nearby sediment dam (SB2) and local surface depressions adjacent to Dam D provide a possible source for increasing water levels providing recharge to the groundwater system even during periods of little to no rainfall.

7.5.3 Potential impacts

Increasing water levels and salinity recorded at P29 are isolated around the southern area of the RLD and are unlikely to cause negative impacts to nearby environmental receptors, nearby bore P58 which is screened deeper in the Napperby formation is demonstrating a downward EC trend since the end of 2025.

Filled markers indicate values above limit of reporting; and
Empty markers indicate values below limit of reporting.

Australasian Groundwater and Environmental Consultants Pty Ltd
Water Quality Plots

Figure 7.15 Seepage monitoring bore EC and locations

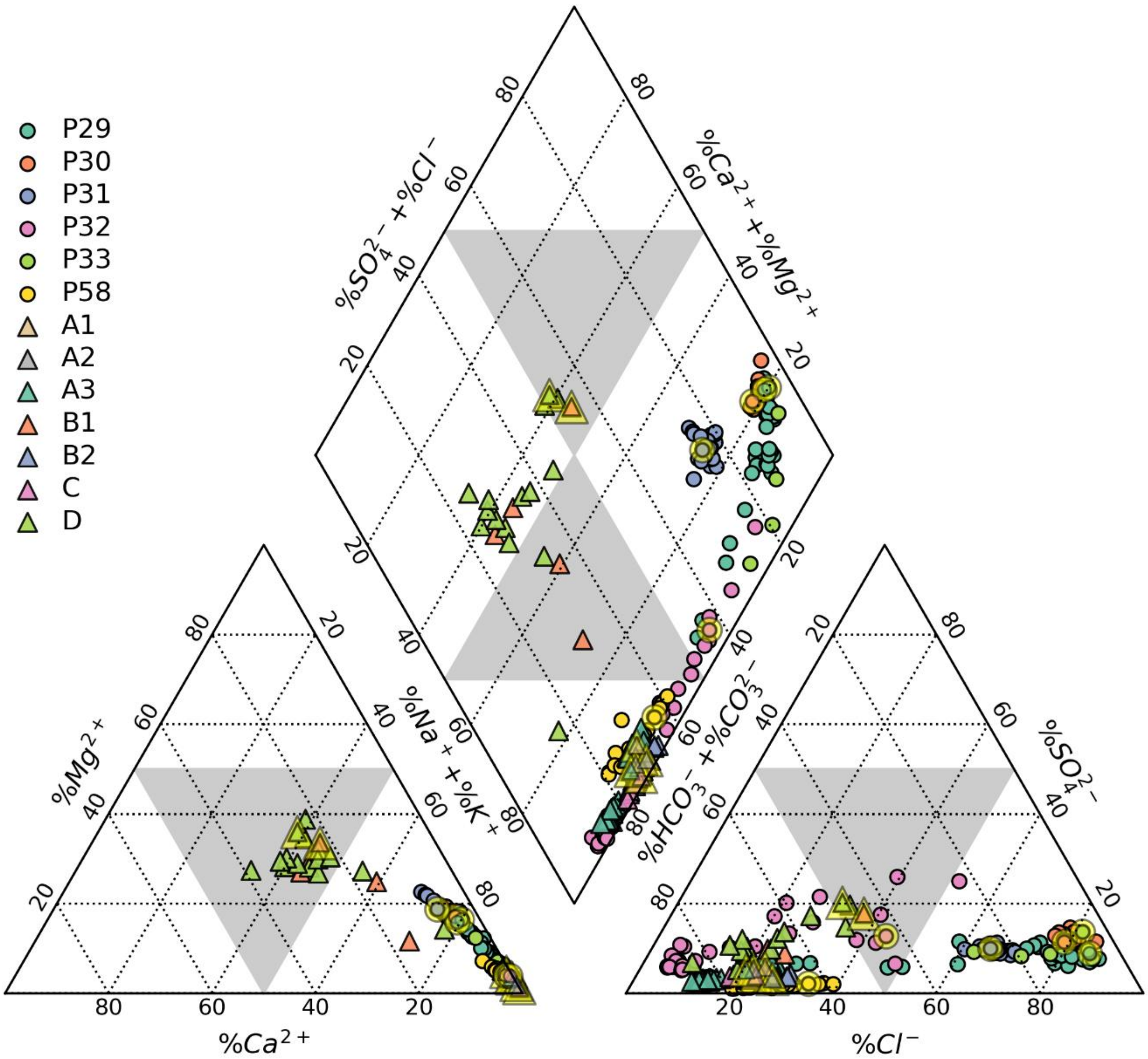

Figure 7.16 Piper diagram for monitoring bores P29 and surrounding sites, including rail loop dams B1, A1 and C

P32 - water quality - EC exceedance

Bore P32 is a seepage monitoring bore located east of Dam D (Figure 2.2), the bore is installed in Napperby Formation from 9 m bgl to 15 m bgl. The monitoring bore was installed in 2012 when the dams were installed. EC values initially declined after installation to mid-2015. Since 2015 values have fluctuated with an overall increase concurrent with a recent increase in water levels (Figure 7.17).

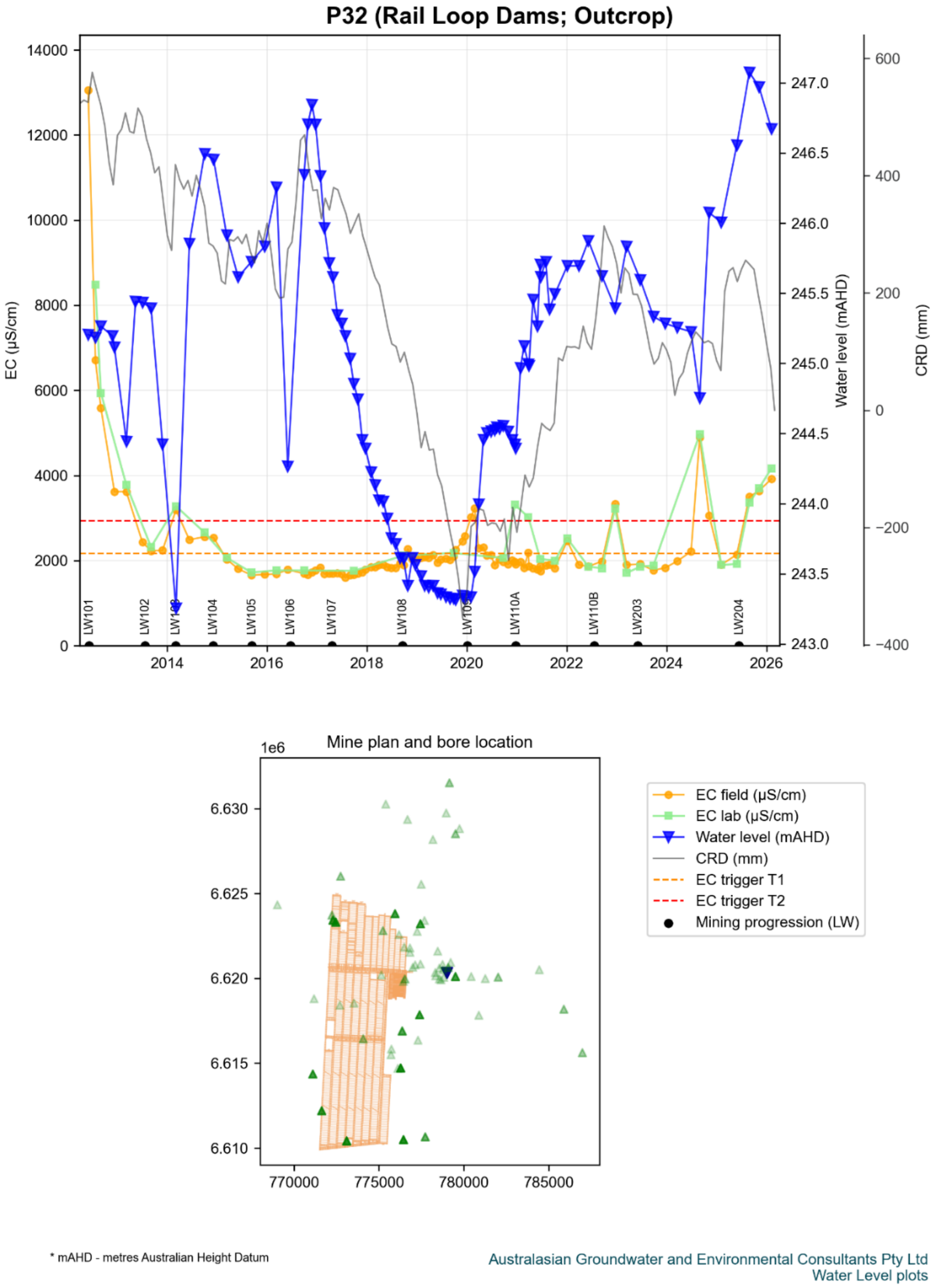

Figure 7.17 P32 EC field and laboratory measurements plotted with water levels

7.5.3.1 Natural climate factors

Groundwater levels recorded at P32 fluctuate in very similar fashion to variations in rainfall with periods of higher rainfall showing elevated groundwater levels. The recent increase in EC occurs together with an increase in groundwater levels recording a near all-time high level in late 2025.

7.5.3.2 Seepage from surface sources

Bore P32 is installed to the east of Dam D between the dam and a smaller depression that holds water during periods of increased rainfall. The recent increase in water levels is likely associated with increases in rainfall and seepage from Dam D and the adjacent area. Bore P32 generally has a Na-HCO_3 type water, but with significant variation in composition in the anions, whereby some proportion of anions can be chloride (up to 55%) and sulfate (up to 28%). Ratios of major ions HCO3-Cl and Na-Cl show fluctuating ratios indicating variable recharge sources. Water stored in Dam D is primarily from Namoi Rive; however, can be used to store water from groundwater bore sources, variations in groundwater composition over time likely indicates that Bore P32 is impacted by seepage from Dam D.

7.5.3.3 Mining-induced mixing

Mixing with groundwater from adjacent hydrostratigraphic units driven by changes in hydraulic gradients is not considered a plausible cause of the increased EC observed at P32. This interpretation is supported by recorded rises in groundwater levels, which indicate that no depressurisation related to nearby mining activities is occurring. Solute release

The proximity of P32 to the RLD and distance from mining indicates solute release from mining as an unlikely source.

7.5.4 Conclusion and recommendations

Recent increases in EC are likely attributed to increases in water level. Although Dam D may contribute recharge to the area surrounding the RLDs it is not considered the main source of elevated salinity as EC measured at Dam D is at 793 µS/cm. Seepage from Dam D may influence the water levels; however, is not directly attributable to increases in EC but rather acts as a medium to mobilise salts that are accumulated in the shallow subsurface as seen in 2020 and end of 2025 when there has been a notable increase in the rate of groundwater rise. The increase in EC is likely due to saturation of previously unsaturated ground due to increasing water levels. Further monitoring of water levels and salinity will confirm this.

7.5.5 Potential impacts

Given that surface water from Dam D is sourced predominantly from the Namoi River, which is considered to be better quality than the groundwater typical of the surrounding area, no negative impact to the groundwater system is expected.

7.5.6 P53 - water quality - EC exceedance

Bore P53 is one of three REA monitoring bores which is located between the REA and a tributary of Kurrajong Creek. The bore was installed in 2016 and is screened from 18 m bgl to 21 m bgl in the Garrawilla Volcanics which outcrop in this area. Groundwater levels show a correlation with rainfall (Figure 7.18), which is consistent with other bores installed in the Garrawilla Volcanics in this area.

From 2016 to early 2022 EC measured in the field remained around 1,060 µS/cm with fluctuations generally no larger than 200 µS/cm. In mid-2022 EC values began to increase, a trend that is also seen in the laboratory measurements, with larger fluctuations in field measurements up to ~700 µS/cm. The EC records at P53 exceeded the Tier 2 trigger levels on 5th July 2022 and TARP level 2 response was enacted on 21 November 2022 when three consecutive exceedances were recorded.

Although several bores around the site have shown increasing EC trends that have been attributed to changing conditions post Tinderbox Drought (2017 to end-2019), this is unlikely to be the cause of increasing salinity recorded at P53. The reason is that, during the drought and the post-drought recovery, EC remained stable and water levels varied consistent with rainfall trends (Figure 7.18).

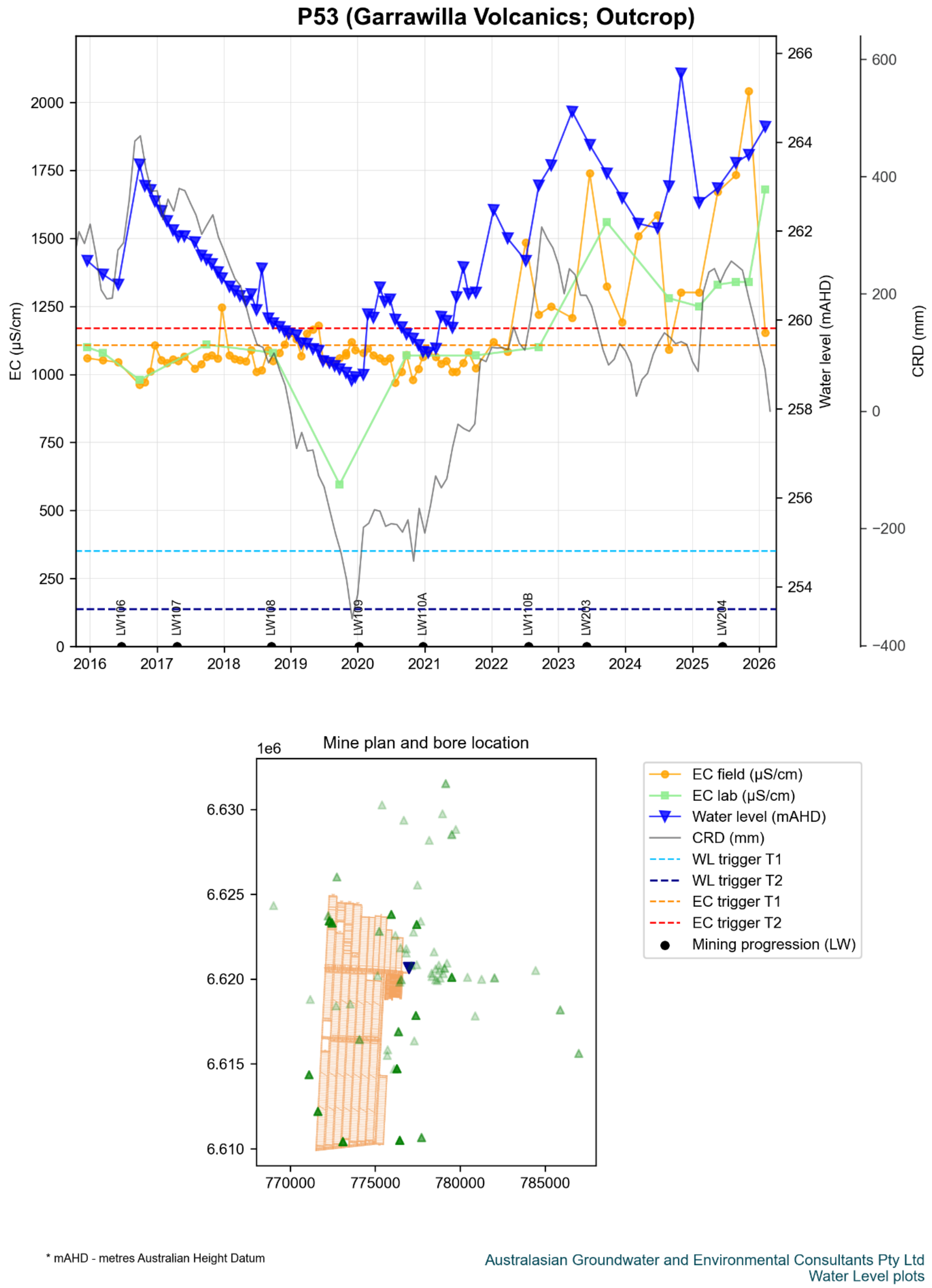

Figure 7.18 P53 EC field and laboratory measurements plotted with water levels

7.5.6.1 Natural climate factors

Both P53 and adjacent bore P52 had increased water levels consistent with changes in rainfall from 2020 to 2023, and during this time, P53 groundwater increased in salinity, while that of P52 decreased. This may indicate that natural climate factors are not likely to be the cause of EC change at P53, as a consistent EC compared to past values (e.g. 1,100 µS/cm) would be expected due to the water level increase. Alternatively, the increase in EC at P53 may be a very delayed response to decreased recharge as a result of the Tinderbox Drought. However, given the shallow depth of P53, and the decrease in salinity at P52, this scenario is also considered unlikely.

7.5.6.2 Seepage from surface sources

The nearest surface water monitoring locations to P53 are KC1US, located on the Kurrajong Creek tributary approximately 1 km upstream of P53, and KC1DS located approximately 2.8 km downstream near where the creek crosses the Kamilaroi Highway. The EC records for KC1DS range from 46 to 1,270 µS/cm (Figure 7.19). No apparent correlation exists in the temporal patterns, e.g., between increasing salinity in the creek and the groundwater, and the groundwater at P53 now has a higher EC than the observed levels in the creek.

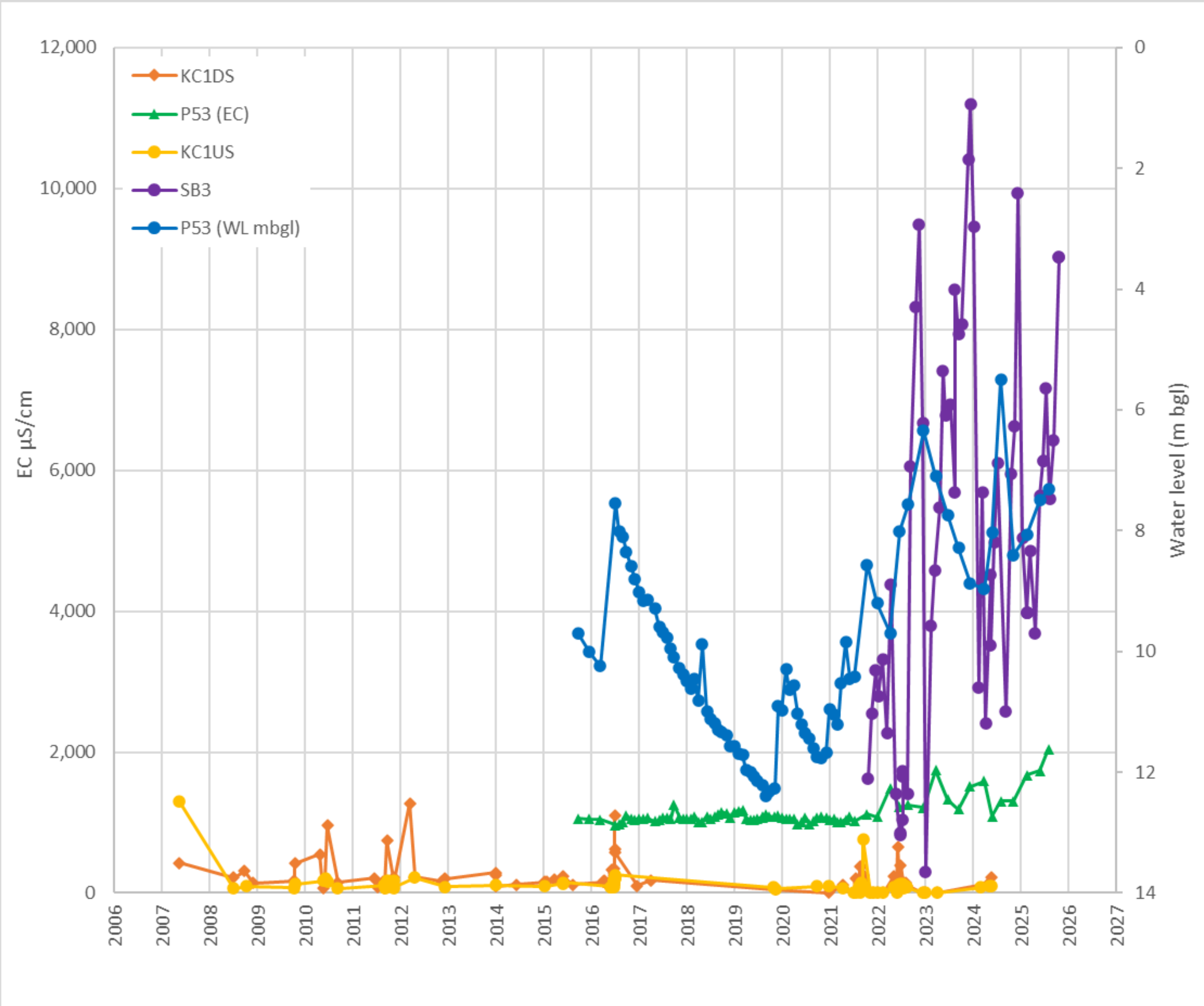

Figure 7.19 Kurrajong Creek tributary EC measured at KC1DS and water level and EC for bore P53

Sediment dam SB3 is located immediately south of P51 and 300 m northeast of P53. Sampling throughout 2025 recorded a field EC in the SB3 dam ranging from 4,860 to 9,930 µS/cm. Recent groundwater levels recorded at P51 and P53 indicate a groundwater flow direction from P53 to P51 (P53 water level higher). Therefore, seepage directly from SB3 is an unlikely cause of elevated salinity at P53, as a physical pathway is either absent or less likely since EC changed in 2022. Two evaporator fans sourced with water from SB3 are located south of the SB3, approximately 250 m east of P53. The evaporator fans provide a more direct source of water from SB3 to P53; however, the purpose of these fans is to atomise water to a fine mist to increase evaporation with infiltration of this water less likely. Further examination of water quality of SB3 compared with P53 is required to confirm this as the source.

HCO_3/Cl ratios for P53 groundwater (Figure 7.20) show the ratio of HCO_3 to Cl decreases from 2022, indicating more relative chloride present (or a depletion of bicarbonate) during the period of higher EC. This indicates that the water is becoming a more chloride type water, whereas water from mine inflows and Hoskissons Coal is more dominated by bicarbonate (Figure 7.21). If changes in water quality were due to water contamination from the REA, it would be expected that the water at P53 would become more bicarbonate-dominated with time and increasing EC.

Groundwater major ions for bore P52 show an increasing ratio of HCO_3 to Cl indicating that P52 is becoming more bicarbonate dominate (depletion of chloride), during this time EC at P52 decreased to become less saline. EC (Figure 7.20) and major ions (Figure 7.22) indicate mixing of the water types at the two bores (P53 and P52) to become similar to each other. Since 2022, both bores have EC approaching ~2,000 µS/cm, and a HCO_3/Cl mass ratio approaching 1.5 (Figure 7.20). Both bores show similar water level trends consistent with variations in rainfall. This could indicate that a source of water with that composition is influencing the groundwater at both sites via mixing.

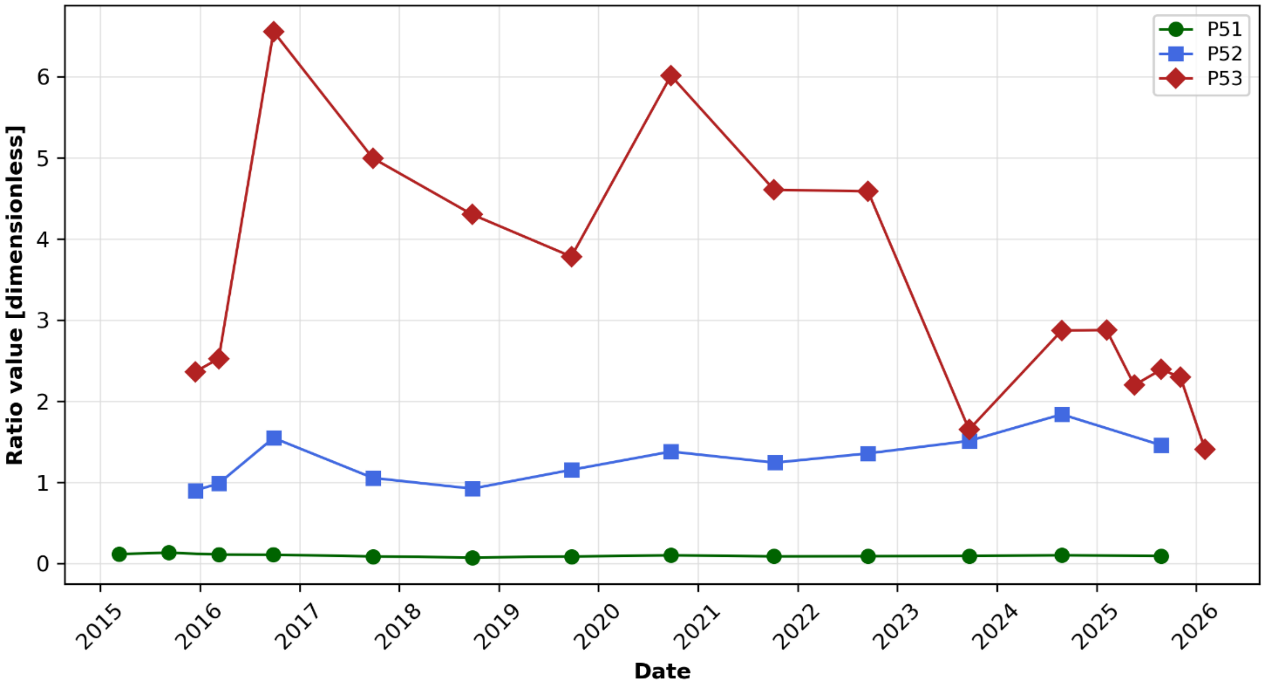

Figure 7.20 P51, P52 and P53 HCO3/Cl ratios

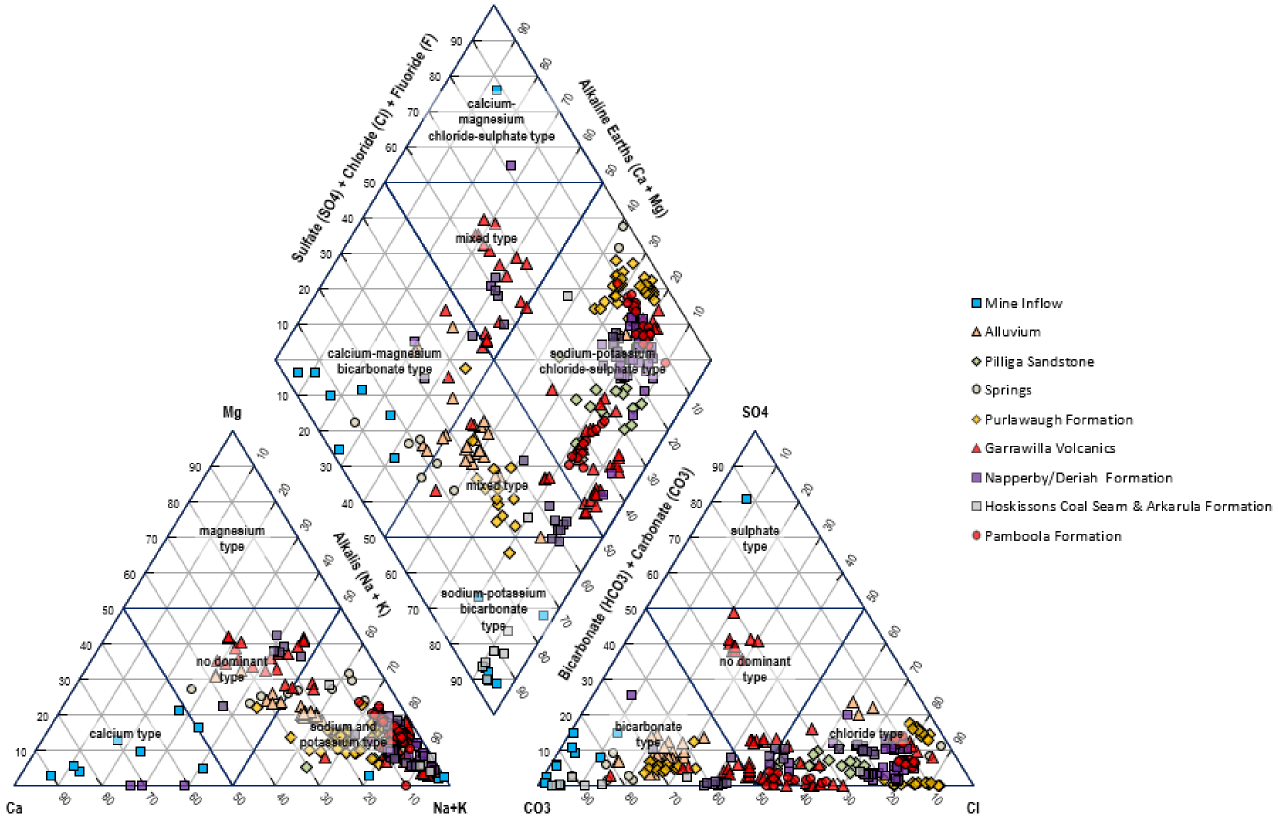

Figure 7.21 Piper plot grouped by formation

7.5.6.3 Mining-induced mixing

Water chemistry recorded at P53 is mixed type for cations, and bicarbonate-dominated for anions (Figure 7.22) P53 plots similar to P52 although P52 has higher relative portions of chloride. A linear mixing trend in the anions is visible with an increase in relative chloride. This trend, coupled with the higher EC recorded in P52 (2,000-2,400 µS/cm) indicates possible mixing with P52, possibly caused by changing water flow paths.

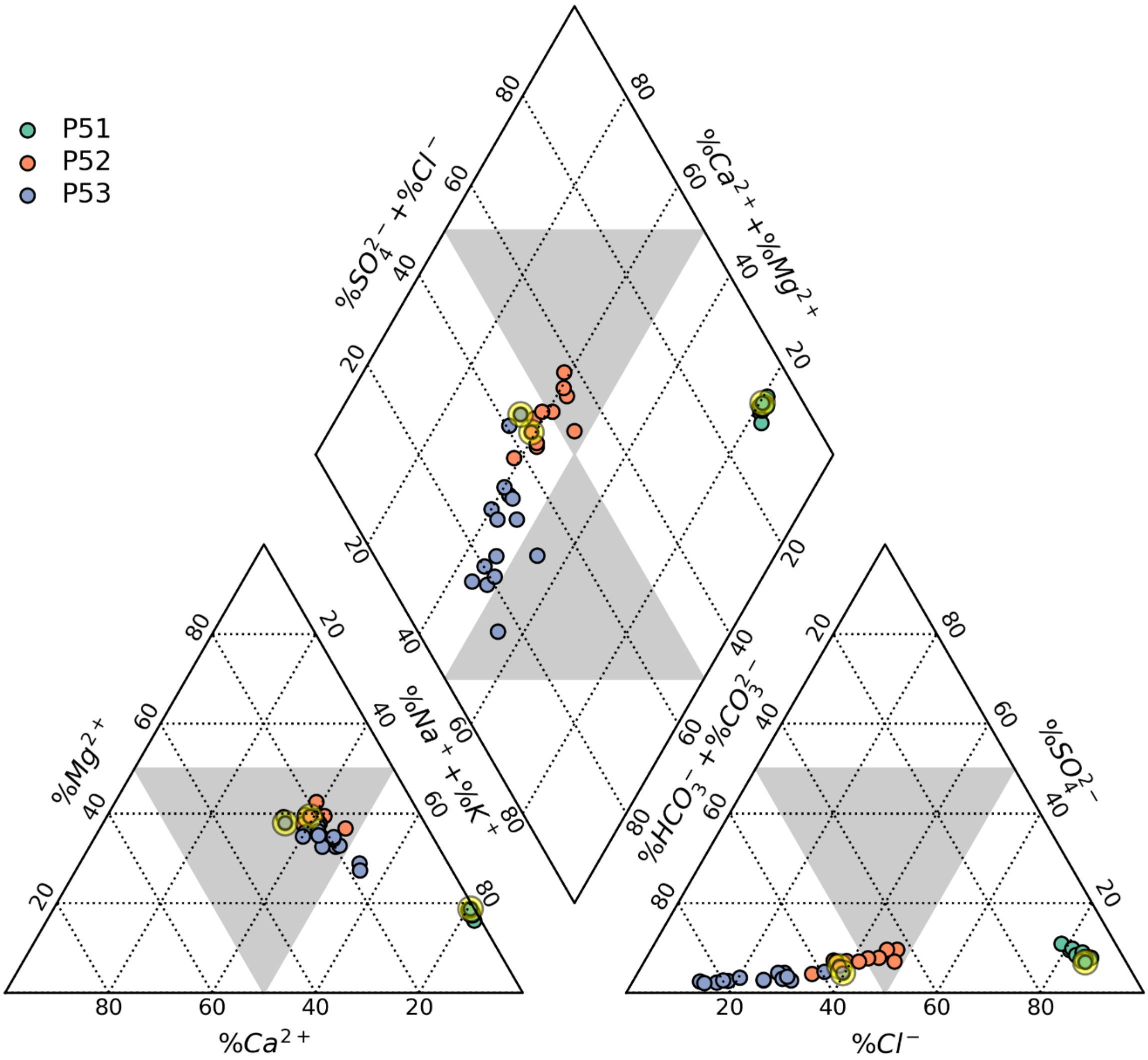

Figure 7.22 Piper plot REA bores P51, P52 and P53

7.5.6.4 Solute release

Differences in major ion compositions of mine inflow and coal seam water with that of P53 indicate solute release from mining is not a likely cause of elevated EC.

7.5.7 Conclusion and recommendations

The sources of increases in EC recorded at P53 and linear mixing trends apparent in the Piper Plots indicate that either groundwater mixing is occurring between bores P53 and P52 or the same source of water such as that from SB3 is acting on both bores. The evaporator fans located near bores P53 and P52 provides a potential source. This is being further investigated.

7.5.8 Potential impacts

No sensitive environmental receptors are located nearby and other bores surrounding the RLD show no signs of seepage. Therefore, no significant environmental impacts are expected from the elevated EC measurements.

8 Conclusions

Conclusions and recommendations for individual exceedances are included in each section. A summary of findings, comparison with previous findings and recommendations for further work are included in Table 8.1. This includes recommendations from annual reporting that states that bores with recorded exceedances should consider the following:

- does the conclusion that changes are associated with these climatic events remain true; and
- has a new adjusted baseline been established, if so, a review of the baseline data and trigger levels is recommended.

For bores with no current recommendation for further work monitoring should continue with data reviewed quarterly to determine if bore has reached equilibrium or any other changes are noticeable.

Table 8.1 Summary of exceedances and further work

Bore ID	Formation	Exceedance	Likely cause	New baseline / triggers established	Further work required
P7	Pilliga	pH	Natural variability of formation	No	Consider aquifer specific trigger
P10	Napperby	EC	Natural variations / major climate event	No	Remove from list of triggers and use as information only
P29	Napperby	EC	Saturation of unsaturated zone	N/A	No
P32	Napperby	EC	Saturation of unsaturated zone	N/A	No
P39A	Watermark	EC	Natural variations / major climate event / seepage from nearby dams	Tier 1 7,710 µS/cm Tier 2 8,031 µS/cm	Update triggers and sample groundwater quality from nearby bores
P39B	Alluvium	EC	Natural variations / major climate event / seepage from nearby dams	Tier 1 13,662 µS/cm Tier 2 14,198 µS/cm	Update triggers and sample groundwater quality from nearby bores
P53	Garrawilla	EC	Mixing with other groundwater and/or infiltration of water from REA	N/A	Review major ions and groundwater types against nearby SB3

Yours faithfully,

Kathryn Job
Team Lead and Senior Project Hydrogeologist
Australasian Groundwater and
Environmental Consultants Pty Ltd