Tahmoor Coal Pty Ltd

SIX MONTHLY SUBSIDENCE IMPACT REPORT

Western Domain Longwalls West 1 – West 4

1 January 2023 – 30 June 2023

Report 8 – September 2023

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Document Control

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Executive Summary

This report is the eighth six-monthly report to be submitted since the commencement of extraction in the Western Domain, in accordance with the requirements of the Longwall West 1 and West 2 (LW W1-W2) Extraction Plan and the Longwall West 3 and West 4 (LW W3-W4) Extraction Plan.

Extraction of coal from Longwalls West 1 to West 4 was completed on 6 November 2020, 17 June 2021, 21 March 2022 and 13 September 2022, respectively. Subsidence impacts discussed in this report are for those observed after the extraction of LW W4.

The maximum observed vertical subsidence relating to the extraction of LW W4 was 897 mm recorded along the LW W1-W4 crossline survey.

There were seven (7) environmental aspects that were associated with Trigger Action Response Plans (TARPs) triggers. All triggers have been reviewed by the Environmental Response Group / Structural Response Group / specialists to determine if any further action is required. These TARP triggers included:

- Pool Water Level TARP – Level 2 and 3 triggered due to pool water level reduction at monitoring site CB and monitoring site CE on Cedar Creek. During the periods of water level decline the water level remained above the previously recorded minimum and did not decline atypically. No further actions other than ongoing monitoring are required. Tahmoor Coal is reporting on pool water level on a 3-monthly basis to DPE;
- Natural Drainage Behaviour TARP – Level 3 triggered due to laminar fracturing at SR17 Rockbar from November 2021 onwards, and fracturing at SR20 Rockbar from August 2022 onwards. A Level 3 TARP trigger was associated for both locations as the rockbar fracturing was formed during mining (was not present during baseline inspections), and there was no reduction in pool water level, drainage or overland connected flow (taking into account climatic conditions and observations during the baseline monitoring period). No further actions other than ongoing monitoring are required;
- Surface Water Quality TARP – Level 2 triggered due to elevated dissolved aluminium at various pools throughout the reporting period. These elevated aluminium concentrations were attributed to prevailing climatic conditions. No further actions other than ongoing monitoring is required;
- Groundwater Bore Level TARP – Level 2 triggered during the reporting period, however a trend in groundwater recovery was evident. Groundwater bore level will continue to be monitored in accordance with the LW W3-W4 Water Management Plan, and Tahmoor Coal will continue to provide 3-monthly reports to DPE for surface water and groundwater;
- Shallow Groundwater Pressures TARP – Level 2 triggered during the reporting period, however a trend in groundwater recovery was evident. No further actions other than ongoing monitoring are required. Tahmoor Coal is reporting on groundwater levels on a 3-monthly basis to DPE;
- Deep Groundwater Pressures TARP – Level 2 triggered during the reporting period. No further actions other than ongoing monitoring are required. Tahmoor Coal is reporting on groundwater levels on a 3-monthly basis to DPE; and
- Groundwater Quality TARP – Level 2 triggered during the reporting period. No further actions other than ongoing monitoring are required. Tahmoor Coal is reporting on groundwater quality on a 3-monthly basis to DP.

During previous reporting periods, cracking on sandstone culverts at 88.400 km and 88.980 km resulted in an exceedance of subsidence performance measure for ‘other Aboriginal and heritage sites’. Tahmoor Coal notified DPE and Heritage NSW of the trigger via the NSW Major Projects Planning Portal on 21 September 2021. A warning letter from DPE was received on 16 May 2022 regarding the breach against Section 4.2(1)(b) of the *Environmental Planning and Assessment Act 1979.* Tahmoor Coal completed remediation of the two sandstone culverts in May 2023, and DPE were notified of this completion on 19 May 2023. A site inspection of the culverts with Transport Heritage NSW was completed on 2 May 2023, and a letter was received from Transport Heritage NSW after the site inspection stating they were satisfied with the repairs completed. A site inspection of the culverts with DPE was also completed on 6 June 2023.

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1 Introduction

1.1 Background

Tahmoor Coal Mine (Tahmoor Mine) is an underground coal mine located approximately 80 kilometres (km) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (NSW) (refer to **Figure 1-1**). Tahmoor Mine produces up to three million tonnes of Run of Mine coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla for Australian domestic customers and export customers.

Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (Tahmoor Coal) since Tahmoor Mine commenced in 1979 using bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group.

Tahmoor Coal has mined 36 longwalls to the north and west of Tahmoor Mine's current pit top location. The 'Western Domain' is a mining area located north-west of the Main Southern Rail between the townships of Thirlmere and Picton (**Figure 1-1**). The Western Domain is within the Tahmoor North mining area and is within Mining Lease (ML) 1376 and ML 1539.

Extraction Plan approval for the third and fourth longwalls in the Western Domain (LW W3-W4) was granted by DPIE (now DPE) on 13 September 2021. A copy of this Project Approval is available on the Tahmoor Coal website (http://www.simec.com/mining/tahmoor-coking-coal-operations/). The Study Area for this extraction plan is provided in **Figure 1-2**.

Extraction of coal from Longwalls West 1 to West 4 were completed on 6 November 2020, 17 June 2021, 21 March 2022 and 13 September 2022, respectively.

Extraction Plan approval for Tahmoor South Domain A Series was granted on 20 September 2022, and extraction of LW S1A commenced 18 October 2022. Subsidence Impact Reporting for Tahmoor South Domain is reported separately to that of the Western Domain.

1.2 Purpose

1.2.1 Six-Monthly Subsidence Impact Report Requirements

The purpose of this report is to address the requirements for six-monthly reporting on impacts and environmental monitoring results associated with the extraction of LW W3-W4. These requirements are outlined in Section 6.1.4 of the LW W3-W4 Extraction Plan, which are derived from the Section 6 of the DPE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). It is noted that an updated version of the Guidelines was published in October 2022.

This report provides with a summary of subsidence and environment monitoring results, subsidence impacts and management actions undertaken during the reporting period. The reporting period for this report is defined in **Section 1.3**.

In addition, a letter from DPE dated 19 December 2022 provided three additional reporting requirements for future Six-Monthly Subsidence Impact Reports for the Western Domain. Similar additional reporting requirements for future Six-Monthly Subsidence Impact Reports for the Western Domain were also requested in a letter from DPE dated 5 April 2023.

Reporting requirements are listed in **Table 1-1** below, together with the cross-reference where the requirements are addressed in this report.

Table 1-1 Six Monthly Subsidence Impact Report Requirements

Requirement No.	Requirement Description	Section Addressed
Reporting Requirements as per Section 6.1.2 of the LW W3-W4 Extraction Plan		
1	A comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);	Section 3.1
2	Any proposed actions resulting from triggers being met in the TARP, or other actions;	Section 3.2
3	An assessment of compliance with all relevant performance measures and indicators; and	Section 4
4	A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and level data, piezometer readings.	Section 2
Reporting Requirements as requested by DPE on 19 December 2022		
1	Continue to include an assessment against performance measures and performance indicators, and any recommendations in relation to ongoing monitoring or corrective actions;	Section 3.2, Section 4
2	Continue to include a review and update on the status of recommendations made in previous reports; and	Section 2.2.6 and Section 2.3.5
3	Include an update on the progress of remediation of the two sandstone culverts impacted by mining of LW W1-W4.	Section 2.6
Reporting Requirements as requested by DPE on 5 April 2023		
1	An update on the status of recommendations made in previous six-monthly monitoring reports;	Section 2.2.6 and Section 2.3.5
2	A review of recommended further surface water and groundwater monitoring against performance measures and performance indicators; and	Section 3.2, Section 4
3	An update on the progress of remediation of the two sandstone culverts impacted by mining of LW W1-W4.	Section 2.6

This report will be distributed to the stakeholders listed in **Section 5.4**.

1.2.2 Three-monthly Reporting Requirements

This report forms part of three-monthly reporting for surface water and groundwater following an investigation of Level 4 TARP triggers relating to depressurisation of groundwater aquifers and water level at surface water monitoring site CB (Pool CR14). This reporting requirement was requested by NSW Department of Planning and Environment following the notification of these TARP triggers.

This report includes a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and a summary and progress of any recommendations in relation to ongoing monitoring or corrective actions (refer to **Section 2.2.6** and **Section 2.3.5, Appendix B,** and **Appendix D**).

1.2.3 Annual Review Requirements

An Annual Review for Tahmoor Mine operations during the previous calendar year is required in accordance with Condition E13 (SSD 8445) and Condition 45 of DA 67/98, and is submitted by 31 March annually to Department of Planning and Environment and other stakeholders, as well as upload to the Tahmoor Coal Website. This Six-Monthly Subsidence Impact Report will assist with the completion of the 2023 Annual Review, and will be provided as an appendix to the Annual Review.

1.3 Scope

1.3.1 Reporting Period

This report is the eighth six-monthly report to be submitted since the commencement of extraction of LW W1, in accordance with the requirements of the LW W1-W2 Extraction Plan and LW W3-W4 Extraction Plan. The reporting period of this report is from 1 January 2023 to 30 June 2023, and covers subsidence impacts observed following completion of LW W4 extraction.

Table 1-2 summarises the monitoring and reporting completed during the reporting period, as well as the timeframe of data reviewed for each monitoring component.

1.3.2 LW W3-W4 Study Area

The Extraction Plan Study Area for LW W3-W4 is defined as the surface area that is likely to be affected by the extraction of LW W3-W4 from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (mm) subsidence contour resulting from the extraction of LW W3-W4; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW W3-W4.

The Study Area is illustrated in **Figure 1-2**.

1.3.3 LW W3-W4 Extraction Plan Context

The LW W3-W4 Extraction Plan is part of the Tahmoor Coal Environmental Management Structure, which is illustrated in **Figure 1-3**. As part of the LW W3-W4 Extraction Plan, a set of management plans was prepared to manage particular environment or built features with the LW W3-W4 Study Area, which consisted of the following:

- Water Management Plan;
- Land Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Stonequarry Creek Rockbar Management Plan;
- Built Features Management Plan, with a number of sub-plans to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction; and
- Public Safety Management Plan.

The overall framework for subsidence monitoring and management of impacts of the LW W3-W4 Extraction Plan is provided in the relevant Subsidence Monitoring Programs. Monitoring of environmental and built features has been completed by Tahmoor Coal in accordance with management plans listed above.

It is noted that the management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan.

Monitoring of features from the LW W1-W2 Extraction Plan as part of post-mining monitoring has been either completed or incorporated into the LW W3-W4 Subsidence Monitoring Programs.

Subsidence monitoring results and any impacts for the Tahmoor South Domain will be reported separately to that of the Western Domain.

Table 1-2 Monitoring and Reports Reviewed for this Reporting Period

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Subsidence Monitoring Program	Subsidence	General subsidence	• SMEC • Building Inspection Service • Comms Network Solutions	• Mine Subsidence Engineering Consultants (MSEC)	• Post-mining report for 1 January 2023 to 30 June 2023	Appendix A
Water Management Plan	Surface Water	Stonequarry Creek flow	• WaterNSW	• ATC Williams	• 6-Monthly report for 1 January 2023 to 30 June 2023	Appendix B
		Pool water level	• ALS			
		Stream water quality				
		Flooding	• SMEC	• WRM	• Post-mining Report completed following LW W4 extraction	Available on request
		Natural drainage behaviour	• Brienan Environment and Safety	• Brienan Environment and Safety	• Post-mining reports for January, February and May 2023 (monitoring required on a 3-monthly basis during the post-mining period)	Appendix C
	Groundwater	Groundwater quality	• GeoTerra • CES	• SLR	• 6-Monthly report for 1 January 2023 to 30 June 2023	Appendix D
		Groundwater bore level	• GeoTerra • CES			
		Shallow groundwater pressures				
		Deep groundwater pressures	• Groundwater Exploration Services • SLR • CES			
		Groundwater Inflow	• Tahmoor Coal			

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Land Management Plan	Landscape	Cliff lines Steep Slopes Surface cracking (excluding railway corridor) Dams	• Douglas Partners	• Douglas Partners	• Post-mining reports for March and June 2023 (monitoring required on a 3-monthly basis during post-mining period)	Available on request
		Dams	• Bloor Rail • Newcastle Geotechnical	• MSEC • Bloor Rail • Newcastle Geotechnical	(No inspections required as outside mining period)	NA
		Dams	• Building Inspection Service (BIS)	• BIS	(No inspections required as outside mining period)	NA
	Agricultural Land	Agricultural Land	• BIS	• BIS	• Post-mining report for March and June 2023 (monitoring required on a 3-monthly basis during post-mining period)	Available on request
Biodiversity Management Plan	Aquatic Ecology	Macroinvertebrates	• Niche	• Niche	• Aquatic Ecology Monitoring Report for Autumn 2023	Available on request
	Terrestrial Ecology	Amphibians Riparian Vegetation	• Niche	• Niche	• Terrestrial Ecology Monitoring Report for Autumn 2023	Available on request
Heritage Management Plan and Stonequarry Creek Rockbar Management Plan	Aboriginal heritage	Grinding Grooves	• SMEC	• MSEC	• Post-mining report for 1 January 2023 to 30 June 2023	Appendix A
			• EMM Consulting	• EMM Consulting	(No inspections required as outside mining period. End of Panel for LW W4 completed and reported on in previous reporting period)	NA

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Heritage Management Plan and Stonequarry Creek Rockbar Management Plan	Aboriginal heritage	SR17 Rockbar	• SMEC • Michael Nicholson Consulting • PSM	• MSEC	(No inspections required as outside mining period)	NA
	Historical heritage	Railway culverts	• Newcastle Geotechnical	• Newcastle Geotechnical	(No inspections required as outside mining period)	NA
			• EMM Consulting	• EMM Consulting	(No inspections required as outside mining period. End of Panel for LW W4 completed and reported on in previous reporting period)	NA
Built Features Management Plan	Built Features	Electricity Infrastructure Gas Infrastructure Potable Water Sewerage Infrastructure Telecommunications Local roads, bridges and culverts Built Structures	• SMEC • BIS • Comms Network Solutions •	• MSEC	• Post-mining report for 1 January 2023 to 30 June 2023	Appendix A
		Picton-Mittagong Loop Line	• Southern rail Services • Bloor Rail	• MSEC	(No inspections required as outside mining period)	NA

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Built Features Management Plan	Built Features	Transport for NSW (TfNSW) Infrastructure	• SMEC • Southern Rail Services • BIS	• MSEC	• Monthly Victoria Street Status Reports during post-mining period. Victoria Bridge Status Reports have been continued well beyond the extraction of LW4 due to a large rock mass movement towards the Stonequarry Creek incised valley. The rock mass anomalous movement was first observed in the mining of LW32 where relative survey ground movement vectors showed the ground moving towards the incised creek valley and away from the goaf. The rock mass only started to be seen at Victoria Bridge on the extraction of LW W3 and LW W4.	Available on request
		Main Southern Railway (MSR)	• SMEC • Southern rail Services • Bloor Rail • BIS • Comms Network Solutions • Newcastle Geotech	• MSEC	• Monthly MSR Status Reports during post-mining of LW W4.	Available on request

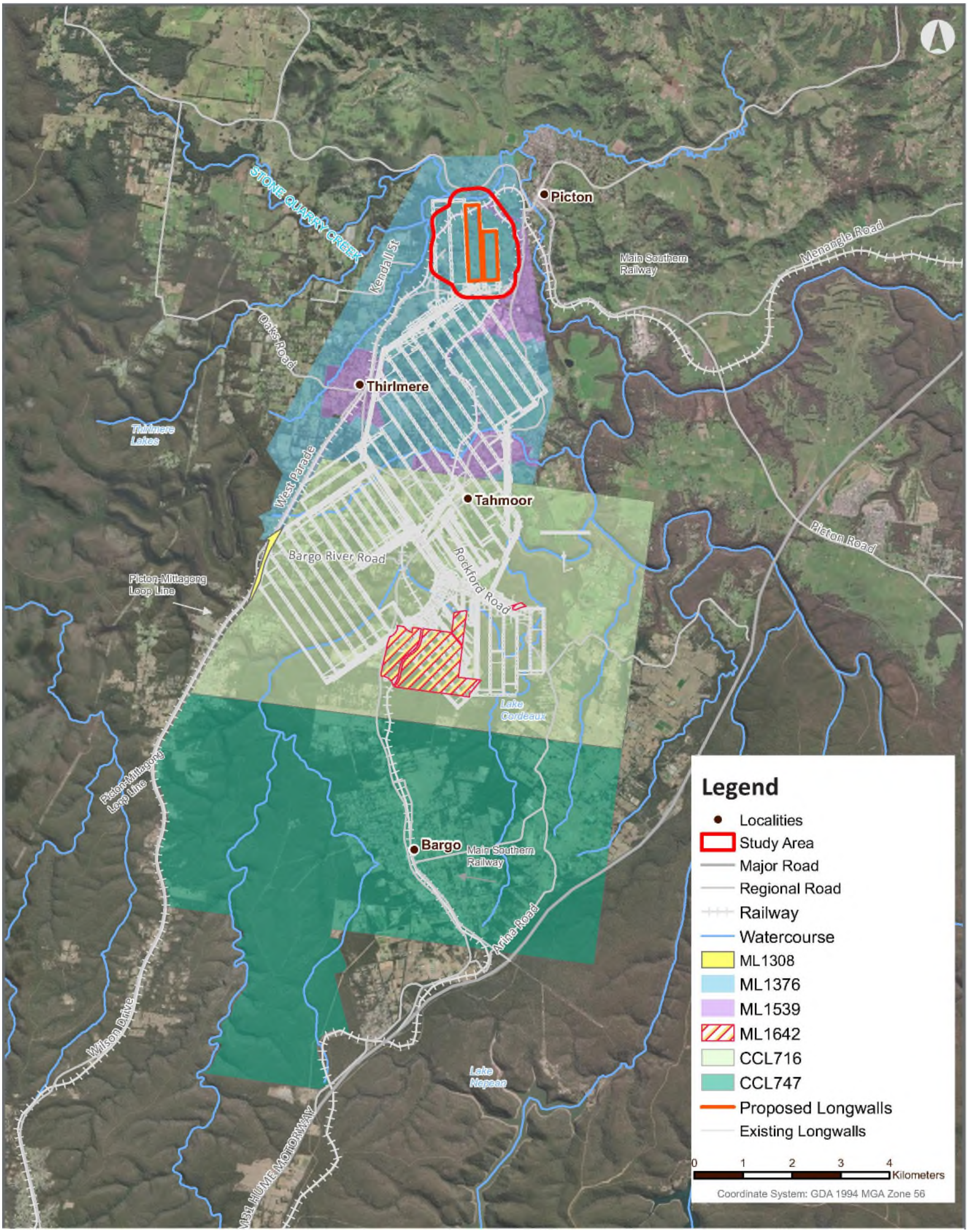

Figure 1-1 Tahmoor Mine Area and Tenure (source: LW W3-W4 Extraction Plan)

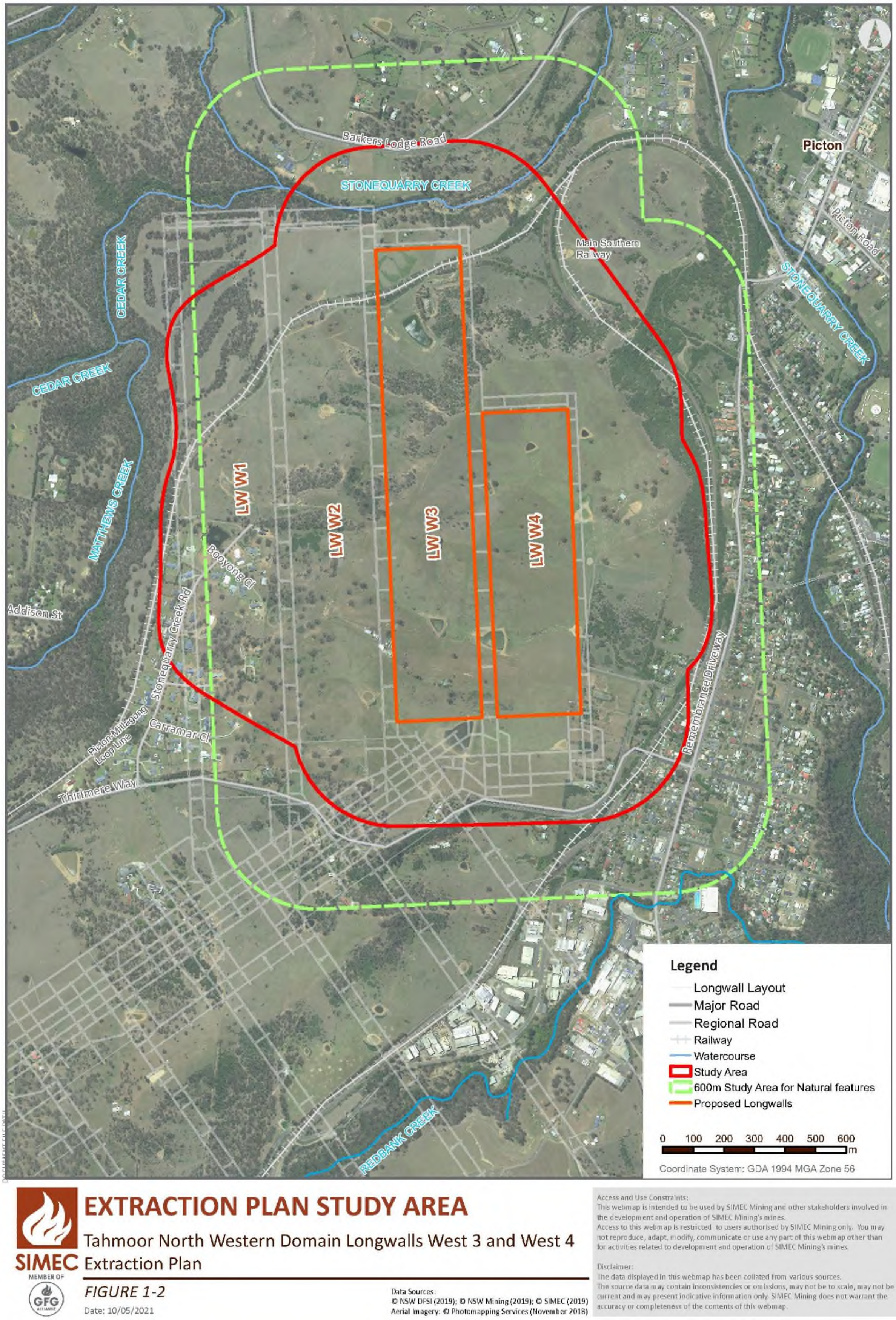

Figure 1-2 LW W3-W4 Extraction Plan Study Area (source: LW W3-W4 Extraction Plan)

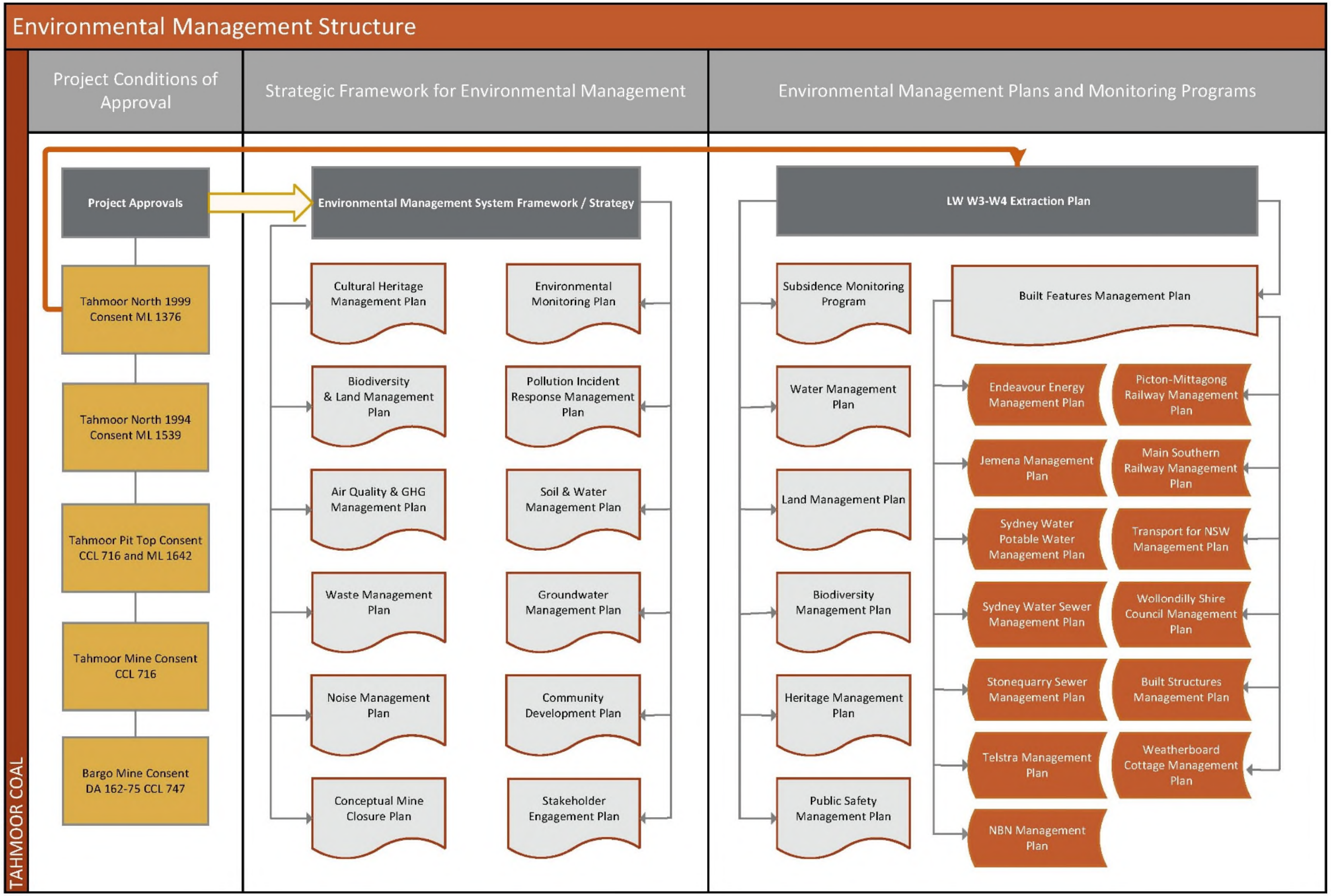

Figure 1-3 Overview of Environmental Management Structure for Tahmoor Coal (source: LW W3-W4 Extraction Plan)

2 Summary of Environmental Monitoring Results

2.1 Subsidence Monitoring

During the reporting period, the LW W3-W4 Subsidence Monitoring Program have been implemented to monitor subsidence impacts within the Study Area. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-3**. The Subsidence Monitoring Program includes seventeen (17) Global Navigation Satellite System (GNSS) units measuring absolute horizontal and vertical positions in real time installed directly above and adjacent to LW W3-W4. Nine GNSS units have been removed from privately owned properties in July 2023.

A summary of all surveys and inspections completed during the reporting period is provided in MSEC1263 LW W4 Subsidence Monitoring Report 21 (refer **Appendix A**).

Longwall West 4 (LW W4) extraction commenced on 16 May 2022 was completed on 13 September 2022.

Table 2-1 summarises the maximum observed ground movements within the active subsidence zone at the start and end of this reporting period. During the reporting period, a maximum of 897 mm of vertical subsidence relating to the extraction of LW W4 was recorded along the LW W1-W4 crossline survey. Very minor subsidence movements have been observed during the post-mining period of LW W4.

Table 2-1 Subsidence Monitoring Observations during this Reporting Period (source: Appendix A)

	Report 21 (MSEC1263) for LW W4	
Monitoring Period	1/1/2023 – 30/06/2023	
Progress of extraction	LW W4 completed on 13 September 2022	
Observed Ground Movement Parameters	**Maximum Observed Total**	**Location**
Subsidence (mm)	897	LW W1-W4 Crossline
Tilt (mm/m)	9.8	LW W1-W4 Crossline
Hogging Curvature (km^{-1})	0.35	LW W1-W4 Crossline
Sagging Curvature (km^{-1})	-0.33	LW W3 Centreline
Tensile Strain (mm/m)	1.3	LW W2 Centreline
Compressive Strain (mm/m)	-5.6	LW W4 Centreline

2.1.1 Ground Survey Results

The development of subsidence at pegs and GNSS units located on the LW W4 centreline that have been mined directly beneath by LW W4 are illustrated in **Figure 2-1**.

GNSS Site 24 is located directly above the centreline of LW W4, approximately 200 metres from the commencing end. The unit has recorded approximately 660 mm subsidence and has also moved to the east and south. Rates of change have reduced to very low levels. GNSS Site 24 recorded an additional 16 mm of vertical subsidence in the reporting period, which is likely to be attributed to normal ground movement from climatic variations.

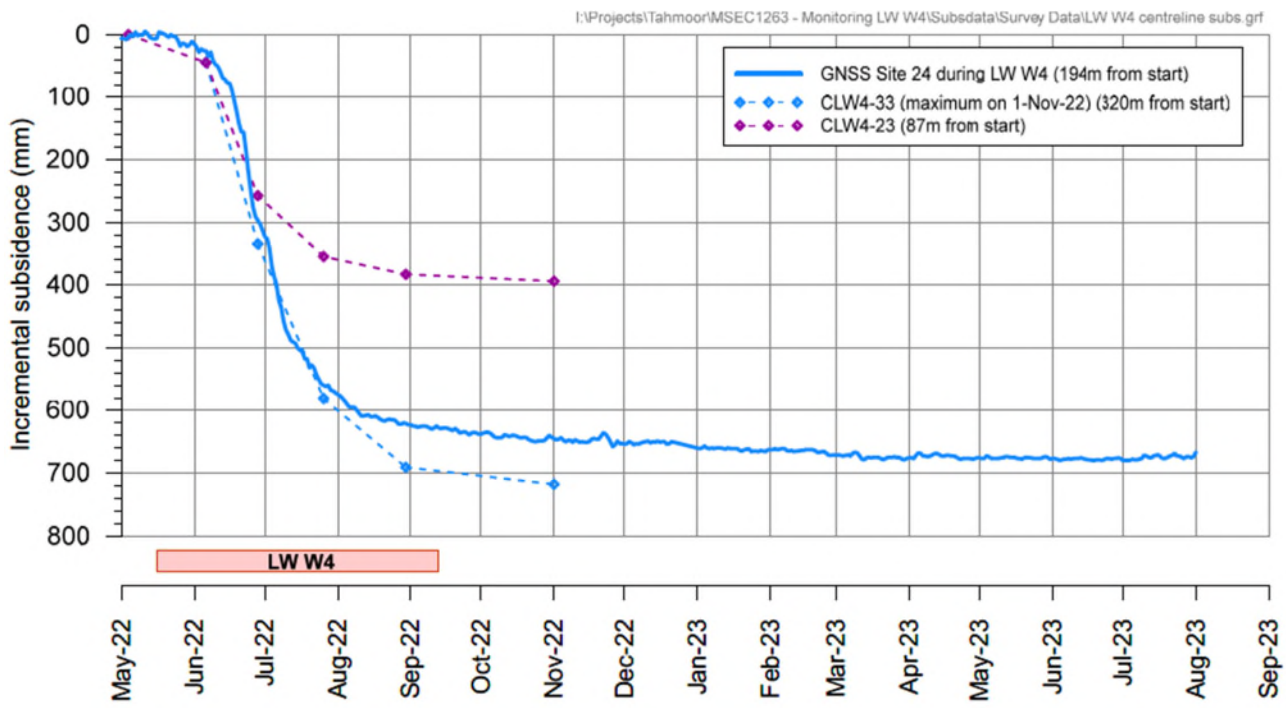

Figure 2-1 Development of subsidence along centreline of LW W4 (source: MSEC, Subsidence Monitoring Report 21, Appendix A).

The results from all GNSS units show that some trends can be seen in the results of the observed GNSS movements, with the closest GNSS units generally moving towards the extracted panel as expected.

Changes in horizontal distances between GNSS units stationed near each other and on opposite sides of a waterway as a result of the extraction of LW W1-W4 are shown in **Figure 2-2**. During LW W4 extraction, only minor changes have been observed between the GNSS units.

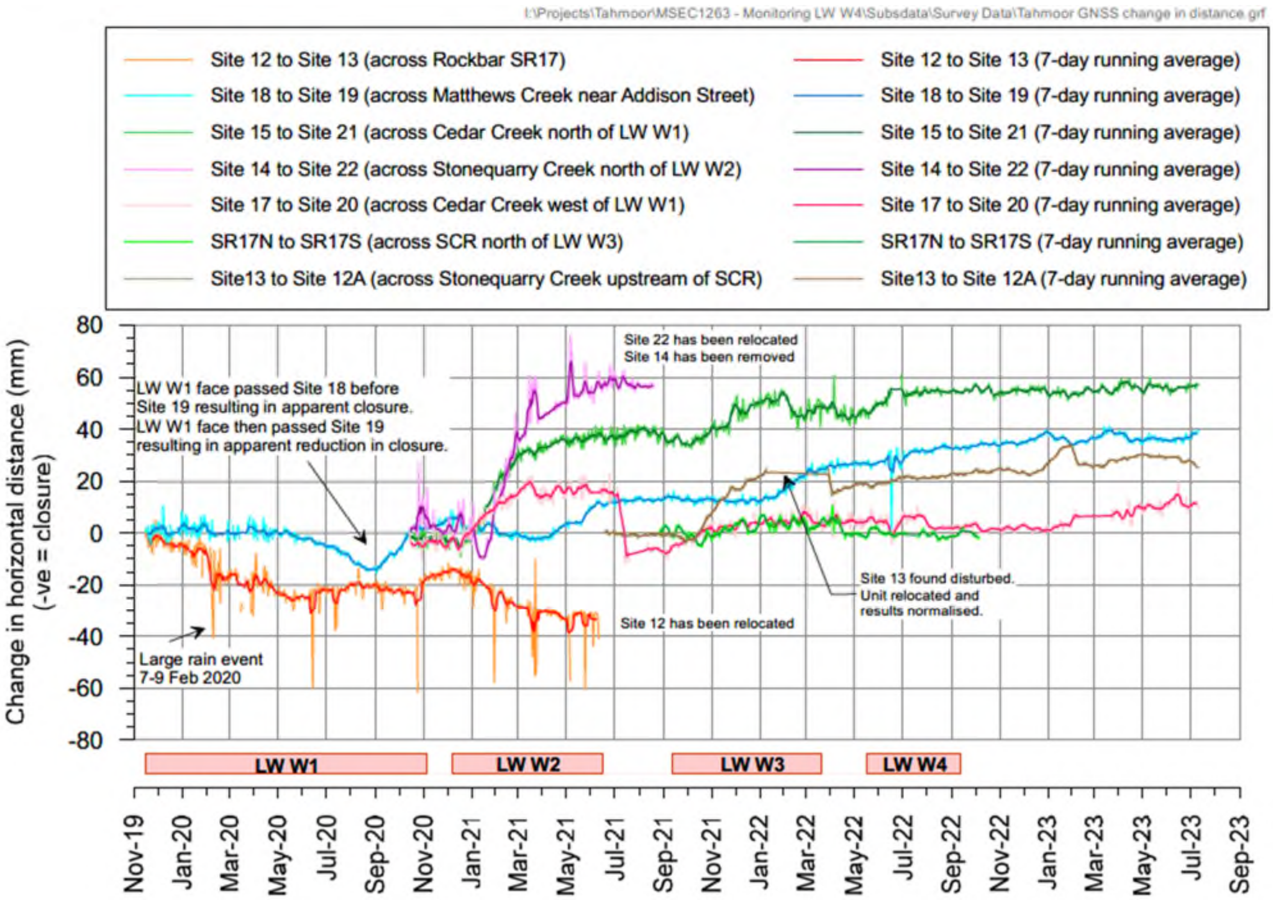

Figure 2-2 Observed changes in horizontal distances between GNSS units during LW W1-W4 extraction (source: MSEC, Subsidence Monitoring Report 21, Appendix A).

2.1.2 Valley Closure in Creeks

Survey marks installed across rockbars in Stonequarry Creek, Cedar Creek and Matthews Creek are illustrated in **Figure 2-3**.

During the extraction of LW W3, valley closure was measured to develop across Stonequarry Creek at SQ104 and SQ105, which are located near the confluence of Stonequarry Creek and Cedar Creek. Minor closure was developing across SQ104, SQ105, SQ106 and SQ107 up to 3 November 2021. The survey pegs for SQ101 to SQ109 were removed following the survey on 3 November, as requested by the landowner.

Survey completed at the end of LW W4 noted minor changes in horizontal distances both along and across Rockbar SR17. Minor ground shortening was also observed in the south-east corner of the rockbar. Very little change in closure along Cedar Creek and Matthews Creek was observed during the mining of LW W4.

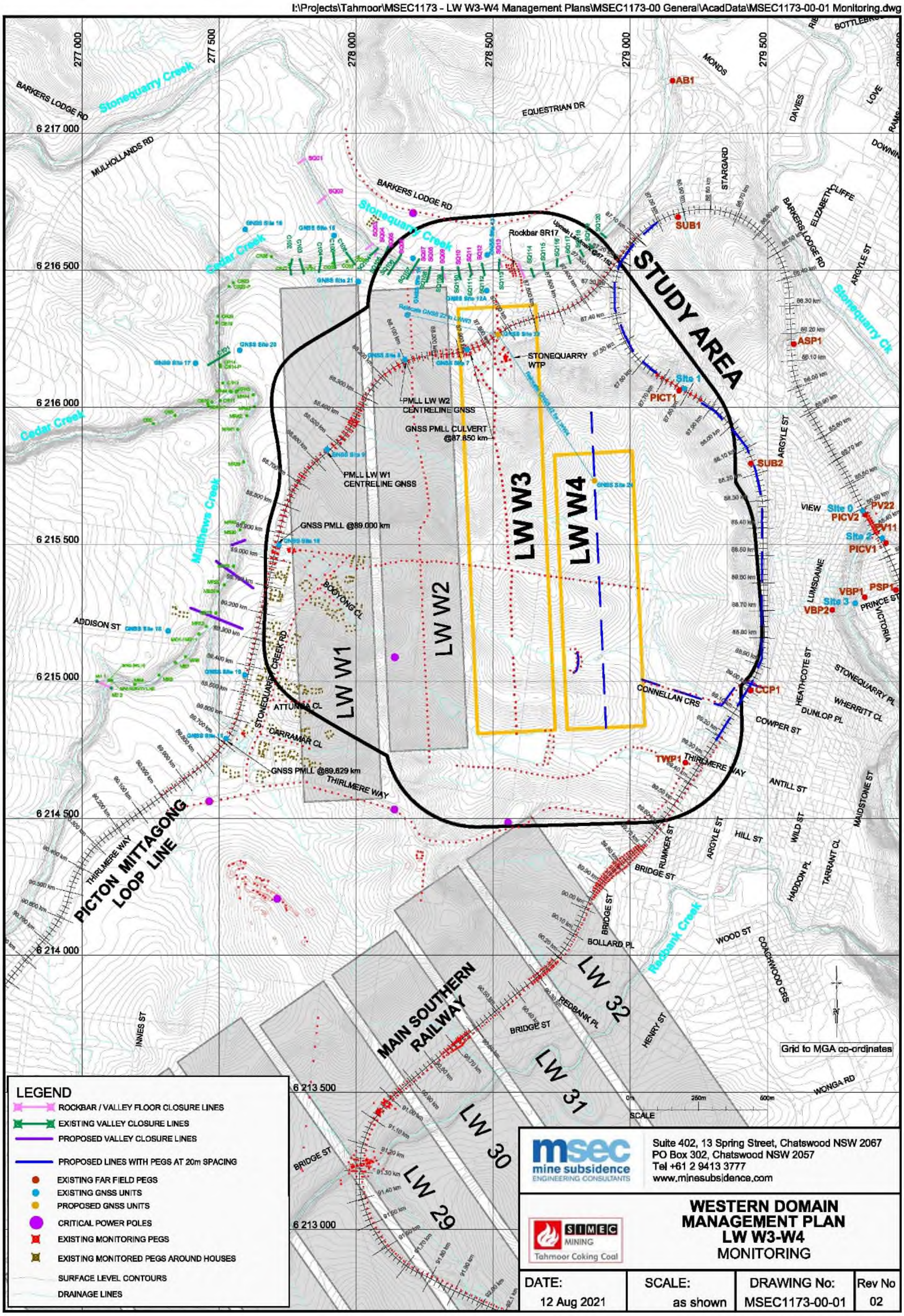

Figure 2-3 LW W3-W4 Subsidence Monitoring Program (source: LW W3-W4 Subsidence Monitoring Program)

2.2 Surface Water Monitoring

The LW W3-W4 Water Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on surface water in accordance with Condition 13H(vii)(c) of DA 67/98.

During this reporting period, the LW W3-W4 Water Management Plan have been implemented to monitor surface water:

- Flow, pool water level and surface water quality monitored for Stonequarry Creek, Cedar Creek and Matthews Creek – monthly monitoring data reviewed and reported by ATC Williams on a monthly basis during the post-mining phase (refer to **Appendix B**); and
- Creek monitoring for natural drainage behaviour – visual inspections and reporting by Brienan Environment and Safety completed on a quarterly frequency during the post-mining phase (refer to **Appendix C** for referenced report).

The following sections summarise the observations made during the reporting period for each surface water category. Performance against all Surface Water Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2**.

2.2.1 Stonequarry Creek Flow

The assessment of downstream reduction in catchment flow rate recorded at the WaterNSW gauging station Stonequarry Creek at Picton (GS212053) relies on a calibrated streamflow model which enabled comparison of modelled and monitored streamflow rates. The locations of GS212053 is illustrated in **Figure 2-4**.

The rating curve for Stonequarry Creek at Picton (GS212053) was revised by WaterNSW in July and November 2020 and, as such, the streamflow records for the site have changed thereby invalidating the previous model calibration. Despite attempts to recalibrate the streamflow model, challenges were encountered due to the limitations of the gauging station at Stonequarry Creek at Picton (GS212053), the limitations of catchment rainfall records, water extraction from Stonequarry Creek catchment and the inability to adequately match the monitored and modelled flows. As such, the assessment method, and subsequently assessment of trigger exceedances in relation to catchment flow rate in Stonequarry Creek at Picton, have been discontinued.

2.2.2 Pool Water Level

Surface water level data has been recorded at the pool monitoring sites on Matthews Creek, Cedar Creek and Stonequarry Creek as shown in **Figure 2-4**. Continuous surface water level data has been recorded at three pool monitoring sites on Matthews Creek, seven monitoring sites on Cedar Creek and four monitoring sites on Stonequarry Creek. Manual water level measurements have also been undertaken monthly at the sites shown in **Figure 2-4**.

With the exception of monitoring site CB and CE in Cedar Creek (discussed further below), water levels at monitoring sites on Matthews Creek, Stonequarry Creek, and Cedar Creek remained above minimum baseline levels and/or were consistent with baseline conditions during the reporting period. Monitoring site SE in Stonequarry Creek had occurrences in the reporting period where the water level was at or marginally below the baseline minimum.

Charts illustrating monitored pool water level hydrographs for pools on Matthews Creek, Cedar Creek and Stonequarry Creek are presented in the Surface Water Monitoring Report (refer to **Appendix B**).

Further discussion of the reduced water level occurrences and related TARP triggers is provided in **Section 3.2.1**.

2.2.2.1 Monitoring Site CB (Pool CR14)

Except following high rainfall periods, the water level at monitoring site CB (pool CR14) was recorded below the CTF level and below the baseline minimum for the majority of the review period. The water level declined by a maximum of 0.53 m below the baseline minimum in March 2023 although was recorded at the CTF level in late May to June 2023.

The decline in water level recorded intermittently at monitoring site CB during the review period is considered a result of below average rainfall conditions, a reduction in streamflow contribution from upstream sites (including upstream reference sites) and complex groundwater-surface interactions occurring in the vicinity of monitoring site CB which may be exacerbated by the mobilisation of fractures which is considered to have occurred during mining of LW W1-W4.

2.2.2.2 Monitoring Site CE (Pool CR25)

From 13 February to 4 April 2023, the water level recorded at monitoring site CE (pool CR25) declined slightly below the baseline minimum (maximum of 0.07 m below the baseline minimum). The water level then rose from early May and was trending around the baseline minimum for the remainder of the review period.

Water level decline was recorded at several monitoring sites in February and March 2023 and to a lesser extent in April and May 2023, including at reference site CC1A on Cedar Creek and reference site MA on Matthews Creek.

The period of slight water level decline recorded at monitoring site CE was consistent with the period of water level decline recorded at monitoring site CB. As such, it is considered that the water level decline recorded at monitoring site CE was related to a decline in surface flow from upstream monitoring site CB in combination with below average rainfall conditions.

2.2.3 Natural Drainage Behaviour

Visual and photographic surveys for subsidence impacts on creeks have been completed quarterly for all monitoring pools on Stonequarry Creek, Cedar Creek and Matthews Creek in the post-mining monitoring period. The purpose of these surveys is to note whether change has occurred to pool level, drainage or overland flow, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify rock bar and/or stream base cracking, gas release, or increased iron precipitation.

Creek monitoring locations are illustrated on **Figure 2-5**, and a summary of creek observations for the reporting period is provided below:

- Surficial fracturing of the controlling rockbar at Pool SR17 and a rockbar at Pool SR20 have been noted, and have not changed since the last inspection in 2022;
- There were no additional surface fracturing or cracking noted in the waterways during the reporting period;
- No reduction in pool water level, flow or connective overland flow was observed in the waterways during the reporting period;
- Iron hydroxide precipitation was observed to have reduced in Cedar Creek in February 2023, and are no longer present in Matthew Creek in February 2023; and
- No gas release was noted in the waterways during the reporting period.

The surficial fracturing of the controlling rockbar at Pool SR17 was first noted following the visual inspection on 17 November 2021. The fractures occurred in thinly bedded, laminated sandstone and were likely in response to mining related differential compression in combination with the presence of existing delamination in the rockbar surface formed by natural weathering processes. This surficial fracturing had been noted to be stable during the reporting period.

The surficial fracturing of a rockbar at Pool SR20 was noted following the inspection on 18 August 2022. Two fractures were noted and it was confirmed that one crack was the development of an existing (pre-mining) joint / discontinuity, while the other was first observed during mining of LW W4. The fractures had been noted to be stable during the reporting period.

Further discussion of surficial fracturing and related TARP triggers is provided in **Section 3.2.2**.

2.2.4 Surface Water Quality

Surface water quality data has been recorded at the following sites (refer to **Figure 2-4**):

- Cedar Creek: Cedar US, CC1, CA, CB, CC, CD, CE, CF, CG;
- Matthews Creek: MB, MC1, MG; and
- Stonequarry Creek: SC1, SC2, SC, SD, SE.

Field analyses are undertaken for pH, electrical conductivity (EC), dissolved oxygen, temperature and oxidation reduction potential. Laboratory analyses are undertaken for pH, EC, TDS, alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium, fluoride, nitrate+nitrite, total kjeldahl nitrogen, phosphorus and the following total and dissolved metals: aluminium, arsenic, barium, copper, lead, lithium, manganese, nickel, selenium, strontium, zinc and iron.

A summary of observations for the reporting period is provided in **Table 2-2**. Charts illustrating water quality results for monitored pools on Matthews Creek, Cedar Creek and Stonequarry Creek are presented in Appendix C of the Surface Water Review reports (refer to **Appendix B**).

To date, there has been negligible evidence of an influence of mining LW W1-W4 on surface water quality in Matthews Creek, Cedar Creek or Stonequarry Creek. The water quality characteristics of monitoring sites following commencement of mining LW W1-W4 have been largely consistent with baseline conditions and/or consistent with reference site conditions.

During January and February 2023, isolated occurrences of elevated dissolved aluminium were recorded at some monitoring sites on Cedar Creek (monitoring site CG) and Stonequarry Creek (monitoring sites SC2 and SD). Elevated concentrations of dissolved aluminium were also recorded at associated reference sites and, as such, the elevated concentrations are considered to be catchment wide and related to the prevailing climatic conditions. The dissolved aluminium concentrations recorded at all sites declined to the limit of detection in March 2023.

Further discussion of the elevated water quality occurrences and related TARP triggers is provided in **Section 3.2.3**.

Table 2-2 Summary of Notable Results for Key Water Quality Parameters for the Reporting Period

Parameter	Matthews Creek	Cedar Creek	Stonequarry Creek
pH	• Near neutral pH conditions. • pH recorded during the review period was within the range of baseline values.	• Slightly acidic to near neutral pH conditions. • pH values recorded in April at CC1 and CA and in June at CC1, CA and CC were low (around pH 5) in comparison to the previous reporting period, however, were within the range of baseline values.	• Near neutral pH conditions. • pH values recorded during the review period were within the historical range.
Electrical Conductivity	• Field EC values were generally consistent with baseline values (less than 500 µS/cm) for the majority of the review period. • Field EC recorded at monitoring site MB was slightly elevated in June 2023 in comparison to MC1 and MG, however, was within the range of baseline values.	• Field EC values generally increased during the review period, however, remained within the range of baseline values.	• Field EC values generally increased during the review period. • The EC values recorded at reference sites SC1 and SE in June 2023 slightly exceeded the maximum EC value recorded at reference site SC1 during the baseline period.
Dissolved Aluminium	• The concentrations of dissolved aluminium were within the range of baseline concentrations for the duration of the review period.	• Dissolved aluminium concentrations declined at the majority of sites in comparison to the previous review period. • The concentrations of dissolved aluminium were within the range of baseline concentrations for the duration of the review period.	• Slightly elevated concentrations of dissolved aluminium, in comparison to the baseline period, were recorded at the majority of monitoring sites in February 2023. • The dissolved aluminium concentrations declined from March 2023 and were consistent with baseline concentrations.
Dissolved Barium	• The concentrations of dissolved barium were consistent with baseline concentrations for the duration of the review period.	• A generally increasing trend in dissolved barium was recorded at all sites from January 2023, however, the concentrations remained within the range of baseline concentrations.	• A generally increasing trend in dissolved barium was recorded at all sites from January 2023, however, the concentrations remained within the range of baseline concentrations.
Dissolved Iron	• The concentrations of dissolved iron were consistent with baseline concentrations for the duration of the review period.	• The concentrations of dissolved iron were within the range of baseline concentrations for the duration of the review period.	• The concentrations of dissolved iron were within the range of baseline concentrations for the duration of the review period.
Dissolved Manganese	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.
Dissolved Nickel	• Concentrations recorded at all sites were consistent with baseline values.	The concentrations of dissolved nickel were within the range of baseline concentrations for the duration of the review period.	• Concentrations recorded at all sites were consistent with baseline values.

Parameter	Matthews Creek	Cedar Creek	Stonequarry Creek
Dissolved Zinc	• The concentrations of dissolved zinc recorded at all sites were consistent with or less than baseline values.	• Variable concentrations of dissolved zinc were recorded over the duration of the review period, however, concentrations were within the range of baseline concentrations.	• The concentrations of dissolved zinc recorded at all sites were consistent with or less than baseline values.
Sulphate	• Slightly elevated concentrations of sulphate (less than 30 mg/L) were recorded at reference site MB and monitoring site MC1 in January 2023 in comparison to the baseline period. • From February 2023, the sulphate concentrations were within the range of baseline concentrations.	• Concentrations recorded at all sites were generally consistent with baseline values.	• The concentrations of sulphate recorded at all sites were within the range of baseline concentrations.

2.2.5 Flooding

Following the completion of mining in the Western Domain, a post-mining flood study was completed to assess the potential impacts of subsidence on flooding in Matthews Creek, Cedar Creek and Stonequarry Creek. This assessment was completed to fulfil the requirements of Condition 7 of DA 67/98, which requires that mining does not result in the subsidence of any habitable floors to below the 1 in 100 year flood level (1% annual exceedance probability [AEP] flood level).

The report (WRM, 2022) concluded that flooding is confined to the Matthews Creek system (which includes Matthews Creek, Cedar Creek and Stonequarry Creek), and subsidence has not resulted in any habitable floor areas to fall below the 1 in 100 year flood level.

2.2.6 Recommendations and Actions

2.2.6.1 Current Surface Water Monitoring Recommendations

As discussed in the Surface Water Review (**Appendix B**), ongoing review of surface monitoring data is recommended to continue in accordance with the WMP. From the current review period, no further recommendations have been made.

2.2.6.2 Previous Surface Water Monitoring Recommendations

Table 2-3 provides the recommendations as made in the previous Six Monthly Subsidence Impact Report (June to December 2022, submitted in March 2023) for surface water, the previous quarterly surface water report (January to March 2023, submitted in June 2023), along with an update on the progress of these recommendations.

Table 2-3 Surface Water Monitoring Recommendations from the previous Surface Water Review and Current Progress

Item	Previous Recommendation	Progress of Recommendation
1	**Previous Six monthly Subsidence Impact Report** Re-calibration of field instrumentation has been recommended due to intermittent records of potentially erroneous field pH values.	Re-calibration of field instrumentation has been requested of the relevant field personnel. Field personnel have confirmed that appropriate calibration of field instrumentation is undertaken routinely. There have been no further anomalousfield values recorded.
2	**Previous Quarterly Surface Water Report** Decommission monitoring site SF.	Site has been decommissioned.

Item	Previous Recommendation	Progress of Recommendation
3	**Previous Quarterly Surface Water Report** Re-survey rockbar and monitoring instrumentation at monitoring site MB.	Field personnel identified that water was no longer flowing over the rockbar control, rather was flowing through the embankment. The location of embankment flow comprises sandy soil and is directly beneath a tree that was dislodged during a flood event. It is considered that the change in water level behaviour reflects the change in site conditions. As such, re-survey of the rockbar and monitoring instrumentation is no longer considered required.

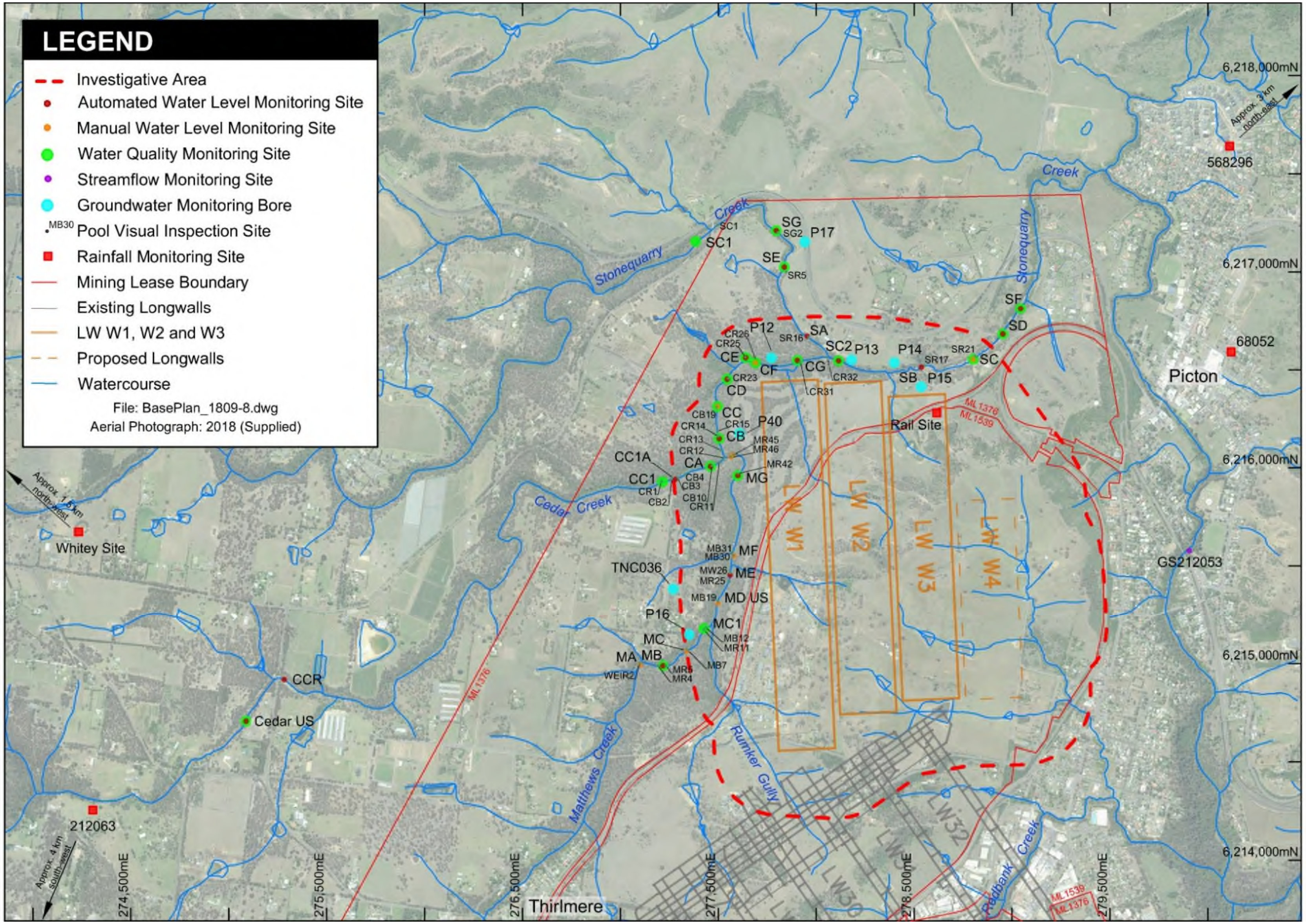

Figure 2-4 LW W3-W4 Surface Water Monitoring Locations (source: ATC Williams, Surface Water Reviews, Appendix B).

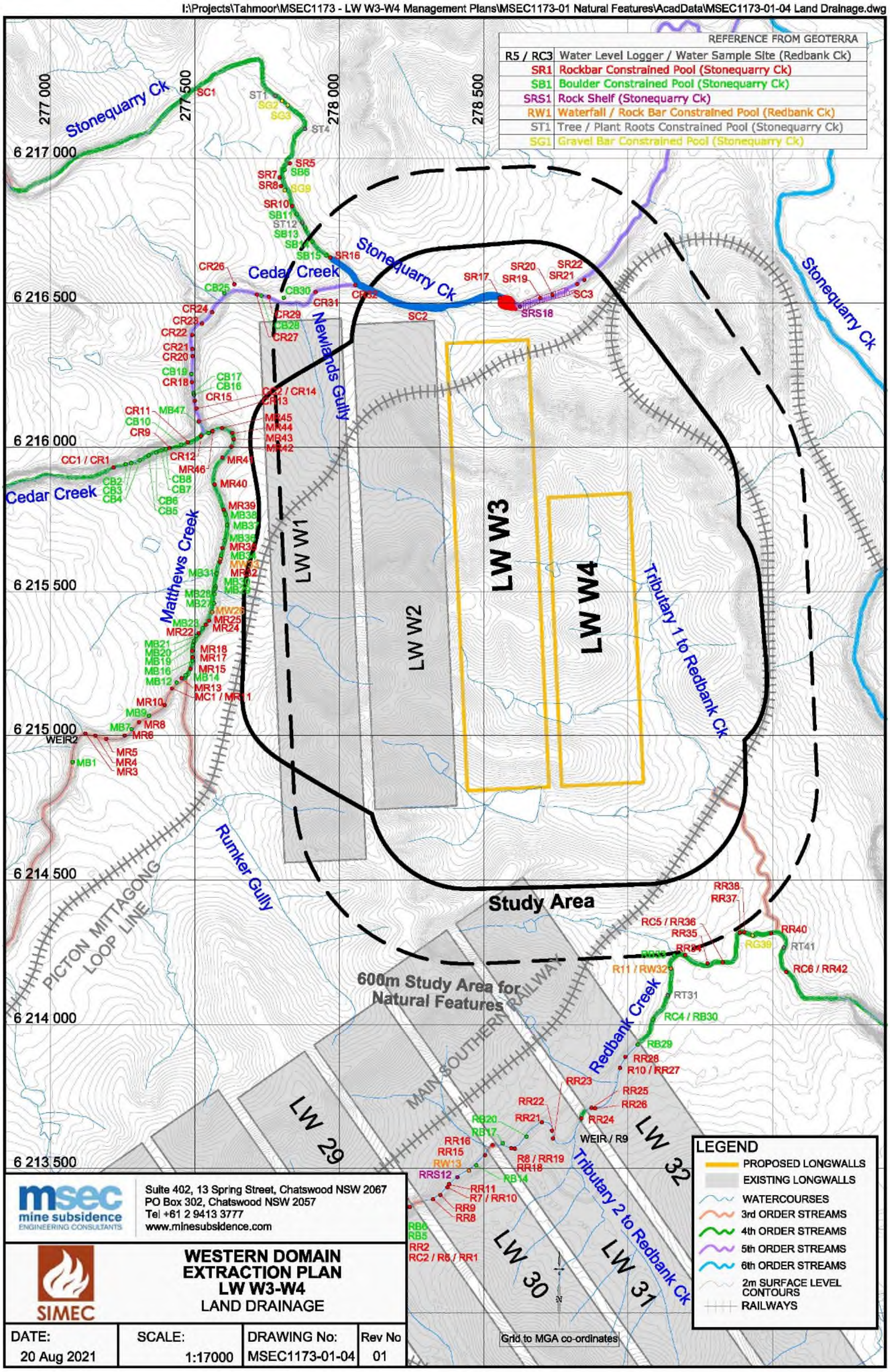

Figure 2-5 LW W3-W4 Creek Monitoring Locations (source: MSEC, 2021; LW W3-W4 Subsidence Predictions and Impact Assessment Report)

2.3 Groundwater Monitoring

The LW W3-W4 Water Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on groundwater in accordance with Condition 13H(vii)(c) of DA 67/98.

During this reporting period, the LW W3-W4 Water Management Plan have been implemented to monitor groundwater:

- Shallow groundwater levels, quality and pressures, and deep groundwater levels / pressures – monthly monitoring data reviewed and reported by SLR on a quarterly basis during the post-mining phase (refer to **Appendix D**); and
- Mine water intake – data for this reporting period reviewed and reported by SLR (refer to **Appendix D**).

The following sections summarise the observations made during the reporting period for each groundwater category. Performance against all Groundwater Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.3.1 Groundwater Bore Levels

A total of 17 open standpipe piezometers (OSPs) have been installed at six locations in the Western Domain – P12 to P17, and a number of private groundwater bores form part of the groundwater monitoring program for LW W3-W4. It is noted that Tahmoor Coal no longer has access to piezometers P13 and P17 due to land access constraints. The locations of these groundwater bores are illustrated in **Figure 2-6**.

Further detail on the below groundwater level triggers, including graphs showing progressive groundwater levels, are provided in the SLR groundwater reports (refer to **Appendix D**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.4**.

At monitoring bores P12, P14, P15, P16 and private bores, ongoing recovery of groundwater levels are being observed following the completion of mining in the Western Domain.

Groundwater level at P12C is still recovering from a maximum groundwater depressurisation of 11m in February 2021 at P12C. Overall, groundwater levels have increased since the previous reporting period, and are approaching baseline levels. Groundwater level at P16C continue to remain relatively stable following successive periods of recovery in 2021 and 2022.

2.3.2 Groundwater Pressures

VWP arrays have been installed at locations TNC36, TNC40, TNC43, P40, P41, WD01 and WD02 (refer to **Figure 2-6**). TNC043 was decommissioned due to terminated site access and has been removed from the TARP assessment from July 2022 onwards. WD01 was decommissioned in April 2023. VWP arrays have been installed in the newly completed WD02, however trigger levels for groundwater levels of each VWP pressure sensor are yet to be established.

Further detail on the below groundwater level triggers, including graphs showing progressive groundwater levels, are provided in the SLR groundwater reports (refer to **Appendix D**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.5** and **Section 3.2.6**.

LW W3 and LW W4 extraction had no significant effects on shallow and deep groundwater across the Western Domain throughout the reporting period.

Groundwater elevations at P40 and P41 typically remained stable during the reporting period with the groundwater elevation in all sensors observed above the creek bed elevation.

Groundwater levels at TNC036 are steadily increasing at most sensors with significant recovery observed in the deeper sensors in the Bulgo Sandstone aquifer. The impacts of groundwater depressurisation are continuing to be evident in the deeper piezometers, although recovery is occurring. Groundwater levels in the Bulgo Sandstone aquifer at 169m started to recover in late September 2022 and whilst showing a significant recovery during the reporting period, the observed groundwater levels remain below baseline levels as of June 2023.

Groundwater levels at TNC040 slightly declined over the reporting period. A delayed mining effect on groundwater levels due to previous mining of LW W4 was not observed at TNC040 during the reporting period. Observed drawdown at TNC036 (BGSS-412.5m) exceeded predicted (modelled) drawdown but was within 30 m of predicted (modelled) drawdown during the reporting period. Over the past 6 months, observed drawdown appears to be trending closer to the predicted (modelled) drawdown.

2.3.3 Mine Water Intake

Tahmoor Coal has a Groundwater Licence (WAL 36442) to extract 1642 ML/year of groundwater make from underground.

The inferred water make (groundwater that has seeped into the mine from the strata) is calculated from the difference between total mine inflows and total mine outflows. This calculation is assisted by input from flow meters installed on fresh water supply lines that pump water into the mine (mine inflow from Sydney Water supply to underground workings), and flow meters on three pipelines that extract water from underground (mine outflow). In addition, mine inflow and outflow also includes a measurement of water that enters and exits the mine through other means such as moisture in air vented in and out of the mine (water in vented air), and moisture in coal extracted from the mine.

Water make calculations provide an indication of the groundwater pumped out of the total Tahmoor Mine underground workings, which include water make from the Western Domain.

SLR completed an analysis of water make for Tahmoor Mine recorded between 1 January 2009 to 30 June 2023 (**Appendix D**). During this period, observed inflows to Tahmoor Mine have been ranging between 2 to 7 ML/d.

In October 2022, the Western Domain blocks were sealed. Since this time, the average groundwater inflow from Tahmoor underground workings is reported as 2.3 ML/d. As of 30 June 2023, the cumulative groundwater make for water year 2022/23 is 1,068 ML, which remains below the groundwater entitlement of 1,642 ML/y.

2.3.4 Groundwater Quality

A total of 17 open standpipe piezometers (OSPs) have been installed at six locations in the Western Domain – P12 to P17, and a number of private groundwater bores form part of the groundwater monitoring program for LW W3-W4. It is noted that Tahmoor Coal no longer has access to piezometers P13 and P17 due to land access constraints. The locations of these groundwater bores are illustrated in **Figure 2-6**.

Further detail on the above groundwater quality triggers, including graphs showing progressive groundwater quality results for pH, EC and selected metals, are provided in the SLR reports included in **Appendix D**. Further detail and discussion of TARP triggers for groundwater quality are also discussed in **Section 3.2.7**.

Overall, improvement in groundwater quality is being observed across most of the shallow open standpipes within the monitoring network (where data was available).

2.3.4.1 Electrical conductivity and pH

During the reporting period, a number of short-term exceedances (less than three months) of normal pH and electrical conductivity (EC) levels were observed. These minor breaches of the trigger levels are in line with historical natural fluctuations and are unlikely to be attributable to mining.

At P12A, pH levels were elevated during the full reporting period. pH levels at P12B and P12C remain within the lower and upper pH trigger levels. Therefore, the exceedance at P12A is likely to be localised and natural. The general trend in pH over time in P12A, P12B and P12C is consistent.

2.3.4.2 Metal concentrations

A number of elevated metal concentrations were noted during the review period, and these short-term increases (less than three months) were noted. These minor breaches of the trigger levels are in line with historical natural fluctuations and are unlikely to be attributable to mining.

At P12C, elevated iron concentrations were observed in January and February before returning to within baseline conditions, then noting an exceedance again in May and June 2023. Dissolved iron concentrations have significantly fluctuated over the past 12 months. The increase in dissolved iron concentrations is suggested to be localised and likely to be caused by iron mobilisation during groundwater recovery.

At P12C, elevated manganese concentrations were observed across the full reporting period. The increase in the dissolved concentrations of iron and manganese appear to be correlated and the natural fluctuation in groundwater quality could be associated with the increasing trend at site P12. Site P12B follows the same trend, although it did not breach the trigger.

At P16A, elevated nickel concentrations were observed in January, February, April, May and June 2023. Concentrations of nickel has fluctuated over the past 12 months with periods of high concentration followed by periods of baseline variability. Additional monitoring is required to confirm post-mining nickel trends at P16A.

At P16B, elevated strontium concentrations were observed across the whole reporting period. Elevated strontium concentrations were also observed in January, February and March 2023, and November and December 2022, resulting in six consecutive months of a TARP Level 2 exceedance. No strontium concentration data is available between July and November 2022.

2.3.5 Recommendations and Actions

2.3.5.1 Current Groundwater Monitoring Recommendations

The following groundwater recommendations were made for this reporting period by SLR (refer **Appendix D**):

- Where a TARP Level 1 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report;
- Where TARP Level 2 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report. In addition, it is recommended to:
  - Groundwater Quality – for all sites with Level 2 TARPs in place, closely monitor concentrations against TARP trigger levels for the site and associated control sites as set out in the TARP;
  - Groundwater Levels - for all sites with Level 2 TARPs in place, closely monitor groundwater levels against TARP trigger levels for the site and associated control sites as set out in the TARP;

- o Groundwater Pressures – continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. For all sites with Level 2 TARPs in place, closely monitor groundwater pressures levels against TARP trigger levels for the site and associated control sites as set out in the TARPs;
- o Revise the trigger level for dissolved iron at P15D to 2.5 mg/L; and
- o Revise the trigger level at GW105228 to 0.25 mg/L to align with the lithium trigger level at GW115860.

Progress of these recommendations will be provided in the next quarterly surface water and groundwater monitoring report for the Western Domain (to be provided in December 2023).

2.3.5.2 Groundwater Recommendations from the previous Six Monthly Subsidence Impact Report and Quarterly Groundwater Report

Table 2-4 provides the recommendations as made in the previous Six Monthly Subsidence Impact Report (June to December 2022, submitted in March 2023) for groundwater, the previous quarterly groundwater report (January to March 2023, submitted in June 2023), along with an update on the progress of these recommendations.

Table 2-4 Groundwater recommendations from the previous Six Monthly Subsidence Impact Report and Quarterly Groundwater Report and Current Progress

Item	Previous Recommendation	Progress of Recommendation
1	**Previous Six Monthly Subsidence Impact Report** Continue the monitoring program, reporting groundwater level and quality data in the next groundwater review report for January-March 2023.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3, Section 3.2; Appendix D**).
2	**Previous Six Monthly Subsidence Impact Report** For P12C, P16B, P16C, TNC036 (HBSS-97m) and TNC036-169m with Level 2 TARPs in place for groundwater levels, continue monitoring and reviewing groundwater level response. **Previous Quarterly Groundwater Report** Groundwater Levels - for all sites with Level 2 TARPs in place, closely monitorground water levels against TARP trigger levels for the site and associated control sites as set out in the TARPs	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (Sections 2.3, Section 3.2; Appendix D). During this reporting period, ongoing recovery of groundwater levels were observed following the completion of mining in the Western Domain. Specifically pertaining to those mentioned: • P12C: Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period. • P16B: returned to normal conditions (level 1). • P16C: Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period. • TNC036 (HBSS-97m): returned to normal conditions (level 1). • TNC036 (BGSS -169m): Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period.

Item	Previous Recommendation	Progress of Recommendation
3	**Previous Six Monthly Subsidence Impact Report** For TNC036 (BGSS-214m and BGSS-412.5m) with Level 2 TARPs in place for groundwater levels, continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. **Previous Quarterly Groundwater Report** Groundwater Pressures – continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. For all sites with Level 2 TARPs in place, closely monitor groundwater pressures levels against TARP trigger levels for thesite and associated control sites as set out in the TARPs.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3, Section 3.2; Appendix D**). During this reporting period, ongoing recovery of groundwater levels were observed following the completion of mining in the Western Domain. Specifically pertaining to those mentioned (TNC036 BGSS-214m and BGSS-412.5m), both bores have shown recovery and are within or showing less than the predicted modelled drawdown.
4	**Previous Six Monthly Subsidence Impact Report** For all sites with Level 1 TARPs in place for groundwater quality, continue monitoring pH, EC and metal concentrations against TARP trigger levels. **Previous Quarterly Groundwater Report** Where a TARP Level 1 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3; Appendix D**).
5	**Previous Six Monthly Subsidence Impact Report** For all sites with Level 2 TARPs in place for groundwater quality (EC, pH and metals), continue monitoring concentrations against TARP trigger levels. **Previous Quarterly Groundwater Report** Groundwater Quality – for all sites with Level 2 TARPs in place, closely monitor concentrations against TARP trigger levels for the site and associated control sites asset out in the TARPs.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, short-term exceedances of pH and EC levels were observed, and are likely associated with natural fluctuations rather than attributable to mining.
6	**Previous Six Monthly Subsidence Impact Report** For site P12C with a Level 2 TARP in place for groundwater quality (iron and manganese), continue closely monitoring Fe and Mn concentrations at the nearby monitoring bores (P12A and P12B).	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, dissolved iron concentrations have significantly fluctuated over the past 12 months, and is suggested to be localised and likely cause by iron mobilisation during groundwater recovery. The increase in dissolved manganese is likely to be associated with natural fluctuations, resulting in a trend of increased concentration at site P12 (as also observed in P12B).

Item	Previous Recommendation	Progress of Recommendation
7	**Previous Six Monthly Subsidence Impact Report** For site P15D with a Level 2 TARP in place for groundwater quality (iron), continue closely monitoring Fe concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, dissolved iron concentrations exceeded the trigger level in May and June 2023. A revision of the trigger level for dissolved iron at P15D was recommended.
8	**Previous Six Monthly Subsidence Impact Report** For site P16C with a Level 3 TARP in place for groundwater quality (zinc), continue closely monitoring Zn concentrations at the nearby monitoring bores (P16A, B and private bore GW105546 and GW105467).	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, short-term exceedances of the dissolved zinc trigger level at P16C occurred in January 2023 before returning to Level 1 (normal conditions).
9	**Previous Six Monthly Subsidence Impact Report** For site P15A, B and C with a Level 2 TARP in place for groundwater quality (strontium), continue closely monitoring Sr concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, short-term exceedances of the dissolved strontium trigger level occurred at P15A June 2023, at P15B in April, May and June 2023, and at P15C in April and June 2023. Trends are attributed to natural fluctuations.
10	**Previous Six Monthly Subsidence Impact Report** For site P15A and GW105228 with a Level 2 TARP in place for groundwater quality (lithium), continue closely monitoring Li concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bore GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023), as well as part of this Six Monthly Subsidence Impact Report (**Sections 2.3.4, Section 3.2; Appendix D**). During this reporting period, short-term exceedances of the dissolved lithium trigger level occurred at P15A in May and June 2023, and at GW105228 in January and April 2023. No exceedances of the lithium trigger level were observed at the nearby bore GW115860. Trends are attributed to natural fluctuations.
11	**Previous Six Monthly Subsidence Impact Report** Complete an extended purge at P12C, P15A, P15D, P16C in the next round of monitoring to remove groundwater potentially contaminated with iron stain, grout or other localised source of metals before sampling.	As stated in the previous Quarterly Groundwater Report, field technicians undertook a purge of P15A, P16C and P12A in December 2022. Field technicians also undertook a purge of P15D in July 2023 to remove potentially contaminated groundwater with iron staining. During the reporting period, dissolved iron concentrations were still elevated at P12C (January, May and June 2023), P15A (February 2023) and P15D (February, May and June 2023). P16C showed no exceedances.

Item	Previous Recommendation	Progress of Recommendation
12	**Previous Six Monthly Subsidence Impact Report** For the next round of monitoring, undertake sampling of groundwater levels and yield test at GW105546 and GW105467.	As stated in Previous Quarterly Groundwater Report, after a review of land access and suitability of these bores, these bores have been removed from the monitoring program due to lack of suitability (private bore owner installed infrastructure making it an unsuitable site for monitoring) and lack of land access.
13	**Previous Six Monthly Subsidence Impact Report** Investigate blockages at P16B and GW072402.	At GW072402, the blockage of this bore is understood to have occurred prior to mining in the Western Domain. Therefore, this bore has been removed from the monitoring program. At P16B, the previous blockage was resolved, and water level and quality data was available for the full reporting period.
14	**Previous Quarterly Groundwater Report** For WD02, establish trigger levels for groundwater levels for each VWP pressure sensor.	Construction of WD02 is complete and data collection has commenced. Given the conclusion of mining in the Western Domain and lack of baseline data collected, it is recommended that triggers not be established for this bore (insufficient baseline data prior to cessation of compliance report). The bore will be incorporated into the broader regional monitoring network associated with ongoing extraction activities underway by Tahmoor Coal.

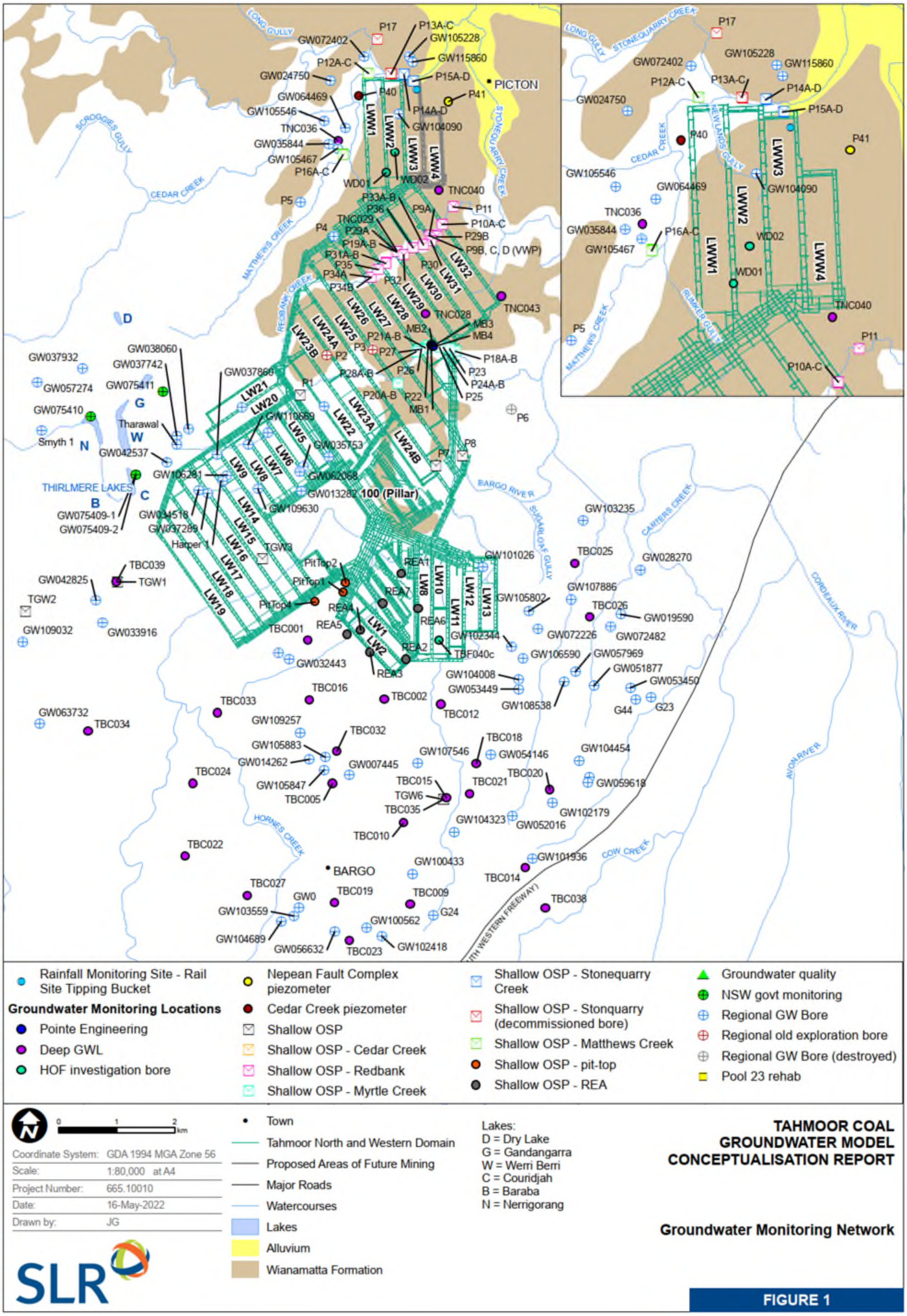

Figure 2-6 LW W3-W4 Groundwater Monitoring Bores (source: Groundwater Six-Month Review, SLR; Appendix D)

2.4 Land Monitoring

The LW W3-W4 Land Management Plan was prepared to manage the potential environmental consequences of LW W3-W4 extraction on steep slopes, dams, agricultural land, and land in general in accordance with Condition 13H(vii)(e) of DA 67/98.

During this reporting period, the LW W3-W4 Land Management Plan have been implemented to monitor the following landscape features:

- Steep slopes and dams – quarterly visual inspections and reporting by geotechnical engineers from Douglas Partners during the post-mining phase; and
- Agricultural land – quarterly visual inspections and reporting by Building Inspection Service during the post-mining phase.

It is noted that there are no cliffs or rock outcrops within the LW W3-W4 Study Area.

The following sections summarise the observations made during the reporting period for each land category. Performance against all Land Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.4.1 Steep Slopes

Visual and photographic surveys for subsidence impacts on structures near steep slopes have been completed quarterly during the post-mining phase for features within the LW W3-W4 active subsidence zone. The locations of steep slopes within the LW W3-W4 Study Area are illustrated in **Figure 2-7**.

During the reporting period, structures located on Stonequarry Creek Road, Booyong Close, Attunga Close, Carramar Close, Thirlmere Way, Star Street, Connellan Crescent, and the Waste Water Treatment Plant (WWTP) were inspected. There were no signs of distress or changes in the areas inspected that could be attributed to mine subsidence.

2.4.2 Dams

Visual and photographic surveys for subsidence impacts on dams were completed on a quarterly basis during the post-mining phase for dams within the LW W3-W4 active subsidence zone. The location of dams within the LW W3-W4 Study Area are illustrated in **Figure 2-8**.

During the reporting period, there were no observable changes to farm dams that were considered to be due to mine subsidence.

During the previous reporting period, farm dam 3 (FD3) was noted to have localised slumping in the southern spillway cut batter and the upstream embankment face. In September 2022, a larger landslide was noted to be developing in the hillside to the south of the southern spillway. Tahmoor Coal reduced the pond level of FD3 by syphoning method as a precautionary action. This change was not considered to be due to mine subsidence, and remained unchanged since the October 2022 inspection.

New tension cracking at farm dam 6 (FD6) was noted in March 2023. However this new cracking was considered to be due to reduced support in the adjacent eroded slot failure in the farm dam embankment, and was not considered to be due to mine subsidence.

Reactivation and propagation of previous landsliding at farm dam 7 (FD7) was noted in March and June 2023, affecting the north-eastern slope and perimeter drain above FD7. This change was considered unlikely to be due to mine subsidence.

Shallow soil slumping along the upstream face of farm dams 2 (FD2), 12 (FD12) and 16 (FD16) were noted in March and June 2023. These changes were considered to be due to subvertical batters probably due to previous cattle tracking along the water edge. These changes were considered unlikely to be due to mine subsidence.

2.4.3 Agricultural Land

Visual and photographic surveys for subsidence impacts on agricultural land have been completed on a quarterly basis during the post-mining monitoring period. Inspections points were set up prior to the commencement of LW W3 mining to provide vantage of agricultural land within the LW W3-W4 Study Area. The purpose of the surveys is to note whether change has occurred to agricultural land, and to assist in determining if any change can be attributed to mining impacts. Surveys noted the presence of erosion, condition of boundary and internal fencing components, paddock gate condition, out-building condition, paddock dam condition, presence of any surface slumping or cracking, and the presence of vegetation dieback.

Agricultural land identified within the LW W3-W4 Study Area are illustrated on **Figure 2-9**.

During the reporting period, it was noted that seasonal changes had affected vegetation growth, however there were no observable changes to agricultural land in comparison to pre-mining baseline data.

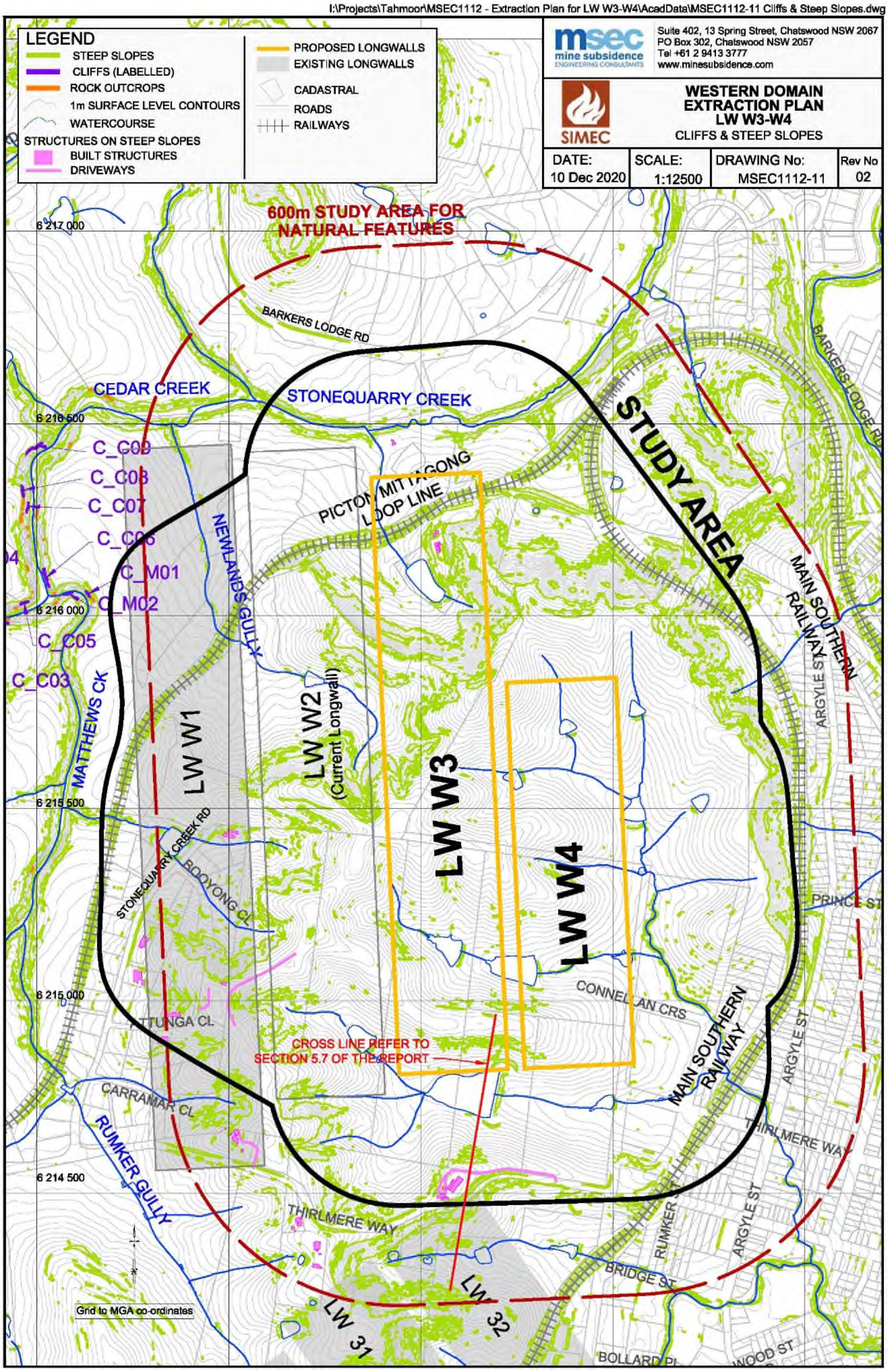

Figure 2-7 Steep slopes within the LW W3-W4 Study Area (source: MSEC, 2021 - LW W3-W4 Subsidence Predictions and Impact Assessment Report)

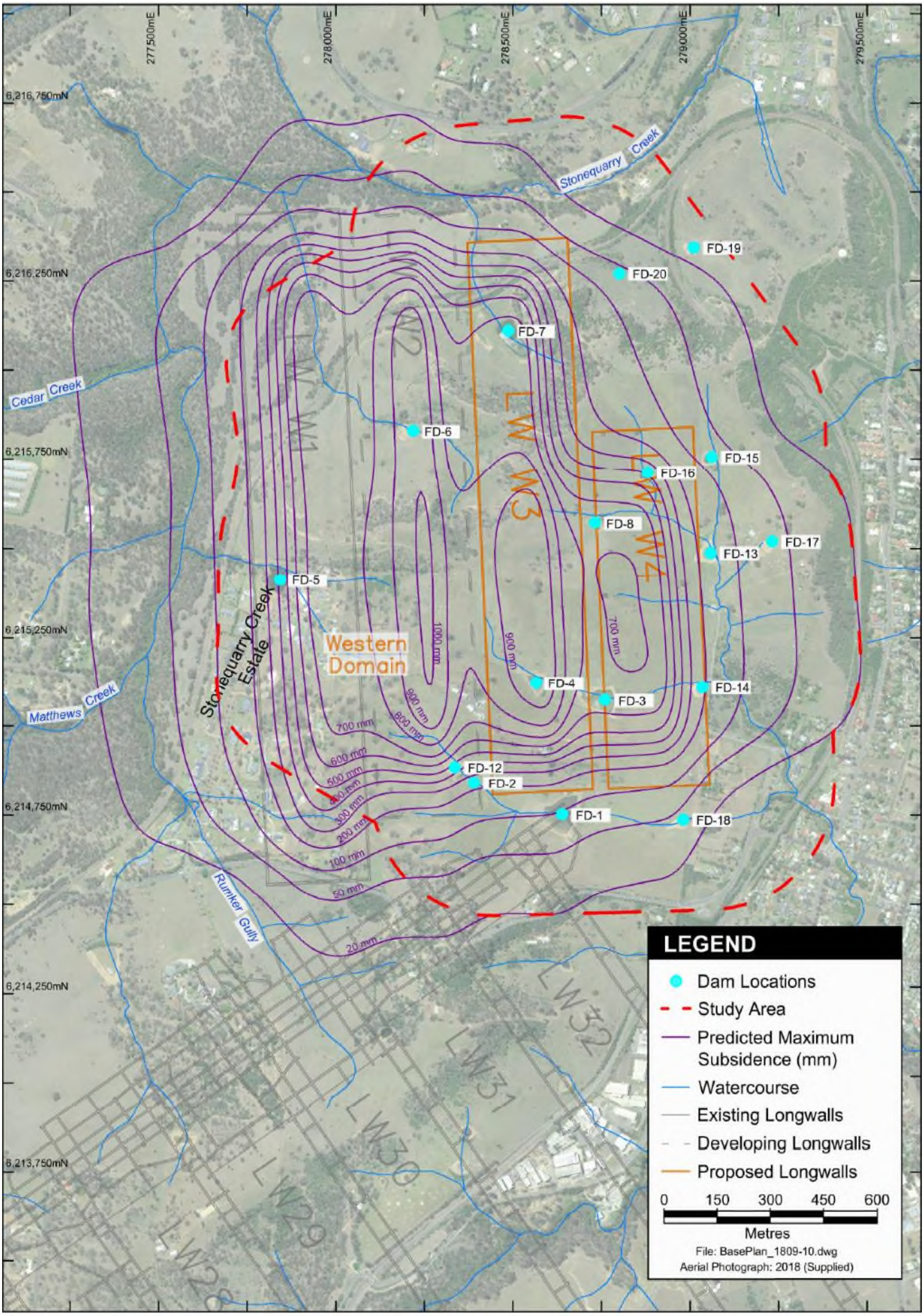

Figure 2-8 Dams within the LW W3-W4 Study Area (source: LW W3-W4 Water Management Plan)

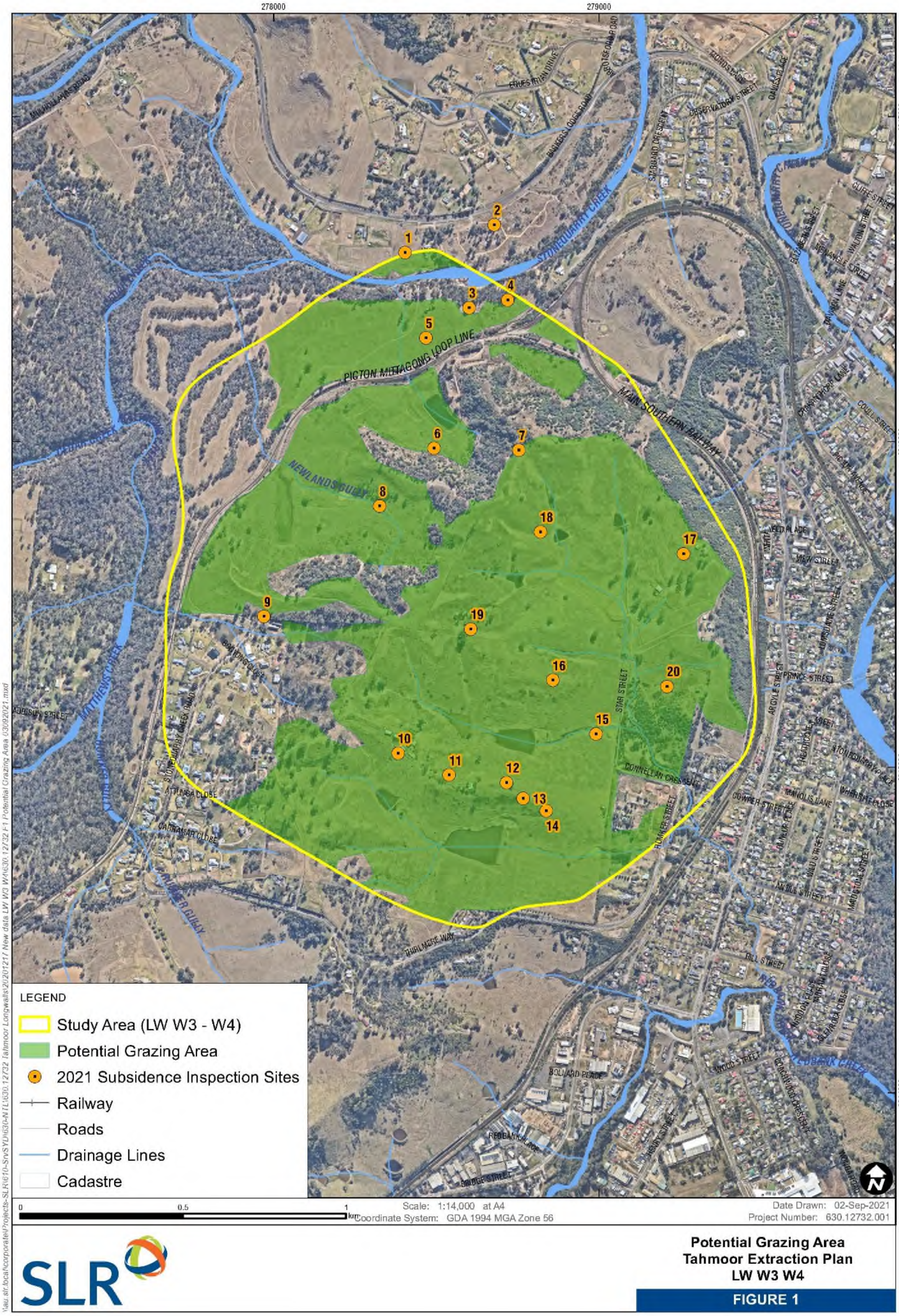

Figure 2-9 Agricultural land and inspection points within the LW W3-W4 Study Area (source: SLR Agricultural Subsidence Monitoring LW W3-W4 Report (SLR, 2021))

2.5 Biodiversity Monitoring

The LW W3-W4 Biodiversity Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on aquatic and terrestrial flora and fauna in accordance with Condition 13H(vii)(d) of DA 67/98.

During the reporting period, the LW W3-W4 Biodiversity Management Plan has been implemented to monitor ecology in the Study Area, as outlined below:

- Aquatic ecology – macroinvertebrate monitoring during Autumn 2023 by Niche Environment and Heritage; and
- Terrestrial ecology – amphibian and riparian vegetation monitoring during Autumn 2023 by Niche Environment and Heritage.

The following sections summarise the observations made during the reporting period for aquatic and terrestrial ecology. Performance against all Biodiversity Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.5.1 Aquatic Ecology

The aquatic ecology monitoring program for LW W3-W4 has been designed to monitor subsidence-induced impacts on aquatic ecology. The following survey methods have been completed during the post-mining monitoring phase:

- Aquatic habitat assessment:
  - The Australian River Assessment System (AUSRIVAS);
  - Riparian Channel and Environment (RCE) Inventory;
- Macroinvertebrate survey:
  - AUSRIVAS macroinvertebrate sampling;
  - Quantitative benthic macroinvertebrate monitoring program; and
  - Water quality sampling.

The aquatic ecology monitoring program is primarily focused on macroinvertebrate monitoring regimes including AUSRIVAS and quantitative using Before After Control Impact (BACI) design. A total of sixteen locations were sampled within Stonequarry Creek, Cedar Creek and Matthews Creek comprised of eight impact sites and eight control sites. The locations of monitoring sites are illustrated in **Figure 2-10**.

2.5.1.1 Autumn 2023 Monitoring Results

Aquatic monitoring for autumn 2023 was conducted by Niche Environment and Heritage in March and April 2023. The following results were observed for Autumn 2023 monitoring:

- There was aquatic habitat present at all sites in autumn 2023;
- AUSRIVAS Observed to expected ratio (OE50) scores were generally lower than in the previous (spring 2022) season, but are within the typical range of results recorded throughout the program, including the baseline period;
- SIGNAL2 scores were low but were comparable to pre-mining scores and tended to cluster together, indicating the influence of prevailing catchment scale conditions at the monitoring sites;
- Ephemeroptera Plecoptera Trichoptera (EPT) scores and numbers of taxa recorded at the sites were comparable to pre-mining surveys;

- The macroinvertebrate assemblages showed that temporal change was the primary driver of differences among sites (i.e. between surveys). The 2023 data was significantly different to the 2022 data, reflecting the differences in environmental conditions between these two periods;
- Despite observed changes temporally, the quantitative results in autumn 2023 did not indicate any subsidence impact, rather the change in environmental conditions over time;
- Overall, the results are likely to reflect the variability of changes in the prevailing environmental conditions within the catchment over time, specifically change in rainfall and associated flow regimes; and
- Following reduced flow conditions in autumn 2023, it is likely that the aquatic habitats and macroinvertebrate assemblages will require some time to adapt to the change in prevailing conditions.

2.5.2 Terrestrial Ecology

The terrestrial ecology monitoring program for LW W3-W4 has been designed to monitor subsidence-induced impacts on terrestrial ecology including riparian vegetation and amphibian monitoring. The following survey methods have been completed during the post-mining monitoring phase:

- Riparian vegetation monitoring involving floristic surveys within established vegetation monitoring plots;
- Amphibian monitoring along established transects:
  - Spotlighting;
  - Call provocation;
  - Listening for diagnostic frog calls; and
  - Tadpole identification.

In particular, two threatened frog species – the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophryne australis*) – were targeted in the amphibian monitoring.

A total of nine locations were sampled within Stonequarry Creek, Cedar Creek and Matthews Creek comprised of four impact sites and five control sites. The locations of monitoring sites are illustrated in **Figure 2-11**.

2.5.2.1 Autumn 2023 Monitoring Results

Riparian vegetation monitoring for Autumn 2023 was conducted by Niche Environment and Heritage between 6 April and 21 April 2023, and amphibian monitoring for Autumn 2023 was conducted between 18 April and 25 May 2023.

The following results were observed for Autumn 2023 monitoring:

Riparian monitoring:

- River-flat Eucalypt Forest, which is listed as an Endangered Ecological Community (EEC) under the BC Act, was recorded at control Site 9 and impact Site 11, along Stonequarry Creek;
- Autumn 2023 impact Sites had a slightly lower mean flora species richness than control Sites. Control Sites also had higher percentage vegetation cover than impact Sites. This is inconsistent with Autumn 2022 findings, as previously flora species richness was higher at impact Sites, when compared with control Sites; and

- Statistical analyses identified a significant difference between vegetation cover for 'After' data between control and impact Sites, specifically, Autumn 2021, Autumn 2022, and Autumn 2023. Given that there were noticeable reductions in vegetation cover across control Sites 6, 7 and 9, as well as impact Sites 3, 4 and 5, impacts cannot be attributed to mining. Based on stream morphology, persistent rainfall during the La Niña climatic period, and other associated factors, these Sites appeared to be heavily affected by the recent (March 2022) flooding event (e.g., destabilisation of the embankments, loss of riparian vegetation and large accumulation of flood debris).

Amphibian monitoring:

- Amphibian detection rates were variable between Before and After monitoring for most Sites. In Autumn 2023, the most widespread amphibian species was the Common Eastern Froglet (*Crinia signifera*), which was detected at all but two of the Sites. Stony Creek Frog (*Litoria lesueuri*) was detected at three of the nine sites (two of which being impact sites) and was the most abundant amphibian species. The greatest number of amphibians detected were at Site 11 (impact) with 81 Common Eastern Froglet individuals recorded;
- For all Autumn data, there was a significant difference in amphibian assemblages at the control Sites and impact Sites, and a significant difference in amphibian assemblages Before and After. However, there was no significant BACI interaction for amphibian assemblages. Inspection of the data (reference graph) suggests a high degree of similarity between the control sites before and after, whereas the after-impact data has a lower degree of variability than the before data. While amphibian richness was reduced in the after data, abundances were observed to have increased. Given that no significant BACI interaction was detected and that amphibian numbers are greater in the after period (albeit with lower species richness) this does not suggest an indication of mining impact;
- The four amphibian species detected represent an otherwise normal assemblage of common species that may be expected to be present in the Study Area under the current climatic conditions;
- The targeted threatened amphibian species were not detected during the survey and appear not to be present in the Study Area, at least not in numbers that can be detected by the current monitoring program. While the Study Area contains superficially suitable habitat, it is possible that the species would no longer be able to survive in the area due to the impact of the multiple flooding events that have occurred over the past four years, including a major flooding event that preceded the Autumn 2022 surveys. Predation pressures from two introduced predators: the Eastern Gambusia and the Freshwater Crayfish (*Cherax destructor*), both of which were detected at all Sites, may also be impacting on the suitability of the habitat for these threatened frogs; and
- Amphibian detection rates fluctuated between monitoring events for most Sites, likely due to the highly variable weather and climatic conditions experienced across all monitoring events.

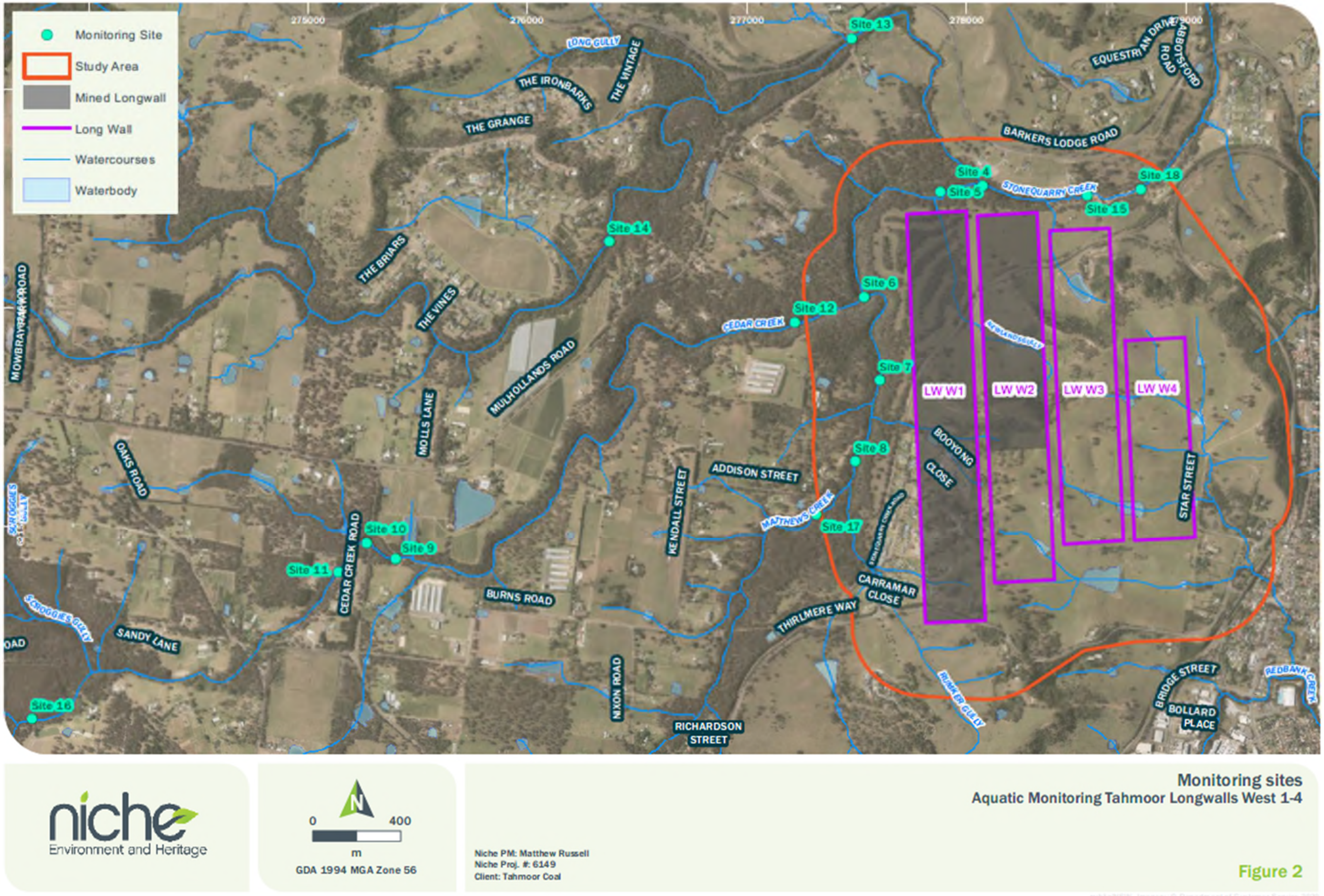

Figure 2-10 *LW W1-W4 Aquatic Ecology Monitoring Locations (source: Niche, 2022a)*

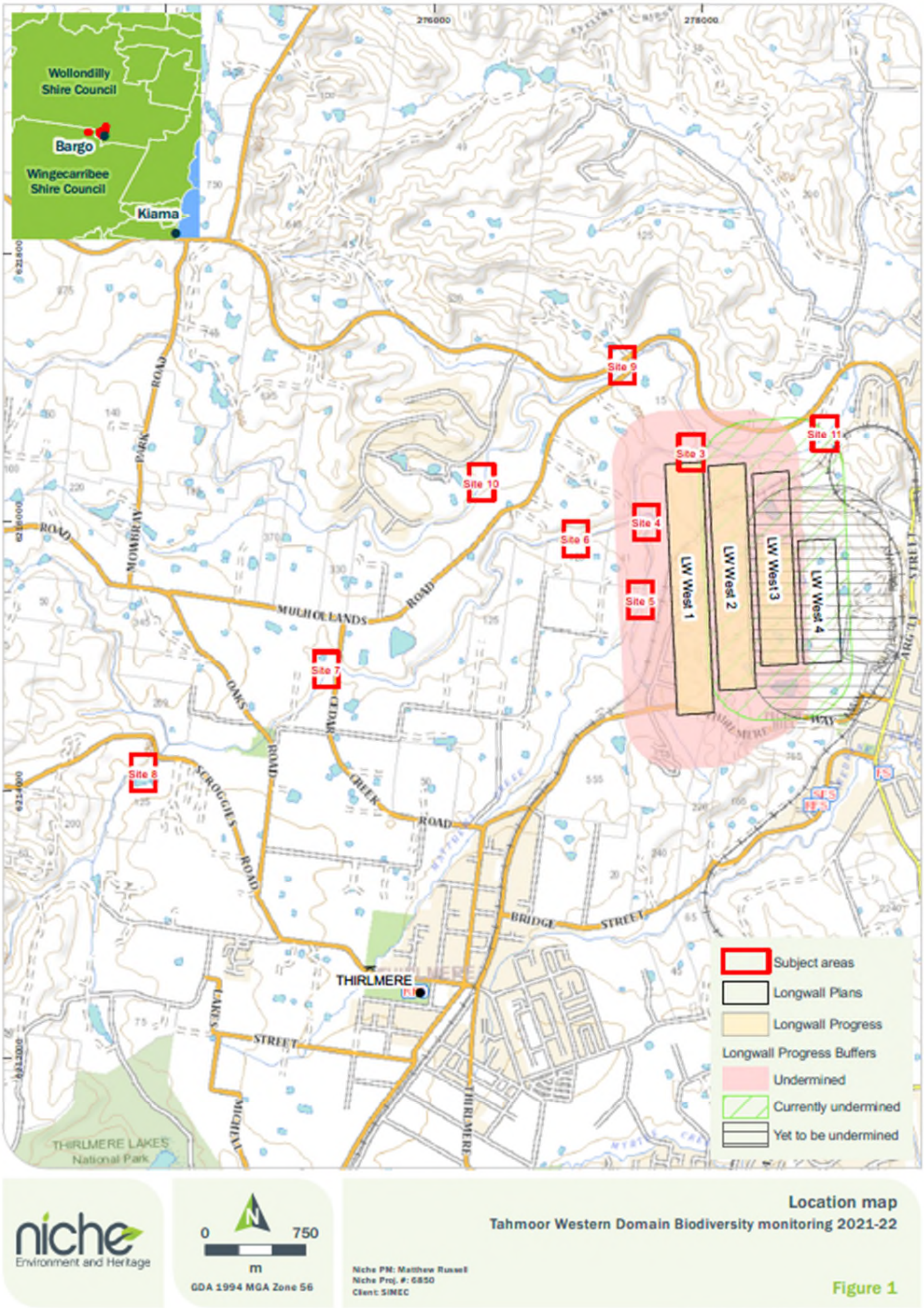

Figure 2-11 LW W1-W4 Terrestrial Ecology Monitoring Locations (source: Niche, 2022b)

2.6 Heritage Monitoring

The LW W3-W4 Heritage Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on Aboriginal heritage and historical heritage sites and values in accordance with Condition 13H(vii)(f) of DA 67/98.

During the reporting period, monitoring of Aboriginal heritage (**Figure 2-12**) and historical heritage items (**Figure 2-13** and **Figure 2-14**) was not required, in accordance with the LW W3-W4 Heritage Management Plan.

Performance against all Heritage Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

As discussed in previous Six Monthly Subsidence Impact Reports, a Level 3 TARP trigger in accordance with the LW W1-W2 Heritage Management Plan and LW W3-W4 Heritage Management Plan had occurred due to subsidence-induced cracking on sandstone culverts at 88.400 km and 88.980 km. These impacts included cracking on the portal ends of the sandstone culverts at 88.980 km and 88.400 km and the barrel of the culvert at 88.400 km were confirmed to be due to mining-related impacts.

Cracking on the sandstone culverts also resulted in an exceedance of subsidence performance measure for ‘other Aboriginal and heritage sites’, as adopted from DA 67/98 Modification 5 or the LW W1-W2 Extraction Plan Approval conditions. Tahmoor Coal notified DPE and Heritage NSW of the trigger via the NSW Major Projects Planning Portal on 21 September 2021. A warning letter from DPE was received on 16 May 2022 regarding the breach against Section 4.2(1)(b) of the *Environmental Planning and Assessment Act 1979.*

Tahmoor Coal completed remediation of the two sandstone culverts in May 2023 in accordance with the proposed rehabilitation methodology and as prescribed in the TfNSW Structures Repair Standard TMC302. The repair work included crack epoxy injection, bed joint reinforcement, stone voussoir pinning, stone voussoir reattachment with epoxy, and repointing. The texture and coloring of the repair work was noted to generally match the surrounding sandstone masonry. Photos of the repair works are provided in **Appendix E**.

DPE were notified of the completion of culvert remediation on 19 May 2023. A site inspection of the culverts with Transport Heritage NSW was completed on 2 May 2023, and a letter was received from Transport Heritage NSW after the site inspection stating they were satisfied with the repairs completed. A site inspection of the culverts with DEP was also completed on 6 June 2023.

SIMEC

This information has been retracted

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Figure 2-13 Historical Heritage Sites (registered sites) in the LW W3-W4 Study Area and Surrounds (Source LW W3-W4 Heritage Management Plan)

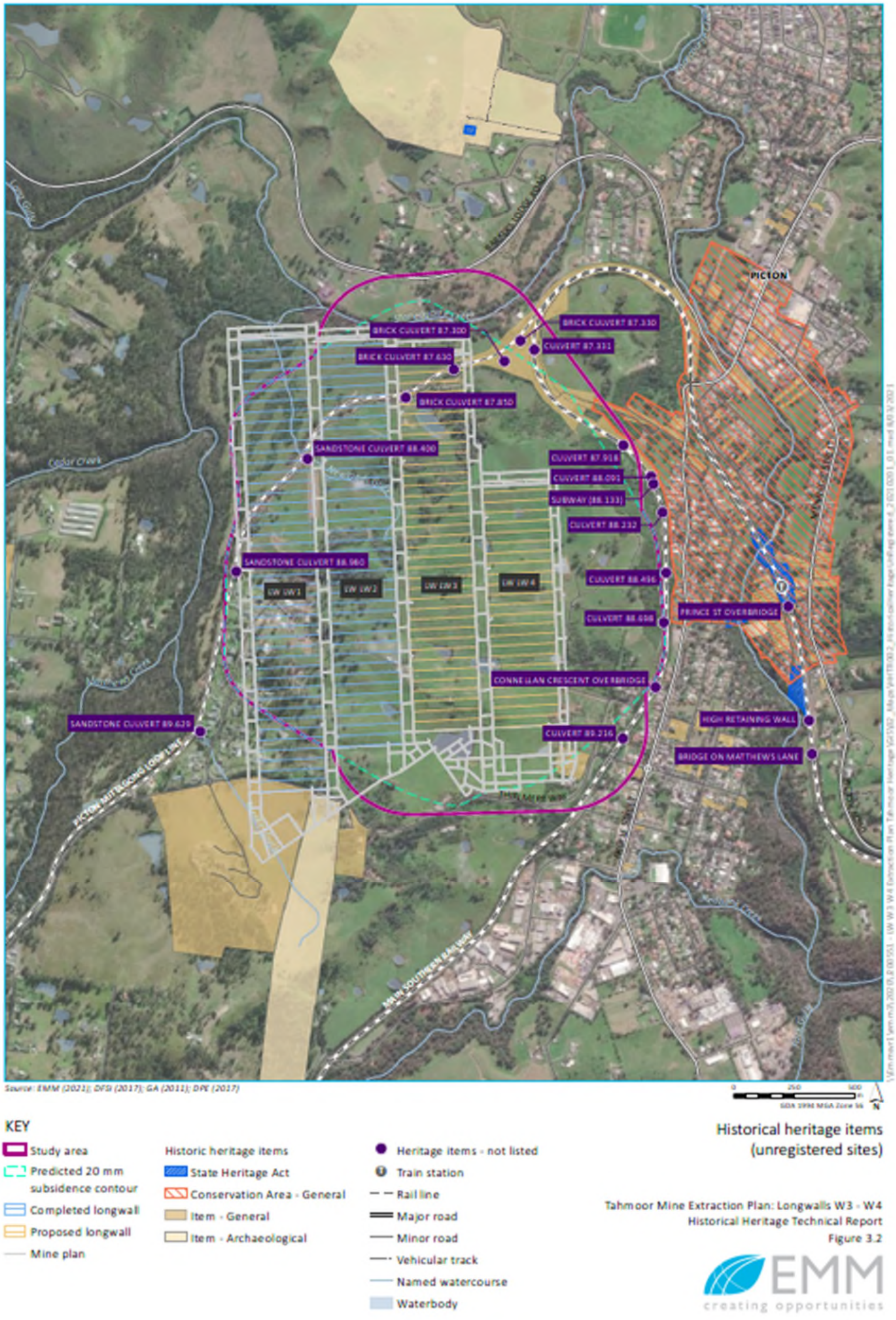

Figure 2-14 Historical Heritage Sites (unregistered sites) in the LW W3-W4 Study Area and Surrounds (Source LW W3-W4 Heritage Management Plan)

2.7 Built Features Monitoring

The LW W3-W4 Built Features Management Plan and associated sub-plans were prepared to manage the potential environmental consequences of LW W3-W4 extraction on built features in accordance with Condition 13H(vii)(b) of DA 67/98.

During this reporting period, the LW W3-W4 Subsidence Monitoring Program have been implemented to monitor subsidence impacts on infrastructure owned by Endeavour Energy (electrical infrastructure), Sydney Water (potable water infrastructure and sewer infrastructure), Bradcorp (sewer infrastructure), Jemena (gas infrastructure), Wollondilly Shire Council (roads, bridges and culverts), Telstra (telecommunications infrastructure), NBN (telecommunications infrastructure), ARTC (rail infrastructure), Transport Heritage NSW (rail infrastructure), Weatherboard House (historical building) and private property owners. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-3**.

A post-mining report for the reporting period was completed by MSEC (**Appendix A**).

The following sections summarise the observations made during the reporting period for built infrastructure. Performance against all built infrastructure TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.7.1 Local Roads

No roads are located above LW W4, and no mining-induced impacts were detected from ground surveys and visual inspections. Impacts noted during LW W4 extraction were noted to be largely related to large rainfall events (end February to early March 2022) and heavy traffic as opposed to subsidence.

No monitoring of local roads was completed during this reporting period, in accordance with the LW W3-W4 Built Features Management Plan and associated sub-plans.

2.7.2 Built Structures

There are no structures located above LW W4, and no mining-induced impacts were noted during the mining of LW W4.

No monitoring of built structures was completed during this reporting period, in accordance with the LW W3-W4 Built Features Management Plan and associated sub-plans.

2.7.3 Main Southern Railway

Regular surveys were conducted along the Main Southern Railway during and after the mining of LW W4. All results were within survey tolerance during mining, and visual inspections did not identify any issues associated with mine subsidence. Continued ongoing horizontal movements have been observed along the Main Southern Rail and at the Thirlmere Way Underbridge and Connellan Crescent Overbridge.

One Blue Level Trigger was noted on the Main Southern Railway in the previous reporting period in relation to differences in track geometry at one location. Track geometry was improved following recent resurfacing by ARTC in early September 2022, and the geometry has been improved. This change was not attributed to mine subsidence. No further changes have been noted during this reporting period.

2.7.4 Picton Mittagong Loop Line

No monitoring along the Picton-Mittagong Loop Line was completed during this reporting period, in accordance with the LW W3-W4 Built Features Management Plan and associated sub-plans.

2.7.5 Transport NSW Infrastructure

Regular surveys were conducted at the Victoria Bridge over Stonequarry Creek during and after the mining of LW W4. Very small and gradual closure was observed across Stonequarry Creek. Visual inspections did not identify any impacts associated with mine subsidence but the gap between the deck and the eastern abutment was observed to almost close during the mining of LW W3. The buffer board was replaced on 7 June 2022 and the gap reinstated. A gap of 35 mm was measured between the structural cross beam and abutment on 10 June. The gap has gradually reduced over time to 19 mm.

TfNSW agreed to continue surveys on a monthly period, unless adverse changes are observed. Automated, continuous monitoring of GNSS units and laser distance meters continue to monitor continuously and results are reported once a month.

Rates of change showed a reduction to very low levels in the reporting period. As triggers are not forecast to be exceeded in the next three months due to residual subsidence, surveys and reporting periods have been reduced further to three monthly intervals as of May 2023.

2.7.6 Other Built Features

Monitoring of other built features (gas infrastructure, electrical infrastructure, telecommunications infrastructure, potable water infrastructure, sewer infrastructure) was not completed during this reporting period, in accordance with the LW W3-W4 Built Features Management Plan and associated sub-plans.

2.8 Public Safety Monitoring

The LW W3-W4 Public Safety Management Plan were prepared to manage the potential consequences as a result of LW W3-W4 extraction on public safety within the Study Area in accordance with Condition 13H(vii)(g) of DA 67/98.

As noted in **Section 1.3** of this report, management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan. Monitoring of steep slopes and other landscape features has been conducted for the reporting period in accordance with the LW W3-W4 Land Management Plan (refer to **Section 2.4** for a summary of monitoring results). In addition, monitoring of infrastructure items has also been conducted for the reporting period in accordance with the LW W3-W4 Built Features Management Plan (refer to **Section 2.7** for a summary of monitoring results).

No subsidence impacts were identified during the reporting period that were considered to pose a risk to public safety.

3 Overview of Impacts and Actions

3.1 Summary of Impacts

This section provides a comprehensive summary of all impacts during the reporting period, including a revised characterisation according to the relevant TARPs (if required).

Table 3-1 and **Table 3-2** provides a summary of the TARP levels that support the LW W3-W4 Extraction Plan. A summary of monitoring results for relevant TARPs is given in **Table 3-3**. A full list of TARPs for environmental features that are applicable is provided in Appendix D of the LW W3-W4 Extraction Plan.

Table 3-1 Risk Levels for Environmental Feature TARPs

Risk Level	Trigger Description
Level 1	Normal – Operations within predicted impacts.
Level 2	Within Prediction – Operations within predicted impacts but exceeds or potentially exceeds predictions.
Level 3	Almost Exceeds Prediction – Operations within predicted impacts but are likely to almost exceed predictions.
Level 4*	Exceeds Prediction – Operations exceed predicted impact.

Note: * Level 4 is only used in the Water Management Plan TARPs.

Table 3-2 Trigger Levels for Railway Features (applicable to Picton-Mittagong Loop Line, Main Southern Railway, Transport for NSW, and Stonequarry Creek Rockbar features)

Trigger Level	Trigger Description
Green	Observations within predictions. Operate as normal.
Blue	Observations outside predictions but within operating tolerance. Investigate cause. Some action may be required to prevent operating restrictions.
Yellow	Restrictions on operations. Action required. Appropriate speed restriction applied until altered to Green or Blue level.
Red	Stop trains until altered to Green or Blue level.

As all results during this report period are consistent with the current TARPs, a revision of the TARPs for environmental features is not considered necessary at this point in time.

Table 3-3 Summary of TARP Triggers for January to June 2022

Aspect	Feature	Corresponding Management Plan and TARP	January 2023	February 2023	March 2023	April 2023	May 2023	June 2023
Surface Water	Stonequarry Creek flow	Water Management Plan – Downstream reduction in catchment flow rate in Stonequarry Creek at Picton Gauging Station (GS212053)	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]
	Pool water level	Water Management Plan – Impact to pool water level	LEVEL 3 TRIGGERED[2] Pool water level at monitoring site CB for 2-3 January and 9-18 January 2023.	LEVEL 3 TRIGGERED[2] Pool water level at monitoring site CB for 19 February to 28 April 2023. LEVEL 2 TRIGGERED[3] Surface water level triggers occurred at monitoring site CE for 13 February – 4 April 2023.	LEVEL 3 TRIGGERED[2] Pool water level at monitoring site CB for 19 February to 28 April 2023. LEVEL 2 TRIGGERED[3] Surface water level triggers occurred at monitoring site CE for 13 February – 4 April 2023.	LEVEL 3 TRIGGERED[2] Pool water level at monitoring site CB for 19 February to 28 April 2023. LEVEL 2 TRIGGERED[3] Surface water level triggers occurred at monitoring site CE for 13 February – 4 April 2023.	LEVEL 2 TRIGGERED[3] Surface water level triggers occurred at monitoring site CB for 6 May to 30 June 2023.	LEVEL 2 TRIGGERED[3] Surface water level triggers occurred at monitoring site CB for 6 May to 30 June 2023.
	Natural drainage behaviour	Water Management Plan – Impact to pool level, natural drainage behaviour or overland connected flow	LEVEL 3 TRIGGERED[4] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	LEVEL 3 TRIGGERED[4] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	NR – No monitoring required.	NR – No monitoring required.	LEVEL 3 TRIGGERED[4] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	NR – No monitoring required.
	Flood levels	Water Management Plan – Impact to flood levels	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Stream water quality	Water Management Plan – Stream water quality impact	LEVEL 2 TRIGGERED[5] Surface water quality triggers occurred at SC2 (Al) and CG (Al).	LEVEL 2 TRIGGERED[5] Surface water quality triggers occurred at SC2 (Al), SD (Al) and CG (Al).	No observations of water quality trigger exceedances or visual evidence of increased iron staining that was not observed in the baseline period.	No observations of water quality trigger exceedances or visual evidence of increased iron staining that was not observed in the baseline period.	No observations of water quality trigger exceedances or visual evidence of increased iron staining that was not observed in the baseline period.	No observations of water quality trigger exceedances or visual evidence of increased iron staining that was not observed in the baseline period.
Groundwater	Groundwater bore level	Water Management Plan – Groundwater levels at monitoring bores and private groundwater bores	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C, P16B and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at P12C and P16C.
	Shallow groundwater pressures	Water Management Plan – Shallow groundwater pressures at VMPs TNC036, TNC040, and TNC034	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).
	Deep groundwater pressures	Water Management Plan – Deep groundwater pressures at VMPs TNC036, TNC040, and TNC043	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred at TNC36 (intake 412.5 mbgl).
	Groundwater quality	Water Management Plan – Groundwater quality at monitoring bores and private groundwater bores	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper), P12C (Fe, Mn), P14B (pH upper), P15A (Ni), P15B (Sr), P15C (Al, As, Sr), P15D (Al), P16A (pH upper, Ni), P16B (Sr), P16C (Zn), GW105228 (Li).	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper), P12C (Fe, Mn), P15A (Fe, Li, Sr), P15B (EC, Pb, Al, Sr), P15C (Fe, As, Sr), P15D (Fe, Mn), P16A (Ni), P16B (Sr).	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper, Pb), P12B (Cu), P12C (EC, Mn, Cu), P14A (Al), P15A (Li, Sr), P15B (Sr), P15C (Fe, As, Sr), P16B (Sr).	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper), P12C (Mn), P14B (pH lower, EC), P15B (Sr), P15C (Sr), P16A (pH upper, Ni), P16B (Sr), GW104090 (Ba, Sr), GW105228 (Li).	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper), P12C (Fe, Mn), P14A (Al), P15A (Li), P15B (Sr), P15C (As, Sr), P15D (Fe), P16A (Ni), P16B (Sr).	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (pH upper, Pb), P12C (Fe, Mn, Cu, Pb), P14A (Cu), P14B (Sr), P14C (Cu), P14D (Cu), P15A (Li, Sr), P15B (Sr), P15C (Fe, As, Sr), P15D (Fe), P16A (pH upper, Ni), P16B (Sr).

Aspect	Feature	Corresponding Management Plan and TARP	January 2023	February 2023	March 2023	April 2023	May 2023	June 2023
Landscape	Cliff lines	Land Management Plan – Cliff line damage or instability	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Steep Slopes	Land Management Plan – Steep slope damage or instability	NR – No monitoring required.	NR – No monitoring required.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	NR – No monitoring required.	NR – No monitoring required.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.
	Surface cracking	Land Management Plan – Surface cracking (excluding railway corridor)	NR – No monitoring required.	NR – No monitoring required.	No signs of change in the areas inspected that could be attributed to mine subsidence.	NR – No monitoring required.	NR – No monitoring required.	No signs of change in the areas inspected that could be attributed to mine subsidence.
	Dams	Water Management Plan – Impacts to dams	NR – No monitoring required.	NR – No monitoring required.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	NR – No monitoring required.	NR – No monitoring required.	No signs of change to farm dams inspected that could be attributed to mine subsidence.
Agricultural Land	Agricultural Land	Land Management Plan – Agricultural land	NR – No monitoring required.	NR – No monitoring required.	No signs of change since baseline at sites inspected.	NR – No monitoring required.	NR – No monitoring required.	No signs of change since baseline at sites inspected.
Aquatic Ecology	Macroinvertebrates	Biodiversity Management Plan – Decline or significant negative change in macroinvertebrate indicators.	NR – No monitoring required.	NR – No monitoring required.	Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.	Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.	NR – No monitoring required.	NR – No monitoring required.
		Biodiversity Management Plan – Reduction in aquatic habitat through loss of pools or associated reduction in water quality (AURIVAS habitat assessment)	NR – No monitoring required.	NR – No monitoring required.	No signs of mining impact resulting in a reduction in aquatic habitat.	No signs of mining impact resulting in a reduction in aquatic habitat.	NR – No monitoring required.	NR – No monitoring required.
Terrestrial Ecology	Amphibians	Biodiversity Management Plan – Decline in amphibian populations within watercourses of the Study Area	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	No signs of subsidence impacts to amphibian populations.	No signs of subsidence impacts to amphibian populations.	NR – No monitoring required.
	Riparian Vegetation	Biodiversity Management Plan – Dieback of riparian vegetation within watercourses of the Study Area	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	No signs of subsidence impacts to riparian vegetation.	NR – No monitoring required.	NR – No monitoring required.
Aboriginal Heritage	Grinding grooves, scarred tree	Heritage Management Plan – Aboriginal heritage	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	SR17 Rockbar	Stonequarry Creek Rockbar Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
Historical Heritage	Railway Culverts	Heritage Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Weatherboard House	Heritage Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
Built Features	Picton-Mittagong Loop Line	Picton-Mittagong Railway Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Main Southern Railway	Main Southern Railway Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Electricity Infrastructure	Endeavour Energy Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Gas Infrastructure	Jemena Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Potable Water	Sydney Water Potable Water Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.

Aspect	Feature	Corresponding Management Plan and TARP	January 2023	February 2023	March 2023	April 2023	May 2023	June 2023
	Sewerage Infrastructure	Stonequarry Creek Sewer Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Telecommunications	Telstra Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
		NBN Co Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Local roads, bridges and culverts	Wollondilly Shire Council Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Built Structures	Built Structures Management Plan	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.	NR – No monitoring required.
	Transport for NSW Infrastructure	Transport for NSW Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.

Notes:

NR – Monitoring not required this month.

NA – Monitoring data not available as monitoring not completed this month or reporting not yet available.

[1] Stonequarry Creek flow assessment unable to be completed due to invalidation of current model calibration as a result of revision of the rating curve for Stonequarry Creek at Picton (GS 212053) in July 2020 and change of streamflow records from December 2015.

[2] Level 3 TARP for pool water level (LW W3-W4 Water Management Plan): The recorded water level has declined, although not atypically, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has not occurred at one of the upstream pools (beyond mining effects).

[3] Level 2 TARP for pool water level (LW W3-W4 Water Management Plan): The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has occurred at one of the upstream pools (beyond mining effects).

[4] Level 3 TARP for natural drainage behaviour (LW W3-W4 Water Management Plan): Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking in account climatic conditions and observations during baseline monitoring period.

[5] Level 2 TARP for stream water quality (LW W3-W4 Water Management Plan): The trigger for pH, EC or dissolved metals defined below occurs in one month, and there is no visual evidence of an increase in iron precipitation that was not observed in the baseline period.

[6] Level 2 TARP for groundwater bore level (LW W3-W4 Water Management Plan): Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[7] Level 2 TARP for shallow groundwater pressures (LW W3-W4 Water Management Plan): Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than 200 m depth) following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[8] Level 2 TARP for deep groundwater pressures (LW W3-W4 Water Management Plan): Calculated or observed drawdown (based on 2009 – 2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.

[9] Level 2 TARP for groundwater quality (LW W3-W4 Water Management Plan): Short term increase (<3 months) in salinity and/or metals, or change in pH outside of baseline variability. The effect does not persist after a significant rainfall recharge event. AND/OR a similar trend or response has been noted at other monitored bores or private groundwater bores.

3.2 Summary of Actions

During the reporting period, there were seven (7) environmental aspects that were associated with TARP triggers. This section provides a summary of actions resulting from triggers being met in the TARPs, as well as required remediation actions. All triggers have been reviewed by the Environmental Response Group / Structural Response Group / specialists to determine any further actions (if required).

3.2.1 Pool Water Level TARP – Levels 2 and 3 Triggers for Pool Water Level Reduction

3.2.1.1 Background

The following TARP trigger occurred during the current reporting period for water level (refer **Appendix B**):

- Monitoring Site CB – Level 3 TARP triggers occurred between 2 to 3 January, 9 to 18 January, and 16 February to 28 April 2023, and a Level 2 TARP trigger between 6 May and 30 June 2023; and
- Monitoring Site CE – Level 2 TARP trigger occurred between 13 February to 4 April 2023.

A Level 4 TARP significance was originally triggered in relation to surface water level decline for the period 19 to 29 January 2021 at monitoring site CB (pool CR14) in Cedar Creek. Whilst not visible on the surface, it is likely that mining induced subsidence had mobilised existing fractures resulting in changes in the water level recession rate of this pool. In addition, it was considered likely that mining induced groundwater drawdown had resulted in the surface water system in the vicinity of pool CR14 transitioning from a gaining stream (baseflow discharge from the groundwater stream to the stream) to a weakly gaining or losing stream (surface water recharge to the groundwater system) (**Appendix B**).

Between 2 January to 28 April 2023, a Level 3 TARP trigger intermittently applied at monitoring site CB (pool CR14). When comparing the monitoring data directly to the TARP level description, it is noted that a Level 4 may apply for this period. However it is considered that the TARP level descriptions do not accurately reflect the nuanced behaviour of water level recorded during this period due to the following reasons:

- The water level at monitoring site CB during this period declined by a maximum of 0.53 m below the baseline minimum. Although the water level decline recorded during the review period is considered atypical in relation to baseline water level trends recorded at monitoring site CB, the water level decline is considered similar to that recorded in late 2020 and early 2021 (refer to **Appendix B**);
- The water level recorded during the review period remained above the historically recorded minimum level (i.e. above the January 2021 minimum level);
- The rate of recession recorded during the review period did not increase from that recorded in late 2020 and early 2021;
- The water level decline occurred during periods of below average rainfall;
- Water level declines were recorded at the majority of upstream monitoring sites during these periods. Water level declines (whilst remaining above the baseline minimum) were also recorded at reference site CC1A on Cedar Creek and reference site MA on Matthews Creek, indicating a reduction in surface flow reporting to monitoring site CB;
- Although water level declines were recorded at downstream monitoring sites CC, CE and CF on Cedar Creek (refer Appendix B) in March 2023, it is considered that the water level declines were small and transient; and
- Following a rainfall event in late April 2023, the water level rose at monitoring site CB and was recorded just below the baseline minimum at the end of the review period.

Between 6 May and the end of the reporting period, a Level 2 TARP trigger applied at monitoring site CB (pool CR14). When comparing the monitoring data directly to the TARP level description, it is noted that a Level 3 may apply for this period. However, it is considered that the TARP level descriptions do not accurately reflect the nuanced behaviour of water level recorded during this period due to the following reasons:

- Water level declined by a maximum of 4 centimetres (cm) below the baseline minimum, which is considered a negligible decline;
- The water level decline occurred during periods of below average rainfall;
- The water level decline was not atypical; and
- A decline in water level was also recorded at upstream monitoring sites CA in Cedar Creek and MG in Matthews Creek during majority of these periods. Although the water level recorded at the upstream sites did not decline below the baseline minimum, it is considered that the decline in water level at these sites was sufficient to result in a reduction in surface flow reporting to monitoring site CB.

Further discuss of the water level observations at monitoring site CB is provided in Appendix B.

From 13 February to 4 April 2023, the water level recorded at monitoring site CE (pool CR25) declined slightly below the baseline minimum with a maximum of 0.07 m below the baseline minimum. When comparing the monitoring data directly to the TARP level descriptions included in Table 8, it is noted that a Level 3 may apply for the period 13 February to 4 April 2023. However, it is considered that the TARP level descriptions do not accurately reflect the nuanced behaviour of water level recorded at the site due to the following reasons:

- The decline in water level recorded at monitoring site CE is considered negligible. Additionally, the water level rose from early May and was trending around the baseline minimum for the remainder of the review period; and
- Water level declines were recorded at several monitoring sites in February and March 2023 and to a lesser extent in April and May 2023. The period of slight water level decline recorded at monitoring site CE was consistent with the period of water level decline recorded at monitoring site CB. As such, it is considered that the water level decline recorded at monitoring site CE was related to a decline in surface flow from upstream monitoring site CB in combination with below average rainfall conditions.

Further discussion of this trigger is provided in **Section 2.2.2** and the Surface Water Review (refer **Appendix B**).

3.2.1.2 Actions Completed

The following actions have been completed in light of the Level 2 and 3 TARP triggers during this reporting period:

- *Continue monitoring as per monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Continue monthly review of data* – quarterly result analysis and reporting in accordance with the post-mining monitoring program;
- *Review relevant surface water level, groundwater level and streamflow data to assess comparative trends* – completed as part of this report for monitoring site CB (refer to **Appendix B**), which suggested that gaining conditions (groundwater contribution to the surface water system) were occurring during this time period in the vicinity of monitoring site CB (pool CR14);
- *Review manual water level measures for additional monitoring sites to identify potential spatial trends in water level decline* – completed as part of this report (refer to **Appendix B**), which suggested that the decline in water level at monitoring site CE and CB was transient and was considered to have had negligible effect on the water level of downstream monitoring sites;

- *Convene Tahmoor Coal Environmental Response Group to review response* – completed and included a discussion of these TARP triggers. There were no actions regarding these TARP triggers; and
- *Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached* – considered as part of the Surface Water Review (**Appendix B**). Given the decline in water level at monitoring sites CB and CE were transient and considered to have had negligible effect on the water levels of downstream monitoring sites, increased frequency of monitoring is not considered required. The water level records for this site will continue to be monitored in accordance with the LW W3-W4 Water Management Plan.

Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021, including the current report provided in **Appendix B**. These reports include a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and any recommendations in relation to ongoing monitoring or corrective actions.

3.2.1.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan, and the next 3-monthly Monitoring Report will be provided to DPE in December 2023.

3.2.2 Natural Drainage Behaviour TARP - Level 3 Trigger for Fracturing

3.2.2.1 Background

The following TARP triggers occurred during the current reporting period for natural drainage behaviour (refer **Appendix B**):

- Rockbar SR17 – Level 3 TARP trigger for laminar fracturing on the SR17 rockbar from November 2021; and
- Rockbar SR20 – Level 3 TARP trigger for fracturing on a rockbar at SR20 from August 2022.

A detailed discussion of these triggers is provided in the Surface Water Review (refer **Appendix B** and **Appendix C**), and a summary is provided below.

Rockbar SR17 was initially reported at a Level 3 TARP trigger on 28 October 2021 due to surficial fracturing of the controlling rockbar (*pers. comm.* MSEC). Brienen Environment & Safety reported this as laminar fracturing and extension of a natural crack in the rockbar following their inspection on 17 November 2021.

Since the initial observation of the laminar fracturing, no gas release or iron precipitation has been noted during visual inspections. In addition, the continuous water level records and manual water levels indicate that the fracturing of the rockbar has not resulted in an impact to the pool water holding capacity. Consequently, a Level 3 trigger significance in relation to physical features and natural behaviour of rockbar SR17 has been derived for this observation (17 November 2021 to current) (**Appendix C**).

Rockbar SR20 was reported by Brienen Environment & Safety as a Level 3 significance due to surface fracturing (Natural Drainage Behaviour TARP - Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions) and no reduction in pool water level, drainage or overland connected flow, taking in account climatic conditions and observations during baseline monitoring period), and was first observed on 18 August 2022. No gas release or iron precipitation were observed during the visual inspections and actions completed are discussed below.

3.2.2.2 Actions Completed

In accordance with the Stonequarry Creek Rockbar Management Plan, mining of LW W3 was temporarily suspended on 28 October 2021 following initial identification of surficial fracturing of the rockbar at pool SR17. Subsequently, the Subsidence Technical Committee convened to review the required actions and responses in accordance with the Stonequarry Creek Rockbar Management Plan TARP. Additional monitoring, inspection and reporting was then implemented in accordance with the TARP. Subsequent visual inspections identified an increase in the extent of fracturing. On 1 November 2021, approval was granted to recommence mining of LW W3 subject to the continuation of monitoring at an increased frequency and initial progress of the longwall capped to a maximum of 50 metres per week.

It is noted that this fracturing has not affected the water level at Pool SR17.

Geotechnical reviews of the rockbar identified that:

- The fractures occurred in thinly bedded, laminated sandstone and were considered a response to mining related differential compression in combination with the presence of existing delamination in the rockbar surface formed by natural weathering processes;
- There was no evidence of new cracking outside the existing fractured area;
- The extension of the fractured area was associated with a veneer of sandstone sitting on top of competent sandstone;
- The fracturing was considered consistent with subsidence monitoring results and was effectively an extension of the original fracture site; and
- The fracturing provided a release for mining induced stress and was confined to the sheeted sandstone above the competent sandstone.

The following actions have been completed in light of the Level 3 TARP trigger during this reporting period:

- *Continue monitoring as per monitoring program* - quarterly monitoring was ongoing during the reporting period;
- *Continue review of data* – completed on a quarterly basis during the reporting period (following completion of quarterly monitoring, as required by the LW W3-W4 Water Management Plan);
- *Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climate:*
    - Rockbar SR17 – In response to the Level 3 trigger exceedances in relation to physical features at rockbar SR17, the Environmental Response Group convened and the surface water level data was reviewed. The water level records for monitoring site SB indicated that the surficial fracturing of the rockbar has not resulted in an impact to the pool water holding capacity. The water levels recorded at monitoring site SB (rockbar SR17) have not declined below the baseline minimum water level and no atypical water level behaviour was recorded at this site between 1 October 2021 and 15 May 2023 (extent of available monitoring data); and
    - Rockbar SR20 – In response to the Level 3 trigger exceedances in relation to physical features at rockbar SR17, the Environmental Response Group convened and surface water level data, pre-mining drone footage and subsidence measurements were reviewed. From a review of pre-mining drone footage, it was determined that one of the fractures was initially observed in July 2019 during pre-mining survey. The water level records for monitoring sites SB (upstream), SC and SD (downstream) indicated that the fracturing has not resulted in an impact to pool water holding capacity. The water level recorded at monitoring sites SB, SC and SD has not declined below the baseline minimum water level during the reporting period. Additionally, MSEC indicated that there was no measurable change in closure associated with the fracturing based on the latest survey.

- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger; and
- *Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached* - an increase in the frequency of visual inspections and review of data in relation to rockbar physical features, natural drainage behaviour and pool water level is not considered to be required at this stage.

3.2.2.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan, with quarterly visual inspections to continue at rockbars SR17 and SR20.

3.2.3 Surface Water Quality TARP – Level 2 Trigger for Surface Water Quality

3.2.3.1 Background

The following TARP triggers occurred during the current reporting period for surface water quality (refer **Appendix B**):

- Monitoring Site CG – Level 2 TARP trigger for Aluminium in January and February 2023;
- Monitoring Site SC2 – Level 2 TARP trigger for Aluminium in January and February 2023; and
- Monitoring Site SD – Level 2 TARP trigger for Aluminium in January 2023.

As discussed in **Section 2.2.4**, the elevated concentrations of dissolved aluminium across Cedar Creek and Stonequarry Creek were noted to be catchment wide and related to the prevailing climatic conditions.

A detailed discussion of these triggers is provided in the Surface Water Review document (refer **Appendix B**), and a summary is provided in **Section 2.2.4**.

3.2.3.2 Actions Completed

The following actions have been completed in response to the Level 2 TARP triggers during this reporting period:

- *Continue monitoring as per monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Continue monthly review of data including analysis of water quality trend along creek (upstream to downstream) to identify spatial changes* – completed on a quarterly basis during the post-mining stage; and
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed following the reporting of this data, including discussions of these TARP triggers. There were no actions regarding this TARP trigger.

3.2.3.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan.

3.2.4 Groundwater Bore Level TARP – Level 2 Triggers for Open Standpipe Piezometer Groundwater Levels

3.2.4.1 Background

During this reporting period, a number of groundwater intakes in OSPs have recorded reduced water level elevation below the baseline range. This was noted in the following OSP intakes (refer to **Appendix D**):

- P12C – Level 2 TARP trigger from January to June 2023 (entire reporting period);
- P16B – Level 2 TARP trigger for January 2023; and
- P16C – Level 2 TARP trigger from January to June 2023 (entire reporting period).

P12C, P16B and P16C recorded a Level 4 TARP trigger from December 2020 to August 2021.

During this reporting period, groundwater level at P12C was generally stable, noting a slight increase over the reporting period. Groundwater remained below the TARP Level 2 during the reporting period, and it is expected that a TARP Level 1 is likely to apply in the next reporting period.

During the reporting period, a Level 2 TARP applied at P16B for January 2023 only, before resolving to a Level 1 TARP (normal conditions) for the remainder of the reporting period.

During the reporting period, a Level 2 TARP applied at P16C for the entire reporting period. Groundwater levels continue to remain relatively stable following successive periods of recovery in 2021 and 2022.

3.2.4.2 Actions Completed

On 30 December 2020, Level 4 TARP triggers for the reduced water level elevations at P12C, P16B, P16C and TNC036 were notified to DPE and NRAR. This reduction was attributed to mining induced depressurisation of deeper groundwater aquifer, however this also correlated to a reduction in rainfall recharge events.

In light of the Level 4 TARP triggers, Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021. This Six Monthly Subsidence Impact Report includes this 3-monthly monitoring reporting. These reporting requirements include a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and any recommendations in relation to ongoing monitoring or corrective actions.

The following actions have been completed in light of the Level 2 TARP trigger during this reporting period:

- *Continue monitoring program* – monthly monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data* – result analysis and reporting has been completed on a quarterly basis during the post-mining stage;
- *Review relevant surface water level, groundwater level and streamflow data to assess comparative trends* – completed as part of 3-monthly Monitoring Reporting for surface water and groundwater. The next monitoring report will be provided to DPE in December 2023; and
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers. There were no actions regarding this TARP trigger.

3.2.4.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program, and the next 3-monthly Monitoring Report will be provided to DPE in December 2023.

3.2.5 Shallow Groundwater Pressures TARP – Level 2 Triggers for Shallow Vibrating Wire Piezometer Groundwater Pressure

3.2.5.1 Background

During this reporting period, a number of groundwater intakes in shallow (<200 mbgl) Vibrating Wire Piezometers (VWPs) have recorded a trend of depressurisation below the baseline range. This trend has been noted in the following VWP intakes (refer to **Appendix D**):

- TNC036 HBSS-97m – Level 2 TARP trigger in January and March 2023; and
- TNC036 HBSS-169m – Level 2 TARP trigger from January to June 2023 (entire reporting period).

At TNC036 HBSS-97m, a Level 2 TARP was observed during in January and March 2023 only. For all other months during the reporting period, the groundwater resolving to a Level 1 TARP (normal conditions).

At TNC036 HBSS-169m, a Level 2 TARP was observed for the full reporting period. Groundwater levels in the Bulgo Sandstone aquifer at 169m started to recover in late September 2022 and whilst showing a significant recovery during the reporting period, the observed groundwater levels remain below baseline levels as of June 2023.

3.2.5.2 Actions Completed

On 30 December 2020, Level 4 TARP triggers for the reduced water level elevations at P13C, P16B, P16C and TNC036 were notified to DPE and NRAR. This reduction was attributed to mining induced depressurisation of deeper groundwater aquifer, however this also correlated to a reduction in rainfall recharge events. The Level 4 TARP triggers observed during this reporting period are a continuation of the trend as previously notified.

In light of the Level 4 TARP triggers, Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021. This report incorporates the 3-monthly monitoring reporting requirement, including a review and interpretation of monitoring data, assessment against performance measures and performance indicators for groundwater (Refer to **Section 2.3**; **Appendix D**), and any recommendations in relation to ongoing monitoring or corrective actions (**Section 2.3.5**).

The following actions have been completed in light of the Level 2 TARP trigger during this reporting period:

- *Continue monitoring program* - monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data* – result analysis and reporting has been completed on a quarterly basis during the post-mining stage; and
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers. There were no actions regarding this TARP trigger.

3.2.5.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program, and the next 3-monthly Monitoring Report will be provided to DPE in December 2023.

3.2.6 Deep Groundwater Pressures TARP – Level 2 Trigger for Deep Vibrating Wire Piezometer Groundwater Pressure

3.2.6.1 Background

During this reporting period, groundwater intakes in deep (>200 mbgl) VWPs have recorded a trend of depressurisation below the baseline range. This consisted of a Level 2 TARp trigger at TNC036 BGSS-412.5m for January to June 2023 (full reporting period) (refer to **Appendix D**).

At TNC036 BGSS-412.5m, a TARP Level 2 was observed during the full reporting period. Observed drawdown at TNC036 (BGSS-412.5m) exceeded predicted (modelled) drawdown but was within 30 m of predicted (modelled) drawdown during the reporting period. Following the commencement of mining at LW W1, observed drawdown has exceeded the predicted (modelled) drawdown at since mid-2020. Over the past 6 months, observed drawdown appears to be trending closer to the predicted (modelled) drawdown. A TARP Level 1 is likely to apply in the next reporting period.

Groundwater levels at TNC036 are steadily increasing at most sensors with significant recovery observed in the deeper sensors in the Bulgo Sandstone aquifer. The impacts of groundwater depressurisation are continuing to be evident in the deeper piezometers, although recovery is occurring and a TARP Level 1 is likely to apply at TNC036 (BGSS-412.5m) in the next reporting period.

3.2.6.2 Actions Completed

The following actions have been completed in light of the Level 2 TARP trigger during this reporting period:

- *Continue monitoring program* - monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data* – result analysis and reporting has been completed on a quarterly basis during the post-mining stage; and
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers. There were no actions regarding this TARP trigger.

3.2.6.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program.

3.2.7 Groundwater Quality TARP – Level 2 Triggers for Groundwater Quality

3.2.7.1 Background

A number of Level 2 TARP triggers occurred for groundwater quality (refer to **Table 3-3**). These short-term increases in groundwater quality are considered to be due to natural fluctuations rather than mining related effects. Further discussion of these triggers is provided in the groundwater report located in **Appendix D**.

3.2.7.2 Actions Completed

As discussed in the groundwater reports in **Appendix D**, the following actions were completed in response to the Level 2 TARP triggers for this reporting period:

- *Continue monitoring as per monitoring program* - monthly groundwater monitoring is ongoing according to the monitoring program;
- *Ongoing review of water quality data* – result analysis and reporting has been completed on a quarterly basis during the post-mining stage; and
- *Convene Tahmoor Coal Environmental Response Group to review response* - completed following the reporting of this data, which included the discussion of these TARP triggers.

3.2.7.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan. In addition, the following actions are proposed for groundwater quality investigations:

- At all sites with Level 2 trigger for groundwater quality, to continue monitoring program and a review of water quality data in the next quarterly groundwater report.

4 Assessment of Environmental Performance

4.1 Environmental Performance Measures and Indicators

The following development consents include subsidence impact performance measures as conditions for the extraction of LW W3-W4:

- DA 67/98 Modification 5:
  - Condition 13A – Performance Measures for Natural and Heritage Features;
  - Condition 13E – Performance Measures for Built Features;
- LW W3-W4 Extraction Plan Approval:
  - Condition 1 – Performance Measures for Stonequarry Creek, Cedar Creek and Matthews Creek.

The subsidence impact performance measures were adopted as part of the LW W3-W4 Extraction Plan and associated management plans. To assist in defining the performance measures, each measure has been assigned subsidence performance indicator(s).

These performance measures and indicators are provided in **Table 4-1**, as well as an assessment of performance.

Table 4-1 Assessment of Environmental Performance

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Water Management				
Stonequarry Creek, Cedar Creek and Matthews Creek (LW W3-W4 Extraction Plan Approval)	No subsidence impact or environmental consequence greater than minor*	This performance indicator will be considered to be exceeded if mining-induced fracturing in a rockbar or stream bed results in a reduction in pool water level below historically recorded water levels, taking into account rainfall and observations during the baseline monitoring period, for: • More than 10% of pools located within the 600 m Study Area for Natural Features; and/or • Pool SR17.	**No** Less than 10% of the pools within the Investigative Area have been impacted and the surficial fracturing of the rockbar at pool SR17 and surface cracking of SR20 in Stonequarry Creek has not resulted in an impact to pool water level. Consequently, there is negligible evidence to date of subsidence impacts with environmental consequences greater than minor associated with mining in the Western Domain.	Sections 2.2.2 and 2.2.3
	No connective cracking between the surface, or the base of the alluvium, and the underground workings.	This performance indicator will be considered to be exceeded if analysis of inflow data suggests high correlation to rainfall events and significant departure from recent groundwater model predictions. This would be supported by analysis of pre- and post-mining goaf centreline bore data.	**No** *Note: Post-mining goaf centreline bore data not yet available.*	Section 2.3.3
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	Flooding This performance indicator will be considered to be exceeded if subsidence results in the post-mining 1% AEP flood level being above the floor level of one or more dwelling.	**No**	Section 2.2.5

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Land Management				
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	<u>Landscape Features</u> This performance indicator will be considered to be triggered if subsidence impacts to landscape features result in the collapse of cliffs, rock outcrops or steep slopes in proximity to members of the public.	**No**.	Section 2.4
Biodiversity Management				
Threatened species, threatened populations, or endangered ecological communities (DA 67/98 Condition 13A)	Negligible environmental consequences**.	This performance indicator will be considered to be triggered if: • Changes in macroinvertebrate and stream health indicators are statistically significant; • If visual assessment of aquatic habitat identifies mining subsidence induced impacts. • Statistically significant changes in amphibian diversity is detected toward baseline attributed to mining, as detected during amphibian monitoring; and/or • Statistically significant changes in riparian vegetation is detected toward baseline attributed to mining, as detected during riparian monitoring.	**No**	Section 2.5

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
Heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**. Negligible loss of heritage value**.	<u>Isolated finds/artefact scatters (AHIMS items)</u> No performance indicators are currently established as impacts are predicted to be negligible.	**No** *Note: The LW W3-W4 Heritage Management Plan assessed the probability of impacts to isolated finds / artefact scatters from the proposed longwall mining as very unlikely. Impacts to open sites, such as artefact scatters, are limited to cracking in the surface soils which is unlikely to affect the artefacts. Therefore monitoring of these sites have not been included in the monitoring program.*	Not applicable
		<u>Scarred tree (AHIMS item)</u> This performance indicator will be considered to be triggered if: • subsidence monitoring identifies a perceptible tilt increase that places the tree at risk of falling; and/or • subsidence monitoring identifies a perceptible cracking in the tree unrelated to natural weathering or trauma damage	**No** *Note: The LW W3-W4 Heritage Management Plan assessed the probability of impacts to the scarred tree from the proposed longwall mining as very unlikely.* *Impacts to open sites, such as the scarred trees, are limited to cracking in the surface soils which is unlikely to affect the item. Therefore monitoring of this item has not been included in the monitoring program.*	Section 2.6.1
		<u>Grinding grooves (AHIMS item)</u> This performance indicator will be considered to be triggered if: • subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking; and • these subsidence impacts result in impacts to the heritage values of the site.	**No**	Section 2.6.1

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
Heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**. Negligible loss of heritage value**.	Main Southern Railway Heritage Items (Mushroom Tunnel, Picton Tunnel, Antill Street Underbridge, Picton Viaduct, Argyle Street Underbridge) This performance indicator will be considered to be triggered if subsidence monitoring identifies cracking of external brick work or physical impacts to the historical heritage values of the structure, measurable tilt or visible perceptible impacts such as subsidence induced cracking, exfoliation, brick movement or brick fall.	**No**	Section 2.6.2
		Main Southern Railway Heritage Items (Pedestain overbridge 86.1 km, MSR culverts, Subway 88.133 km, high retaining wall 84.687 km, bridge on Matthews Lane, Prince Street overbridge, Connellan Crescent Overbridge) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, brick movement or brick fall.	**No**	Section 2.6.2
		Cottage (Weatherboard) This performance indicator will be considered to be triggered if subsidence monitoring identifies damage to external cladding or internal finishes.	**No**	Section 2.6.2
		Redbank Uniting Church This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, brick movement or brick fall.	**No**	Section 2.6.2

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
		Rural Landscape – Thirlmere Way This performance indicator will be considered to be triggered if subsidence monitoring identifies visual subsidence, surface cracks.	**No**	Section 2.6.2
		Rural landscape – Thirlmere Way (local heritage significance) No performance indicators are currently established as impacts are predicted to be negligible.	**No**	Section 2.6.2
Other Aboriginal and heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**.	Loop line Sandstone culverts (local heritage significance) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, exfoliation, block movement or block fall.	**Yes** Cracking on sandstone culverts at 88.400 km and 88.980 km resulted in exceedance of subsidence performance indicators. DPE and Heritage NSW were notified of this exceedance on 21 September 2021. Tahmoor Coal has complete remediation of the two sandstone culverts and there are no residual impacts.	Sections 2.6.2 and 3.2.9
		Loop line brick culverts (local heritage significance) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, exfoliation, brick movement or brick fall.	**No**	Sections 2.6.2

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Built Feature Management				
Key Public Infrastructure: • Main Southern Railway; • Picton-Mittagong Loop Line; and • Electricity transmission lines and towers. (DA 67/98 Condition 13E)	Always safe and serviceable.	None allocated.	**No**	Section 2.7
	Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.	None allocated.	**No**	Section 2.7
Other Infrastructure: • Electricity distribution lines, poles and associated towers; • Unsealed roads and road culverts, fire trails, fences and other built features; and • Other public infrastructure. (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7
Privately-owned residences (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Built Feature Management				
Other privately-owned built features and improvements, including farm dams, swimming pools, tennis courts, roads, tracks and fences (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	None allocated.	**No**	Section 2.7
Mine workings				
First workings (DA 67/98 Condition 13A)	To remain long term stable and non-subsiding.	None allocated.	**No**	Not applicable
Second workings (DA 67/98 Condition 13A)	To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.	None allocated.	**No**	Not applicable

NOTES:

* minor is defined as *not very large, important or serious* by DPE.

** For the purpose of this Extraction Plan and associated documents, 'negligible' is defined as being 'so small and insignificant as to not be worth considering'. A negligible impact is viewed with regards to a long term context, causing little or no impact. If a short-term impact causes a greater than negligible impact, the impact can still be considered negligible if the impacts are of a limited duration and are considered negligible when considered over the long term.

5 Document Information

5.1 References

Department of Planning and Environment (DPE) (2015), Draft Guidelines for the Preparation of Extraction Plans V5.

Mine Subsidence Engineering Consultants (MSEC) (2021), Tahmoor Coal – Longwalls W3 and W4, Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of the Proposed Longwalls W3 and W4 in Support of the Extraction Plan Application. Prepared for Tahmoor Coal, March 2021, document MSEC1112.

Niche (2022a), Aquatic Ecology Monitoring Report 2017-2022, report to Tahmoor Coal, 17 June 2022.

Niche (2022b), Terrestrial Ecology Monitoring Report, Riparian vegetation and amphibian monitoring Autumn 2022, report to Tahmoor Coal, 7 June 2022.

SLR (2021), Agricultural Subsidence Monitoring LW W3-W4, letter report to Tahmoor Coal, 26th August 2021, document 630.12953.001

WRM (2022), Matthews Creek Post-mining Flood Study, LW W1-W4, 15 December 2022, document 1072-08-B1.

Tahmoor Coal Documents:

- Extraction Plan LW W3-W4 Extraction Plan Main Document, TAH-HSEC-326
- Extraction Plan LW W3-W4 Water Management Plan, TAH-HSEC-328
- Extraction Plan LW W3-W4 Land Management Plan, TAH-HSEC-330
- Extraction Plan LW W3-W4 Biodiversity Management Plan, TAH-HSEC-325
- Extraction Plan LW W3-W4 Heritage Management Plan, TAH-HSEC-331
- Extraction Plan LW W3-W4 Stonequarry Creek Rockbar Management Plan, TAH-HSEC-352
- Extraction Plan LW W3-W4 Built Features Management Plan, TAH-HSEC-332
- Extraction Plan LW W3-W4 Public Safety Management Plan, TAH-HSEC-333
- Extraction Plan LW W3-W4 Subsidence Monitoring Program, TAH-HSEC-329

5.2 Glossary of Terms

Terms references to this document are provided below in **Table 5-1**.

Table 5-1 Glossary of Terms

Term	Definition
Active Subsidence Zone	The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front of the active longwall face and 450 m behind the active longwall face or following 500 m of longwall extraction.
Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence).

Term	Definition
Built features	Includes any building or work erected or constructed on land, including dwellings and infrastructure such as a formed road, street, path, walk, or driveway; any pipeline, water sewer, telephone, gas or other infrastructure service main.
Cliffs	Continuous rockfaces having minimum heights of 10 m, minimum lengths of 20 m and minimum slopes of 2 to 1, i.e. having minimum angles to the horizontal of 63°.
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of mm, is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.
Curvature	Second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of 1/km (km-1), but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually in km. Curvature can be either hogging (i.e. convex) or sagging (e.g. concave).
Longwall	A system of mining coal in which the seam is extracted on a broad front or long face using a coal shearer and the roof is supported by hydraulic roof supports.
Reporting period	1 January 2023 to 30 June 2023.
Run of mine (ROM)	Raw coal production. The unprocessed mined coal that is conveyed to the CPP. ROM may consist of coal and rock.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Study Area	Study Area as defined in the LW W3-W4 Extraction Plan.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of mm. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Subsidence impacts	The physical changes or damage to the fabric or structure of the ground, its surface and environmental features, or built structures that are caused by the subsidence effects. These impacts considerations can include tensile and shear cracking of the rock mass, localised buckling of strata, bed separation, rock falls, collapse of overhangs, failure of pillars, failure of pillar floors, dilation, slumping and also include subsidence depressions or troughs.

Term	Definition
Subsidence consequences	The knock-on results of subsidence impacts, i.e. any change in the amenity or function of a natural feature or built structure that arises from subsidence impacts. Consequence considerations include public safety, loss of flows, reduction in water quality, damage to artwork, flooding, draining of aquifers, the environment, community, land use, loss of profits, surface improvements and infrastructure. Consequences related to environmental features are referred to as environmental consequences.
Tilt	The change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the first derivative of the subsidence profile. Tilt is usually expressed in units of mm/m. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 %, or 1 in 1000.
Western Domain	Area to the north-west of the Main Southern Railway.

5.3 Abbreviations

Abbreviations used in this document are provided below in **Table 5-2**.

Table 5-2 Abbreviations

Abbreviation	Definition
AHIMS	Aboriginal Heritage Information System
ARTC	Australian Rail Track Corporation
AUSRIVAS	The Australian River Assessment System
BACI	Before After Control Impact design
BGSS	Bargo Sandstone
BIS	Building Inspection Service
CTF	Cease to flow
DA	Development Approval
DRNSW	Department of Regional NSW
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
EC	Electrical conductivity
EPA	NSW Environment Protection Authority
EPT	Ephemeroptera Plecoptera Trichoptera scores
GFG	GFG Alliance
GNSS	Global Navigation Satellite System units
HBSS	Hawkesbury Sandstone
HEC	Hydro Engineering and Consulting, now ATC Williams
Km	Kilometres
LW W1	Longwall West 1
LW W1-W2	Longwall West 1 to West 2
LW W2	Longwalls West 2
LW W3	Longwall West 3

Abbreviation	Definition
LW W3-W4	Longwalls West 3 to West 4
LW W4	Longwall West 4
m	metres
mbgl	Metres below ground level
mg/L	Milligrams per litre
ML	Mining Lease
mm	millimetre
MSEC	Mine Subsidence Engineering Consultants
MSR	Main Southern Railway
NRAR	NSW Industry – Land & Water – Natural Resources Access Regulator – East
NSW	New South Wales
OE	Observed expected score
OSP	Open Standpipe Piezometers
pH	pH units
PMLL	Picton-Mittagong Loop Line railway
RCE	Riparian Channel and Environment Inventory
RCP	Reinforced Concrete Pipe
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TfNSW	Transport for NSW
VMP	Vibrating Wire Piezometer
WWTP	Wastewater treatment plant

5.4 Document Distribution

This report and associated documents have been distributed according to **Table 5-3**.

Table 5-3 Distribution List for Six Monthly Subsidence Impact Report

Agency	Contact Person	Position	Electronic Copy
DPE - Planning	(Planning Portal)	(Planning Portal)	(https://www.planningportal.nsw.gov.au/major-projects)
	Jessie Evans	Director – Resource Assessments	Jessie.evans@planning.nsw.gov.au
	Gabrielle Allan	Team Leader	Gabrielle.Allan@planning.nsw.gov.au
DPE - Resources Regulator (Subsidence)	(General email)	(General email)	subsidence.monitoring@planning.nsw.gov.au nswresourcesregulator@service-now.com
	Ray Ramage	Mine Safety Officer - Subsidence	ray.ramage@planning.nsw.gov.au

Agency	Contact Person	Position	Electronic Copy
DRNSW – Mining Exploration and Geoscience	(General email)	(General email)	resource.operations@planning.nsw.gov.au
DRNSW – Resources Regulator – Mining Act Inspectorate	(General email)	(General email)	nswresourcesregulator@service-now.com
	Greg Kininmonth	Manager Environmental Operations (Southern)	greg.kininmonth@planning.nsw.gov.au
Wollondilly Shire Council	(General email)	(General email)	council@wollondilly.nsw.gov.au
	David Henry	Acting Team Leader Environmental Services	david.henry@wollondilly.nsw.gov.au
Subsidence Advisory NSW	(General email)	(General email)	subsidencetechnical@customerservice.nsw.gov.au
	John Johnston	Technical Manager	John.Johnston@customerservice.nsw.gov.au
NRAR	(General email)	(General email)	nrar.servicedesk@dpie.nsw.gov.au
	Guy Ohandja	Manager Compliance Monitoring & Audit	guy.ohandja@nrar.nsw.gov.au
EPA	(General email)	(General email)	epa.illawarra@epa.nsw.gov.au
	Andrew Couldridge	Senior Operations Officer - Metropolitan Illawarra	andrew.couldridge@epa.nsw.gov.au
TCCCC Committee Members	Documents sent to TCCCC Committee Members at private email addresses.		

Appendix A – Subsidence Monitoring Report

Six Monthly Subsidence Monitoring Report for Tahmoor Longwall W4

Summary	
Monitoring period	1 January 2023 to 30 June 2023
Length of extraction of LW W4	LW W4 commenced extraction on 16 May 2022 and finished extraction on 13 September 2022
Distance travelled by longwall since previous report	
Distance to completion of LW W4	

Summary of observed ground movements

Subsidence Parameter		**Maximum observed at completion of LW W4**	**Location**
Subsidence (mm)	*Inc* *Total*	718 897	LW W4 Centreline LW W1-W4 Crossline
Tilt (mm/m)	*Inc* *Total*	9.7 9.8	LW W1-W4 Crossline LW W1-W4 Crossline
Hogging Curvature (km^{-1})	*Inc* *Total*	0.37 0.35	LW W1-W4 Crossline LW W1-W4 Crossline
Sagging Curvature (km^{-1})	*Inc* *Total*	-0.19 -0.33	LW W1-W4 Crossline LW W3 Centreline
Tensile Strain (mm/m)	*Inc* *Total*	0.9 1.3	LW W4 Centreline LW W2 Centreline
Compressive Strain (mm/m)	*Inc* *Total*	-4.8 -5.6	LW W4 Centreline LW W4 Centreline

Actions

HAVE ANY DEFINED TRIGGERS BEEN REACHED SINCE PREVIOUS REPORT?	NO
IS ANY URGENT ACTION REQUIRED?	NO

This monitoring report provides the results of the latest ground surveys for LW W4, in accordance with the requirements of subsidence management plans.

Longwall face position

LW W4 commenced on 16 May 2022 finished extraction on 13 September 2022.

Monitoring Results

Ground monitoring has continued after the extraction of LW W4. Monitoring results are shown graphically at the back of this report.

A map showing the locations of survey marks is provided in Drawing No. MSEC1263-01. Monitoring has continued at GNSS units that are located directly above and adjacent to LW W4. Traditional surveys have continued on a monthly basis along the Main Southern Railway and some of its key infrastructure sites, and at the Victoria Bridge.

Subsidence above LW W4

GNSS Site 24 is located directly above the centreline of LW W4, approximately 200 metres from the commencing end. The unit has recorded approximately 660 mm subsidence and has also moved to the east and south. Rates of change have reduced to very low levels.

The development of subsidence over time, at sites of interest along the centreline, is shown in Figure A. GNSS Site 24 recorded an additional 16 mm of vertical subsidence between 1 January 2023 and 30 June 2023.

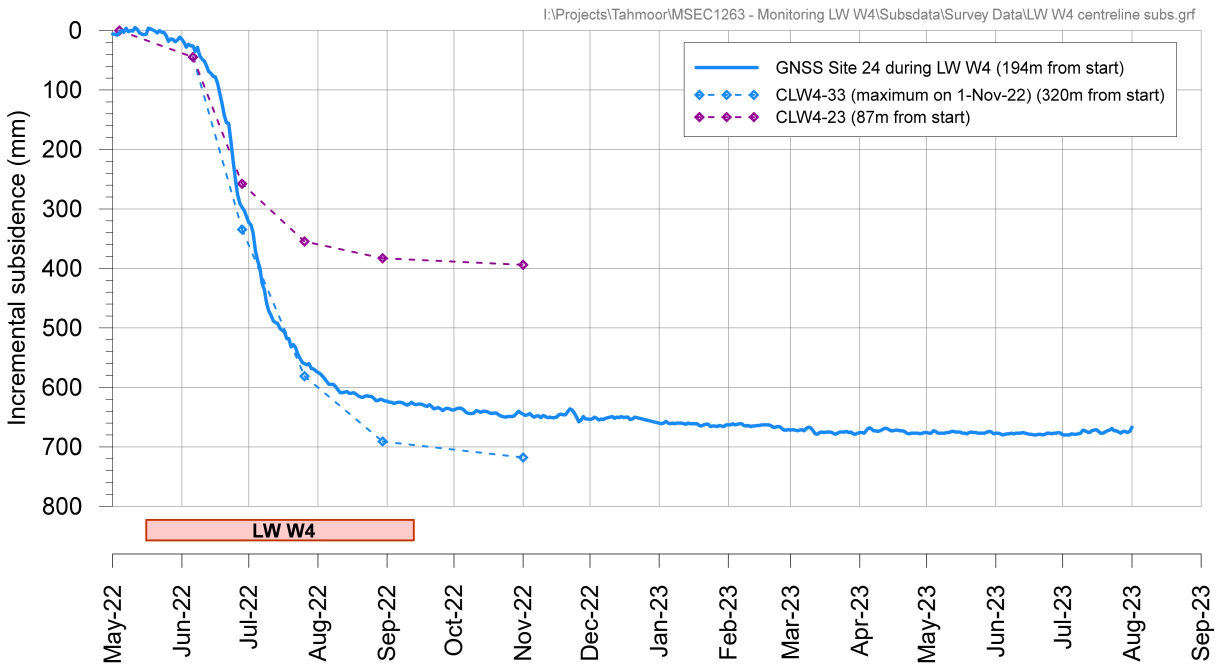

Figure A Development of subsidence along centreline of LW W4

Picton – Mittagong Loop Line

GNSS units 7, 8, 9, 10, 11 and 19 are located at intervals along the Loop Line. The results are shown in Fig. G07 to Fig. G11 and Fig. G19.

Less than 20 mm subsidence was measured during LW W4. Visual inspections did not identify any issues associated with mine subsidence.

It can be seen from Fig. G07 to G09 that GNSS units 7, 8 and 9 have recorded very minor ongoing vertical subsidence during the reporting period. They recorded an additional 5 mm, 2 mm and 4 mm, respectively, of vertical subsidence between 1 January 2023 and 30 June 2023. Very little measurable change was recorded at GNSS units 10, 11 and 19, which are located to the side of the extracted longwall panels.

Main Southern Railway

Monthly surveys were conducted along the Main Southern Railway during and after the mining of LW W4. Results were within survey tolerances during mining. Visual inspections did not identify any issues associated with mine subsidence.

Continued ongoing horizontal movements have been observed along the Railway and at the Thirlmere Way Underbridge and Connellan Crescent Overbridge. Monthly monitoring and reporting continues.

Victoria Bridge

Regular surveys were conducted at the Victoria Bridge over Stonequarry Creek during and after the mining of LW W4. Very small and gradual closure was observed across Stonequarry Creek.

Visual inspections did not identify any impacts associated with mine subsidence but the gap between the deck and the eastern abutment was observed to almost close during the mining of LW W3. The buffer board was replaced on 7 June 2022 and the gap reinstated. A gap of 35 mm was measured between the structural cross beam and abutment on 10 June 2022. The gap between the deck and the eastern abutment was reinstated on 24 January 2023. The gap has gradually reduced over time to 19 mm. Rates of change are reducing to be very low levels. Quarterly monitoring and reporting continues.

GNSS monitoring

Global Navigation Satellite System (GNSS) units are fixed survey stations that continuously measure their absolute horizontal and vertical positions in real time. There are 17 units located directly above and adjacent to LW W3-W4. These include one unit above the commencing end, and along the centreline of, LW W4, being Site 24.

The measured position of each GNSS unit varies depending on atmospheric conditions and the array of satellites that are present in the sky at each time, and the vegetation cover surrounding each unit. Measured variations in height are typically greater than the variations for eastings and northings.

The results from the GNSS units are shown in Fig. G07 to Fig. G21, Fig. G24, Fig. GSR17N and Fig. GSR17S. The 7-day running average readings are the most appropriate reflection of measured changes to date. Some trends can be seen from the results, with the closest GNSS units generally moving towards the extracted panel.

GNSS units 12A, 13, 15, 16, 17, 18, 20, 21, SR17S were removed from privately owned properties in July 2023.

Changes in horizontal distances can be calculated between pairs of GNSS units that are stationed close together and results are shown in Figure B.

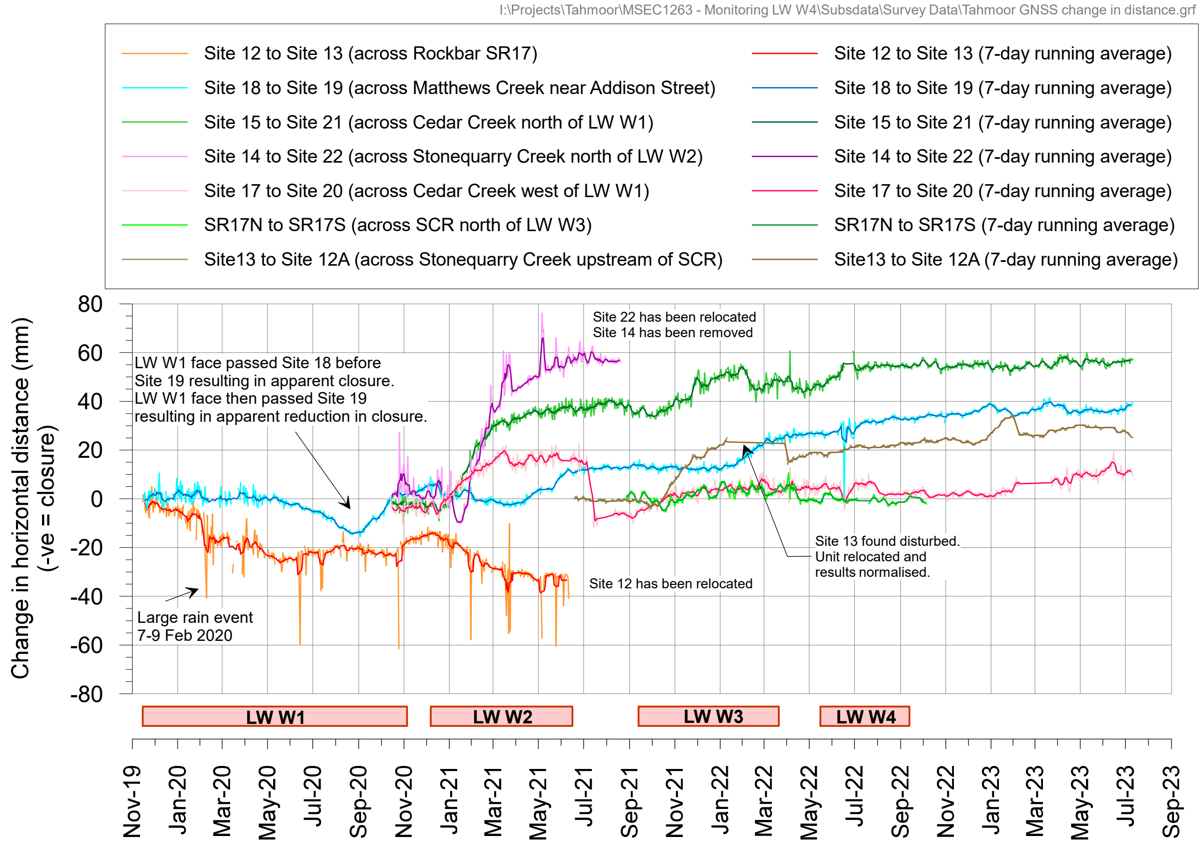

Figure B Observed changes in horizontal distances between GNSS units

It can be seen that the remaining pairs of units have recorded a net ground extension when monitoring ceased in July 2023. Trends of increasing ground extension across Sites 18 and 19 (Matthews Creek) and Sites 15 and 21 (Cedar Creek) ceased in January 2023, with very little change recorded during the reporting period to July 2023.

Ground extension between Sites 12A and 13 (Stonequarry Creek) followed a similar observation of trends appearing to cease around December 2022. As shown in Fig. G12A, Site 12A, however, recorded small irregular movements in the north-south direction between December 2022 and February 2023 that do not appear to be related to mine subsidence. Some construction activity had occurred on the property during this period of time.

Very minor changes in distance were measured between Sites 17 and 20 (Cedar Creek) during the mining of LW W4. A very small increase in ground extension has been observed between the two sites since January 2023. When comparing readings in Fig. G17 and Fig. G20, it appears that the measured position of Site 17 has gradually shifted to the north and west since January 2023, reversing previously observed trends. The changes do not appear to be related to mine subsidence.

Natural Features

Survey marks were installed across rockbars in Cedar, Matthews and Stonequarry Creeks prior to the commencement of LW W1, at locations shown in Drawing No. MSEC1263-01.

Valley closure was measured to develop across Stonequarry Creek at SQ104 and SQ105, which are located near the confluence of Stonequarry Creek and Cedar Creek. Minor closure was developing across SQ104, SQ105, SQ106 and SQ107 up to 3 November 2021, when the pegs were removed as requested by the landowner. Survey peg SQ114-1 has been destroyed during flooding. Minor changes have been observed during the mining of LW W4 across SQ113 to SQ120, including where a new fracture was observed near SQ116. Minor additional closure was observed across SQ111.

Visual inspections prior to the commencement of LW W1 and in December 2019 found that there was no connective overland water flows in Matthews Creek due to the prolonged drought. Most pools were dry with a few pools holding water at low to medium levels. No connective overland water flows were observed in Cedar Creek upstream of the confluence with Matthews Creek due to the prolonged drought. Most pools were dry with a few pools holding water at low to medium levels. Downstream of Matthews Creek, pools in Cedar Creek were full with a trickle flow observed out of the majority of the pools. There was no flow over the sand substrate at the lower reaches of Cedar Creek. The water level in the long pool in Stonequarry Creek fell below the Cease to Flow level in late October 2019 prior to the start of LW W1.

An inspection was conducted on 22 January 2020 following a series of rain events between 8 and 21 January. Pools that were previously dry were observed to contain water and the overland flow was observed over the previously dry lower reaches of Cedar Creek. An inspection was conducted on 27 February 2020 following a large rain event on 7 to 9 February 2020. Higher volumes of connective flow and flood levels were observed in Matthews, Cedar and Stonequarry Creeks.

Monthly monitoring and inspections during the mining of LW W1 observed rising and falling of water levels consistent with rainfall events. No mining-induced impacts were identified in the visual inspections.

No mining-induced impacts were observed to Stonequarry and Matthews Creeks during the mining of LW W2 and LW W3, including the pool at Rockbar SR17 in Stonequarry Creek.

A focussed visual inspection was conducted on 19 January 2021, which confirmed low water levels in 7 pools, which were Pools CB10, CR12, CR13, CR14 and CR15 in Cedar Creek and Pools MR45 and MR46 in Matthews Creek. Rainfall events occurred intermittently during January 2021 and follow up inspections in February 2021 found a return to normal water levels and overland flows. A substantial rainfall event occurred in mid to late March 2021 and inspections in March and April found pool water levels to be full.

Following observations of atypical water level behaviour at Pools CB3, CB10 and CR14 in Cedar Creek in late 2020 and early 2021, water levels returned to normal levels during February in response to a series of rainfall events.

Water level monitoring in March did, however, detect a reduction in water levels in only Pool CR14 until a large storm event refilled the pool in late March 2021. Water levels in Pools CB3 and CB10 remained consistent with baseline conditions during this time.

Visual inspections and water level monitoring have found that water levels have returned to normal since March 2021 at Pool CR14. They have not declined atypically during periods of dry weather. Changes during October 2021 were consistent with periods of rainfall and dry weather. No changes were observed during the most recent inspection on 10 May 2023.

Previously observed gas bubbling at Pool MR45 have not been found in October 2021. Iron-oxy hydroxide precipitation was observed during the October 2021 inspections that was similar to previously observed precipitations during pre-mining baseline inspections and at sites in Stonequarry Creek located well upstream from the longwalls, beyond the influence of mine subsidence. No changes were observed during the most recent inspection on 10 May 2023.

Minor surface fracturing has been observed on Rockbar SR17 in the south-east corner of the rockbar, downstream of the access road. The fractures are in a localised area and limited to the laminar surface rocks only. No changes were observed on 10 May 2023 since the previous inspection in February 2023. Manual water level measurements remain above Cease to Flow levels. Both loggers in the main pool upstream of Rockbar SR17 were lost after major rainfall events but Site SB has been reinstated.

A new minor fracture of approximately 1 metre long and 1-2 mm wide was observed on 18 August 2022 at Site SR20. Pre-mining photographs were checked to confirm that the fracture was new. The fracture is located near survey line SQ116, which had not recorded any measurable closure during the mining of LW W2-W3 up until the last survey on 24 January 2022. A survey prism was lost during subsequent floods. No measurable closure was observed across adjacent closure line SQ115 until the last survey on 22 March 2022. A re-survey of adjacent SQ117 found no measurable change between 24 January 2022 and September 2022. As the surveys only measure closure across the valley, it is possible that closure or extension has occurred along Stonequarry Creek. No changes are observed from surface water monitoring.

The fracture is located 170 metres from the commencing end of LW W3, which is within range of observed mining-induced fractures due to previous longwall mining in the Southern Coalfield. While the observation of the fracture is within expectations, it is surprising that no measurable closure has been observed across SQ116. It is possible, however, that ground closure or extension occurred transverse to the creek, which was not measured. No changes were observed during the last inspection on 10 May 2023.

Local Roads

There are no roads located above LW W4. No mining-induced impacts were detected from ground surveys and visual inspections.

Deterioration of the road surface and a small compression hump was observed along Connellan Crescent following significant rainfall.

Deterioration of the road surface was observed on Rumker Street due to heavy vehicle traffic adjacent a development site.

Deterioration of the road surface on was observed on Star Street due to weather and heavy vehicle traffic. Erosion at the northern end the street partially undermined a stormwater pipe. Council undertook repairs.

Council repaired the culvert and pavement near the intersection of Argyle Street and Prince Street, which were damaged during wet weather events.

No issues were observed along Stonequarry Creek Road, Booyong Close, Attunga Close and Carramar Close. Deterioration of the road surface along Thirlmere Way, and land slips on the high side of the road, were observed due to weather and traffic.

Structures

There are no structures located above LW W4.

Gas Infrastructure

No gas infrastructure is located above LW W4.

No impacts were detected from ground surveys and visual inspections along Thirlmere Way during the mining of LW W4. Deterioration of the road surface was observed along Connellan Crescent following significant rainfall.

Electrical Infrastructure

No telecommunications infrastructure is located above LW W4.

No impacts were detected from ground surveys and visual inspections along Thirlmere Way during the mining of LW W4. Deterioration of the road surface was observed along Connellan Crescent following significant rainfall.

Telecommunications Infrastructure

No telecommunications infrastructure is located above LW W4.

No impacts were detected from ground surveys and visual inspections along Thirlmere Way during the mining of LW W4. Deterioration of the road surface was observed along Connellan Crescent following significant rainfall.

Surveys and visual inspections were conducted along the optical fibre cable beyond the finishing end of LW W4. The pegs were installed and initially surveyed when LW W2 was approximately 450 metres from the finishing end. The results, therefore, included a measure of total subsidence due to the mining of LW W2 to LW W4. A reasonable correlation was found between predicted and observed subsidence. Observed tilts and strains were close to survey tolerance.

Potable Water Infrastructure

No potable water infrastructure is located above LW W4.

No impacts were detected from ground surveys and visual inspections along Thirlmere Way during the mining of LW W4. Deterioration of the road surface was observed along Connellan Crescent following significant rainfall.

Sewer Infrastructure

Surveys have been conducted along the Picton rising main located along Wild and Lumsdaine Streets during the period of active subsidence. Observed subsidence, tilts and changes in horizontal distances were within survey tolerances. Focussed visual inspections did not detect any impacts.

Dams

Regular surveys and inspections were conducted at Farm Dam FD-1 and Farm Dam FD-3 during LW W4.

Subsidence was observed to develop gradually at both dams, with compressive strains developing across and along the dam walls. No mining-induced-impacts were observed.

Archaeological Sites

Very minor ground movements have been measured across Rockbar SR17, with no impacts observed at the grinding groove sites. Surface fractures have been observed on the rockbar approximately 40 metres downstream of the grinding grooves since late October 2021. The fractures have been assessed to have negligible impact on the heritage value of the site.

I:\Projects\Tahmoor\MSEC1263 - Monitoring LW W4\AcadData\MSEC1263-01 General Layout.dwg

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SIMEC

TAHMOOR NORTH WESTERN DOMAIN MONITORING LW W4

GENERAL LAYOUT

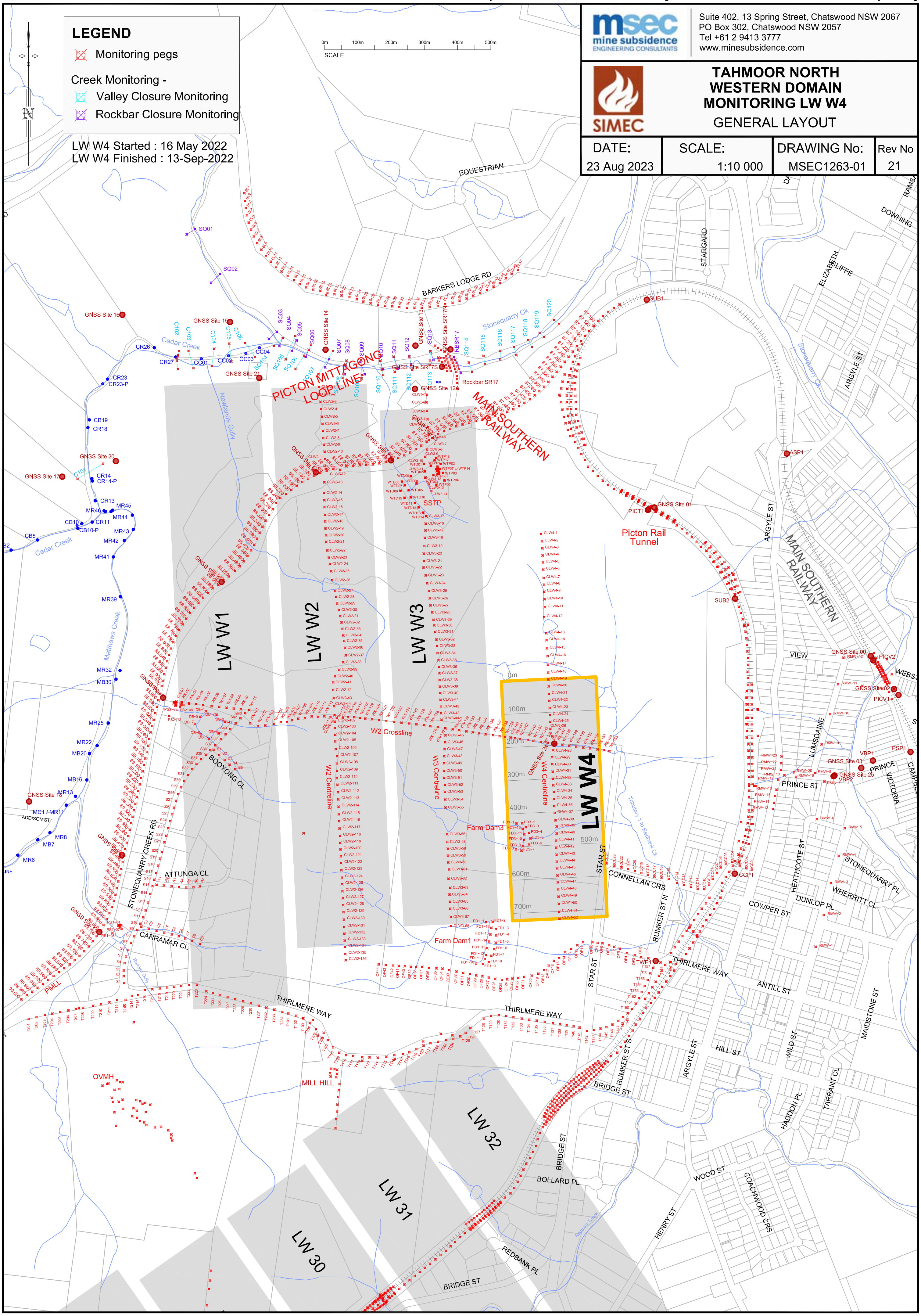
DATE:	SCALE:	DRAWING No:	Rev No
23 Aug 2023	1:10 000	MSEC1263-01	21

LEGEND

- Monitoring pegs

Creek Monitoring -
- Valley Closure Monitoring
- Rockbar Closure Monitoring

LW W4 Started : 16 May 2022
LW W4 Finished : 13-Sep-2022



Tahmoor LW W4 - GNSS Monitoring
Site 7 - PMLL culvert at 87.850km

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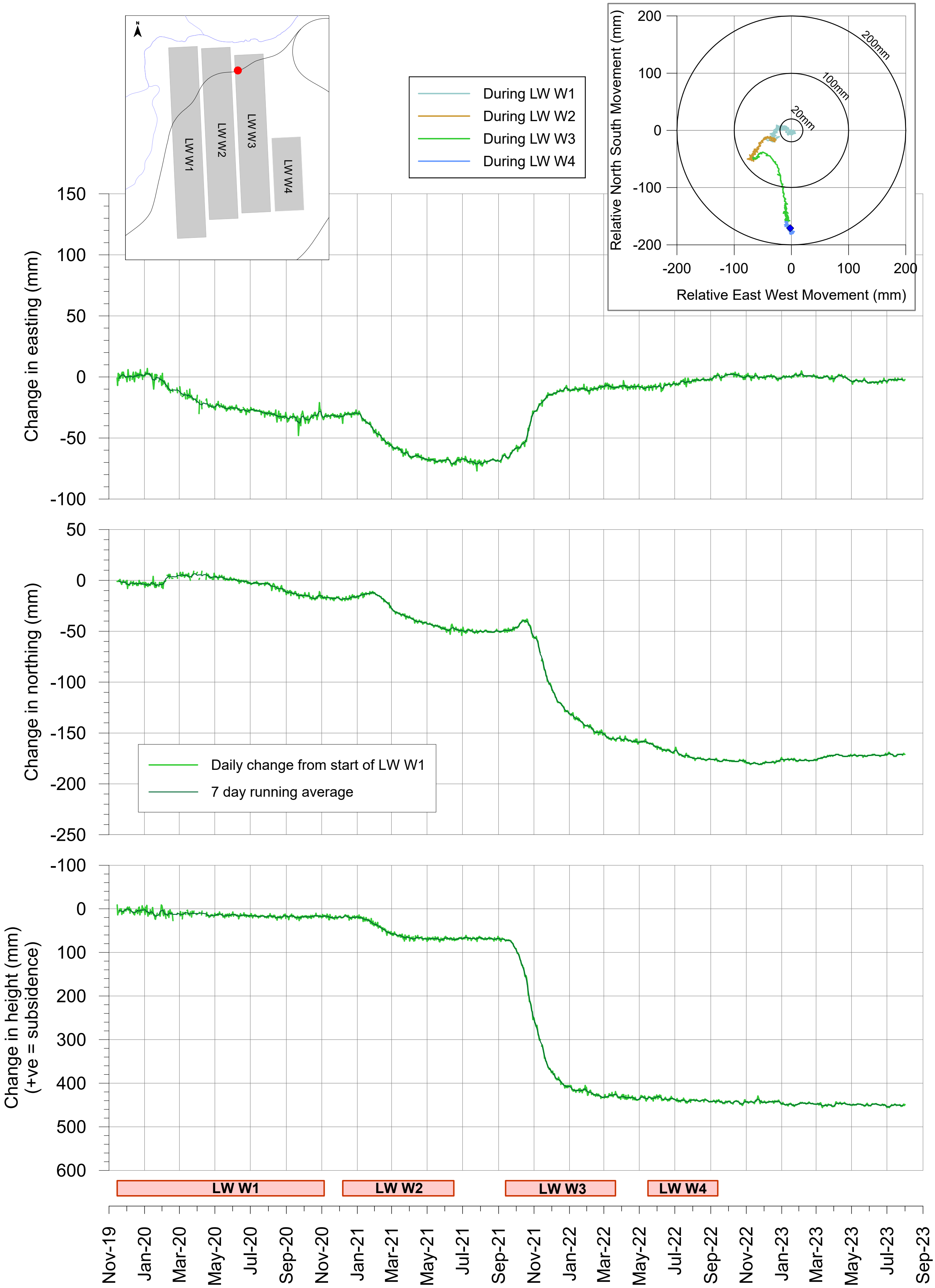

Fig. G07-R21

Tahmoor LW W4 - GNSS Monitoring
Site 8 - LW W2 centreline - PMLL at 88.110km

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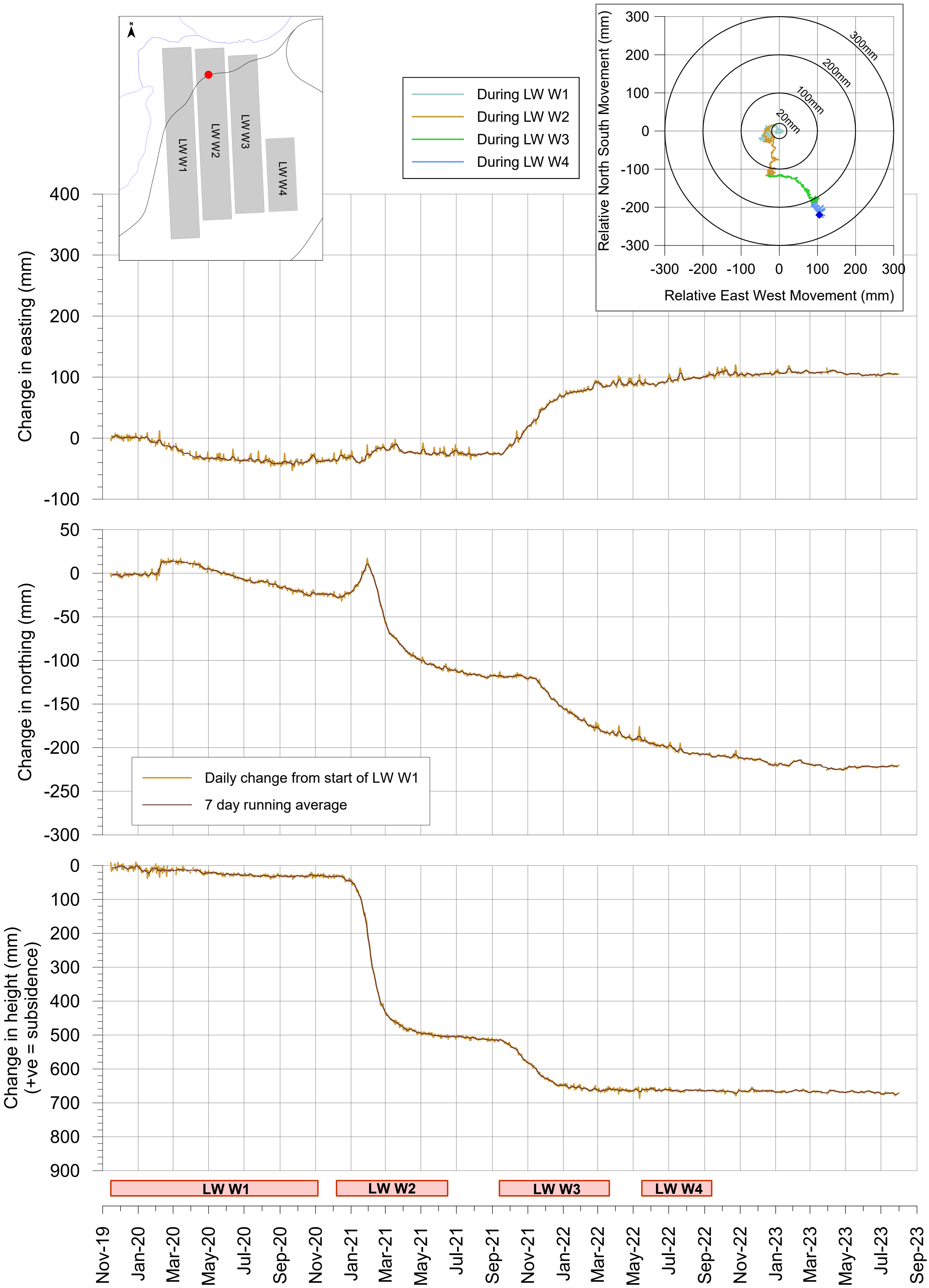

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Fig. G08-R21

Tahmoor LW W4 - GNSS Monitoring
Site 9 - LW W1 centreline - PMLL at 88.550km

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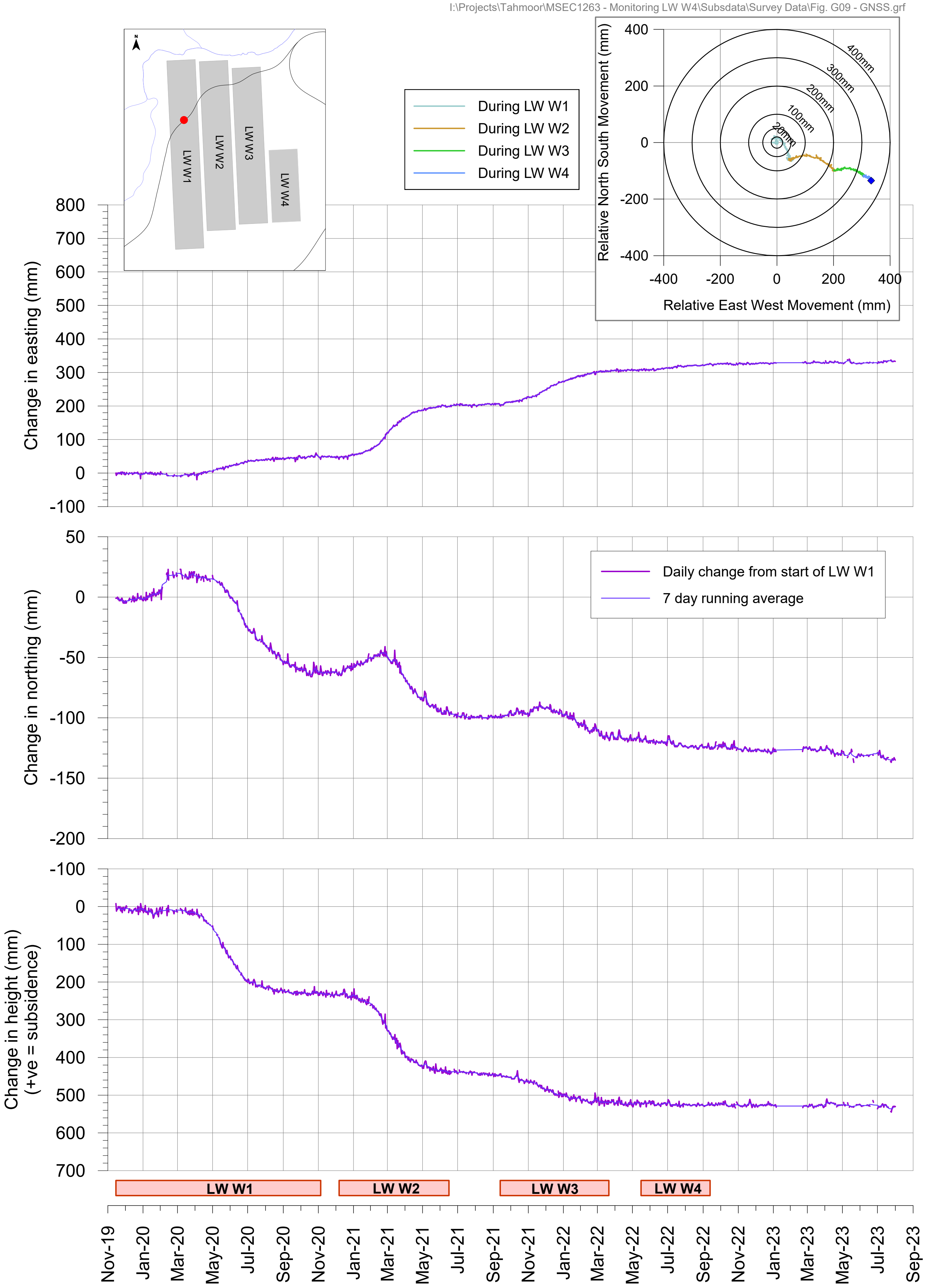

Fig. G09-R21

Tahmoor LW W4 - GNSS Monitoring
Site 10 - PMLL at 89.000km

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Fig. G10-R21

Tahmoor LW W4 - GNSS Monitoring
Site 11 - PMLL at 89.629km

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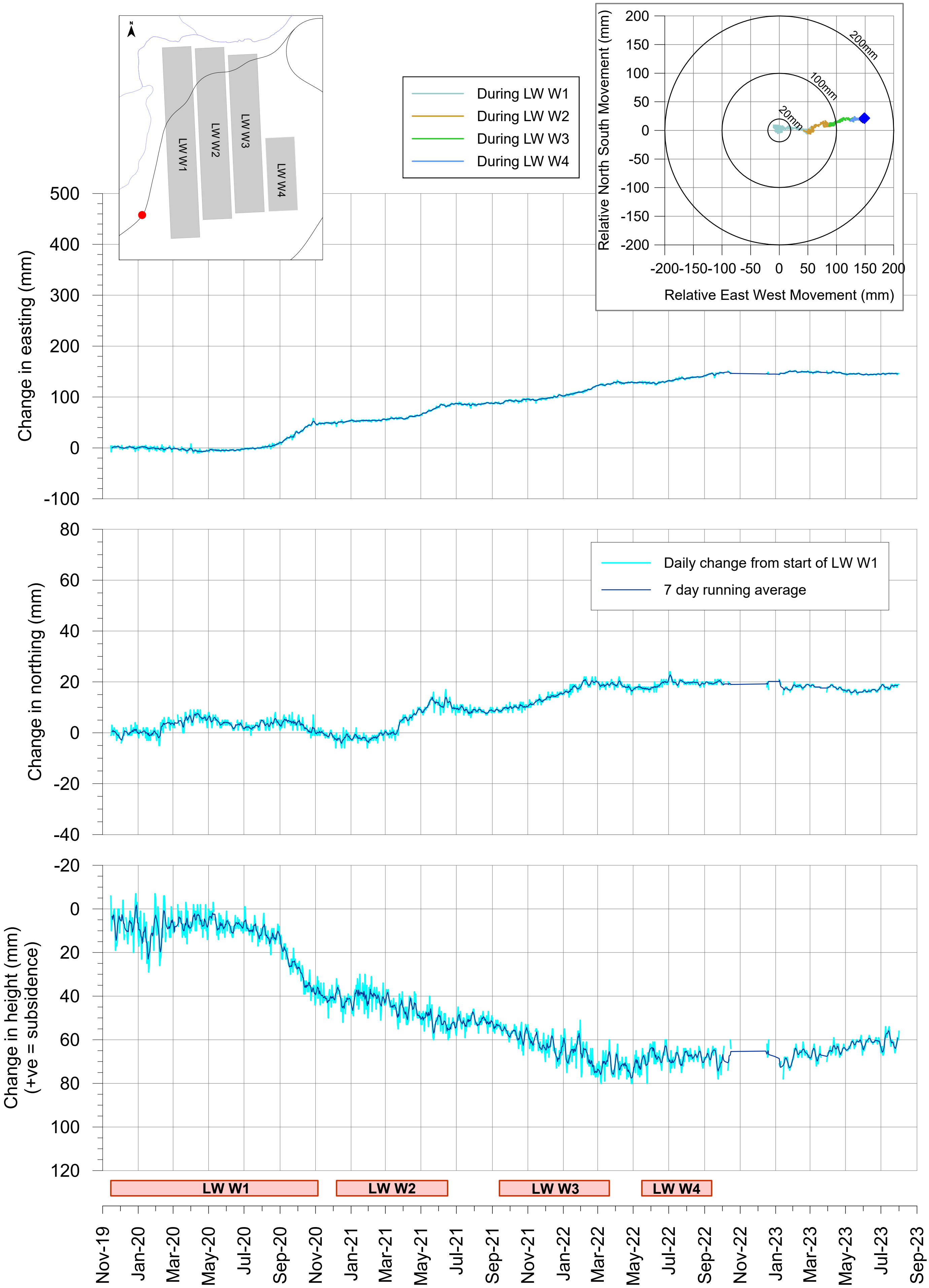

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Fig. G11-R21

Tahmoor LW W4 - GNSS Monitoring
Site 12A - south of Stonequarry Creek upstream of Rockbar SR17

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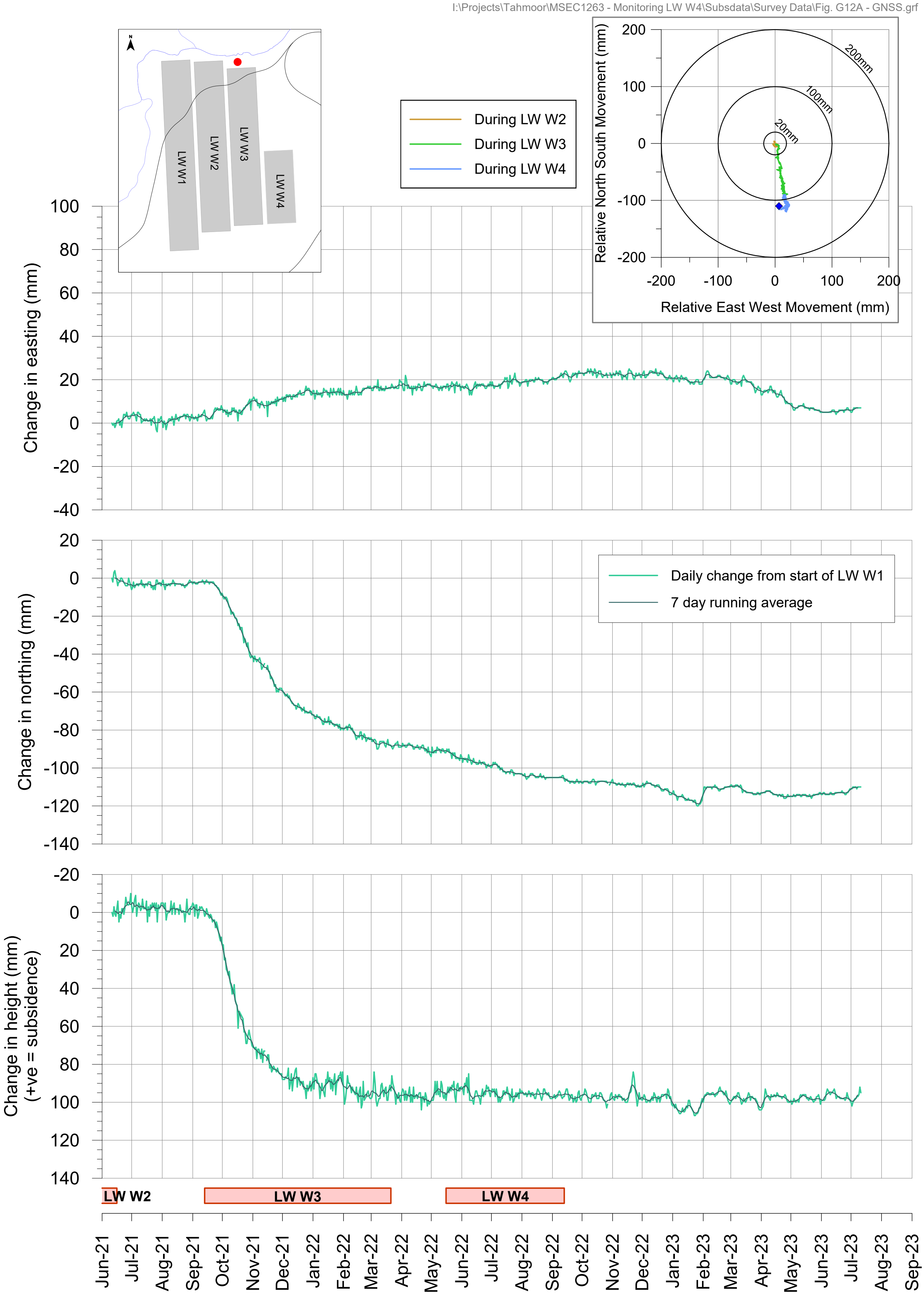

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Fig. G12A-R21

Tahmoor LW W4 - GNSS Monitoring

Site 13 - north of Stonequarry Creek at Rockbar SR17

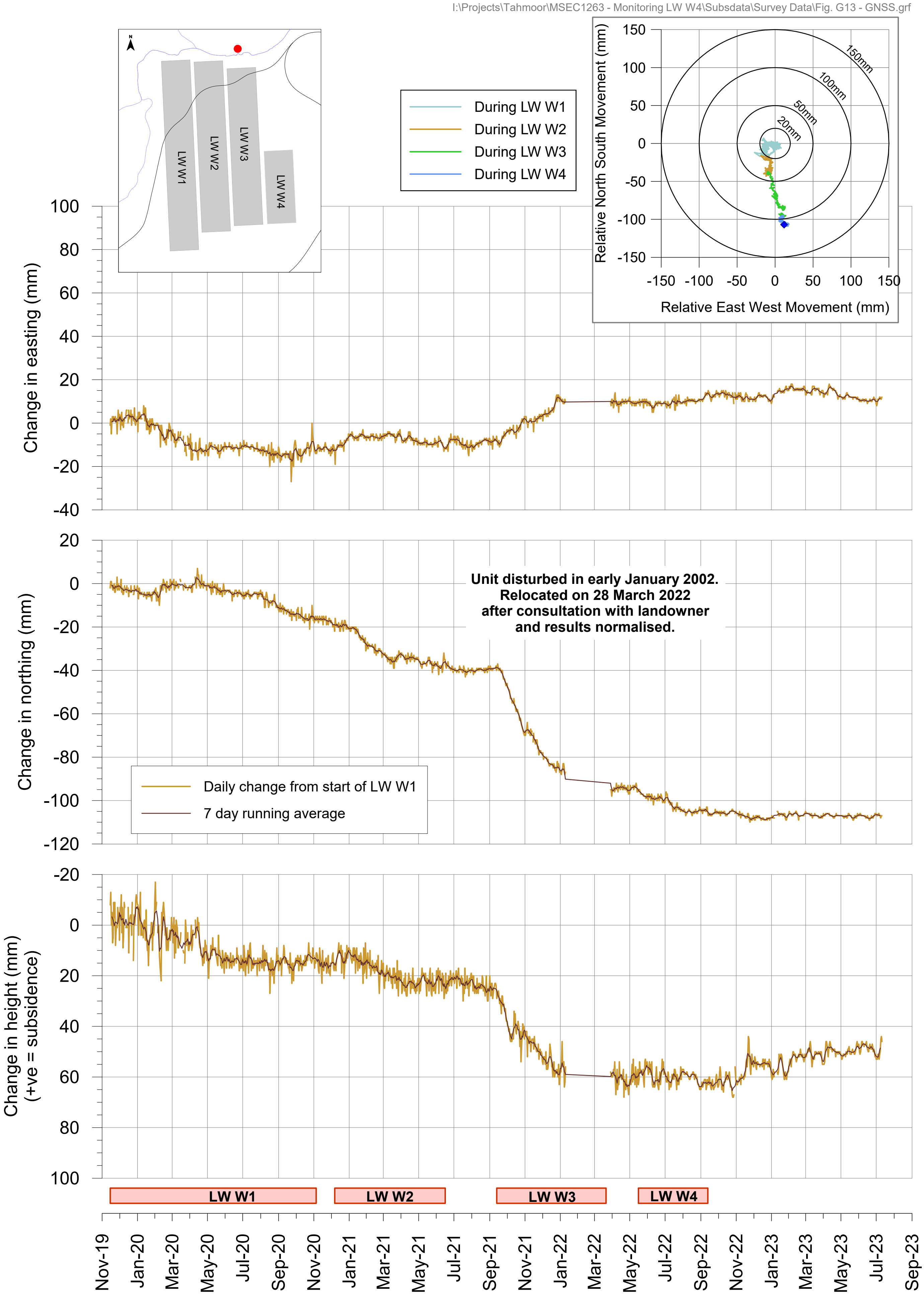

Fig. G13-R21

Tahmoor LW W4 - GNSS Monitoring

Site 15 - Near commencing end of LW W1

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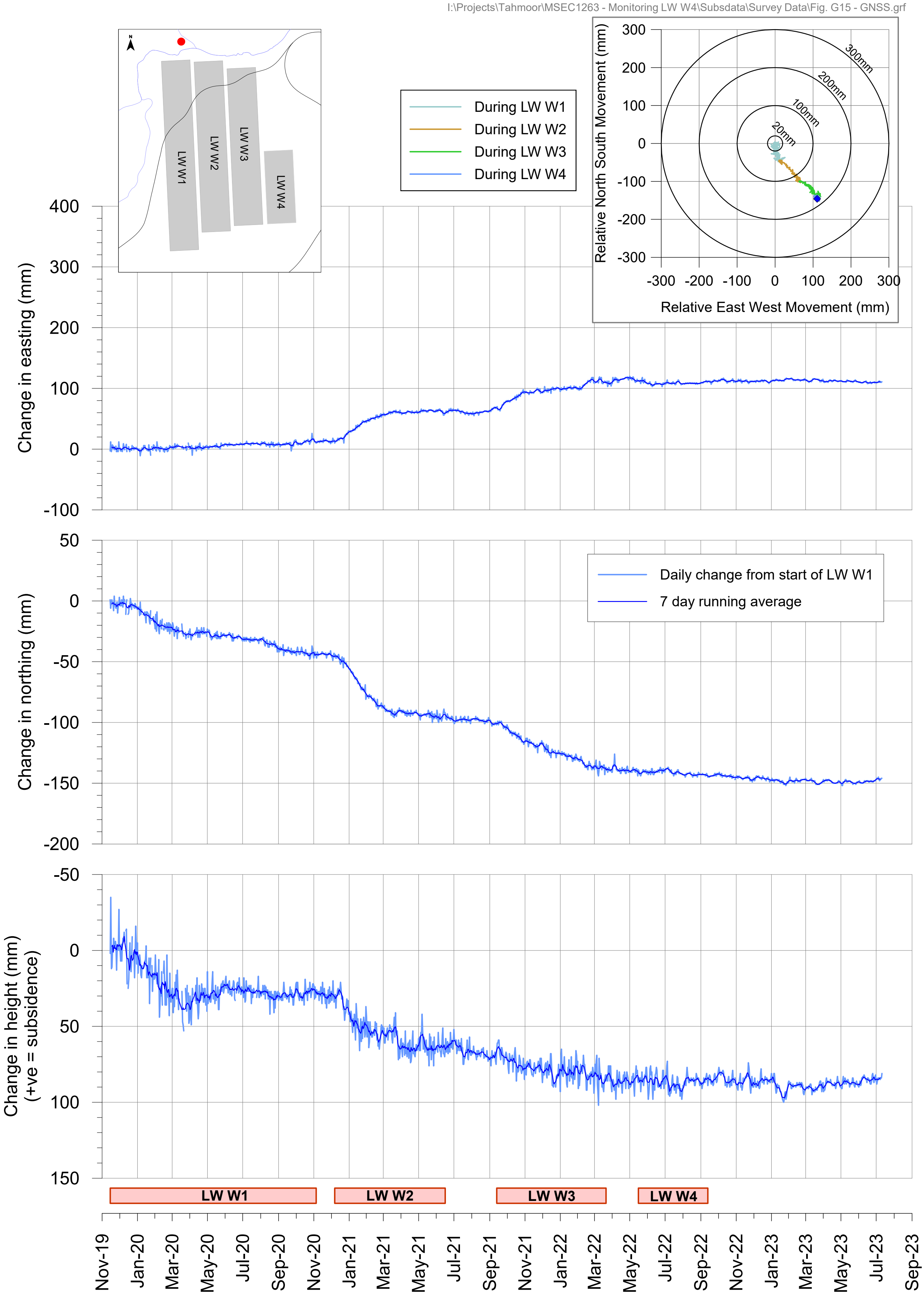

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Fig. G15-R21

Tahmoor LW W4 - GNSS Monitoring
Site 16 - North of Cedar Creek

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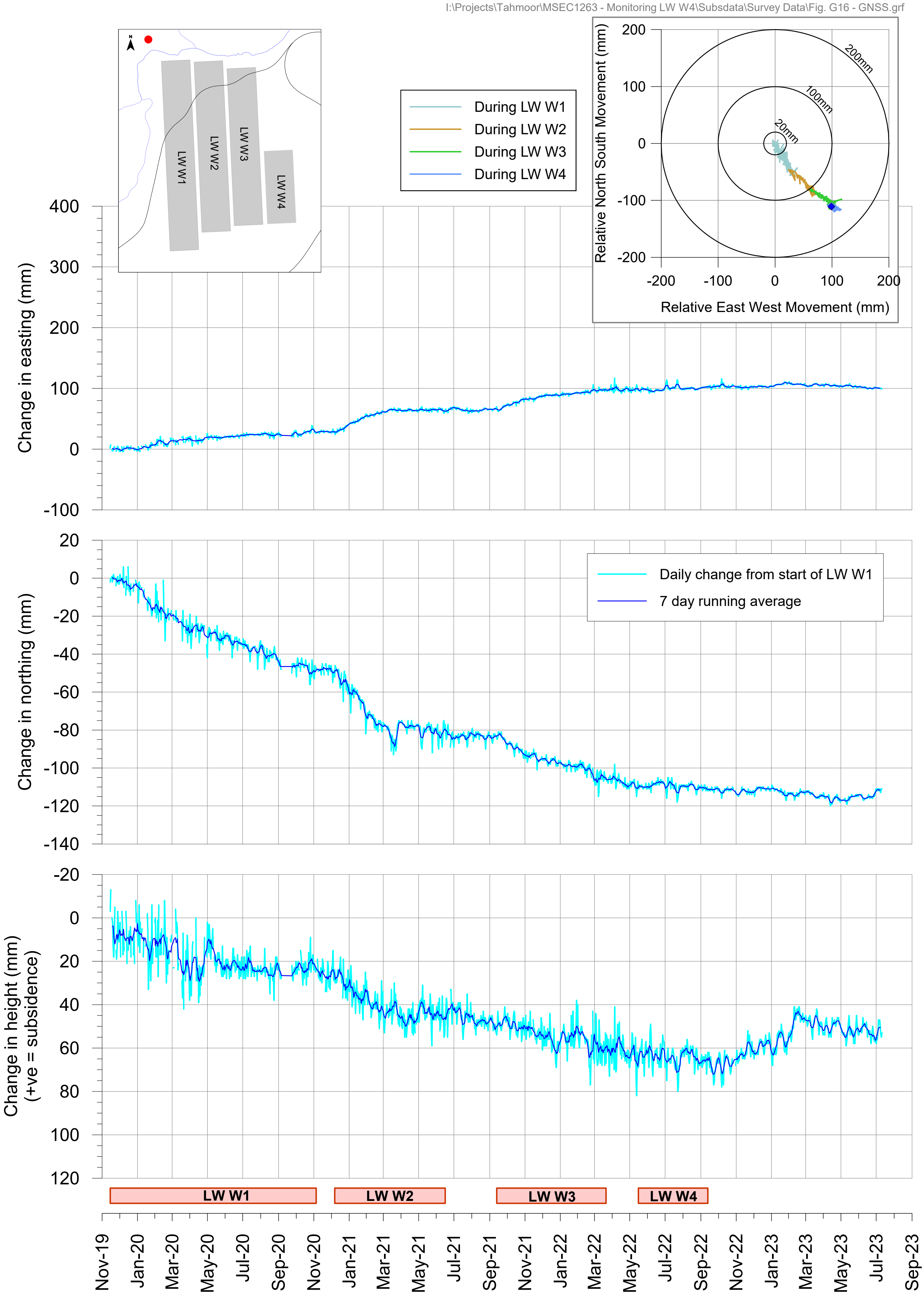

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Fig. G16-R21

Tahmoor LW W4 - GNSS Monitoring
Site 17 - Near confluence of Cedar and Matthews Creeks

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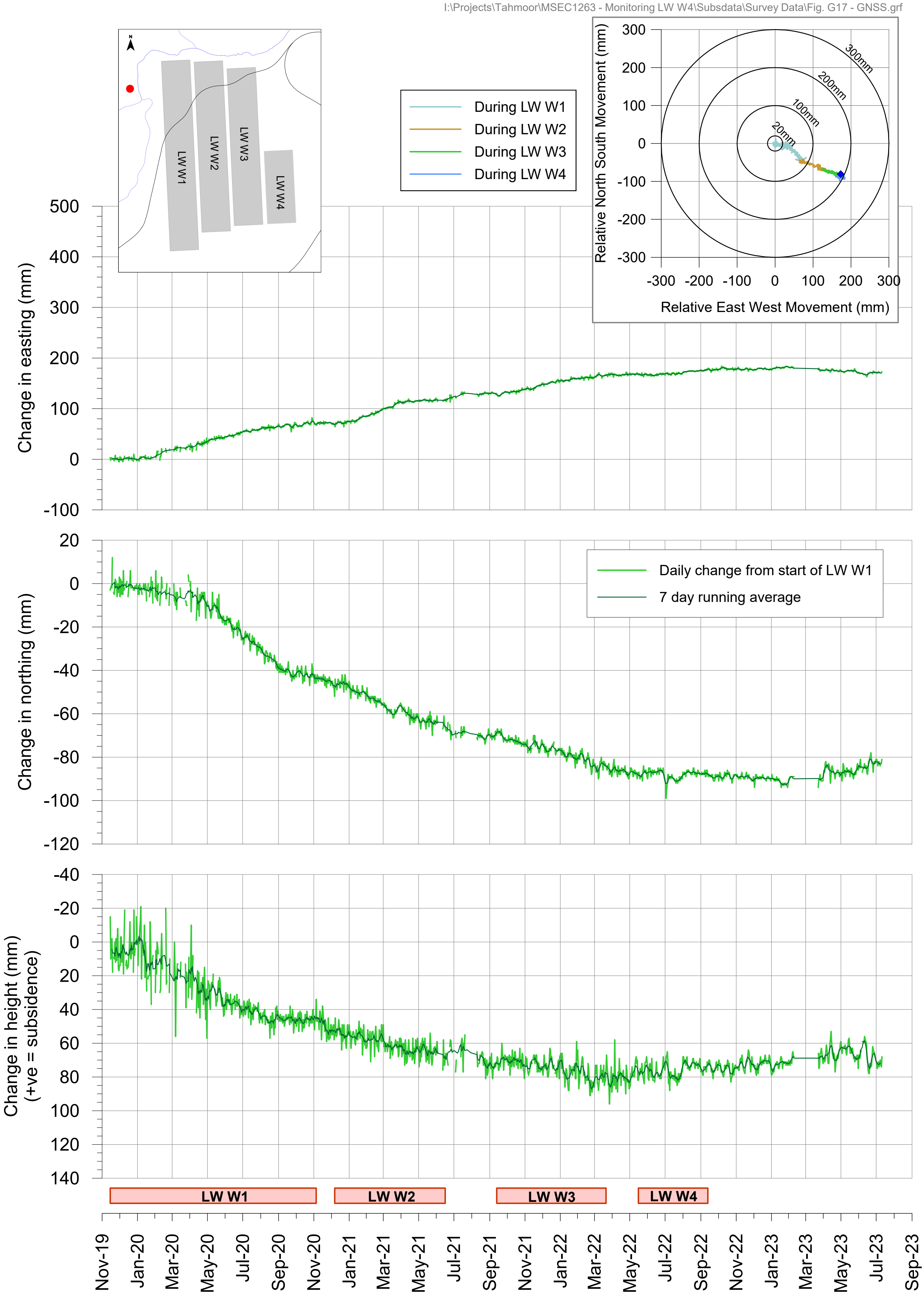

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Fig. G17-R21

Tahmoor LW W4 - GNSS Monitoring
Site 18 - Near confluence of Matthews Creek and Rumker Gully

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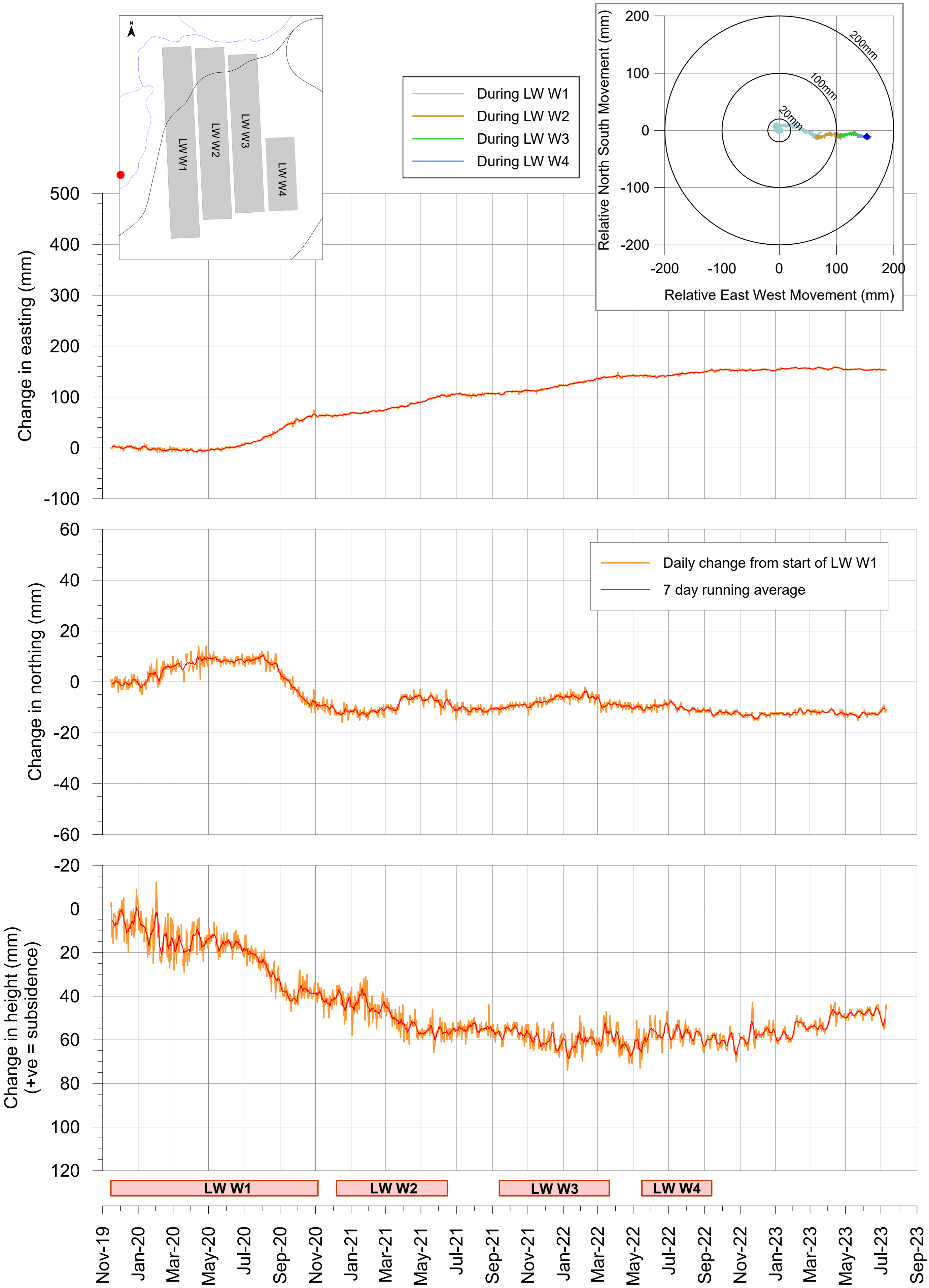

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Fig. G18-R21

Tahmoor LW W4 - GNSS Monitoring
Site 19 - PMLL at 89.440km

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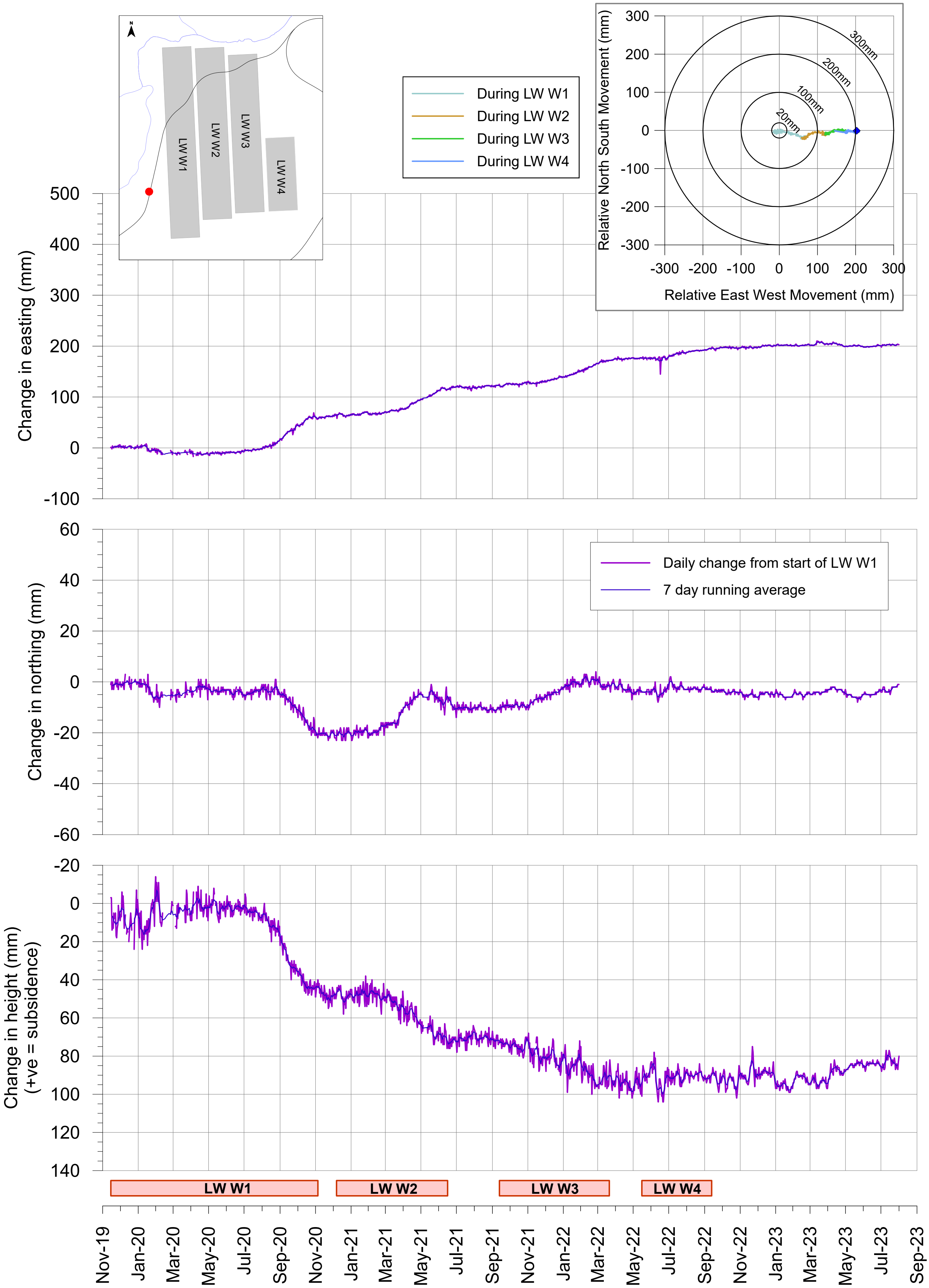

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Fig. G19-R21

Tahmoor LW W4 - GNSS Monitoring
Site 20 - Near confluence of Cedar and Matthews Creeks

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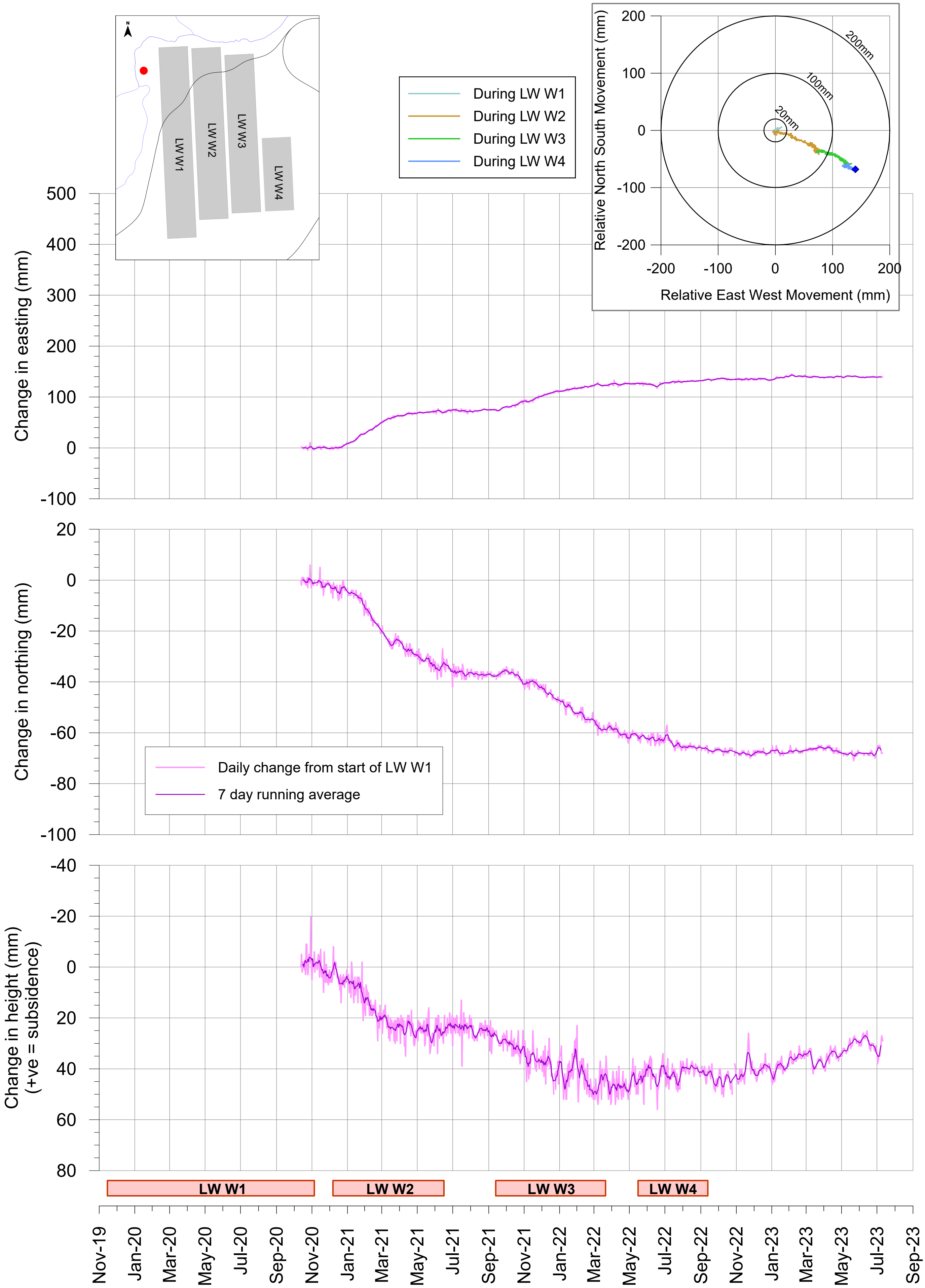

Fig. G20-R21

Tahmoor LW W4 - GNSS Monitoring
Site 21 - LW W1-2 commencing ends

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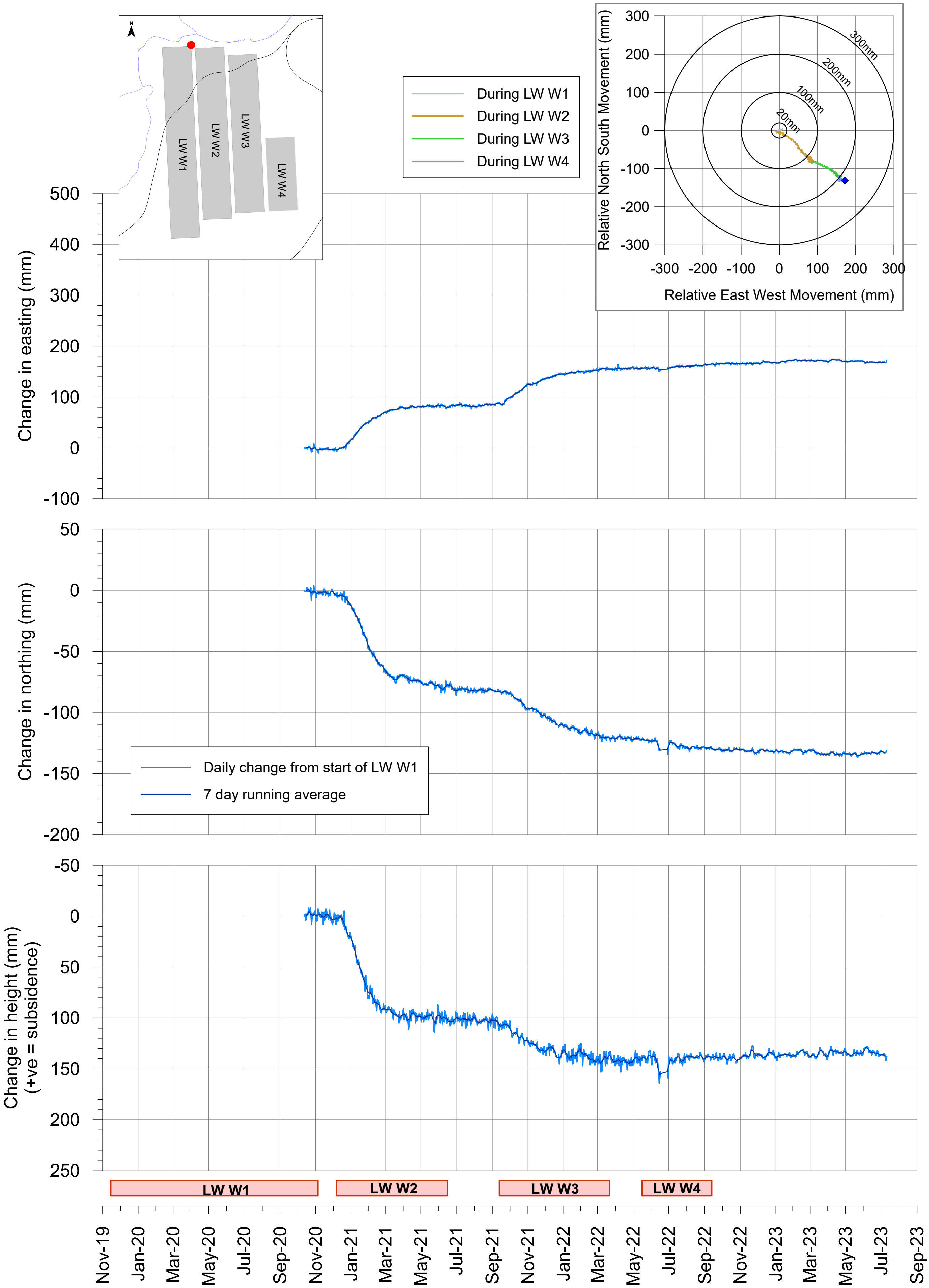

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Fig. G21-R21

Tahmoor LW W4 - GNSS Monitoring
Site 24 above LW W4

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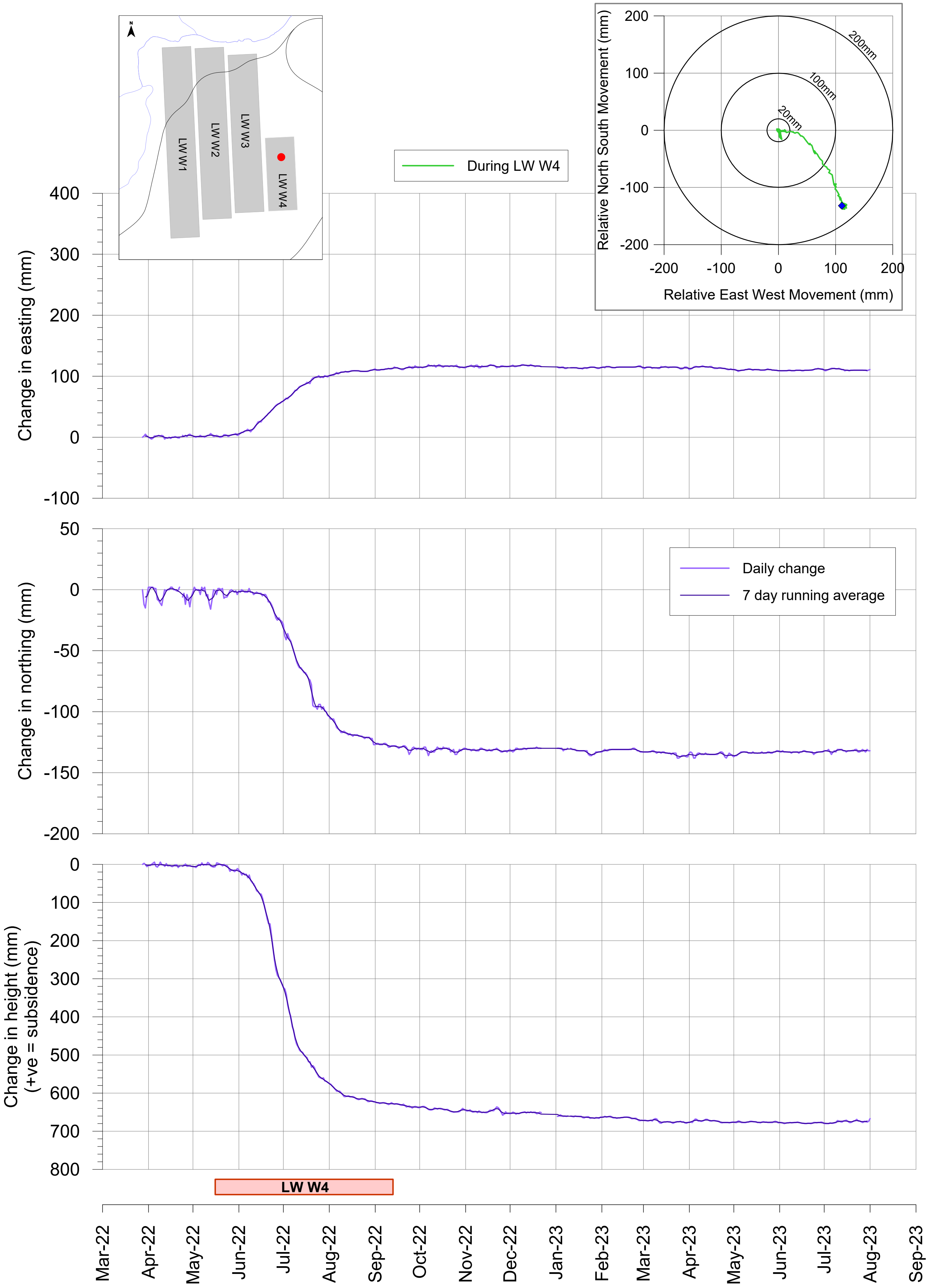

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Fig. G24-R21

Tahmoor LW W3 - GNSS Monitoring

Site SR17N - Northern side of rockbar

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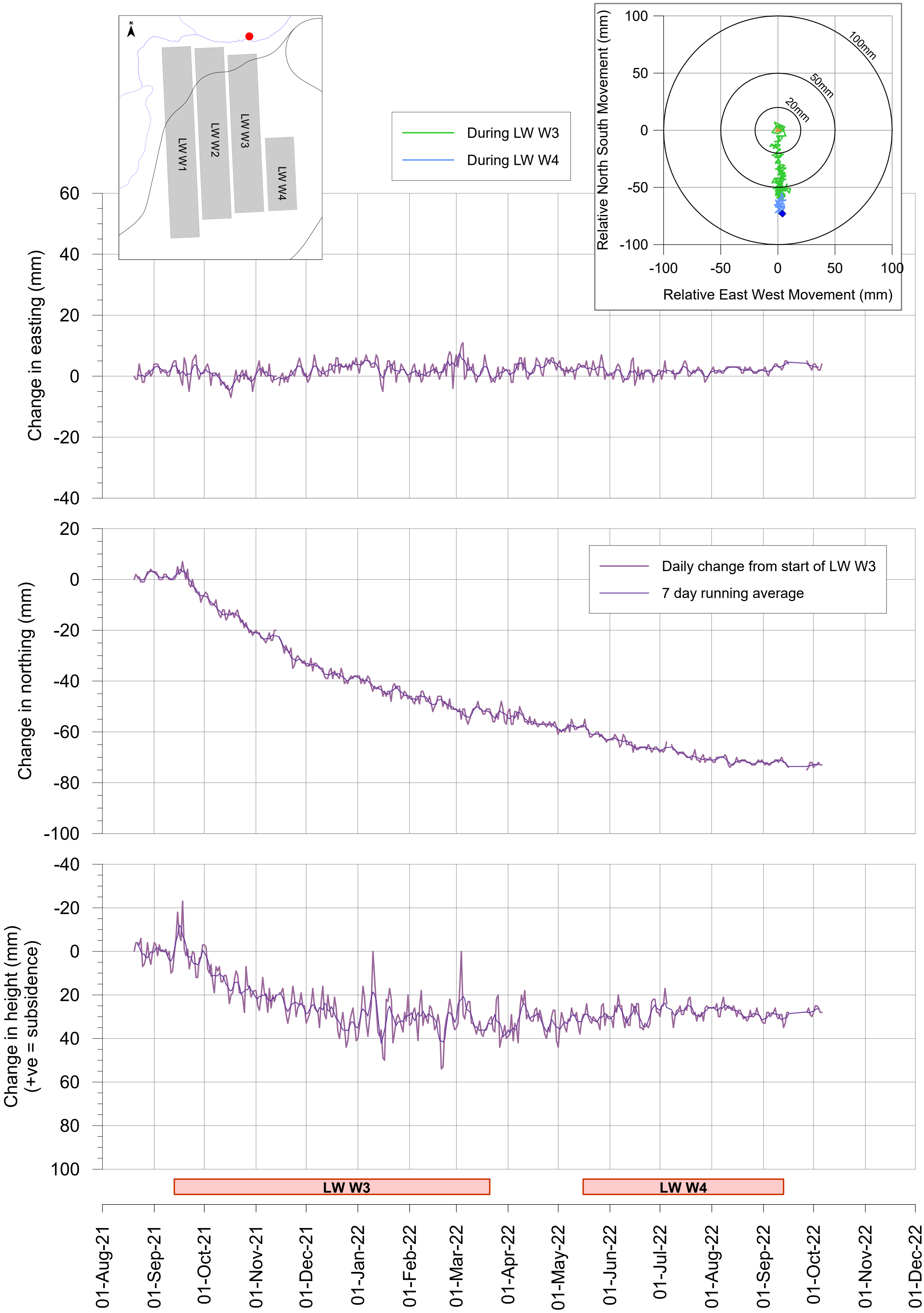

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Fig. GSR17N-R21

Tahmoor LW W3 - GNSS Monitoring
Site SR17S - Southern side of rockbar

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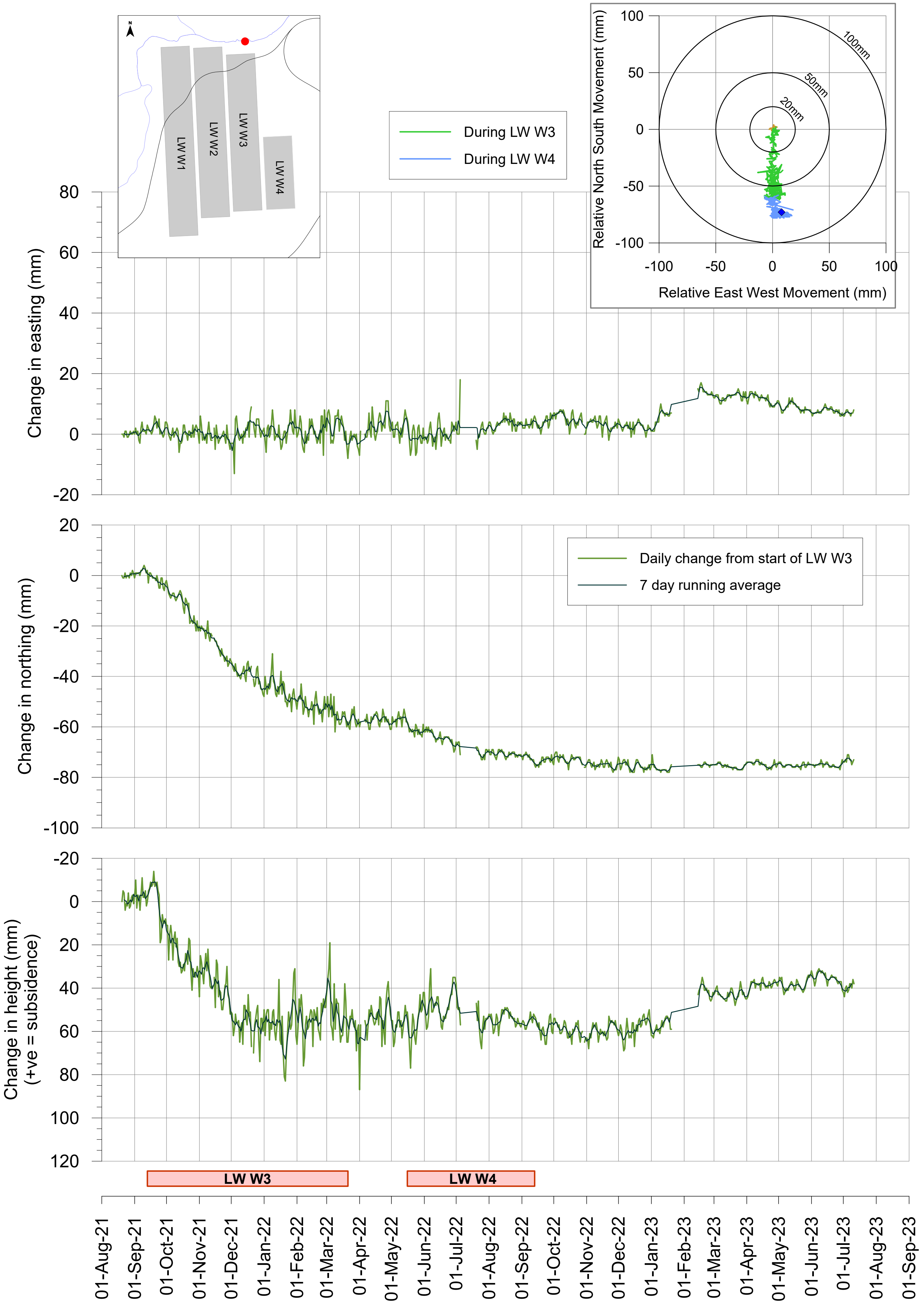

msec

Fig. GSR17S-R21

Appendix B – Surface Water Monitoring Report

ATC WILLIAMS

REPORT

TAHMOOR COAL PTY LTD
ABN: 97076663968

Tahmoor North Western Domain

Surface Water Review
1 January to 30 June 2023

121171-16R007-rev0
SEPTEMBER 2023

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Document Control

Project Name:	Tahmoor Mine Western Domain - Surface Water Review
Document Title:	Surface Water Review 1 January to 30 June 2023
File Location:	N:\Synergy\Projects\121\121171 1809 Tahmoor (SIMEC) Surface Water Assistance\16 Quarterly SW and GW Investigation\Documents\R007 (WD)\Text\121171-16R007-rev0.docx
Document Number:	121171-16R007-rev0.docx

Revision History

Revision	Issue	Issue Date	Prepared by	Reviewed by
Rev A	Draft	13 September 2023	Makaela McGrath / Camilla West	Lee Rigley
Rev B	Draft Rev 2	19 September 2023	Makaela McGrath / Camilla West	Tahmoor Coal
Rev C	Draft Rev 3	27 September 2023	Makaela McGrath / Camilla West	Tahmoor Coal
Rev 0	Final	27 September 2023	Makaela McGrath / Camilla West	Tahmoor Coal

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APPENDICES

1 INTRODUCTION

1.1 Background

The Tahmoor North Western Domain (Western Domain) Investigative Area, which encompasses longwall (LW) West 1 (W1) to West 4 (W4), is shown in **MAP 1**. Mining of LW W1 to LW W2 was conducted from November 2019 to June 2021 while mining of LW W3 to LW W4 was conducted from September 2021 to September 2022.

In accordance with the *Tahmoor North Western Domain Longwalls West 3 and West 4 Water Management Plan* (Tahmoor Coal, 2021; WMP), Tahmoor Coal Pty Ltd (Tahmoor Coal) are required to implement monitoring of groundwater, surface water and subsidence.

Accordingly, Tahmoor Coal have developed a comprehensive rainfall, surface water and groundwater monitoring network within and adjacent to the Western Domain. The surface water monitoring network comprises water level monitoring sites, water quality monitoring sites and visual inspection sites. The locations of the relevant rainfall stations, surface water and groundwater monitoring sites and visual inspection sites are shown in **MAP 1**.

Tahmoor Coal have engaged ATC Williams Pty Ltd (ATCW) to undertake a review and analysis of surface water monitoring data recorded at sites within and adjacent to the Tahmoor North Western Domain (the Western Domain). The groundwater and subsidence review and analysis are undertaken by independent specialists.

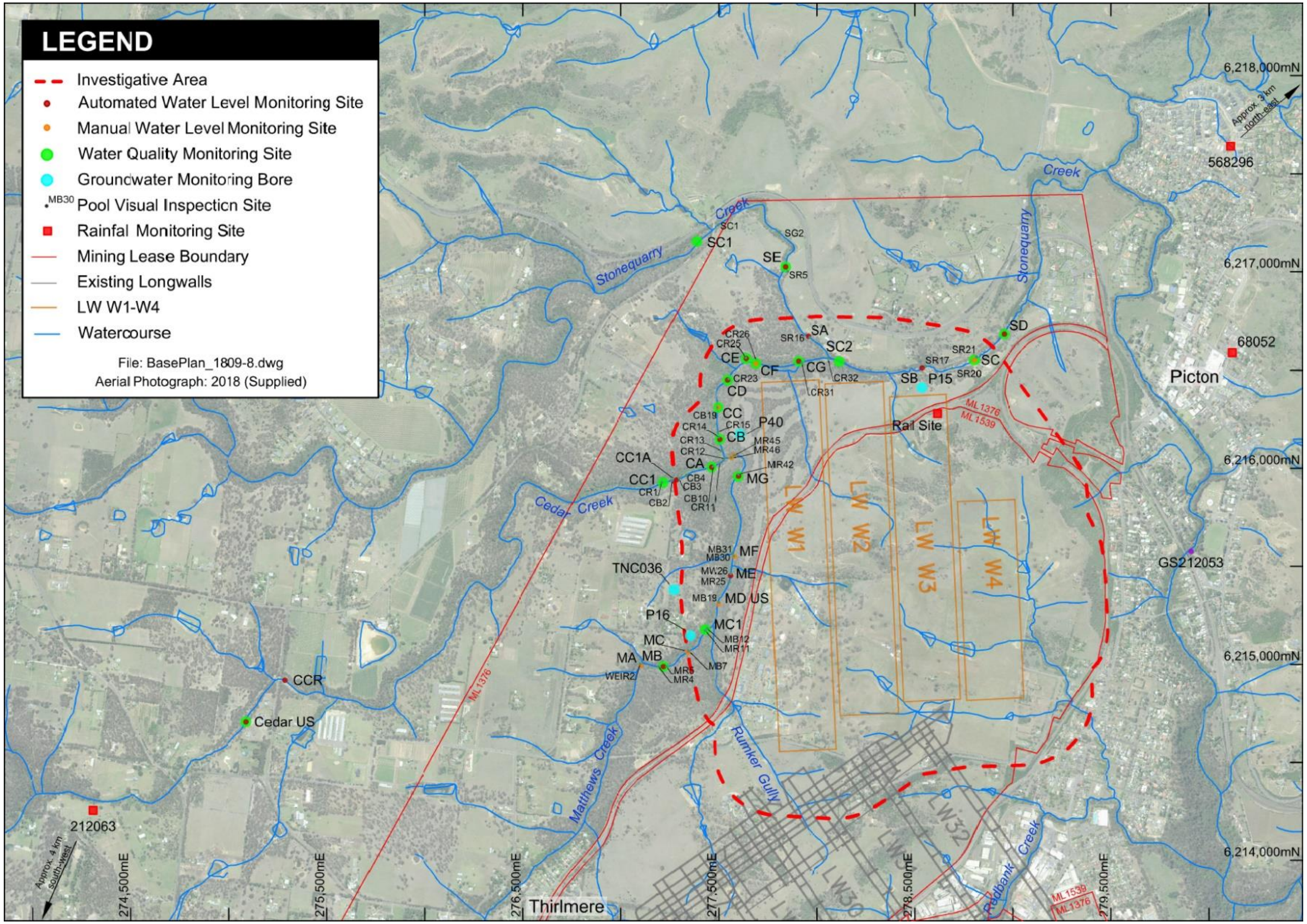
The review period of 1 January to 30 June 2023 comprises the period following cessation of all mining in the Western Domain.

1.2 Scope

This report documents a review undertaken by ATCW of the environmental performance of the LW W3 and LW W4 mining activities in relation to surface water (water resources and watercourses) within and adjacent to the Western Domain Investigative Area for the review period 1 January to 30 June 2023 (the review period). The Western Domain Investigative Area is shown in **MAP 1**. This report forms a component of the *Subsidence Impact Report* for the Western Domain and comprises:

- Review and interpretation of monitoring data recorded over the reporting period;
- Assessment of water level and quality results against the performance measures and performance indicators for surface water in accordance with the *Tahmoor North Western Domain Longwalls West 3 and West 4 Water Management Plan*; and
- Recommendations in relation to ongoing monitoring or corrective actions, where required.

MAP 1: RELEVANT RAINFALL, SURFACE WATER AND GROUNDWATER MONITORING SITES



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2 SURFACE WATER MONITORING PROGRAM

2.1 Overview

Surface water level and quality data has been collected by Tahmoor Coal at monitoring sites located on Matthews Creek, Cedar Creek and Stonequarry Creek as shown in **MAP 1** and detailed in **Appendix A**. The surface water monitoring program is described in the WMP. The purpose of the surface water monitoring program is to ensure compliance with regulatory requirements and to enable identification of potential mining related impacts to:

- physical features and natural drainage behaviour (assessed by independent specialists and summarised herein);
- surface water level; and
- surface water quality.

The surface water level data, water quality data and visual inspection records are assessed against the performance measures, performance indicators and Trigger Action Response Plan (TARP) documented in the WMP.

To facilitate the assessment, surface water monitoring sites have been implemented as follows:

Baseline Site:	Surface water monitoring site that has been monitored for water level and quality prior to the commencement of mining in the Western Domain. Baseline surface water monitoring sites were used to derive Site Specific Guideline Values (SSGVs) which inform the TARPS.
Reference Site:	Surface water monitoring site that is located upstream of the subsidence impact zone and is considered unlikely to be affected by mining activity. These sites are utilised as benchmarks for observations from potential impact sites.
Potential Impact Site:	Surface water monitoring site located within the potential subsidence impact zone (as defined based on mining induced subsidence predictions), from which a potential effect on surface water level or quality from the site activity may be detected.

Based on these definitions, surface water monitoring sites have been classified as follows:

Baseline / Impact Site

- Cedar Creek (CA, CB, CC, CD, CE, CF, CG)
- Matthews Creek (MC/MC1, MD US, ME, MF, MG)
- Stonequarry Creek (SA, SB, SC2, SC, SD)

Reference / Control Site

- Cedar Creek (Cedar US, CC1/CC1A)
- Matthews Creek (MA, MB)
- Stonequarry Creek (SC1, SE)

Further detail on each monitoring site is provided in **Appendix A.**

2.2 Methodology

In accordance with the WMP, surface water monitoring is conducted at the monitoring sites listed in **Section 2** above. Unless otherwise required in accordance with the WMP, the surface water monitoring program comprises:

- Automated water level monitoring measured via a water pressure sensor that continuously records pressure measurements.
- Water level measurements recorded manually on a monthly basis at sites with and without automated water level monitoring.
- Field and laboratory water quality monitoring undertaken monthly.

The monitored water quality constituents are defined in **TABLE 1**.

TABLE 1: SUMMARY OF WATER QUALITY MONITORING PARAMETERS

Field Monitoring	Laboratory Analysis
pH	pH
Electrical Conductivity (EC)	EC
Temperature	major cations and anions: calcium, magnesium, sodium and potassium, sulphate, alkalinity, chloride
Dissolved Oxygen (DO)	dissolved and total metals: aluminium, arsenic, barium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc
Oxidation Reduction Potential (ORP)	total kjeldahl nitrogen
	total nitrogen
	nitrite + nitrate
	total phosphorus
	total cations and total anions

Field work and quality control/quality assurance associated with this monitoring program are undertaken by others. Data constraints associated with the monitoring program are documented in **Section 4.2.1**.

3 SUMMARY OF MONITORED SUBSIDENCE MOVEMENTS

3.1 LW W4 Subsidence Impact Performance Measures

The subsidence impact performance measures and performance indicators for natural features defined in the WMP are summarised in **TABLE 2**. The monitoring results, in conjunction with the TARPs, are used to assess the impacts of mining in the Western Domain against the subsidence impact performance measures specified in **TABLE 2**. This report addresses the first subsidence performance measure listed in **TABLE 2**.

TABLE 2: SUBSIDENCE PERFORMANCE MEASURES AND PERFORMANCE INDICATORS FOR SURFACE WATER AND GROUNDWATER RESOURCES

Feature	Subsidence Performance Measures	Subsidence Performance Indicators
Stonequarry Creek, Cedar Creek and Matthews Creek	No subsidence impact or environmental consequence greater than minor*	This performance measure will be considered to be exceeded if mining-induced fracturing in a rockbar or stream bed results in a reduction in pool water level below historically recorded water levels, taking into account rainfall and observations during the baseline monitoring period, for: • More than 10% of pools located within the Study Area for Natural Features; and/or • Pool SR17.
	No connective cracking between the surface, or the base of the alluvium, and the underground workings	This performance indicator will be considered to be exceeded if analysis of inflow data suggests high correlation to rainfall events and significant departure from groundwater model predictions. This would be supported by analysis of pre- and post-mining goaf centreline bore data.

* Minor is defined as *not very large, important or serious*

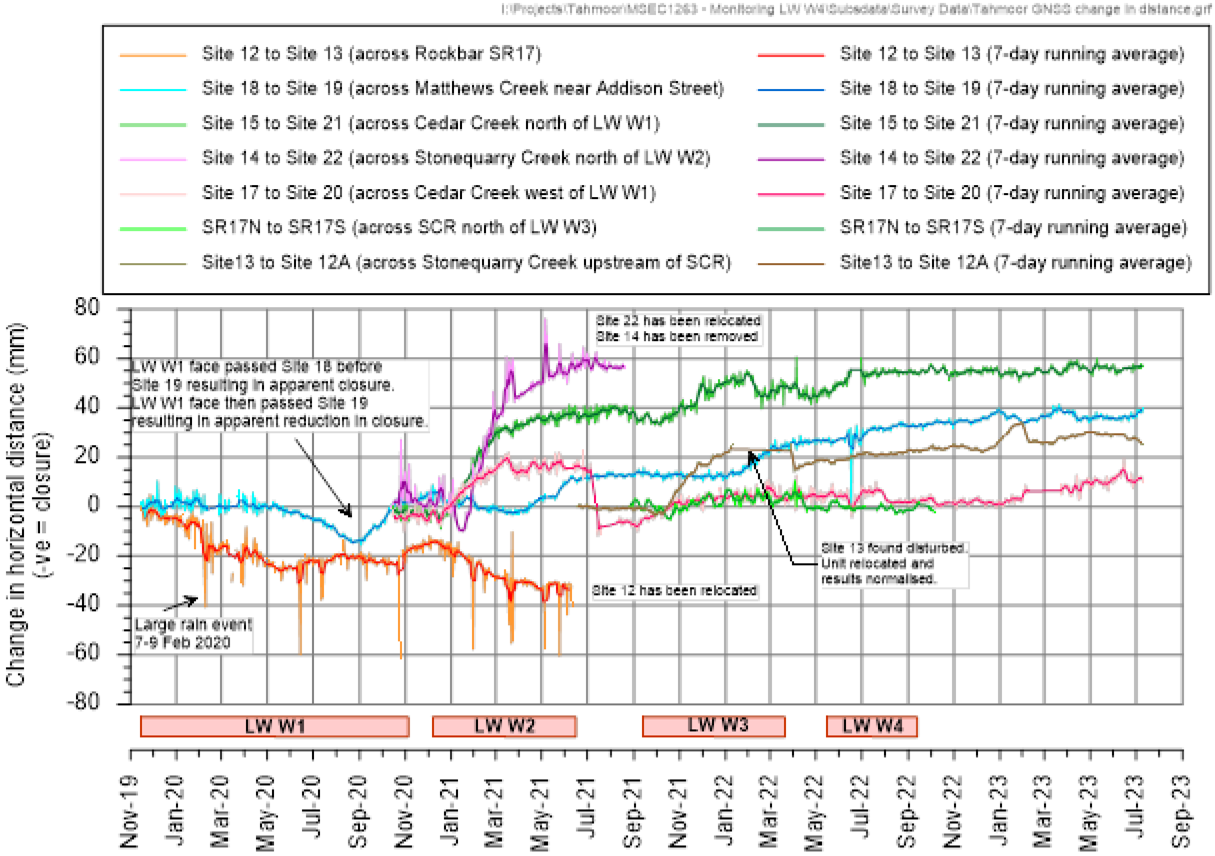
3.2 Summary of Results

Tahmoor Coal has installed many ground survey marks above and adjacent to LW W1–W4 with monitoring of subsidence movements undertaken at key locations across Stonequarry Creek, Matthews Creek and Cedar Creek.

Changes in horizontal distances calculated between GNSS[1] units that are stationed close together are presented in **DIAGRAM 1**.

[1] Global Navigation Satellite System (GNSS) units are fixed survey stations that continuously measure absolute horizontal and vertical positions at a location in real time.

DIAGRAM 1: OBSERVED CHANGES IN HORIZONTAL DISTANCES BETWEEN GNSS UNITS (SOURCE: MSEC, 2023)



From the completion of LW W4 (October 2022) to end of June 2023, the following was recorded (MSEC, 2023):

- Small changes in horizontal distance at Site SR17N to Site SR17S across rockbar SR17 (SCR).
- Less than 10 mm change in horizontal distance at Site 13 to Site 12A, located across Stonequarry Creek upstream of rockbar SR17 (SCR).
- Less than 10 mm change in horizontal distance at Site 18 to Site 19, located across Matthews Creek near Addison Street.
- Less than 20 mm change in horizontal distance at Site 17 to Site 20, located across Cedar Creek to the west of LW W1.

4 SURFACE WATER MONITORING REVIEW

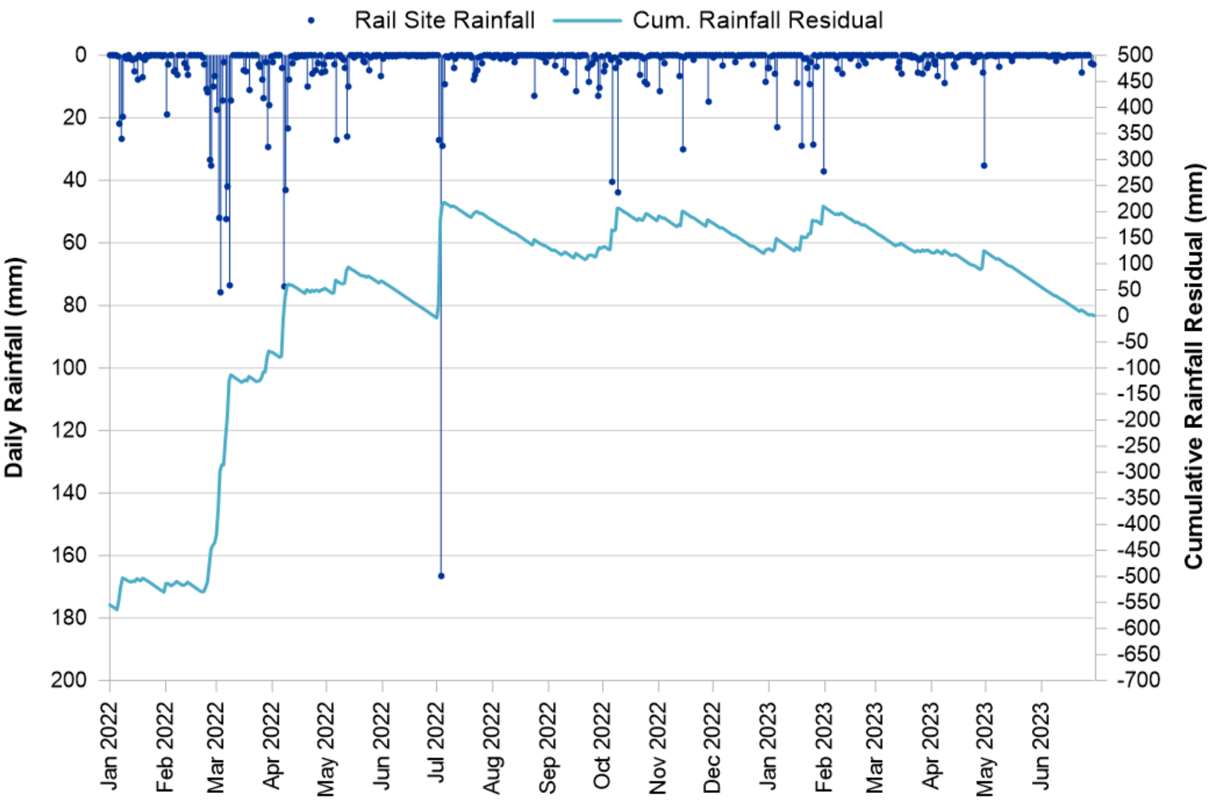
The following sections present a summary of the pool visual inspections outcomes and the surface water level and water quality monitoring data recorded at monitoring sites in Matthews Creek, Cedar Creek and Stonequarry Creek (refer **MAP 1** for site locations). **Section 5** presents further interpretation of monitoring data for sites where a TARP significance level in excess of Level 1 was reported during the review period.

4.1 Rainfall Trends

DIAGRAM 2 presents daily rainfall data recorded at the Tahmoor Coal rainfall station, referred to as “Rail Site”. The cumulative rainfall residual is also presented and has been calculated using SILO Point Data for a location in close proximity to the Western Domain in combination with the Rail Site rainfall data. The cumulative rainfall residual was calculated for the period January 2018 to July 2023 to illustrate climatic trends over a medium to long-term period.

The cumulative rainfall residual represents the cumulative deviation from the average daily rainfall where positive (upward) slope in the plot indicates periods of above average rainfall and negative (downward) slope indicates periods of below average rainfall.

DIAGRAM 2: DAILY RAINFALL AND CUMULATIVE RAINFALL RESIDUAL



The cumulative rainfall residual depicted in **DIAGRAM 2** illustrates a declining trend in rainfall from February to June 2023. This is in comparison to the period of July 2022 to January 2023 where, overall, average rainfall was recorded.

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4.2 Surface Water Level Data

4.2.1 Data Constraints

The following data constraints are noted for the current review period:

- The control at monitoring site SF was previously impacted by flood events and, as such, the water level records are not comparable to pre-flood conditions. Accordingly, monitoring site SF has since been decommissioned.
- A change in water level behaviour has been recorded at monitoring site MB from November 2022. Field personnel identified that water was no longer flowing over the rockbar control, rather was flowing through the embankment. The location of embankment flow comprises sandy soil and is directly beneath a tree that was dislodged during a flood event. It is considered that the change in water level behaviour reflects the change in site conditions.

4.2.2 Surface Water Levels

Appendix B provides charts of the automated and manual water level data for the full period of record. Note that the cease to flow (CTF) level shown on the automated water level plots refers to the point at which surface water ceases to flow over the streamflow control i.e., the lowest point on a controlling rockbar or boulder field. In the event that streamflow over the rockbar or boulder field ceases, there may still be streamflow around or under the rockbar/boulder field control which reports downstream of the control. **TABLE 3** presents a summary of the automated water level monitoring data for the review period. Exceedances of trigger levels are discussed in **Section 5**.

TABLE 3: SUMMARY OF AUTOMATED WATER LEVEL MONITORING DATA FOR THE REVIEW PERIOD

Monitoring Site	Classification	Summary of Recorded Water Level During Review Period	Appendix B - Figure Number
Matthews Creek			
MB (Pool MR5)	Reference Site	The water level remained above the baseline minimum for the duration of the review period. A change in water level behaviour has been recorded at monitoring site MB since November 2022 due to flood related changes to the site.	Figure B2
ME (Pool MR26)	Potential Impact Site	The water level remained above the baseline minimum for the duration of the review period. From January 2023, the water level periodically declined below the CTF level. These declines appear in response to the below average rainfall conditions during this period.	Figure B5
MG (Pool MR42)	Potential Impact Site	The water level remained above the baseline minimum for the duration of the review period. From March 2023, the water level periodically declined below the CTF level. These declines appear in response to the below average rainfall conditions during this period.	Figure B7
Cedar Creek			
Cedar US	Reference Site	The water level was generally at or above the CTF for the duration of the review period, with increases observed in response to rainfall events.	Figure B8

Monitoring Site	Classification	Summary of Recorded Water Level During Review Period	Appendix B - Figure Number
CC1A (Pool CB3)	Reference Site	The water level remained above the baseline minimum for the duration of the review period. The water level was generally at or above the CTF for the duration of the review period, with increases recorded in response to rainfall events.	Figure B9
CA (Pool CB10)	Potential Impact Site	The water level remained above the baseline minimum for the duration of the review period. The water level declined below the CTF level at intermittent periods in March 2023. The decline in water level is considered consistent with pre-mining behaviour and likely a result of below average rainfall conditions.	Figure B10
CB (Pool CR14)	Potential Impact Site	Except following high rainfall periods, the water level was generally recorded below the CTF level and the baseline minimum for the majority of the review period.	Figure B11
CD (Pool CR23)	Potential Impact Site	The water level remained above the baseline minimum and CTF level for the duration of the review period.	Figure B13
CE (Pool CR25)	Potential Impact Site	The water level was recorded below the baseline minimum and CTF level from mid-February to early April, and to a lesser extent from May to early June.	Figure B14
CG (Pool CR31)	Potential Impact Site	The water level remained above the baseline minimum and CTF level for the duration of the review period.	Figure B16
Stonequarry Creek			
SE (Pool SR5)	Reference Site	From January to early May 2023, the water level generally remained above the baseline minimum except for brief periods (less than 24 hours consecutively). From May to end of June the water level was at or marginally below the baseline minimum.	Figure B17
SA (Pool SR16)	Potential Impact Site	The water level remained above the CTF level and baseline minimum for the duration of the review period.	Figure B18
SB (Pool SR17)	Potential Impact Site	The water level remained above the baseline minimum level for the duration of the review period.	Figure B19
SD	Potential Impact Site	The water level remained above the baseline minimum for the duration of the review period. The water level was below the CTF level for the majority of the review period, except for brief periods following high rainfall. The decline in water level is considered consistent with pre-mining trends during periods of below average rainfall.	Figure B21

4.3 Surface Water Quality

The water quality monitoring data has been reviewed for the following constituents which are considered to be primary indicators of potential mining related influences:

- pH;
- Electrical conductivity (EC);
- Dissolved metals: aluminium, barium, iron, manganese, nickel and zinc; and
- Sulphate.

The water quality data recorded during the review period is summarised in **TABLE 4.** Monitoring results for key constituents are also shown on a series of plots in **Appendix C**. Exceedances of trigger levels are discussed in **Section 5**.

TABLE 4: SUMMARY OF KEY WATER QUALITY CONSTITUENTS – 1 JANUARY TO 30 JUNE 2023

Constituent	**Matthews Creek:** MB (reference site), MC1 and MG (potential impact sites)	**Cedar Creek:** Cedar US and CC1 (reference sites), CA, CB, CC, CD, CE, CF and CG (potential impact sites)	**Stonequarry Creek:** SC1 and SE (reference sites), SC2, SC and SD (potential impact sites)
Field pH (Figure C1, Appendix C)	• Near neutral pH conditions. • pH recorded during the review period was within the range of baseline values.	• Slightly acidic to near neutral pH conditions. • pH values recorded in April at CC1 and CA and in June at CC1, CA and CC were low (around pH 5) in comparison to the previous reporting period, however, were within the range of baseline values.	• Near neutral pH conditions. • pH values recorded during the review period were within the historical range.
Field Electrical Conductivity (Figure C3, Appendix C)	• Field EC values were generally consistent with baseline values (less than 500 µS/cm) for the majority of the review period. • Field EC recorded at monitoring site MB was slightly elevated in June 2023 in comparison to MC1 and MG, however, was within the range of baseline values.	• Field EC values generally increased during the review period, however, remained within the range of baseline values.	• Field EC values generally increased during the review period. • The EC values recorded at reference sites SC1 and SE in June 2023 slightly exceeded the maximum EC value recorded at reference site SC1 during the baseline period.

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Constituent	Matthews Creek: MB (reference site), MC1 and MG (potential impact sites)	Cedar Creek: Cedar US and CC1 (reference sites), CA, CB, CC, CD, CE, CF and CG (potential impact sites)	Stonequarry Creek: SC1 and SE (reference sites), SC2, SC and SD (potential impact sites)
Dissolved Aluminium (Figure C5, Appendix C)	• The concentrations of dissolved aluminium were within the range of baseline concentrations for the duration of the review period.	• Dissolved aluminium concentrations declined at the majority of sites in comparison to the previous review period. • The concentrations of dissolved aluminium were within the range of baseline concentrations for the duration of the review period.	• Slightly elevated concentrations of dissolved aluminium, in comparison to the baseline period, were recorded at the majority of monitoring sites in February 2023. • The dissolved aluminium concentrations declined from March 2023 and were consistent with baseline concentrations.
Dissolved Barium (Figure C6, Appendix C)	• The concentrations of dissolved barium were consistent with baseline concentrations for the duration of the review period.	• A generally increasing trend in dissolved barium was recorded at all sites from January 2023, however, the concentrations remained within the range of baseline concentrations.	• A generally increasing trend in dissolved barium was recorded at all sites from January 2023, however, the concentrations remained within the range of baseline concentrations. .
Dissolved Iron (Figure C7, Appendix C)	• The concentrations of dissolved iron were consistent with baseline concentrations for the duration of the review period.	• The concentrations of dissolved iron were within the range of baseline concentrations for the duration of the review period.	• The concentrations of dissolved iron were within the range of baseline concentrations for the duration of the review period.
Dissolved Manganese (Figure C8, Appendix C)	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.
Dissolved Nickel (Figure C9, Appendix C)	• Concentrations recorded at all sites were consistent with baseline values.	• The concentrations of dissolved nickel were within the range of baseline concentrations for the duration of the review period.	• Concentrations recorded at all sites were consistent with baseline values.

Constituent	Matthews Creek: MB (reference site), MC1 and MG (potential impact sites)	Cedar Creek: Cedar US and CC1 (reference sites), CA, CB, CC, CD, CE, CF and CG (potential impact sites)	Stonequarry Creek: SC1 and SE (reference sites), SC2, SC and SD (potential impact sites)
Dissolved Zinc (Figure C10, Appendix C)	• The concentrations of dissolved zinc recorded at all sites were consistent with or less than baseline values.	• Variable concentrations of dissolved zinc were recorded over the duration of the review period, however, concentrations were within the range of baseline concentrations.	• The concentrations of dissolved zinc recorded at all sites were consistent with or less than baseline values.
Sulphate (Figure C11, Appendix C)	• Slightly elevated concentrations of sulphate (less than 30 mg/L) were recorded at reference site MB and monitoring site MC1 in January 2023 in comparison to the baseline period. • From February 2023, the sulphate concentrations were within the range of baseline concentrations.	• Concentrations recorded at all sites were generally consistent with baseline values.	• The concentrations of sulphate recorded at all sites were within the range of baseline concentrations.

4.4 Pool Visual Inspections

The following visual inspections were conducted between 1 January to 30 June 2023:

1. 29 January 2023 - Stonequarry Creek;
2. 15 February 2023 - Matthews, Cedar and Stonequarry Creek; and
3. 10 May 2023 - Matthews, Cedar and Stonequarry Creek.

Based on these visual inspections, all sites inspected at Stonequarry Creek, Cedar Creek and Matthews Creek were reported at a Level 1 trigger significance[2] in relation to physical features and natural behaviour of pools, with the exception of pools SR17 and SR20 in Stonequarry Creek which were reported at a Level 3 trigger significance[3] (BES, 2023a-c).

Pool SR17 was initially reported at a Level 3 significance on 28 October 2021 due to surficial fracturing of the controlling rockbar (pers. comm. MSEC). Brienen Environment & Safety (BES, 2021b) reported this as laminar fracturing and extension of a natural crack in the rockbar following an inspection on 17 November 2021. A Level 3 trigger significance in relation to physical features and natural behaviour of pool SR17 applies for the period including and following 17 November 2021 (BES, 2023a-c).

Pool SR20 was reported by BES (2023a-b) as a Level 3 significance due to surface fracturing of the controlling rockbar observed on 18 August 2022. Two fractures were identified at pool SR20, the first was initially observed in July 2019 during the pre-mining survey and the second during the August 2022

[2] No observed impact to pool level, drainage or overland connected flow.

[3] Rockbar and / or stream base cracking, gas release or iron precipitation noted during visual inspection (in excess of baseline conditions) and no reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during the baseline monitoring period.

visual inspection. Between August and November 2022, it was reported that the fractures had widened, but were reported to have stopped increasing in size at the time of the January, February and May 2023 visual inspections. Since the initial observation of fracturing, no gas release or iron precipitation has been noted during visual inspections.

A Level 3 trigger significance in relation to physical features and natural behaviour of pool SR20 applies for the period including and following 18 August 2022 (BES, 2023a-b).

There was no gas release, reduction in pool flow or connective overland flow at any observed site along Stonequarry Creek during the January, February and May 2023 inspections. Additionally, there was no observed fracturing at any sites on Stonequarry Creek with the exception of rockbar SR17 and SR20.

5 ASSESSMENT AGAINST SURFACE WATER TARPS

5.1 Impact to Pool Water Level, Physical Features and Natural Behaviour

5.1.1 Significance Triggers for Automated Pool Water Level and Physical Features

The significance levels / triggers, as detailed in the WMP, are summarised in **TABLE 5** for pool water level and in **TABLE 6** for physical features and natural behaviour of pools. In accordance with the WMP, the pool water level data and visual inspection observations have been assessed against the tabulated criteria for each trigger level.

TABLE 5: SIGNIFICANCE LEVELS / TRIGGERS FOR POOL WATER LEVEL

TARP Level	Pool Water Level
Level 1	The recorded water level has not declined below the recorded baseline minimum level (in one 24 hour period for automated pool water level) OR the recorded water level has declined below the recorded baseline minimum level (in one 24 hour period for automated pool water level) but the decline is due to a monitoring or sensor error or the magnitude of the decline (below the recorded baseline minimum level) is within the range of sensor accuracy.
Level 2	The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has occurred at one of the upstream pools (beyond mining effects).
Level 3	The recorded water level has declined, although not atypically*, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has not occurred at one of the upstream pools (beyond mining effects).
Level 4	The recorded water level has declined atypically* below the previously recorded minimum level (for more than one 24 hour period for automated pool water level) AND similar behaviour has not occurred at one of the upstream pools (beyond mining effects).

* 'Atypical' surface water characteristics relate to a notable and/or rapid water level decline or change in the slope of the falling limb of the hydrograph or the water level recessionary behaviour below the CTF level which is inconsistent with baseline conditions and cannot be attributed to climatic conditions.

TABLE 6: SIGNIFICANCE LEVELS / TRIGGERS FOR PHYSICAL FEATURES AND NATURAL BEHAVIOUR OF POOLS

TARP Level	Physical Features and Natural Behaviour of Pools
Level 1	No observed impacts to pool level, drainage or overland connected flow.
Level 2	Visually observed reduction in pool level, drainage or overland connected flow AND the above has occurred at one of the upstream pools (beyond mining effects) OR visual monitoring of pools has not noted any mining related impacts*.
Level 3	Rockbar and / or stream base cracking, gas release or iron precipitation noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during the baseline monitoring period.
Level 4	Visually observed reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during the baseline monitoring period AND the above change has not occurred at one of the upstream pools (beyond mining effects).

* Rockbar and/or stream base cracking, gas release or iron precipitation in excess of baseline conditions.

5.2 Assessment of Automated Pool Water Level Data and Visual Inspection Observations

A summary of the pool water level, physical features and natural behaviour TARP significance levels for potential impact sites over the duration of the review period is presented in **TABLE 7** and discussed in the sections which follow.

TABLE 7: SURFACE WATER TARP SIGNIFICANCE LEVELS

Date	Location(s)	Comment	TARP Significance
Surface Water Level			
1 January to 31 March 2023	All monitoring sites in Cedar Creek (excluding CB and CE), Matthews Creek and Stonequarry Creek	The recorded water level did not decline below the baseline minimum level (in one 24 hour period).	Level 1
1 January to 12 February, 4 April to 30 June 2023	Site CE in Cedar Creek	The recorded water level did not decline below the baseline minimum level (in one 24 hour period).	Level 1
13 February to 4 April 2023	Site CE in Cedar Creek	The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has occurred at one of the upstream pools (beyond mining effects).	Level 2
1 January, 4 to 8 January and 19 January to 18 February, 29 April to 5 May 2023	Site CB in Cedar Creek	The recorded water level did not decline below the baseline minimum level (in one 24 hour period).	Level 1
6 May to 30 June 2023	Site CB in Cedar Creek	The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has occurred at one of the upstream pools (beyond mining effects).	Level 2
2, 3 and 9 to 18 January, 19 February to 28 April 2023	Site CB in Cedar Creek	The recorded water level has declined, although not atypically*, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has not occurred at one of the upstream pools (beyond mining effects).	Level 3
Physical Features and Natural Pool Behaviour			
1 January to 30 June 2023	All monitoring sites in Cedar Creek, Matthews Creek and Stonequarry Creek (excluding SR17 and SR20)	No observed impacts to pool level, drainage or overland connected flow.	Level 1*

Date	Location(s)	Comment	TARP Significance
1 January to 30 June 2023	SR17 rockbar in Stonequarry Creek	Rockbar fracturing noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during the baseline monitoring period.	Level 3*
1 January to 30 June 2023	SR20 rockbar in Stonequarry Creek	Rockbar fracturing noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during the baseline monitoring period.	Level 3*

* Source: BES (2023a-c)

5.2.1 Trigger Exceedance Action and Response

TABLE 8 summarises the actions and responses required to be undertaken in relation to the Level 2 exceedances recorded at monitoring sites CB and CE and the Level 3 exceedances recorded at monitoring site CB, pool SR17 and pool SR20.

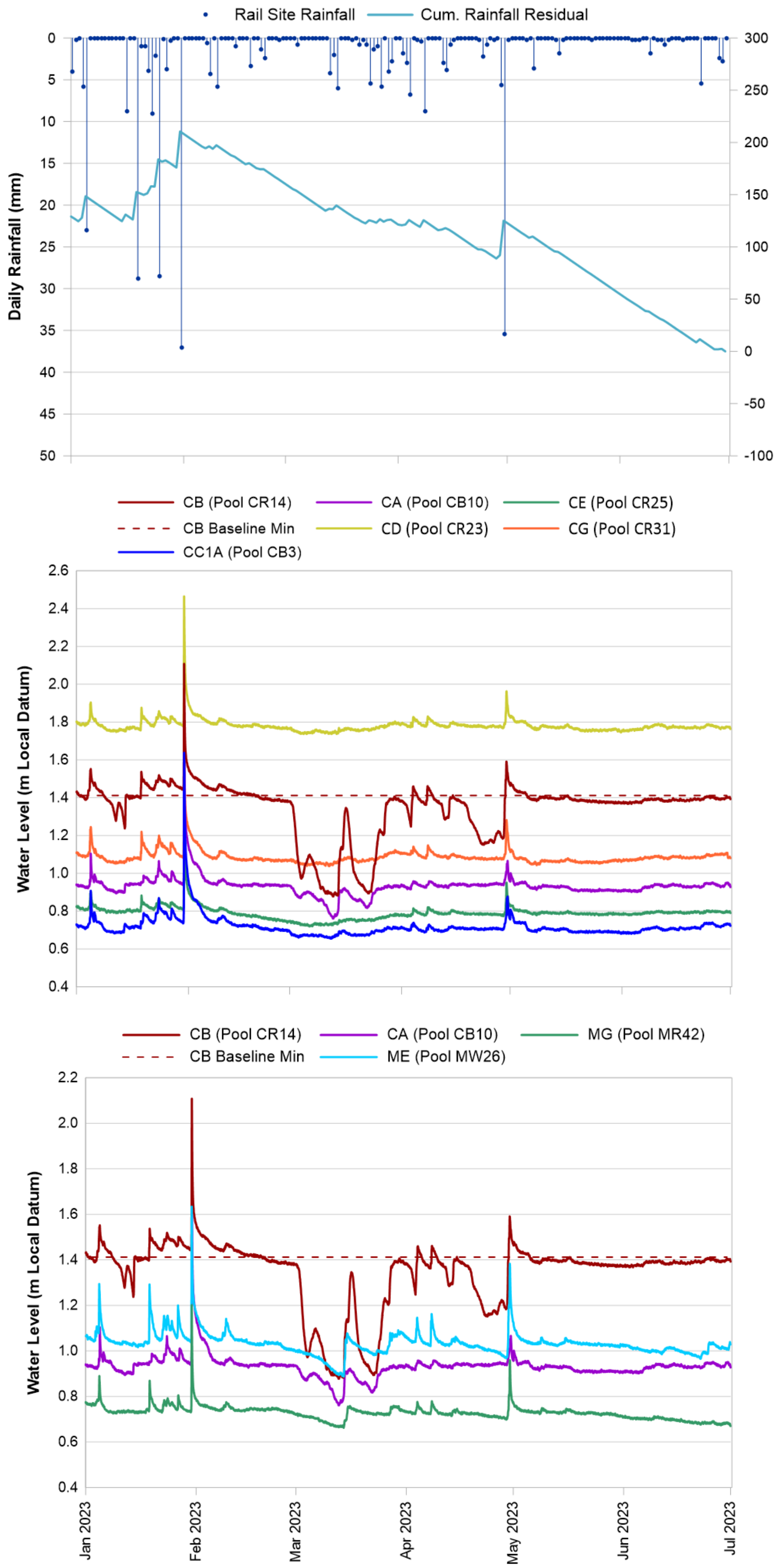
TABLE 8: TRIGGER EXCEEDANCE ACTION AND RESPONSE

Level	Action	Response
Pool water level		
Level 2	• Continue monitoring as per monitoring program • Continue monthly review of data • Convene Tahmoor Coal Environmental Response Group to review response	• As defined by Environmental Response Group
Level 3	• Continue monitoring as per monitoring program • Continue monthly review of data • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends • Convene Tahmoor Coal Environmental Response Group to review response	• As defined by Environmental Response Group • Consider increasing download and review of data frequency to fortnightly for sites where Level 3 has been reached • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline
Impact to physical features and natural behaviour of pools		
Level 3	• Continue monitoring as per monitoring program • Continue monthly review of data • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climatic conditions	• As defined by Environmental Response Group • Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached

<u>Monitoring Site CB (Pool CR14)</u>

CHART 1 presents a comparison of the water level records (converted to metres local datum for comparative purposes) for relevant monitoring sites on Cedar Creek and Matthews Creek for the period 1 January to 30 June 2023. The cumulative rainfall residual is also presented (calculated for the period 1 January 2018 to 1 April 2023).

CHART 1: CEDAR CREEK WATER LEVEL AND RAINFALL



As illustrated in **Chart 1,** except following high rainfall periods, the water level at monitoring site CB (pool CR14) was recorded below the CTF level and below the baseline minimum for the majority of the review period.

It is noted that a Level 4 TARP significance was originally triggered in relation to surface water level decline for the period 19 to 29 January 2021 at monitoring site CB (pool CR14) in Cedar Creek. As stated in HEC (2022), whilst not visible on the surface, it was likely that mining induced subsidence had mobilised existing fractures resulting in changes in the water level recession rate of pool CR14 (monitoring site CB). In addition, it was considered likely that mining induced groundwater drawdown had resulted in the surface water system in the vicinity of pool CR14 transitioning from a gaining stream (baseflow discharge from the groundwater system to the stream) to a weakly gaining or losing stream (surface water recharge to the groundwater system) (HEC, 2022).

As stated in **Table 8**, the following trigger levels in excess of Level 1 are considered to apply for monitoring site CB (pool CR14) for the current review period:

- Level 2 – 6 May to 30 June.
- Level 3 - 2, 3 and 9 to 18 January and 19 February to 28 April.

When comparing the monitoring data directly to the TARP level descriptions included in **Table 8**, it is noted that a Level 3 may apply for the period 6 May to 30 June and a Level 4 may apply for the period 2 to 3 January, 9 to 18 January and 19 February to 28 April 2023. However, it is considered that the TARP level descriptions do not accurately reflect the nuanced behaviour of water level recorded during the review period.

Consequently, the Environmental Response Group convened and the surface water level data was reviewed in relation to climatic conditions, subsidence monitoring data and groundwater level trends.

In relation to the Level 2 trigger exceedances for monitoring site CB, the data presented in **Chart 1** and **Appendix B** shows that:

- From 6 May to 30 June 2023, the water level at monitoring site CB declined by a maximum of 4 centimetres (cm) below the baseline minimum.
- The water level decline occurred during periods of below average rainfall.
- The water level decline was not atypical.
- A decline in water level was also recorded at upstream monitoring sites CA in Cedar Creek and MG in Matthews Creek during majority of these periods.
- Although the water level recorded at the upstream sites did not decline below the baseline minimum, it is considered that the decline in water level at these sites was sufficient to result in a reduction in surface flow reporting to monitoring site CB.
- From 29 May to 30 June 2023, the water level recorded at monitoring site MG declined below the CTF level indicating a notable reduction in surface flow reporting to monitoring site CB (refer **Diagram B7, Appendix B**).

A decline of 4 cm below the baseline minimum is considered negligible, not atypical and related to a reduction in surface flow reporting from Matthews Creek to Cedar Creek, consistent with below average rainfall conditions. Accordingly, a Level 2 trigger is considered to apply in relation to water level decline recorded at monitoring site CB from 6 May to 30 June 2023.

In relation to the Level 3 trigger exceedances for monitoring site CB, the data presented in **Chart 1** and **Appendix B** shows that:

- From 2 to 3 January, 9 to 18 January 2023 and 19 February to 28 April 2023, the water level at monitoring site CB declined by a maximum of 0.53 m below the baseline minimum.
- Although the water level decline recorded during the review period is considered atypical in relation to baseline water level trends recorded at monitoring site CB, the water level decline is considered similar to that recorded in late 2020 and early 2021 (refer **Appendix B**).
- Notwithstanding, the water level recorded during the review period remained above the historically recorded minimum level (i.e. above the January 2021 minimum level).

- Additionally, the rate of recession recorded during the review period did not increase from that recorded in late 2020 and early 2021.
- The water level decline occurred during periods of below average rainfall.
- Water level declines were recorded at the majority of upstream monitoring sites during these periods. Water level declines (whilst remaining above the baseline minimum) were also recorded at reference site CC1A on Cedar Creek and reference site MA on Matthews Creek, indicating a reduction in surface flow reporting to monitoring site CB.
- Although water level declines were recorded at downstream monitoring sites CC, CE and CF on Cedar Creek (refer **Appendix B**) in March 2023, it is considered that the water level declines were small and transient.
- Following a rainfall event in late April 2023, the water level rose at monitoring site CB and was recorded just below the baseline minimum at the end of the review period.

As stated in **Section 3.2**, less than 20 mm change in horizontal distance was recorded at Site 17 to Site 20, located across Cedar Creek to the west of LW W1, from January to June 2023. However, it is noted that some movement was recorded during this period. It is unclear if the recorded movement was a result of residual effects from mining of LW W1-W4 or related to changes in moisture content associated with a notable decline in rainfall.

Groundwater levels recorded at groundwater monitoring site P40 (A, B, C and D) were recorded above the creek bed elevation from approximately December 2022 to 30 June 2023 (SLR, 2023). An upward vertical head hydraulic gradient between P40A and P40B persisted through to the end of the review period. This suggests that groundwater flow was from the mid-Hawkesbury Sandstone to the upper Hawkesbury Sandstone, which likely resulted in baseflow contribution to Cedar Creek in the vicinity of monitoring site CB. However, it is noted that similar water level trends were recorded at P40B in comparison to monitoring site CB (refer SLR, 2023).

As noted in HEC (2022), the presence of fractures in the base of pool CR14 or in the subsurface would prohibit, to some extent, gaining conditions (dependent on the nature of the fractures) occurring at pool CR14 (pers. comm. SLR, 16 December 2021). The decline in water level at monitoring site CB (pool CR14) suggests that, although gaining conditions were prevailing in the vicinity of monitoring site CB, it is likely that fractures in the base of pool CR14 or in the subsurface, resulted in losing conditions occurring at monitoring site CB.

The decline in water level recorded intermittently at monitoring site CB during the review period is considered a result of below average rainfall conditions, a reduction in streamflow contribution from upstream sites (including upstream reference sites) and complex groundwater-surface interactions occurring in the vicinity of monitoring site CB which may be exacerbated by the mobilisation of fractures which is considered to have occurred during mining of LW W1-W4.

It is noted that the water level recorded at monitoring site CB during the review period did not decline to the same level as that recorded in January 2021 when a Level 4 was previously triggered. Accordingly, while it is considered that impacts occurred to monitoring site CB during mining of LW W1-W4 (as detailed in HEC, 2022) and those impacts continue to be evident intermittently during periods of below average rainfall, no further mining related impacts have occurred at monitoring site CB during the review period.

Given the decline in water level at monitoring site CB has occurred intermittently since late 2020 and the decline has not resulted in significant, persistent effects at downstream monitoring sites, increased frequency of monitoring is not deemed to be required. The water level records for this site will continue to be monitored in accordance with the WMP.

Monitoring Site CE (Pool CR25)

From 13 February to 4 April 2023, the water level recorded at monitoring site CE (pool CR25) declined slightly below the baseline minimum (maximum of 0.07 m below the baseline minimum). The water level then trended around the baseline minimum for the remainder of the review period. Consequently, the Environmental Response Group convened, and the surface water level data was reviewed in relation to climatic conditions and groundwater level trends.

When comparing the monitoring data directly to the TARP level descriptions included in **Table 8**, it is noted that a Level 3 may apply for the period 13 February to 4 April 2023. However, it is considered that the TARP level descriptions do not accurately reflect the nuanced behaviour of water level recorded during the review period.

The decline in water level recorded at monitoring site CE is considered negligible – maximum of 0.07 m decline below the baseline minimum recorded between 13 February and 4 April. Additionally, the water level rose from early May and was trending around the baseline minimum for the remainder of the review period, as illustrated in plot Figure B14 of **Appendix B**.

As discussed in the above section, water level declines were recorded at several monitoring sites in February and March 2023 and to a lesser extent in April and May 2023. The period of slight water level decline recorded at monitoring site CE was consistent with the period of water level decline recorded at monitoring site CB. As such, it is considered that the water level decline recorded at monitoring site CE was related to a decline in surface flow from upstream monitoring site CB in combination with below average rainfall conditions.

As the water level decline was negligible, increased frequency of monitoring is not considered to be required. The water level records for this site will continue to be monitored in accordance with the WMP.

Pool SR17

As described in **Section 4.4**, Pool SR17 was initially reported at a Level 3 significance on 28 October 2021 due to surficial fracturing of the controlling rockbar (pers. comm. MSEC). A visual inspection on 10 May 2023 was undertaken with no reduction in water level observed at Pool SR17. Since the initial observation of fracturing, no gas release or iron precipitation has been noted during visual inspections.

In response to the Level 3 trigger exceedances in relation to physical features at monitoring site SB (pool SR17), the Environmental Response Group convened and the surface water level data was reviewed. The water level records for monitoring site SB (pool SR17) shown in Figure B22, **Appendix B**, indicate that fracturing of the rockbar has not resulted in an impact to the pool water holding capacity. The water level recorded at monitoring site SB (pool SR17) has not declined below the baseline minimum water level and no atypical water level behaviour has been recorded at this site to date. As such, there is no requirement to increase the frequency of visual inspections and review of data in relation to pool physical features, natural drainage behaviour and pool water level. The physical features and water level records for this site will continue to be monitored in accordance with the WMP.

Pool SR20

In response to the Level 3 trigger exceedances in relation to physical features at pool SR20, the Environmental Response Group convened, and the surface water level data was reviewed for the monitoring sites upstream of pool SR20 (monitoring site SB) and downstream of pool SR20 (monitoring sites SC and SD). The monitoring data for these sites indicates that the water level has not declined below the baseline minimum water level between 18 August 2022 (date that fracturing was initially observed) and 30 June 2023 (end of review period). Water level records for monitoring site SD show that, with the exception of rainfall periods, the water level declined below the CTF level from January to June 2023. However, this is considered to be consistent baseline and historical behaviour and a result of below average rainfall conditions.

Additionally, as indicated in **Section 3.2**, only minor subsidence movements have been recorded in the Western Domain since the completion of mining (13 September 2022). As such, further mining related widening of the fractures is considered unlikely to occur.

Accordingly, there is no requirement to increase the frequency of visual inspections and review of data in relation to pool physical features, natural drainage behaviour and pool water level. The physical features and water level records for this site will continue to be monitored in accordance with the WMP.

5.3 Surface Water Quality

5.3.1 Significance Triggers for Surface Water Quality

Water quality data has been analysed for key water quality parameters of relevance to surface water systems and the effects of subsidence, namely pH, EC, dissolved (field filtered) aluminium, iron, manganese, nickel and zinc at monitoring sites on Matthews Creek, Cedar Creek and Stonequarry Creek. The monitoring results have been assessed against the criteria for each significance level/trigger listed in **TABLE 9.**

TABLE 9: SIGNIFICANCE LEVELS / TRIGGERS FOR WATER QUALITY

TARP Level	Surface Water Quality
Level 1	The triggers for pH, EC and dissolved metals do not occur and there is no visual evidence of increased iron staining that was not observed in the baseline period.
Level 2	The trigger for pH, EC or dissolved metals occurs in one month and there is no visual evidence of increased iron staining that was not observed in the baseline period.
Level 3	The trigger for pH, EC or dissolved metals occurs in one month and there is visual evidence of increased iron staining that was not observed in the baseline period.
Level 4	Any of the following: • pH: the value falls below a corresponding control (upstream) site(s) mean*, or at the site itself, minus two standard deviations (i.e. the sample becomes more acidic) for more than two consecutive months OR the value rises above corresponding control (upstream) site(s) mean, or at the site itself, plus two standard deviations (i.e. the sample becomes more alkaline) for more than two consecutive months. • EC: the value rises above corresponding control (upstream) site(s) mean*, or at the site itself, plus two standard deviations for more than two consecutive months. • Dissolved metals: a specific metal or metals laboratory value/s rise above corresponding control (upstream) site(s) mean*, or at the site itself, plus two standard deviations for more than two consecutive months.

* The value is compared with the corresponding control (upstream) site(s) mean to date plus two standard deviations and with the baseline mean plus two standard deviations for the site itself.

5.3.2 Assessment of Surface Water Quality

A summary of the water quality TARP significance levels for the review period is presented in **TABLE 10** and discussed in the sections which follow.

TABLE 10: WATER QUALITY TARP SIGNIFICANCE LEVELS – 1 JANUARY TO 30 JUNE 2023

Date	Location(s)	Comment	TARP Significance
Surface Water Quality			
January to June 2023	All monitoring sites in Matthews Creek	The triggers for pH, EC and dissolved metals did not occur.	Level 1
January to June 2023	All monitoring sites in Cedar Creek (excluding CG)	The triggers for pH, EC and dissolved metals did not occur.	Level 1
January to June 2023	All monitoring sites in Stonequarry Creek (excluding SC2 and SD)	The triggers for pH, EC and dissolved metals did not occur.	Level 1
March to June 2023	Site SC2 in Stonequarry Creek	The triggers for pH, EC and dissolved metals did not occur.	Level 1
January, March to June 2023	Site SD Stonequarry Creek	The triggers for pH, EC and dissolved metals did not occur.	Level 1
March to June 2023	Site CG in Cedar Creek	The triggers for pH, EC and dissolved metals did not occur.	Level 1
January and February 2023	Site SC2 Stonequarry Creek	The trigger for dissolved aluminum occurred in one month and there was no visual evidence of increased iron staining that was not observed in the baseline period.	Level 2
February 2023	Site SD in Stonequarry Creek	The trigger for dissolved aluminum occurred in one month and there was no visual evidence of increased iron staining that was not observed in the baseline period.	Level 2
January and February 2023	Site CG in Cedar Creek	The trigger for dissolved aluminum occurred in one month and there was no visual evidence of increased iron staining that was not observed in the baseline period.	Level 2

5.3.3 Trigger Exceedance Action and Response

TABLE 11 summarises the actions and responses required to be undertaken in relation to the Level 2 trigger exceedances in relation to dissolved aluminium recorded at the following monitoring sites during the review period:

- Cedar Creek: CG (January and February)
- Stonequarry Creek: SD (February) and SC2 (January and February)

TABLE 11: TRIGGER EXCEEDANCE ACTION AND RESPONSE

Level	Action	Response
Impact to stream water quality		
Level 2	• Continue monitoring as per monitoring program. • Continue monthly review of data including analysis of water quality trends along creek (upstream to downstream) to identify spatial changes. • Convene Tahmoor Coal Environmental Response Group to review response.	As defined by Environmental Response Group.

For each trigger exceedance, the Environmental Response Group was convened and the surface water quality data reviewed in relation to climatic conditions and water quality trends for the reach of each surface water system monitored.

<u>Cedar Creek Dissolved Aluminium Trigger Exceedance</u>

The dissolved aluminium records for monitoring site CG and reference sites Cedar US and CC1 on Cedar Creek are shown below on **DIAGRAM 3**.

As shown on **DIAGRAM 3**, the dissolved aluminium concentrations recorded at reference site Cedar US, which is located at a notable distance upstream of the Western Domain, was similar to or higher than that recorded at monitoring site CG in January and February 2023 (trigger period). This indicates a catchment wide (non-mining related) and climatic influence on dissolved aluminium concentrations in Cedar Creek. As such, an increase in the monitoring frequency is not considered to be required.

<u>Stonequarry Creek Dissolved Aluminium Trigger Exceedance</u>

The dissolved aluminium records for monitoring sites SC2 and SD and reference sites SC1 and SE on Stonequarry Creek are shown on **DIAGRAM 4.**

DIAGRAM 3: CEDAR CREEK SITE CG AND REFERENCE SITES – DISSOLVED ALUMINIMUM RECORDS

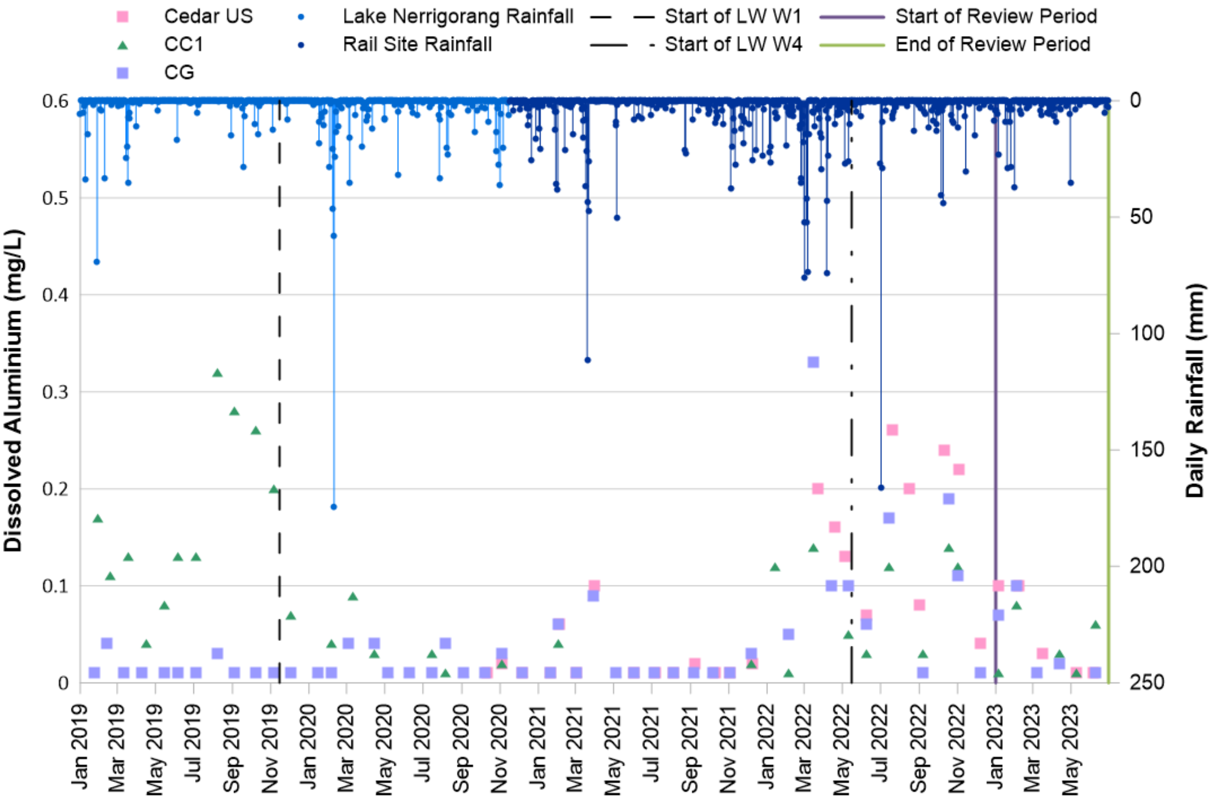
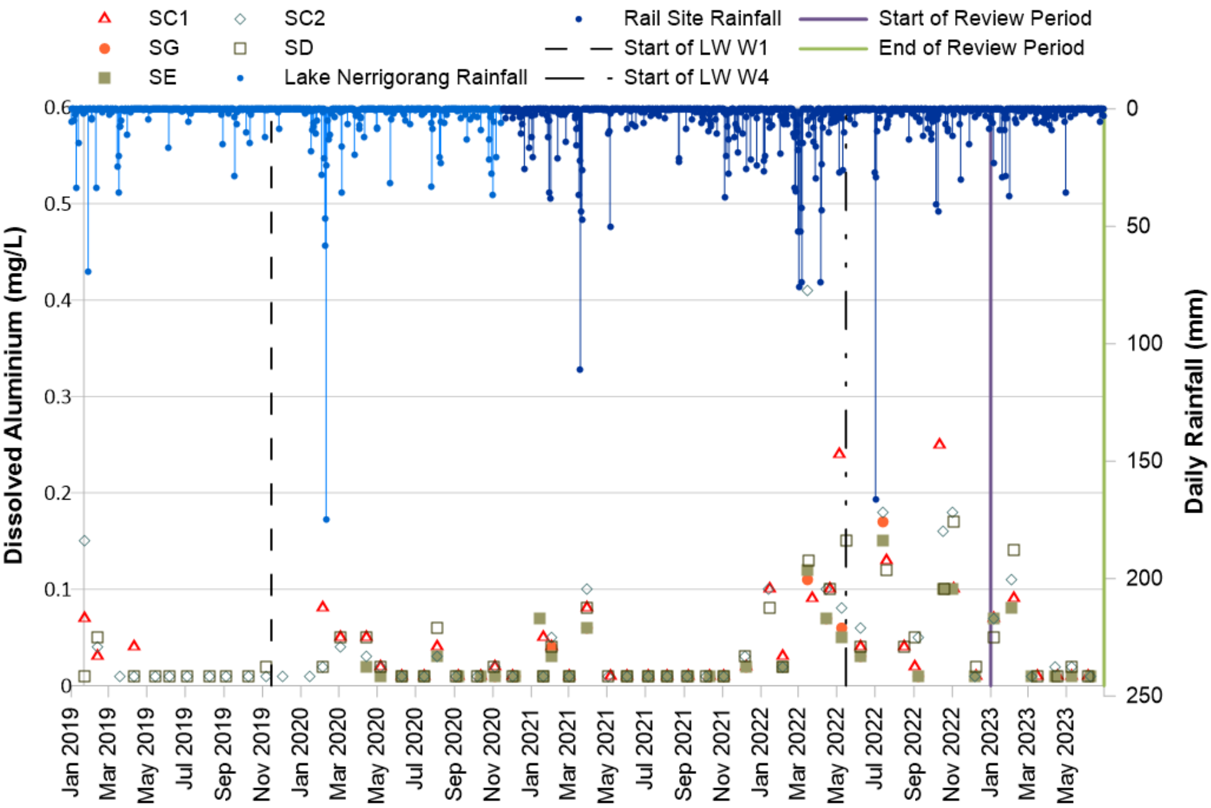


DIAGRAM 4: STONEQUARRY CREEK SITES SC2, SD AND REFERENCE SITES – DISSOLVED ALUMINIMUM RECORDS



As shown on **DIAGRAM 4**, the dissolved aluminium concentrations recorded at reference sites SC1 and SE, located upstream of potential mining related influences, were similar to the dissolved aluminium concentrations recorded at monitoring sites SC2 and SD in January and February 2023. In March 2023, the dissolved aluminium concentrations recorded at all sites declined to the limit of detection. As such, it is considered that the elevated dissolved aluminium concentrations recorded at monitoring sites SC2 and SD in January and February 2023 were related to the prevailing climatic conditions and indicative of natural variability rather than a residual mining effect. Accordingly, the post-mining monitoring frequency is considered appropriate.

5.3.3.1 Summary

In response to the aluminium Level 2 trigger exceedances for Cedar and Stonequarry Creek, the Environmental Response Group convened on 18 April 2023, and the surface water quality data was reviewed in relation to the prevailing climate and catchment wide water quality trends.

The elevated concentrations of dissolved aluminium recorded during the review period occurred during and following rainfall. Additionally, the elevated concentrations of dissolved aluminium were also recorded at reference sites (located upstream of potential mining influences). Accordingly, the elevated dissolved aluminium concentrations are considered to be catchment wide and related to the prevailing climatic conditions. Additionally, dissolved aluminium concentrations following February 2023 were consistent with baseline concentrations. Thus, no actions are considered required.

In accordance with the WMP, monthly monitoring and review of water quality data recorded at sites in Cedar Creek, Stonequarry Creek and Matthews Creek will continue to be undertaken and assessed in relation to the water quality TARP.

6 SUMMARY AND CONCLUSIONS

Review and assessment of surface water monitoring data recorded prior to and during the review period of 1 January to 30 June 2023 has indicated the following:

- Surface Water Level:
  - With the exception of monitoring sites CB and CE in Cedar Creek (refer below), a TARP significance above Level 1 was not reported for any sites in Cedar Creek, Matthews Creek and Stonequarry Creek during the review period.
  - A Level 2 trigger exceedance in relation to pool water level was recorded at monitoring site CB (pool CR14) in Cedar Creek from 6 May to 30 June. The water level declined by a maximum of 0.04 m (4 cm) below the baseline minimum during these periods.
  - A decline of 4 cm below the baseline minimum is considered negligible and related to a reduction in surface flow reporting from Matthews Creek to Cedar Creek, consistent with below average rainfall conditions.
  - A Level 3 trigger exceedance in relation to pool water level was recorded at monitoring site CB (pool CR14) in Cedar Creek from 2 to 3 January, 9 to 18 January 2023 and 19 February to 28 April 2023. The water level declined by a maximum of 0.53 m below the baseline minimum in March 2023. The water level subsequently rose in late April and was recorded just below the baseline minimum from May to June 2023.
  - The decline in water level recorded intermittently at monitoring site CB during the review period is considered a result of below average rainfall conditions, a reduction in streamflow contribution from upstream sites (including upstream reference sites) and complex groundwater-surface interactions occurring in the vicinity of monitoring site CB which may be exacerbated by the mobilisation of fractures which is considered to have occurred during mining of LW W1-W4.
  - A Level 2 trigger exceedance in relation to pool water level was recorded for a brief period in March 2023 at monitoring site CE (pool CR25) in Cedar Creek. The water level declined by a maximum of 0.07 m below the baseline minimum during this period.
  - The period of slight water level decline recorded at monitoring site CE was consistent with the period of water level decline recorded at monitoring site CB. As such, it is considered that the water level decline recorded at monitoring site CE was related to a decline in surface flow from upstream monitoring site CB in combination with below average rainfall conditions.
  - As the decline in water level at monitoring site CE and CB was transient and considered to have had negligible effect on the water level of downstream monitoring sites, increased frequency of monitoring is not considered required. The water level records for all sites will continue to be monitored in accordance with the WMP.
- Physical Features and Natural Behaviour of Pools:
  - A Level 3 trigger exceedance was reported for rockbar SR17 and SR20 located in Stonequarry Creek.
  - The water level records for monitoring site SB (pool SR17) indicate that the surficial fracturing of the rockbar has not resulted in an apparent impact to the pool water holding capacity. As such, an increase in the frequency of monitoring from monthly to fortnightly is not required at this stage. The water level records for downstream monitoring sites SC and SD indicate that the surficial fracturing of the rockbar at pool SR20 has not resulted in an apparent impact to the pool water holding capacity at monitoring sites upstream or downstream on Stonequarry Creek. As such, an increase in the frequency of monitoring is not required at this stage.

- Surface Water Quality:
  - A Level 2 trigger exceedance was reported for dissolved aluminium at some sites in Cedar Creek and Stonequarry Creek in January and February 2023. Elevated concentrations of dissolved aluminium were also recorded at associated reference sites and, as such, the elevated concentrations are considered to be catchment wide and related to the prevailing climatic conditions.

The monitoring data for 1 January to 30 June 2023 indicates that less than 10% of pools within the Investigative Area have been impacted. Consequently, there is negligible evidence to date of subsidence impacts with environmental consequences greater than minor[4] associated with mining in the Western Domain.

7 RECOMMENDATIONS FOR MONITORING PROGRAM

7.1 Current Surface Water Monitoring Recommendations

It is recommended that ongoing review of surface monitoring data is continued to be undertaken in accordance with the WMP. From the current review period, no further recommendations have been made with respect to the assessment outcomes detailed in **Section 5**.

7.2 Previous Surface Water Monitoring Recommendations

Recommendations from the previous review period (1 January to 31 March 2023, ATCW 2023) and the subsequent status/actions are summarised in **TABLE 12**.

TABLE 12: STATUS OF PREVIOUS SURFACE WATER MONITORING PROGRAM RECOMMENDATIONS

Item	Previous Recommendation	Progress of Recommendation
1	Decommission monitoring site SF	Site has been decommissioned.
2	Re-survey rockbar and monitoring instrumentation at monitoring site MB	Field personnel identified that water was no longer flowing over the rockbar control, rather was flowing through the embankment. The location of embankment flow comprises sandy soil and is directly beneath a tree that was dislodged during a flood event. It is considered that the change in water level behaviour reflects the change in site conditions. As such, re-survey of the rockbar and monitoring instrumentation is no longer considered required.

[4] Minor is defined as *not very large, important or serious.*

REFERENCES

[1] ATCW (2023). Surface Water Review 1 January to 31 March 2023 Prepared for Tahmoor Coal Pty Ltd by ATC Williams Pty Ltd (ATCW), June 2023. Doc ref: 121171-16R005-rev0.

[2] BES (2023a). Longwall West 4 Creek Monitoring - 29 January 2023 Stonequarry Creek SR17 and SR20. Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), January 2023.

[3] BES (2023b). Longwall West 4 Creek Monitoring - 23 February 2023, Matthews, Cedar and Stonequarry Creeks. Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), February 2023.

[4] BES (2023c). Longwall West 4 Creek Monitoring – 10 May 2023, Matthews, Cedar and Stonequarry Creeks. Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), May 2023.

[5] SLR (2023) Quarterly Groundwater Reporting: January – June 2023. Prepared for Tahmoor Coal Pty Ltd by SLR Consulting Australia Pty Ltd, August 2023.

[6] HEC (2022). Tahmoor Mine LW W3 Surface Water and Groundwater Review - October to December 2021. Prepared for Tahmoor Coal Pty Ltd by Hydro Engineering & Consulting Pty Ltd. Doc ref: 121171-16.r1c. 24, February 2022.

[7] Tahmoor Coal (2021a). Tahmoor North Western Domain Longwalls West 3 and West 4 Water Management Plan. September 2021.

[8] Tahmoor Coal (2021b). Tahmoor North – Western Domain, LW W3-W4 Stonequarry Creek Rockbar Management Plan. September 2021.

CONDITIONS OF REPORT

This report must be read in its entirety.

This report has been prepared by ATCW for the purposes stated herein and ATCW's experience, having regard to assumptions that can reasonably be expected to make in accordance with sound professional principles. ATCW does not accept responsibility for the consequences of extrapolation, extension or transference of the findings and recommendations of this report to different sites, cases, or conditions.

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APPENDIX A – SUMMARY OF SURFACE WATER MONITORING SITES RELEVANT TO WESTERN DOMAIN

Location	Monitoring Site(s)	Monitoring Component	Classification	Natural Control Characteristics	Water Quality Monitoring Commencement
Cedar Creek	Cedar US	Water level and quality	Reference Site	Rockbar constrained	October 2020
	CC1A (Pool CB3)	Water level	Reference Site	Boulder/rockbar constrained	-
	CC1	Water quality	Reference Site	Boulder/rockbar constrained	January 2019
	CA (Pool CB10)	Water level and quality	Potential Impact Site	Boulder constrained	June 2019
	CB (Pool CR14)	Water level and quality	Potential Impact Site	Rockbar constrained	January 2019
	CD (Pool CR23)	Water level and quality	Potential Impact Site	Rockbar/boulder constrained	January 2021
	CE (Pool CR25)	Water level and quality	Potential Impact Site	Rockbar/boulder constrained	January 2021
	CF	Water level and quality	Potential Impact Site	Rockshelf constrained	January 2021
	CG (Pool CR31)	Water level and quality	Potential Impact Site	Rockshelf constrained	January 2019
Matthews Creek	MB (Pool MR5)	Water level and quality	Reference Site	Rockbar constrained	January 2019
	MC1	Water level and quality	Baseline / Potential Impact Site	Rockshelf/boulder constrained	January 2019
	ME (Pool MR25)	Water level	Potential Impact Site	Boulder/rockbar constrained	-
	MG (Pool MR42)	Water level and quality	Potential Impact Site	Boulder constrained	January 2019
Stonequarry Creek	SA (Pool SR16)	Water level	Potential Impact Site	Rockbar/boulder constrained	-

Location	Monitoring Site(s)	Monitoring Component	Classification	Natural Control Characteristics	Water Quality Monitoring Commencement
Stonequarry Creek	SB (Pool SR17)	Water level	Potential Impact Site	Rockbar constrained	-
	SC	Water level and quality	Baseline / Potential Impact Site	Rockbar constrained	January 2019
	SC1	Water quality	Reference Site	Rockshelf constrained	January 2019
	Pool SR20	Water level and quality	Potential Impact Site	Rockbar constrained	-
	SD	Water level and quality	Baseline / Potential Impact Site	Rockbar constrained	January 2019
	SE (Pool SR5)	Water level and quality	Reference Site	Rockbar constrained	April 2020

APPENDIX B – WATER LEVEL PLOTS

MATTHEWS CREEK SURFACE WATER MONITORING SITES

DIAGRAM B1: MONITORING SITE MA WATER LEVEL RECORDS

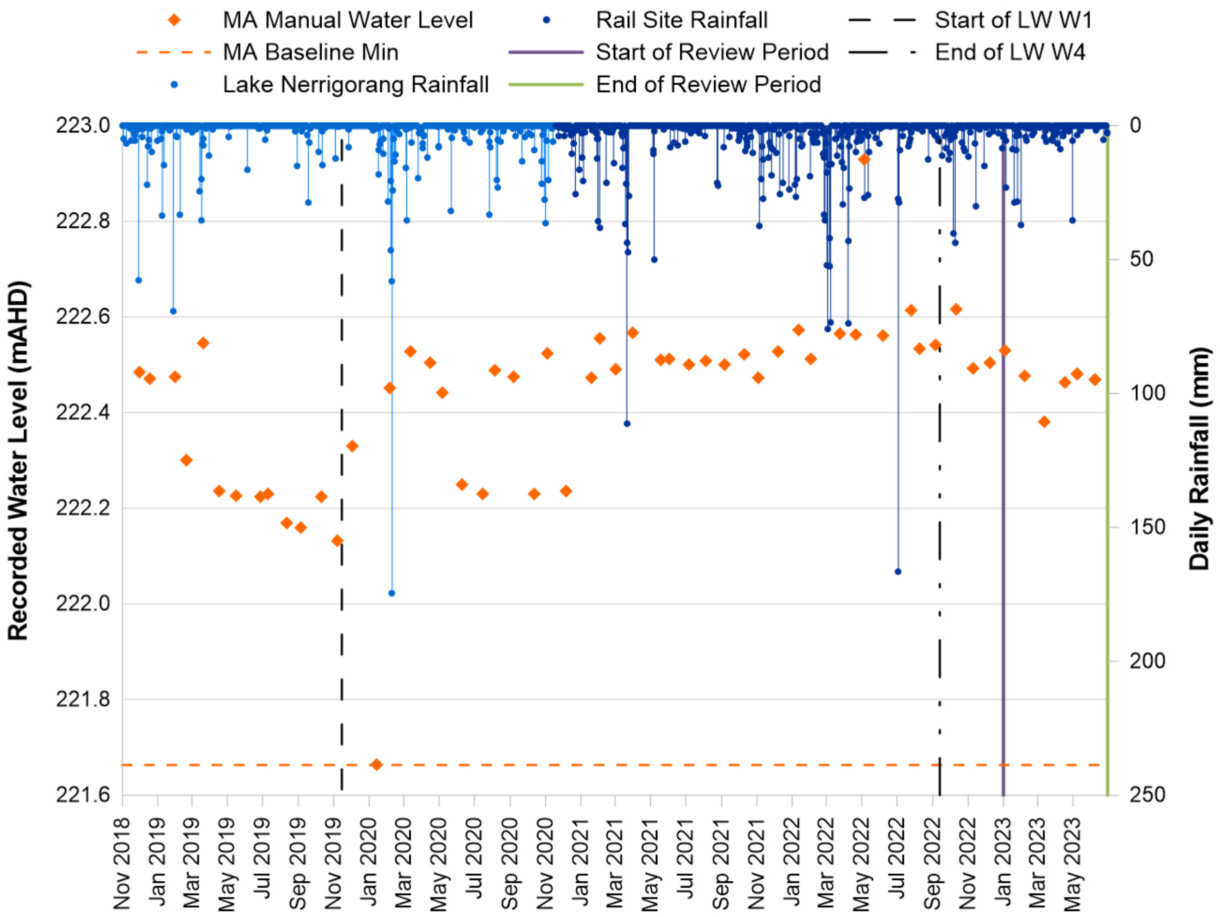


DIAGRAM B2: MONITORING SITE MB WATER LEVEL RECORDS

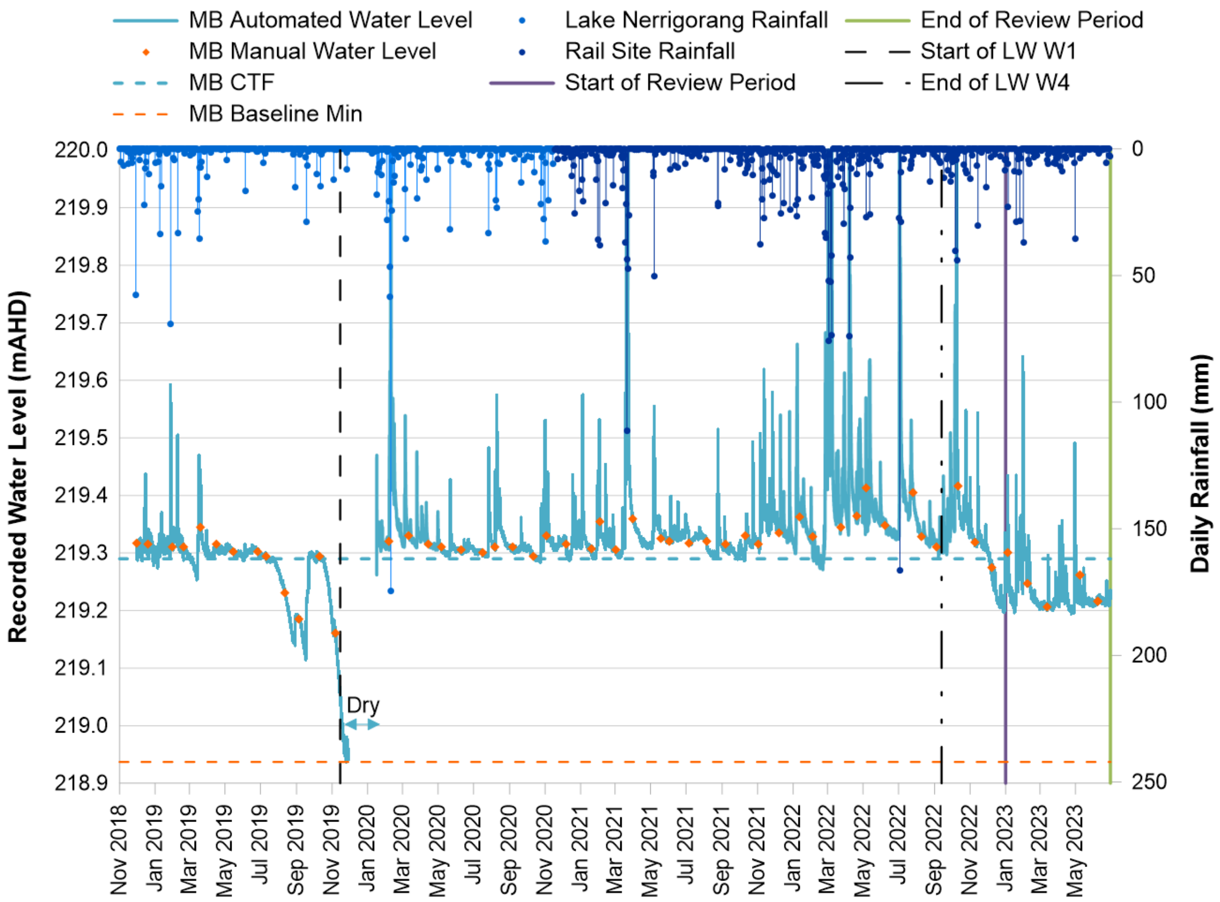


DIAGRAM B3: MONITORING SITE MC WATER LEVEL RECORDS

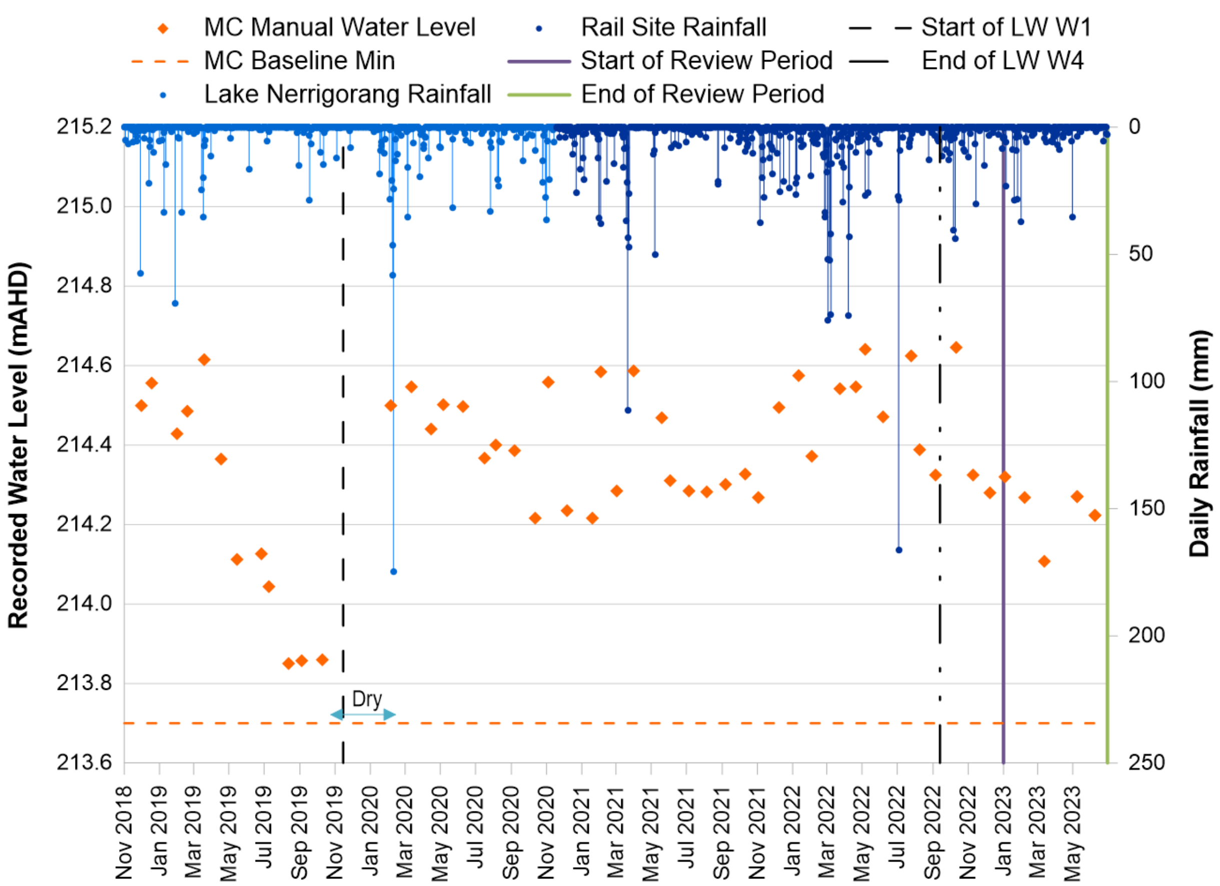


DIAGRAM B4: MONITORING SITE MD US WATER LEVEL RECORDS

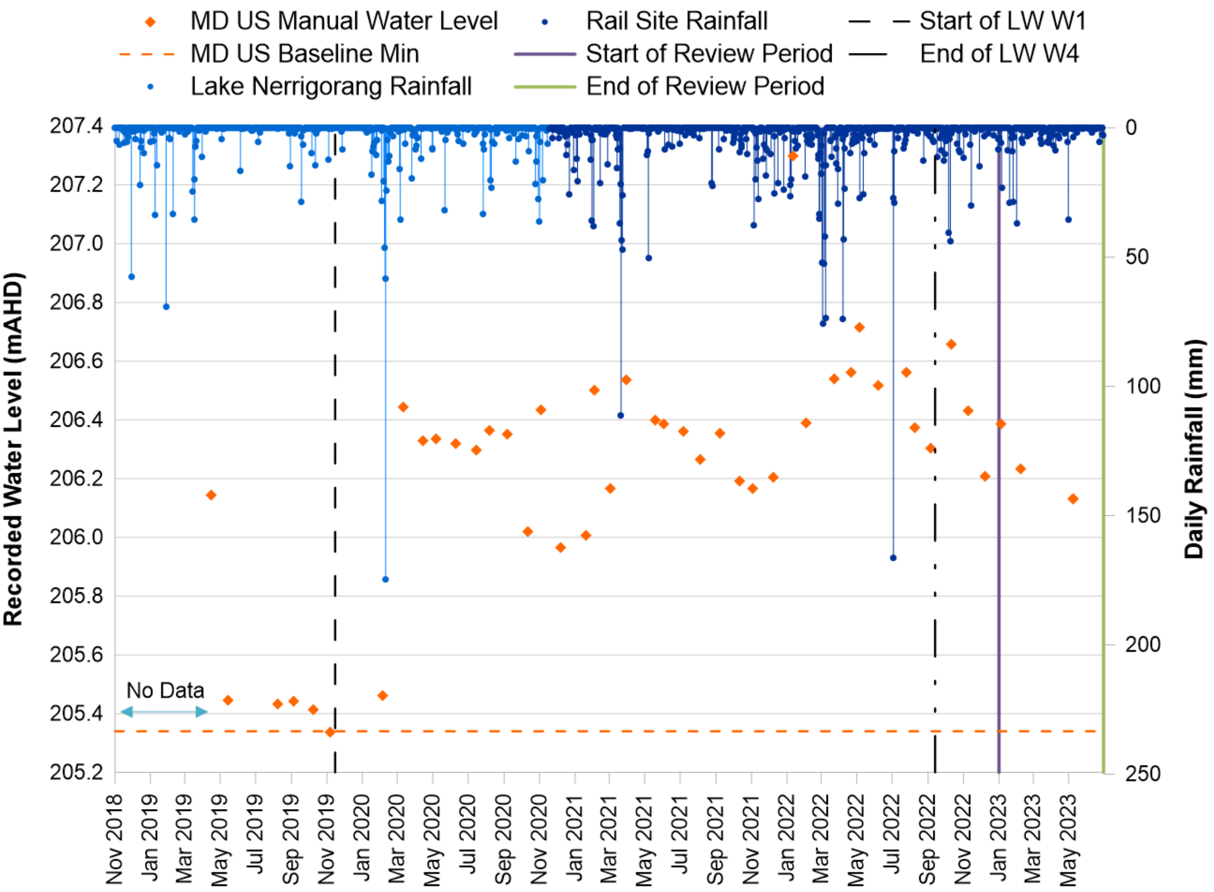


DIAGRAM B5: MONITORING SITE ME WATER LEVEL RECORDS

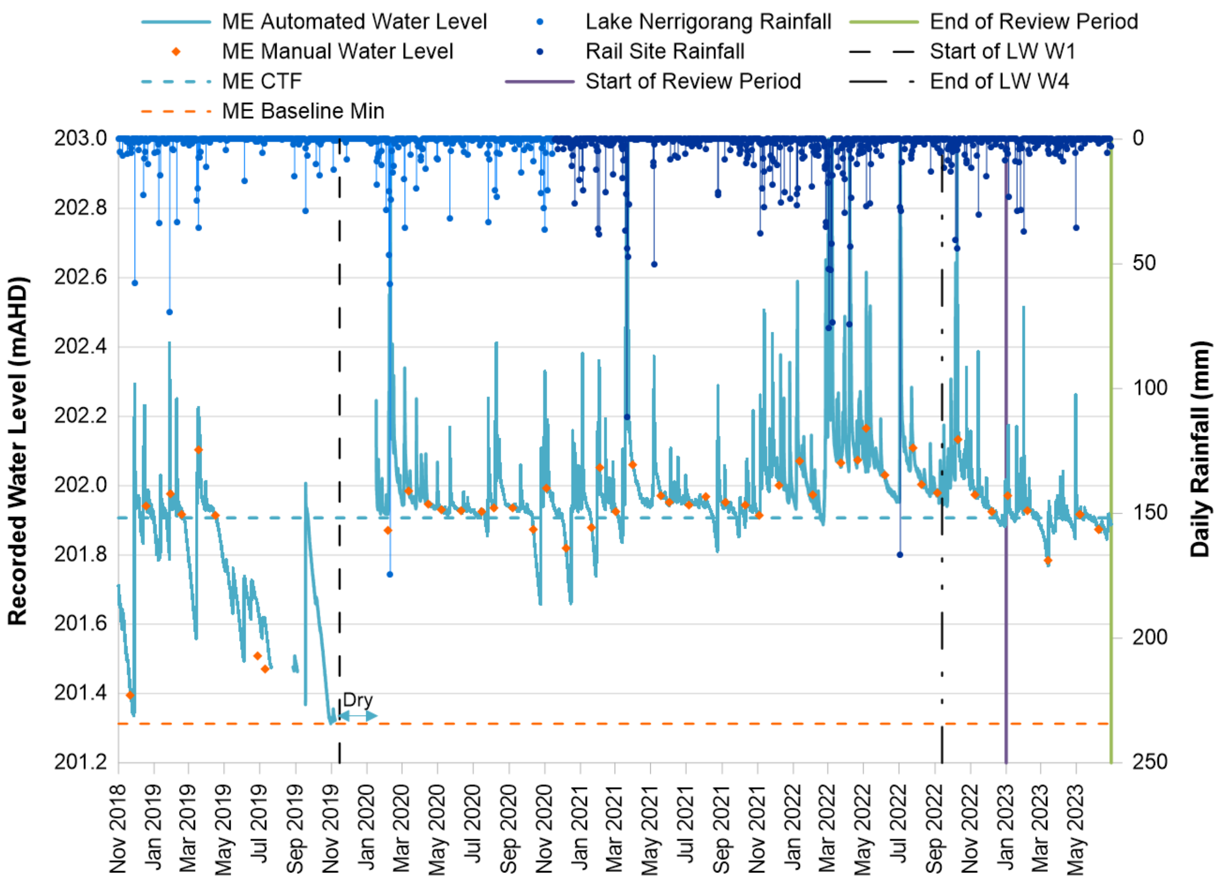


DIAGRAM B6: MONITORING SITE MF WATER LEVEL RECORDS

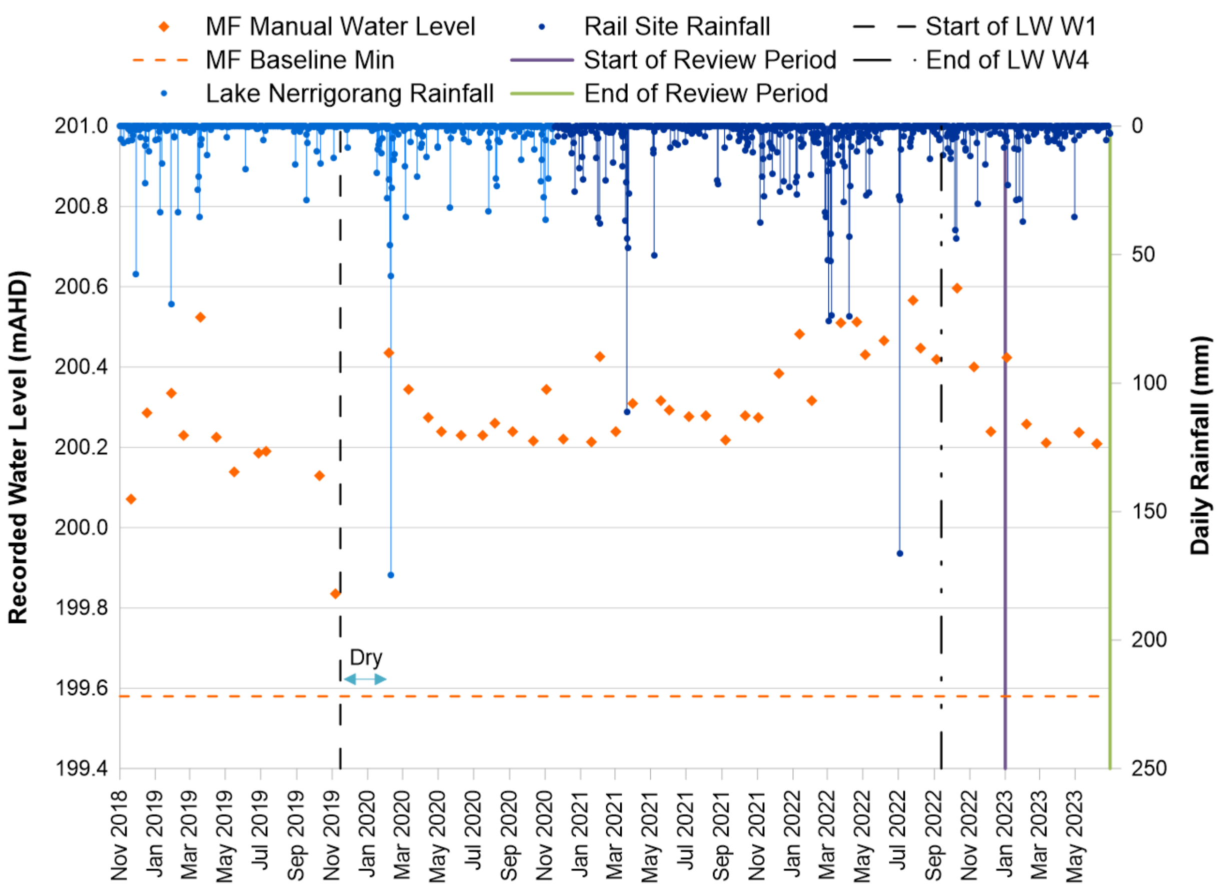
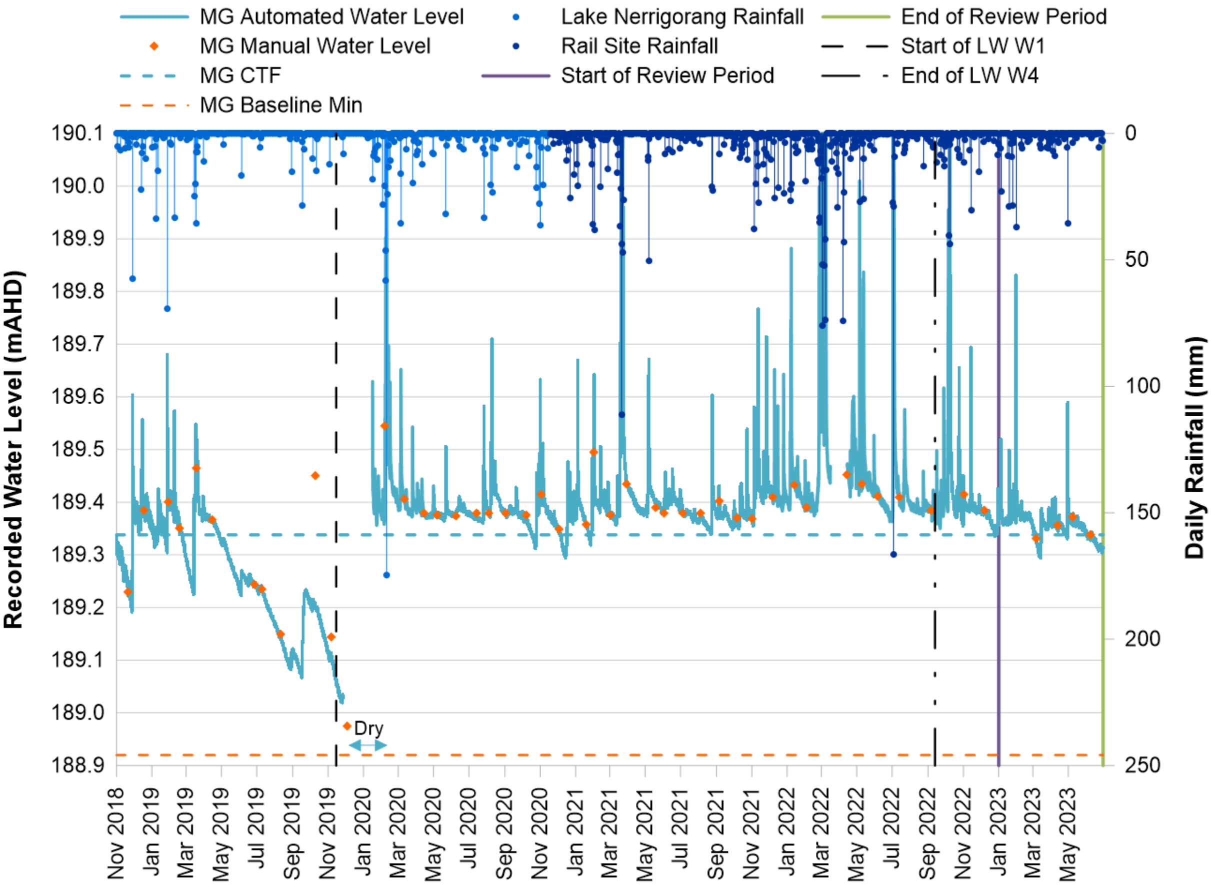


DIAGRAM B7: MONITORING SITE MG WATER LEVEL RECORDS[5]



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[5] No data was recorded between 17 March and 14 April 2022 due to a logger re-start issue.

CEDAR CREEK SURFACE WATER MONITORING SITES

DIAGRAM B8: MONITORING SITE CEDAR US WATER LEVEL RECORDS

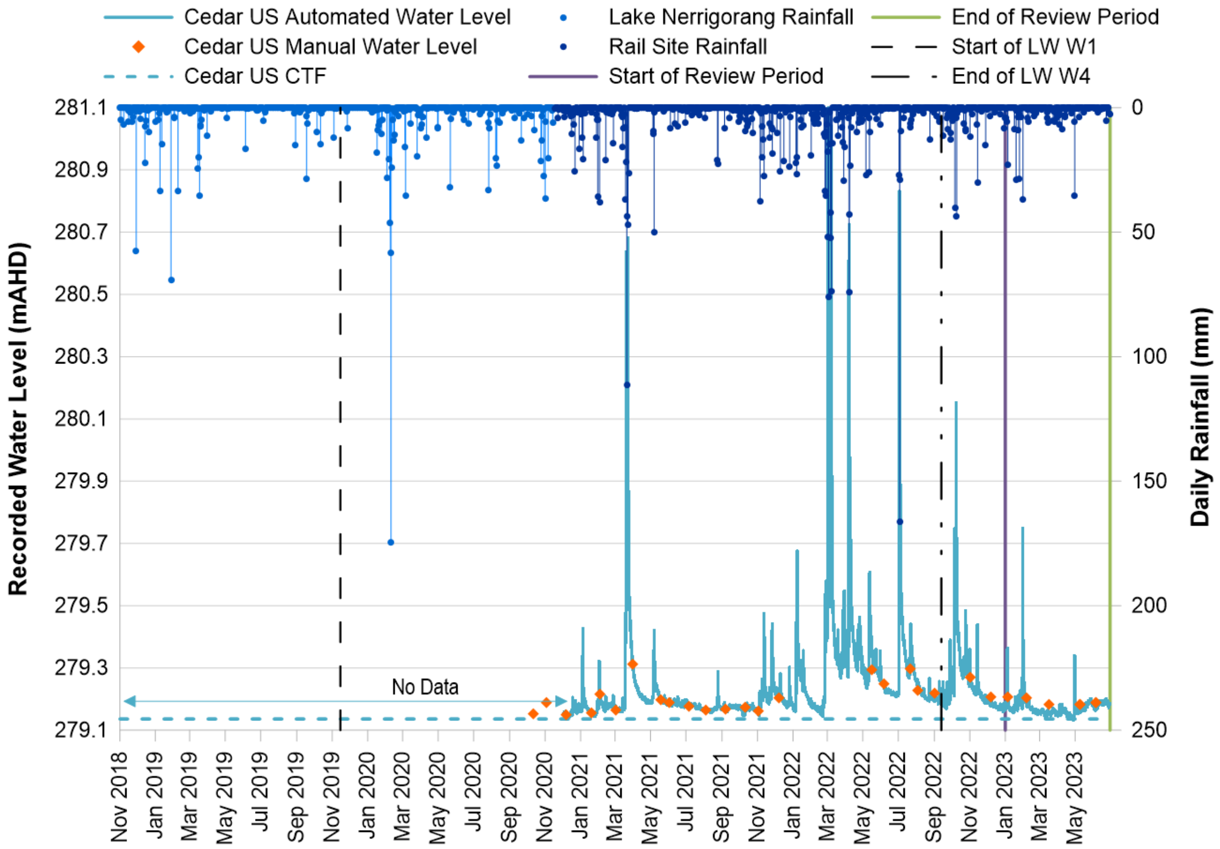


DIAGRAM B9: MONITORING SITE CC1A WATER LEVEL RECORDS

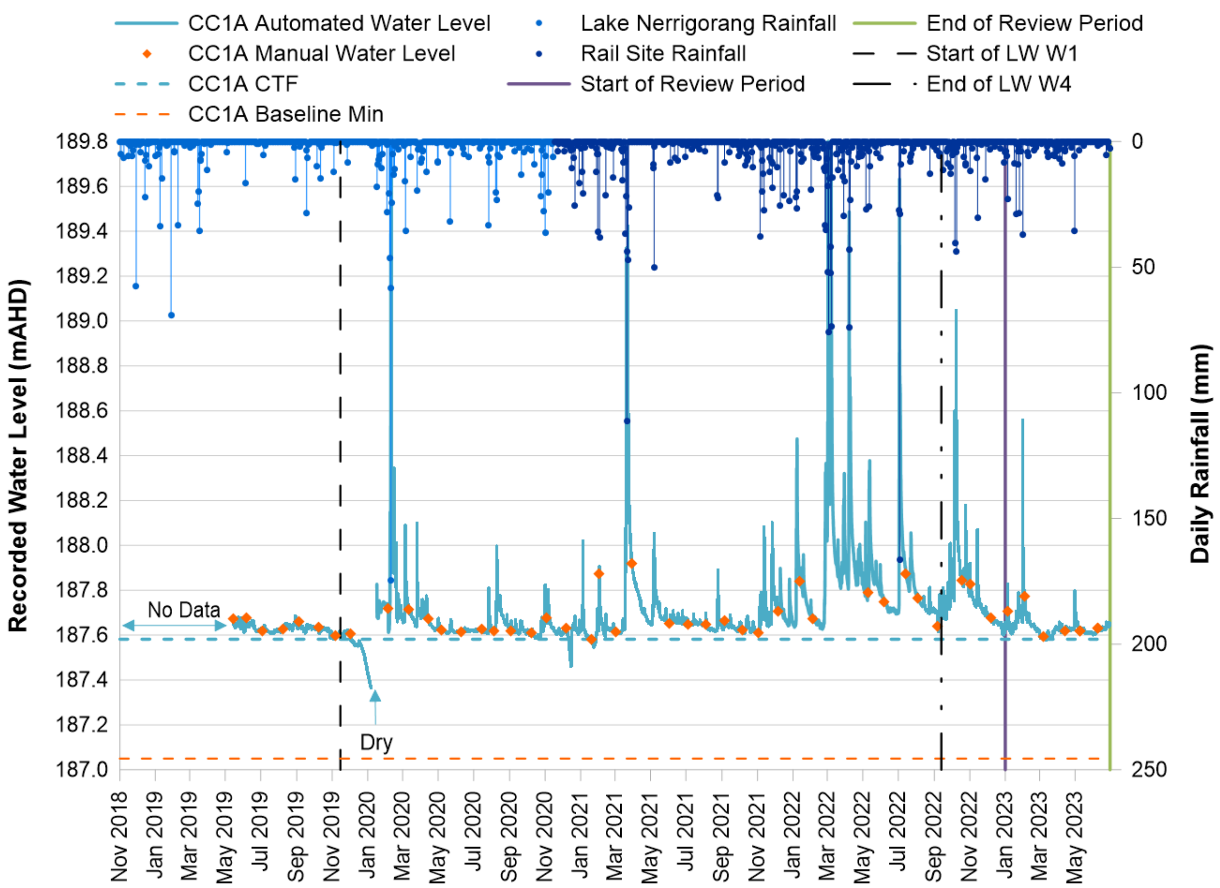


DIAGRAM B10: MONITORING SITE CA WATER LEVEL RECORDS

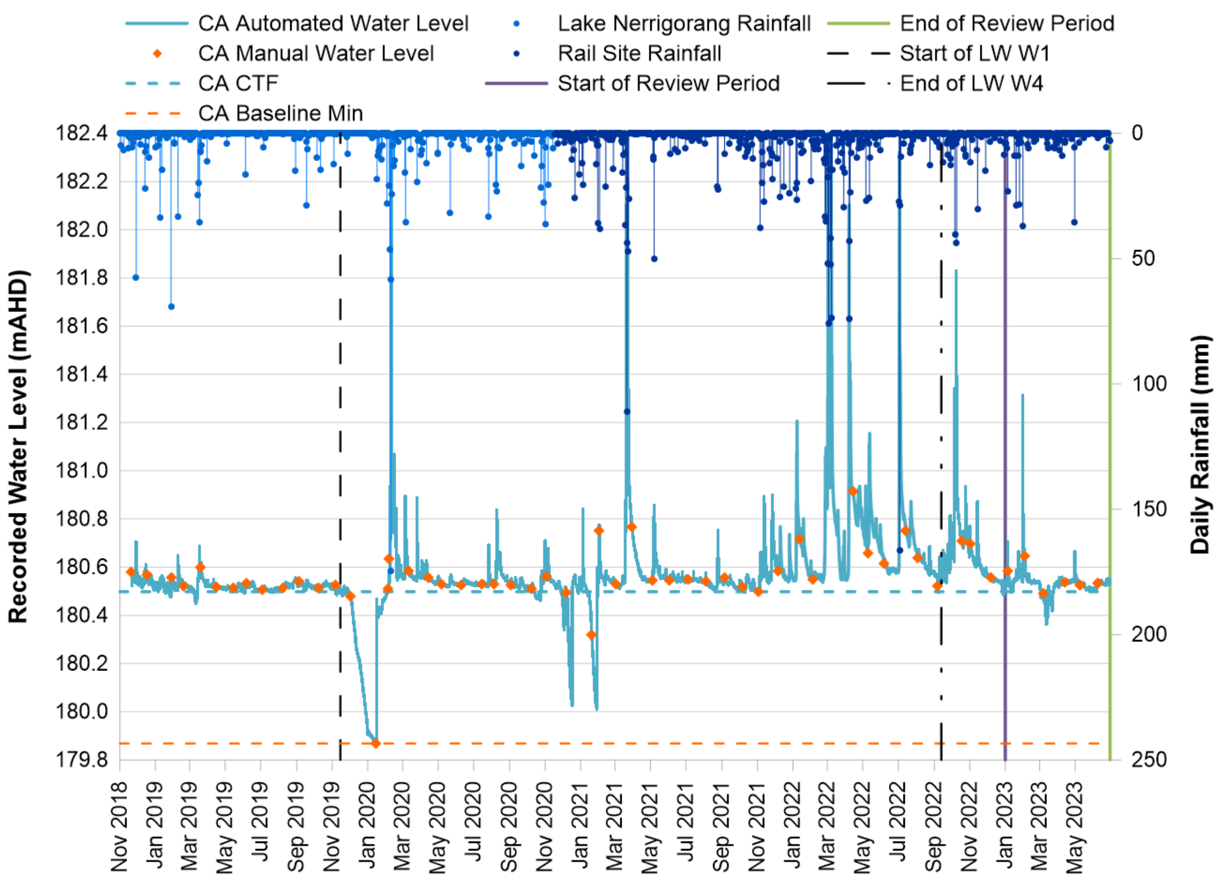


DIAGRAM B11: MONITORING SITE CB WATER LEVEL RECORDS

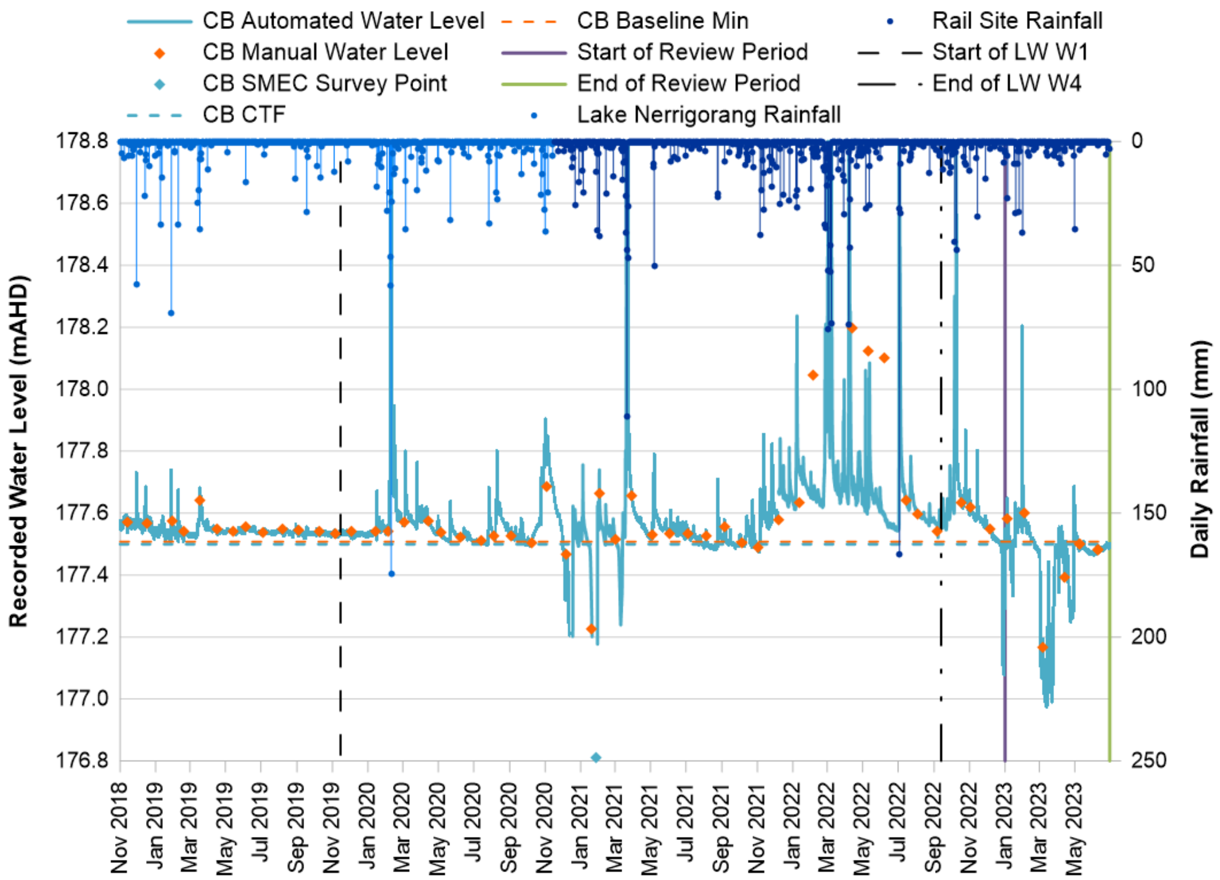


DIAGRAM B12: MONITORING SITE CC WATER LEVEL RECORDS

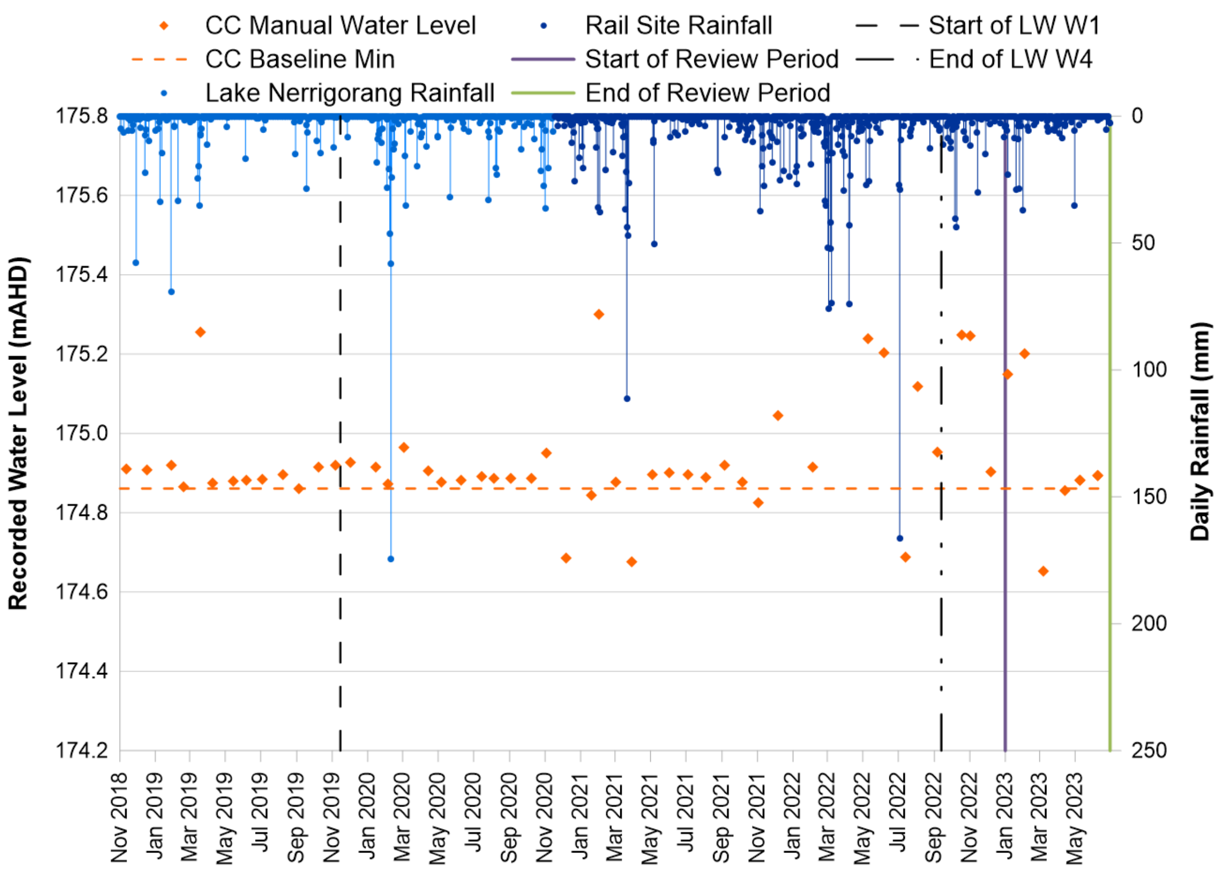


DIAGRAM B13: MONITORING SITE CD WATER LEVEL RECORDS

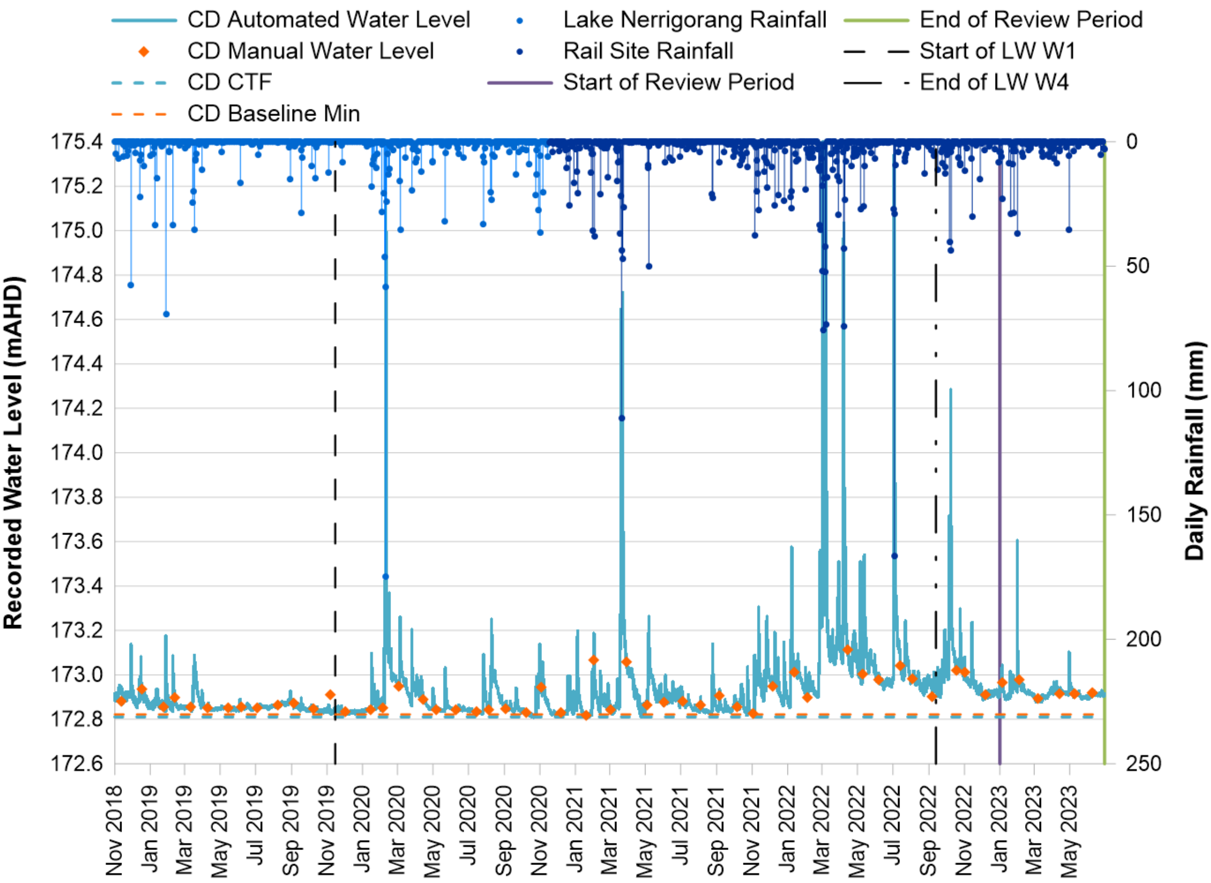


DIAGRAM B14: MONITORING SITE CE WATER LEVEL RECORDS

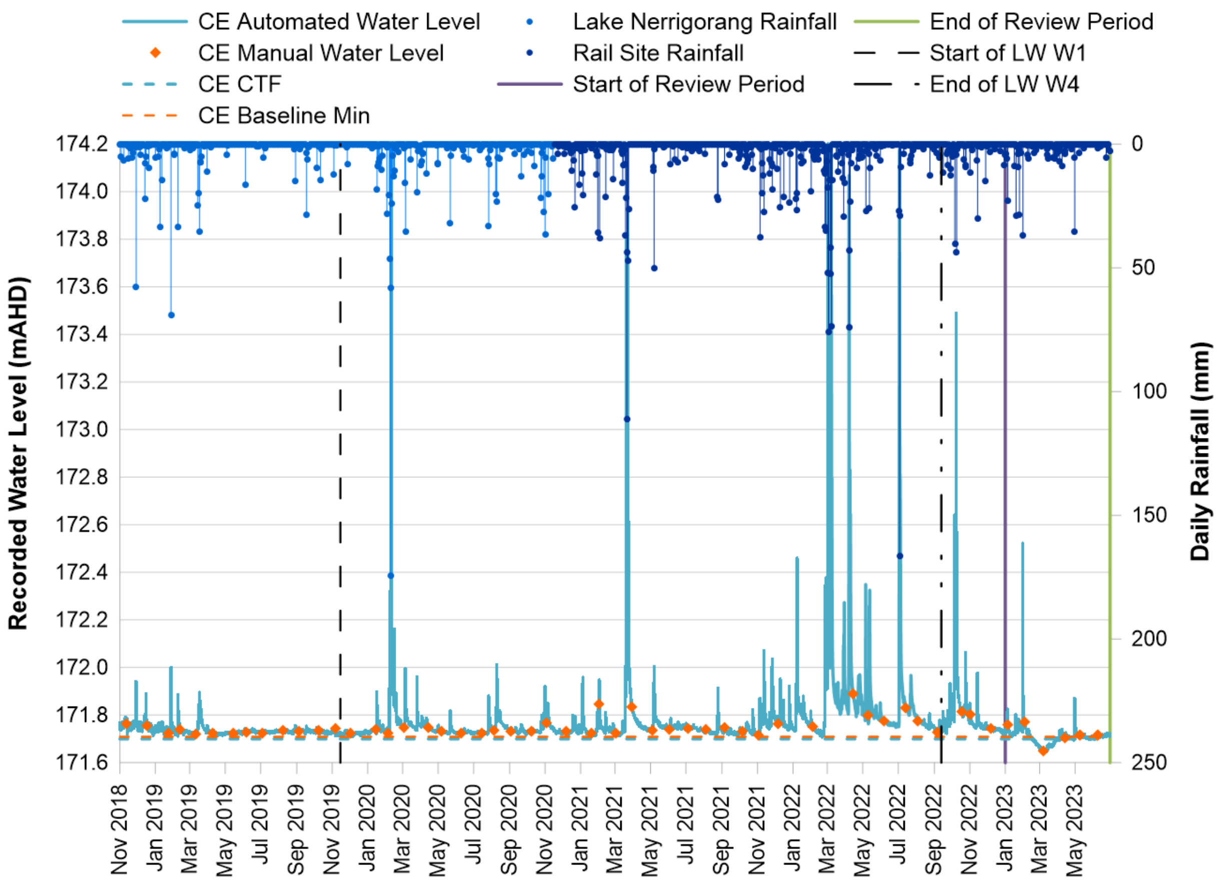


DIAGRAM B15: MONITORING SITE CF WATER LEVEL RECORDS

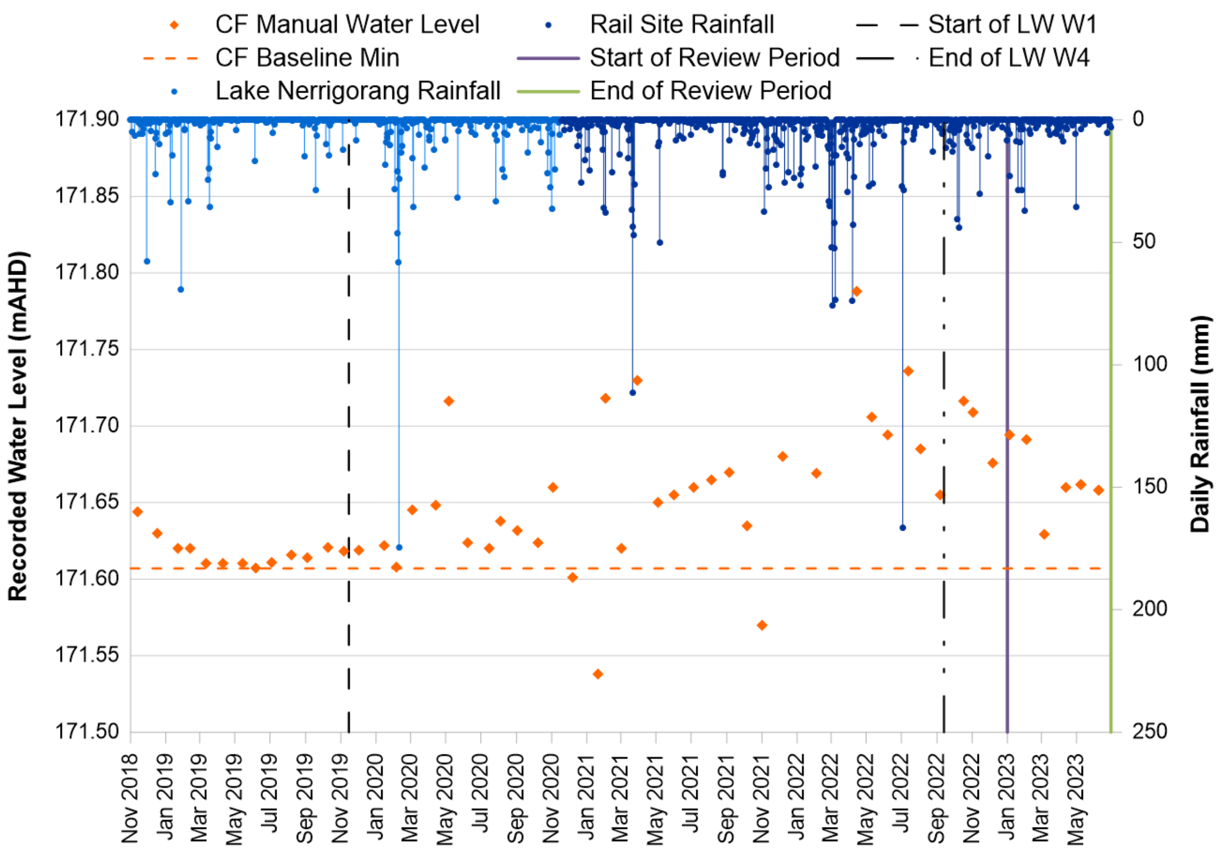
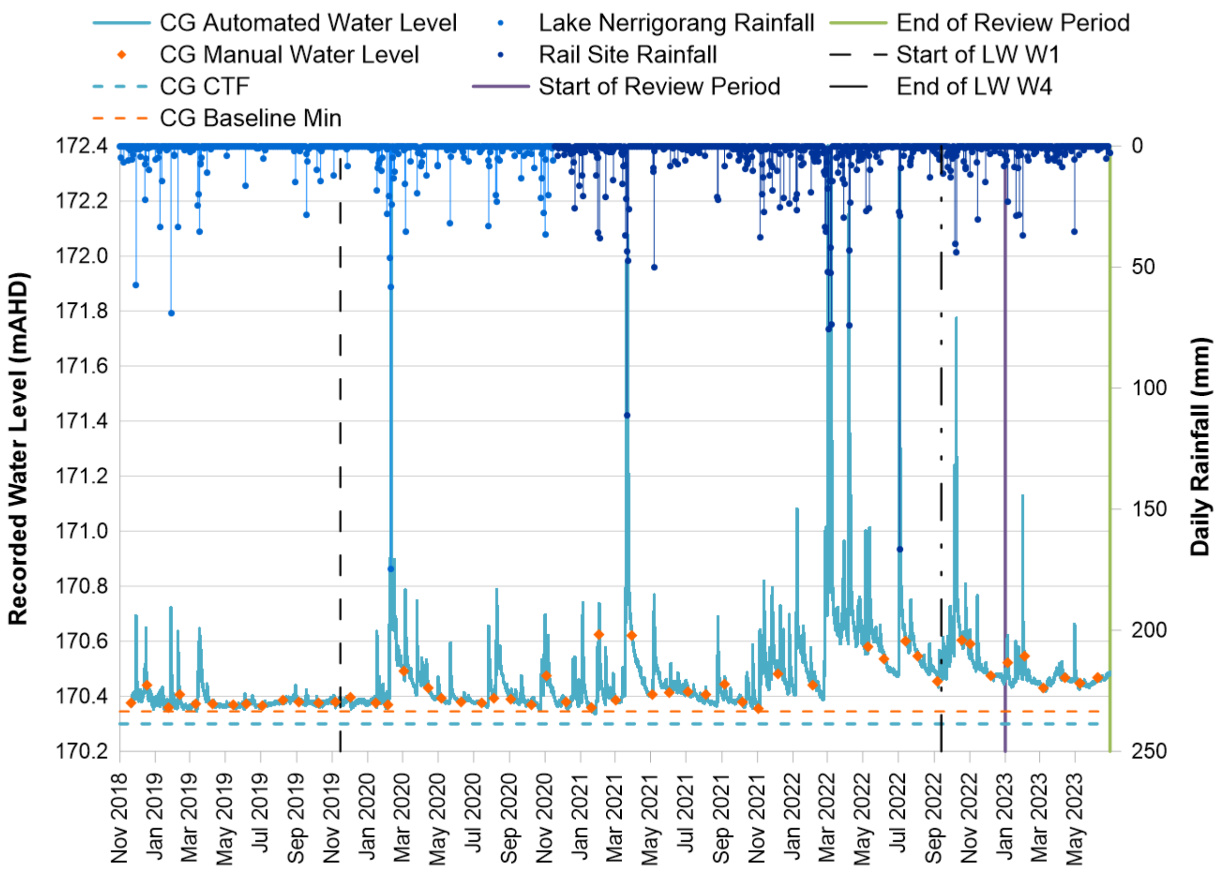


DIAGRAM B16: MONITORING SITE CG WATER LEVEL RECORDS



STONEQUARRY CREEK SURFACE WATER MONITORING SITES

DIAGRAM B17: MONITORING SITE SE WATER LEVEL RECORDS

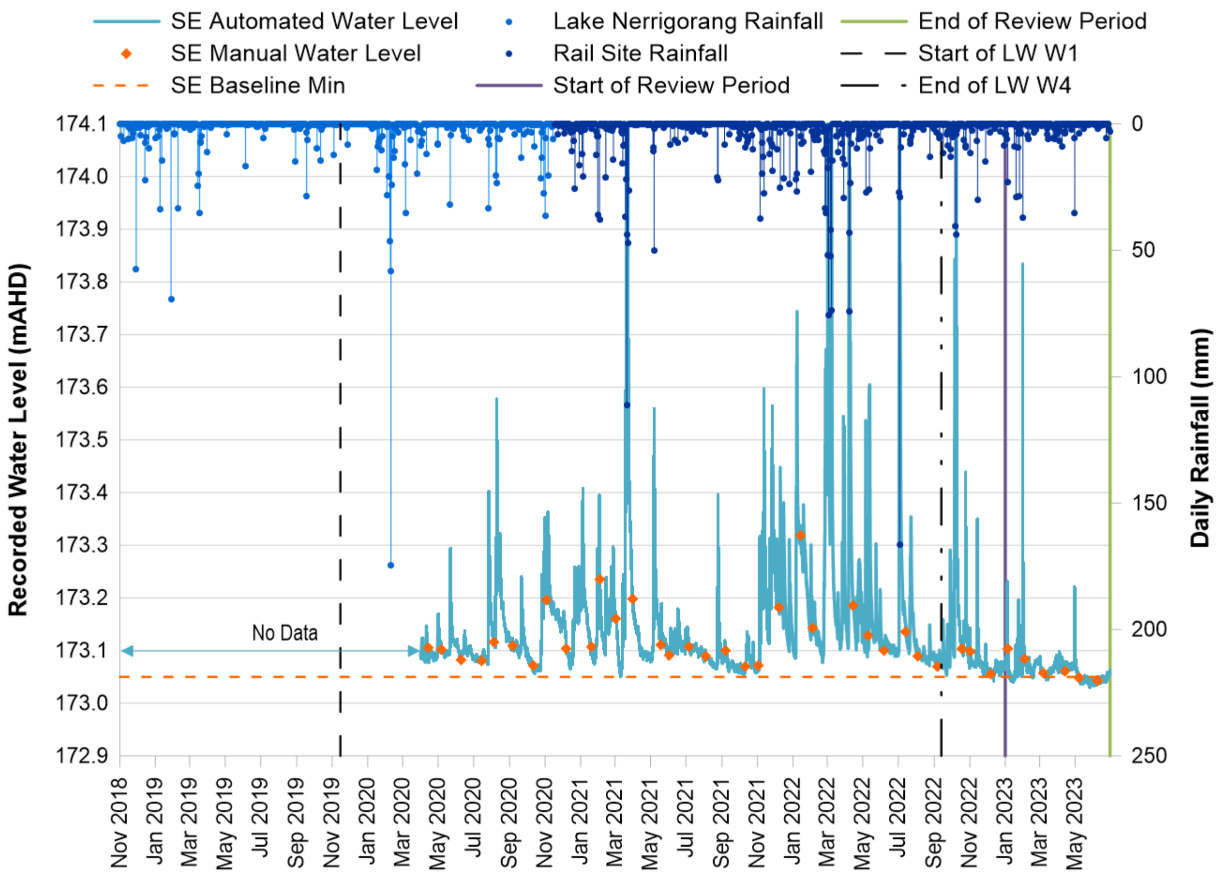
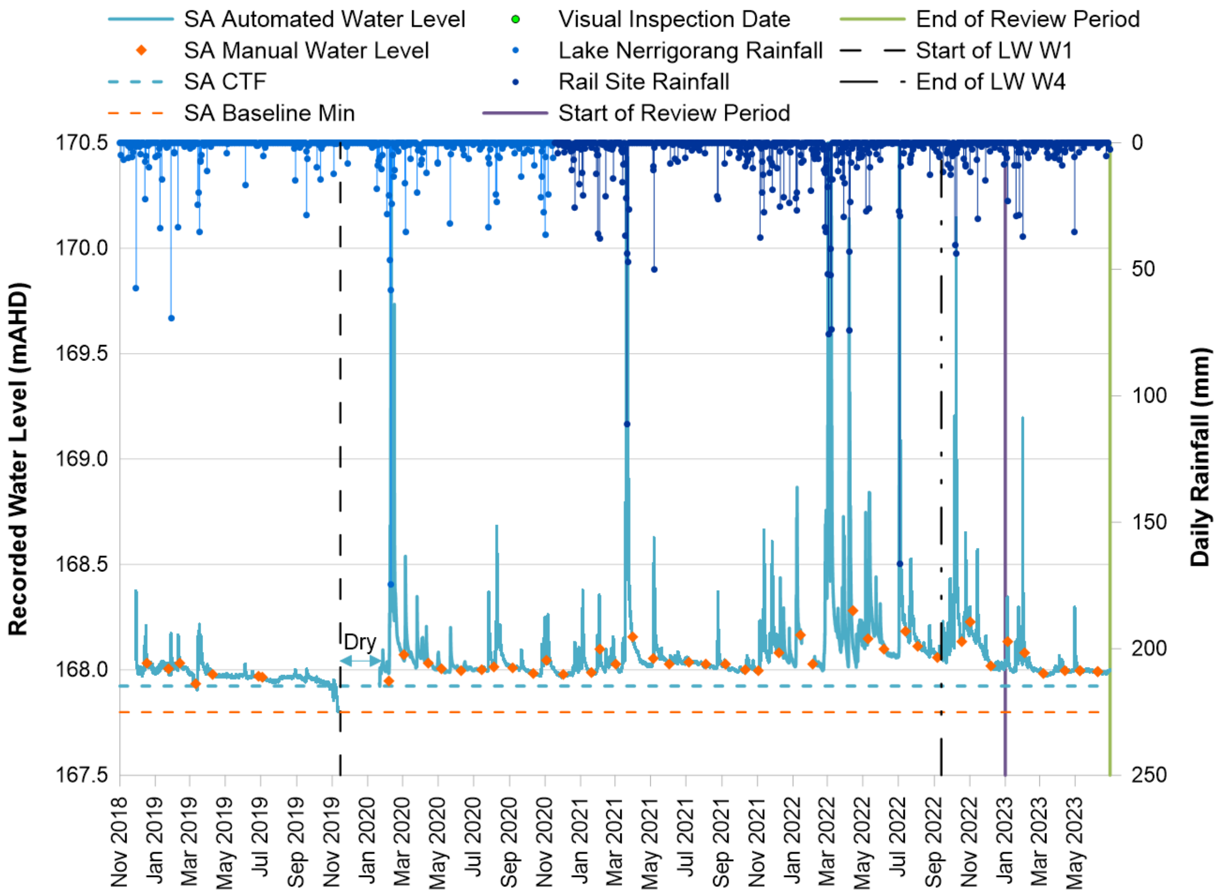
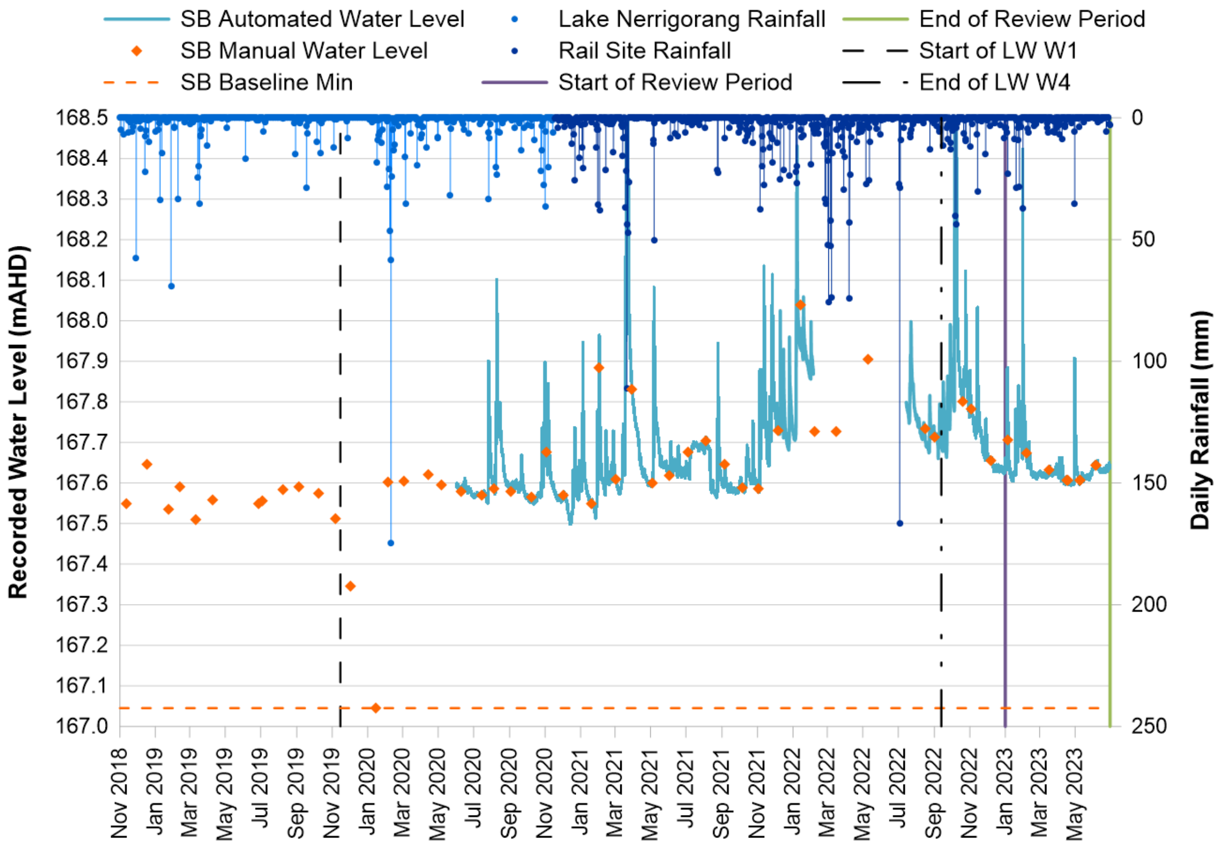


DIAGRAM B18: MONITORING SITE SA WATER LEVEL RECORDS[6]



[6] Between 15 January and 5 February 2022, an incomplete data download occurred at monitoring site SA, or the logger was not correctly restarted, and as such no data is available for this period.

DIAGRAM B19: MONITORING SITE SB WATER LEVEL RECORDS[7]



[7] The logger at monitoring site SB was washed away during a major rainfall event from late February to early March 2022 and as such data has not been collected since 5 February 2022. A manual water level measurement was unable to be recorded in April and June 2022 due to high flow.

DIAGRAM B20: MONITORING SITE SC WATER LEVEL RECORDS

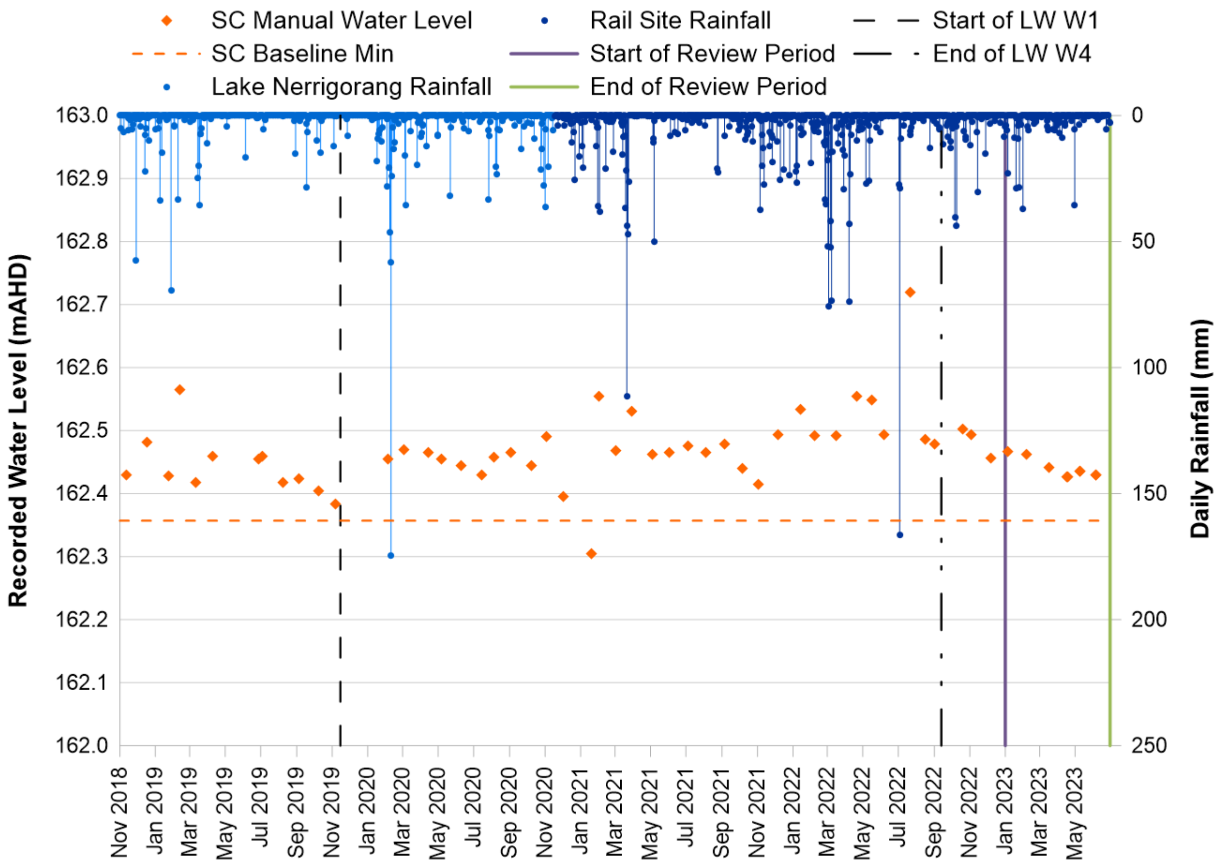
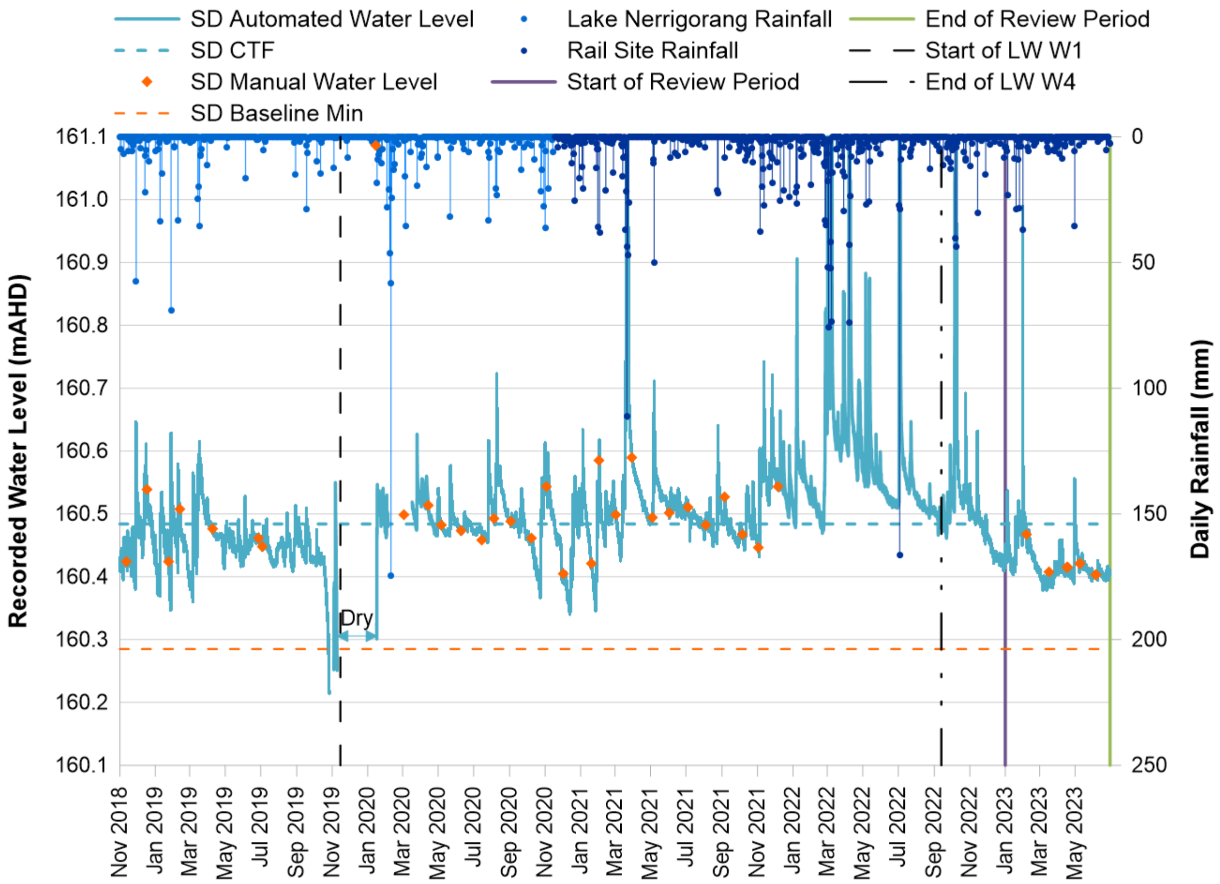


DIAGRAM B21: MONITORING SITE SD WATER LEVEL RECORDS[8]



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[8] The water level sensor has not been located and therefore records are not available from 7 December 2021.

APPENDIX C – WATER QUALITY PLOTS[9]

[9] When the recorded value was below the limit of reporting, the value has been plotted at the limit of reporting in the following plots.

DIAGRAM C1: FIELD PH RECORDS

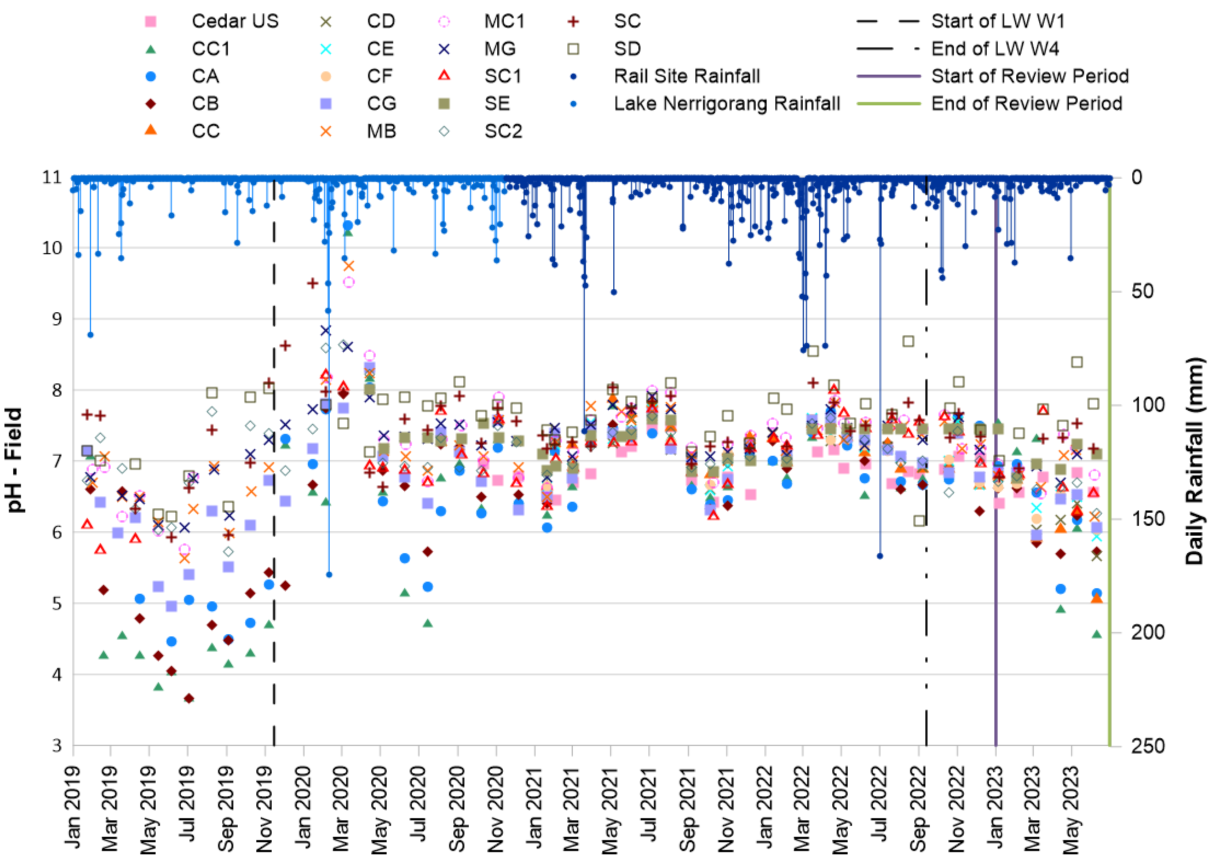


DIAGRAM C2: LABORATORY PH RECORDS

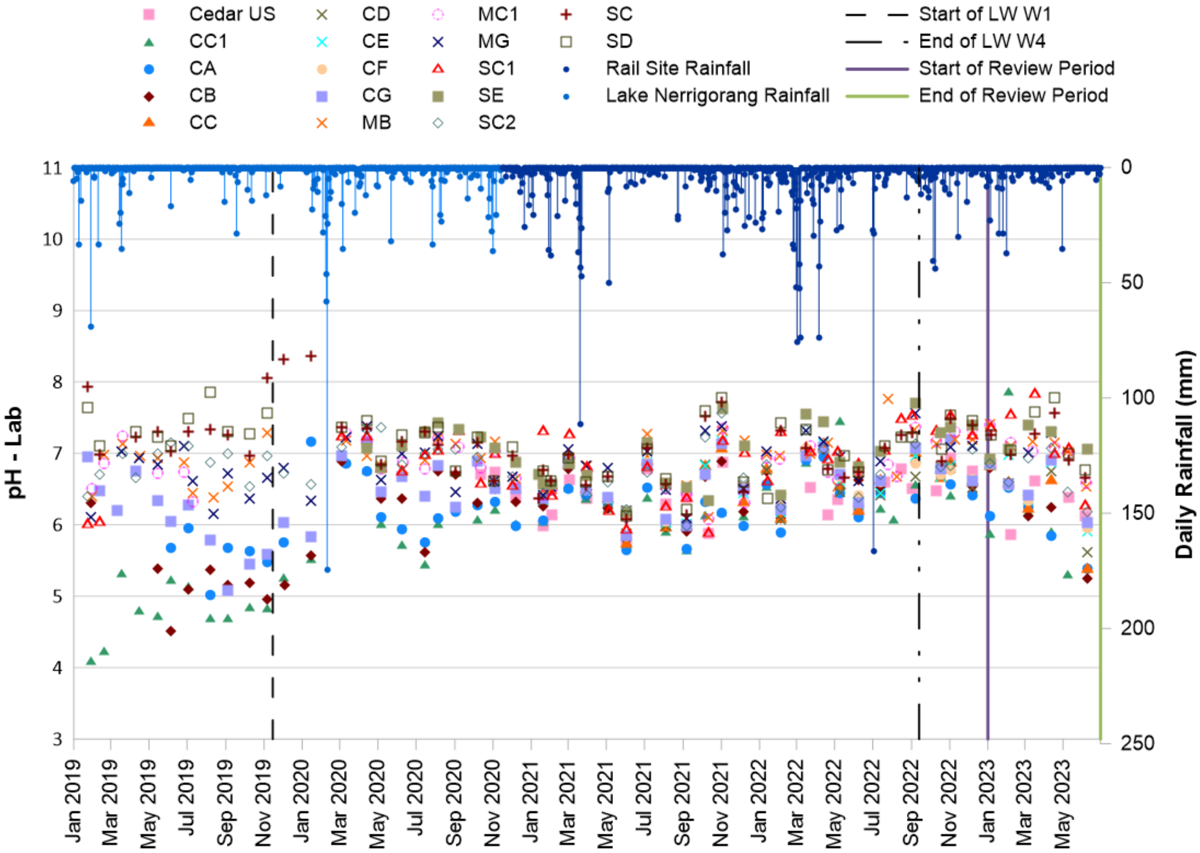


DIAGRAM C3: FIELD ELECTRICAL CONDUCTIVITY RECORDS

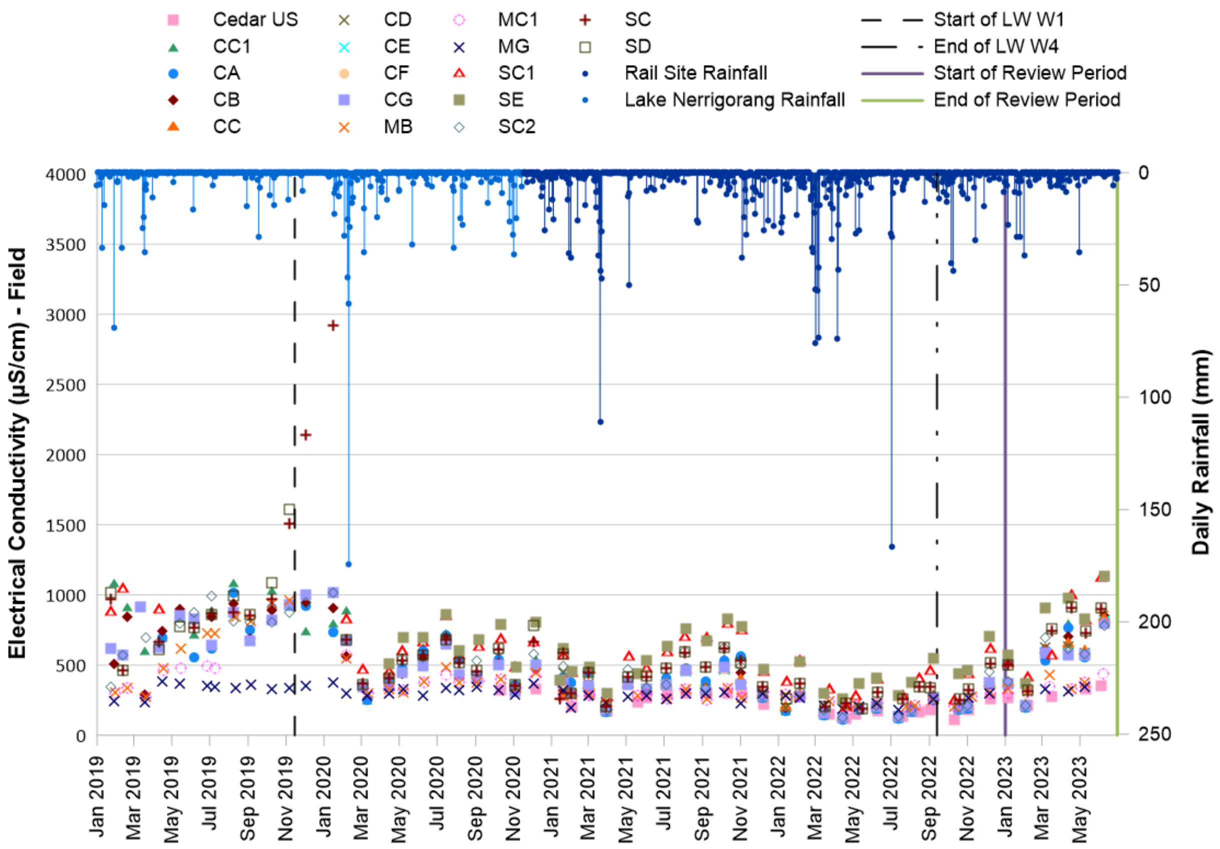


DIAGRAM C4: LABORATORY ELECTRICAL CONDUCTIVITY RECORDS

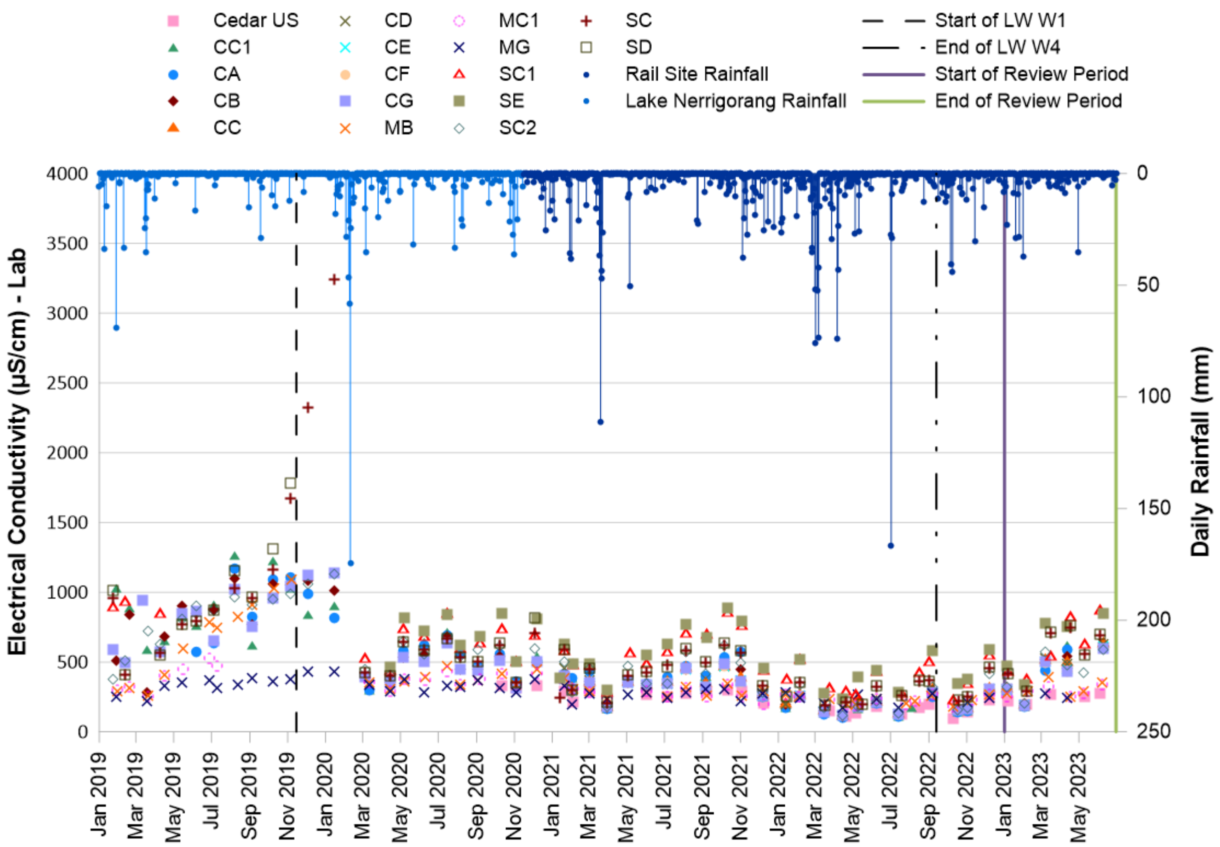


DIAGRAM C5: DISSOLVED ALUMINIUM RECORDS

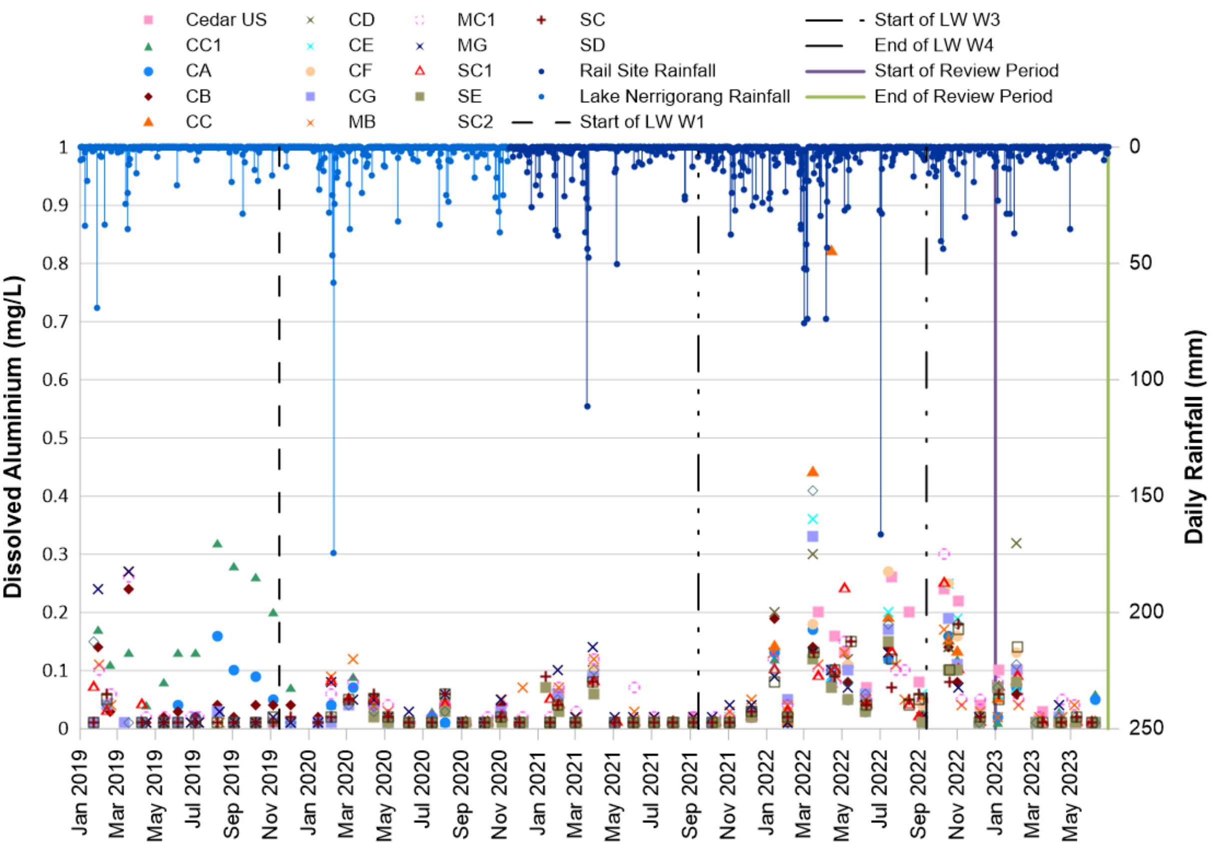


DIAGRAM C6: DISSOLVED BARIUM RECORDS

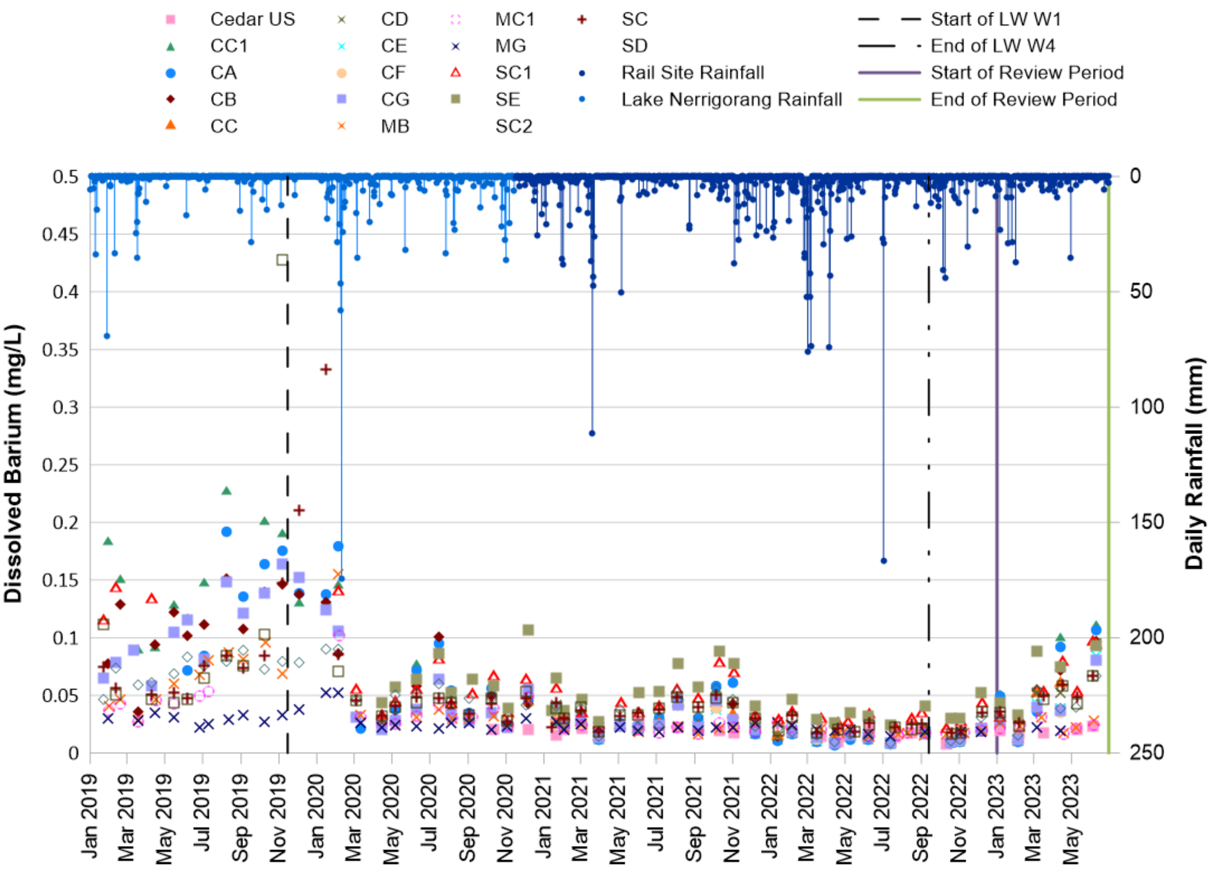


DIAGRAM C7: DISSOLVED IRON RECORDS

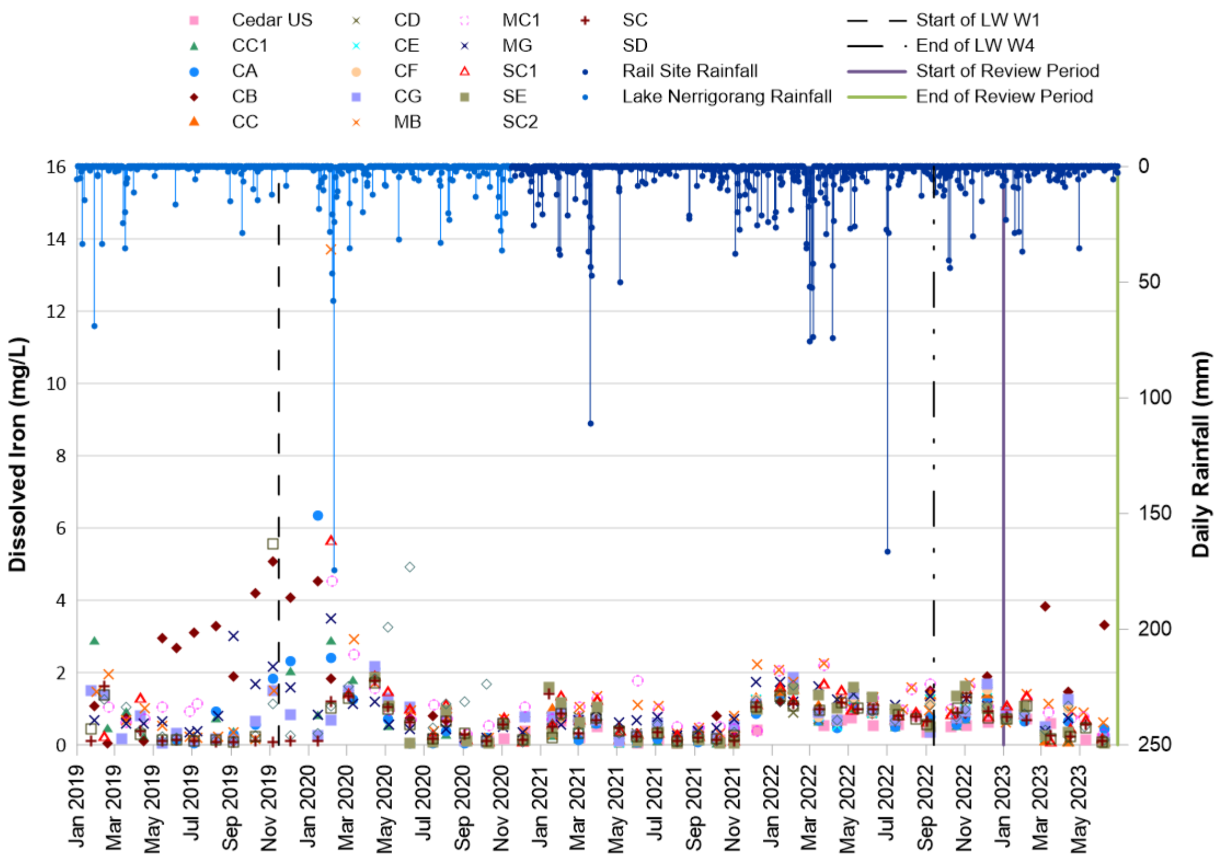


DIAGRAM C8: DISSOLVED MANGANESE RECORDS

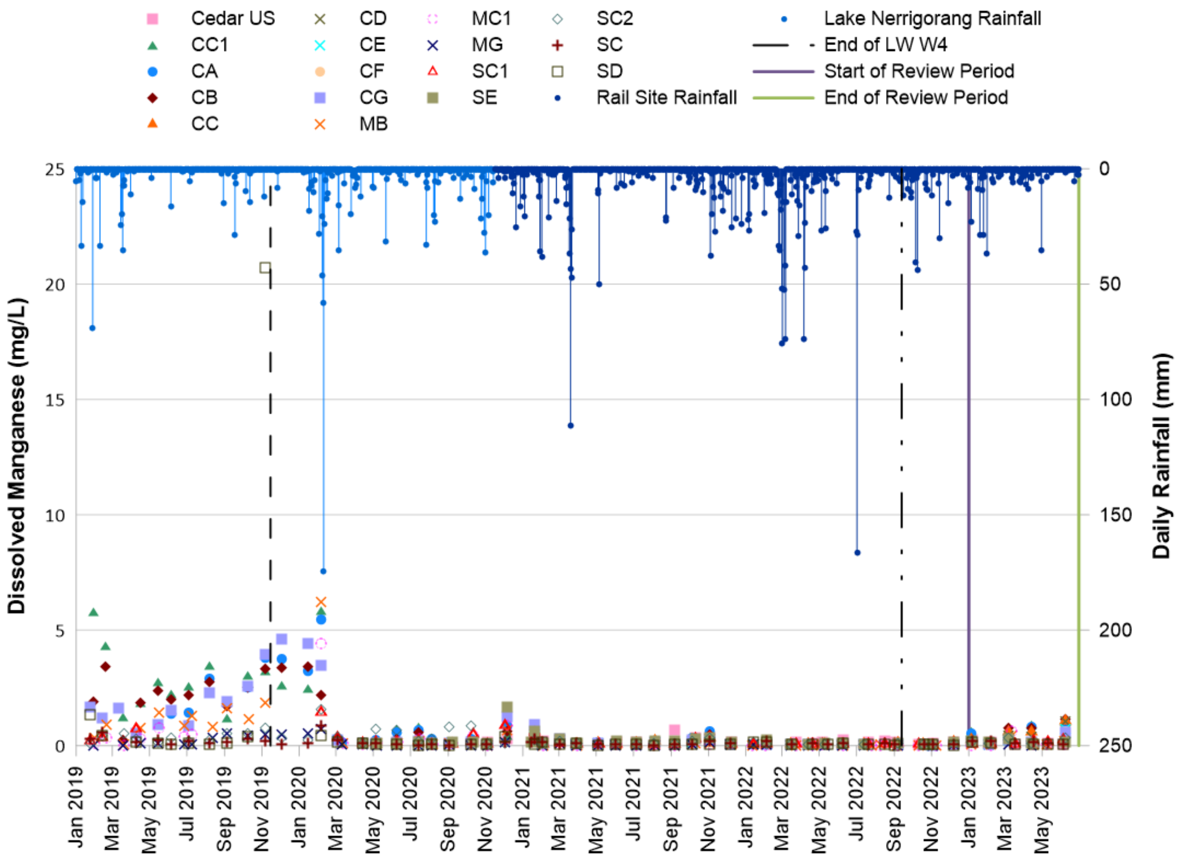


DIAGRAM C9: DISSOLVED NICKEL RECORDS

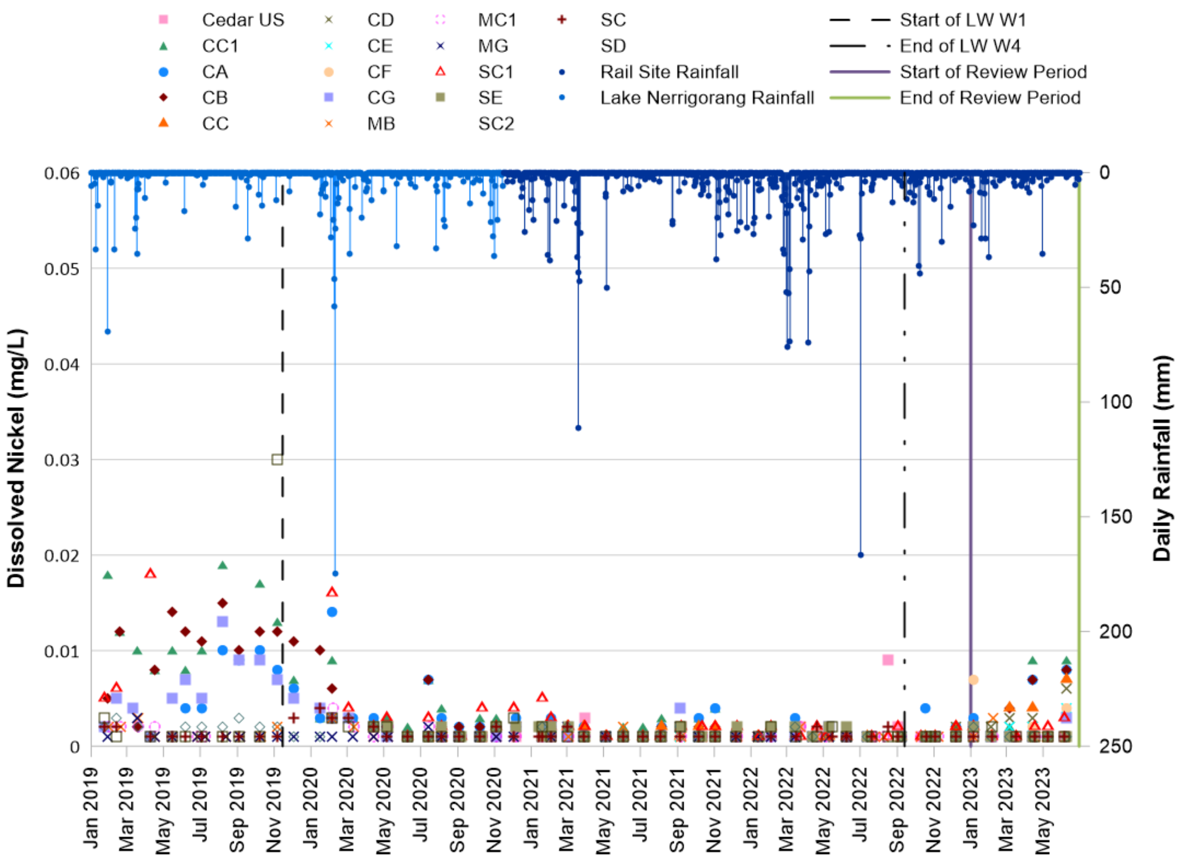


DIAGRAM C10: DISSOLVED ZINC RECORDS

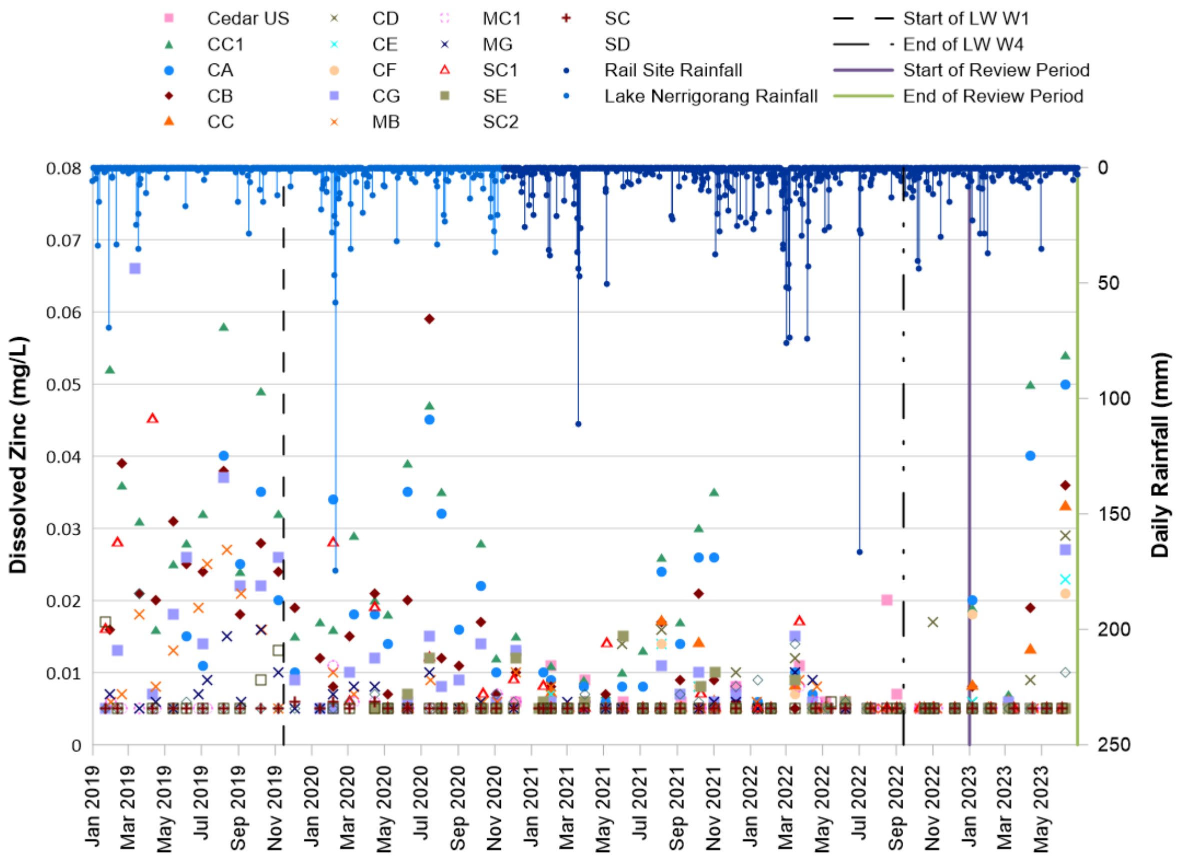
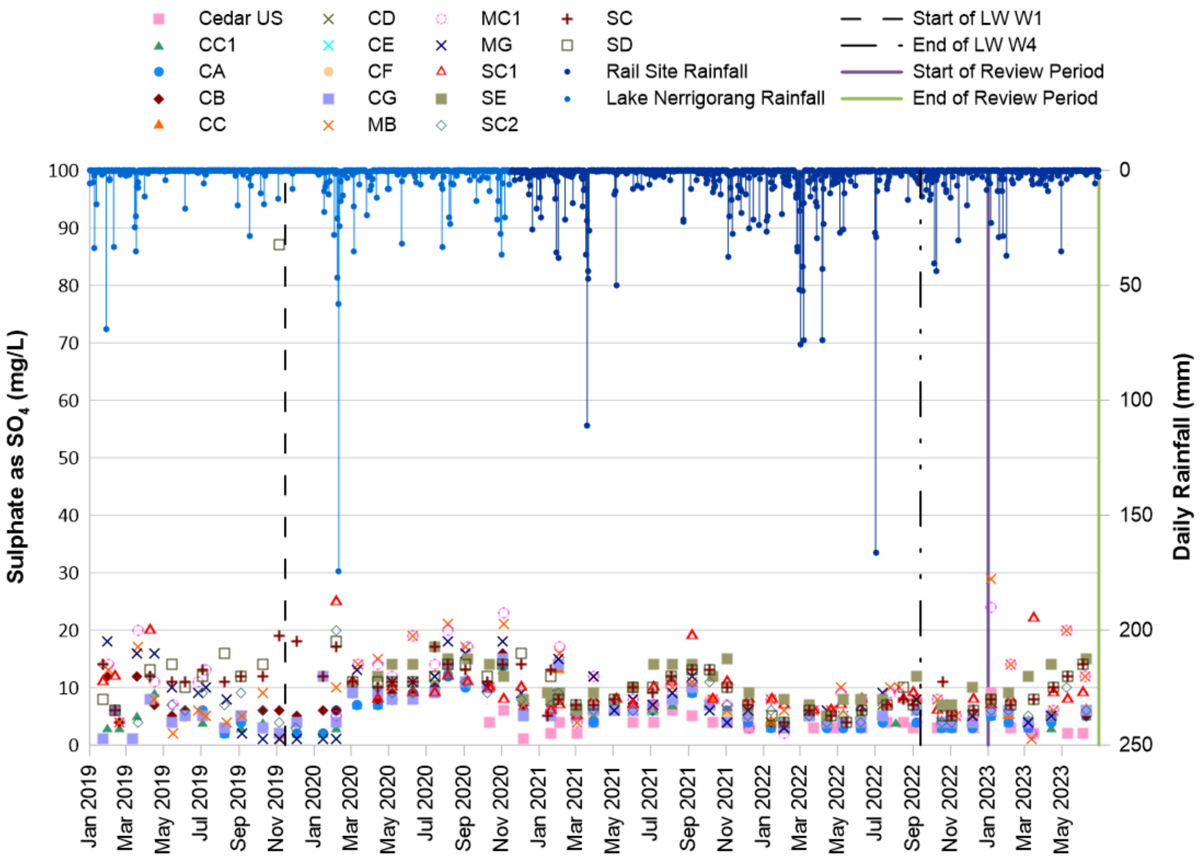


DIAGRAM C11: SULPHATE RECORDS



Appendix C – Creek Monitoring Report

Brienen Environment & Safety
15/17 Cemetery Rd
Helensburgh NSW 2508

SIMEC Mining – Tahmoor Coking Coal
Remembrance Driveway
TAHMOOR NSW 2573

Attention: April Hudson

RE: Longwall West 4 Creek Monitoring:

29 January 2023 Stonequarry Creek SR17 and SR20

April,

Please find discussed below observations at SR17 and SR20 in Stonequarry Creek from the survey conducted on the 29 January 2023

Stonequarry Creek

On 29 January 2023 a visual inspection of the previous fracturing at Stonequarry site SR17 and SR20 near the subsidence area of Longwall West 4 was conducted. Previous surveys in 2022, identified potential mine-induced surface fracturing at SR17 Rockbar, most of which has now sheared away. The previous inspections also noted the presence of tyre tracks near the grinding grooves, and some type of plastic residue marking the area. This has not changed since the last inspection in January 2023

In June 2022, surveyors observed a fluctuation of the depression associated with the quarried stone removed from the west side of Stonequarry at SR17. Despite this, no reduction in the level of the SR17 pool or overland flow was noted during the current inspection.

During July 2022's inspection surface fracturing was identified at SR20, with one new crack (1) and another crack (2) associated with an existing joint or discontinuity. Both cracks appear to have stopped growing, with crack (1) stabilising at 6600 mm in length and its maximum width at 26.75 mm and Crack (2), the joint, stabilising at 2900 mm long and 12.75 mm at its maximum width. The cracks will be monitored further during the February 2023 quarterly inspection and subsequent quarterly inspections. This will allow for any changes in the cracks to be noted and assessed.

- MSEC indicated during the Environmental Response Group (held 17 January 2023) that there was no measurable change associated with the fracturing based on the latest survey.

- ATC Williams indicated during the Environmental Response Group (held 17 January 2023) that there is no indication of water level impact.

Brienen Environment & Safety
15/17 Cemetery Rd
Helensburgh NSW 2508

There was no gas release, reduction in pool flow or connective overland flow observed at any other observed site along Stonequarry Creek.

Sites SR17 at SR20 are both at TARP Level 3.

Brienen Environment & Safety
15/17 Cemetery Rd
Helensburgh NSW 2508

Figure 1 Stonequarry Creek Tarp

Brienen Environment & Safety
15/17 Cemetery Rd
Helensburgh NSW 2508

SIMEC Mining – Tahmoor Coking Coal
Remembrance Driveway
TAHMOOR NSW 2573

Attention: April Hudson

RE: Longwall West 4 Creek Monitoring:

23 February 2023 (Matthews, Cedar and Stonequarry Creeks)

April,

Please find discussed below observations in Mathews, Cedars and Stonequarry Creeks from surveys conducted on the 8 February 2023

Stonequarry Creek

On 8th February 2023, visual inspections were conducted on Stonequarry Creek's pools and associated rock bars near the subsidence area of Longwall West 4. Previous surveys in 2022, identified potential mine-induced surface fracturing at SR17 Rockbar, most of which has now sheared away. The previous inspections also noted the presence of tyre tracks near the grinding grooves, and some type of plastic residue marking the area. This has not changed since the last inspection in January 2023

In June 2022, surveyors observed a fluctuation of the depression associated with the quarried stone removed from the west side of Stonequarry at SR17. Despite this, no reduction in the level of the SR17 pool or overland flow was noted during the current inspection.

During July 2022's inspection surface fracturing was identified at SR20, with one new crack (1) and another crack (2) associated with an existing joint or discontinuity. Both cracks appear to have stopped growing, with crack (1) stabilising at 6600 mm in length and its maximum width at 26.75 mm and Crack (2), the joint, stabilising at 2900 mm long and 12.75 mm at its maximum width. The cracks will be further monitored on a quarterly basis.

- MSEC indicated during the Environmental Response Group (held 21 February 2023) that there was no measurable change associated with the fracturing based on the latest survey.

- ATC Williams indicated during the Environmental Response Group (held 21 February 2023) that there is no indication of water level impact.

Brienen Environment & Safety
15/17 Cemetery Rd
Helensburgh NSW 2508

There was no gas release, reduction in pool flow or connective overland flow observed at any other observed site along Stonequarry Creek.

Sites SR17 at SR20 are both at TARP Level 3. All other sites along Stonequarry Creek were a TARP Level 1.

Cedar Creek

Visual inspections of Cedar Creek's pools and associated rock bars adjacent to Longwall West 3 and West 4 active subsidence area were conducted on 8 February 2023. The inspections at the sites shown in **Figure 2,** indicated that no mine-induced surface fracturing, gas release, reduction in pool levels or connective overland flow was observed. Iron-oxy hydroxide precipitation has significantly reduced due to the 30 mm of rain on the 14th of November 2022. Turbidity has significantly reduced since the last inspection in November 2022, due to no rain in the previous 8 days.

All observed Cedar Creek sites were within TARP Level 1 for the observations of individual pool water level and flow, iron oxyhydroxide precipitation and gas releases as compared to previous surveys or the baseline survey conducted in August 2019.

Matthews Creek

Inspections adjacent to Longwall West 4 active subsidence area of Matthews Creek between sites MB1 and MR46 on 31 January 2023 and 8 February 2023 as shown in **Figure 3**. The identified iron oxy-hydroxide precipitates at MB1 during the November 2022 quarterly inspection are no longer present, after approximately 80 mm of rain fell in Picton on the 30th of January 2023.

No gas discharge was observed in Matthews Creek pool MR45 on 31 January 2023.

All observed Matthew Creek sites were therefore within TARP Level 1 for the observations of individual pool water level and flow, iron oxyhydroxide precipitation and gas releases as compared to previous surveys or the baseline survey conducted in August 2019.

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Helensburgh NSW 2508

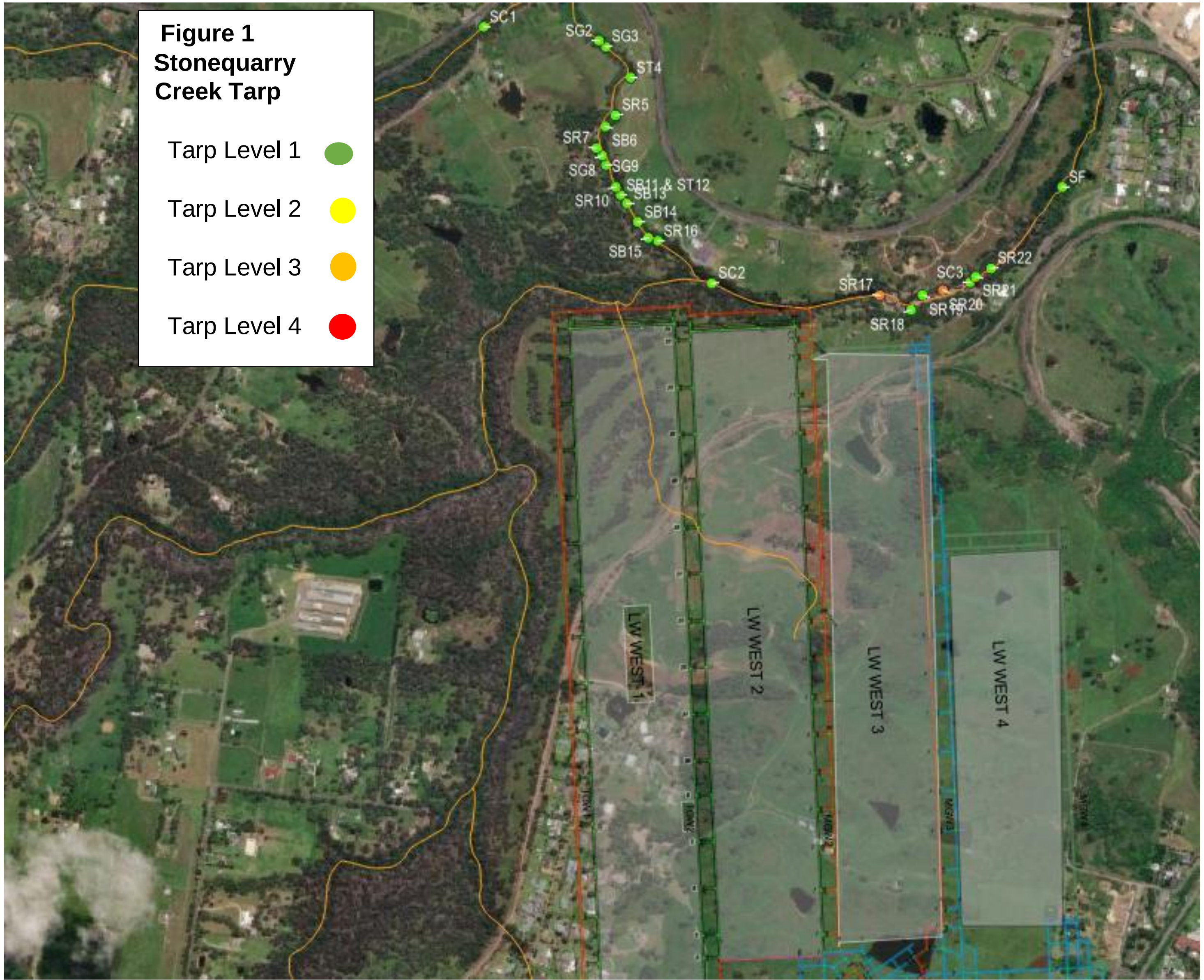

Figure 1
Stonequarry Creek Tarp

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15/17 Cemetery Rd
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Figure 2
Cedar Creek Tarp

Tarp Level 1

Tarp Level 2

Tarp Level 3

Tarp Level 4

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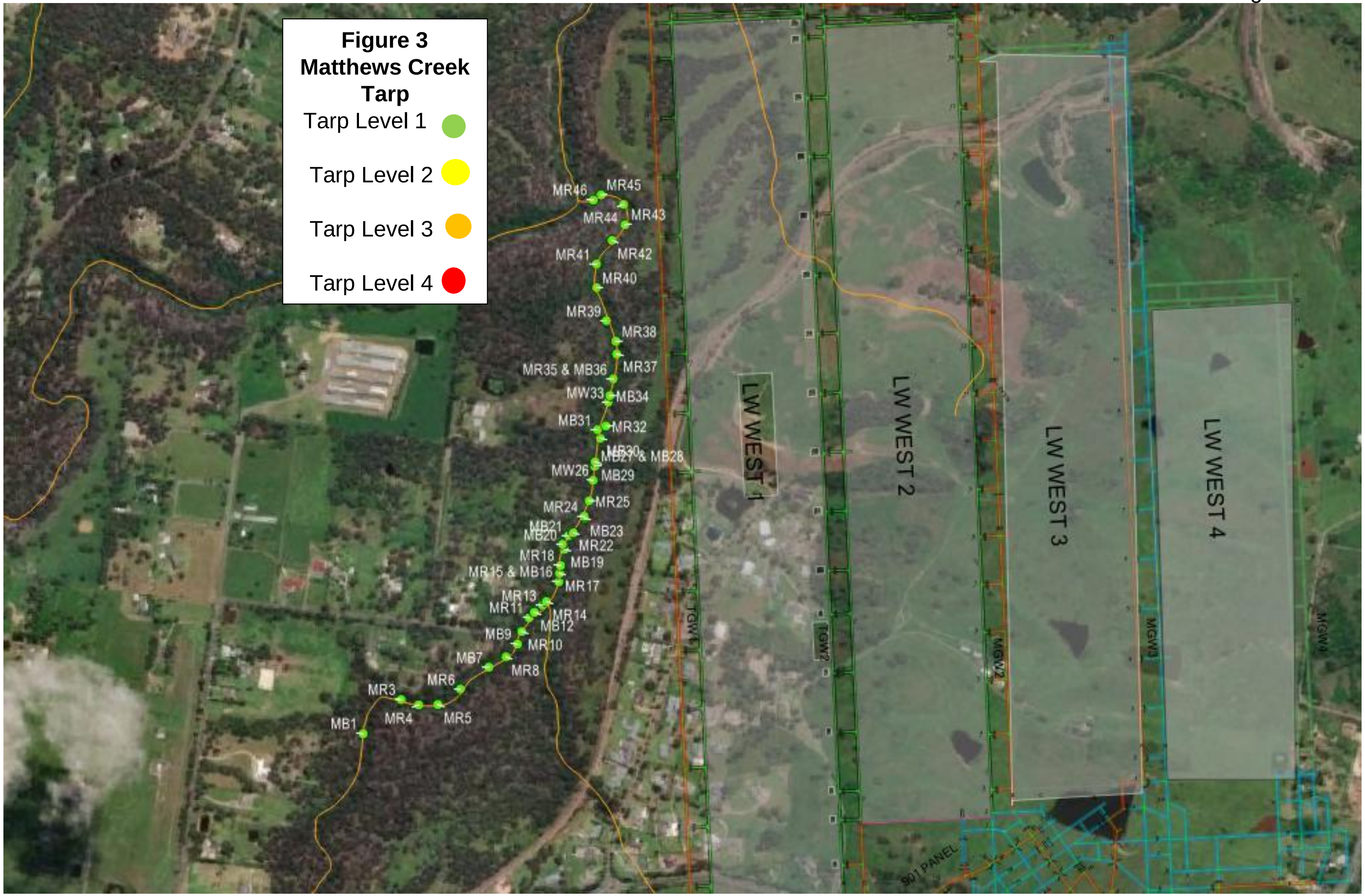

Brienen Environment & Safety
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Helensburgh NSW 2508

SIMEC Mining – Tahmoor Coking Coal
Remembrance Driveway
TAHMOOR NSW 2573

Attention: April Hudson

RE: Longwall West 4 Creek Monitoring:

15 May 2023 (Matthews, Cedar and Stonequarry Creeks)

April,

Please find discussed below observations in Mathews, Cedars and Stonequarry Creeks from surveys conducted on 10 May 2023

Stonequarry Creek

Visual inspections were conducted on Stonequarry Creek's pools and associated rock bars near the subsidence area of Longwall West 4 on 10 May 2023. Previous surveys in 2022 identified potential mine-induced surface fracturing at SR17 Rockbar, most of which has now sheared away. The previous inspections also noted the presence of tyre tracks near the grinding grooves and some type of plastic residue marking the area, which has not changed since the last inspection in February 2023.

In June 2022, surveyors observed a fluctuation of the depression associated with the quarried stone removed from the west side of Stonequarry at SR17. However, no reduction in the level of the SR17 pool or overland flow was noted during the current inspection.

During July 2022's inspection, surface fracturing was identified at SR20. One new crack (1) and another crack (2) associated with an existing joint or discontinuity were observed. Both cracks appear to have stopped growing, with crack (1) stabilizing at 6600 mm in length and its maximum width at 26.75 mm. Crack (2), the joint, stabilized at 2900 mm in length and 12.75 mm at its maximum width. The cracks will be further monitored on a quarterly basis.

- MSEC indicated during the Environmental Response Group (held 21 February 2023) that there was no measurable change associated with the fracturing based on the latest survey.

- ATC Williams indicated during the Environmental Response Group (held 21 February 2023) that there is no indication of water level impact.

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There was no gas release, reduction in pool flow or connective overland flow observed at any other observed site along Stonequarry Creek.

Sites SR17 at SR20 are both at TARP Level 3. All other sites along Stonequarry Creek were a TARP Level 1.

Cedar Creek

Visual inspections of Cedar Creek's pools and associated rock bars adjacent to Longwall West 3 and West 4 active subsidence area were conducted on 10 May 2023. The inspections at the sites shown in **Figure 2,** indicated that no mine-induced surface fracturing, gas release, reduction in pool levels or connective overland flow was observed. Iron-oxy hydroxide precipitation has significantly reduced due to the 42 mm of rain on the 30th of April 2023.

All observed Cedar Creek sites were within TARP Level 1 for the observations of individual pool water level and flow, iron oxyhydroxide precipitation and gas releases as compared to previous surveys or the baseline survey conducted in August 2019.

Matthews Creek

Inspections adjacent to Longwall West 4 active subsidence area of Matthews Creek between sites MB1 and MR46 on 10 May 2023 as shown in **Figure 3**.

No gas discharge was observed in Matthews Creek pool MR45 on 10 May 2023.

All observed Matthew Creek sites were therefore within TARP Level 1 for the observations of individual pool water level and flow, iron oxyhydroxide precipitation and gas releases as compared to previous surveys or the baseline survey conducted in August 2019.

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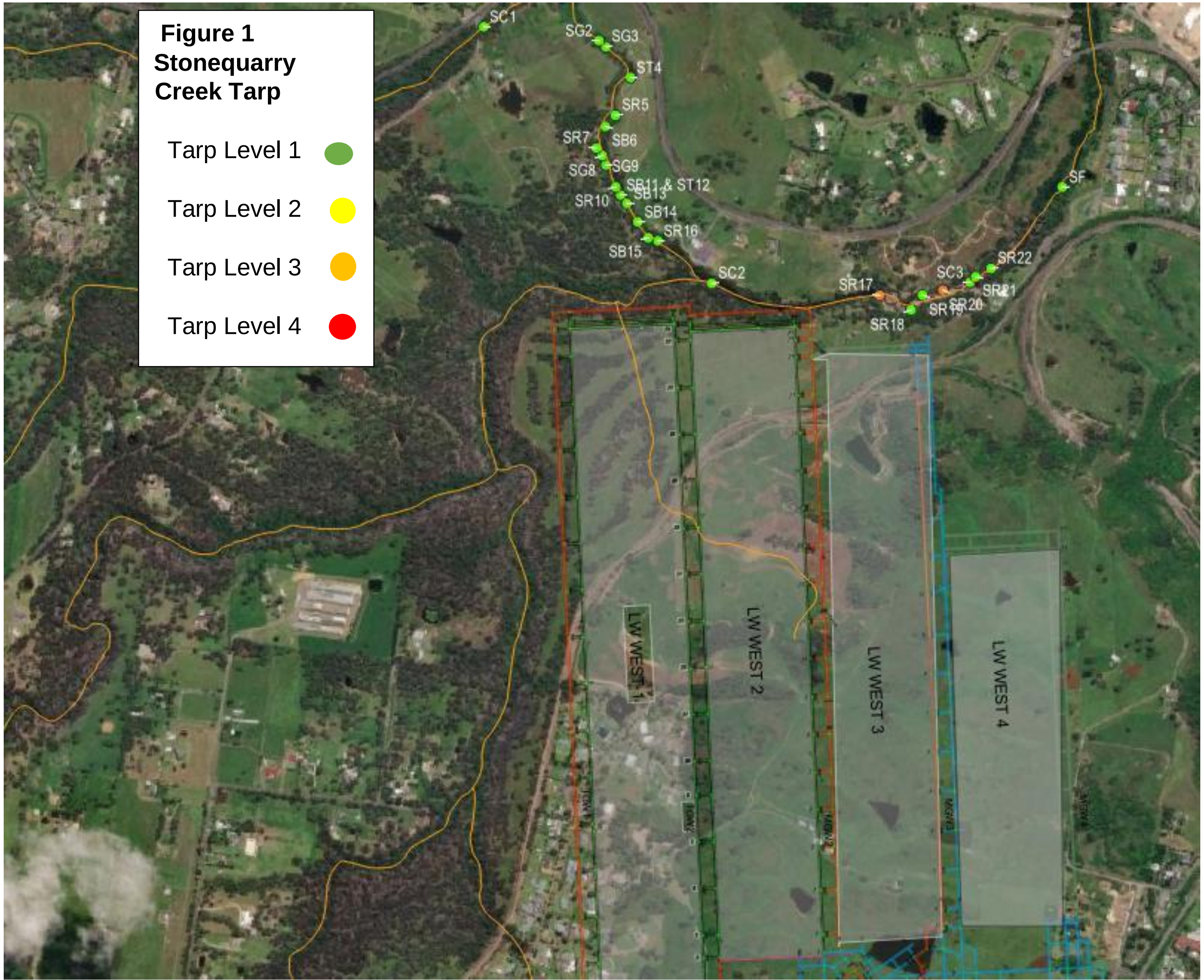

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Figure 2
Cedar Creek Tarp

Tarp Level 1

Tarp Level 2

Tarp Level 3

Tarp Level 4

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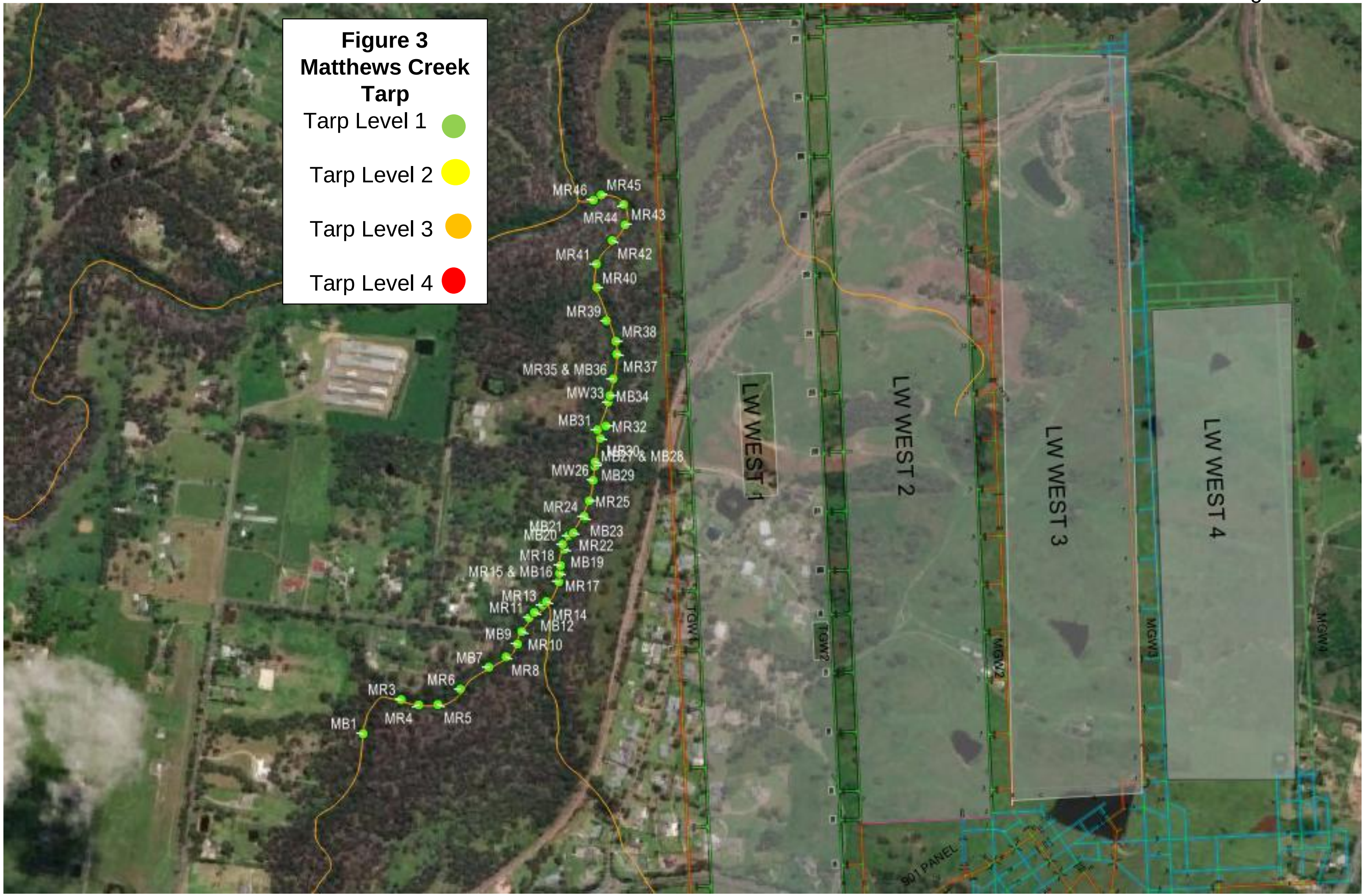
Helensburgh NSW 2508



Appendix D – Groundwater Monitoring Report

Six-monthly Groundwater Reporting: January – June 2023

Tahmoor Western Domain

Tahmoor Coal Pty Ltd

2975 Remembrance Driveway, Bargo NSW 2574

Prepared by:

SLR Consulting Australia Pty Ltd

Level 11, 176 Wellington Parade, East Melbourne, VIC, Australia, 3002

SLR Project No.: 665.10010.00207

21 September 2023

Revision: 2.0

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	31 August 2023	K Selvaratnam	S Hulbert	D Western
2.0	21 September 2023	K Selvaratnam	A Hudson/S Hulbert	S Hulbert

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Tahmoor Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Tables in Text

Figures in Text

Appendices

Acronyms and Abbreviations

Al	Aluminium
As	Arsenic
BHCSS	Bald Hill Claystone
Ba	Barium
BGSS	Bulgo Sandstone
BUCO	Bulli Coal Seam
CCL	Consolidated Coal Lease
Cu	Copper
EC	Electrical Conductivity
Filt	Filtered
HBSS	Hawkesbury Sandstone
Fe	Iron
Pb	Lead
Li	Lithium
LW	Longwall
mbgl	Metres below ground level
Mn	Manganese
ML	Mining Lease
Ni	Nickel
pH	Potential of Hydrogen
SCSS	Scarborough Sandstone
Se	Selenium
SSD	State Significant Development
Sr	Strontium
TDS	Total Dissolved Solids
TARP	Trigger Action Response Plan
VWP	Vibrating Wire Piezometer
WMP	Water Management Plan
WWFM	Wianamatta Form
Zn	Zinc

1.0 Introduction

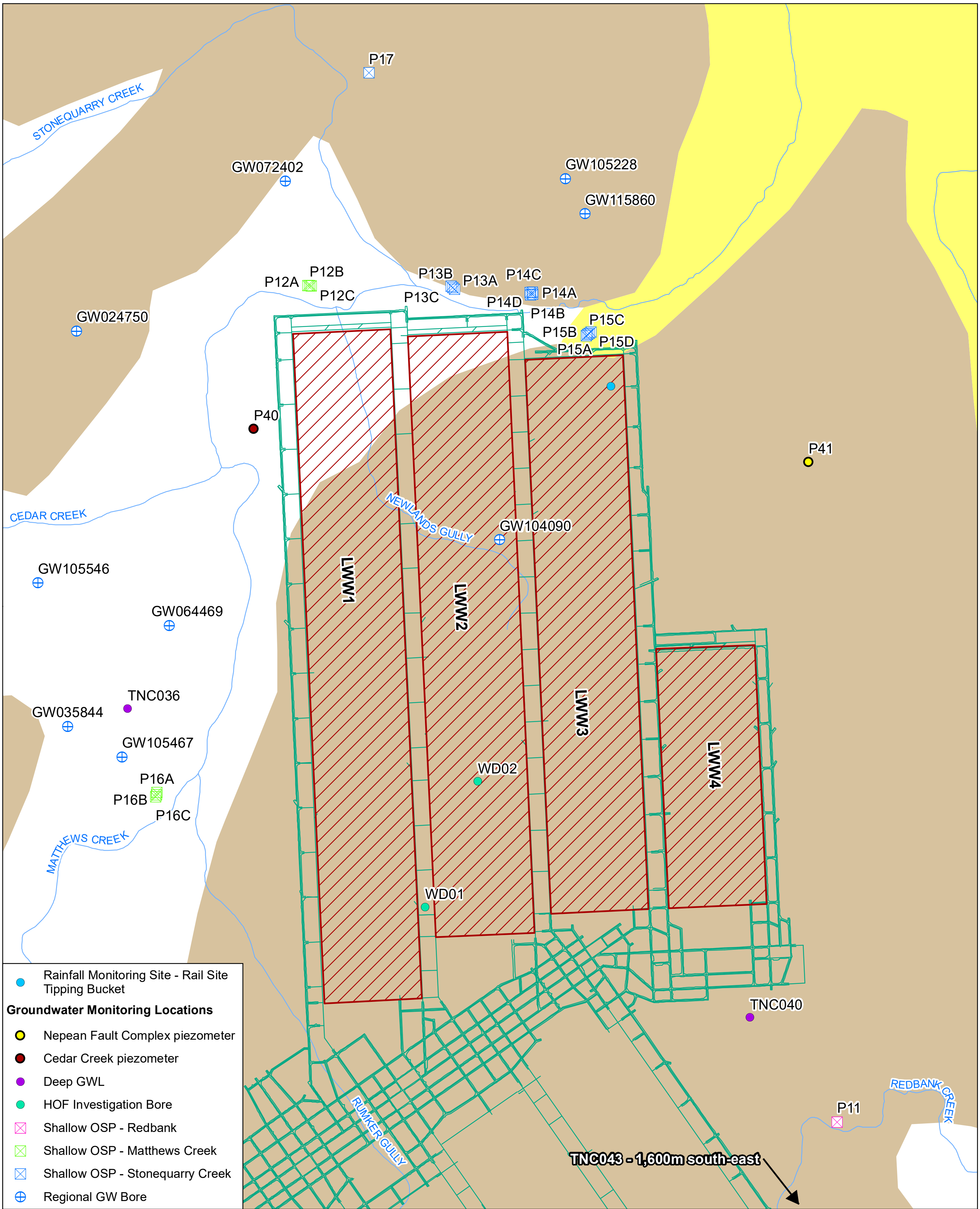
1.1 Background

SLR Consulting Australia Pty Ltd (SLR) was engaged by Tahmoor Coal Pty Ltd (Tahmoor Coal) to undertake a review of groundwater data, which has been collected by Consulting Earth Scientists Pty Ltd (CES), for the Tahmoor Western Domain (Western Domain) of the Tahmoor Coal Mine (Tahmoor Mine).

Tahmoor Mine, located approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW), is an underground mine extracting from the Bulli coal seam via longwall mining.

Mining at Western Domain commenced on 15 November 2019, and concluded on 13 September 2022. The Western Domain mining area lies within Mining Lease (ML) 1376 and ML 1539.

Western Domain comprises 4 longwalls; Longwall (LW) West 1 (W1), LW West 2 (LW W2), LW West 3 (LW W3) and LW West 4 (LW W4) as presented in Figure 1. All Western Domain longwalls are orientated north to south. Extraction associated with LW W3 and LW W4 are the focus of this compliance reporting document, as per the *Longwall W3-W4 Water Management Plan* (Tahmoor Coal, 2021).



0 100 200 m

Coordinate System:	GDA 1994 MGA Zone 56
Scale:	1:14,000 at A4
Project Number:	665.10010
Date:	01-Mar-2023
Drawn by:	JG

SLR

- Town
- Tahmoor Mine Plan Layout
- Major Roads
- Watercourses
- LW W4 Extraction Void (complete on 19/09/2022)
- Alluvium
- Wianamatta Formation
- Hawkesbury Sandstone

TAHMOOR COAL GROUNDWATER SIX-MONTHLY REVIEW (JUNE 2023)

Groundwater Monitoring Network

FIGURE 1

H:\Projects-SLR\620-BNE\665-WOL\665.TAH05 Tahmoor GWMP\GIS\66510010 Fig1 Tahmoor Coal Groundwater Monthly Review (Oct 2022).mxd

1.2 TARPS

Trigger Action Response Plans (TARPs) were developed to outline the appropriate actions to monitor and manage any potential subsidence and/or depressurisation related impacts that may result due to the extraction activities (SLR, 2021). The current TARP considers the natural pre-mining (baseline) variability and trends for groundwater levels at the Western Domain monitoring bores and private bores in the development of triggers.

Prior to the commencement of mining at Longwall W3, the TARPs set out in the Longwall W1-W2 Water Management Plan (Tahmoor Coal, 2019) were applied. Upon commencement of mining at Longwall W3, the TARPs set out in the Longwall W3-W4 Water Management Plan (Tahmoor Coal, 2021) were applied. These are the TARPs pertinent to this reporting.

The TARPs address various components of the groundwater system, as described in the Tahmoor North – Western Domain, LW W3-W4 Water Management Plan (Tahmoor Coal, 2021) and presented in Appendix A. Western Domain groundwater monitoring sites are captured in the following TARPs:

- Groundwater Quality Bores P12, P13, P14, P15, P16, P17 and Private;
- Groundwater Levels P12, P13, P14, P15, P16, P17 and Private;
- Groundwater Pressures (Shallow) TNC036, TNC040, WDO1, WD02; and
- Groundwater Pressures (Deep) TNC036.

1.3 Report Objective

This report assesses the Western Domain groundwater monitoring data against the triggers for groundwater quality, level and pressure in the TARPs for the reporting period from 1 January 2023 to 30 June 2023 (inclusive).

This report includes a:

- summary of TARP exceedances during the reporting period;
- summary of trigger exceedances over time including the identification of breaches of triggers that remain within normal condition in this reporting period;
- summary of general groundwater level and quality trends across the monitoring network;
- high-level outline of potential factors influencing exceedances (a detailed analysis of exceedances is not discussed in this report) during the reporting period;
- evaluation of mine groundwater inflows;
- summary of actions that were undertaken during the reporting period to address the recommendations presented in the previous reporting period; and
- recommendation of relevant actions and responses to be undertaken in 2023, consistent with those actions in the TARPs.

The information in this six-monthly report will be included in the Annual Review.

2.0 Monitoring Period Summary

2.1 Mine Operations

No mining activities were undertaken at Western Domain during the reporting period, with extraction concluded on 13 September 2022.

The schedule of previously mined longwalls is summarised in Table 1.

Table 1 Western Domain Mining Operations

Longwall	Start Date	End Date
LW W1	15 November 2019	6 November 2020
LW W2	7 December 2020	17 June 2021
LW W3	13 September 2021	21 March 2022
LW W4	16 May 2022	13 September 2022

2.2 Rainfall Analysis

Rainfall over the past 12 months, in comparison to the long-term average (i.e., January 1900 – present) is shown in Table 2. The SILO climate record for the location 0.05° x 0.05° tile centred on a location within proximity of Tahmoor Mine (latitude: -34.25, longitude: 150.60) has been used for this assessment to understand long-term rainfall trends.

During the reporting period, April 2023 was a particularly wet month, where above average rainfall was observed with a total monthly total rainfall of 101.9mm. Comparatively, the remainder of the reporting period was relatively dry with below average rainfall observed. May and June 2023 were particularly dry conditions with a total monthly rainfall of 10.3mm and 16.8mm respectively.

Table 2 Monthly Rainfall vs Long-Term Average Rainfall

SILO (-34.25, 150.60)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Long-term average rainfall (mm)	84.6	113.7	98.9	69.5	53.6	63.3	40.2	47.3	44.2	64.2	79.9	66.2
January – June 2023 monthly rainfall (mm)	147.4	32.9	54.7	101.9	10.3	16.8	-	-	-	-	-	-

Long-term monthly average rainfall, potential evaporation and estimated actual evapotranspiration is presented in Figure 2. Excluding the month of June, the evaporation and evapotranspiration are, on average, higher than rainfall.

The historical record of monthly rainfall and the calculated trend in rainfall, using the cumulative residual departure from mean method, is presented in Figure 3 where a positive gradient indicates above average rainfall, whilst a declining trend represents below average. During the reporting period, there have been below average rainfall conditions.

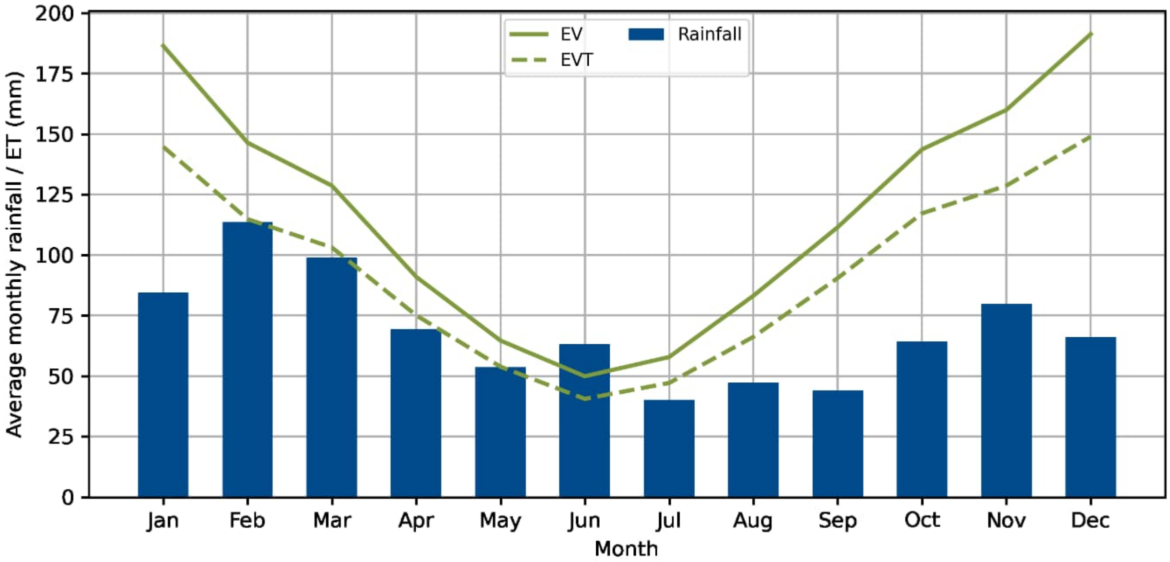


Figure 2 Average Monthly Rainfall, Evaporation and Evapotranspiration

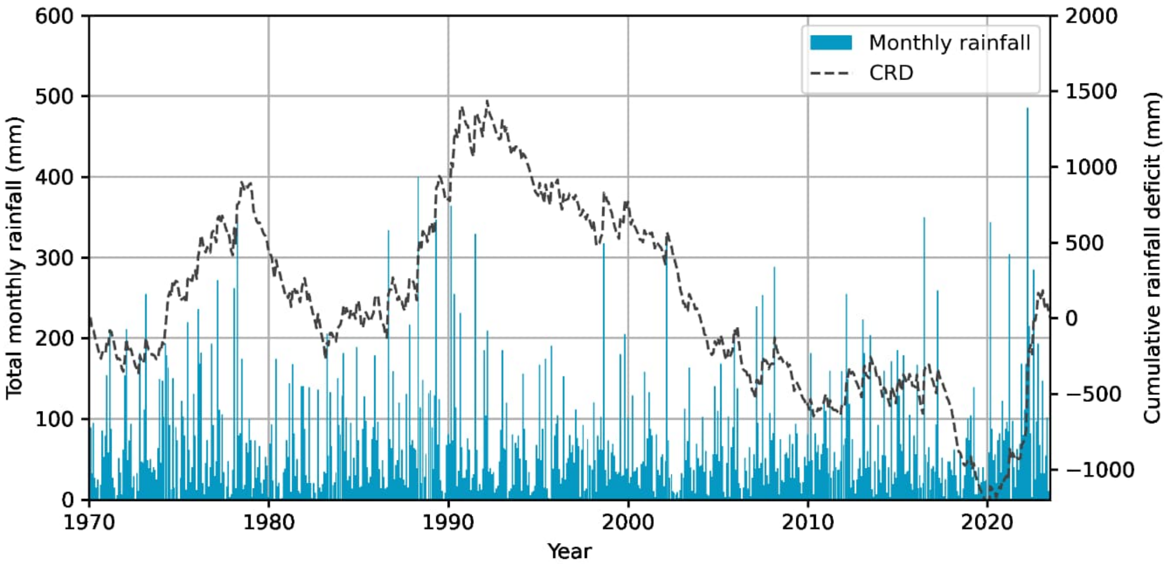


Figure 3 Cumulative Rainfall Departure and Total Monthly Rainfall

2.3 Monitoring Network Status

Details for each of the Western Domain groundwater monitoring network bores is presented in Appendix A. Bore locations are shown on Figure 1.

An update on the status of the groundwater monitoring network bores during the reporting period includes:

- Groundwater level data at P9 was not available after 2 June 2023 because the next download of this logger data is not scheduled to occur until early September 2023.
- Groundwater level data at P11 was not available after 5 June 2023 because the next download of this logger data is not scheduled to occur until early September 2023.

- WD01 logger was decommissioned in April 2023.
- Groundwater monitoring data is not available at private bores GW072402, GW105546 and GW105467. This is because GW072402 has been blocked for several years (SLR, 2023a), and GW105546 and GW105467 are inaccessible.
- Groundwater quality data was not collected at private bores GW104090, GW105228 and GW115860 in May 2023 or June 2023.
- Groundwater level (manual measurement) data was not collected in April 2023 at three private bores (GW104090, GW105228 and GW115860).

The bores which were monitored during this reporting period are:

- Groundwater Quality: P12A-C, P14A-D, P15A-D, P16A-C, GW104090, GW105228, GW115860.
- Groundwater Level: P9, P11, P12A-C, P14A-D, P15A-D, P16A-C, GW104090, GW105228, GW115860.
- Groundwater Pressures (Shallow): P40, P41, TNC036, TNC040.
- Groundwater Pressures (Deep): TNC036.

3.0 TARP Assessment

3.1 TARP Exceedances

Temporal groundwater monitoring data is presented against the relevant TARP trigger levels, for all relevant monitoring locations, in Appendix C (groundwater level triggers) and Appendix D (groundwater quality triggers).

TARP exceedances observed during the reporting period are summarised in Table 3. The final column of Table 3 indicated those TARP exceedances that remain active as of June 2023.

Table 3 January – June 2023 Exceedances

Exceedance Site	Exceedance Level	Exceedance Parameter	TARP	Active Exceedance June 2023
P12C	2	Groundwater level	Level (Shallow)	Active
P16B	2	Groundwater level	Level (Shallow)	Inactive
P16C	2	Groundwater level	Level (Shallow)	Active
TNC036 (BGSS-97m)	2	Groundwater level	Pressures (Shallow)	Inactive
TNC036 (BGSS-169m)	2	Groundwater level	Pressures (Shallow)	Active
TNC036 (BGSS-412.5m)	2	Groundwater level	Pressures (Deep)	Active
P12A	2	pH upper, Pb	Quality	Active (pH upper, Pb)
P12B	2	Cu	Quality	Inactive
P12C	2	EC, Fe, Mn, Cu	Quality	Active (Fe, Mn, Cu only)
P14A	2	Al, Cu	Quality	Active (Cu only)
P14B	2	pH upper, pH lower, EC, Sr	Quality	Active (Sr only)
P14C	2	Cu	Quality	Active (Cu)
P14D	2	Cu	Quality	Active (Cu)

Exceedance Site	Exceedance Level	Exceedance Parameter	TARP	Active Exceedance June 2023
P15A	2	Fe, Ni, Li, Sr	Quality	Active (Li, Sr only)
P15B	2	EC, Pb, Al, Sr	Quality	Active (Sr only)
P15C	2	Al, Fe, As, Sr	Quality	Active (Fe, As, Sr)
P15D	2	Fe. Mn	Quality	Active (Fe only)
P16A	2	pH upper, Ni	Quality	Active (pH upper, Ni)
P16B	2	Sr	Quality	Active (Sr)
P16C	2	Zn	Quality	Inactive
GW105228	2	Li	Quality	Inactive
GW104090	2	Ba, Sr	Quality	Inactive

3.2 Trigger Summary

An assessment of groundwater monitoring data against the TARPs, for all relevant monitoring locations, are presented in Appendix C (groundwater level triggers) and Appendix D (groundwater quality triggers).

A summary of groundwater level trigger breaches over time is presented in Table 4 where the performance of each bore against each trigger is indicated as “L1”, meaning that the groundwater level remains consistent with baseline variability and pre-mining trends, or indicated as “L2” and highlighted, meaning that the trigger was breached in that month and is an exceedance.

A summary of groundwater quality trigger breaches in this reporting period is presented in Table 5, where the performance of each bore against each trigger is indicated as “L1”, meaning that there is no observable changes outside of the baseline variability in groundwater quality, or indicated as “L2” and highlighted, meaning that the trigger was breached in that month and is an exceedance.

Table 4 Groundwater Level Trigger Summary: January 2023 – June 2023

Bore	Type	Jan 23	Feb 23	Mar 23	Apr 23	May 23	Jun 23
P12A	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P12B	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P12C	Shallow Open Standpipe	L2	L2	L2	L2	L2	L2
P14A	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P14B	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P14C	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P14D	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P15A	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P15B	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P15C	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P15D	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P16A	Shallow Open Standpipe	L1	L1	L1	L1	L1	L1
P16B	Shallow Open Standpipe	L2	L1	L1	L1	L1	L1
P16C	Shallow Open Standpipe	L2	L2	L2	L2	L2	L2
GW104090	Private Bore	L1	L1	L1			L1
GW105467	Private Bore	*	*	*	*	*	*
GW105228	Private Bore	L1	L1	L1			L1
GW072402	Private Bore	#	#	#	#	#	#
GW115860	Private Bore	L1	L1	L1			L1
GW105546	Private Bore	*	*	*	*	*	*
P41A	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1
P41B	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1
P41C	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1

Bore	Type	Jan 23	Feb 23	Mar 23	Apr 23	May 23	Jun 23
P41D	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1
TNC036 (HBSS-65m)	Shallow VWP (< 200m)	L1	L1	L1	L2^	L1	L1
TNC036 (HBSS-97m)	Shallow VWP (< 200m)	L2	L1	L2	L1	L1	L1
TNC036 (BGSS-169m)	Shallow VWP (< 200m)	L2	L2	L2	L2	L2	L2
TNC040 (WNFM-27m)	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1
TNC040 (HBSS-65m)	Shallow VWP (< 200m)	L1	L1	L1	L1	L1	L1
TNC036 (BGSS-214m)	Deep VWP (> 200m)	L1	L1	L1	L1	L1	L1
TNC036 (BGSS-412.5m)	Deep VWP (> 200m)	L2	L2	L2	L2	L2	L2

* Bore is inaccessible

Bore is blocked

$ Bore not surveyed

^ Data erroneous

Table 5 Groundwater Quality Trigger Summary: January – June 2023

Bore	Month	pH Upper	pH Lower	EC	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
P12A	Jan	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12A	Feb	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12A	Mar	L2	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1
P12A	Apr	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12A	May	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12A	Jun	L2	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1
P12B	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12B	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12B	Mar	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12B	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12B	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12B	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	Jan	L1	L1	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	Feb	L1	L1	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	Mar	L1	L1	L2	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	Apr	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	May	L1	L1	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P12C	Jun	L1	L1	L1	L2	L2	L2	L2~	L1	L1	L1	L1	L1	L1	L1	L1
P14A	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14A	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14A	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1
P14A	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14A	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1
P14A	Jun	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	Jan	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	Apr	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14B	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P14C	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14C	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14C	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14C	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14C	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14C	Jun	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1

Bore	Month	pH Upper	pH Lower	EC	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
P14D	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14D	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14D	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14D	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14D	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P14D	Jun	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15A	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P15A	Feb	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L2	L1	L2	L1
P15A	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L2	L1
P15A	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15A	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1
P15A	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L2	L1
P15B	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15B	Feb	L1	L1	L2	L1	L1	L1	L2	L1	L1	L2	L1	L1	L1	L2	L1
P15B	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15B	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15B	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15B	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15C	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L2	L1	L1	L2	L1
P15C	Feb	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L2	L1	L1	L2	L1
P15C	Mar	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L2	L1	L1	L2	L1
P15C	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P15C	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L2	L1
P15C	Jun	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L2	L1	L1	L2	L1
P15D	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1
P15D	Feb	L1	L1	L1	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15D	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15D	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15D	May	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P15D	Jun	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16A	Jan	L2	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P16A	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P16A	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16A	Apr	L2	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P16A	May	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P16A	Jun	L2	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1
P16B	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P16B	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1

Bore	Month	pH Upper	pH Lower	EC	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
P16B	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P16B	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P16B	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P16B	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1
P16C	Jan	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1	L1	L1	L1	L1
P16C	Feb	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16C	Mar	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16C	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16C	May	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
P16C	Jun	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
GW104090	Jan	L1	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^
GW104090	Feb	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW104090	Mar	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW104090	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L2	L1
GW104090	May	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW104090	Jun	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105467	Jan	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105467	Feb	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105467	Mar	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105467	Apr	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GW105467	May	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GW105467	Jun	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GW105228	Jan	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1
GW105228	Feb	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105228	Mar	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105228	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L2	L1	L1	L1
GW105228	May	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105228	Jun	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW072402	Jan	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^	^
GW072402	Feb	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^	^
GW072402	Mar	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^	^
GW072402	Apr	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
GW072402	May	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
GW072402	Jun	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
GW115860	Jan	L1	L1	L1	^	^	^	^	^	^	^	^	^	^	^	^
GW115860	Feb	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW115860	Mar	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW115860	Apr	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1

Bore	Month	pH Upper	pH Lower	EC	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
GW115860	May	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW115860	Jun	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105546	Jan	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105546	Feb	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105546	Mar	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
GW105546	Apr	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GW105546	May	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GW105546	Jun	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

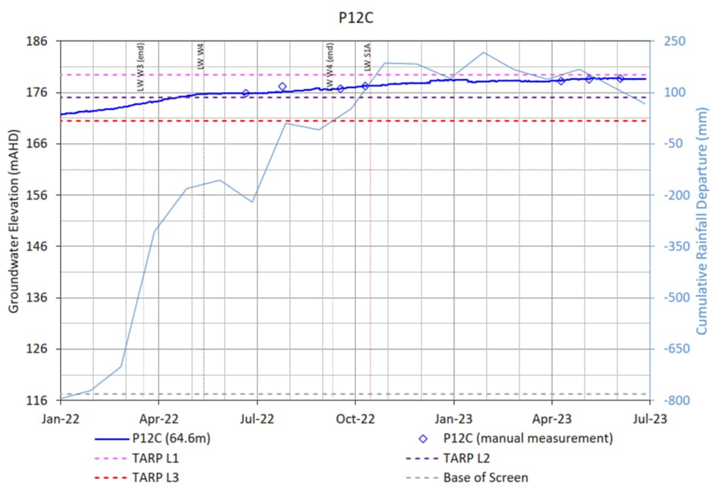
^ Data unavailable, * Bore is inaccessible, # Bore is blocked, $ Bore not surveyed, ~ data erroneous

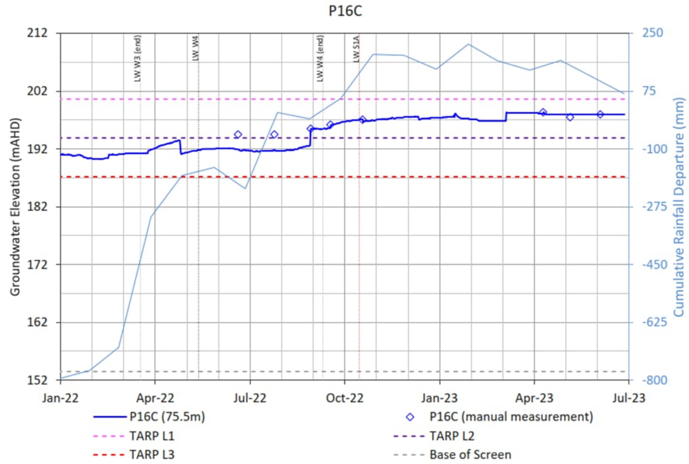
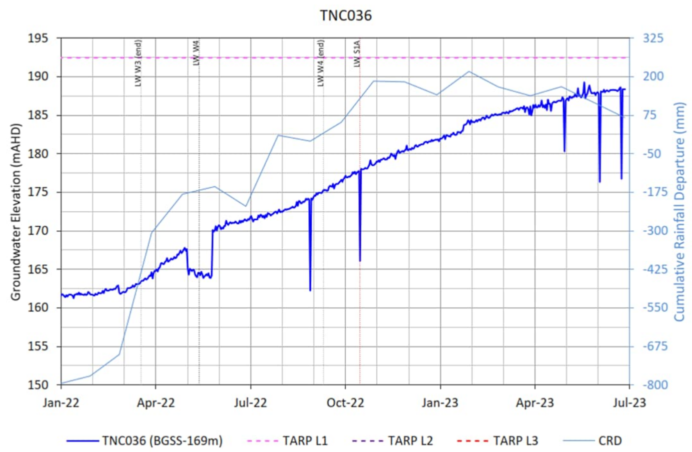
3.3 Groundwater Level Trends

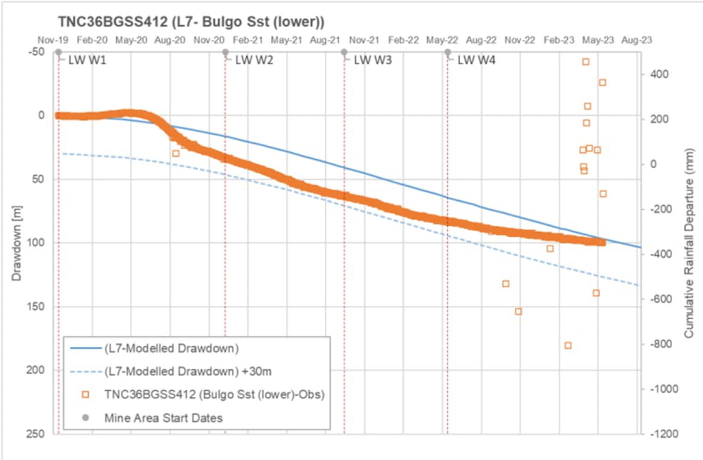
3.3.1 Discussion

Table 6 provides a brief discussion pertaining to each of the observed exceedances listed in Table 3. This is not a detailed cause and effect analysis, rather a consideration of potential influencing factors and observations. Where the exceedance is present in June 2023 (considered an active exceedance), the temporal plot is provided for additional context.

Table 6 Groundwater Level Exceedances Discussion

Site	Discussion
P12C	TARP Level 2 exceedance was observed during every month of the reporting period, following recovery in groundwater levels experiencing TARP Level 3 prior to May 2022. Overall, groundwater levels have increased since the previous reporting period. Groundwater levels are generally stable, noting slight increase over the reporting period, following an increase in groundwater levels during the previous reporting period. This increase occurred after maximum groundwater depressurisation was observed in February 2021, which was caused by mining at LW W1-W2. TARP Level 1 is likely to apply in the next reporting period. 
P16C	TARP Level 2 exceedance was observed during the entire reporting period. Groundwater levels continue to remain relatively stable following successive periods of recovery in 2021 and 2022. Upcoming groundwater monitoring data

Site	Discussion
	will inform whether post-mining conditions will allow full groundwater recovery at the P16C site. 
TNC036 (BGSS-169m)	TARP Level 2 exceedance was observed during the full reporting period. Groundwater levels in the Bulgo Sandstone aquifer at 169m started to recover in late September 2022 and whilst showing a significant recovery during the reporting period, the observed groundwater levels remain below baseline levels as of June 2023. Upcoming groundwater monitoring data will inform whether post-mining conditions will allow full groundwater recovery, as indicated by the current trend. 
TNC036 (BGSS-412.5m)	TARP Level 2 exceedance was observed during the full reporting period. Observed drawdown at TNC036 (BGSS-412.5m) exceeded predicted (modelled) drawdown but was within 30 m of predicted (modelled) drawdown during the reporting period. Following the commencement of mining at LW W1, observed drawdown has exceeded the predicted (modelled) drawdown at since mid-2020. Over the past 6 months, observed drawdown appears to be trending closer to the predicted (modelled) drawdown. TAPR Level 1 is likely to apply in the next reporting period.

Site	Discussion
	

3.3.2 General Trends

3.3.2.1 Site P9/P11

Groundwater elevations at P9A and P9B, located on Redbank Creek upstream from P11, appear to have decreased over the reporting period however the loggers are potentially faulty with the monitoring data appearing erroneous. A possible medium to long term impact at Site 9 is suggested due to historic mining (i.e., LW 32) and LW W1-W2. Further monitoring data is required at P9A and P9B to assess post-mining groundwater conditions, and to confirm logger functionality.

Groundwater elevation at P11 has remained stable over the reporting period.

A delayed mining effect on groundwater levels due to previous mining of LW W4 was not observed at P9A, P9B and P11 during the review period.

3.3.2.2 VWPs

Groundwater elevations at P40 and P41 typically remained stable during the reporting period with the groundwater elevation in all sensors observed above the creek bed elevation. Groundwater levels at P40C from April 2023 onwards are likely to be influenced by a faulty sensor but will continue to be reviewed in future reporting periods. Groundwater levels at P41D, P41E and P41F are likely influenced by faulty sensors (SLR, 2023a) but will continue to be reviewed in future reporting periods.

Groundwater levels at TNC036 are steadily increasing at most sensors with significant recovery observed in the deeper sensors in the Bulgo Sandstone aquifer. The impacts of groundwater depressurisation are continuing to be evident in the deeper piezometers, although recovery is occurring and a TARP Level 1 is likely to apply at TNC036 (BGSS-412.5m) in the next reporting period.

Groundwater levels at TNC040 slightly declined over the reporting period. A delayed mining effect on groundwater levels due to previous mining of LW W4 was not observed at TNC040 during the reporting period.

3.3.2.3 Site P12, P14, P15, P16 and Private Bores

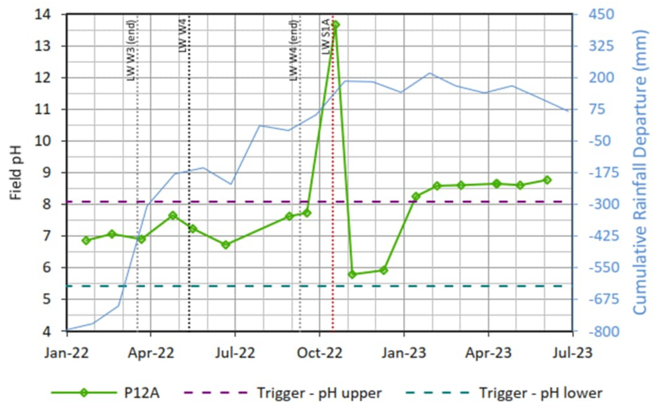
Overall, recovery of groundwater levels is being observed in most of the shallow open standpipes and private bores within the monitoring network.

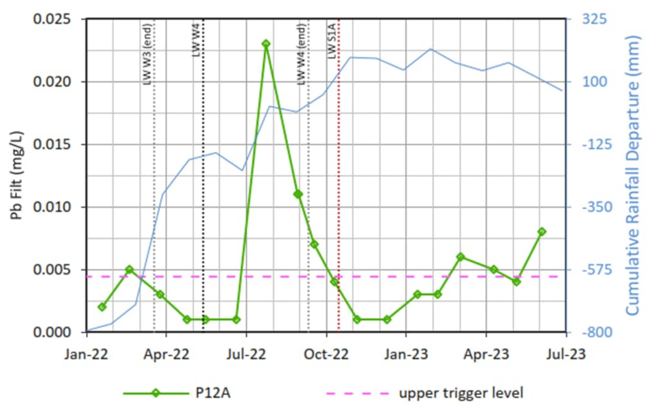
3.4 Groundwater Quality Trends

3.4.1 Discussion

Table 7 provides a brief discussion pertaining to each of the observed exceedances as listed in Table 3. This is not a detailed cause and effect analysis, rather a consideration of potential influencing factors and observations. Where the exceedance is present in June 2023 (considered an active exceedance), the temporal plot is provided for additional context.

Table 7 Groundwater Level Exceedances Discussion

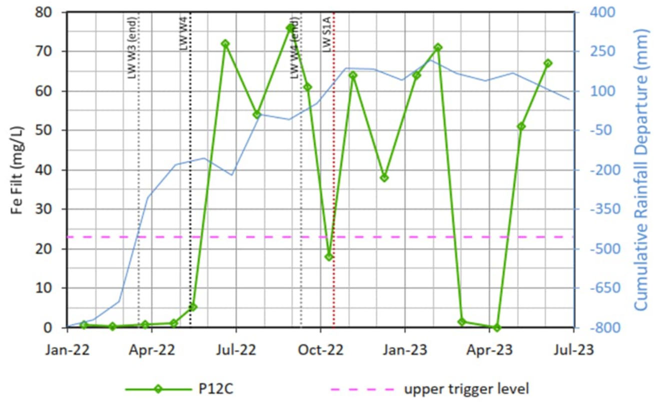
<table>
<tr><th>Site</th><th>Discussion</th></tr>
<tr><td>P12A</td><td>TARP Level 2 exceedance of pH upper observed over the full reporting period. pH levels have generally remained stable, although above the pH upper trigger level, since January 2023. pH levels at P12B and P12C remain within the lower and upper pH trigger levels. Therefore, the exceedance at P12A is likely to be localised and natural, however additional monitoring is required to confirm post-mining pH trends at P12A. The general trend in pH over time in P12A, P12B and P12C is consistent.


TARP Level 2 exceedance of lead was observed in March, April and June. The concentration of lead returned to within baseline variability in January, February and May 2023. Dissolved lead concentrations have significantly fluctuated over the past 12 months. Continued observation is required however is expected to be localised and within natural fluctuations observed historically.

</td></tr>
<tr><td>P12B</td><td>A short-term increase (TARP Level 2 exceedance) in the concentration of copper (March 2023) was observed before returning to normal conditions.</td></tr>
</table>

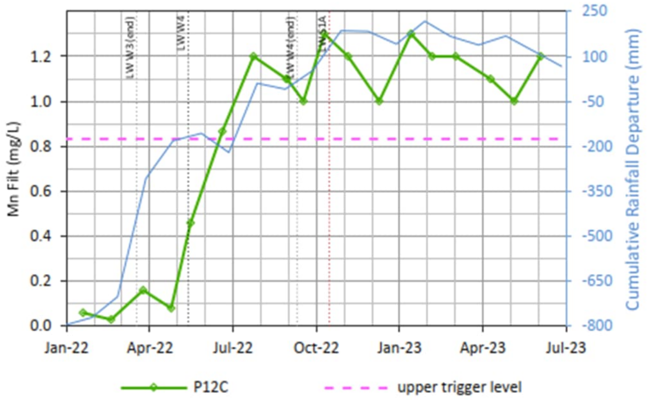
<table>
<tr><th>Site</th><th>Discussion</th></tr>
<tr><td>P12C</td><td>

A short-term increase (TARP Level 2 exceedance) in the observed EC (March 2023) was observed before returning to normal conditions.

TARP Level 2 exceedance of iron was observed in January and February before returning to within baseline conditions, then noting an exceedance again in May and June 2023. The concentration of iron returned to within baseline variability in March and April 2023. Dissolved iron concentrations have significantly fluctuated over the past 12 months. The increase in dissolved iron concentrations is suggested to be localised and likely to be caused by iron mobilisation during groundwater recovery (SLR, 2023a).

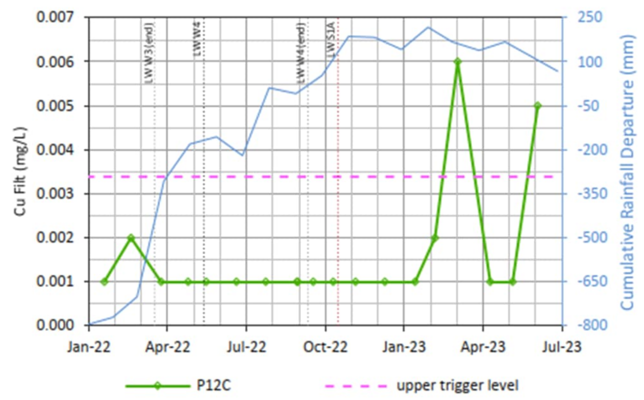
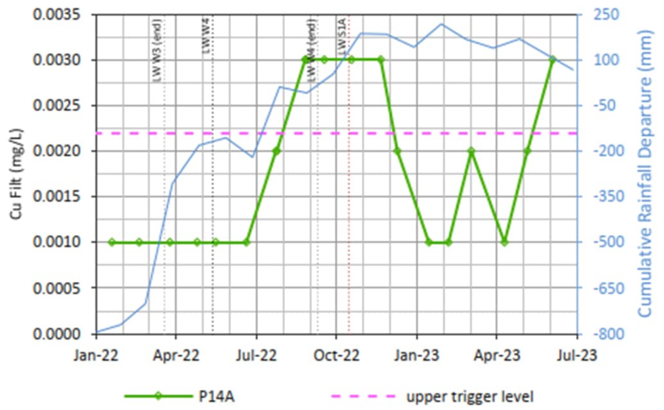


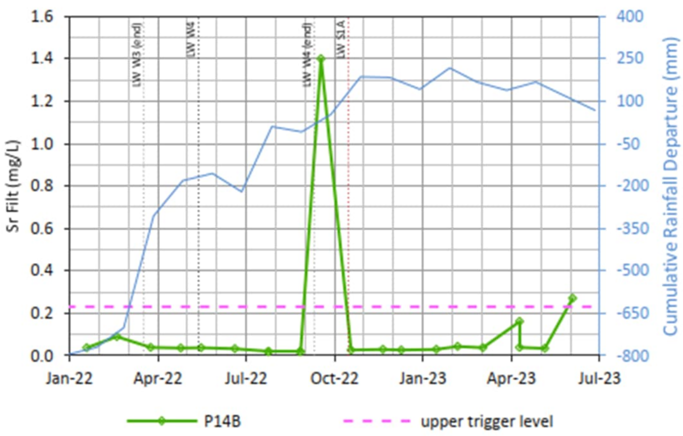
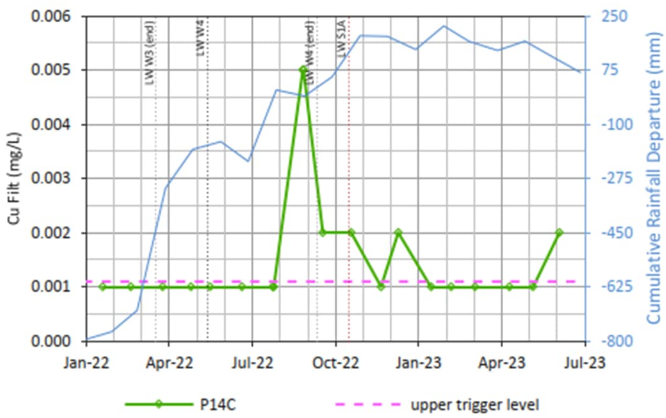
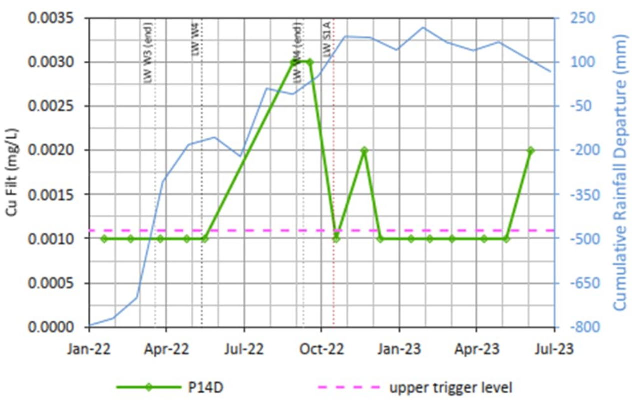
TARP Level 2 exceedance of manganese was observed across the full reporting period. The increase in the dissolved concentrations of iron and manganese appear to be correlated and the natural fluctuation in groundwater quality could be associated with the increasing trend at site P12 (SLR, 2023a). Site P12B follows the same trend, although it was not breaching the trigger.



A short-term increase (TARP Level 2 exceedance) in the concentration of copper was observed in March and June 2023. Given the recent high level of fluctuations, the site will continue to be monitored and reviewed.

</td></tr>
</table>

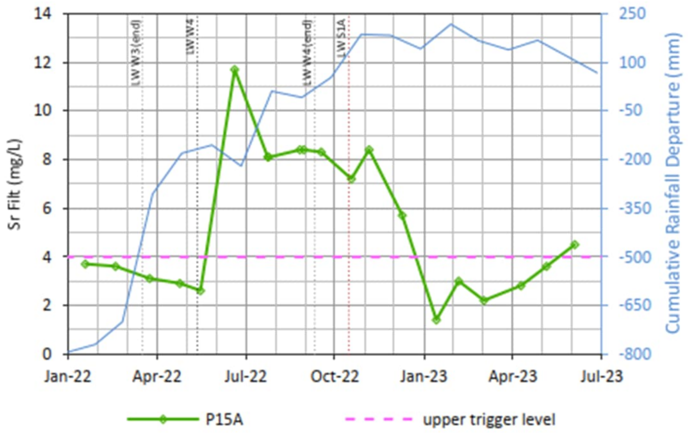
Site	Discussion
	
P14A	A short-term increase (TARP Level 2 exceedance) in the concentration of aluminium (March and May 2023) was observed before returning to normal conditions. A short-term increase (TARP Level 2 exceedance) in the concentration of copper (June 2023) was observed. The concentration of Cu in June is not out of line with historical fluctuations and is not considered likely to be a result of historical mining activities. 
P14B	A short-term increase (TARP Level 2 exceedance) above the EC trigger level was observed in April 2023 before returning to within normal conditions. A short-term increase (TARP Level 2 exceedance) above the pH upper trigger level was observed in January 2023 before returning to within normal conditions A short-term decrease (TARP Level 2 exceedance) below the pH lower trigger level was observed in April 2023 before returning to within normal conditions. A short-term increase (TARP Level 2 exceedance) in EC (April 2023) and in the concentration of strontium (June 2023) was observed.

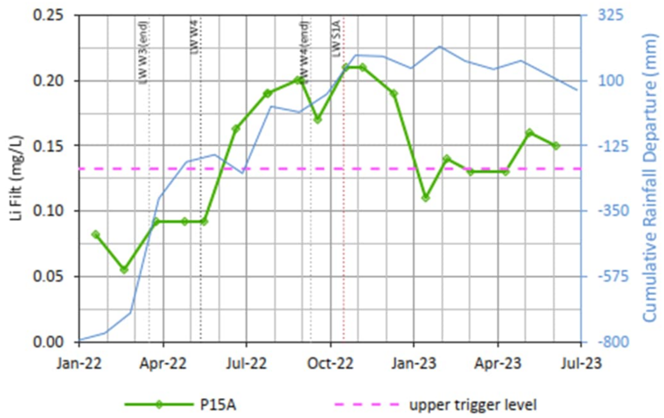
Site	Discussion
	
P14C	A short-term increase (TARP Level 2 exceedance) in the concentration of copper was observed in June 2023. Considering historical fluctuations this increase in unlikely to be persistent and not attributable to mining. 
P14D	A short-term increase (TARP Level 2 exceedance) in the concentration of copper was observed in June 2023. The trends observed here align with those in P14C (above) and this exceedance is unlikely to be persistent or attributable to mining. 
P15A	A short-term increase (TARP Level 2 exceedance) in the concentration of Iron (May and June 2023), and strontium (June 2023) was observed A short-term increase (TARP Level 2 exceedance) in the concentration of iron (February 2023) and nickel (January 2023) occurred before returning to baseline conditions.

<table>
<tr><th>Site</th><th>Discussion</th></tr>
<tr><td></td><td>

A short-term increase in lithium (May and June 2023), and strontium (June 2023) was observed.

These minor breaches of the trigger are in line with historical natural fluctuations and are unlikely to be attributable to mining.

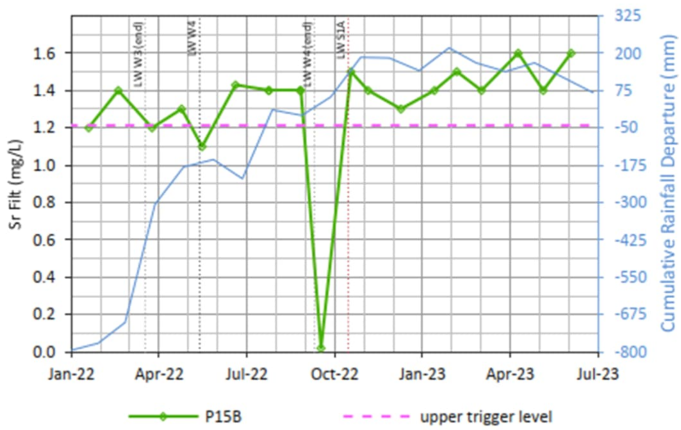




</td></tr>
<tr><td>P15B</td><td>

Short-term increase (TARP Level 2 exceedance) in the concentration of EC, aluminium and lead occurred in February 2023, however was within baseline conditions for the rest of the reporting period.

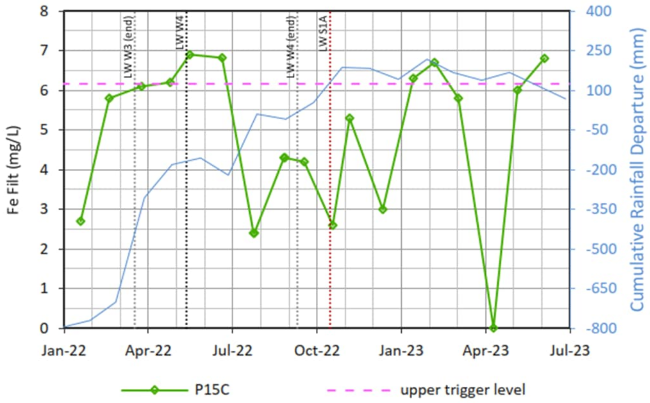
TARP Level 2 exceedance of strontium was observed in April, May and June 2023. The concentration of dissolved strontium has fluctuated over the past 12 months and additional monitoring is required to confirm post-mining strontium trends.



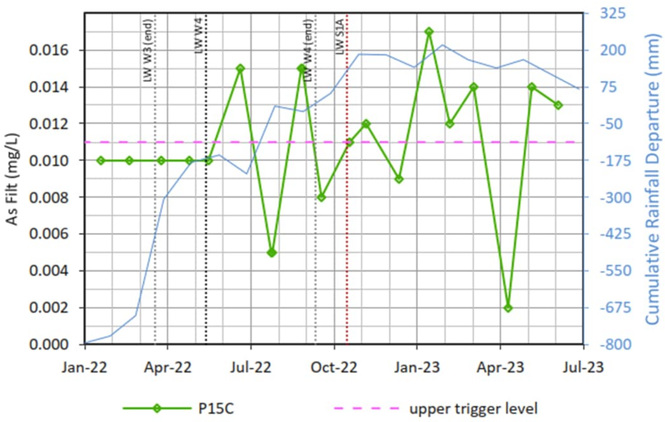
</td></tr>
</table>

<table>
<tr><th>Site</th><th>Discussion</th></tr>
<tr><td>P15C</td><td>
A short-term increase (TARP Level 2 exceedance) in the concentration of aluminium was observed in January 2023 before returning to baseline conditions.

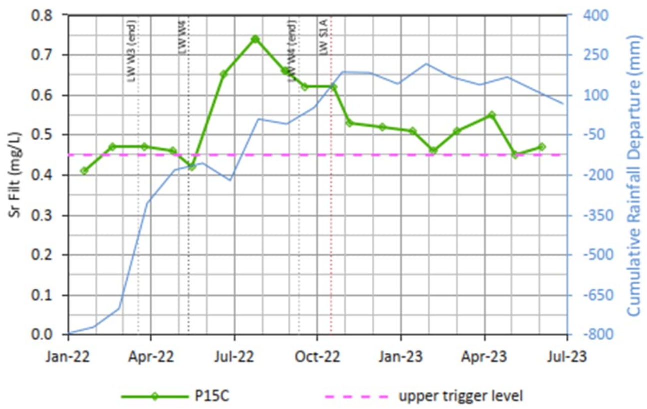
A short-term increase (TARP Level 2 exceedance) in the concentration of iron was observed in February and March before returning to baseline conditions, with an exceedance noted again in June 2023. These exceedances appear to be in line with natural fluctuations.



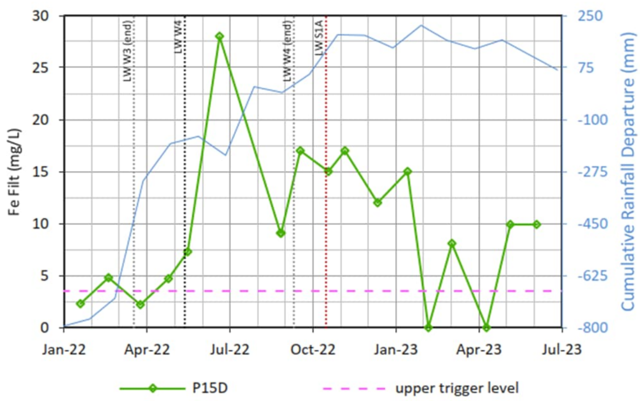
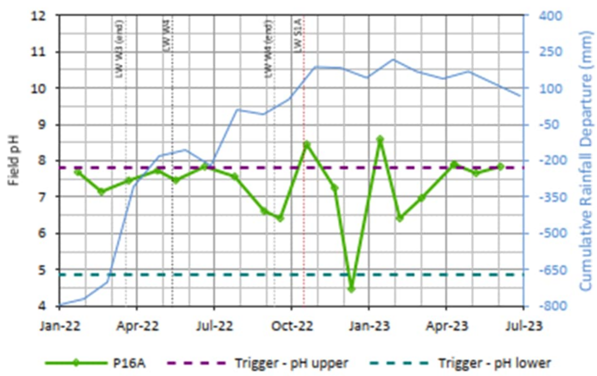
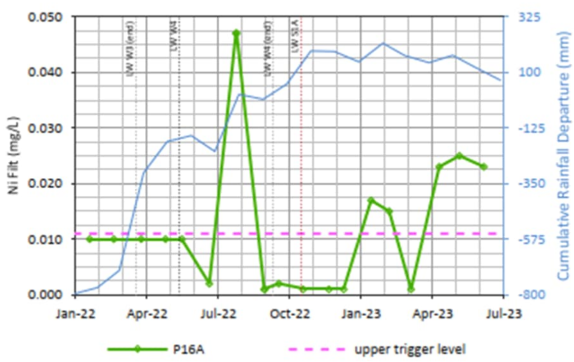
TARP Level 2 exceedance of arsenic was observed in May and June 2023. The concentration of dissolved arsenic has fluctuated over the past 12 months and additional monitoring is required to confirm trends. It is likely the trigger level needs amending to reflect the natural fluctuations observed.

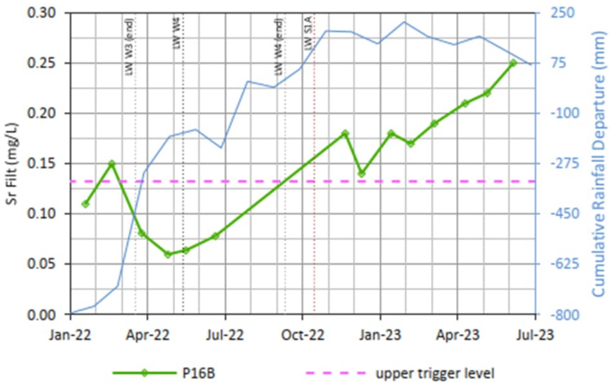


TARP Level 2 exceedance of strontium was observed in April and June 2023. The dissolved strontium concentrations observed at P15B and P15C remain well below the US health-based screening level benchmark of 4 mg/L.



</td></tr>
</table>

Site	Discussion
P15D	A short-term increase (TARP Level 2 exceedance) in the concentration of aluminium was observed in January 2023 before returning to baseline conditions. TARP Level 2 exceedance of iron was observed in May and June 2023. The trigger level for dissolved iron concentration P15D is considered too conservative, and it is recommended to revise the trigger level for dissolved iron at P15D to 2.5 mg/L (SLR, 2023a). Using the revised trigger level, a TARP Level 1 (normal conditions) applies in the current reporting period. 
P16A	A short-term increase (TARP Level 2 exceedance) above the pH upper trigger level was observed in January, April and June 2023. The pH level at P16A has previously shown large fluctuations and additional monitoring is required to confirm post-mining pH trends at P16A.  TARP Level 2 exceedance of nickel was observed in January, February, April, May and June 2023. Concentrations of nickel has fluctuated over the past 12 months with periods of high concentration followed by periods of baseline variability. Additional monitoring is required to confirm post-mining nickel trends at P16A. 

Site	Discussion
P16B	TARP Level 2 exceedance of strontium was observed across the whole reporting period. Elevated strontium concentrations were also observed in January, February and March 2023, and November and December 2022, resulting in six consecutive months of a TARP Level 2 exceedance. No strontium concentration data is available between July and November 2022. Close monitoring of strontium concentrations and rainfall events in the next reporting period is required to confirm post-mining strontium trends and if a TARP Level 3 or 4 applies. 
P16C	A short-term increase (TARP Level 2 exceedance) in the concentration of zinc was observed in January 2023 before returning to baseline conditions.
GW105228	TARP Level 2 exceedance of lithium was observed in January and April 2023. No lithium concentration data is available in May and June 2023. Since April 2022, lithium concentrations have gradually increased above the trigger level (0.026mg/L) and it is considered appropriate to revise the trigger level at GW105228 to 0.25 mg/L to align with the lithium trigger level at GW115860 (SLR, 2023a). Using a revised trigger level of 0.25 mg/L at GW105228, a TARP Level 1 applies in April 2023.
GW104090	TARP Level 2 exceedance of strontium was observed in April 2023. No strontium concentration data is available in May and June 2023. Since January 2022, strontium concentrations have remained above the trigger level (1.21 mg/L). It is noted that minimal baseline data exists at GW104090 (SLR, 2023a) and therefore the trigger level may not be appropriate. Additional monitoring is required to inform the potential pos-mining strontium trends at GW104090. TARP Level 2 exceedance of barium was observed in April 2023. No strontium concentration data is available in May and June 2023. Since January 2022, barium concentrations have remained above the trigger level (0.143mg/L) although concentrations have been decreasing over this time. It is likely that a TARP Level 1 will apply in the next reporting period.

3.4.2 General Trends

Overall, improvement in groundwater quality is being observed across most of the shallow open standpipes within the monitoring network (where data was available).

4.0 Mine Inflows

Since 2009, observed inflows to Tahmoor Mine have ranged from approximately 2 to 7 ML/d. In October 2022, the Western Domain blocks were sealed. Since this time, the average groundwater inflow from Tahmoor underground workings is reported as 2.3 ML/d.

The cumulative groundwater inflows, as calculated from the mine water balance and pump-out records, for each water year since the 2019-20 water year (i.e., since mining commencement at Western Domain) is presented in Figure 4.

The reporting period occurs within the water year 2022-23. As of 30 June 2023, the cumulative groundwater make for water year 2022-23 is 1,068 ML, which remains below the groundwater entitlement of 1,642 ML/y (**Figure 4**).

Figure 4 Tahmoor Mine Groundwater Inflows

5.0 Previous Actions

Table 8 provides a summary of the recommendations made in the most recent quarterly and six-monthly reviews and a status update.

Table 8 Status of previous recommendations

Item	Previous Recommendation	Progress of Recommendation
1	**Previous Six-monthly Groundwater report** Continue the monitoring program, reporting groundwater level and quality data in the next groundwater review report for January-March 2023.	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report.
2	**Previous Six-monthly Groundwater report** For P12C, P16B, P16C, TNC036 (HBSS-97m) and TNC036-169m with Level 2 TARPs in place for groundwater levels, continue monitoring and reviewing groundwater level response. Groundwater Levels - for all sites with Level 2 TARPs in place, closely monitor ground water levels against TARP trigger levels for the site and associated control sites as set out in the TARPs	Completed as part of the previous quarterly groundwater report (submitted June 2023) and this report. During this reporting period, ongoing recovery of groundwater levels were observed following the completion of mining in the Western Domain. Specifically pertaining to those mentioned: P12C: Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period. P16B: returned to normal conditions (level 1) P16C: Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period. TNC036 (HBSS-97m): returned to normal conditions (level 1) TNC036 (BGSS -169m): Level 2 but showing ongoing recovery, likely to be normal conditions (level 1) next period.

Item	Previous Recommendation	Progress of Recommendation
3	**Previous Six-monthly Groundwater report** For TNC036 (BGSS-214m and BGSS-412.5m) with Level 2 TARPs in place for groundwater levels, continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. **Previous Quarterly Groundwater Report** Groundwater Pressures – continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. For all sites with Level 2 TARPs in place, closely monitor groundwater pressures levels against TARP trigger levels for the site and associated control sites as set out in the TARPs.	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report. During this reporting period, ongoing recovery of groundwater levels were observed following the completion of mining in the Western Domain. Specifically pertaining to those mentioned (TNC036 (BGSS-214m and BGSS-412.5m), both bores have shown recovery and are within or showing less than the predicted modelled drawdown.
4	**Previous Six-monthly Groundwater report** For all sites with Level 1 TARPs in place for groundwater quality, continue monitoring pH, EC and metal concentrations against TARP trigger levels. **Previous Quarterly Groundwater Report** Where a TARP Level 1 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report.	Completed as part of the previous quarterly groundwater report (submitted June 2023 and this report.
5	**Previous Six-monthly Groundwater report** For all sites with Level 2 TARPs in place for groundwater quality (EC, pH and metals), continue monitoring concentrations against TARP trigger levels. **Previous Quarterly Groundwater Report** Groundwater Quality – for all sites with Level 2 TARPs in place, closely monitor concentrations against TARP trigger levels for the site and associated control sites as set out in the TARPs.	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report. During this reporting period, short-term exceedances of pH and EC levels were observed, and are likely associated with natural fluctuations rather than attributable to mining.
6	**Previous Six-monthly Groundwater report** For site P12C with a Level 2 TARP in place for groundwater quality (iron and manganese), continue closely monitoring Fe and Mn concentrations at the nearby monitoring bores (P12A and P12B).	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report. During this reporting period, dissolved iron concentrations have significantly fluctuated over the past 12 months and is suggested to be localised and in line with natural fluctuations. The increase in dissolved manganese is likely to be associated with natural fluctuations, resulting in a

Item	Previous Recommendation	Progress of Recommendation
		trend of increased concentration at site P12 (as also observed in P12B).
7	**Previous Six-monthly Groundwater report** For site P15D with a Level 2 TARP in place for groundwater quality (iron), continue closely monitoring Fe concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report. During this reporting period, dissolved iron concentrations exceeded the trigger level in May and June 2023. A revision of the trigger level for dissolved iron at P15D was recommended.
8	**Previous Six-monthly Groundwater report** For site P16C with a Level 3 TARP in place for groundwater quality (zinc), continue closely monitoring Zn concentrations at the nearby monitoring bores (P16A, B and private bore GW105546 and GW105467).	Completed as part of the previous quarterly groundwater report (submitted June 2023 and this report. During this reporting period, short-term exceedances of the dissolved zinc trigger level at P16C occurred in January 2023 before returning to level 1.
9	**Previous Six-monthly Groundwater report** For site P15A, B and C with a Level 2 TARP in place for groundwater quality (strontium), continue closely monitoring Sr concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023), and this report. During this reporting period, short-term exceedances of the dissolved strontium trigger level occurred at P15A June 2023, at P15B in April, May and June 2023, and at P15C in April and June 2023. Trends are attributed to natural fluctuations.
10	**Previous Six-monthly Groundwater report** For site P15A and GW105228 with a Level 2 TARP in place for groundwater quality (lithium), continue closely monitoring Li concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bore GW115860.	Completed as part of the previous quarterly groundwater report (submitted June 2023 and this report. During this reporting period, short-term exceedances of the dissolved lithium trigger level occurred at P15A in May and June 2023, and at GW105228 in January and April 2023. No exceedances of the lithium trigger level were observed at the nearby bore GW115860. Trends are attributed to natural fluctuations.
11	**Previous Six-monthly Groundwater report** Complete an extended purge at P12C, P15A, P15D, P16C in the next round of monitoring to remove groundwater potentially contaminated with iron stain, grout or other localised source of metals before sampling.	As stated in the previous Quarterly Groundwater Report, field technicians undertook a purge of P15A, P16C and P12A in December 2022. Field technicians also undertook a purge of P15D in July 2023 to remove potentially contaminated groundwater with iron staining. During the reporting period, dissolved iron concentrations were still elevated sporadically at P12C (January, May and June 2023), P15A (Feb 2023) and P15D (Feb, May and June 2023). P16C showed no exceedances.
12	**Previous Quarterly Groundwater Report**	As stated in Previous Quarterly Groundwater Report, after a review of land access and suitability of these bores, these bores have been

Item	Previous Recommendation	Progress of Recommendation
	For the next round of monitoring, undertake sampling of groundwater levels and yield test at GW105546 and GW105467.	removed from the monitoring program due to lack of suitability (private bore owner installed infrastructure making it an unsuitable site for monitoring) and lack of land access.
13	**Previous Quarterly Groundwater Report** Investigate blockages at P16B and GW072402.	At GW072402, the blockage of this bore is understood to have occurred prior to mining in the Western Domain. Therefore, this bore has been removed from the monitoring program. At P16B, the previous blockage was resolved, and water level and quality data was available for the full reporting period.
14	**Previous Quarterly Groundwater Report** For WD02, establish trigger levels for groundwater levels for each VWP pressure sensor.	Construction of WD02 is complete and data collection has commenced. Given the conclusion of mining in the Western Domain and lack of baseline data collected, it is recommended that triggers not be established for this bore (insufficient baseline data prior to cessation of compliance reporting). The bore will be incorporated into the broader regional monitoring network associated with ongoing extraction activities underway by Tahmoor Coal.

6.0 Recommendations

It is recommended that:

- Where a TARP Level 1 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report.
- Where TARP Level 2 applied during the reporting period, continue the groundwater monitoring program and reporting of groundwater level and quality data in the next groundwater review report. In addition, it is recommended to:
    - Groundwater Quality – for all sites with Level 2 TARPs in place, closely monitor concentrations against TARP trigger levels for the site and associated control sites as set out in the TARPs (Tahmoor Coal, 2021).
    - Groundwater Levels - for all sites with Level 2 TARPs in place, closely monitor groundwater levels against TARP trigger levels for the site and associated control sites as set out in the TARPs (Tahmoor Coal, 2021).
    - Groundwater Pressures – continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time. For all sites with Level 2 TARPs in place, closely monitor groundwater pressures levels against TARP trigger levels for the site and associated control sites as set out in the TARPs (Tahmoor Coal, 2021).
    - Revise the trigger level for dissolved iron at P15D to 2.5 mg/L (SLR, 2023a).
    - Revise the trigger level at GW105228 to 0.25 mg/L to align with the lithium trigger level at GW115860 (SLR, 2023a).

7.0 References

HydroSimulations/SLR, 2019. Tahmoor LW W1-W2 Extraction Plan: Groundwater Technical Report. Report HS2019/14c for Tahmoor Coal Pty. Ltd., July 2019.

SLR, 2021. Tahmoor Coal LW W3-W4 Extraction Plan: Groundwater Technical Report. Prepared for Tahmoor Coal Pty Ltd, Report No: 665.10010.00006-R01-v3.0.

SLR, 2023a. Western Domain Quarterly Groundwater Report: Oct – Dec 2022. Prepared for Tahmoor Coal Pty. Ltd., March 2023, Report No: 610.30977.0000-M01-v3.0.

SLR, 2023b. Western Domain Quarterly Groundwater Report: Jan – Mar 2023. Prepared for Tahmoor Coal Pty. Ltd., June 2023, Report No: 640.30614.00000.

Tahmoor Coal Pty Ltd, 2021. Tahmoor North - Western Domain, LW W3-W4 Water Management Plan. TAH-HSEC-326 (September 2021, Ver4)

Appendix A TARPs (Tahmoor Coal, 2021)

Six-monthly Groundwater Reporting: January – June 2023

Tahmoor Western Domain

Tahmoor Coal Pty Ltd

SLR Project No.: 665.10010.00207

21 September 2023

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Groundwater Levels at monitoring bores and private groundwater bores.	GROUNDWATER LEVEL – Monitoring bores **Locations** (refer to Figure 3-5) Impact sites – P12, P13, P14, P15, P16, and any additional bore(s) (to be drilled) Control sites – P17, and possibly P11 **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter. Baseline data available since May 2019. During mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter. Post mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). GROUNDWATER LEVEL – Private groundwater bores **Locations** (refer to Figure 3-5) Control sites - GW72402, GW105228, GW105467, GW115860 and GW105546 and any other private bores where access is negotiated with landholder. **Frequency** Pre-mining - Standing Water Level (where available) and yield data. Pre-mining testing completed in bore census (GeoTerra, 2019). During mining - Manual monitoring (flow rate and, where available, standing water level) on a 3-monthly basis. Post mining - Manual monitoring (flow rate and, where available, standing water level) on a 3-monthly basis for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• Groundwater level remains consistent within baseline variability and/or pre-mining trends, with reductions in groundwater level less than two metres and does not trigger Level 2 to Level 4 Significance Levels (refer to Table 6-2).	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) (refer to Table 6-2 for TARP Significance Level 2). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Water level declines below the water level of TARP Significance Level 3 (refer Table 6-2, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Water level reduction greater than the maximum modelled drawdown (refer to Table 6-1 for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response. • Compare against base case and deterministic model scenarios.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • For monitoring bores: If it is concluded that there has been a mining-related impact, then implement an investigation including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites. • For private groundwater bores: If it is concluded that there has been a mining-related impact, then implement actions in accordance with the make good provisions (Section 6.2.4 of the Water Management Plan) in consultation with DPIE and the affected landholder.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Shallow Groundwater Pressures at VWPs TNC036, TNC040, WD01 and WD02 (once installed).	GROUNDWATER PRESSURE **Locations** <u>Impact sites</u> – TNC36, WD01 and WD02 (once installed) (refer to Section 5.2.2). <u>Control sites</u> - Groundwater bores/VWPs TNC40 (refer to Figure 3-5). **Frequency** <u>Pre-mining</u> - Minimum continuous 24-hourly readings with monthly logger download. <u>During mining</u> - Minimum continuous 24-hourly readings with monthly logger download. <u>Post mining</u> - Minimum continuous 24-hourly readings with monthly logger download for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• No observable mining induced change at VWP intakes located at or above (i.e. shallower than) 200 m depth.	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than) 200 m depth following the commencement of extraction at LW W1 (and LW W2, W3 and W4) (refer to Table 6-2 for TARP Significance Level 2). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data. • Convene with Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Water level declines below the water level of TARP Significance Level 3 (refer Table 6-2, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Water level reduction greater than the maximum modelled drawdown (refer to Table 6-2 for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response. • Compare against base case and deterministic model scenarios.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • If it is concluded that there has been a mining-related impact, implement an investigation report.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Deep Groundwater Pressures at VWPs TNC036.	GROUNDWATER PRESSURE **Locations** Impact site – TNC36 (refer to Figure 3-5). Control site - Groundwater bores/VWPs TNC40 (refer to Figure 3-5). **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download. During mining - Minimum continuous 24-hourly readings with monthly logger download. Post mining - Minimum continuous 24-hourly readings for 12 months after LW W4 completed. Monthly logger downloaded for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• Observed data does not exceed predicted (modelled) impacts at VWP intakes located below (i.e. deeper than) 200 m depth (excluding those monitoring the Bulli Coal Seam).	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.	• Continue monitoring program. • Ongoing review of water level data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 6 months or more.	• Continue monitoring program. • Ongoing review of water level data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group. • Consider increasing download frequency at groundwater bores where Level 3 has been reached to a fortnightly basis. Consider increasing review frequency to fortnightly.
		Level 4		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 12 months or more.	• Continue monitoring and review as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess whether change in behaviour is related to LW W1-W2 mining effects.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • If it is concluded that there has been a mining-related impact, implement an investigation report.

Table A2 Trigger Action Response Plan – Groundwater Quality

Feature	Methodology and relevant monitoring	Management: Trigger	Management: Action	Management: Response
Groundwater Quality at monitoring bores and private groundwater bores.	GROUNDWATER QUALITY – Monitoring bores **Locations** (refer to Figure 3-5) Impact sites – P12, P13, P14, P15, P16, and any additional bore(s) (to be drilled) Control sites – P17 **Frequency** Pre-mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters). During mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters). Post mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters) for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). GROUNDWATER QUALITY – Private groundwater bores **Locations** (refer to Figure 3-5) Control sites - GW72402, GW105228, GW105467, GW115860 and GW105546 and any other private bores where access is negotiated with landholder. **Frequency** Pre-mining - Field water quality (EC, pH) and iron staining. Pre-mining testing completed during bore census (GeoTerra, 2019). During mining - Field water quality and laboratory analysis on a 3-monthly basis (refer to Section 5.2.1 for parameters). Post mining - Field water quality and laboratory analysis on a 3-monthly basis (refer to Section 5.2.1 for parameters) for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	**Level 1**		
		• No observable change in salinity, pH or metals outside of the baseline variability.	• Continue monitoring program. • Ongoing review of water quality data.	• No response required.
		Level 2		
		• Short term increase (< 3 months) in salinity and/or metals, or change in pH outside of baseline variability*. The effect does not persist after a significant rainfall recharge event. AND/OR • A similar trend or response has been noted at other monitored bores or private groundwater bores.	• Continue monitoring program. • Ongoing review of water quality data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Short term increase (< 3 months) in salinity and/or metals or change in pH outside of baseline variability*. The effect persists after a significant rainfall recharge event. AND/OR • The change in water quality is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring program. • Ongoing review of water quality data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Medium to long term increase in salinity and / or metals or a change in pH outside of baseline variability* with the effect persisting for greater than 3 months or after a significant rainfall recharge event. AND • The reduction in water quality is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Continue review of water quality data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • For monitoring bores: If it is concluded that there has been a mining-related impact, then implement an investigation report. • For private groundwater bores: If it is concluded that there has been a mining-related impact, then implement actions in accordance with the make good provisions (Section 6.2.4 of the Water Management Plan) in consultation with the affected landholder.

Footnote:
* The baseline variability was estimated using available data and refers to the proposed trigger levels (refer to Section 6.2.2 and Table 6.2 of the Groundwater Technical Report.

Appendix B Groundwater Monitoring Network

Six-monthly Groundwater Reporting: January – June 2023

Tahmoor Western Domain

Tahmoor Coal Pty Ltd

SLR Project No.: 665.10010.00207

21 September 2023

Table A-1: Western Domain Groundwater Monitoring Network

Monitoring bore or VWP ID	Owner	Easting[1] (GDA94)	Northing[1] (GDA94)	Bore screen or VWP sensor depth (mBGL)	Status
Shallow Groundwater Levels (monitoring bores/standpipe piezometers)					
P12A	Tahmoor Coal	277771	6216561	14.6 - 19.6	EX
P12B	Tahmoor Coal	277776	6216560	31.6 - 34.6	EX
P12C	Tahmoor Coal	277781	6216559	61.6 - 64.6	EX
P13A	Tahmoor Coal	278180	6216550	19.5 - 22.5	D
P13B	Tahmoor Coal	278175	6216554	33.5 - 37.5	D
P13C	Tahmoor Coal	278170	6216558	64.5 - 67.5	D
P14A	Tahmoor Coal	278398	6216536	4.5 - 6.0	EX
P14B	Tahmoor Coal	278393	6216534	13.6 - 16.6	EX
P14C	Tahmoor Coal	278397	6216542	28.6 - 31.6	EX
P14D	Tahmoor Coal	278391	6216540	58.6 - 61.6	EX
P15A	Tahmoor Coal	278550	6216426	16.1-17.6	EX
P15B	Tahmoor Coal	278545	6216423	18.6-20.1	EX
P15C	Tahmoor Coal	278556	6216427	30.5-32.0	EX
P15D	Tahmoor Coal	278561	6216431	66 (bore depth)	EX
P16A	Tahmoor Coal	277351	6215147	24.5 - 27.5	EX
P16B	Tahmoor Coal	277350	6215140	42.5 - 45.5	EX
P16C	Tahmoor Coal	277347	6215135	72.5 - 75.5	EX
P17	Tahmoor Coal	277941	6217153	19.6 - 22.6	D
GW072402	Private	277708	6216852	8.2 - 72.0	EX
GW105228	Private	278490	6216858	23.0 - 63.0	EX
GW105467	Private	277253	6215247	73.0 - 79.0	EX
GW105546	Private	277018	6215732	48.0 - 56.0	EX
GW115860	Private	278543	6216760	20, 48 and 55	EX
Shallow Groundwater Pressures (VWPs < 200 mBGL)					
P40(A-D)	Tahmoor Coal	277620.6	6216160.1	HBSS-39	EX
				HBSS-44	EX
				HBSS-49	EX
				HBSS-85	EX
P41(A-F)	Tahmoor Coal	279167	6216068	WMFM-53 (vertical)	EX
				HBSS-71 (vertical)	EX
				HBSS-88 (vertical)	EX
				HBSS-106 (vertical)	EX
				HBSS-123 (vertical)	EX
				140 (vertical)	EX
TNC036	Tahmoor Coal	277269	6215382	HBSS-65	EX

Monitoring bore or VWP ID	Owner	Easting[1] (GDA94)	Northing[1] (GDA94)	Bore screen or VWP sensor depth (mBGL)	Status
				HBSS-97	EX
				BGSS-169	EX
TNC040	Tahmoor Coal	279004	6214521	WMFM-27	EX
				HBSS-65	EX
				HBSS-111	F
TNC043	Tahmoor Coal	280077	6212671	HBSS-65	L
				HBSS-111.5	L
WD01	Tahmoor Coal	278099	6214828	HBSS-70	EX
				HBSS-90	EX
				HBSS-190	F
WD02	Tahmoor Coal	278246	6215178	TBC	EX
Deep Groundwater Pressures (VWPs > 200 mBGL)					
TNC036	Tahmoor Coal	277269	6215382	BGSS-214	EX
				BGSS-298.5	F
				BGSS-412.5	EX
				BUSM-463.5	F
TNC040	Tahmoor Coal	279004	6214521	HBSS-225	F
				BHCS-252	F
				BGSS-352	F
				SCSS-482	F
				BUCO-501.9	F
TNC043	Tahmoor Coal	280077	6212671	HBSS-213	D
				BGSS-240	D
				BGSS-332.6	D
				BGSS-405.2	D
				BUCO-476.3	D
WD01	Tahmoor Coal	278099	6214828	210-HBSS	EX
				230-Newport Fm	F
				300-BGSS	F
				330-BGSS	F
				350-BGSS	F
WD02	Tahmoor Coal	278246	6215178	TBC	EX

WNFM – Wianamatta Group, HBSS – Hawkesbury Sandstone, BHCS – Bald Hill Claystone, BGSS – Bulgo Sandstone, SPCS – Stanwell Park Claystone, SCSS – Scarborough Sandstone, WBCS - Wombarra Claystone, CCSS – Coal Cliff Sandstone, BUCO– Bulli Coal Seam, WWCO – Wongawilli Coal Seam

VWP – Vibrating Wire Piezometer, OSP – Open Stand-pipe

EX – Existing, F -Failed, D – Destroyed

SLR

Appendix C Hydrographs – Groundwater Level TARPs

Six-monthly Groundwater Reporting: January – June 2023

Tahmoor Western Domain

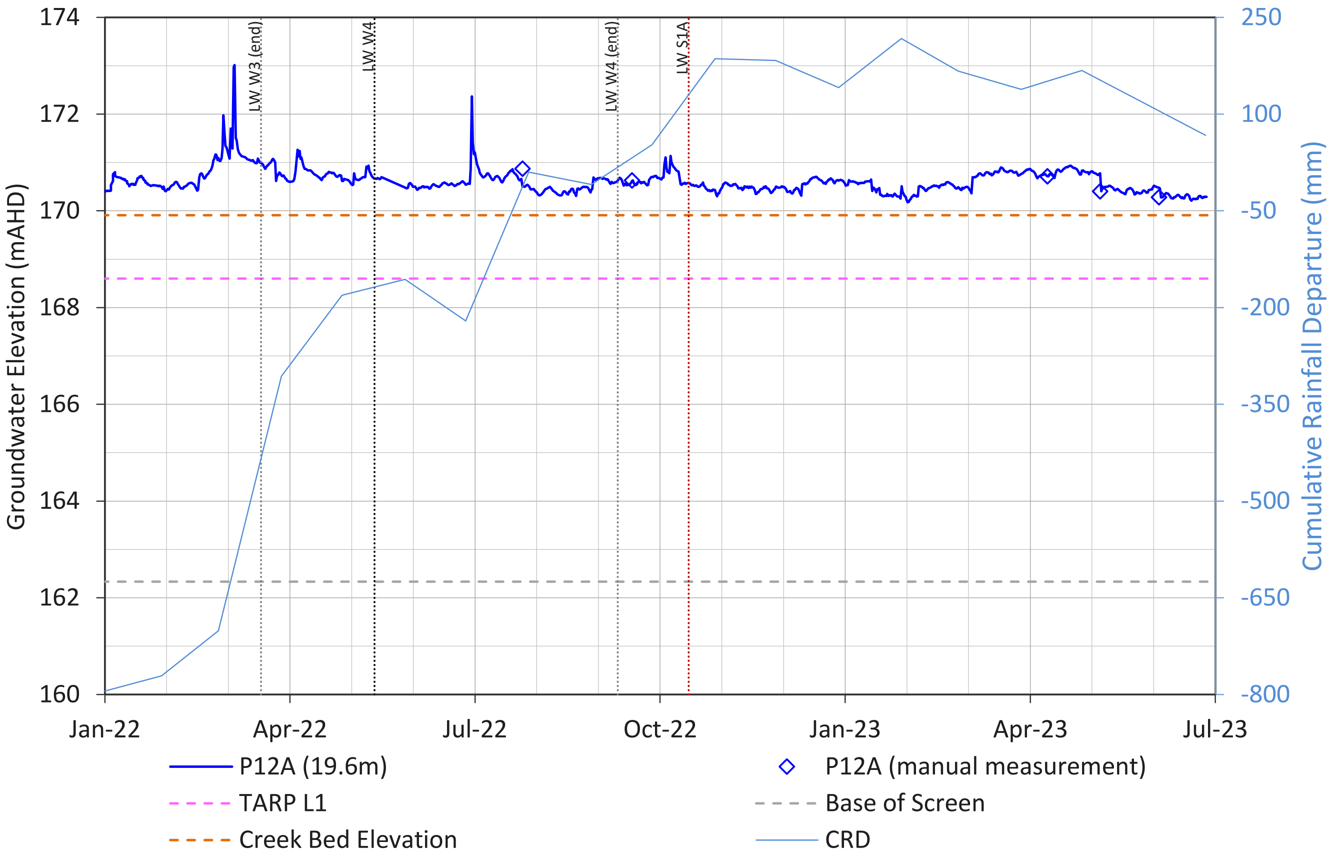
Tahmoor Coal Pty Ltd

SLR Project No.: 665.10010.00207

21 September 2023

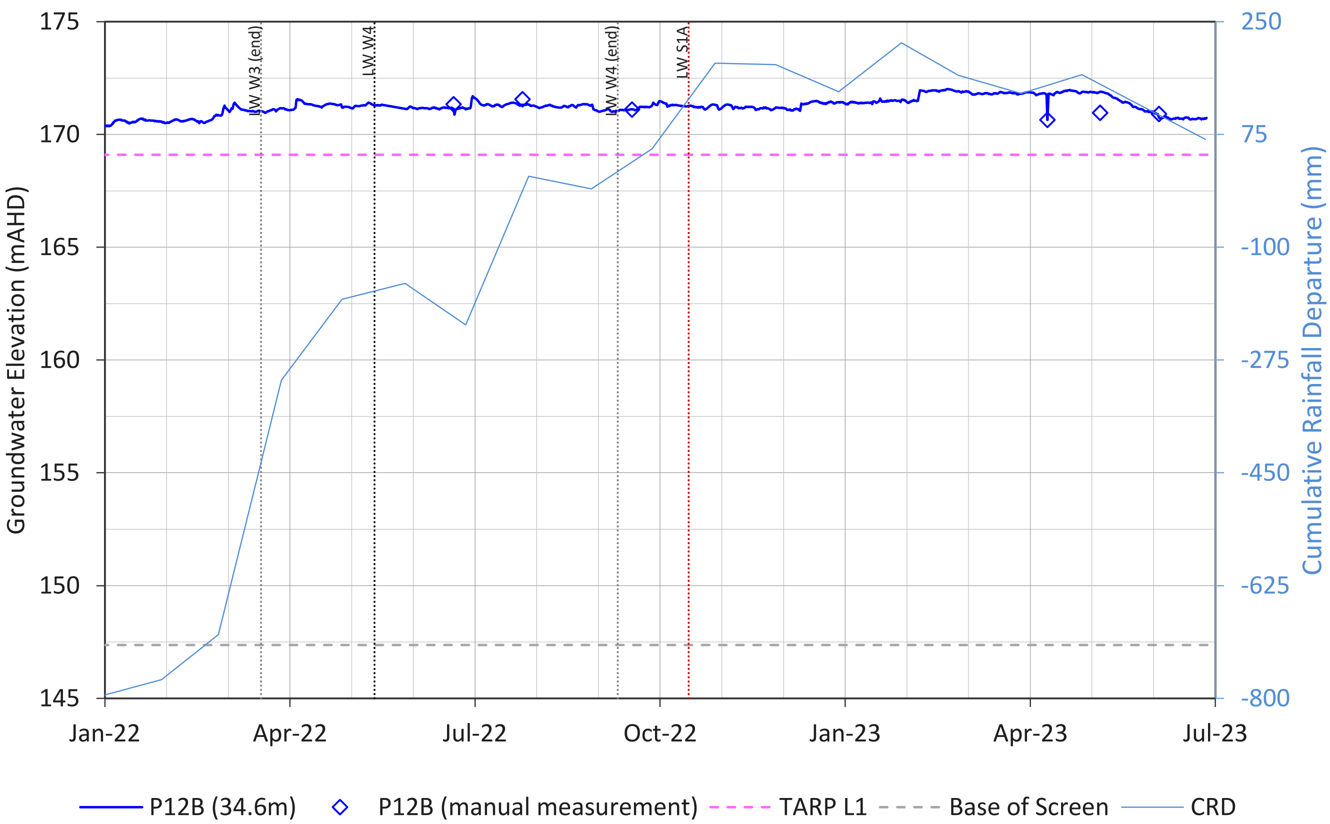
Note: The hydrogrphas presented here reference TARP Levels 1, 2 and 3 – these are in fact pertaining to TARP Levels 2, 3 and 4 resepctively as they are written in the Water Management Plan (i.e., the TARP Level 1 marker on the plot is, in reality, the Level 2 TARP with Level 1 representing baseline conditions and not presented).

P12A

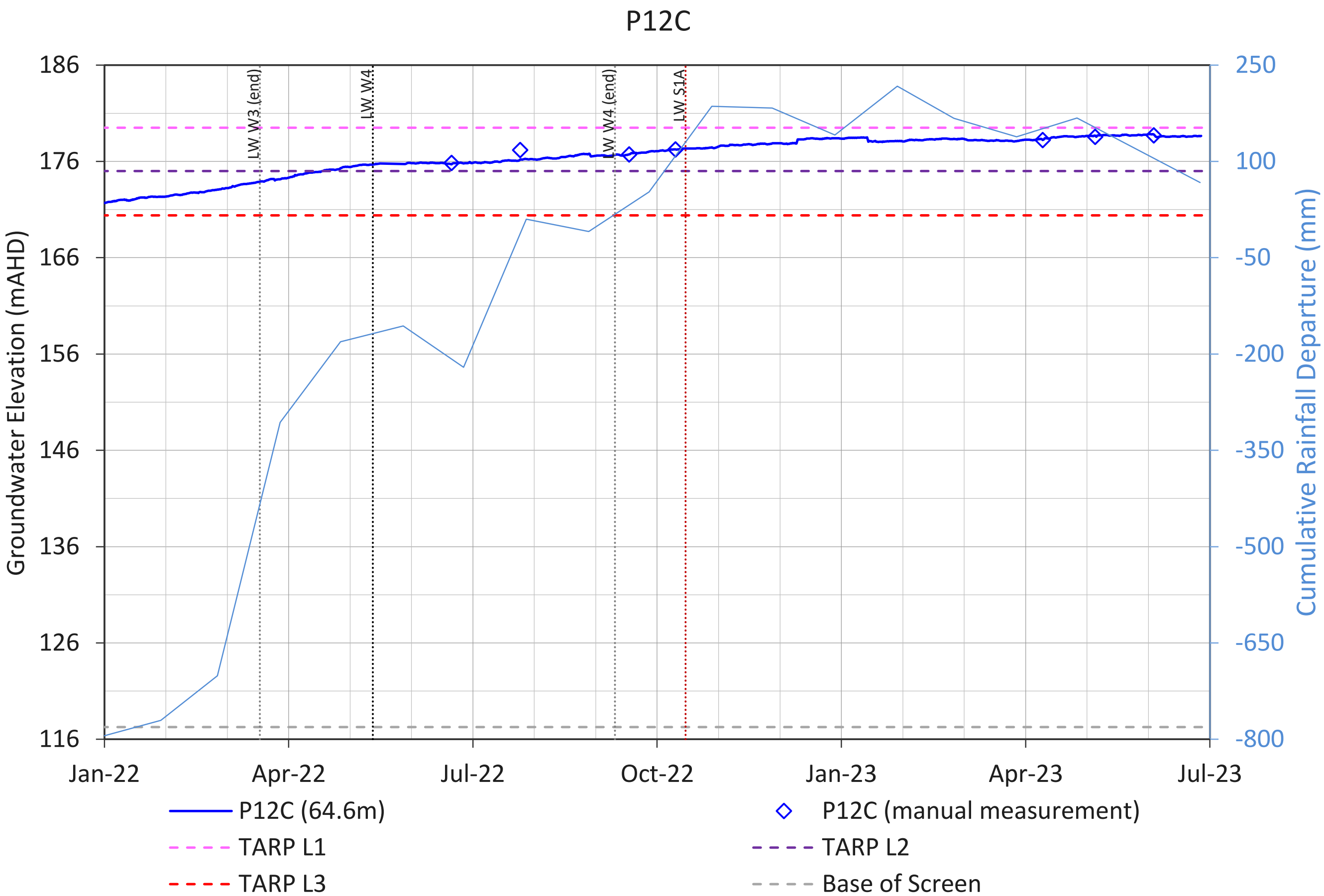


174
172
170
168
166
164
162
160
Groundwater Elevation (mAHD)
250
100
-50
-200
-350
-500
-650
-800
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A (19.6m)
P12A (manual measurement)
TARP L1
Base of Screen
Creek Bed Elevation
CRD

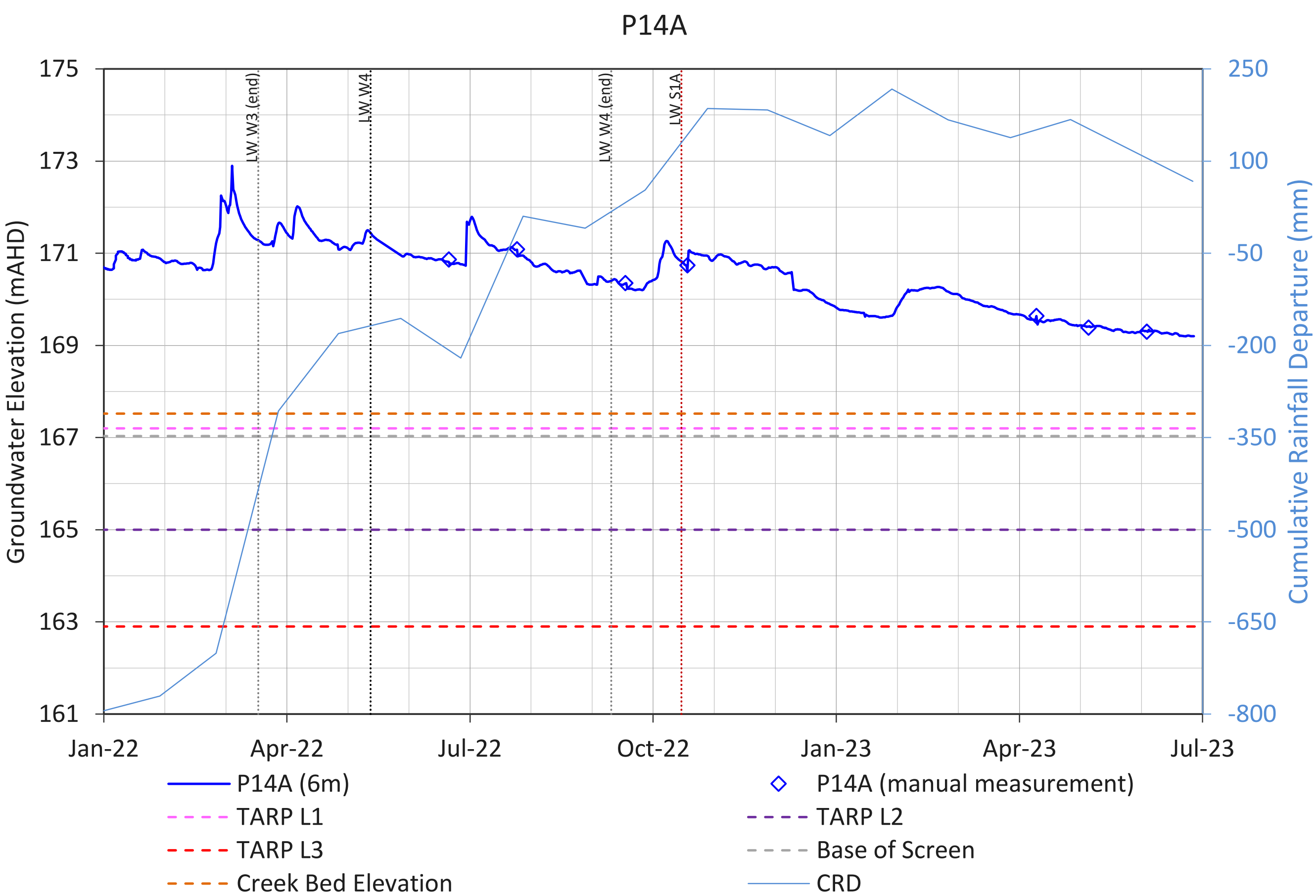
P12B



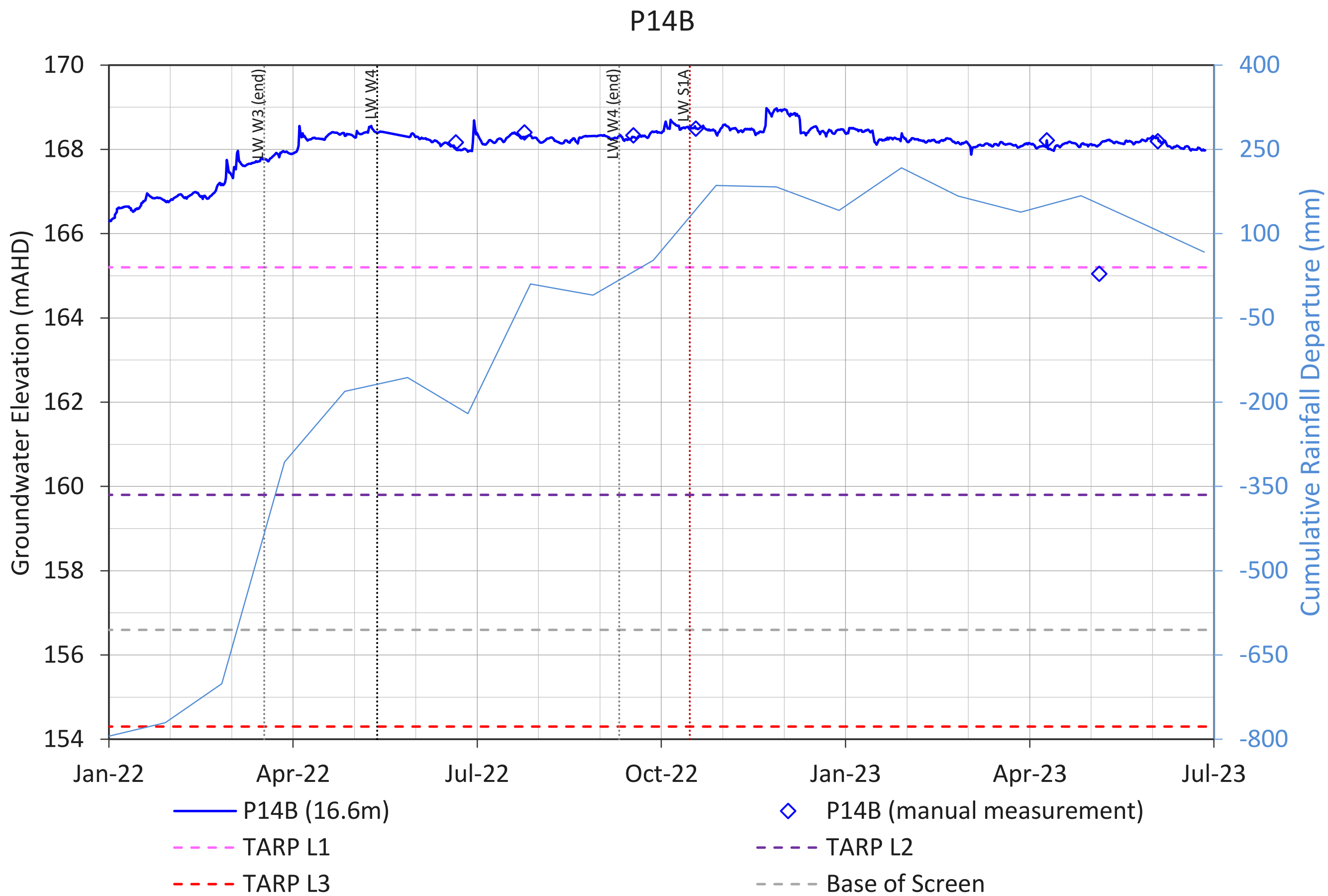
175
170
165
160
155
150
145
Groundwater Elevation (mAHD)
250
75
-100
-275
-450
-625
-800
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12B (34.6m)
P12B (manual measurement)
TARP L1
Base of Screen
CRD



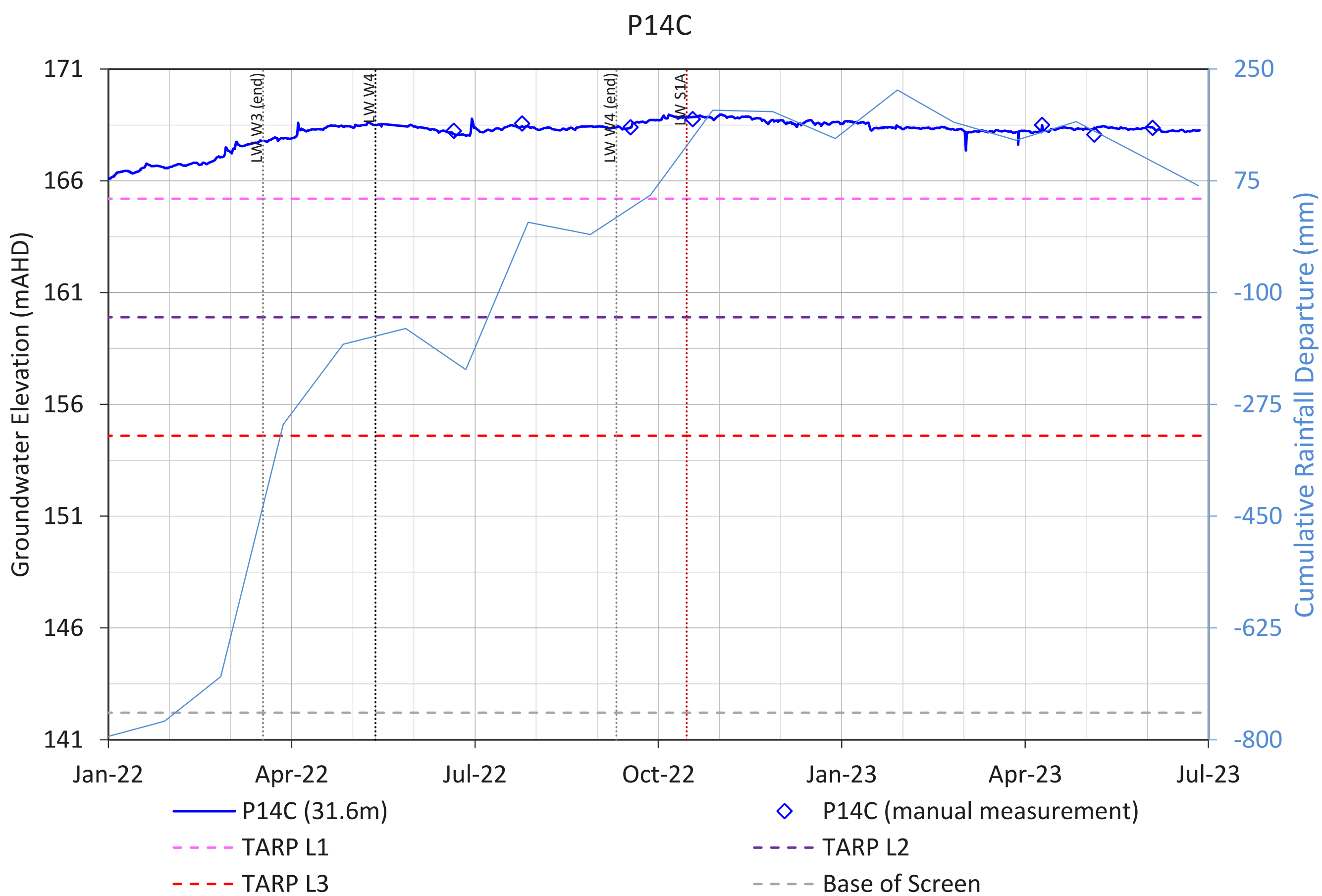
P12C
186
176
166
156
146
136
126
116
250
100
-50
-200
-350
-500
-650
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12C (64.6m)
P12C (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen



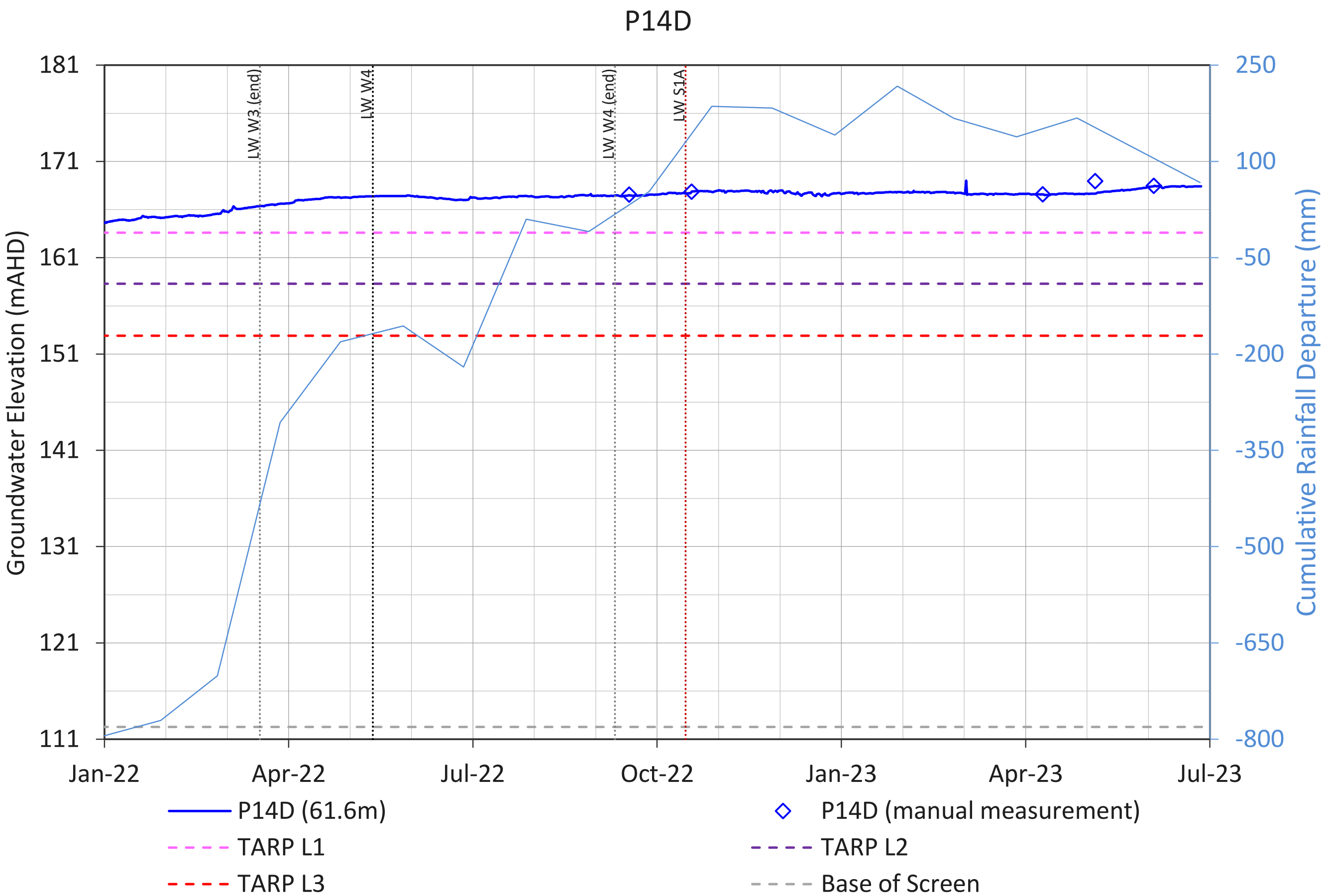
P14A
175
173
171
169
167
165
163
161
250
100
-50
-200
-350
-500
-650
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14A (6m)
P14A (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen
Creek Bed Elevation
CRD



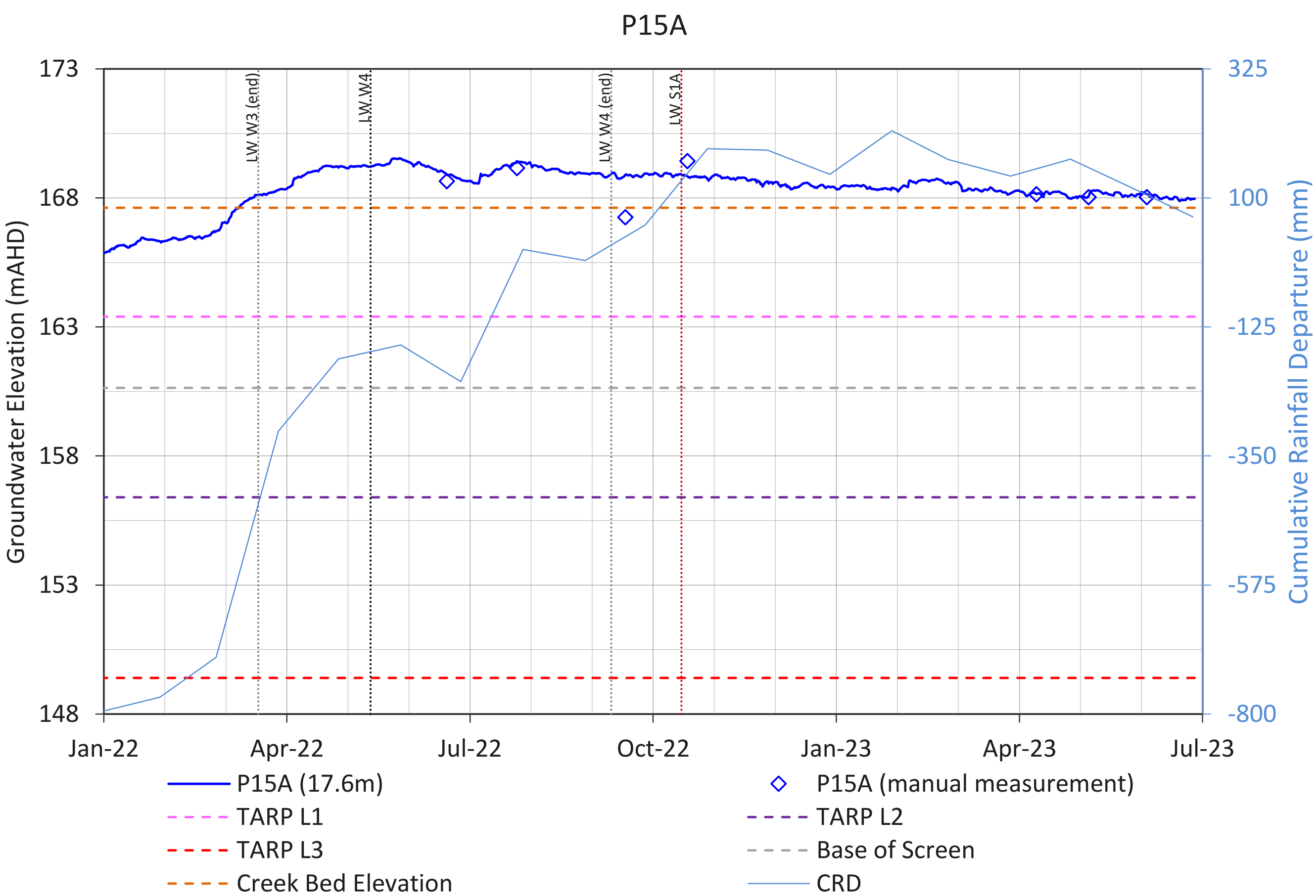
P14B
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
170
168
166
164
162
160
158
156
154
400
250
100
-50
-200
-350
-500
-650
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14B (16.6m)
P14B (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen



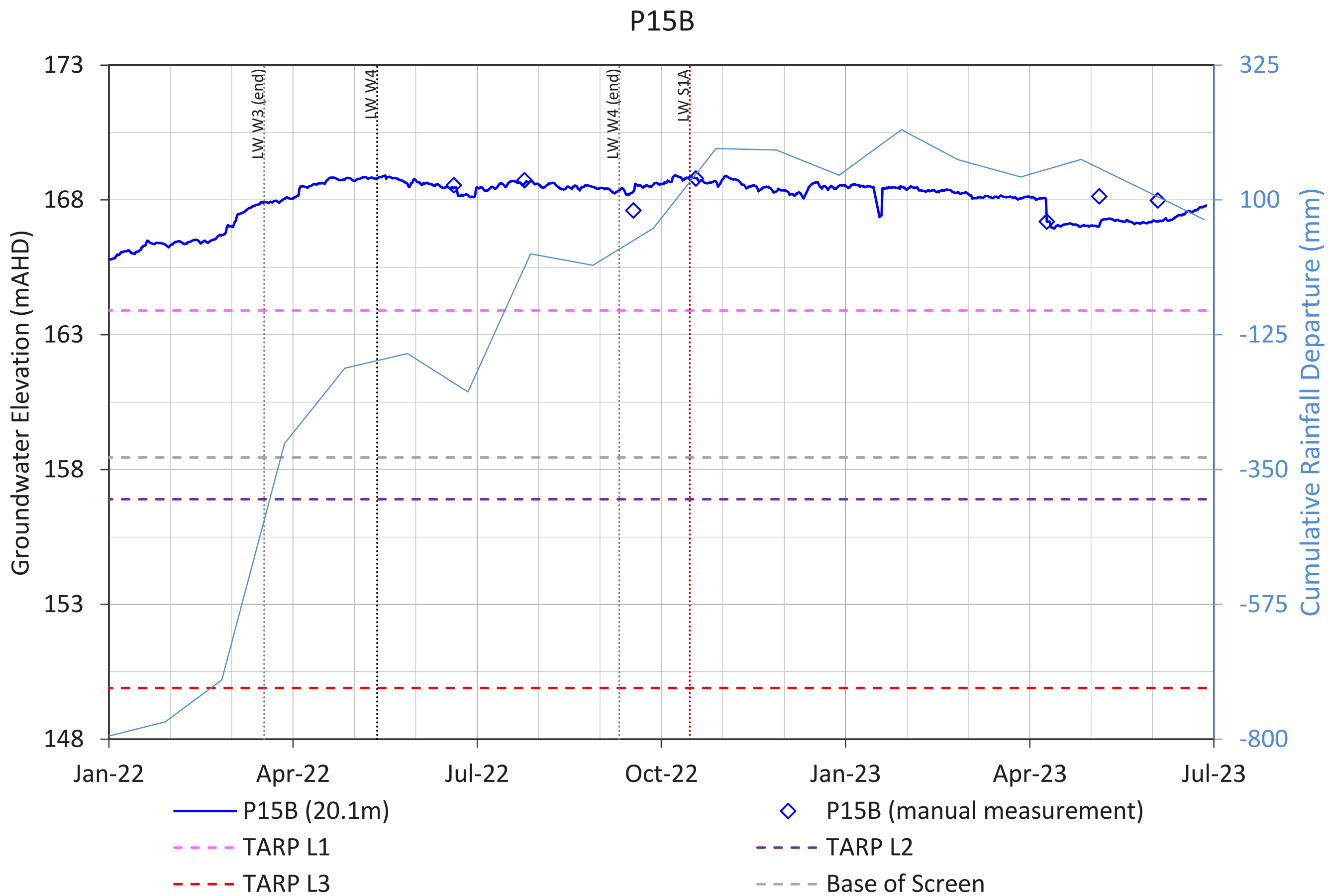
P14C
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
171
166
161
156
151
146
141
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14C (31.6m)
P14C (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen

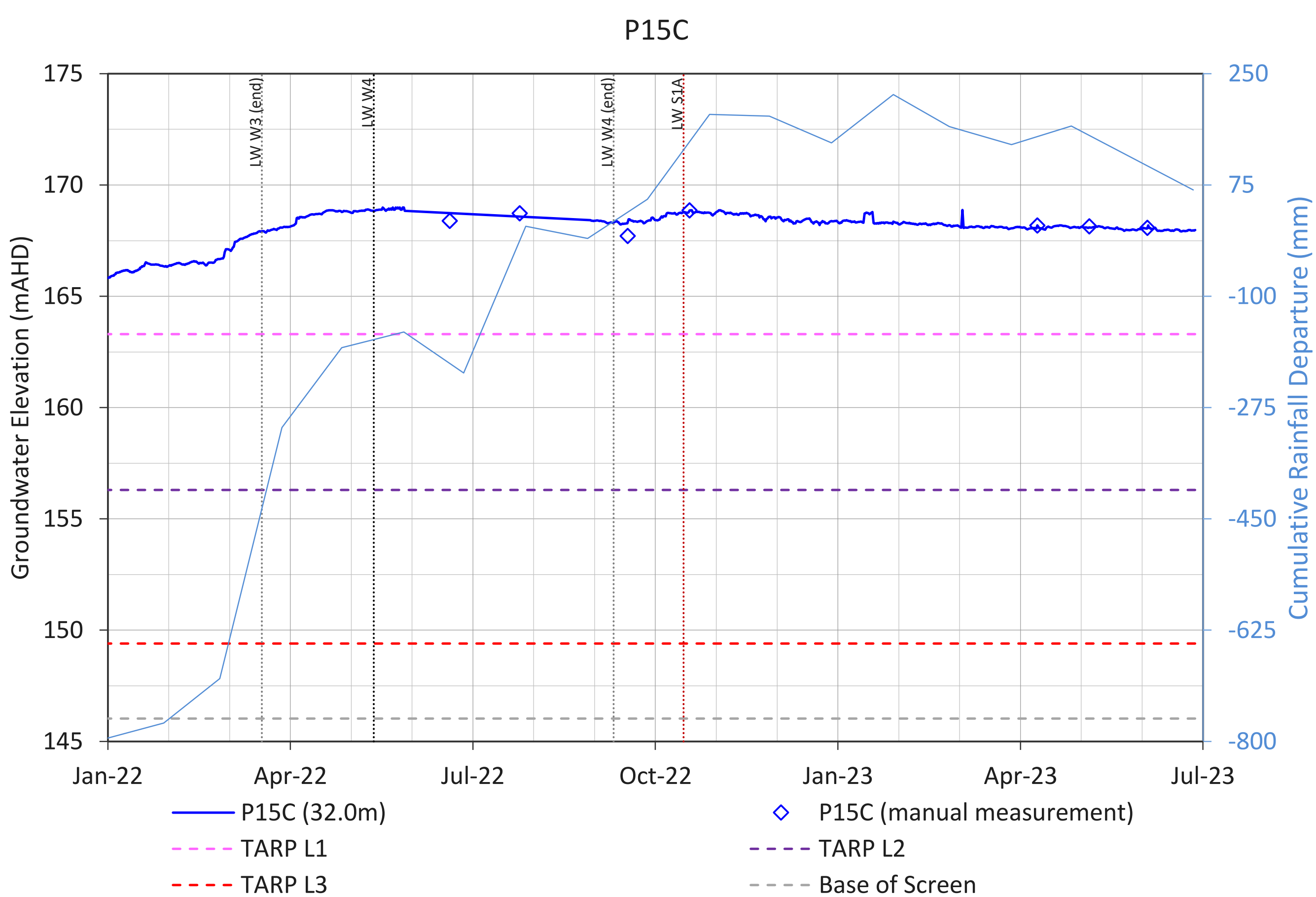


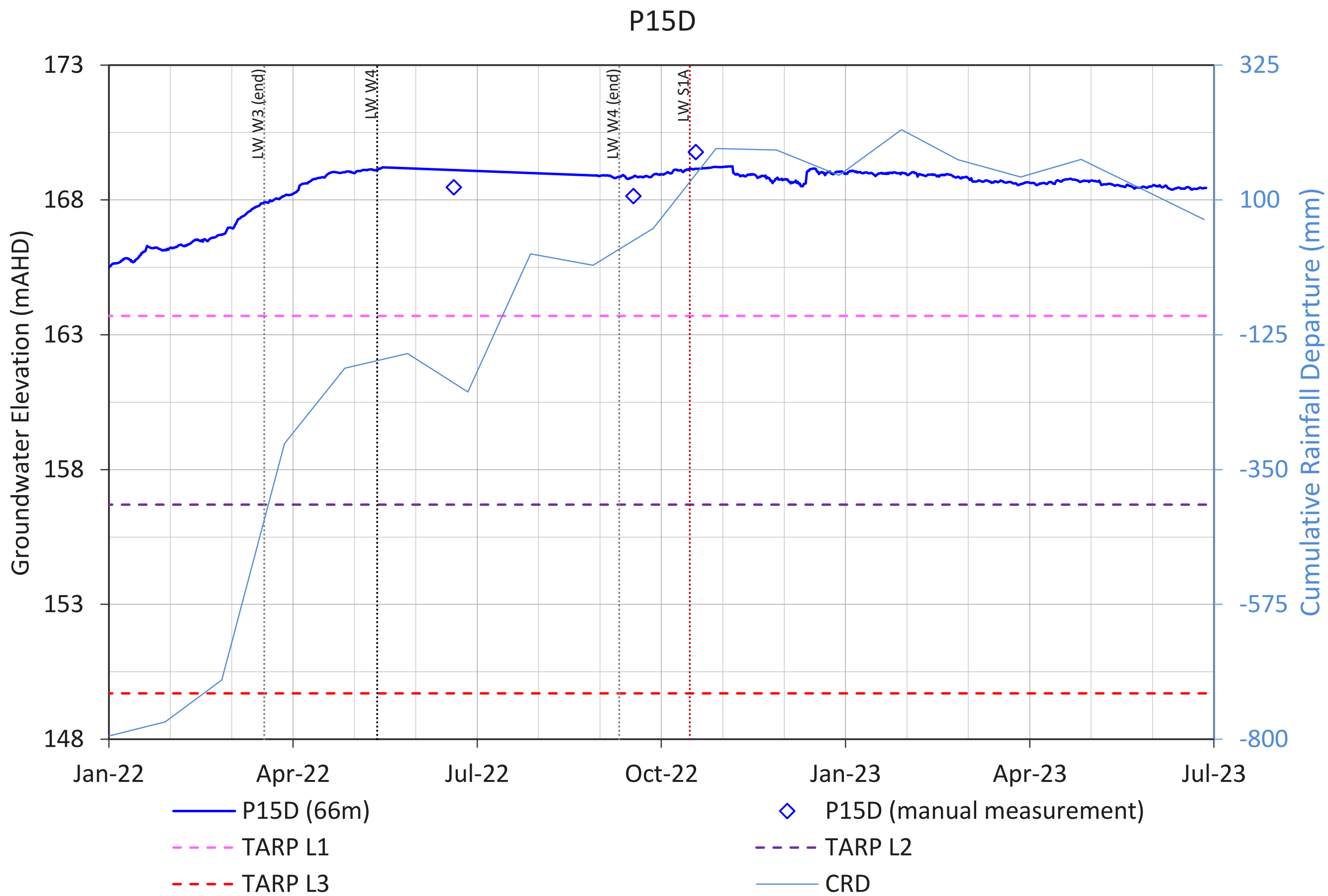
P14D
181
171
161
151
141
131
121
111
250
100
-50
-200
-350
-500
-650
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14D (61.6m)
P14D (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen

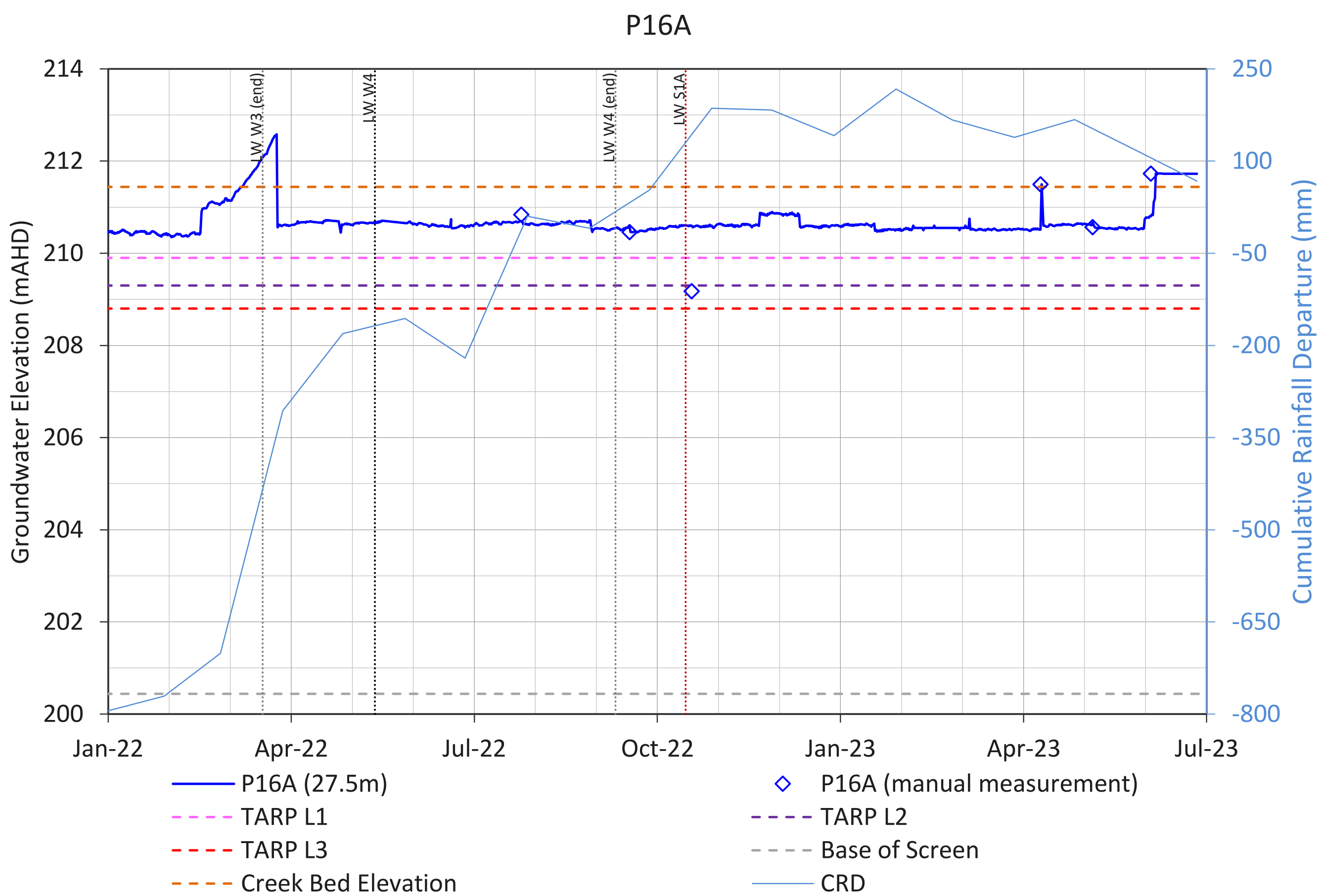


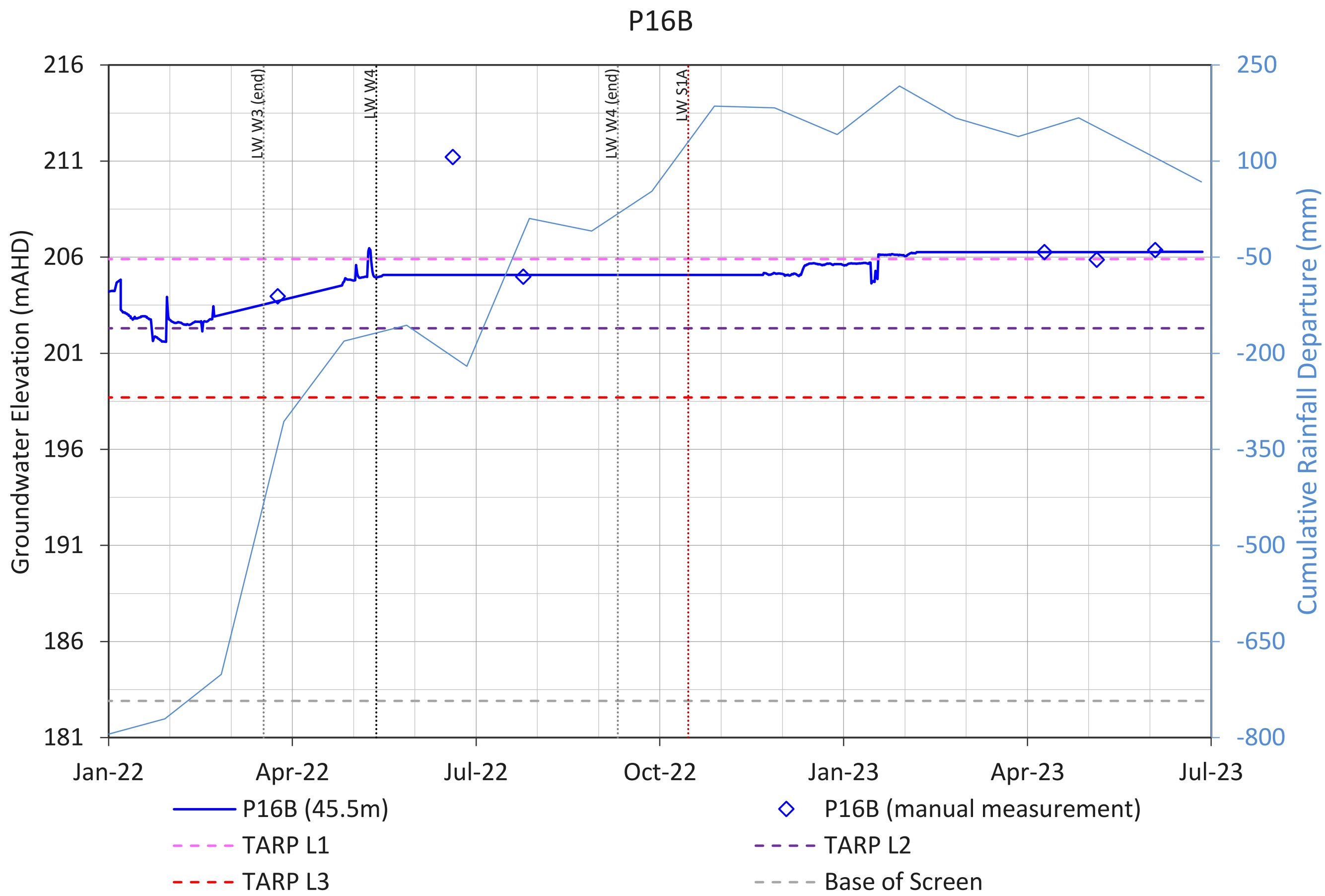
P15A
173
168
163
158
153
148
325
100
-125
-350
-575
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15A (17.6m)
P15A (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen
Creek Bed Elevation
CRD

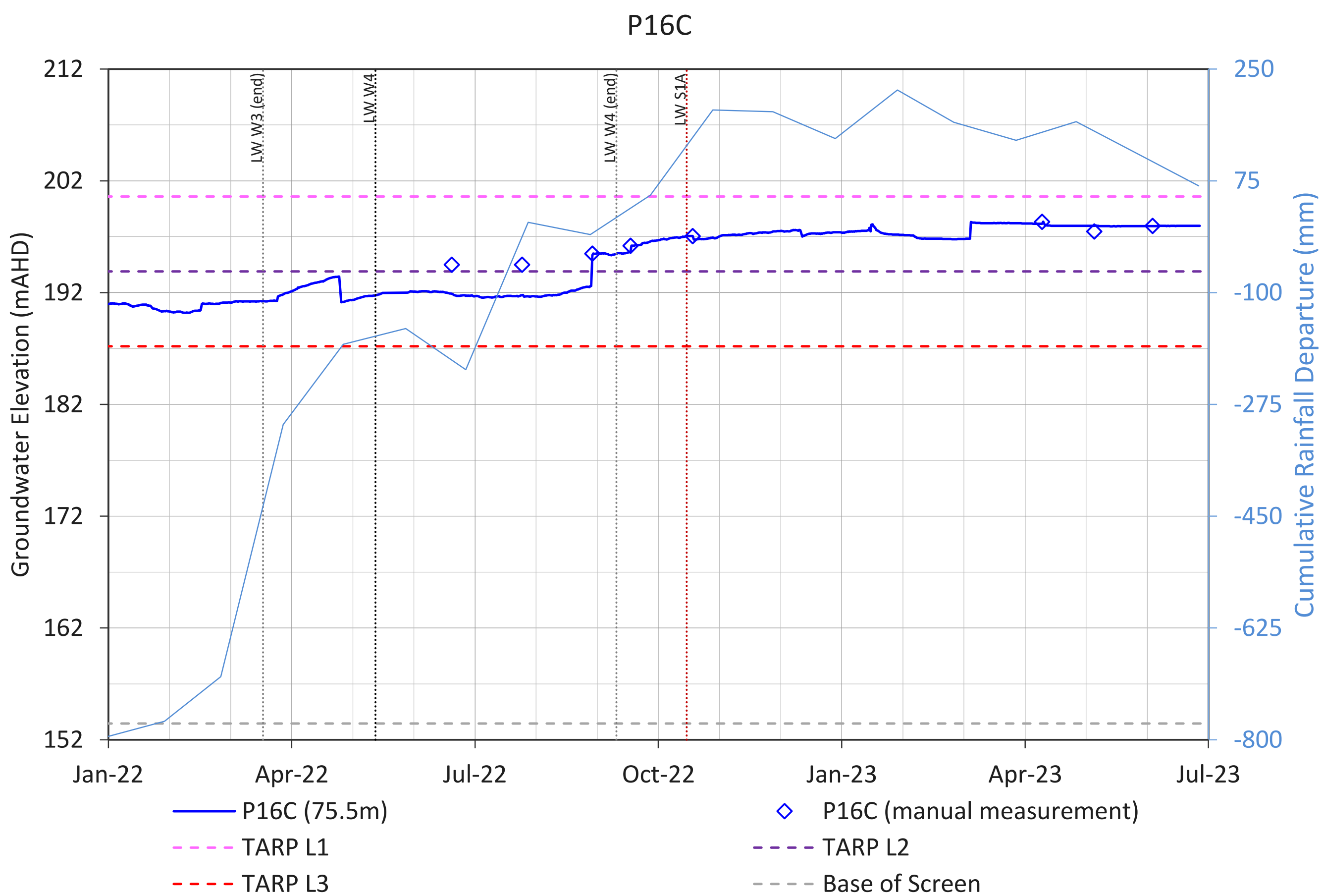

P15B
173
168
163
158
153
148
325
100
-125
-350
-575
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15B (20.1m)
P15B (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen

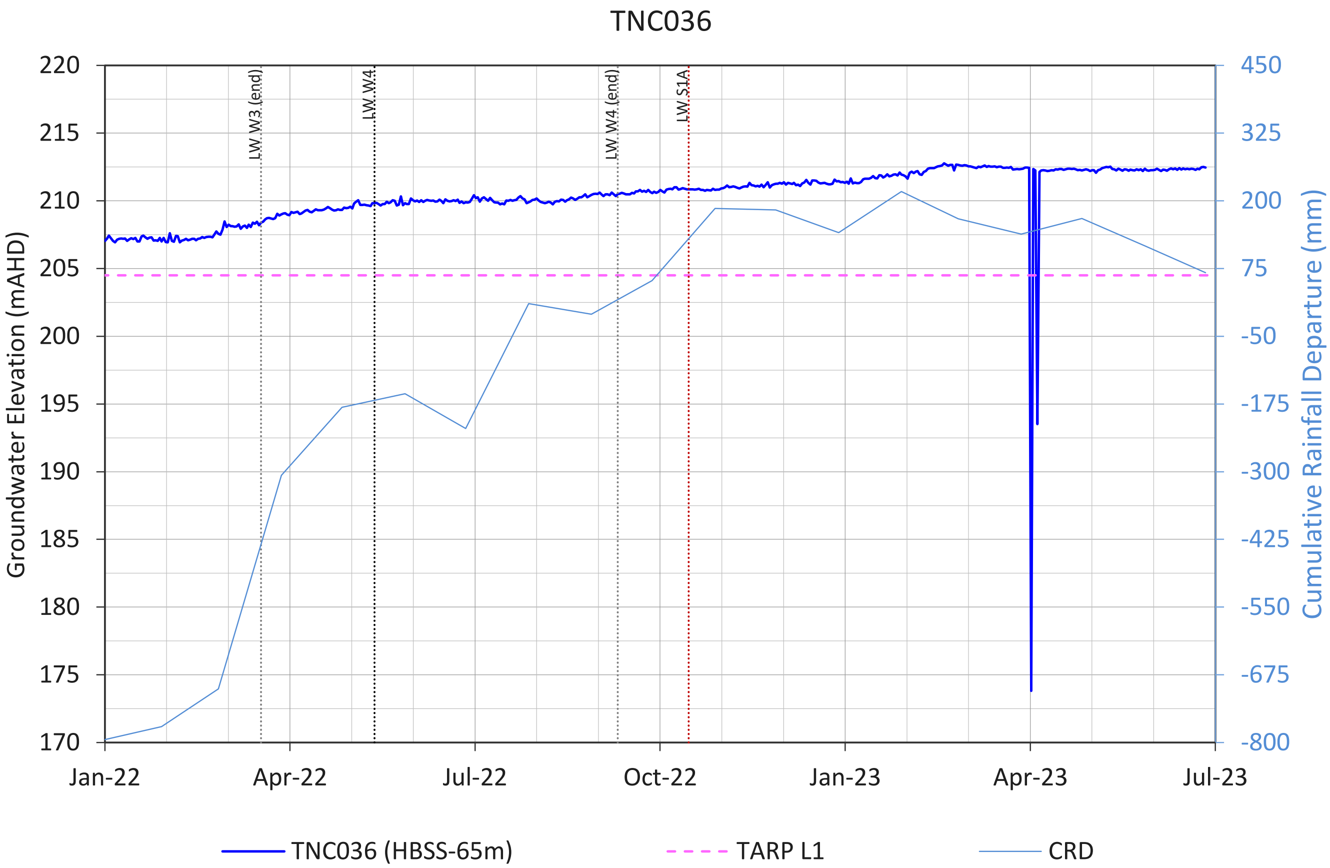

P15C
175
170
165
160
155
150
145
250
75
-100
-275
-450
-625
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C (32.0m)
P15C (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen


P15D
173
168
163
158
153
148
325
100
-125
-350
-575
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15D (66m)
P15D (manual measurement)
TARP L1
TARP L2
TARP L3
CRD

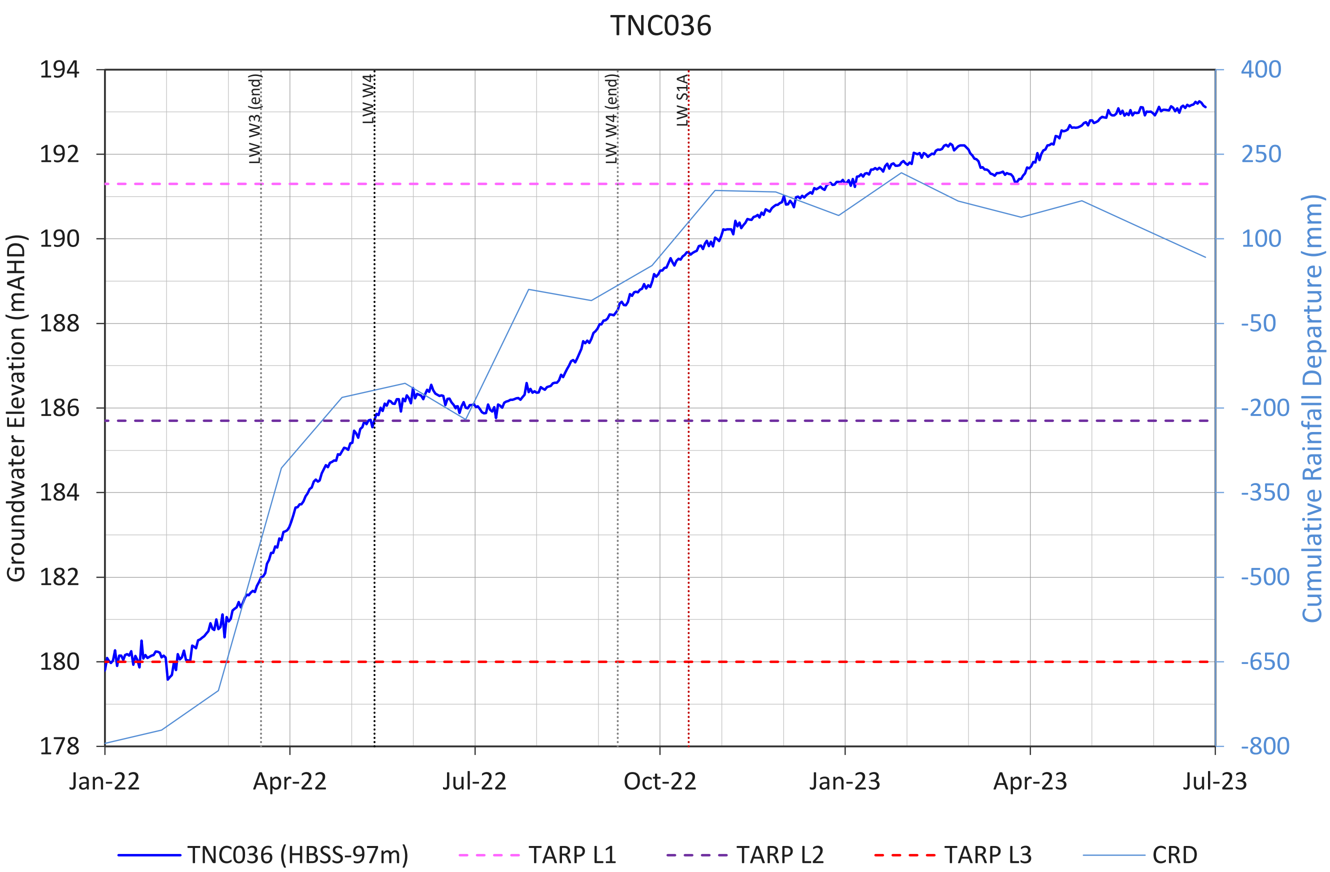

P16A
214
212
210
208
206
204
202
200
250
100
-50
-200
-350
-500
-650
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16A (27.5m)
P16A (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen
Creek Bed Elevation
CRD


P16B
216
211
206
201
196
191
186
181
250
100
-50
-200
-350
-500
-650
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16B (45.5m)
P16B (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen

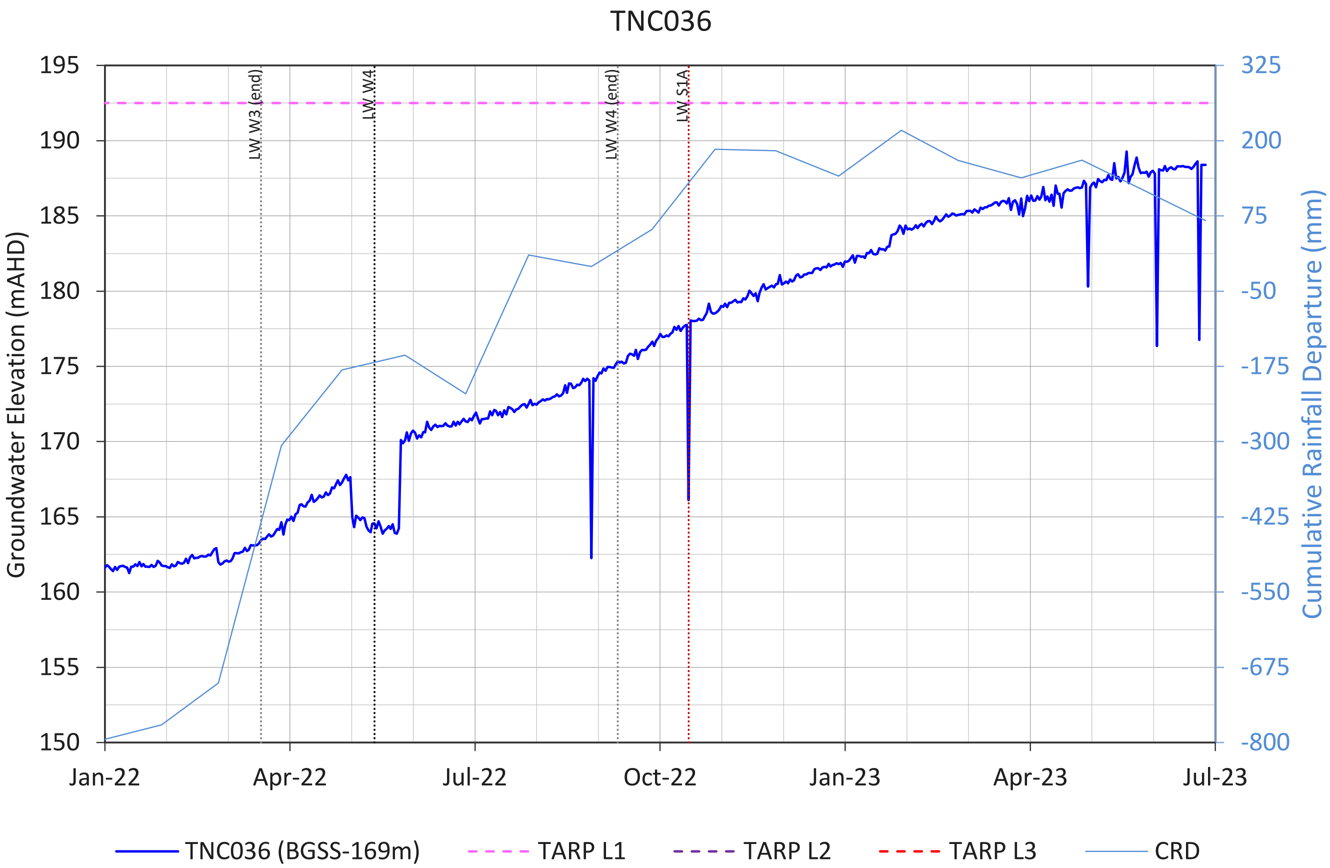

P16C
212
202
192
182
172
162
152
250
75
-100
-275
-450
-625
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16C (75.5m)
P16C (manual measurement)
TARP L1
TARP L2
TARP L3
Base of Screen

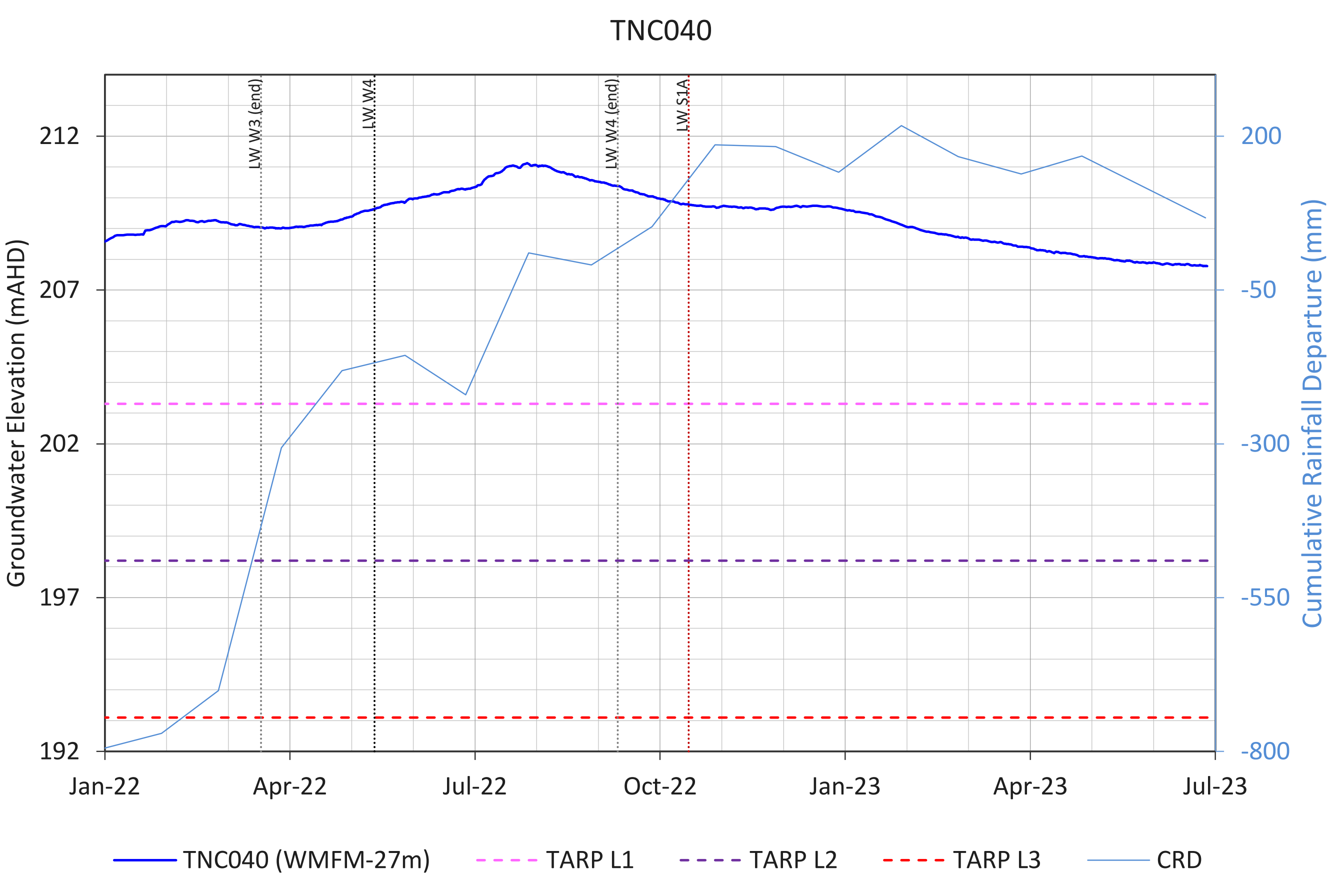


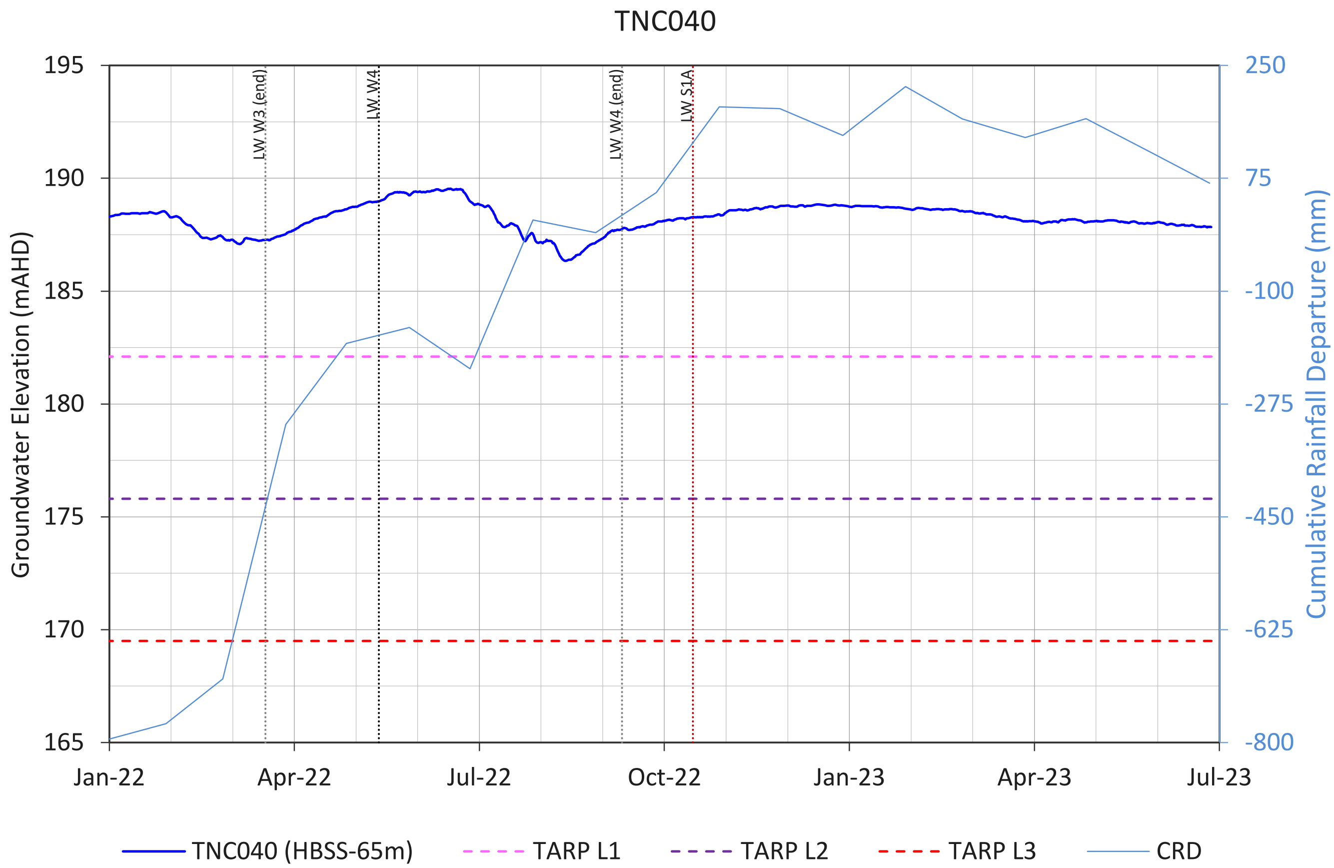
TNC036
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
220
215
210
205
200
195
190
185
180
175
170
450
325
200
75
-50
-175
-300
-425
-550
-675
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
TNC036 (HBSS-65m)
TARP L1
CRD



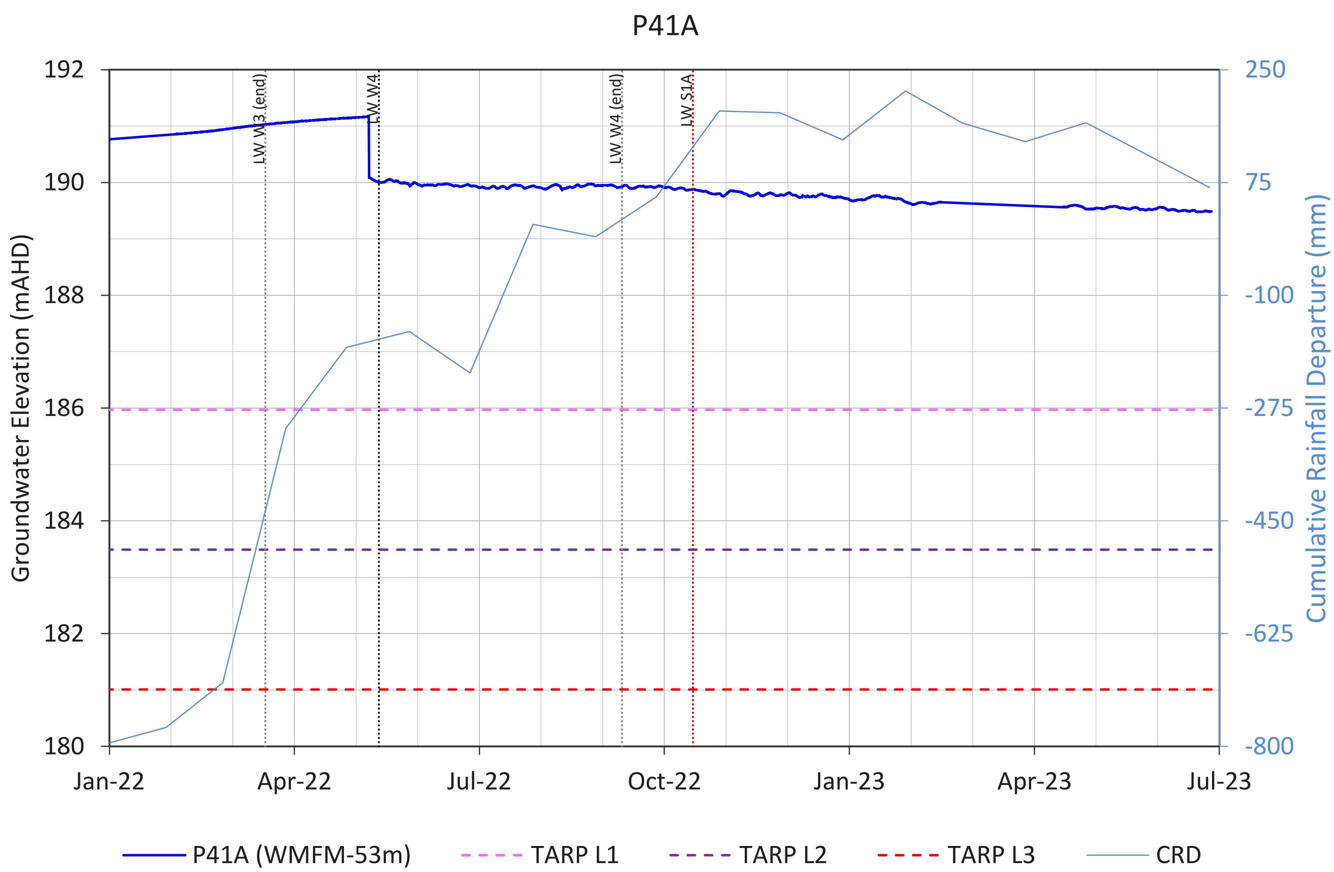
TNC036
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
194
192
190
188
186
184
182
180
178
400
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
TNC036 (HBSS-97m)
TARP L1
TARP L2
TARP L3
CRD


TNC036
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
195
190
185
180
175
170
165
160
155
150
325
200
75
-50
-175
-300
-425
-550
-675
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
TNC036 (BGSS-169m)
TARP L1
TARP L2
TARP L3
CRD

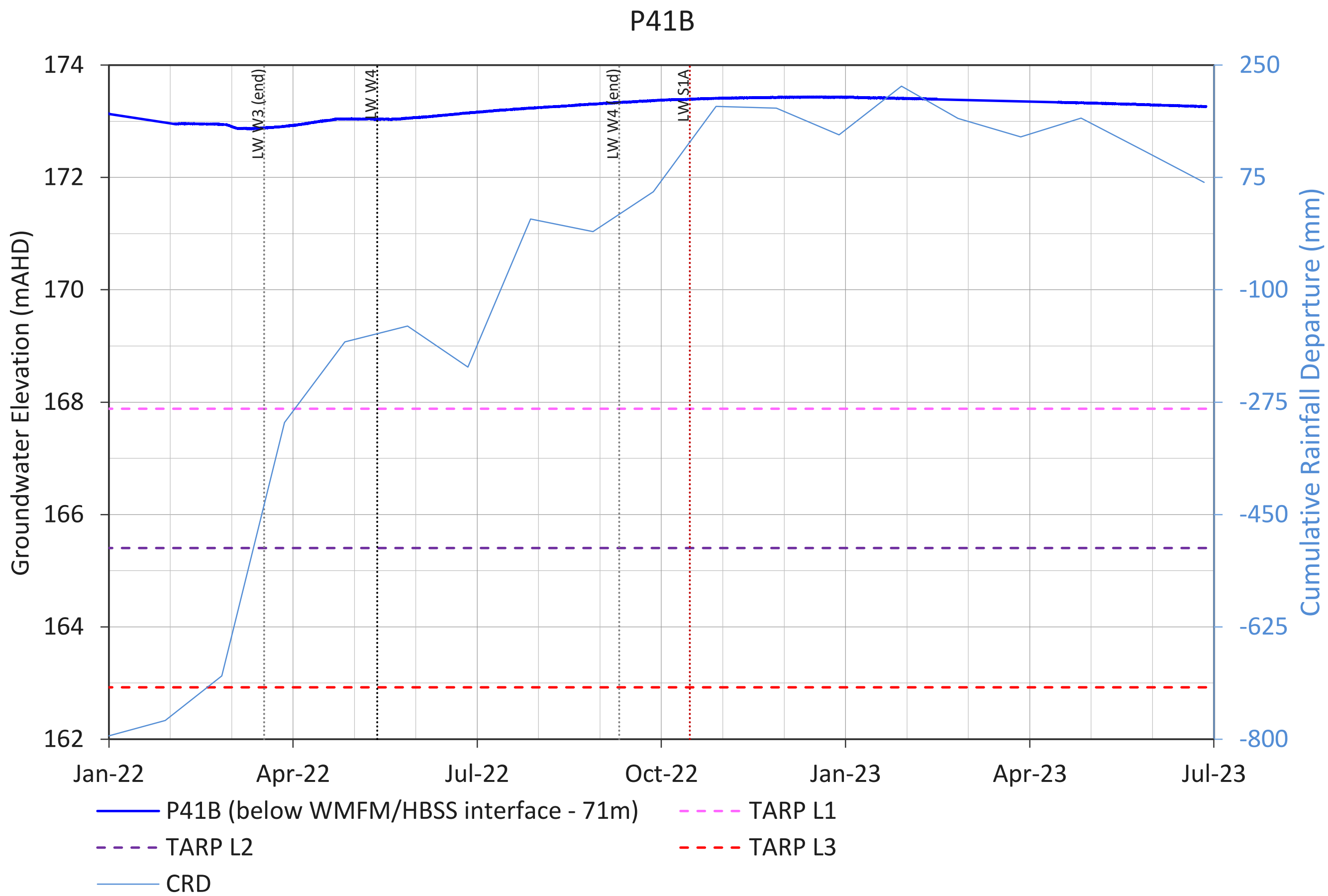

TNC040
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
212
207
202
197
192
200
-50
-300
-550
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
TNC040 (WMFM-27m)
TARP L1
TARP L2
TARP L3
CRD

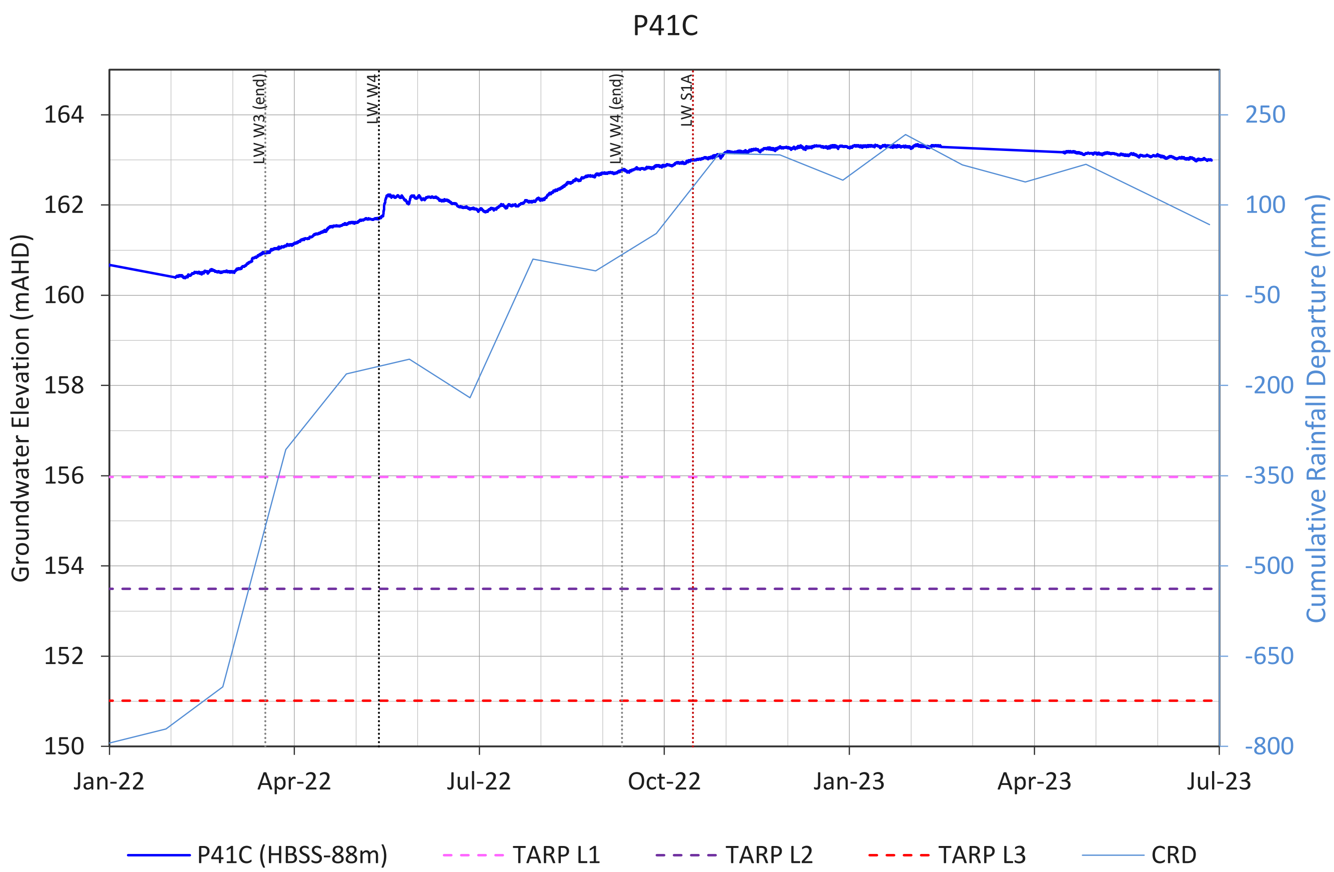


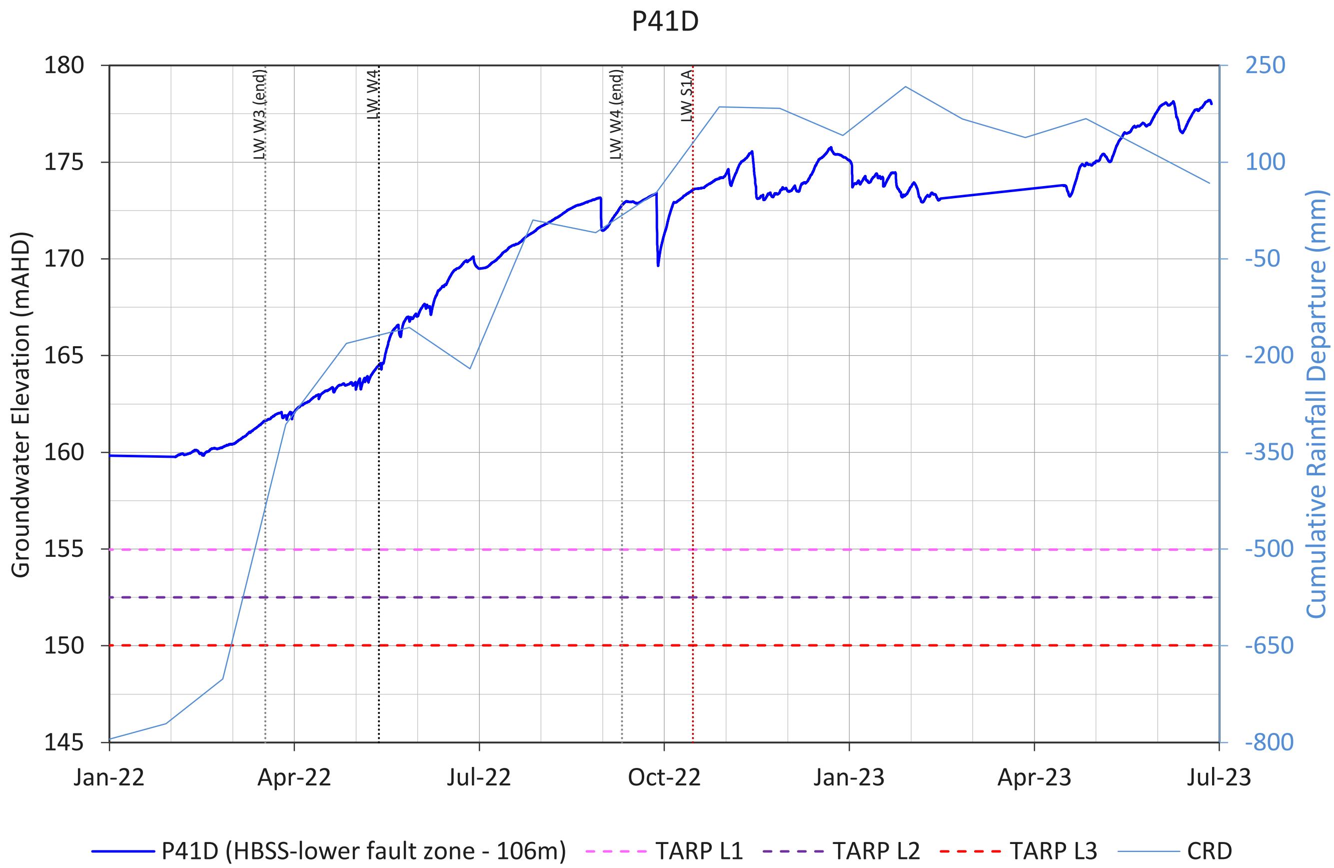
TNC040
195
190
185
180
175
170
165
250
75
-100
-275
-450
-625
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
TNC040 (HBSS-65m)
TARP L1
TARP L2
TARP L3
CRD



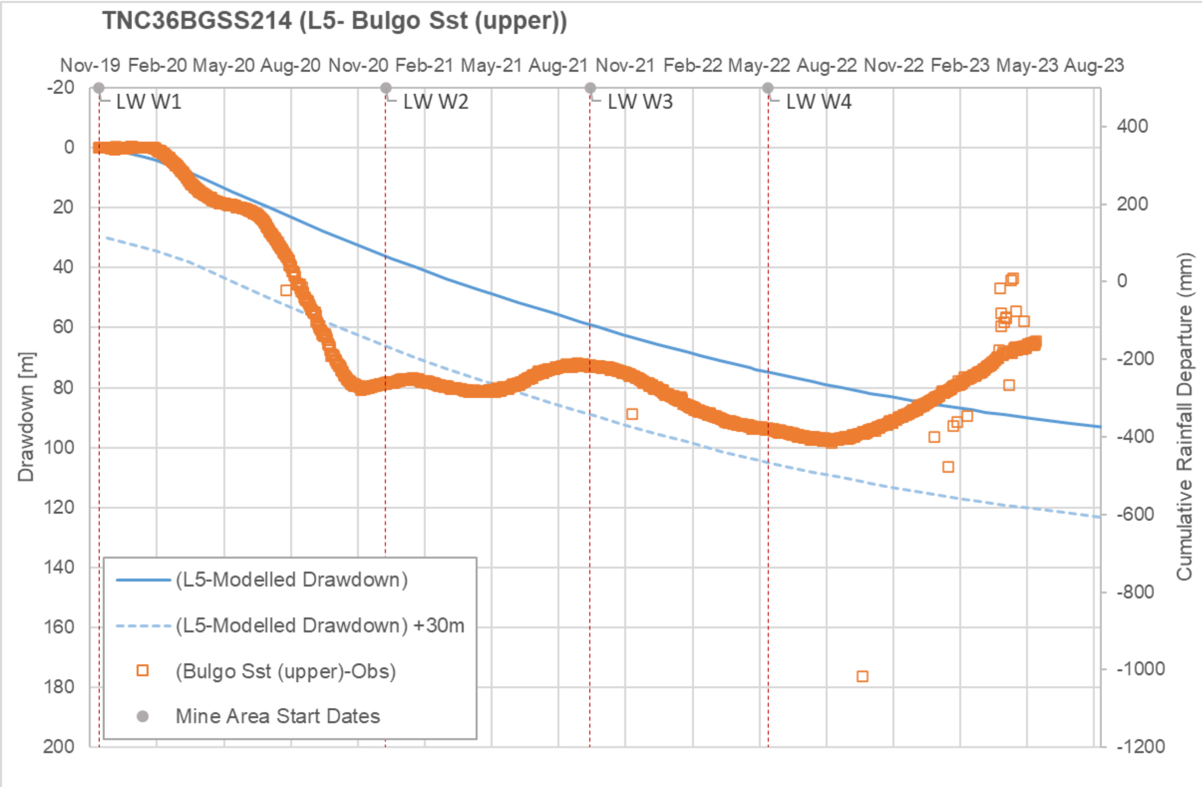
P41A
192
190
188
186
184
182
180
250
75
-100
-275
-450
-625
-800
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P41A (WMFM-53m)
TARP L1
TARP L2
TARP L3
CRD

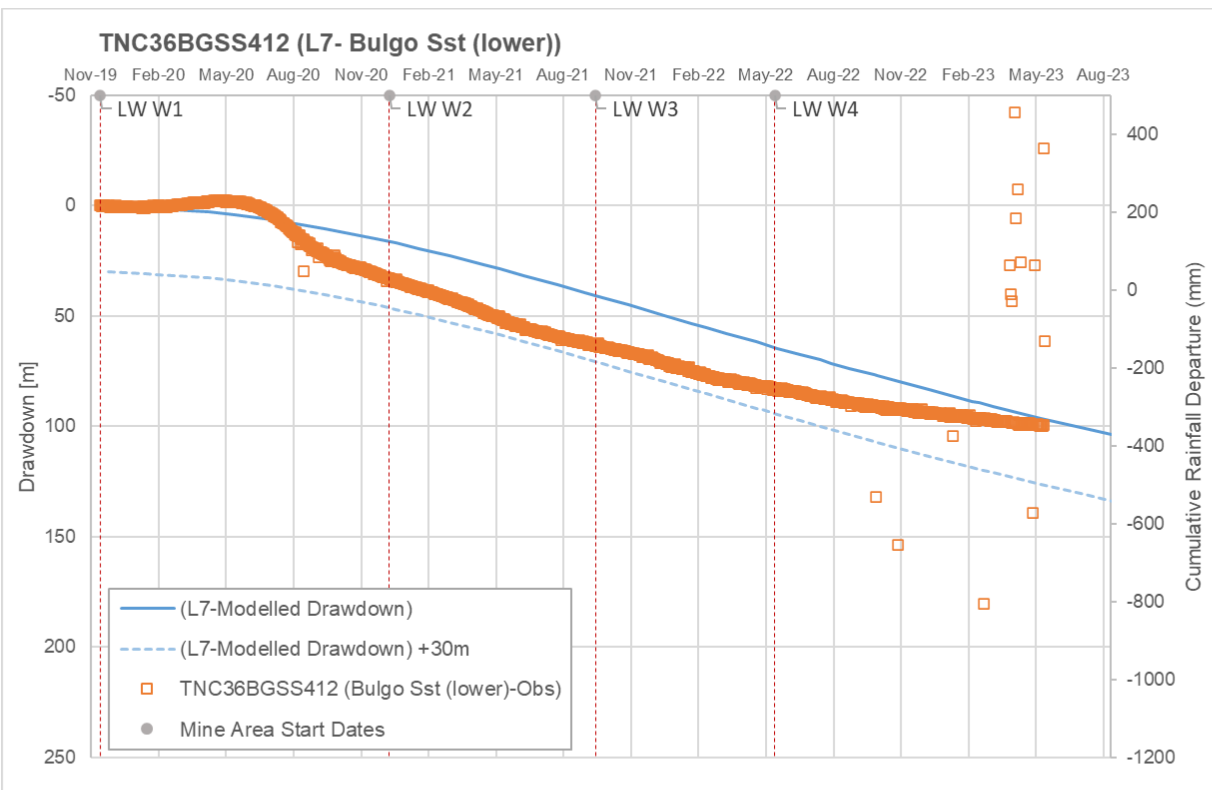

P41B
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
174
172
170
168
166
164
162
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P41B (below WMFM/HBSS interface - 71m)
TARP L1
TARP L2
TARP L3
CRD


P41C
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
164
162
160
158
156
154
152
150
250
100
-50
-200
-350
-500
-650
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P41C (HBSS-88m)
TARP L1
TARP L2
TARP L3
CRD



P41D
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
180
175
170
165
160
155
150
145
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P41D (HBSS-lower fault zone - 106m)
TARP L1
TARP L2
TARP L3
CRD


TNC36BGSS214 (L5- Bulgo Sst (upper))
Nov-19 Feb-20 May-20 Aug-20 Nov-20 Feb-21 May-21 Aug-21 Nov-21 Feb-22 May-22 Aug-22 Nov-22 Feb-23 May-23 Aug-23
LW W1
LW W2
LW W3
LW W4
Drawdown [m]
Cumulative Rainfall Departure (mm)
-20
0
20
40
60
80
100
120
140
160
180
200
400
200
0
-200
-400
-600
-800
-1000
-1200
(L5-Modelled Drawdown)
(L5-Modelled Drawdown) +30m
(Bulgo Sst (upper)-Obs)
Mine Area Start Dates


TNC36BGSS412 (L7- Bulgo Sst (lower))
Nov-19 Feb-20 May-20 Aug-20 Nov-20 Feb-21 May-21 Aug-21 Nov-21 Feb-22 May-22 Aug-22 Nov-22 Feb-23 May-23 Aug-23
LW W1
LW W2
LW W3
LW W4
Drawdown [m]
Cumulative Rainfall Departure (mm)
-50
0
50
100
150
200
250
400
200
0
-200
-400
-600
-800
-1000
-1200
(L7-Modelled Drawdown)
(L7-Modelled Drawdown) +30m
TNC36BGSS412 (Bulgo Sst (lower)-Obs)
Mine Area Start Dates

Appendix D Plots – Groundwater Quality TARPs

Six-monthly Groundwater Reporting: January – June 2023

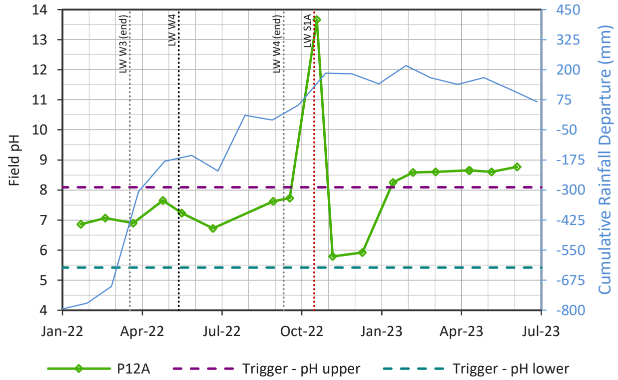
Tahmoor Western Domain

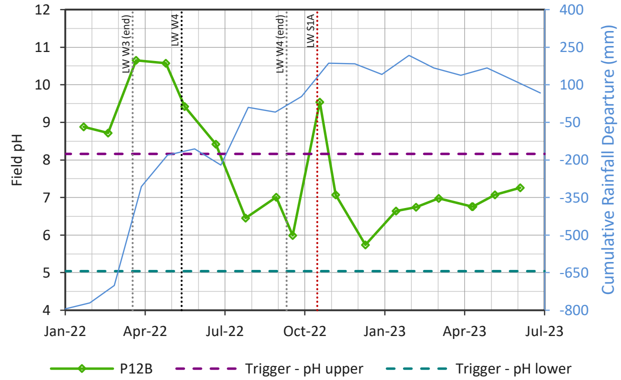
Tahmoor Coal Pty Ltd

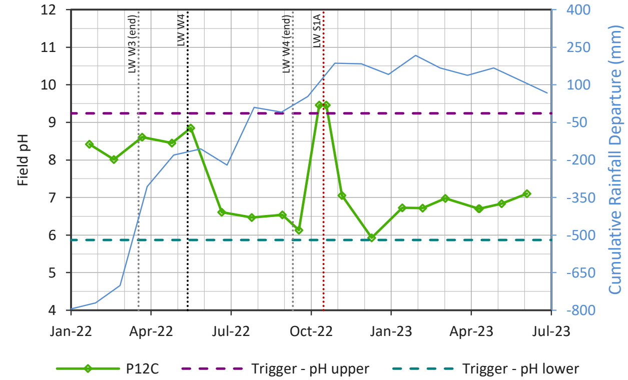
SLR Project No.: 665.10010.00207

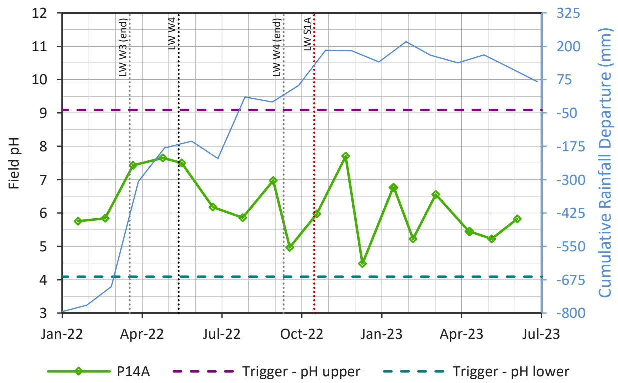
21 September 2023

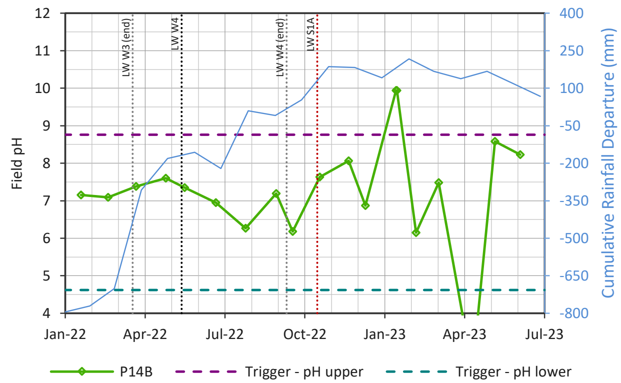
Note: The time-series plots presented here reference TARP Levels 1, 2 and 3 – these are in fact pertaining to TARP Levels 2, 3 and 4 resepctively as they are written in the Water Management Plan (i..e the TARP Level 1 marker on the plot, is in reality, the Level 2 TARP – with Level 1 representing baseline conditions and not presented).

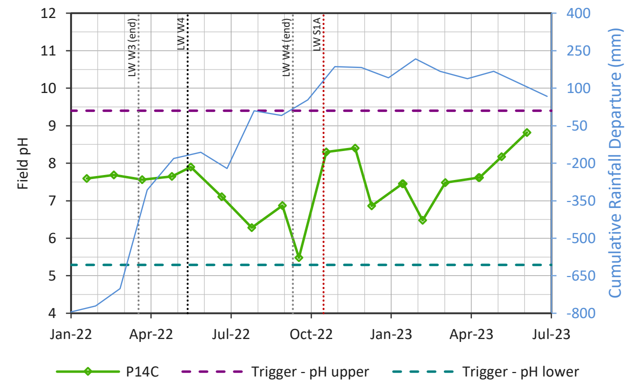

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
Trigger - pH upper
Trigger - pH lower

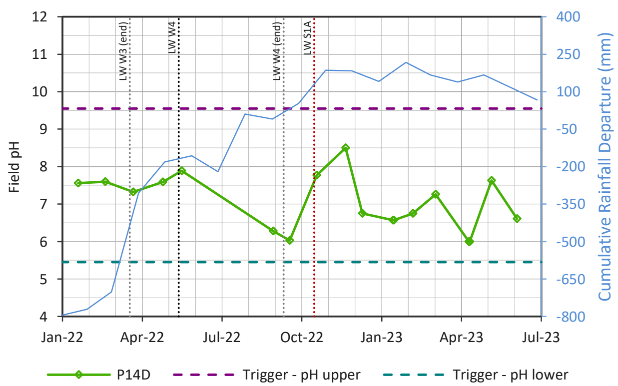

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12B
Trigger - pH upper
Trigger - pH lower

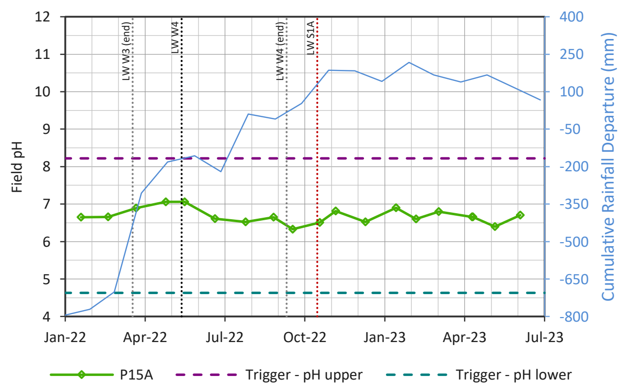

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12C
Trigger - pH upper
Trigger - pH lower

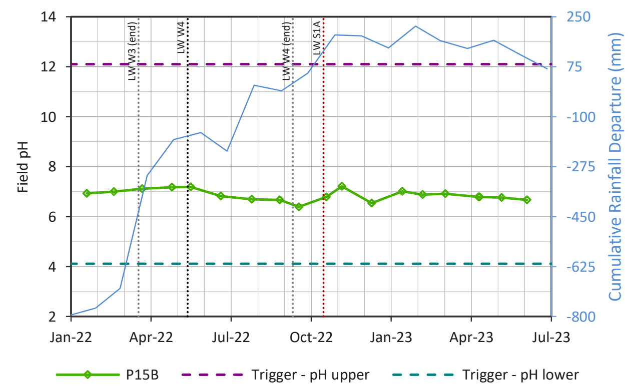

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14A
Trigger - pH upper
Trigger - pH lower

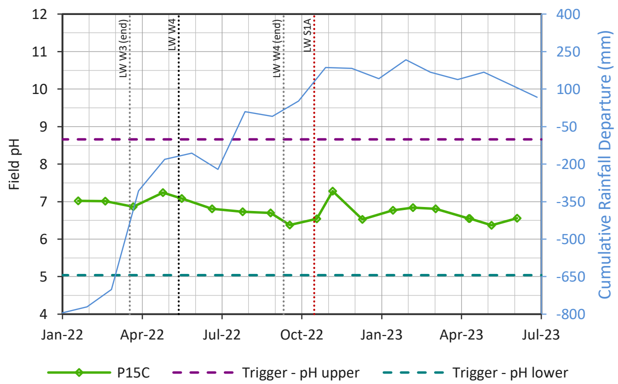

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14B
Trigger - pH upper
Trigger - pH lower

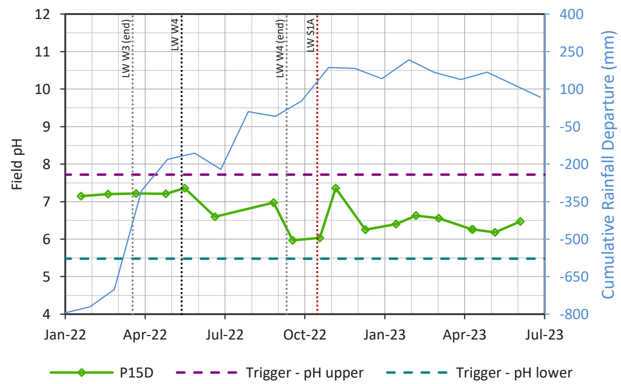

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14C
Trigger - pH upper
Trigger - pH lower

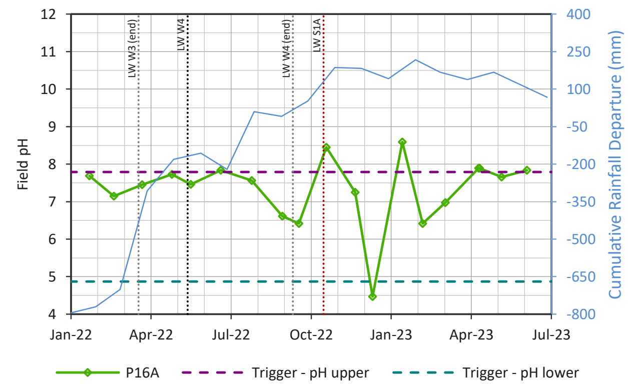

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14D
Trigger - pH upper
Trigger - pH lower

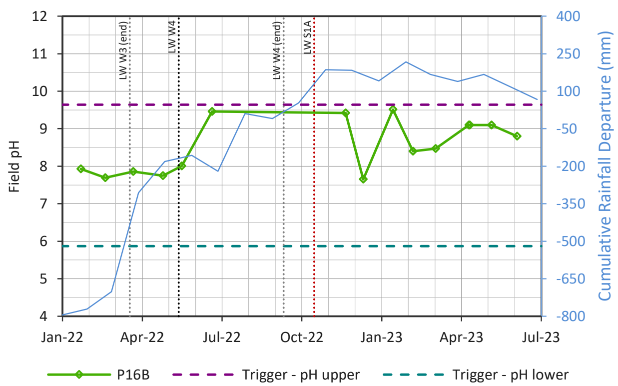

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15A
Trigger - pH upper
Trigger - pH lower

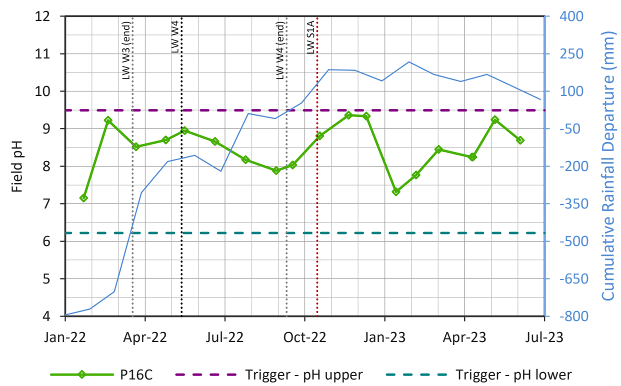

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15B
Trigger - pH upper
Trigger - pH lower

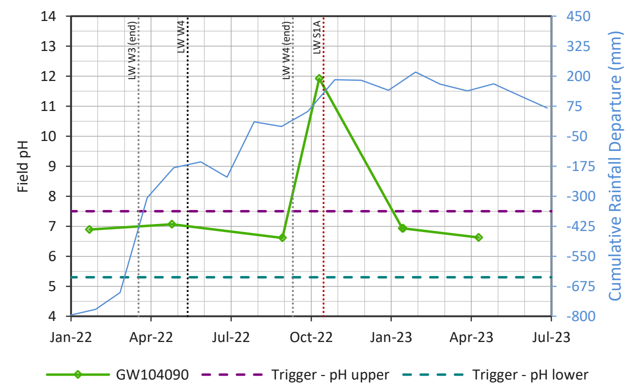

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15C
Trigger - pH upper
Trigger - pH lower

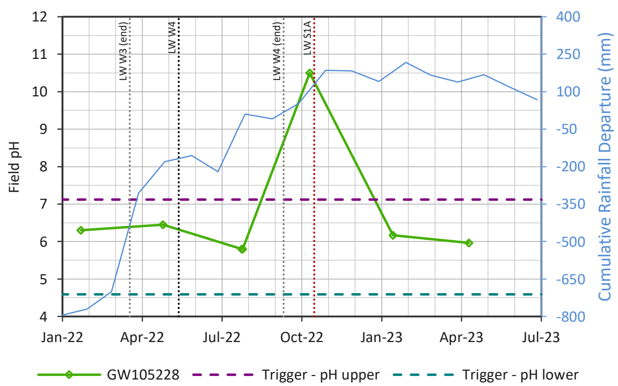

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15D
Trigger - pH upper
Trigger - pH lower

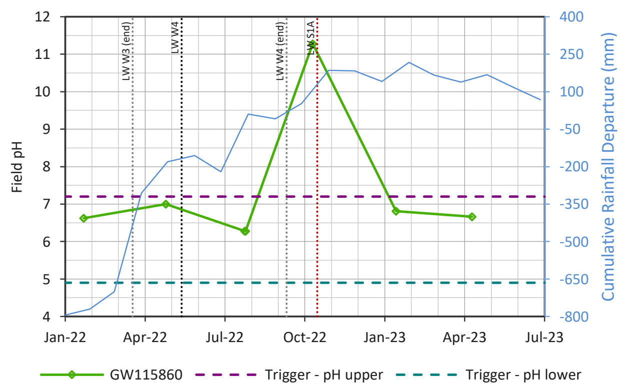

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16A
Trigger - pH upper
Trigger - pH lower

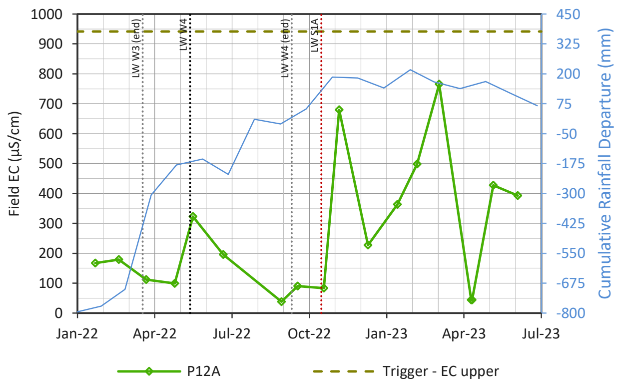

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16B
Trigger - pH upper
Trigger - pH lower

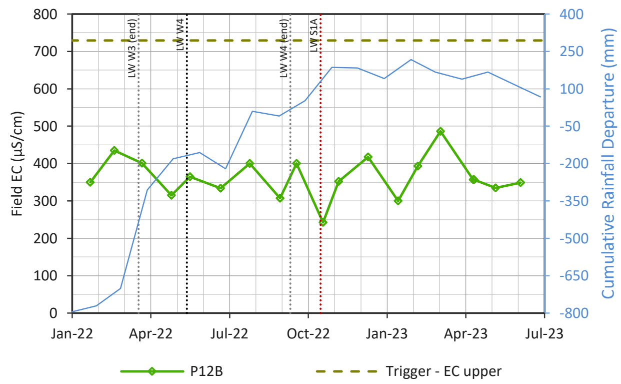

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16C
Trigger - pH upper
Trigger - pH lower

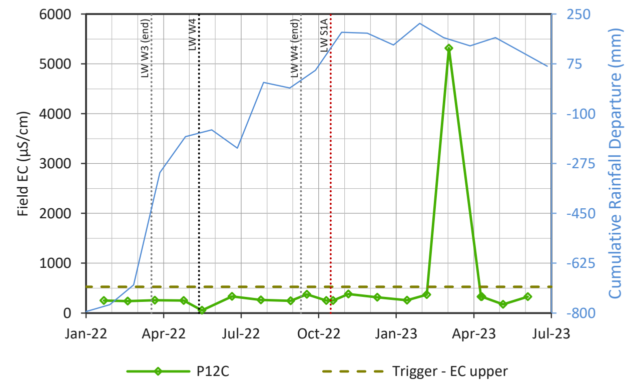

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW104090
Trigger - pH upper
Trigger - pH lower

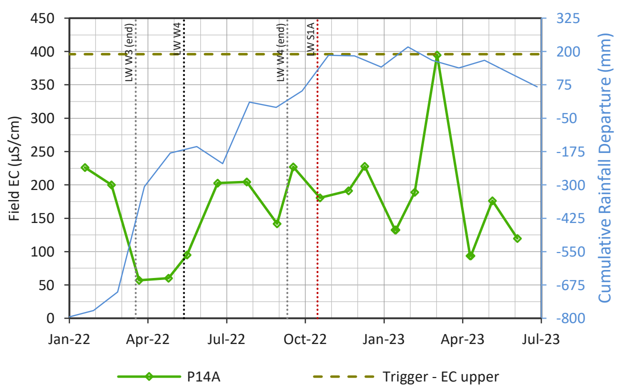

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW105228
Trigger - pH upper
Trigger - pH lower

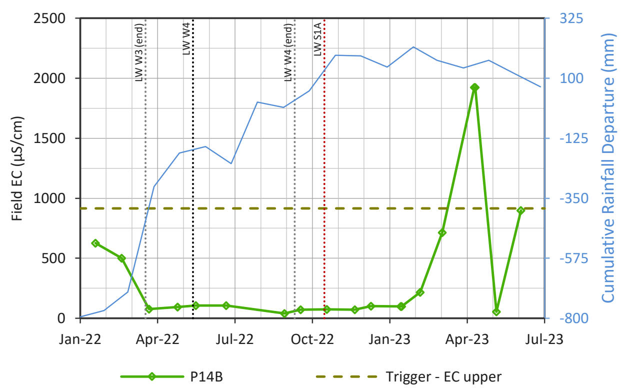

Field pH
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW115860
Trigger - pH upper
Trigger - pH lower

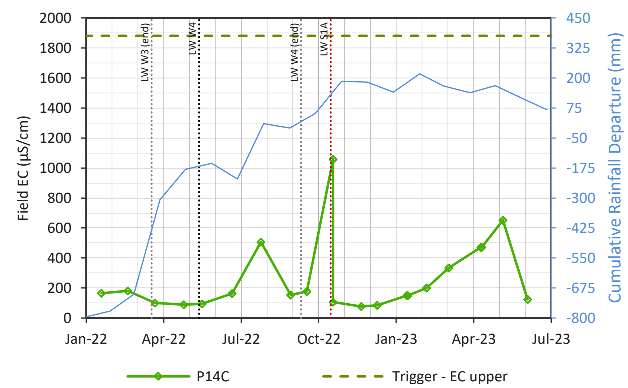

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12A
Trigger - EC upper

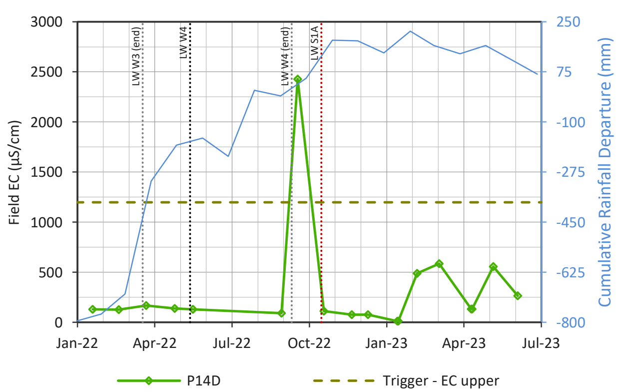

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12B
Trigger - EC upper

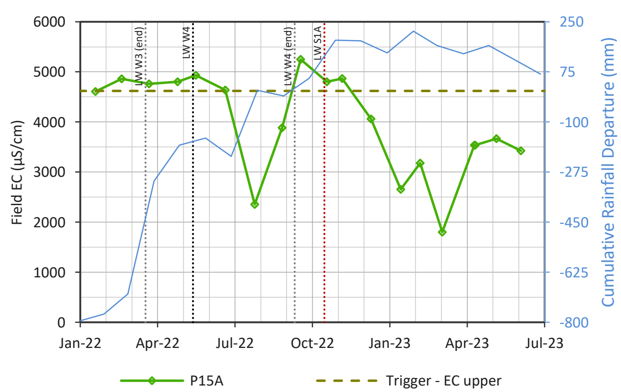

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12C
Trigger - EC upper

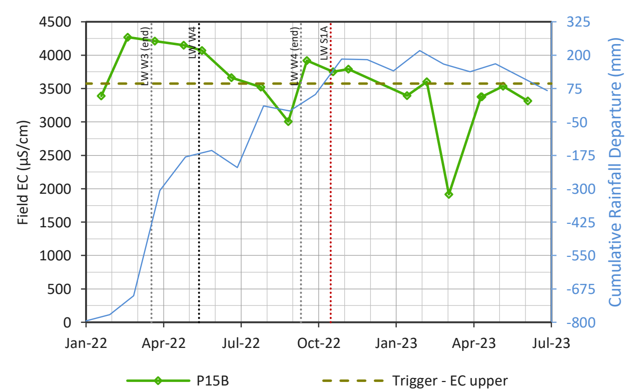

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14A
Trigger - EC upper

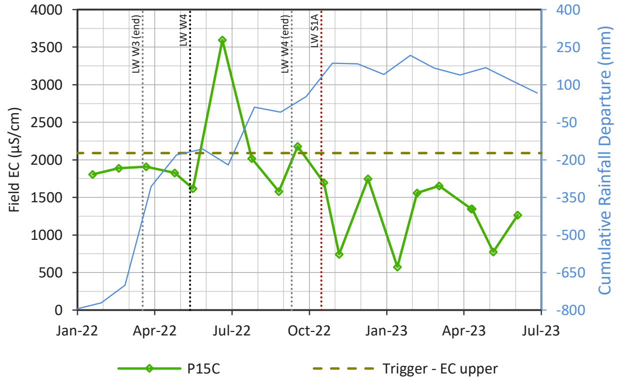

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14B
Trigger - EC upper

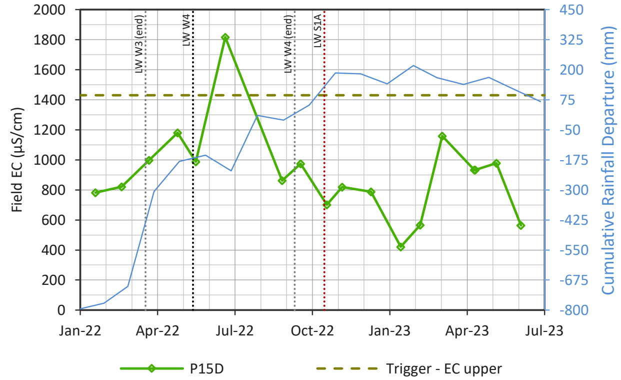

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14C
Trigger - EC upper

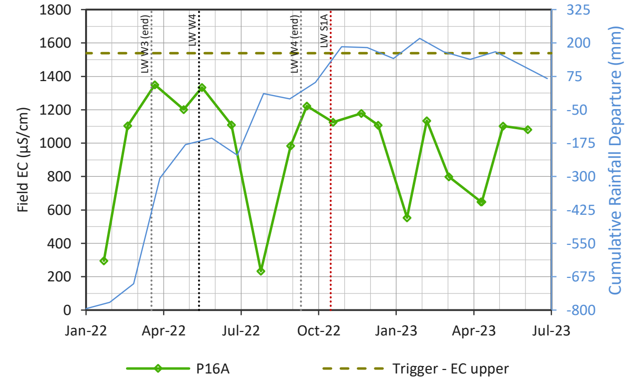

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14D
Trigger - EC upper

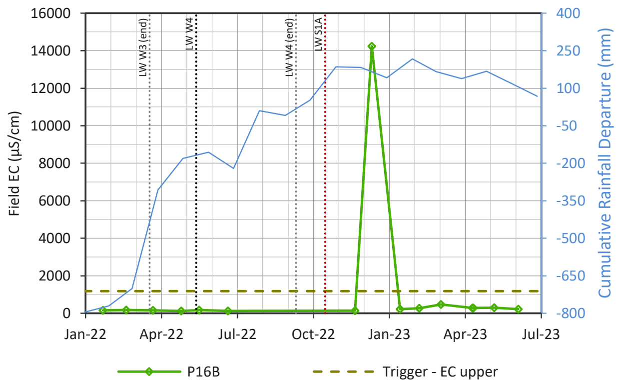

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15A
Trigger - EC upper

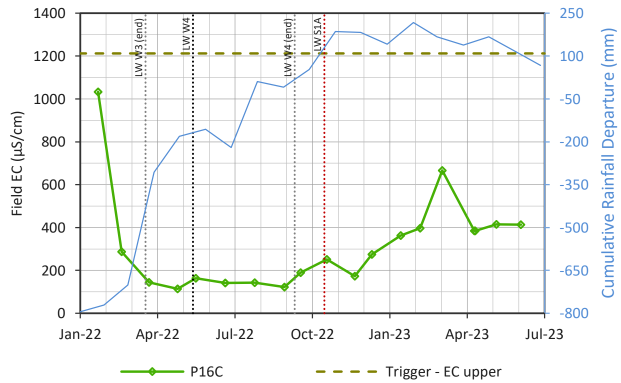

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15B
Trigger - EC upper

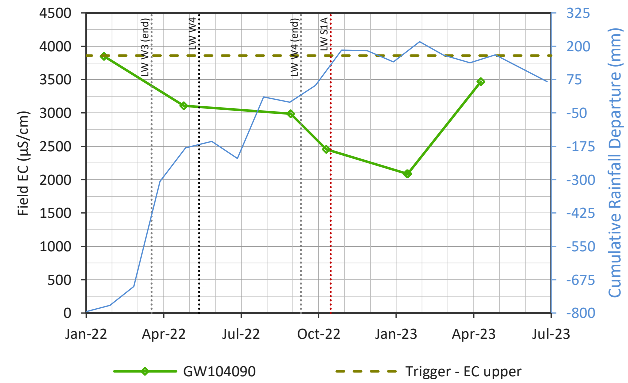

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15C
Trigger - EC upper

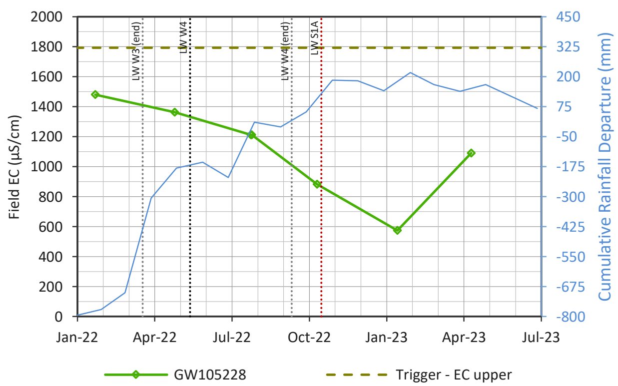

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15D
Trigger - EC upper

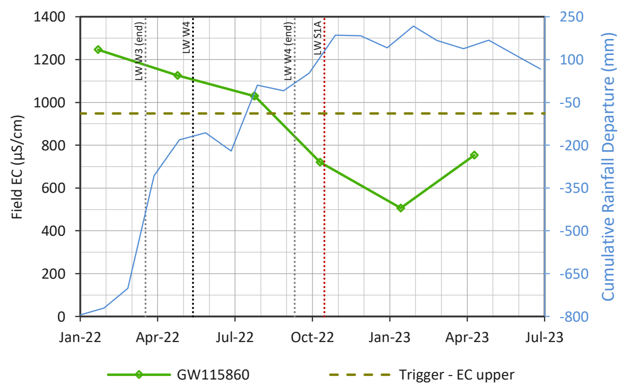

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16A
Trigger - EC upper

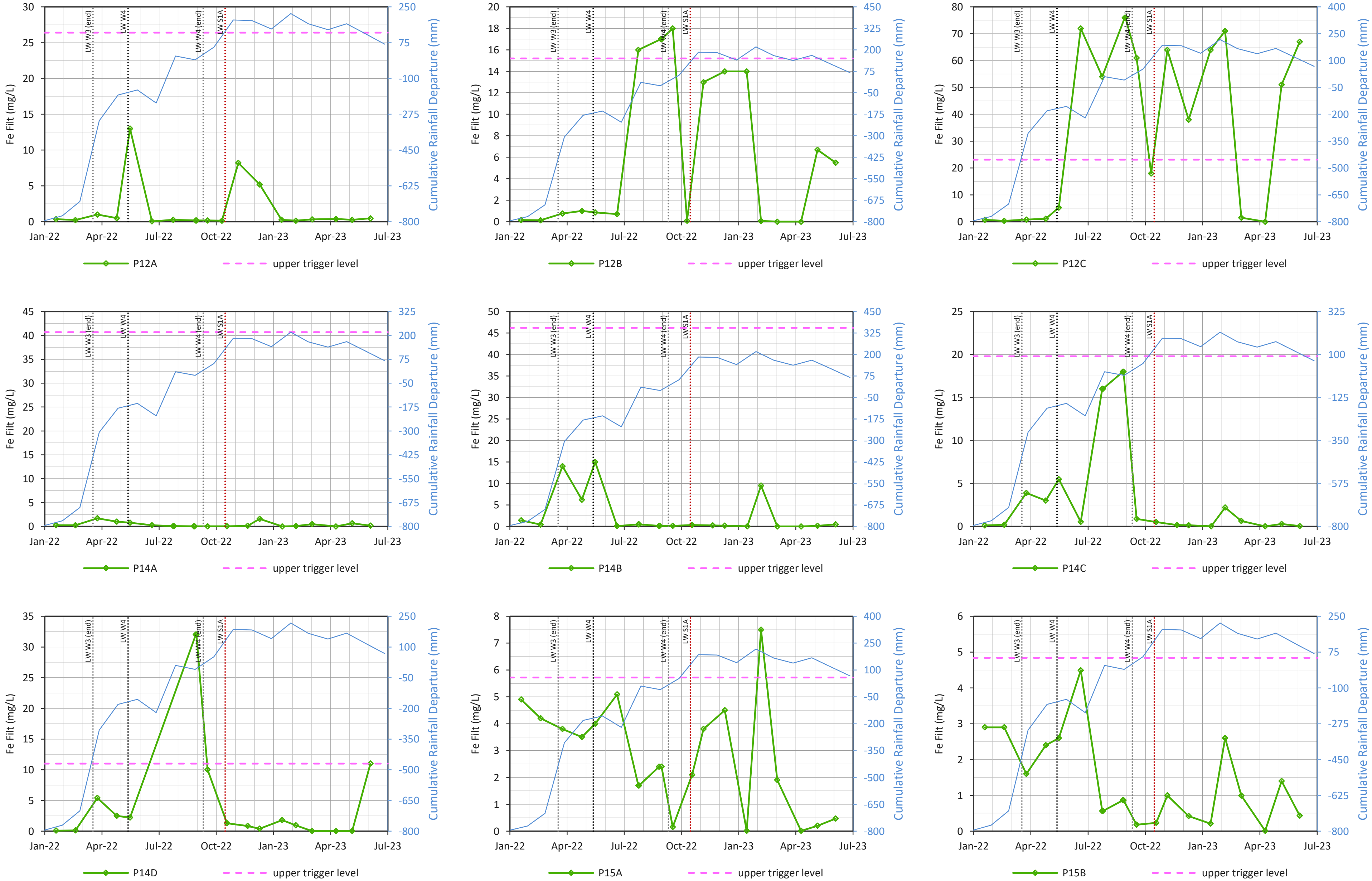

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16B
Trigger - EC upper


Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16C
Trigger - EC upper

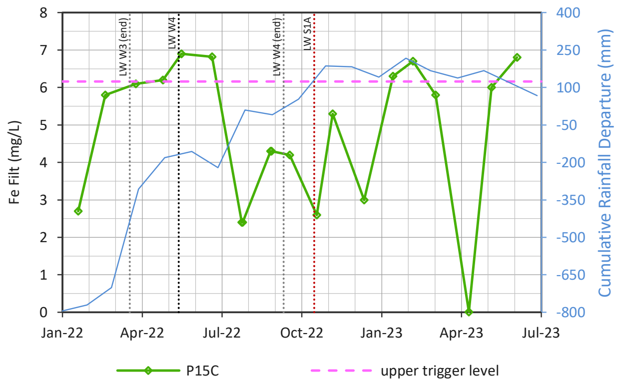

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104090
Trigger - EC upper

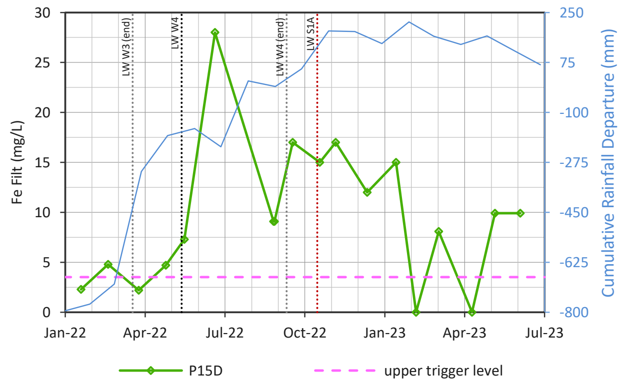

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105228
Trigger - EC upper

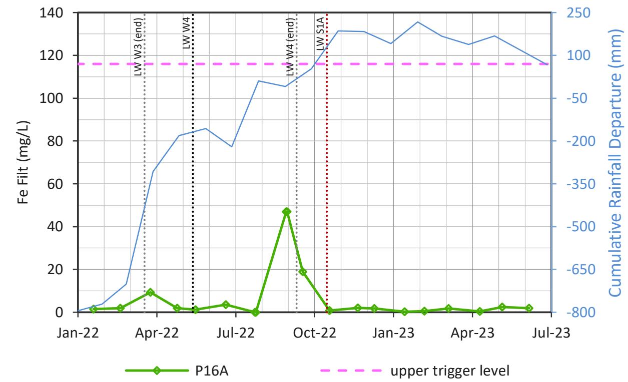

Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW115860
Trigger - EC upper

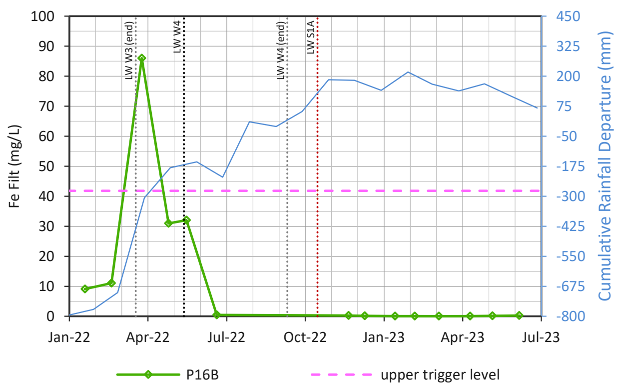


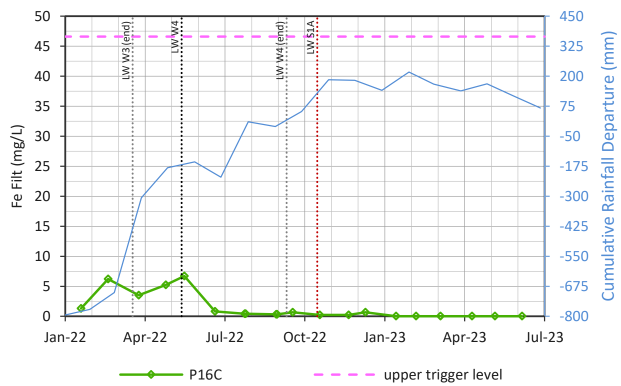
Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
P12B
P12C
P14A
P14B
P14C
P14D
P15A
P15B
upper trigger level

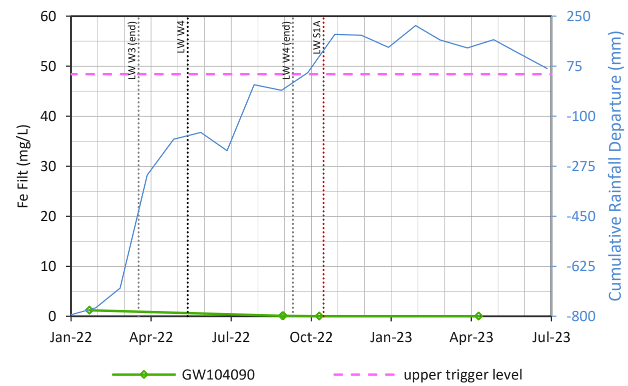

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C
upper trigger level

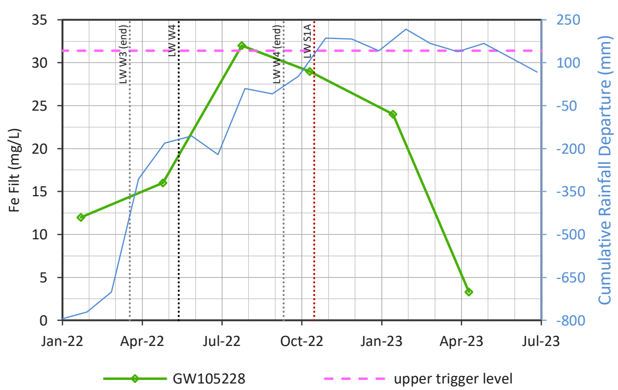

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15D
upper trigger level

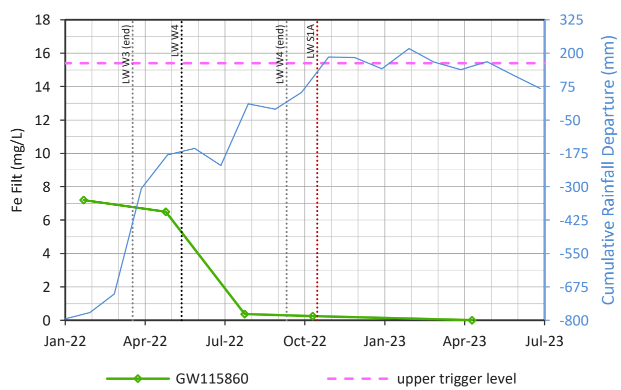

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16A
upper trigger level

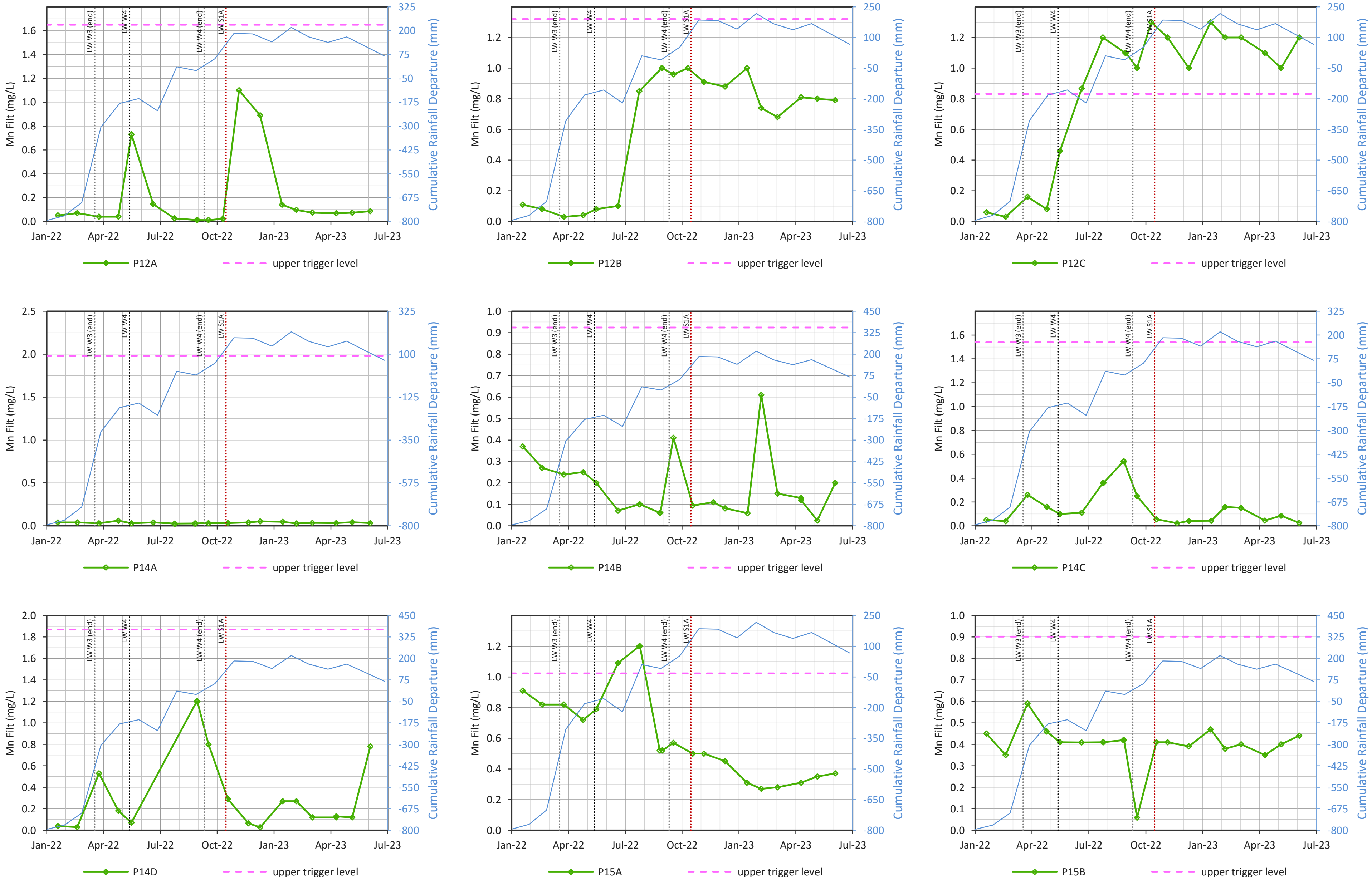

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16B
upper trigger level

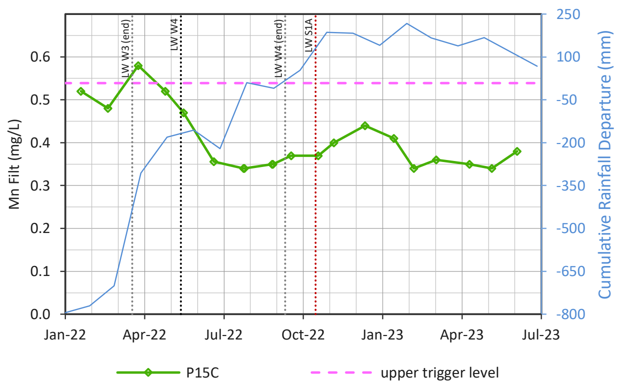

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16C
upper trigger level

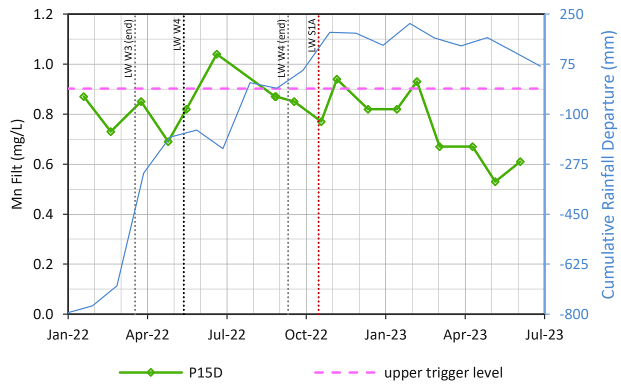

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW104090
upper trigger level

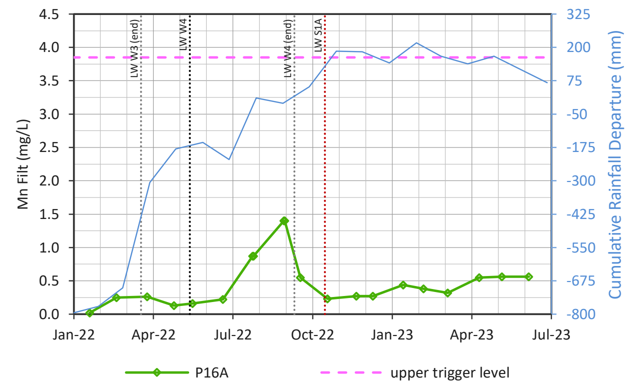

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW105228
upper trigger level

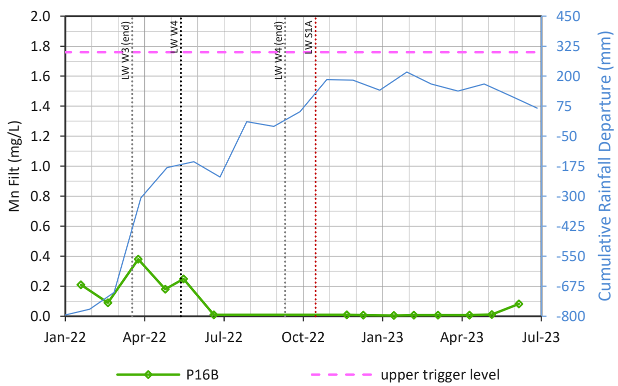

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW115860
upper trigger level

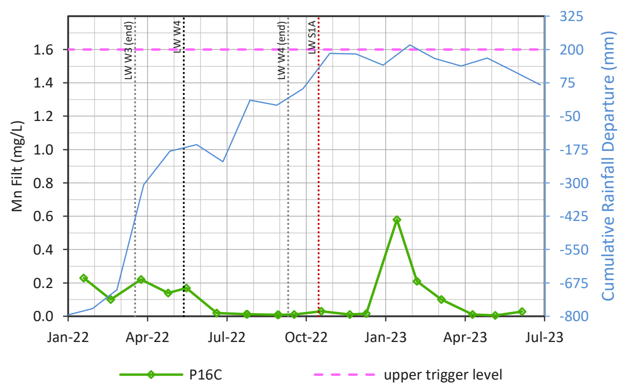

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
P12B
P12C
P14A
P14B
P14C
P14D
P15A
P15B
upper trigger level

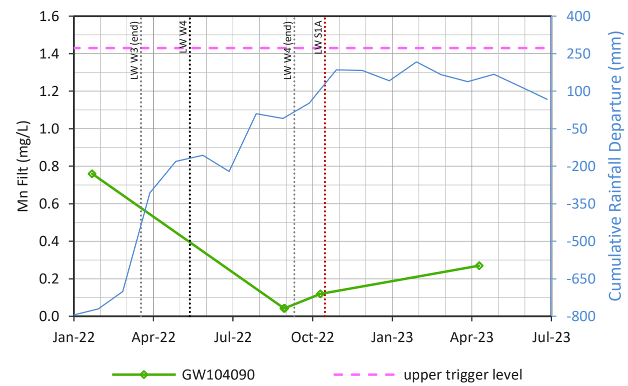

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15C
upper trigger level

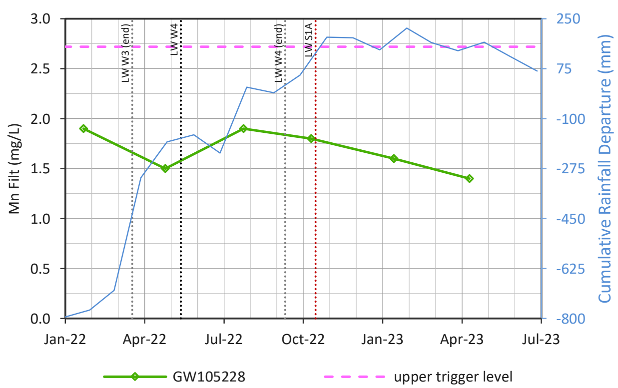

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15D
upper trigger level

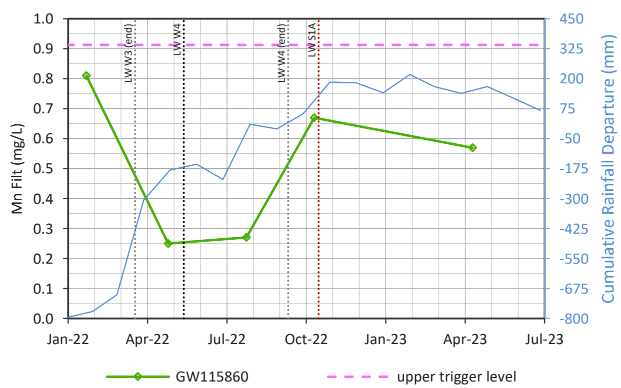

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16A
upper trigger level

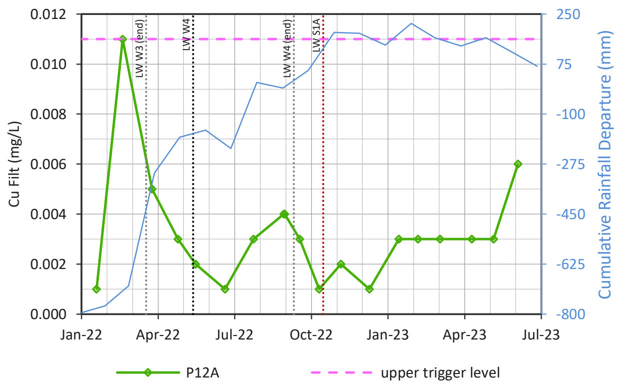

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16B
upper trigger level

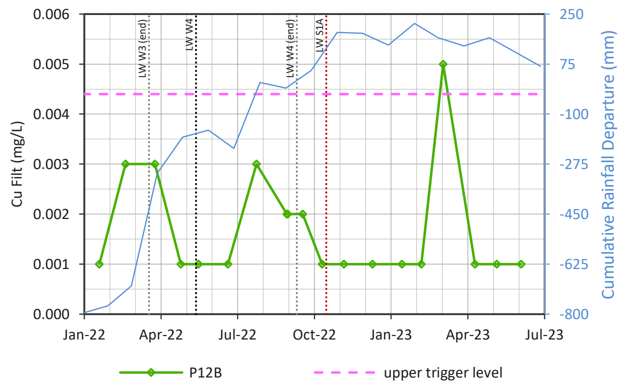

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16C
upper trigger level

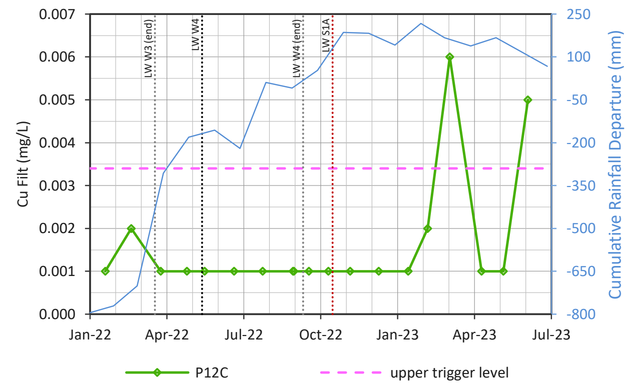

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW104090
upper trigger level

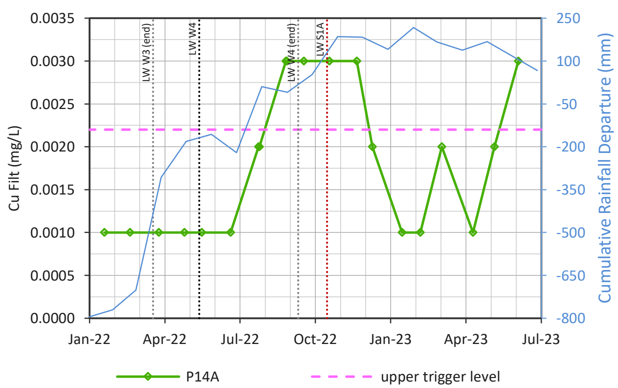

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW105228
upper trigger level

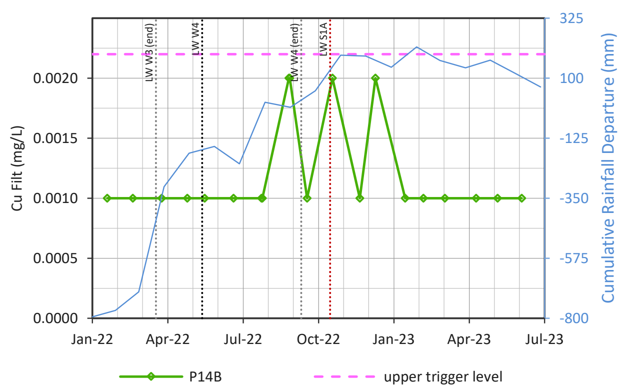

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW115860
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12A
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12B
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12C
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14A
upper trigger level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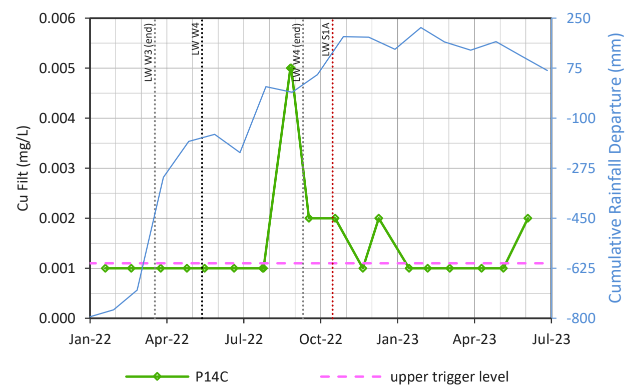
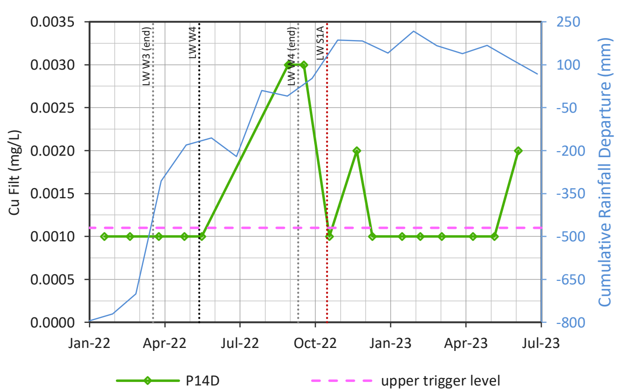
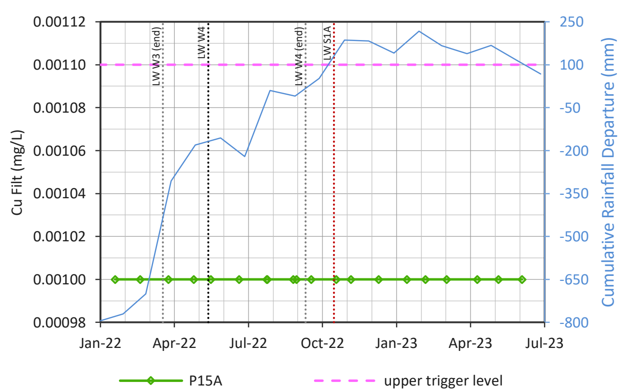
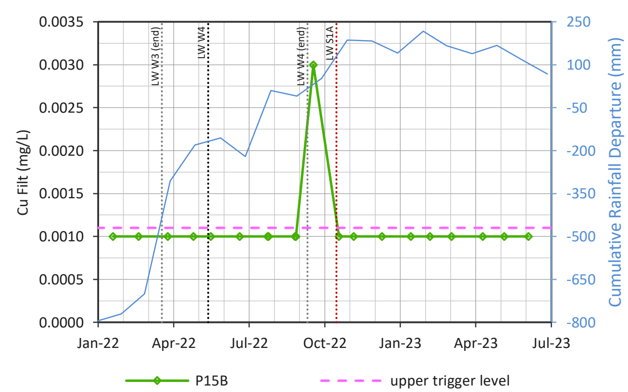
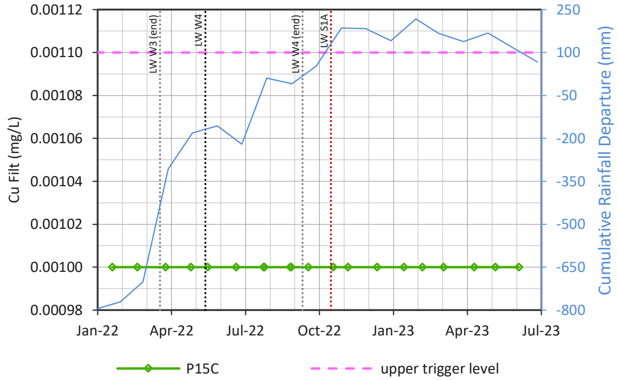
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14B
upper trigger level

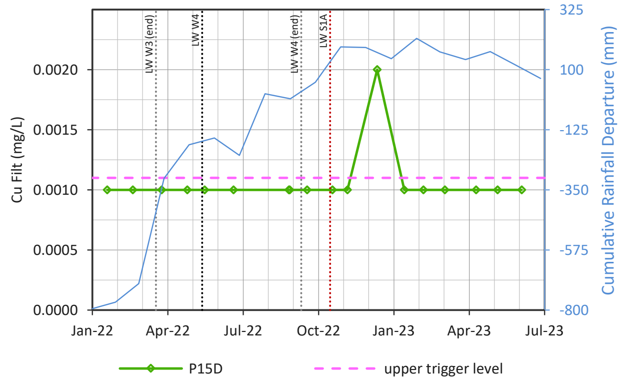

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14C
upper trigger level

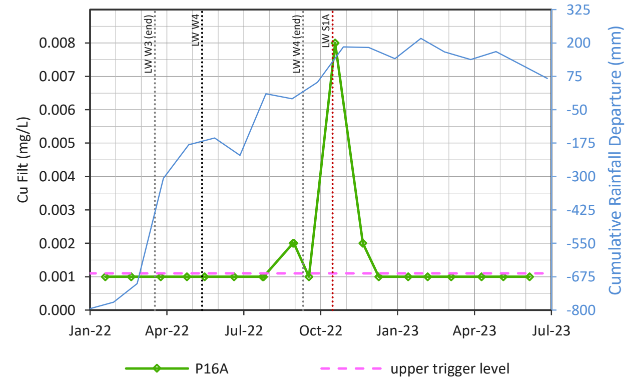

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14D
upper trigger level

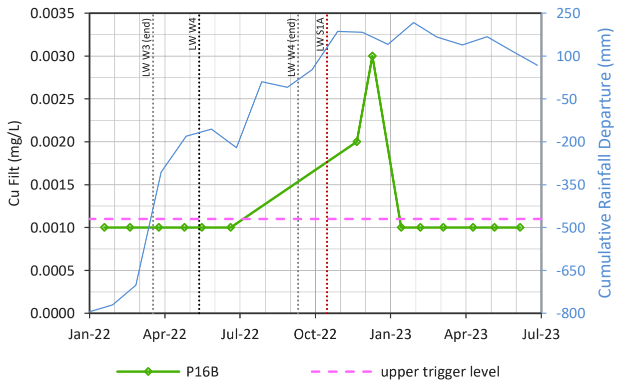

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15A
upper trigger level

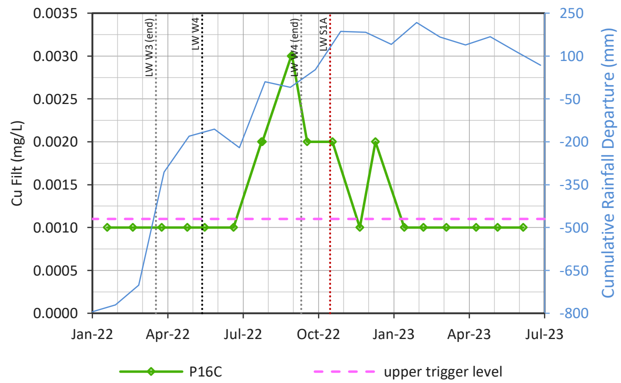

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15B
upper trigger level

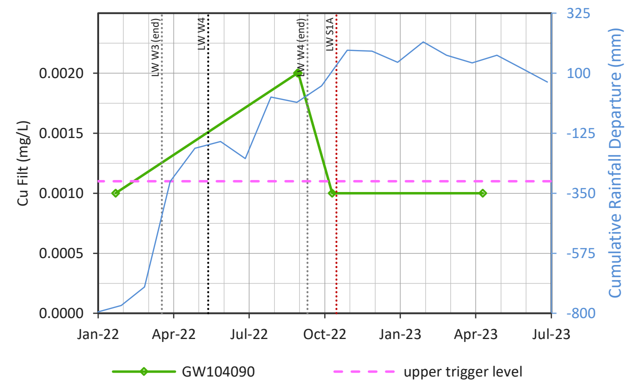

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15C
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15D
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16A
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16B
upper trigger level


Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16C
upper trigger level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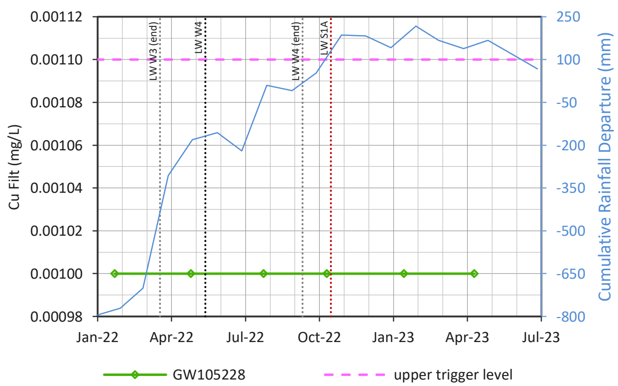
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104090
upper trigger level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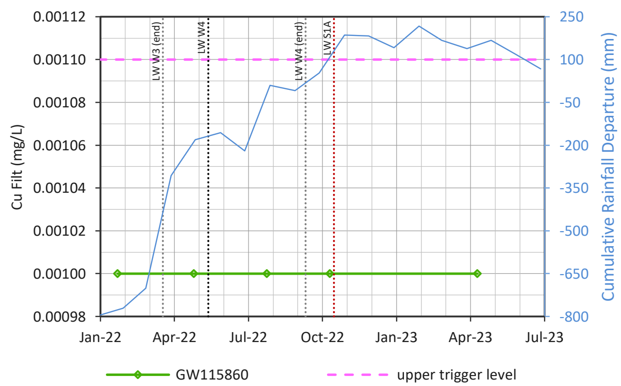
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105228
upper trigger level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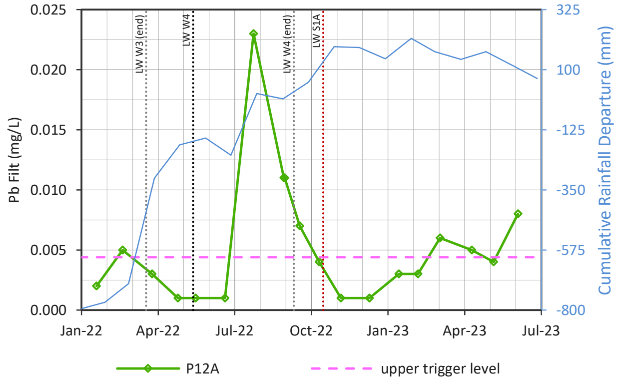
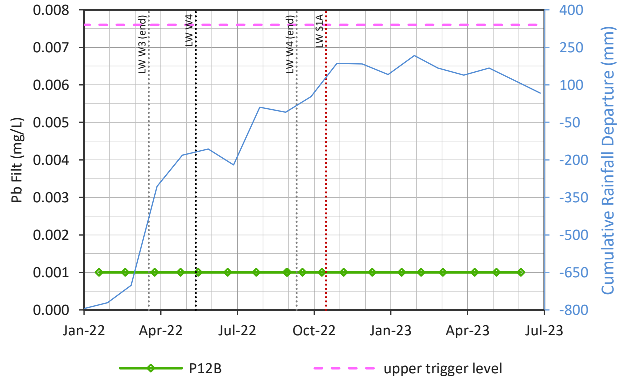
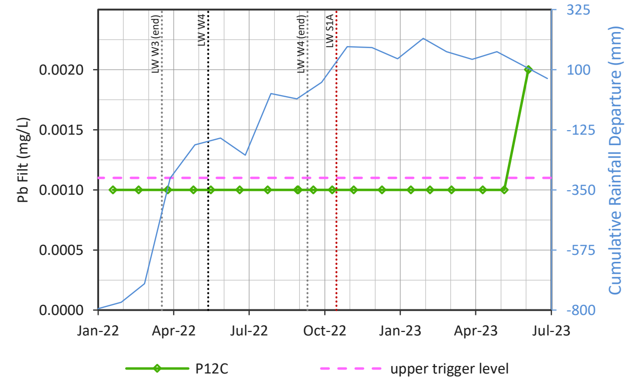
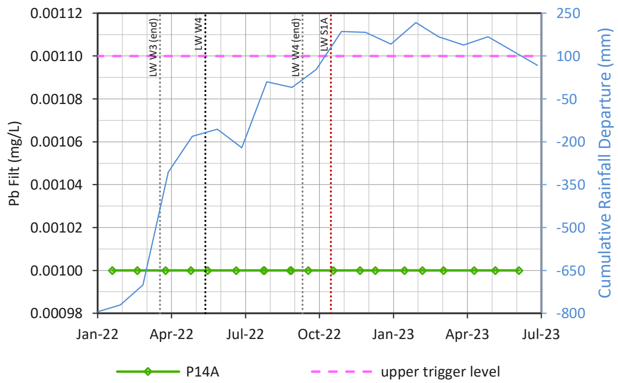
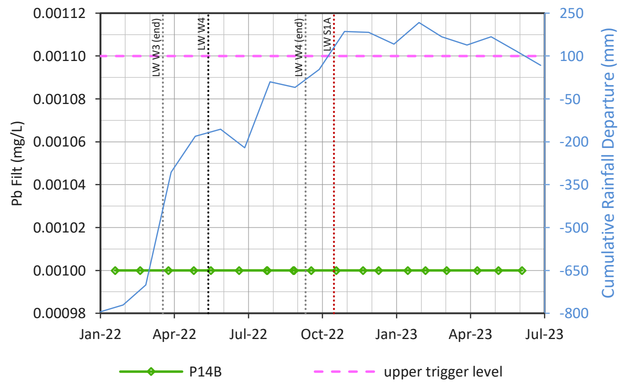
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW115860
upper trigger level

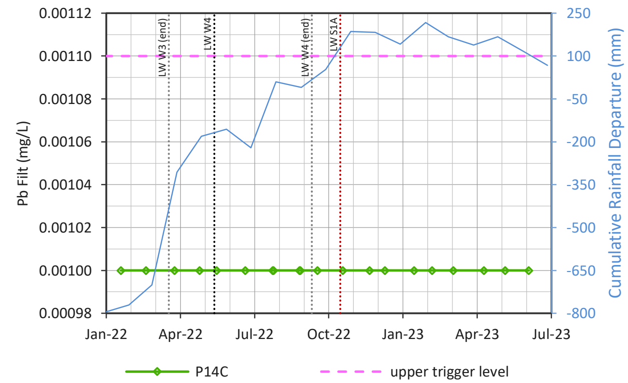

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.025
0.020
0.015
0.010
0.005
0.000
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
upper trigger level

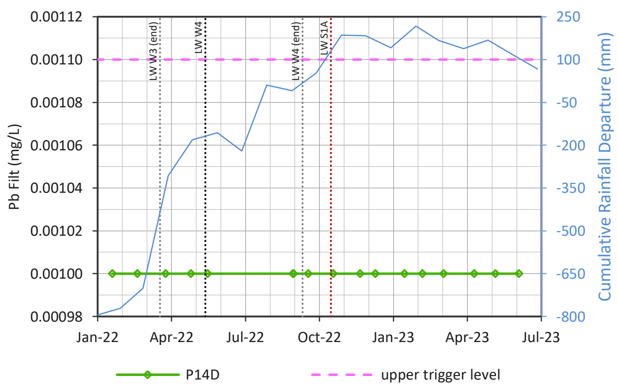

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
400
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12B
upper trigger level

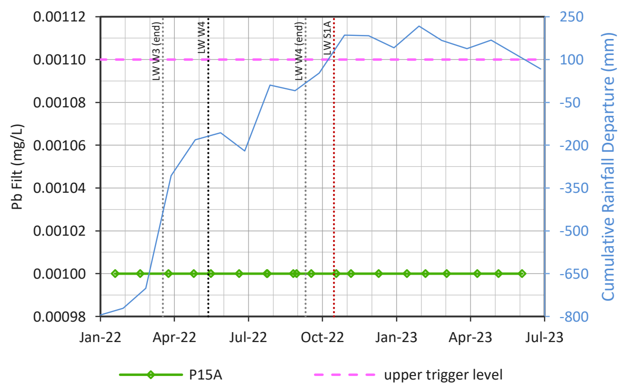

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.0020
0.0015
0.0010
0.0005
0.0000
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12C
upper trigger level

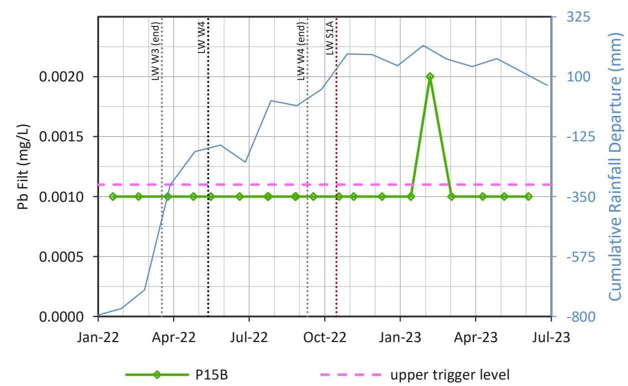

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14A
upper trigger level

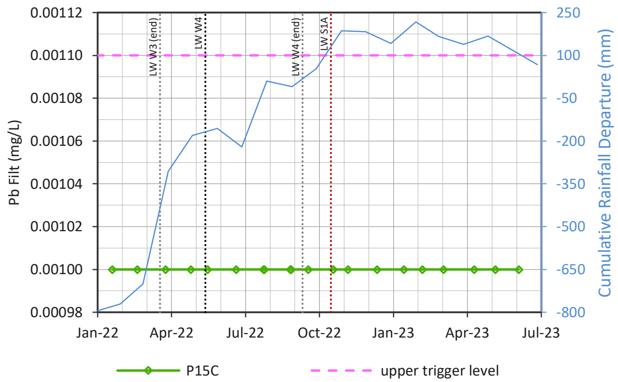

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14B
upper trigger level

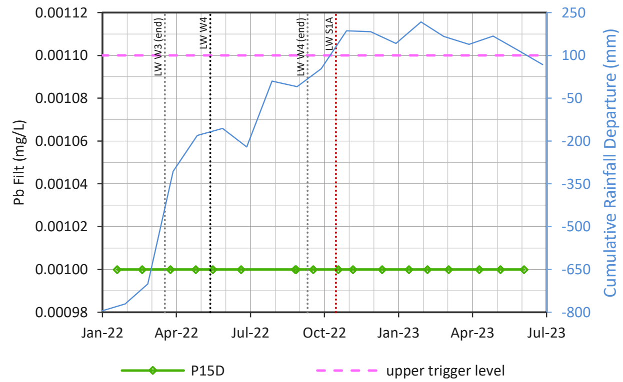

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14C
upper trigger level

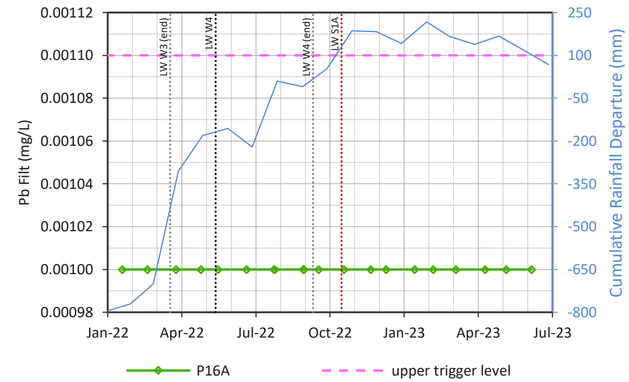

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14D
upper trigger level

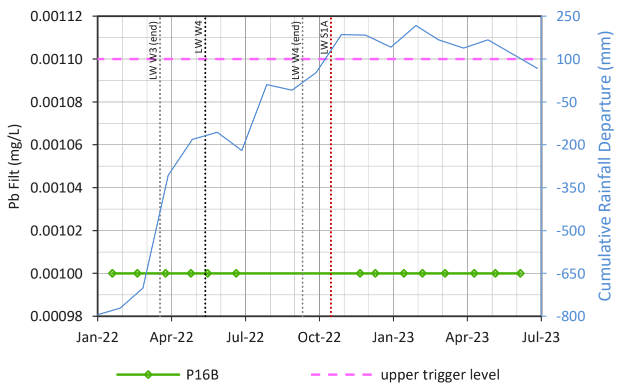

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15A
upper trigger level

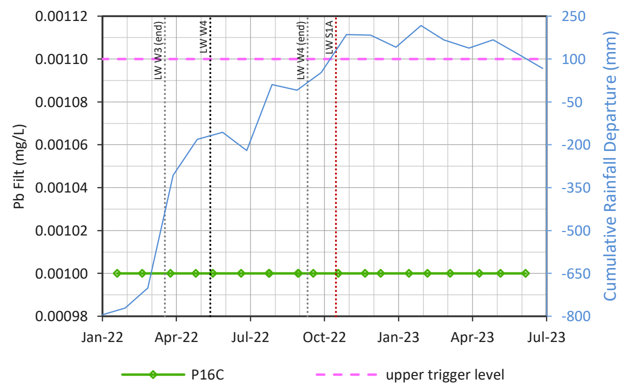

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.0020
0.0015
0.0010
0.0005
0.0000
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15B
upper trigger level

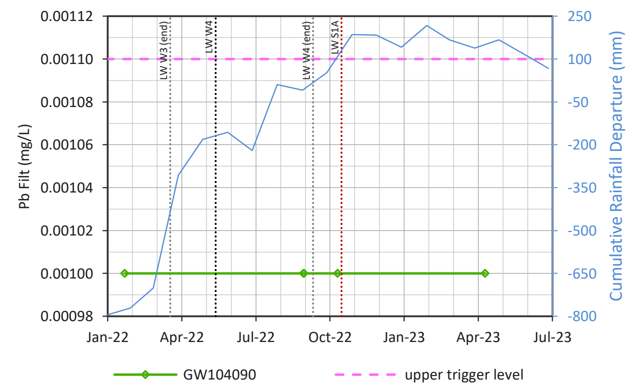

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15C
upper trigger level

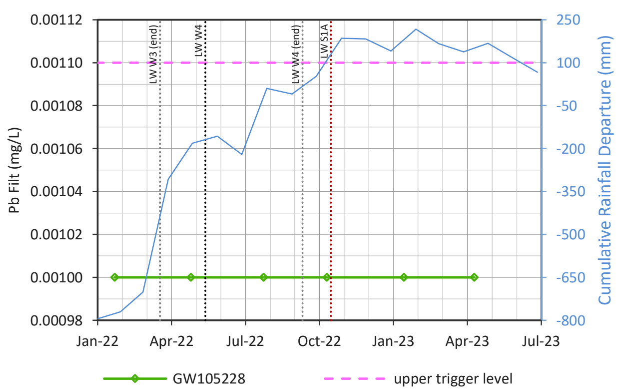

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15D
upper trigger level

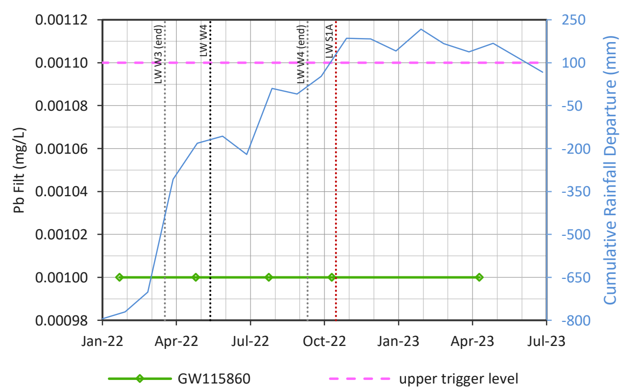

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16A
upper trigger level

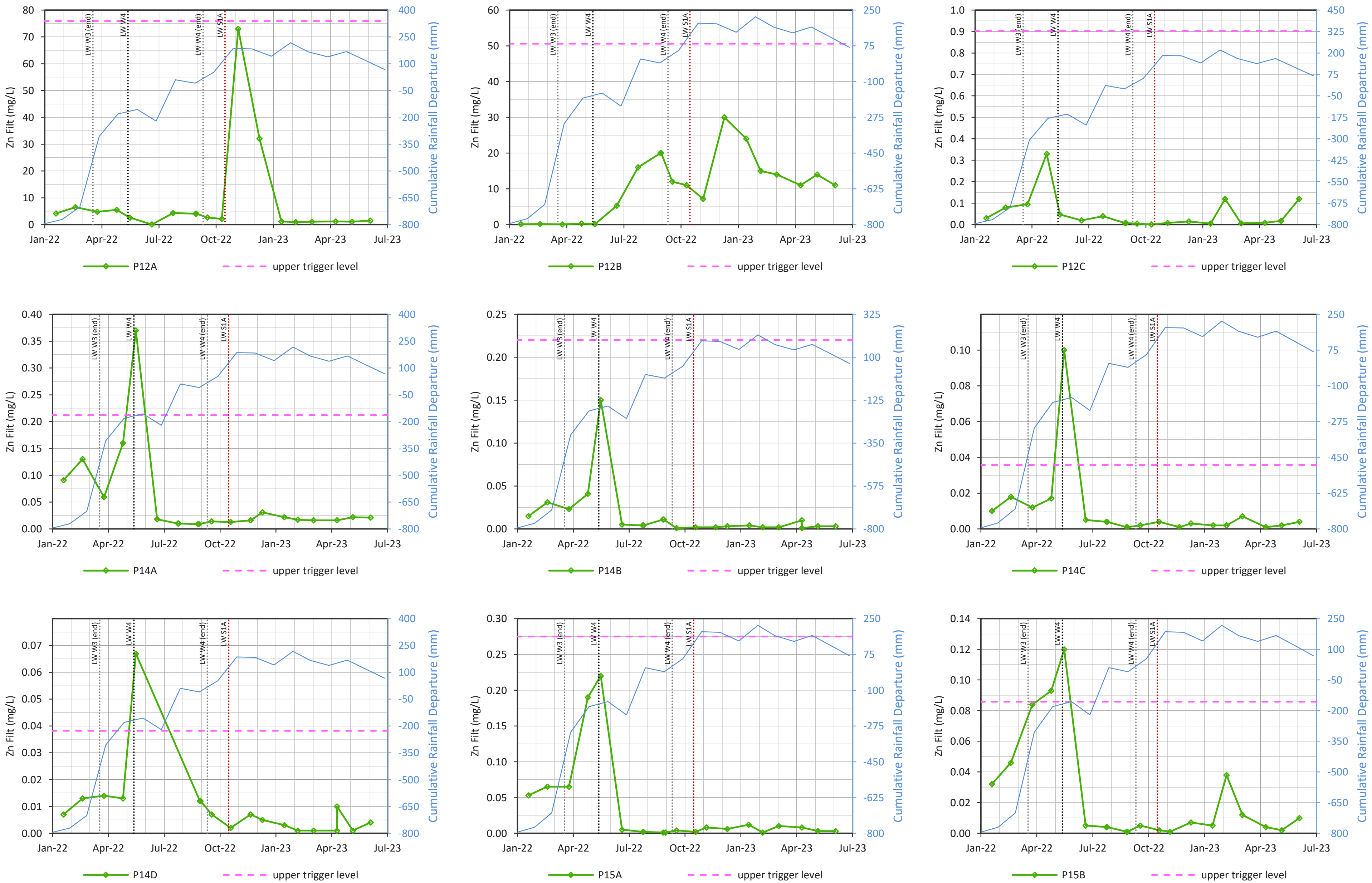

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16B
upper trigger level

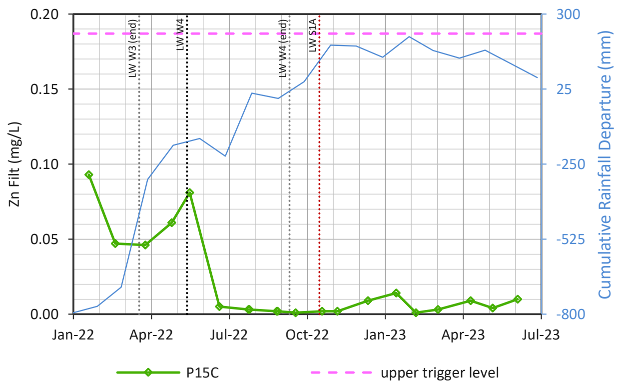

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16C
upper trigger level

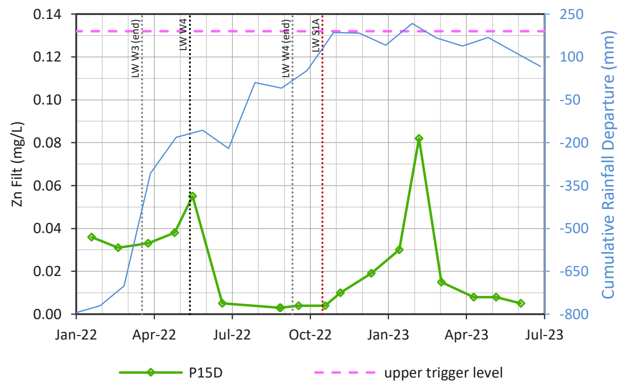

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104090
upper trigger level

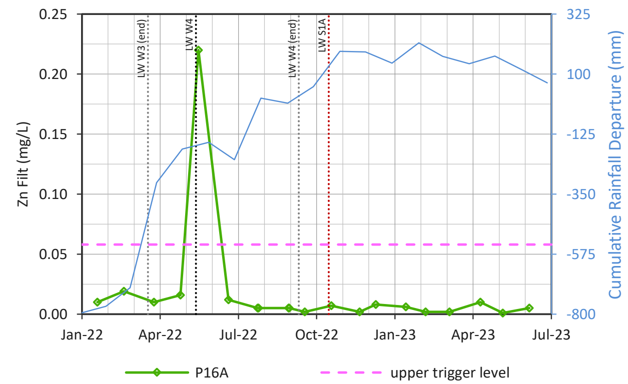

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105228
upper trigger level

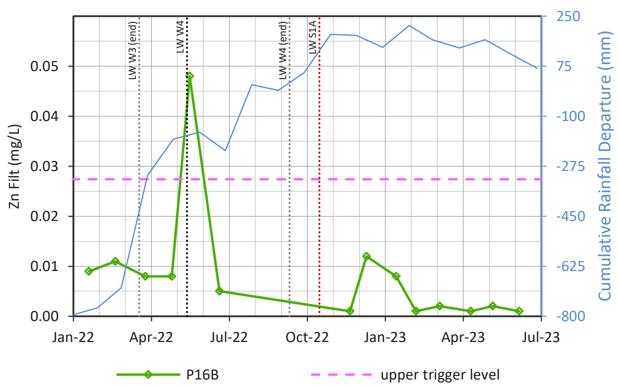

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.00112
0.00110
0.00108
0.00106
0.00104
0.00102
0.00100
0.00098
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW115860
upper trigger level

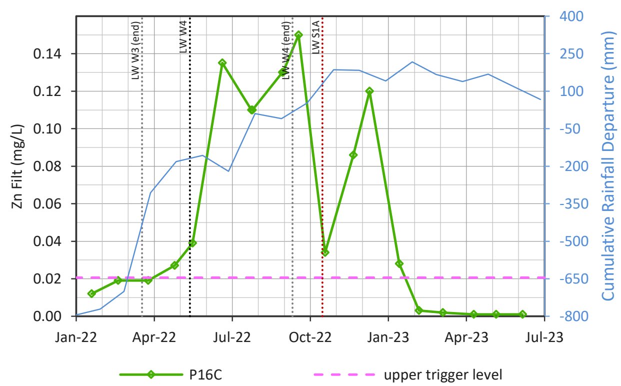

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
upper trigger level
P12B
upper trigger level
P12C
upper trigger level
P14A
upper trigger level
P14B
upper trigger level
P14C
upper trigger level
P14D
upper trigger level
P15A
upper trigger level
P15B
upper trigger level

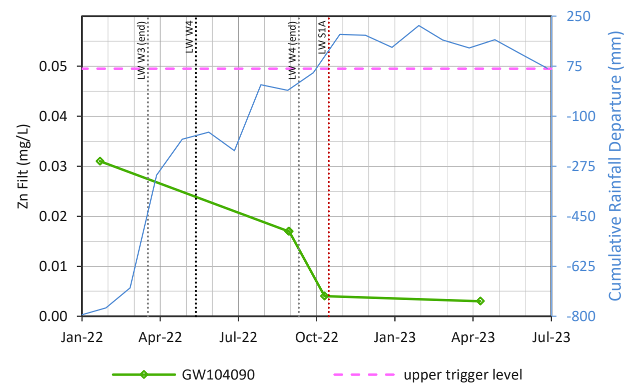

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.20
0.15
0.10
0.05
0.00
300
25
-250
-525
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C
upper trigger level

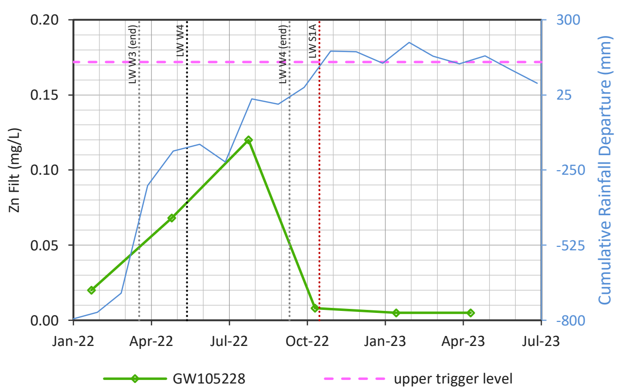

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15D
upper trigger level

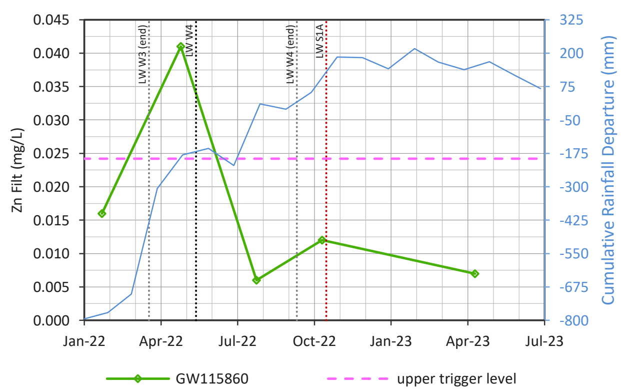

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.25
0.20
0.15
0.10
0.05
0.00
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16A
upper trigger level

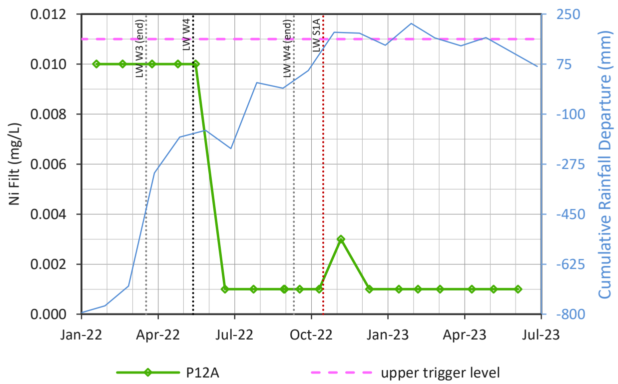

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.05
0.04
0.03
0.02
0.01
0.00
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16B
upper trigger level

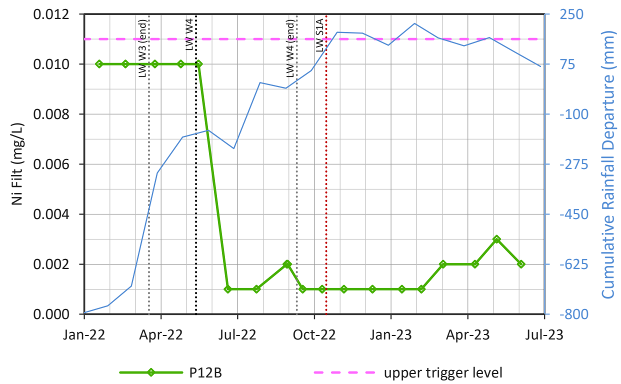

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
400
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16C
upper trigger level

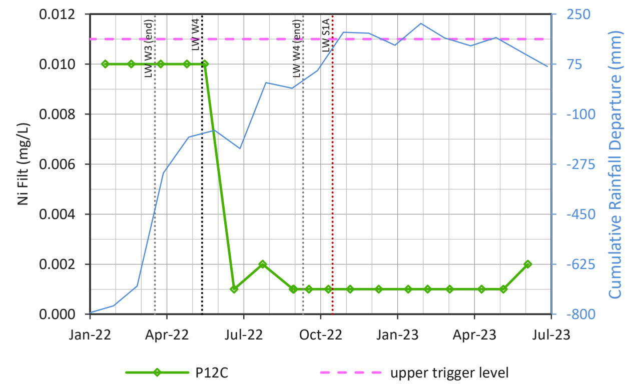

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.05
0.04
0.03
0.02
0.01
0.00
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW104090
upper trigger level

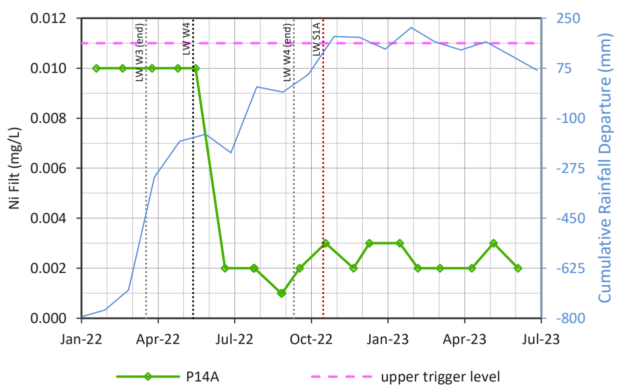

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.20
0.15
0.10
0.05
0.00
300
25
-250
-525
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW105228
upper trigger level

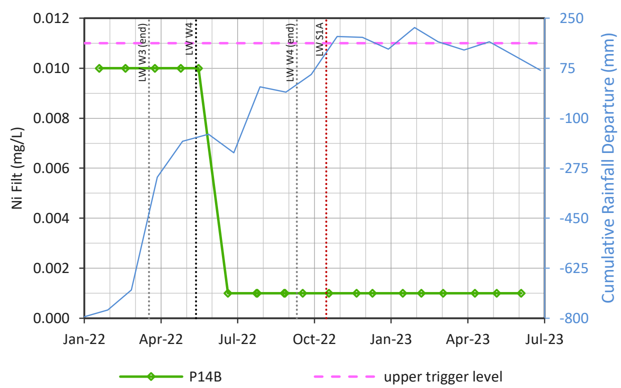

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
325
200
75
-50
-175
-300
-425
-550
-675
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW115860
upper trigger level

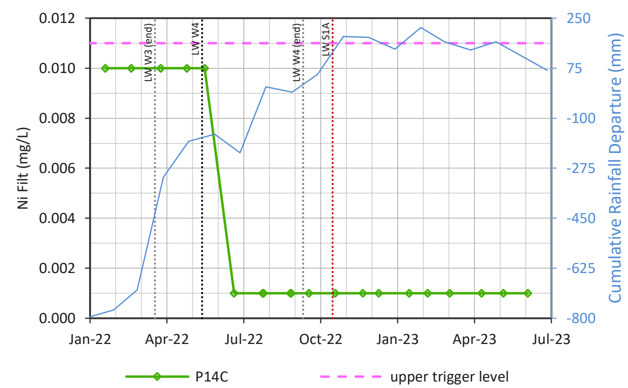

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12A
upper trigger level

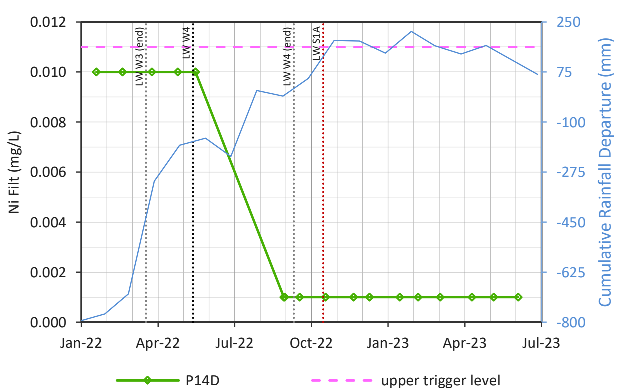

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12B
upper trigger level

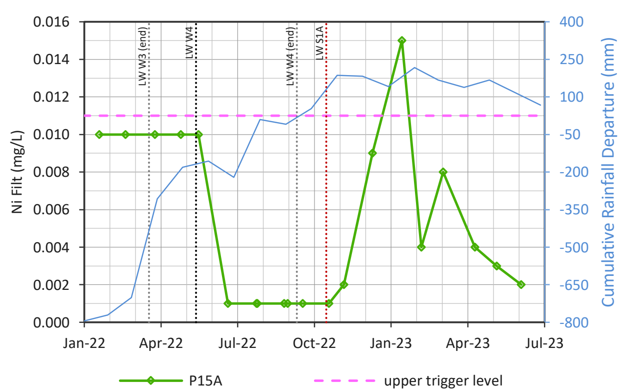

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12C
upper trigger level

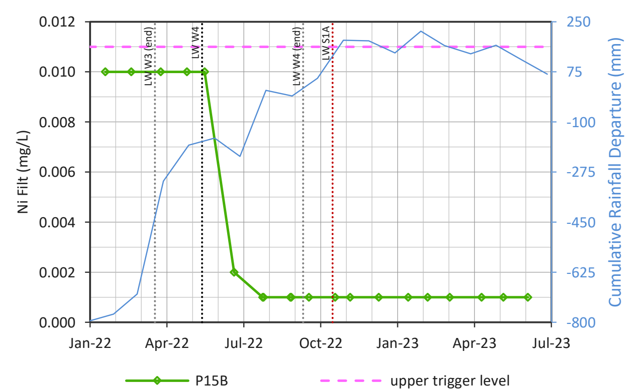

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14A
upper trigger level

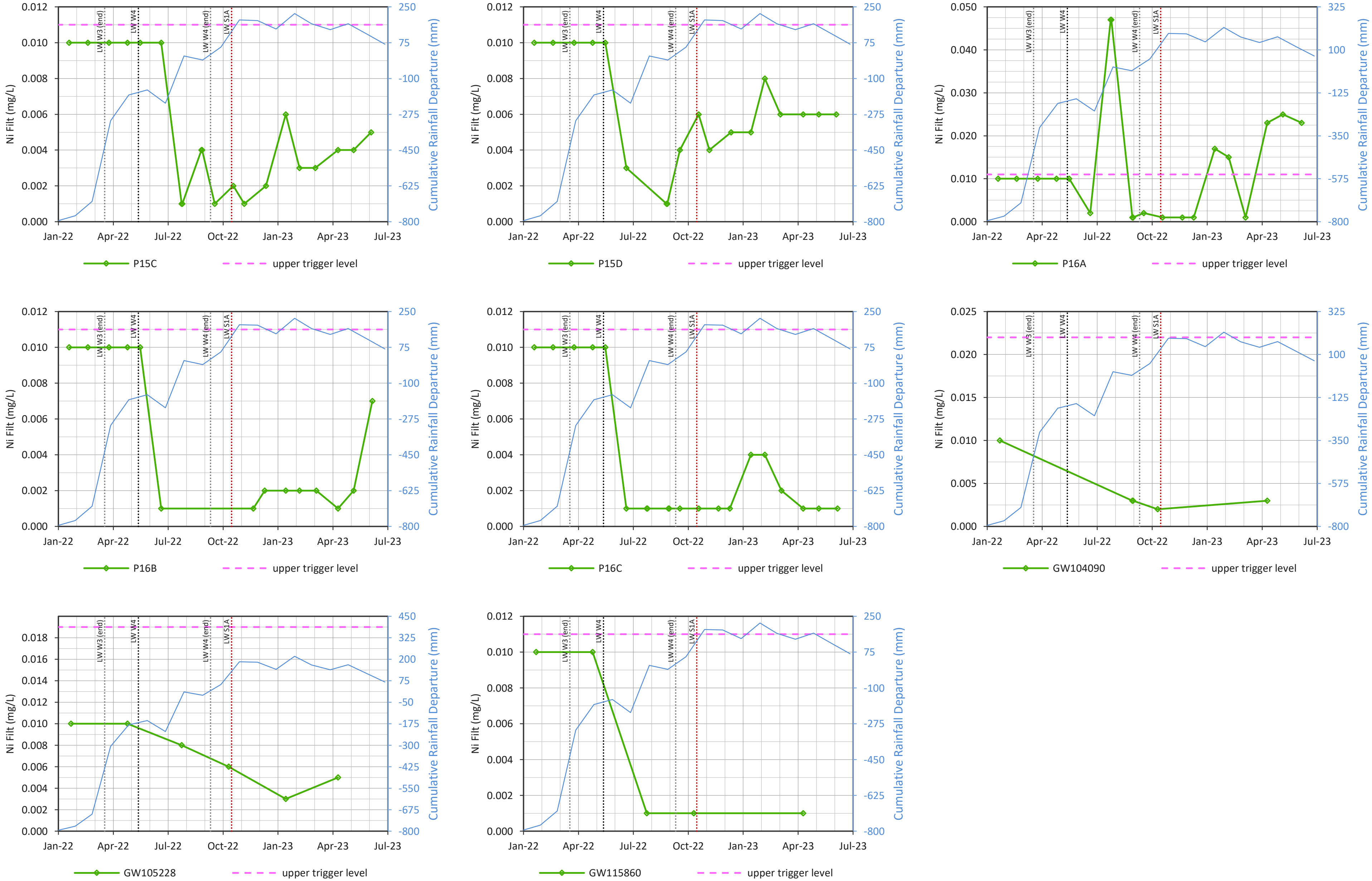

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14B
upper trigger level


Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14C
upper trigger level

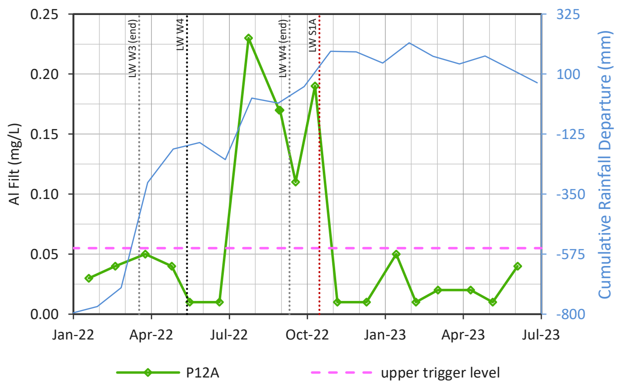

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14D
upper trigger level

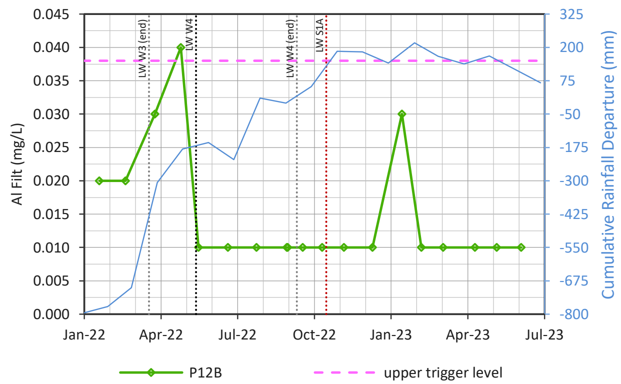

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.016 0.014 0.012 0.010 0.008 0.006 0.004 0.002 0.000
400 250 100 -50 -200 -350 -500 -650 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15A
upper trigger level

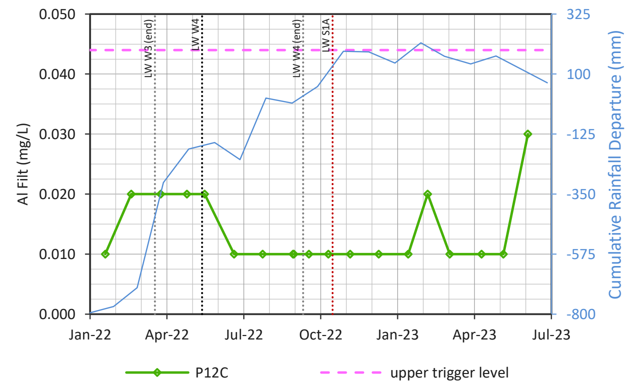

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.012 0.010 0.008 0.006 0.004 0.002 0.000
250 75 -100 -275 -450 -625 -800
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15B
upper trigger level

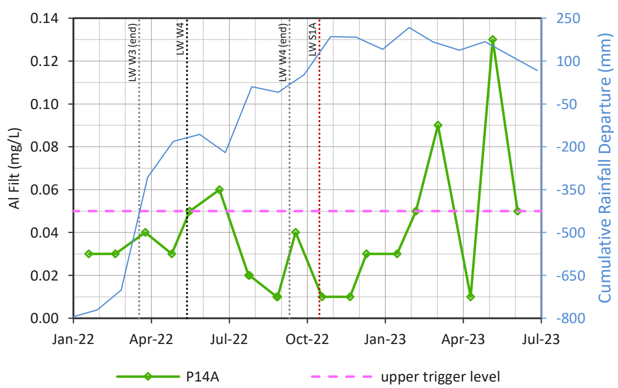


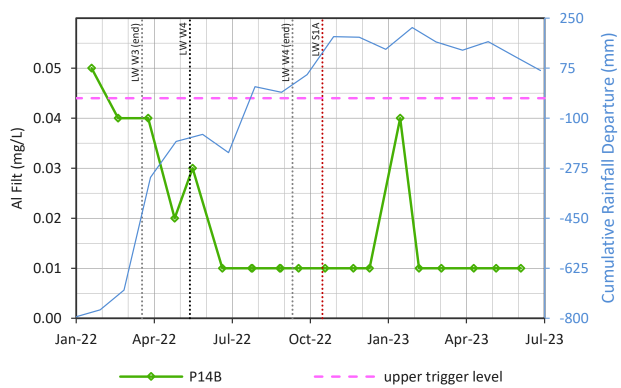
Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C
upper trigger level
P15D
upper trigger level
P16A
upper trigger level
P16B
upper trigger level
P16C
upper trigger level
GW104090
upper trigger level
GW105228
upper trigger level
GW115860
upper trigger level

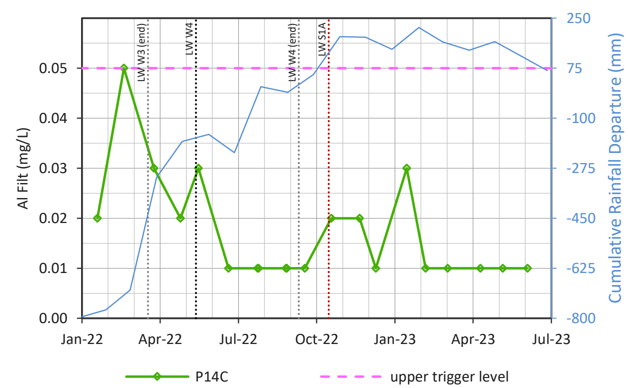

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
upper trigger level

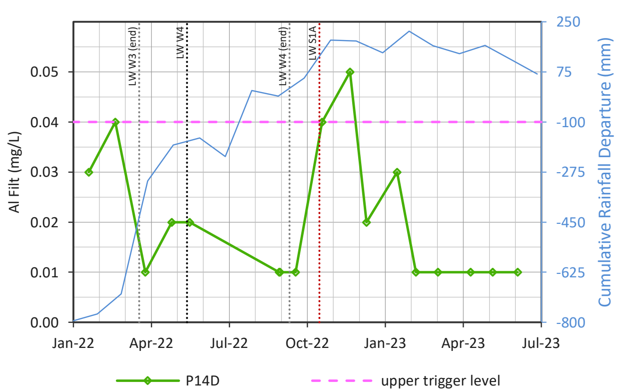

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12B
upper trigger level

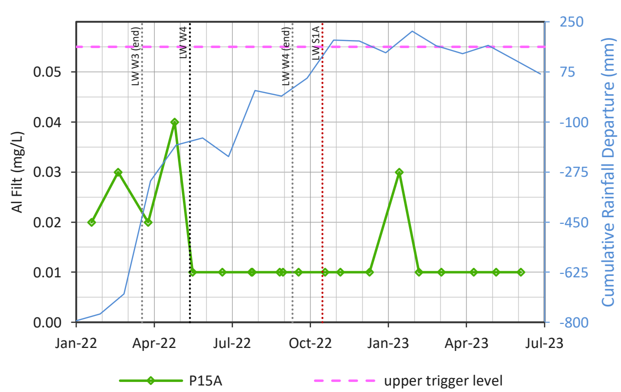

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12C
upper trigger level

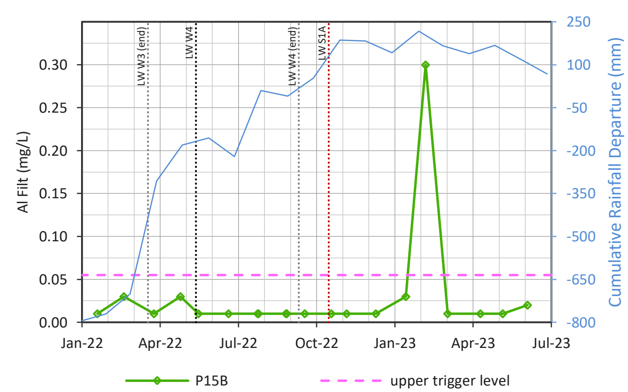

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14A
upper trigger level

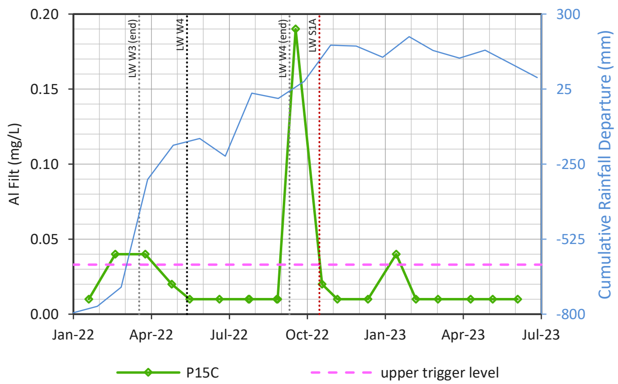

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14B
upper trigger level

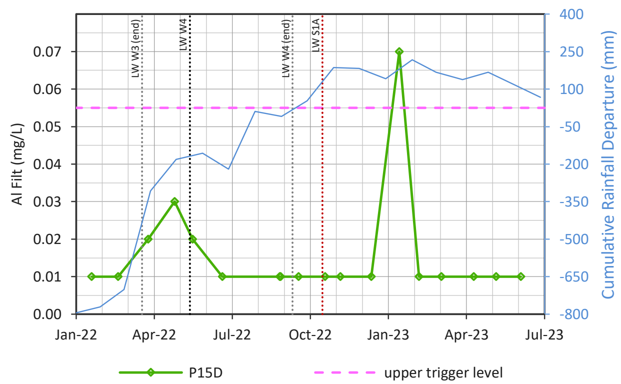

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14C
upper trigger level

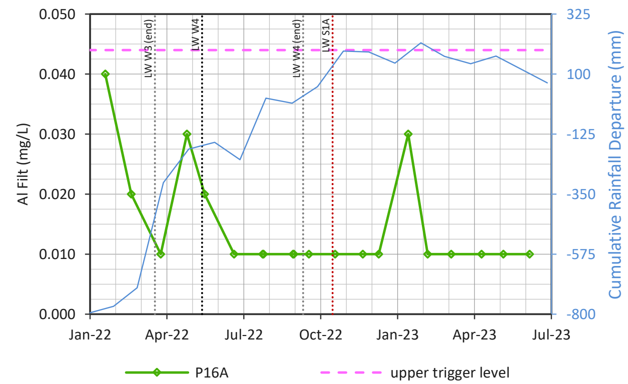

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14D
upper trigger level

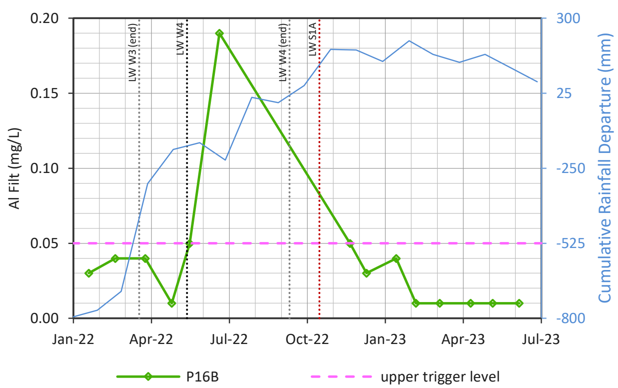

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15A
upper trigger level

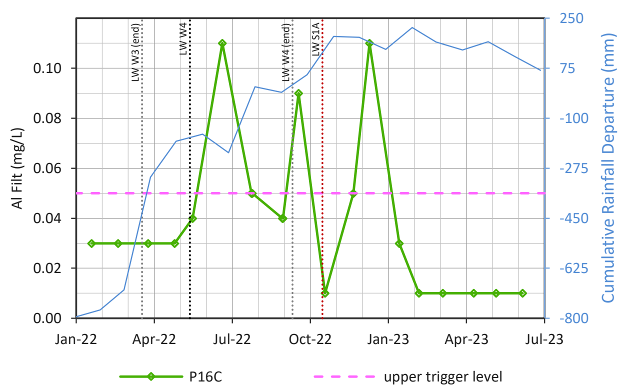

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15B
upper trigger level

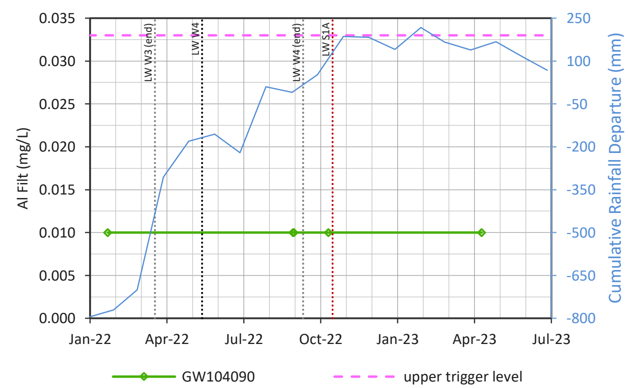

Al Filt (mg/L)
0.20
0.15
0.10
0.05
0.00
Cumulative Rainfall Departure (mm)
300
25
-250
-525
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15C
upper trigger level

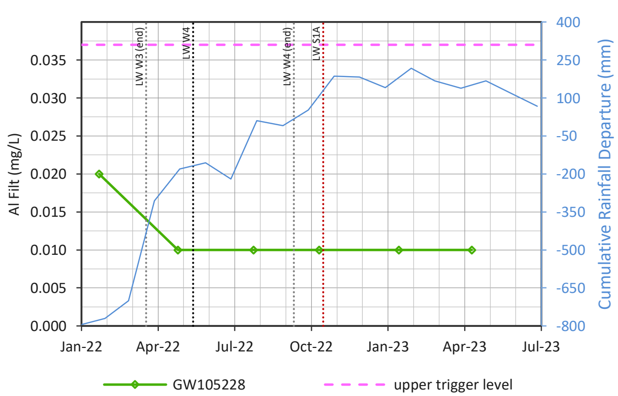

Al Filt (mg/L)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Cumulative Rainfall Departure (mm)
400
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15D
upper trigger level

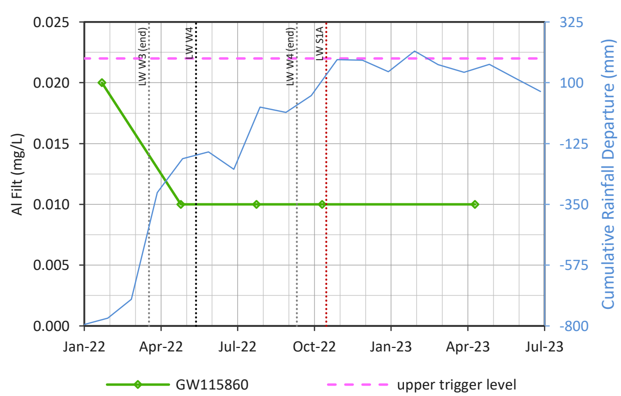

Al Filt (mg/L)
0.050
0.040
0.030
0.020
0.010
0.000
Cumulative Rainfall Departure (mm)
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16A
upper trigger level

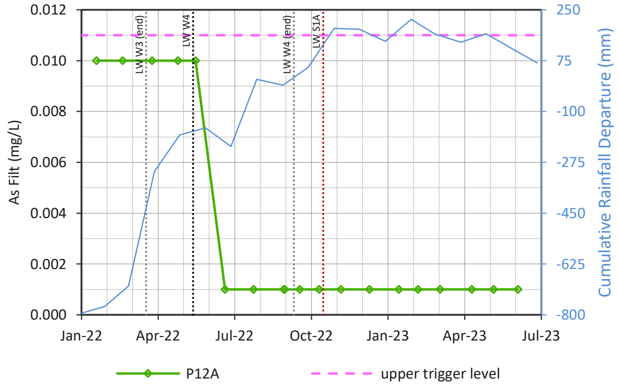

Al Filt (mg/L)
0.20
0.15
0.10
0.05
0.00
Cumulative Rainfall Departure (mm)
300
25
-250
-525
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16B
upper trigger level


Al Filt (mg/L)
0.10
0.08
0.06
0.04
0.02
0.00
Cumulative Rainfall Departure (mm)
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P16C
upper trigger level

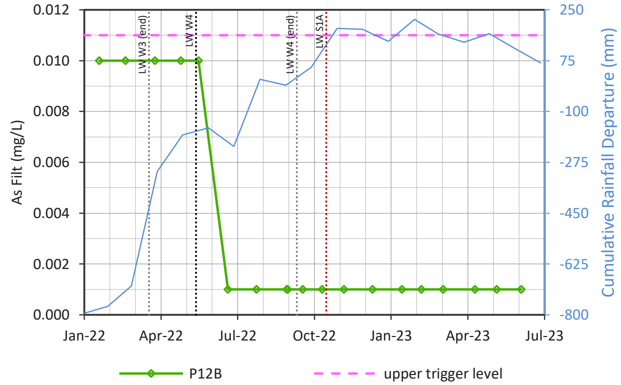

Al Filt (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Cumulative Rainfall Departure (mm)
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104090
upper trigger level


Al Filt (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Cumulative Rainfall Departure (mm)
400
250
100
-50
-200
-350
-500
-650
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105228
upper trigger level

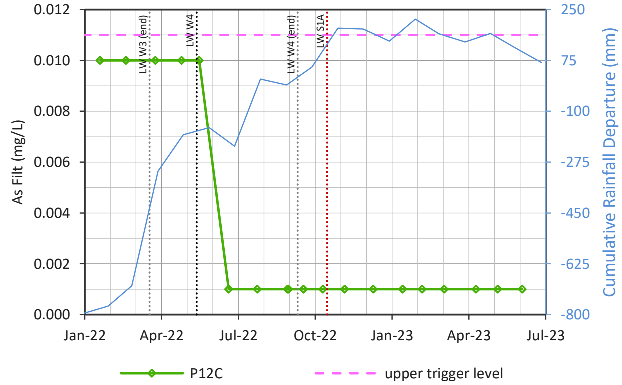

Al Filt (mg/L)
0.025
0.020
0.015
0.010
0.005
0.000
Cumulative Rainfall Departure (mm)
325
100
-125
-350
-575
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW115860
upper trigger level



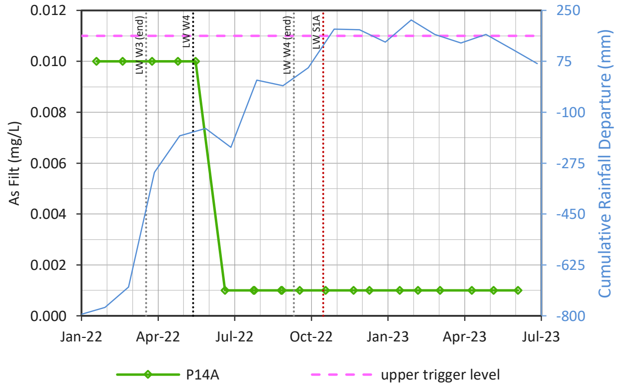
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12A
upper trigger level



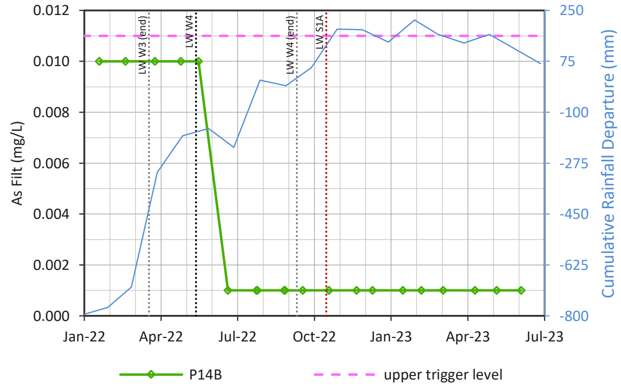
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12B
upper trigger level



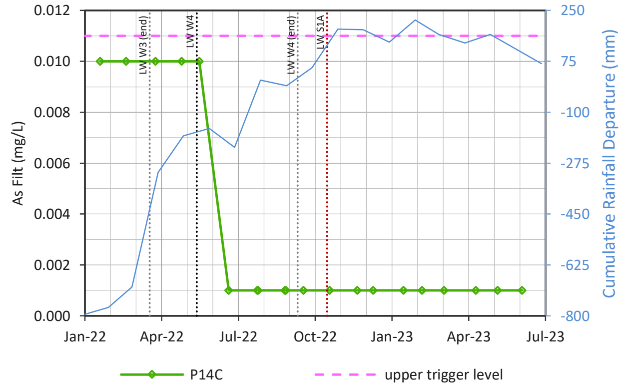
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P12C
upper trigger level



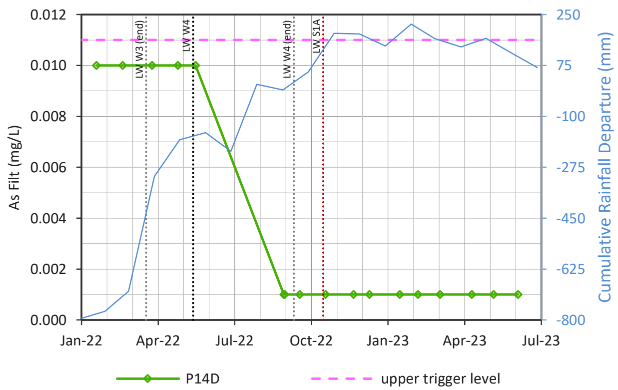
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14A
upper trigger level



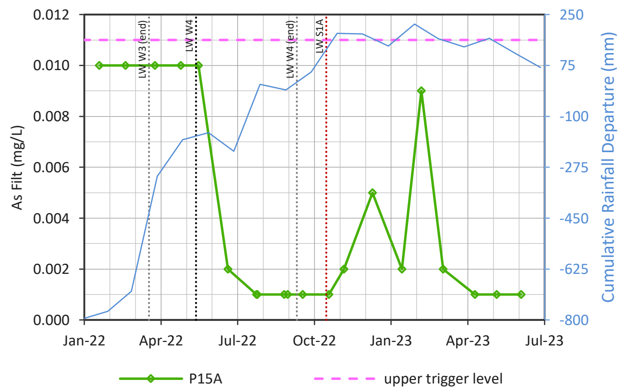
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14B
upper trigger level



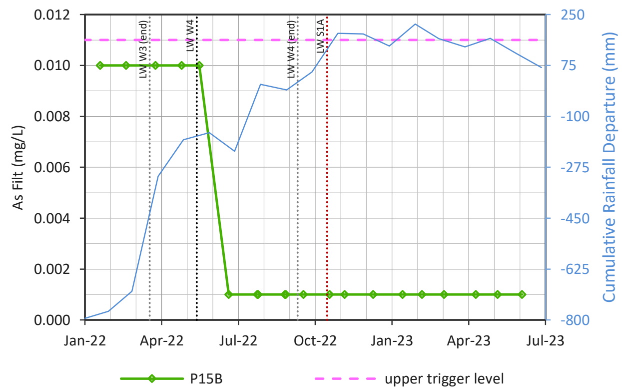
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14C
upper trigger level



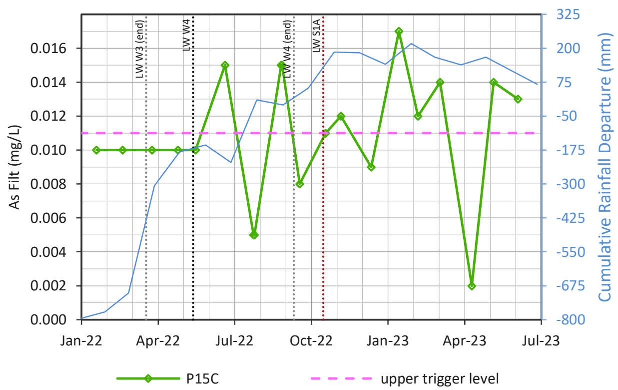
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P14D
upper trigger level

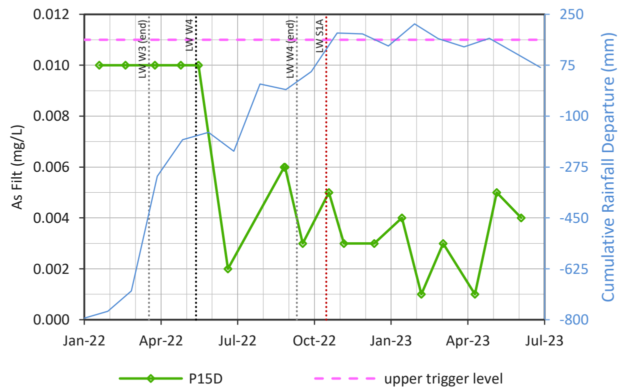


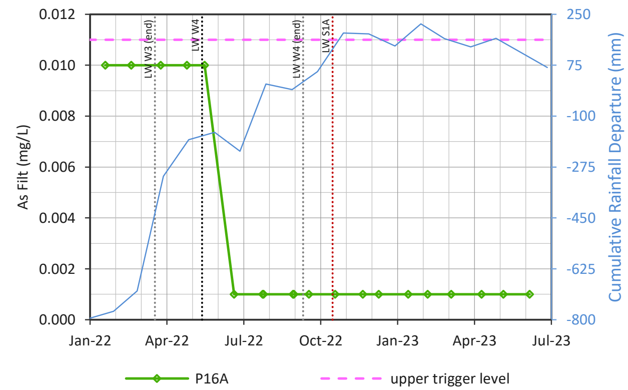
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15A
upper trigger level

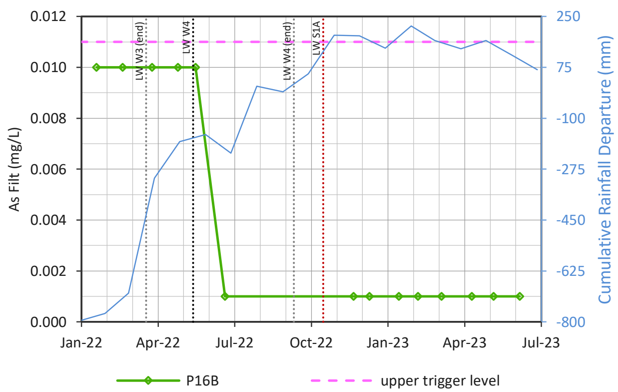


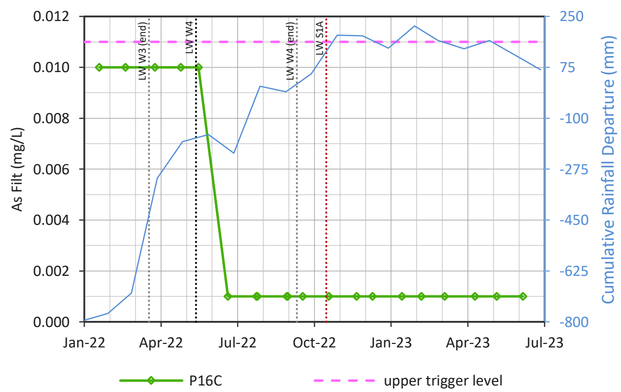
As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P15B
upper trigger level

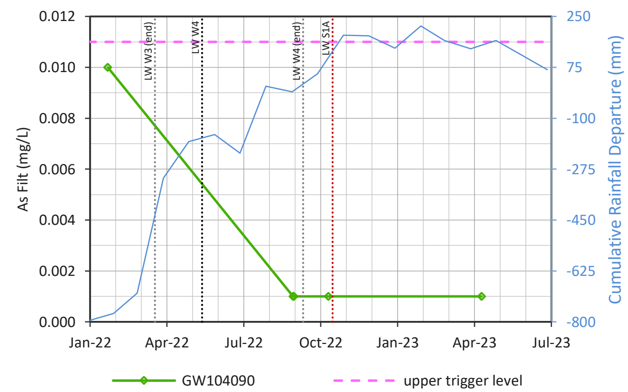

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
325
200
75
-50
-175
-300
-425
-550
-675
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C
upper trigger level

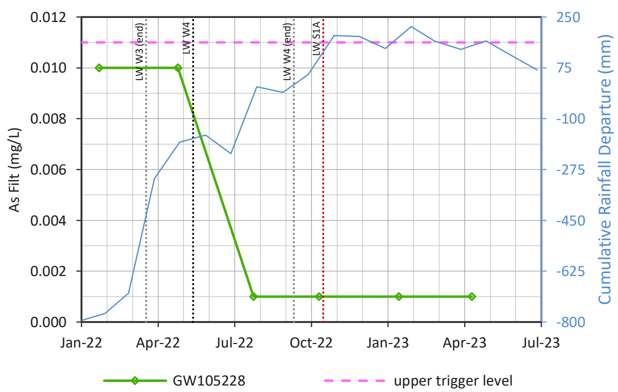

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15D
upper trigger level

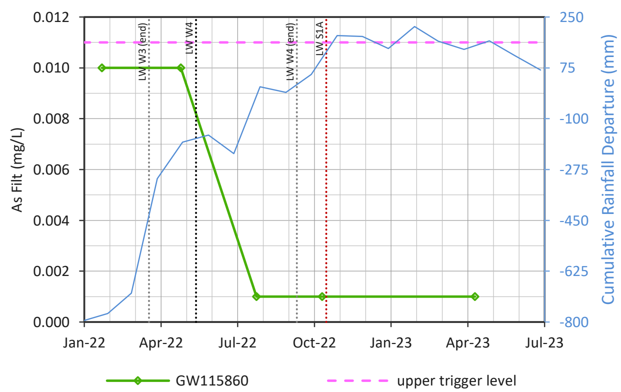

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16A
upper trigger level

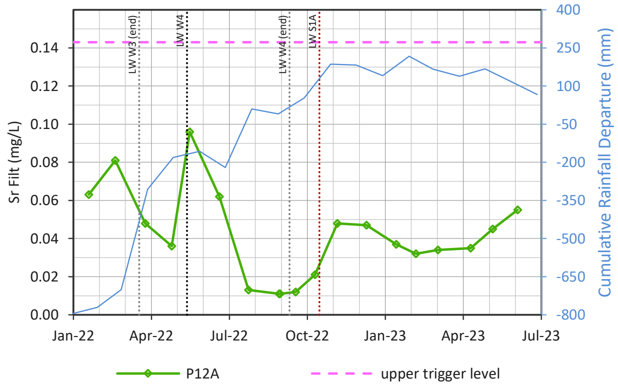

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16B
upper trigger level

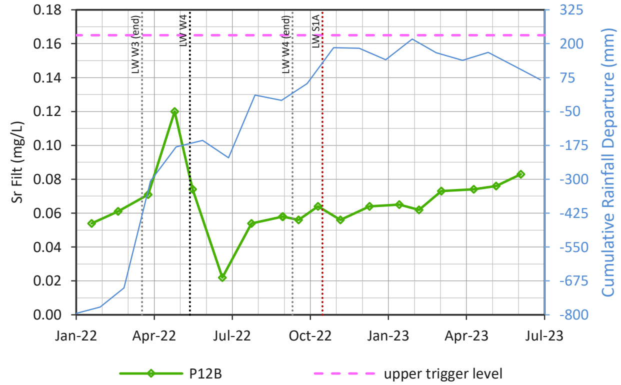

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16C
upper trigger level

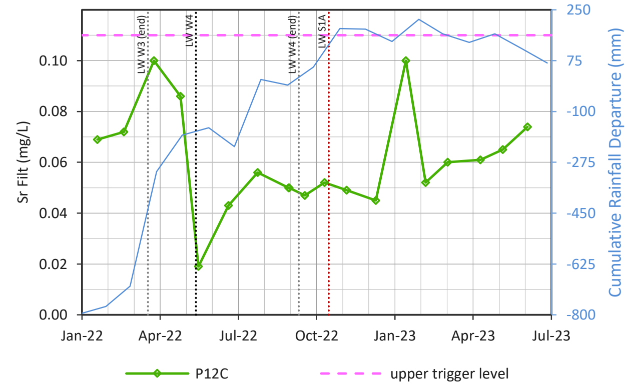

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW104090
upper trigger level

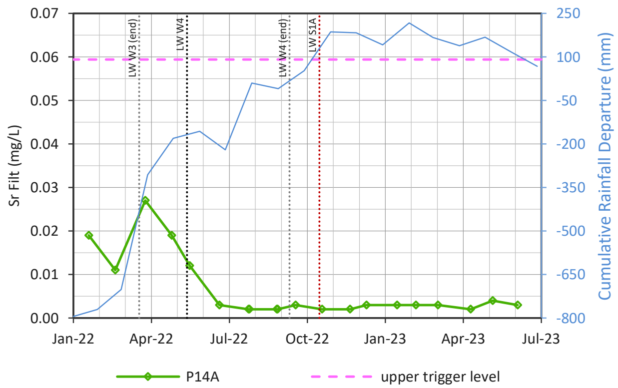

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW105228
upper trigger level

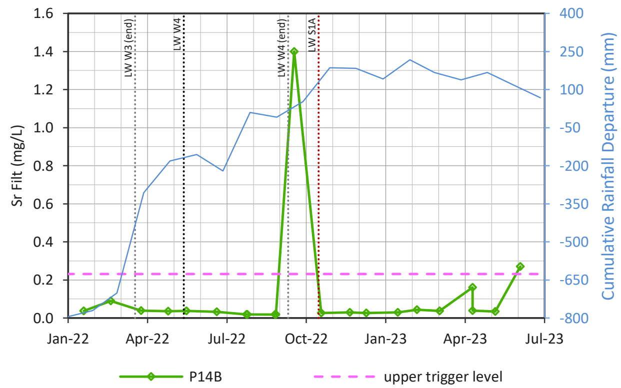

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
0.000
0.002
0.004
0.006
0.008
0.010
0.012
250
75
-100
-275
-450
-625
-800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW115860
upper trigger level

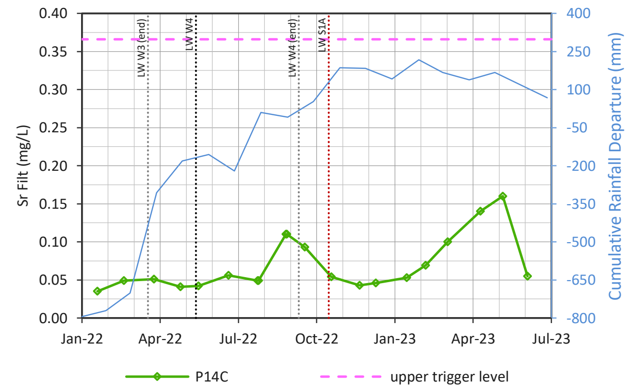

Sr Filt (mg/L)
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14
Cumulative Rainfall Departure (mm)
400 250 100 -50 -200 -350 -500 -650 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12A
upper trigger level

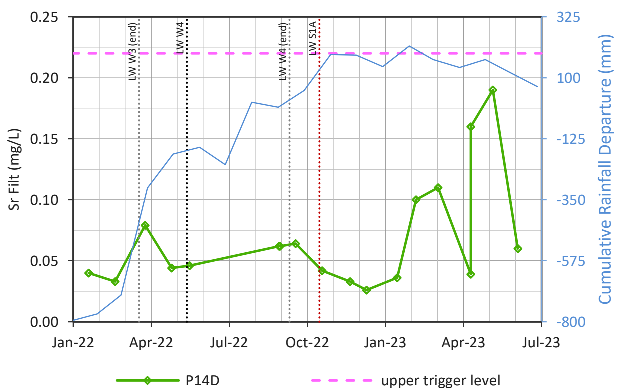

Sr Filt (mg/L)
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18
Cumulative Rainfall Departure (mm)
325 200 75 -50 -175 -300 -425 -550 -675 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12B
upper trigger level

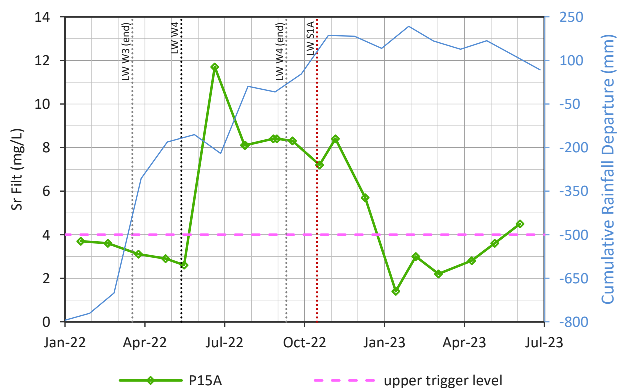

Sr Filt (mg/L)
0.00 0.02 0.04 0.06 0.08 0.10
Cumulative Rainfall Departure (mm)
250 75 -100 -275 -450 -625 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12C
upper trigger level

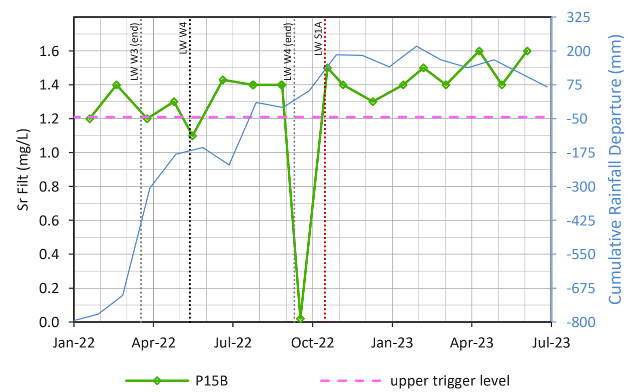

Sr Filt (mg/L)
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07
Cumulative Rainfall Departure (mm)
250 100 -50 -200 -350 -500 -650 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14A
upper trigger level

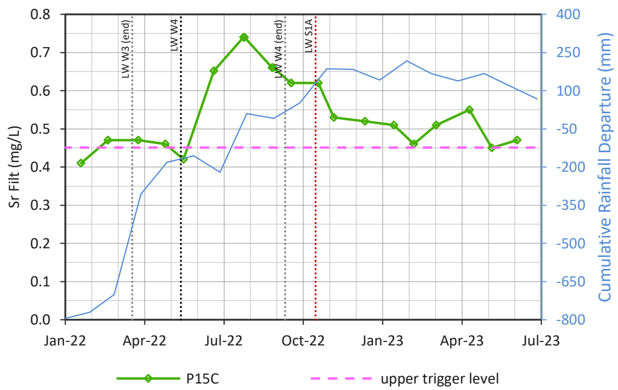

Sr Filt (mg/L)
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6
Cumulative Rainfall Departure (mm)
400 250 100 -50 -200 -350 -500 -650 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14B
upper trigger level

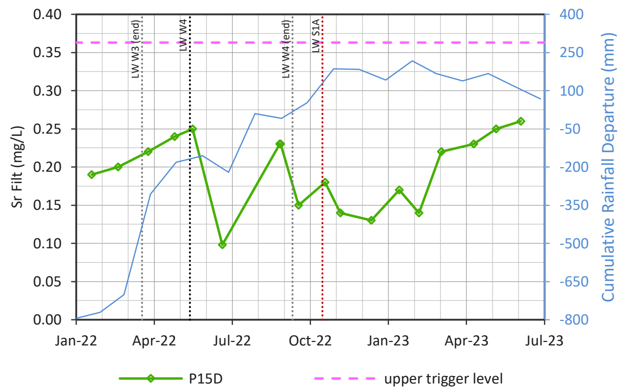

Sr Filt (mg/L)
0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40
Cumulative Rainfall Departure (mm)
400 250 100 -50 -200 -350 -500 -650 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14C
upper trigger level

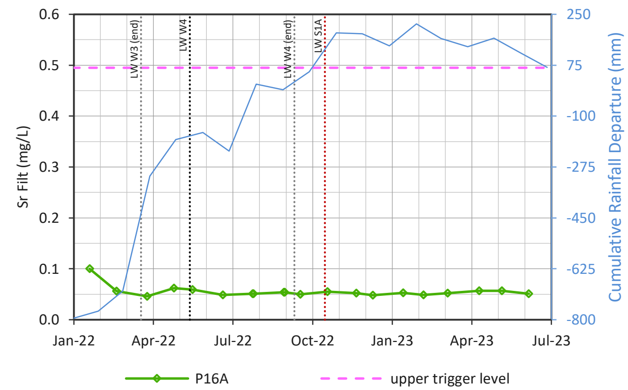

Sr Filt (mg/L)
0.00 0.05 0.10 0.15 0.20 0.25
Cumulative Rainfall Departure (mm)
325 100 -125 -350 -575 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14D
upper trigger level

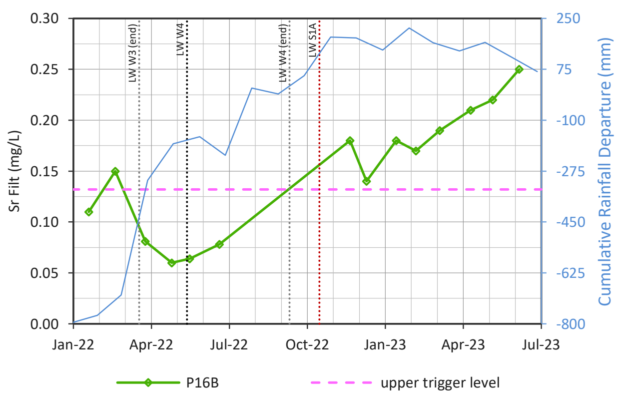

Sr Filt (mg/L)
0 2 4 6 8 10 12 14
Cumulative Rainfall Departure (mm)
250 100 -50 -200 -350 -500 -650 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15A
upper trigger level

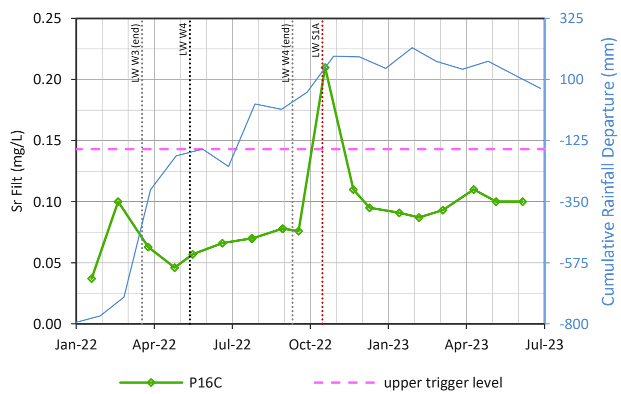

Sr Filt (mg/L)
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6
Cumulative Rainfall Departure (mm)
325 200 75 -50 -175 -300 -425 -550 -675 -800
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15B
upper trigger level

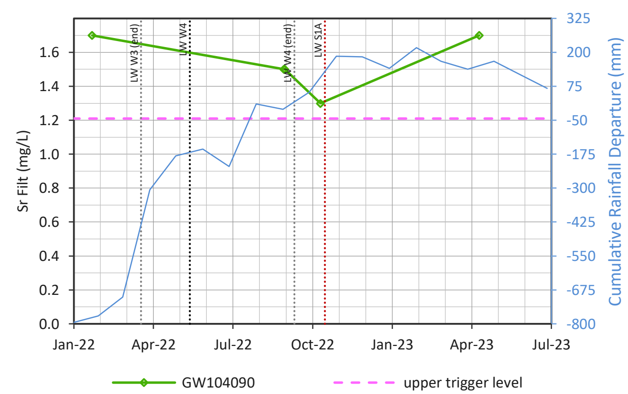

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15C
upper trigger level

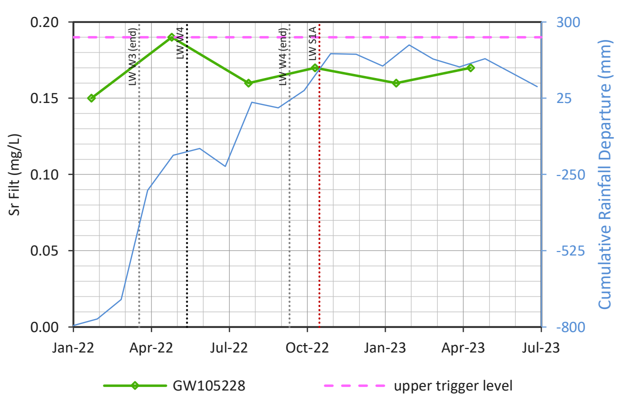

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15D
upper trigger level

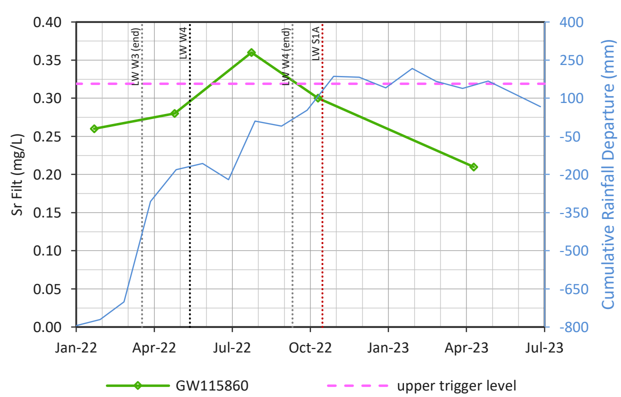

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16A
upper trigger level

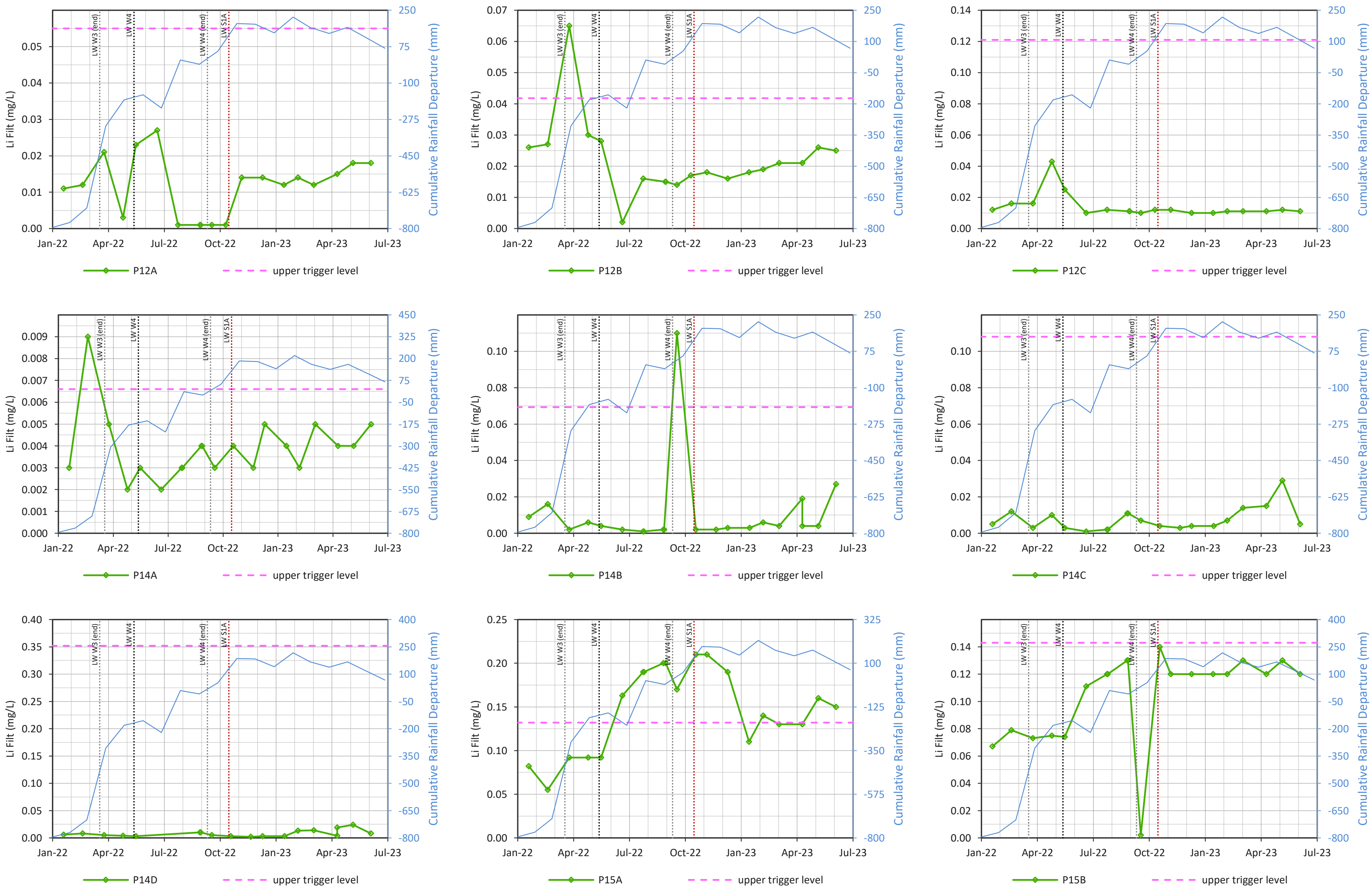

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16B
upper trigger level

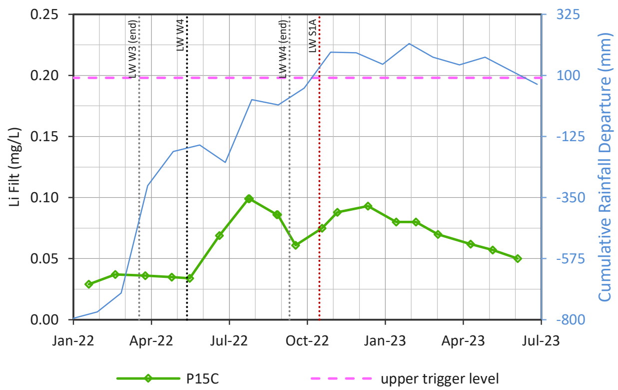

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16C
upper trigger level

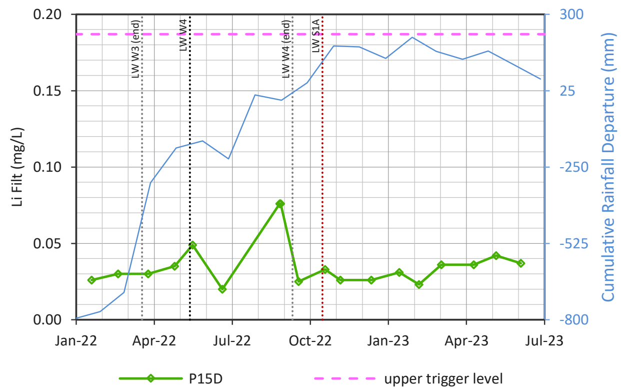

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW104090
upper trigger level

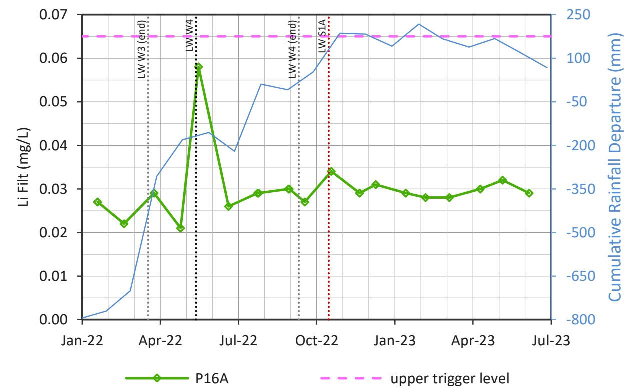

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW105228
upper trigger level

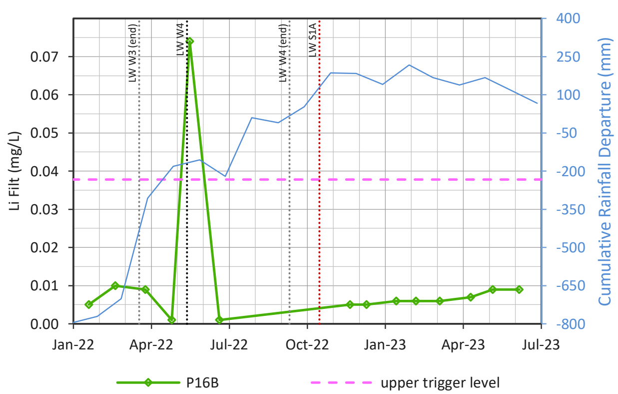

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW115860
upper trigger level

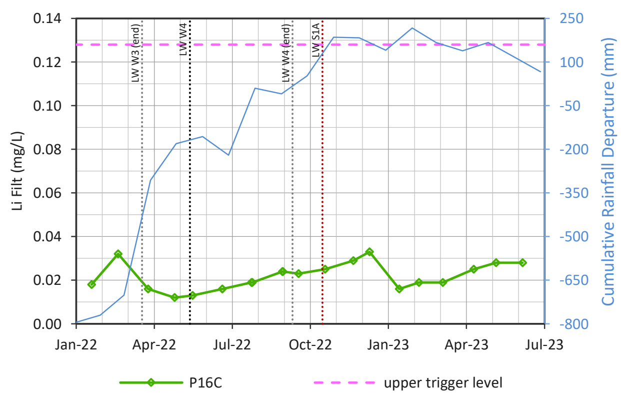

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
P12B
P12C
P14A
P14B
P14C
P14D
P15A
P15B
upper trigger level

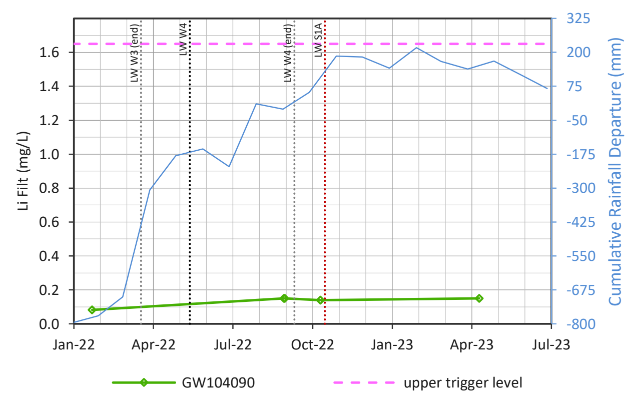

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15C
upper trigger level

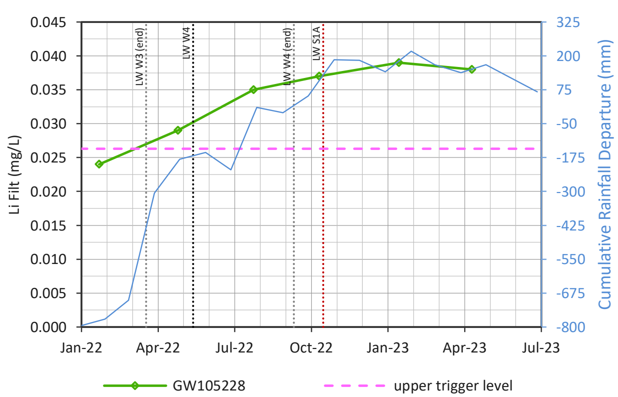

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P15D
upper trigger level

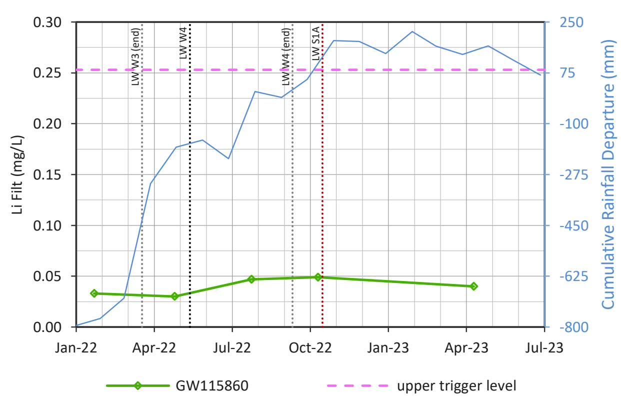

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16A
upper trigger level

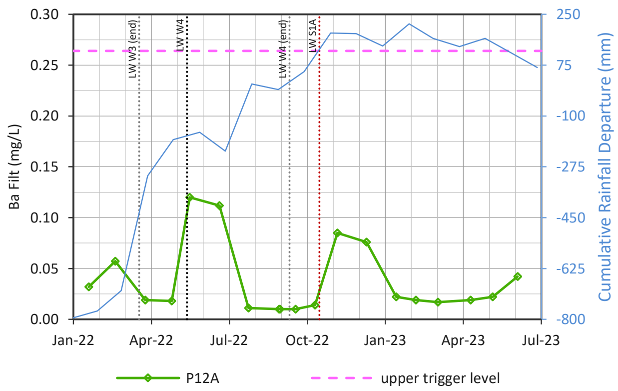

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16B
upper trigger level


Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P16C
upper trigger level

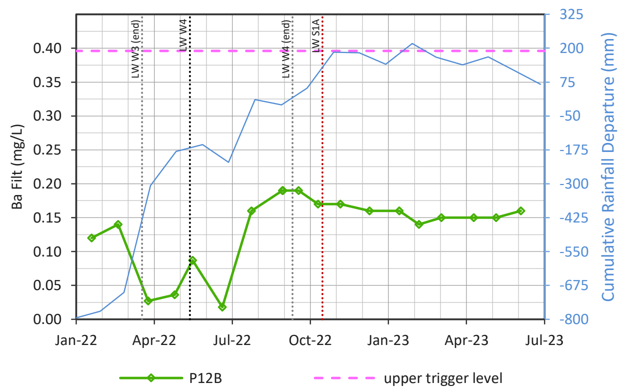

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW104090
upper trigger level


Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW105228
upper trigger level

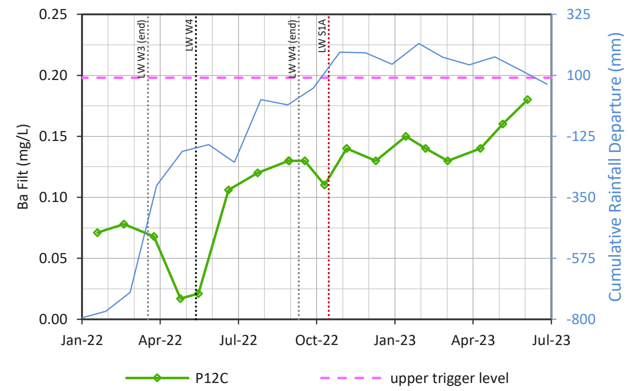

Li Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
GW115860
upper trigger level



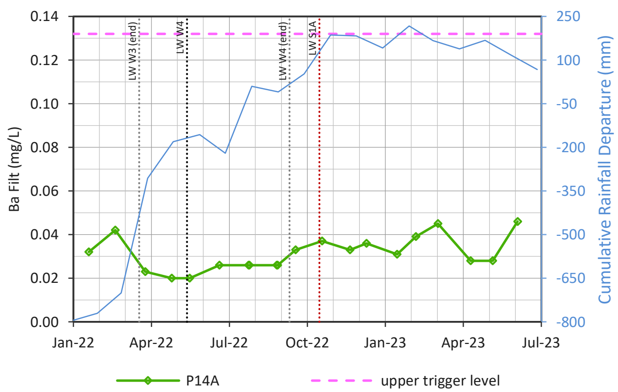
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12A
upper trigger level



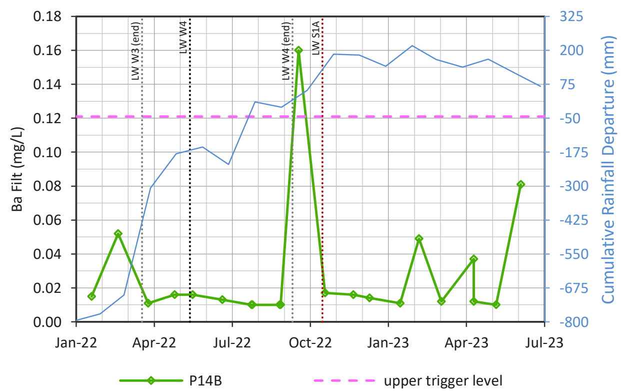
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12B
upper trigger level



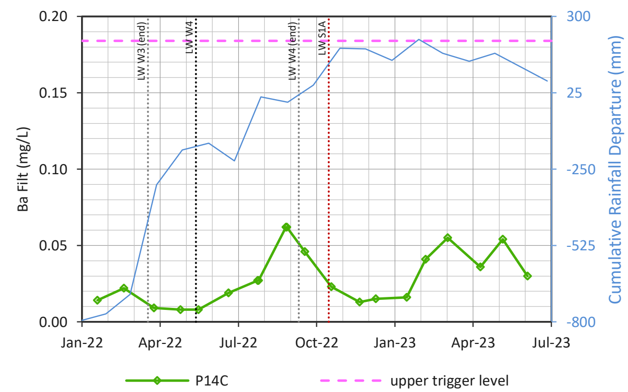
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P12C
upper trigger level



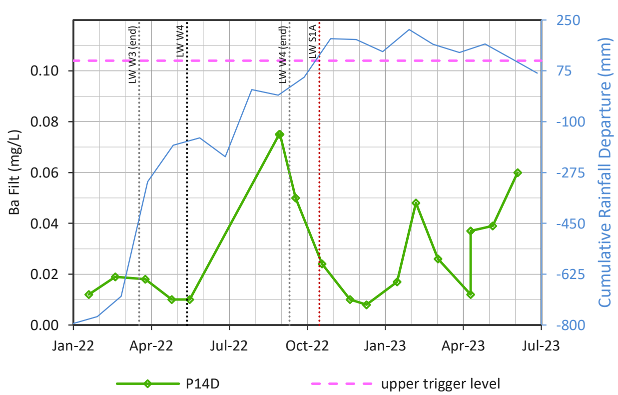
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14A
upper trigger level



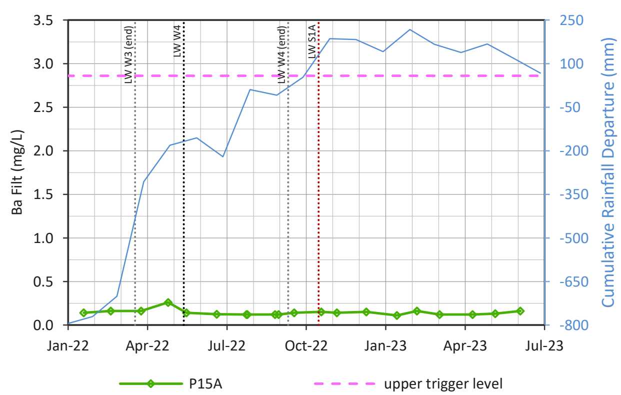
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14B
upper trigger level



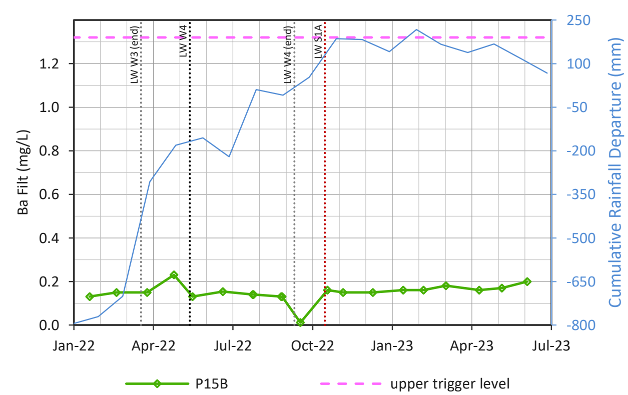
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14C
upper trigger level



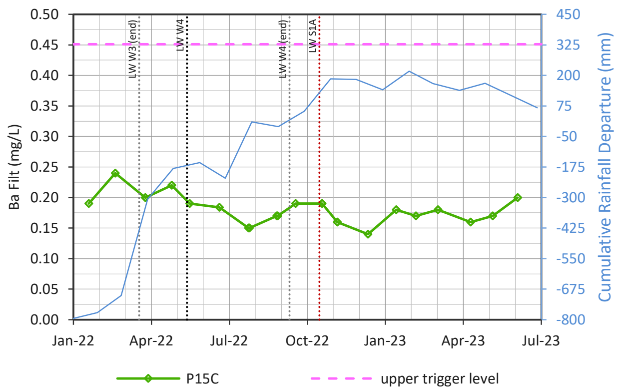
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P14D
upper trigger level

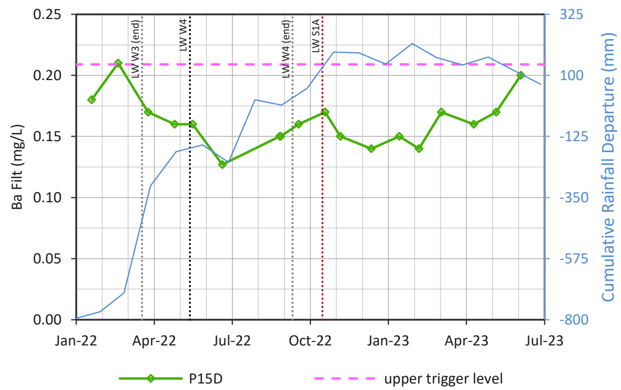


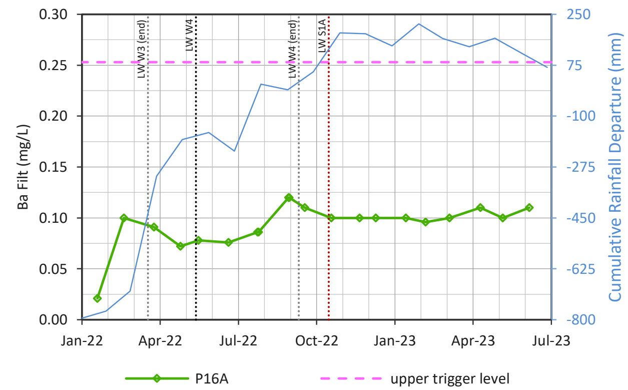
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15A
upper trigger level

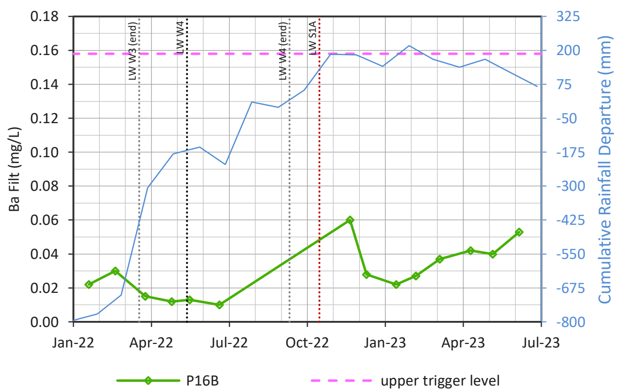


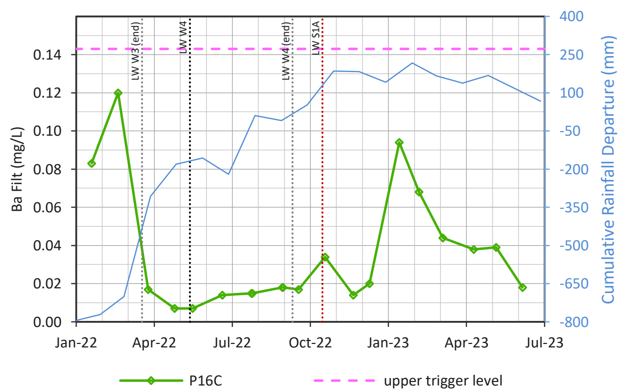
Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15B
upper trigger level

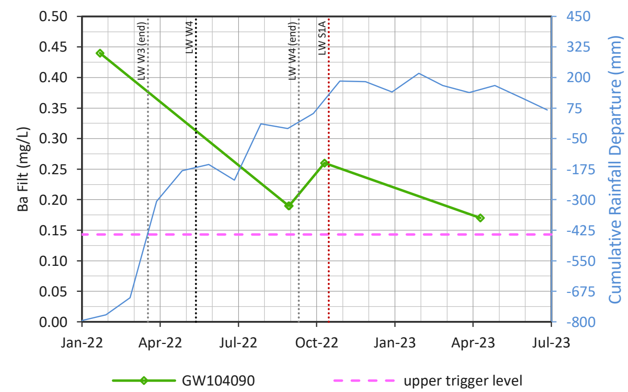

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15C
upper trigger level

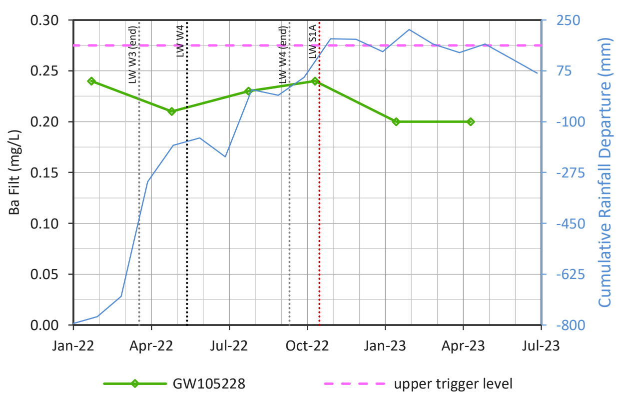

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P15D
upper trigger level

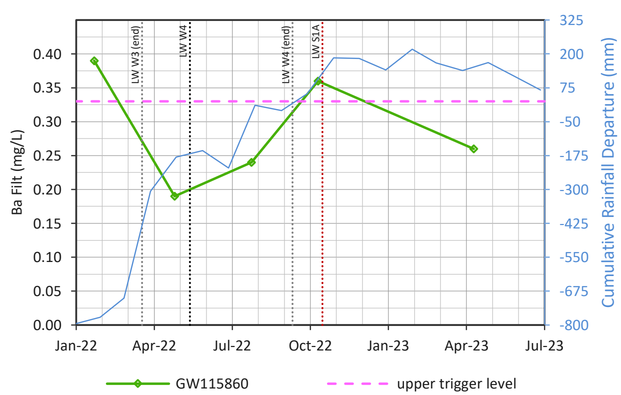

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16A
upper trigger level

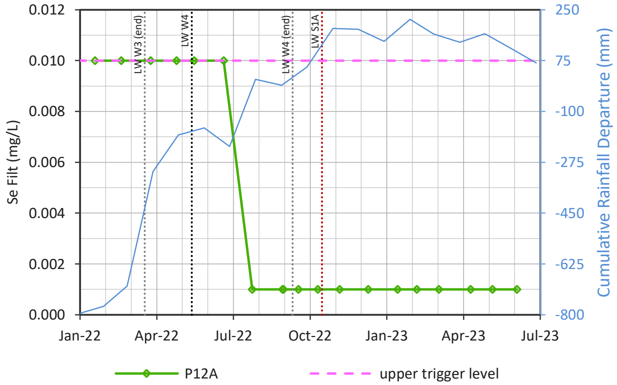

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16B
upper trigger level

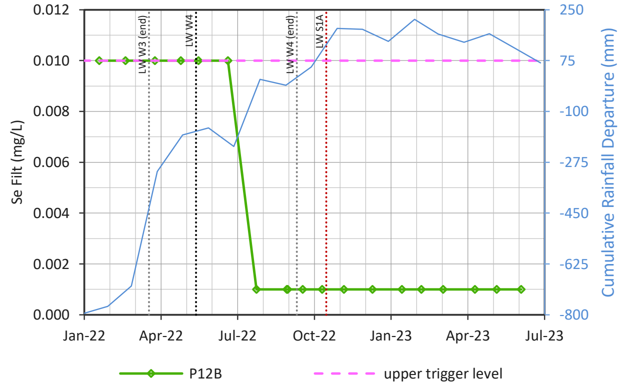

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
P16C
upper trigger level

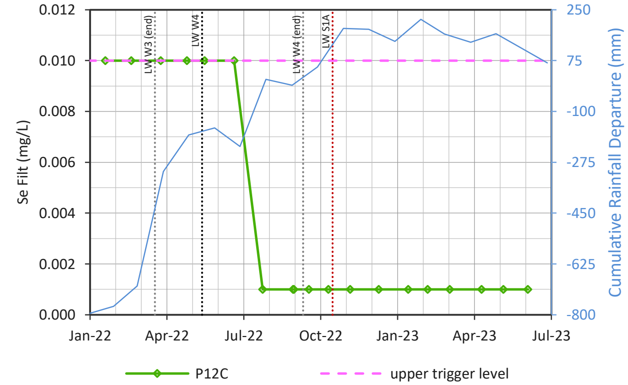

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW104090
upper trigger level

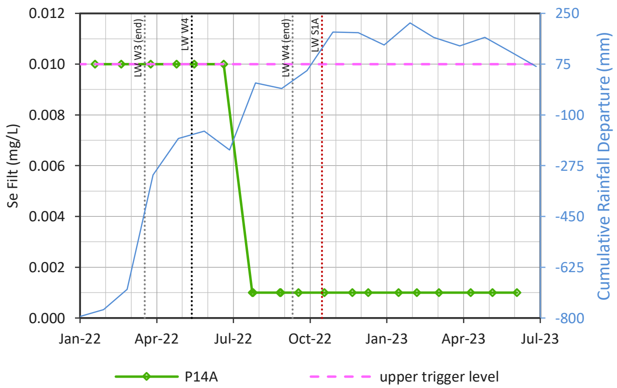

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW105228
upper trigger level

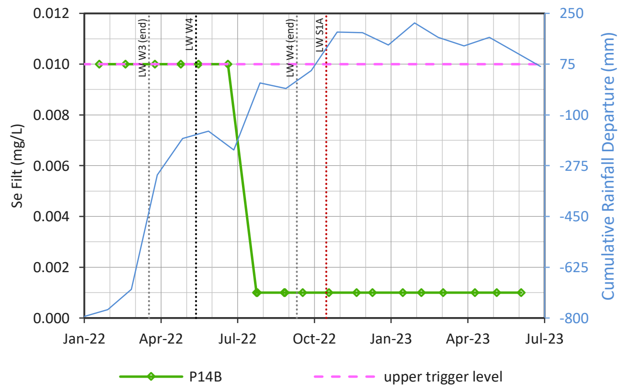

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22 Apr-22 Jul-22 Oct-22 Jan-23 Apr-23 Jul-23
GW115860
upper trigger level


Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.012
0.010
0.008
0.006
0.004
0.002
0.000
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12A
upper trigger level


Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.012
0.010
0.008
0.006
0.004
0.002
0.000
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12B
upper trigger level


Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.012
0.010
0.008
0.006
0.004
0.002
0.000
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P12C
upper trigger level


Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
0.012
0.010
0.008
0.006
0.004
0.002
0.000
250
75
-100
-275
-450
-625
-800
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
P14A
upper trigger level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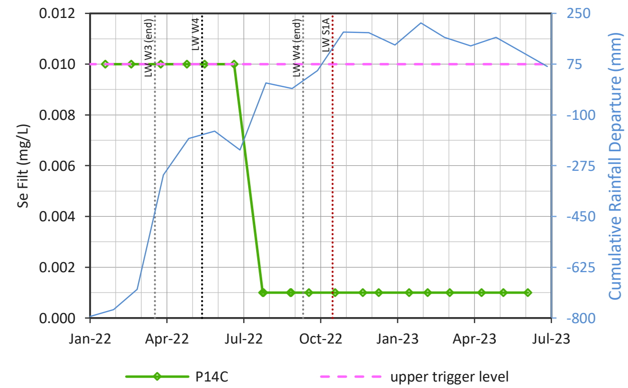
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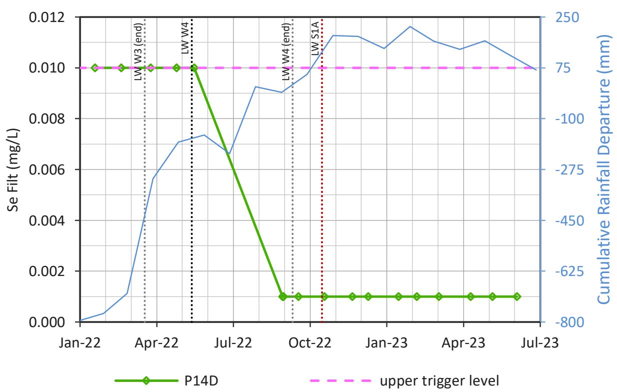
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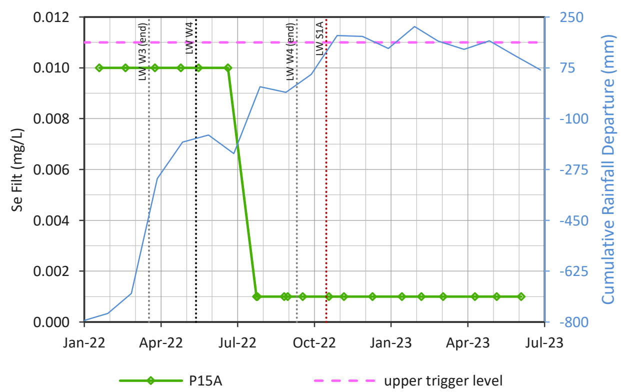
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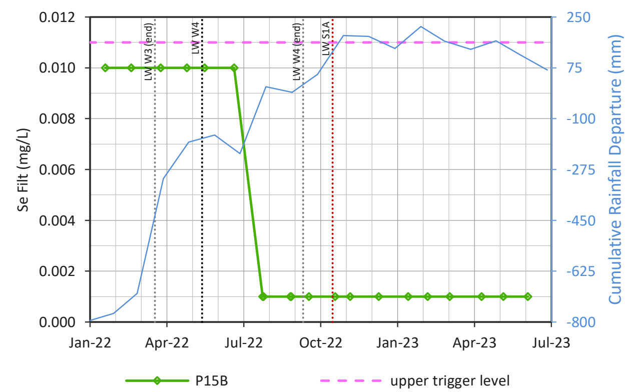
upper trigger level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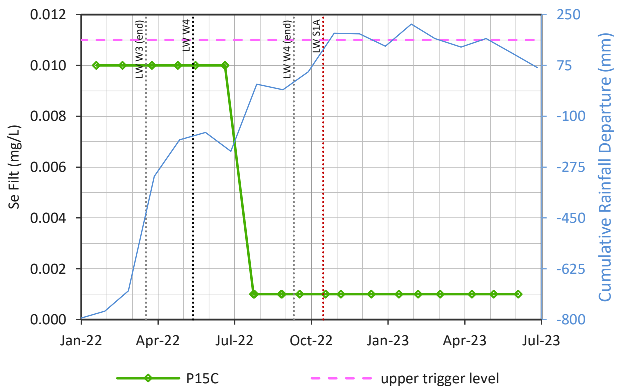
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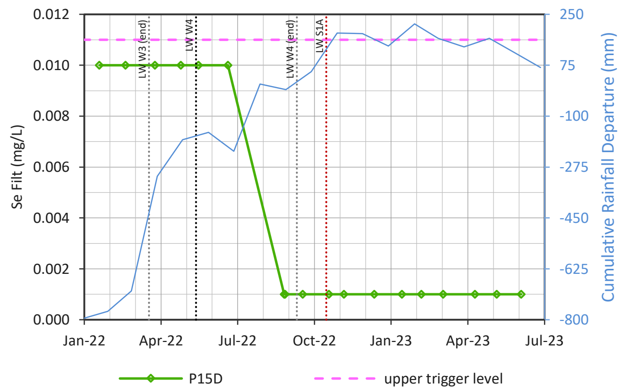
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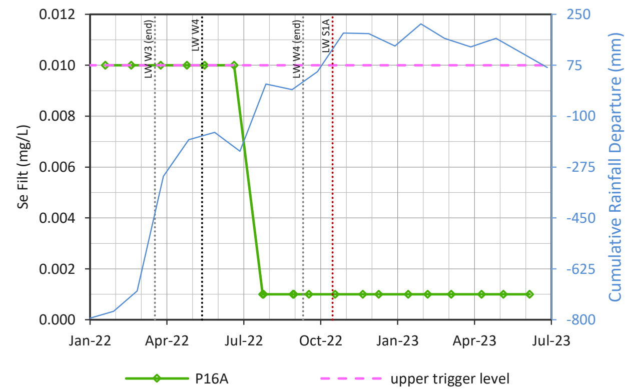
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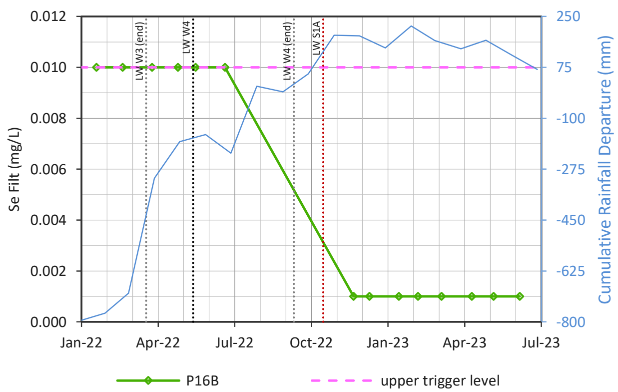
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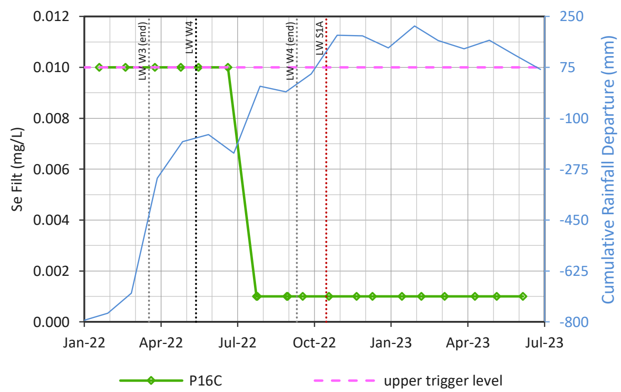
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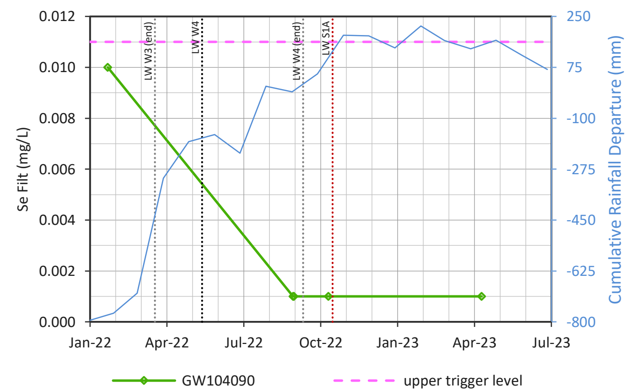
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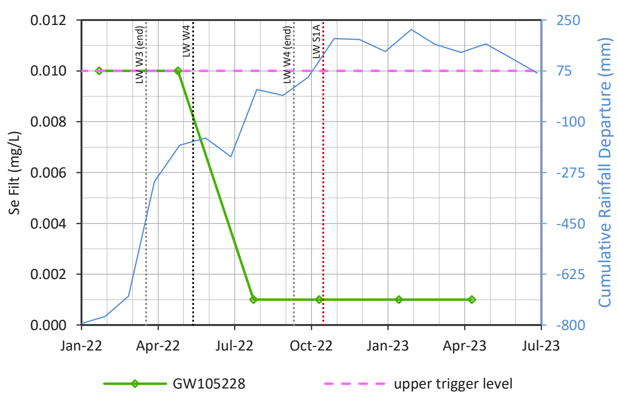
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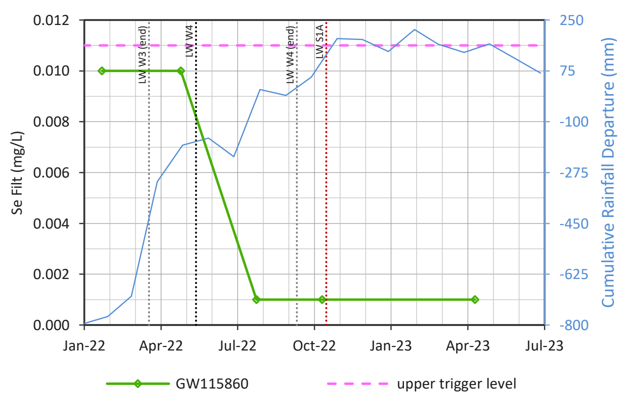
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LW S1A
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upper trigger level

Making Sustainability Happen

Appendix E – PMLL Culvert Rehabilitation Reports

19 May 2023

Katrina O'Reilly
Team Leader - Compliance
NSW Department of Planning and Environment

Uploaded to DPE Major Projects Portal

Dear Katrina,

Re: Rehabilitation of PMLL Culverts

During the extraction of longwalls in the Western Domain of Tahmoor Coal's operations, visible perceptible impacts were observed at two sandstone culverts along the Picton-Mittagong Loop Line (PMLL) at chainage 88.980 and 88.400. As per your letter dated 16 May 2022, this impact resulted in an exceedance of the performance measure for 'other Aboriginal and heritage sites' specified in Schedule 2, Condition 13A, Table 1 of DA 67/98.

Tahmoor Coal would like to advise that the rehabilitation works program for the two sandstone culverts has been completed in accordance with the Transport for NSW (TfNSW) Structure Repair Standard. Attached is the Pointe Engineering report demonstrating the completion of the repair works, as well as inspection reports from JMA Solutions and Robinson Rail confirming that the repairs have been completed to a satisfactory level.

A site inspection of the culverts was completed on 2 May 2023 with Transport Heritage NSW (THNSW), and THNSW is satisfied with the repair completed (refer attached letter).

As per your letter dated 27 February 2023, Tahmoor Coal can facilitate an inspection of the two culverts in the week commencing Monday 5th June to close out this component of work. Please advise on an appropriate date and time.

Please do not hesitate to contact me on mobile 0438 284 106 or email zina.ainsworth@simecgfg.com should you require clarification or further information.

Yours sincerely,

Zina Ainsworth

Zina Ainsworth
Environment and Community Manager

Attached: Pointe Engineering Report
JMA Solutions Inspection Report
Robinson Rail Inspection Report
THNSW Sign-off letter received 17 May 2023

POINTE ENGINEERING PTY LTD
ABN 34 613 639 740
PO Box 4018, Moorland, 2443
pointeengineering.com

11 May 2023

Kevin Golledge
Tahmoor Coal

RE: PMLL Construction Photos

Kevin,

Pointe Engineering undertook repair work of three culverts throughout March, April and May of 2023. The work was completed on the Picton – Mittagong Loop Line Culverts under contract from Tahmoor Coal.

The repair work included crack epoxy injection, bed joint reinforcement, stone voussoir pinning, stone voussoir reattachment with epoxy and re pointing. This was completed as detailed in J M A Solutions report R0809-R2.

Three culverts were remediated at chainages:

- 88.400 km
  - crack epoxy injection
  - bed joint reinforcement
  - stone voussoir pinning
  - stone voussoir reattachment with epoxy
  - re pointing
- 88.980 km
  - stone voussoir pinning
  - re pointing
- 89.629 km
  - re pointing as per Client request additional monitor repair work completed to pre-existing crack in the headwall to support PMLL asset
  - Removal of the Tahmoor Coal installed plastic shotcrete protection barrier as requested

Pointe under the direction of Tahmoor Coal also completed an additional heritage improvement task that was observed during the construction phase or pre-handover inspection:

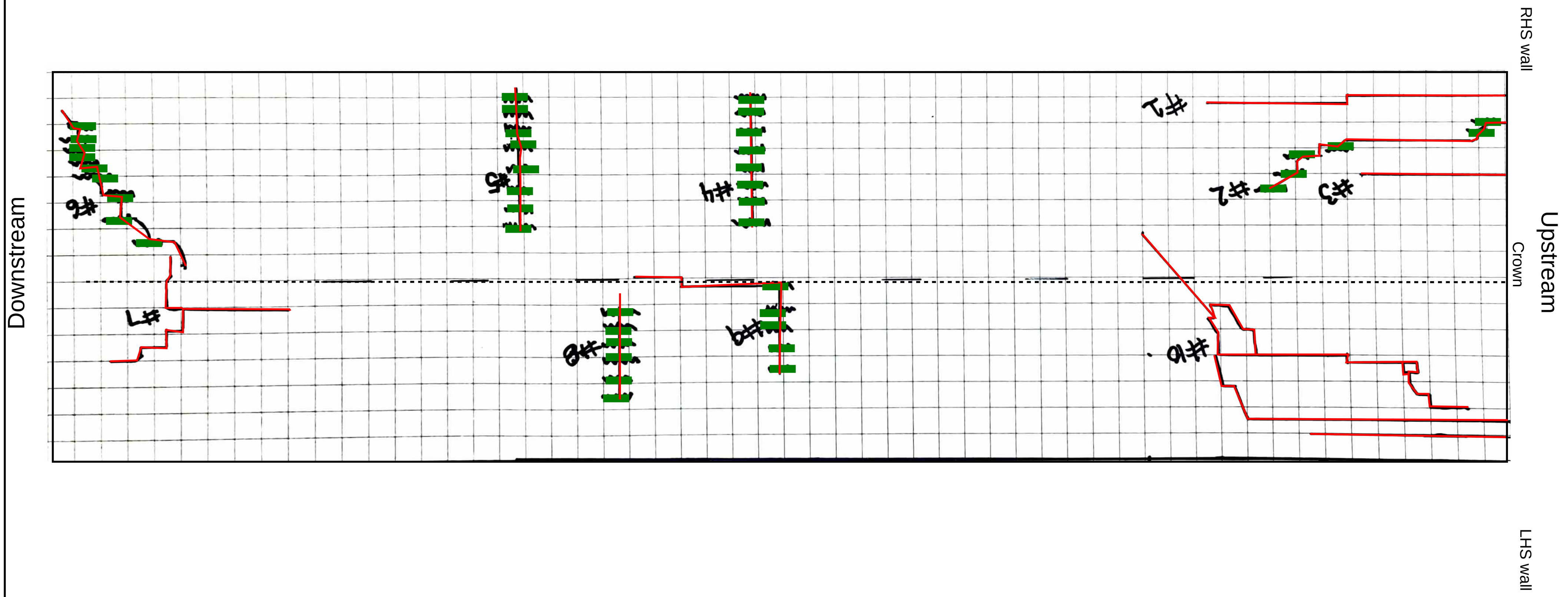
- Observed additional hairline cracks in 88.400km
- Repointing several pre-existing mortar loss locations where prudent to improve the asset
- Repointed several floor locations where it was observed that mining mitigation bolts were removed

The work crack repair work completed is shown in figures 1 to 3. These detail the locations of crack repairs. Three appendices are attached providing a series of photos from the remediation works:

- Appendix A - 88.400 km work
- Appendix B - 88.980 km work
- Appendix C - 89.629 km work

Yours faithfully,
POINTE ENGINEERING PTY LTD

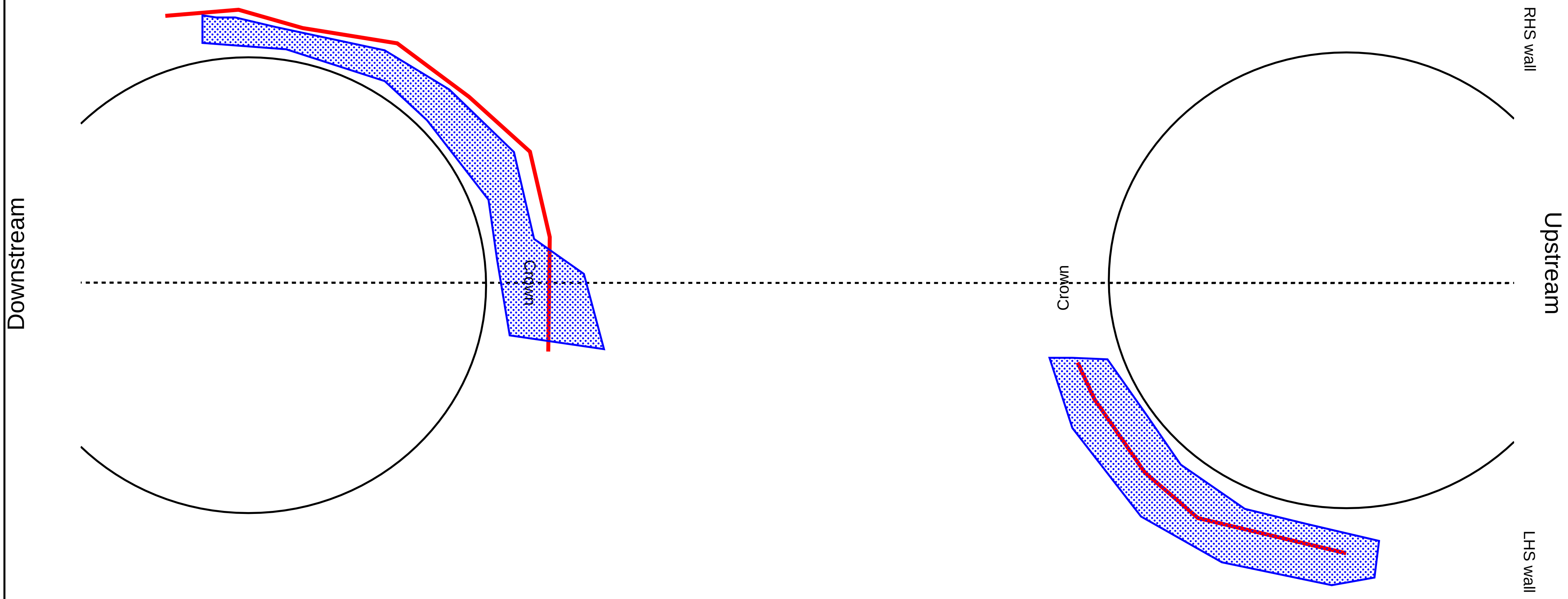
Glynn Price, CPEng.
Snr Geotechnical Engineer



LEGEND
Helibar
Injected Fracture

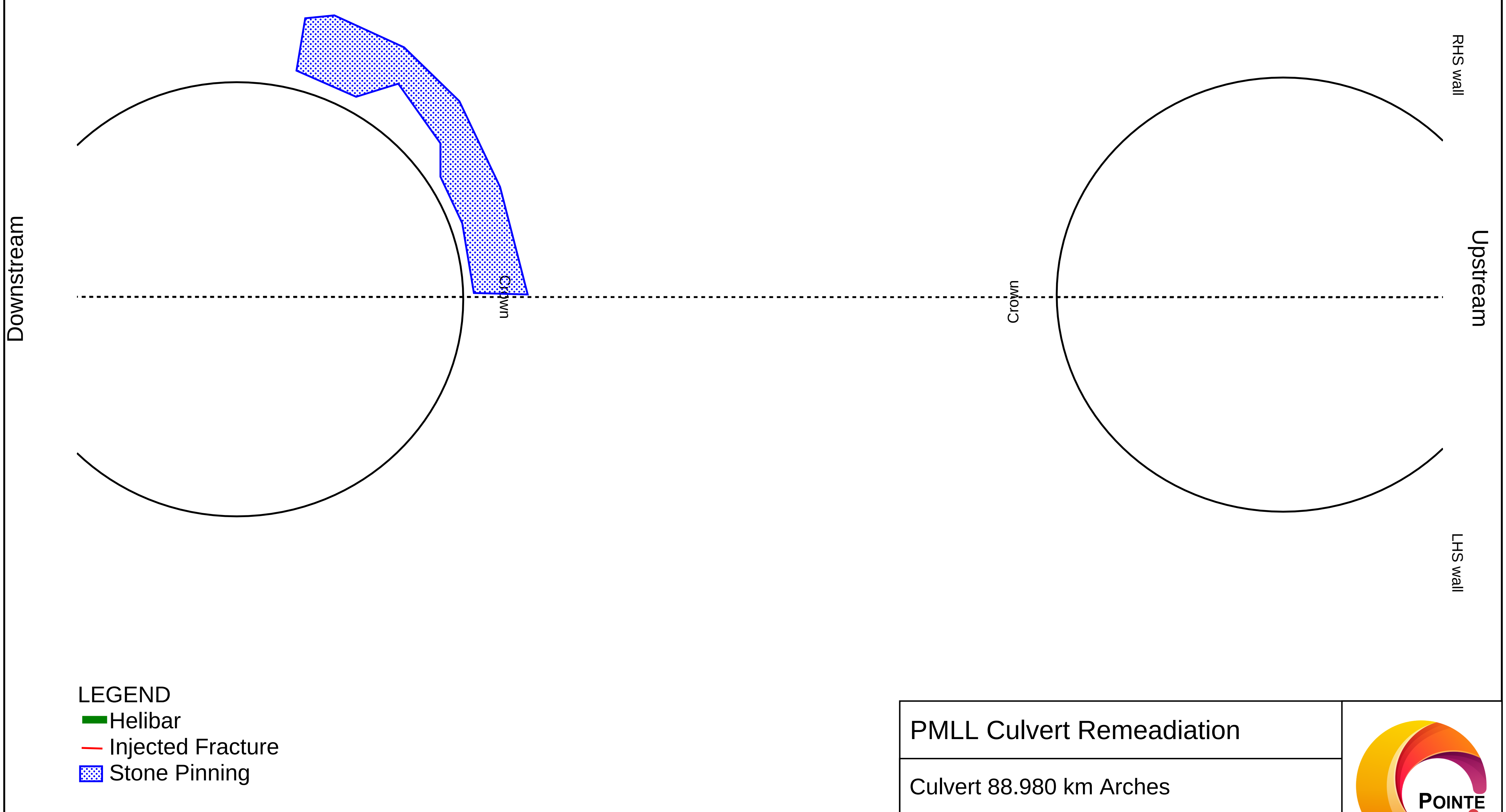
PMLL Culvert Remediation	
Culvert 88.400 km Flat Layout	
Figure 1 Rev 1	G.Price

POINTE



LEGEND
Helibar
Injected Fracture
Stone Pinning

PMLL Culvert Remeadiation		
Culvert 88.400 km Arches		
Figure 2 Rev 1	G.Price	POINTE



PMLL Culvert Remeadiation

Culvert 88.980 km Arches

Figure 3 Rev 1 | G.Price

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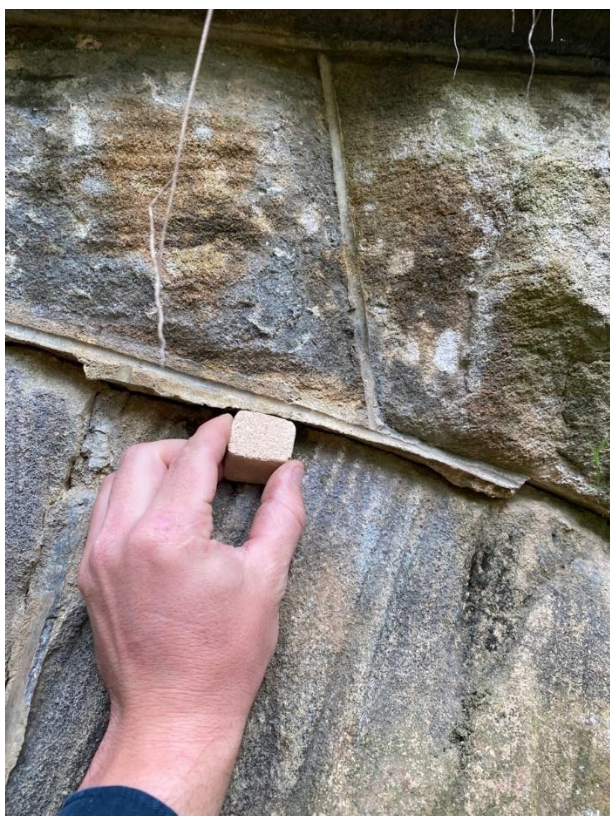
ABN 34 613 639 740
PO Box 4018, Moorland, 2443
pointeengineering.com

Appendix A - Culvert 88.400 km Work

1. **Colour Matching**



2. **Colour Matching**

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3. Route cracked mortar beds

4. Route cracked mortar beds

5. Install Helifix HBR60

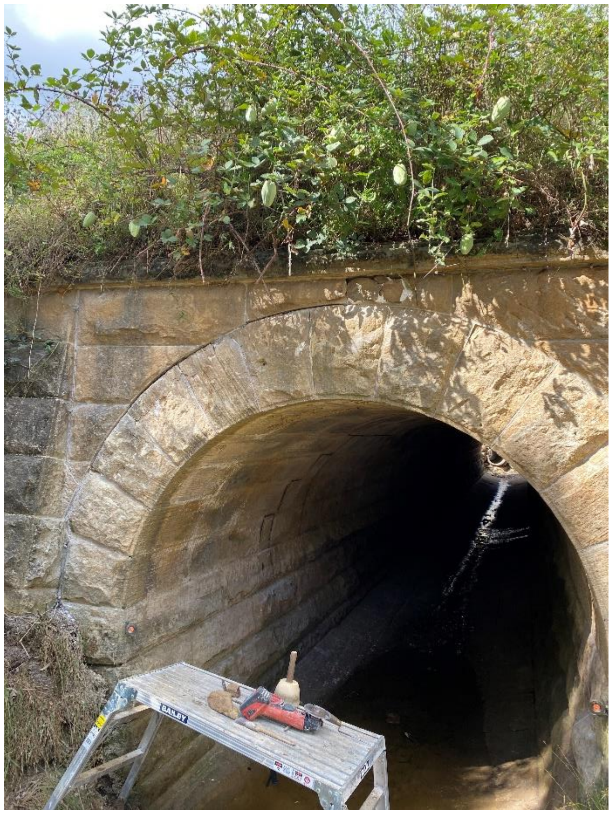
6. Install Helifix HBR60

7. Sealing crack prior to injection

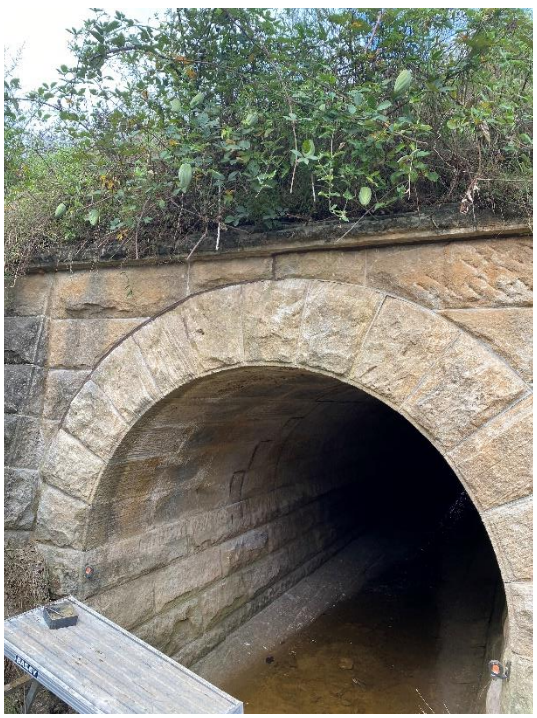
8. Sealing crack prior to injection

9. Epoxy crack injection

10. After re pointing, prior to drying



11. **Downstream end during the work**



12. **Downstream end completed**

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pointeengineering.com

Appendix B - Culvert 88.900 km Work

1. Cored holes in stone

2. 6 mm SS pins

3. Downstream before

4. Downstream after

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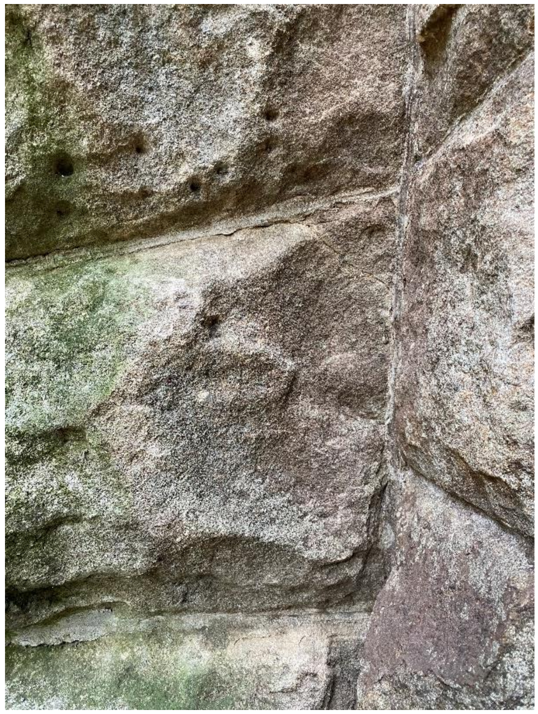
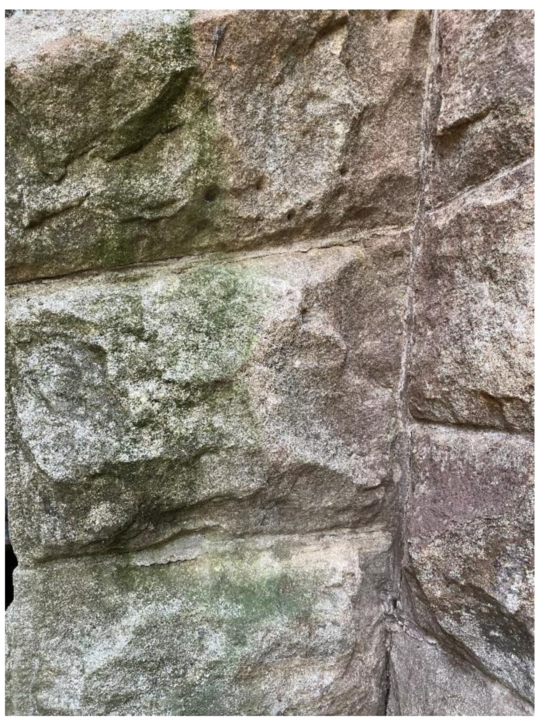
pointeengineering.com

Appendix C- Culvert 89.629 km Work



1. **Before pointing**



2. **After pointing**

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pointeengineering.com

3. Before pointing

4. After pointing

POINTE ENGINEERING PTY LTD
ABN 34 613 639 740
PO Box 4018, Moorland, 2443
pointeengineering.com

Ref: P2002

Tahmoor Coal Pty Ltd
2975 Remembrance Drive, Bargo
PO Box 100, Tahmoor NSW 2573

Our Ref: J M A Solutions 20230502: PMLL Culvert repairs at 88.400km, 88.980km & 89.629km

Date of site visit: 2 May 2023

JMA Report Number: R0809-R2

Tahmoor Coal Pty Ltd mined coal in the western domain of the North Tahmoor lease from Longwall Panels W1-W4 beneath and adjacent to the Picton-Mittagong Loop Line (PMLL). As longwall mining proceeded, the roof above the extracted coal seams caved, forming goaf behind the retreating longwall faces, which caused vertical subsidence, horizontal ground strain and tilt to develop, which primarily impacted the culvert at 88.400km with very slight impacts at 88.98km and a slight widening of a pre-existing crack across the arch behind the line of the overlying headwall at 89.629km.

A repair brief for the culverts at 88.400km, 88.980km and 89.629km was prepared by JMA Solutions, details of which were presented in JMA report R0808-R2. The culvert repair work was carried out by Pointe Engineering Pty Ltd, which was documented in their report ref: P2002.

The repair work was inspected by John Matheson from this firm on 2 May 2023, in the company of Messrs. R. Barber and K. Gollege from Simec and G. Robinson from Robinsonrail. At the time of the inspections, the work generally appeared to conform with the scope of work described in JMA report R0809-R2, noting that the texture and coloring of the repair work generally matched the surrounding sandstone masonry.

Yours faithfully,
John Matheson & Associates Pty Ltd

John Matheson

Director

ROBINSON RAIL

17 May 2023

SIMEC Mining
2975 Remembrance Driveway
Bargo NSW 2574

Ross Barber
Project Manager Subsidence
e: Ross.Barber@simecgfg.com

Dear Ross

Tahmoor Coal: Picton to Mittagong Loop Line (PMLL)

Final Inspection of Heritage Sandstone Culverts Along the PMLL After Impacts from Longwall Mining and Following Completion of Recommended Crack Repairs

Background

Pre-Mining Dilapidation Report

Robinson Rail was initially commissioned by Tahmoor Coal (SIMEC) to carry out a dilapidation inspection and report of primary heritage culverts within the subsidence zone of proposed mining of the Western Domain area, namely longwalls W1, W2, W3 and W4, beneath the Picton to Mittagong Loop Line (PMLL) prior to commencement of mining operations. See Figure 1 – Mining Layout (Courtesy MSEC), for culvert locations relative to mining and the PMLL.

An inspection was carried out of the following four culverts in June 2019, and a Final report titled: Tahmoor Colliery – Western Domain, Longwalls W1 and W2, Report on Pre-Mining Condition of Picton to Mittagong Loop Line (PMLL) Culverts, was issued in August 2019:

- 87.861 km – 1500 mm dia. Brick Arch Culvert BAC (circa 1919, part of section built to join onto Main Southern Railway), Directly above LW W3
- 88.400 km – 2400 mm dia. Sandstone Arch Culvert SAC (circa 1867), Directly above LW W1
- 88.980 km – 2400 mm dia. Sandstone Arch Culvert SAC (circa 1867, restored as part of Stonequarry Estate development), <100 m west of LW W1
- 89.629 km – 3000 mm dia. Sandstone arch culvert SAC (circa 1867), >200 m west of LW W1

Post-Mining Dilapidation Report

Following completion of mining by Tahmoor Coal beneath the PMLL in September 2022 and after ongoing monitoring by Tahmoor Coal's Rail Management Group (RMG) for any residual subsidence, Robinson Rail was engaged by Tahmoor Coal to carry out a post-mining inspection and report to identify any changes in the structures as a result of mining influence, and a recommendation of scope of work required to carry out any repairs. *{Ref: Tahmoor Colliery – Western Domain: Longwalls W1, W2, W3 and W4 Report on Post-Mining Condition of Picton to Mittagong Loop Line (PMLL) Culverts, Dec 2022}*.

Please note the following summary of the results of inspection and recommended actions for repairs, by John Matheson and Associates (JMA) *{Ref: JMA report R0808-R2}*, to be carried out by a suitable stone mason to ensure that the culverts are in the same, if not better condition post-mining as they were beforehand:

1. 87.861 km – 1500 mm dia. Brick arch culvert BAC

The façade and headwall on the Down side (inlet) had quite major cracking at various locations pre-mining as a result of the overturning loads exerted by the fill directly behind the top of the culvert barrel, with an outward displacement above the centre of the culvert of 17 mm.

A similar failure had occurred to the façade and headwall on the Up side (outlet) as has occurred on the Down side with major cracking and failure of the brick headwall up to 35 mm outward displacement of the upper brick arch ring, all cracks were noted as obviously pre-mining. This may have been a result of tree roots above the culvert headwalls but the mechanism for this was not that evident. This caused the wall to move out from the top of the culvert and as a result was cracking the rowlock course over the culvert on each end and separating the ring courses of bricks that formed the culvert barrel.

Existing cracks on both the upside and downside were associated with outward movement / rotation of the brick headwall relative to the brick arch culvert, most likely associated with embankment earth pressure.

This was not mining related, so no action was proposed or carried out.

2. 88.400 km – 2400 mm dia. Sandstone Arch Culvert (SAC)

This culvert was in relatively good condition from the outside with wingwalls and the portals showing little impact from weather over its life prior to mining. Pre-mining inspection of inside the barrel of the culvert from both ends noted there were some signs of relatively minor erosion above the springline evidenced by striation, surface weathering and random affected mortar joints but no notable cracking was obvious.

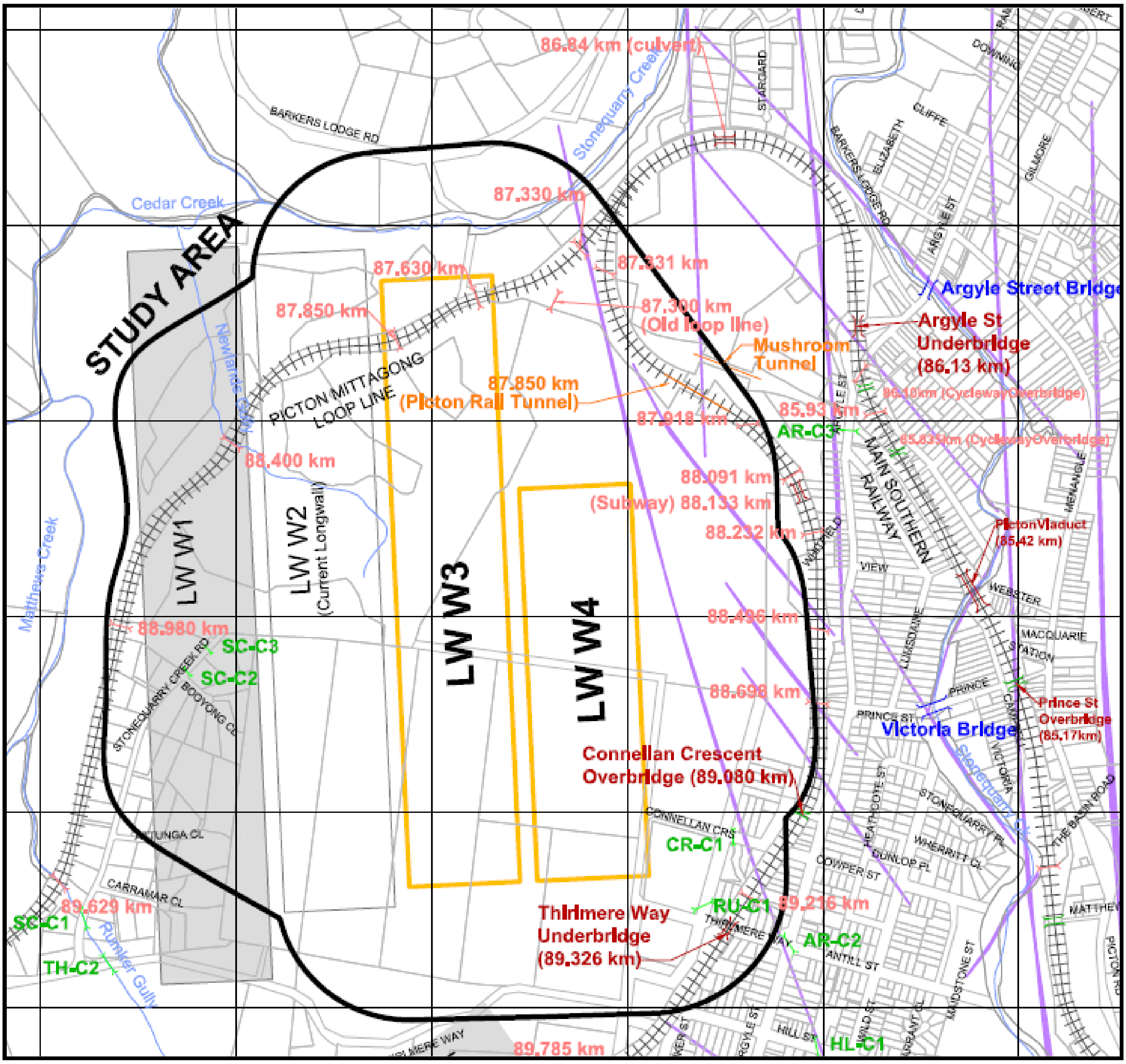

Figure 1 – Mining Layout (Courtesy MSEC)

However, new cracks had appeared most likely as a result of mining just inside each portal then running along the walls for 4-6 m.

A circumferential crack had also formed about midpoint of the culvert in the floor, walls and soffit.

It was recommended that all cracks in the culvert should be repaired by a combination of epoxy grout injection and cement grout injection as specified by JMA as follows:

- New cracks have appeared as a result on each headwall and rather extensive, but minor cracking has occurred running horizontally extending a total length of 5.4 m and 6.8 m in from the Upstream end and 1.65 m and 2.4 m from the Downstream end of the culvert from each end of the culvert toward the mid-point. JMA recommended that these should be repaired by Type 2 cement grout injection for the full thickness of the culvert barrel.

- Circumferential cracking at two locations was observed near mid-length of the culvert and joined by a horizontal mortar joint crack, approximate total length of 24 m. JMA recommended that these should be repaired by Type 2 cement grout injection for the full thickness of the culvert barrel.

As proposed in JMA's structural report, it was recommended that both cracks in the barrel of the culvert should be repaired by a combination of epoxy grout injection and cement grout injection as specified therein.

It should be noted that this culvert was the only structure noticeably affected by mining influence.

3. 88.980 km – 2400 mm dia. Sandstone Arch Culvert (SAC)

This culvert appeared to be in good condition from the outside with wingwalls and the portals showing little impacts from weather over its 160 year life. However, the inside of the culvert from both ends, exhibited severe erosion that had occurred over its life that may render the crown of the culvert unstable and have an impact on its long-term structural integrity if not rectified. Large sections of sandstone blocks had been eroded, reduced in section and/or completely dislodged with virtually no effective mortar throughout, more specifically, maintenance repairs are warranted in future above the springline.

There had been no noticeable effects from mining. However, some minor cracking on the Up side façade has started to laminate and had opened by about 2 mm during the course of mining but was not detrimental to the structural integrity of the culvert. Even though these cracks were not evidenced as a result of mining, it was recommended for repairs to be made, in conjunction with other nearby culverts as specified by JMA.

4. 89.629 km – 3000 mm dia. Sandstone arch culvert SAC

Generally, this culvert was in good, serviceable condition with no obvious signs of excessive wear or any indications that would likely affect its structural integrity. However, the later addition of brick wingwalls on the Down side were constructed on sub-standard foundation material that had led to the start of their structural failure and potentially imposing additional loading to the lip of the Down side barrel of the culvert causing it to crack about 400-500 mm in the soffit.

Shotcreting and stabilisation of the foundations by Tahmoor Coal prior to mining has strengthened and decelerated the overturning motion of the wingwalls and stabilised the integrity of the walls at present.

As proposed in JMA's structural report, it is recommended that the 2 mm wide cracks in the barrel of the culvert should be repaired by Type 2 cement grout injection as specified therein.

Final Inspection Post Repairs

A final Inspection, following masonry repairs by masonry contractor *Pointe Engineering Pty Ltd* (commissioned by Tahmoor Coal), was carried out on 2 May 2023. Those present during the inspection included:

- Les Kelleher (THNSW)
- Ross Barber, Project Manager Subsidence, SIMEC
- Kevin Golledge, Rail Project Manager, SIMEC
- Graeme Robinson, Robinson Rail (RR)
- John Matheson, John Matheson Associates (JMA)

The inspection commenced at the culvert that was most effected by mining at 88.400 km, then proceeded toward Thirlmere inspecting culverts at 88.980 km and 89.629 km where photographs were taken of the repairs, comparing them with the previous photos taken in the post-mining dilapidation inspection/reporting.

The repairs carried out in the culverts were compared with the specification detailed in the JMA report and some samples of the repairs can be seen in Figures 2 – 5.

Request for some minor repairs and some additional works following inspection on 2 May were issued to Pointe and the works carried out in the following week to complete the job.

Final Repairs by Pointe

A report by Pointe Engineering Pty Ltd issued on 11 May 2023, confirmed that the initial repair work included crack epoxy injection, bed joint reinforcement, stone voussoir pinning, stone voussoir reattachment with epoxy and re pointing. This was completed as detailed in JMA Solutions report R0809-R2 prior to the inspection on 2 May 2023.

Three culverts were remediated as follows:

88.400 km – 2400 mm dia. Sandstone Arch Culvert (SAC):

- crack epoxy injection;
- bed joint reinforcement;
- stone voussoir pinning;
- stone voussoir reattachment with epoxy;
- repointing.

88.980 km – 2400 mm dia. Sandstone Arch Culvert (SAC):

- stone voussoir pinning;
- repointing.

89.629 km – 3000 mm dia. Sandstone Arch Culvert SAC

- re pointing as per Client request additional monitor repair work completed to preexisting crack in the headwall to support PMLL asset;
- Removal of the Tahmoor Coal installed plastic shotcrete protection barrier as requested.

Pointe, under the direction of Tahmoor Coal, also completed additional heritage improvement tasks that were observed during the construction phase or pre-handover inspection, and following the Final Inspection on 2 May 2023 that included:

- Repointing of observed additional hairline cracks in the culvert at 88.400 km;
- Repointing several pre-existing mortar loss locations where prudent to improve the asset;
- Repointed several floor locations where it was observed that mining mitigation bolts were removed.

Conclusion

The repair work was inspected by Graeme Robinson (Robinson Rail) in association with colleagues and stakeholders on 2 May 2023, and it was of the opinion of all that the work carried out by Pointe was excellent and generally appeared to comply with the requirements of the JMA report.

Attention to detail was exceptional in terms of color and texture matching making it very difficult to identify the original pointing from the new repairs.

Thank you again for inviting *Robinson Rail* to provide railway consulting services along this important section of historic rail infrastructure.

Please contact the undersigned for clarification or to discuss any matters contained in this offer.

Yours Sincerely

Graeme Robinson
Director
78 Mistletoe Lane POKOLBIN NSW 2320
Phone 0410 455 911
Email graeme@robinsonrail.com.au
ROBINSON RAIL

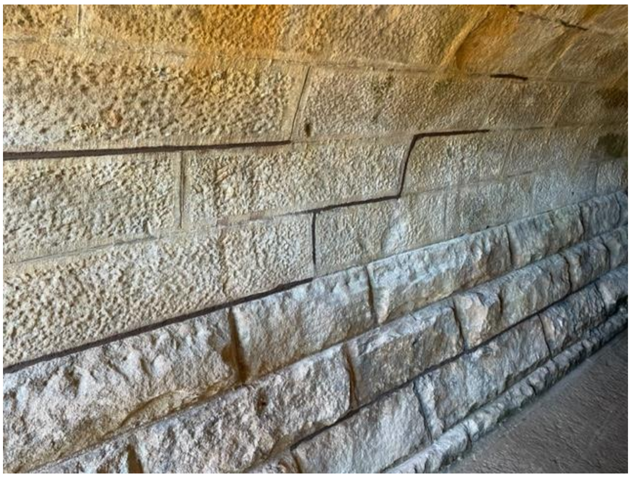

Figure 2 – Mortar repairs/replacement

Figure 3: Crack and mortar repairs

Figures 4 & 5 - Repointing

TRANSPORT HERITAGE NSW

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Ultimo NSW 2007
P: 0437 032 079
E: operations@thnsw.com.au

By email
Kevin Golledge
Project Manager, Rail
SIMECGFG
Kevin.Golledge@simecgfg.com

Dear Kevin,

We are writing to confirm acceptance of the repairs to culverts at 88.400km, 88.890km and 89.629km respectively, based on the Pointe Engineering Report dated 11 May 2023, and a further site inspection undertaken by THNSW Rail Track & Corridor Maintenance Manager Les Kelleher on 2 May 2023. THNSW is satisfied with the repairs undertaken and considers the remediation complete.

Kind regards,

Daniel Page
Rail Operations Manager