

Appendix A

EPBC Approvals Compliance Reports

Table A.1 EPBC Approval 2012/6637 Compliance Report

Condition	Actions During the Reporting Period	Status
1. The approval holder must not clear more than 611 ha of native woodland vegetation.	514.3 ha of native woodland vegetation has been cleared to date as part of the Project.	Compliant
2. To compensate for the loss of approximately 557 ha of Regent Honeyeater, Swift Parrot and Grey Headed Flying Fox habitat, 611 ha of Large-eared Pied Bat habitat and approximately 65 Slaty Red Gum trees, the approval holder must provide for the protection of offset lands identified in the maps at Schedule 1 of this notice as: • Reedy Valley Offset Site • Wollombi Brook Conservation Area • Broke Road Offset Site. These offset lands must meet the requirements of the EPBC Offsets Policy and provide for the protection of threatened species habitat on these sites for the duration of the action's impact through a legally binding conservation covenant which must be in force within 3 years of the commencement of the action. Written evidence of compliance against this condition must be provided to the Department prior to the commencement of the action including evidence that action is being taken to put in place a suitable legally binding conservation covenant.	Not applicable, this occurred outside the reporting period. Bulga Coal has formerly established these offset sites as Conservation Agreements under the <i>National Parks and Wildlife Act 1974</i>. The Conservation Agreements were signed by the NSW Minister for the Environment on 7 May 2019.	Not Applicable
3. The approval holder must submit for the Minister's approval a Biodiversity Management Plan (BMP) which provides for the offsetting of residual impacts to matters of national environmental significance including but not limited to: • Regent Honeyeater; • Swift Parrot;	The Biodiversity Management Plan was submitted to the former Department of Environment (now Commonwealth DCCEEW) on 23 February 2015. The Commonwealth DCCEEW provided comments on the draft plan in April 2016, December 2016 and April 2017 and subsequently approved the document in April 2017.	Compliant

Condition	Actions During the Reporting Period	Status
- Large-eared Pied Bat; - Slatey Red Gum. The BMP must include: a). management actions designed to improve the ecological quality of habitat for the above species on offset lands identified in Condition 2 and protect these sites from ecological degradation for the duration of the action's impact on matters of national environmental significance;	A revised version of the Biodiversity Management Plan (following SSD-4960 Mod 3 approval) was submitted to DPHI in November 2020 and approved by DPHI on 14 October 2021. The revised BMP was then submitted to the Commonwealth DCCEEW on 18 November 2021 and approved by the Commonwealth DCCEEW on the 23 June 2022.	
b). an ecological monitoring program to monitor the success of the management actions in the BMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on habitat for matters of national environmental significance. Management actions prescribed by the BMP must be clear, measurable, auditable and time bound;	The Biodiversity Management Plan contains an ecological monitoring program, monitoring commenced in 2015. Results are summarised in this Annual Review.	Compliant
c). clear objectives and performance indicators as well as corrective actions for circumstances where a management action fails to meet its prescribed objective or performance indicator. The BMP must be approved in writing by the Minister within 3 months of approval of the action. The approved BMP must be implemented and must be published on the approval holder's website within one month of approval of the BMP and remain published on this website for the duration of the action.	The Biodiversity Management Plan meets the requirements of this condition. The Biodiversity Management Plan was approved by the Commonwealth DCCEEW in April 2017. The Biodiversity Management Plan is available on the Bulga Coal website.	Compliant
4. The approval holder must submit for the Minister's approval a Water Management Plan (WMP) which provides for the avoidance, mitigation and offsetting of residual impacts to water resources. The WMP must include: a). management actions, mitigation measures and practices	The Water Management Plan was approved by the Commonwealth DCCEEW in February 2017. A revised version of the Water Management Plan (following SSD-4960 Mod 3 approval) was submitted to DPHI in November 2020 and approved by DPHI on 14 October 2021. A copy of the revised	Compliant

Condition	Actions During the Reporting Period	Status
designed to limit impacts of the proposal on surface and groundwater resources;	WMP was then submitted to the Commonwealth DCCEEW on 18 November 2021 for their records, in accordance with Condition 12. The revised WMP plan is available on the Bulga Coal website .	
b). surface and groundwater monitoring programs to monitor the success of the management actions in the WMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on water resources. Management actions, mitigation measures and practices prescribed by the plan must be clear, measurable, auditable and time bound;	The Water Management Plan meets the requirements of this condition.	Compliant
c). clear objectives and performance indicators, as well as corrective actions for circumstances where a management action, mitigation measure or practice fails to meet its prescribed objective or performance indicator. The WMP must be approved in writing by the Minister within 3 months of commencement of the action. The approved WMP or plan revised under condition 12 must be implemented.	The Water Management Plan meets the requirements of this condition.	Compliant
5. The approval holder must provide written evidence and detailed documentation relating to the conservation covenant specified in Condition 2 to the Department within one month of the conservation covenant coming into force. This must include offset attributes, shapefiles and textual descriptions and maps to clearly define the location and boundaries of the offset sites.	Not applicable, this occurred prior to the reporting period. Evidence and documentation was provided to the Commonwealth DCCEEW on 20 January 2020.	Not applicable
6. Unless otherwise agreed to in writing by the Minister, the approval holder must provide the approved plans referred to in these conditions of approval to members of the public upon request. Copies must be provided within 14 days of the request.	There have been no requests from members of the public to provide approved plans referred to in the conditions of approval. Notwithstanding, the approved plans are available to the public on the Bulga Coal website .	Not Applicable

Condition	Actions During the Reporting Period	Status
7. Within 30 days after the commencement of the action, the approval holder must advise the Department in writing of the actual date of commencement of the action.	Not triggered within the audit period. Action under this approval commenced 3 December 2014. Notification of the commencement of the action was provided by Bulga Coal to the Commonwealth DCCEE on 2 December 2014.	Not applicable
8. The approval holder must maintain accurate records substantiating all activities associated with or relevant to these conditions of approval, including measures taken to implement the management plans, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be published on the Department's website. The results of audits may also be publicised through the general media.	Accurate records substantiating all activities associated with conditions of approval are maintained in accordance with the Bulga Coal Environmental Management System. Results are also summarised in the Bulga Coal Annual Review. There have been no audits to date.	Compliant
9. By 31 March each year, the approval holder must publish a report on their website addressing compliance with each of the conditions of this approval including implementation of the management plans for the previous calendar year (i.e. 01 January to 31 December). Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published.	The 2024 Bulga Coal Annual Review (compliance report) was published on the website on 28 March 2025 and provided to Commonwealth DCCEE on 28 March 2025.	Compliant
9A. Potential or actual contraventions of conditions of approval must be reported to the Department in writing within 2 business days of the approval holder becoming aware of the actual or potential contravention. All contraventions must also be included in the annual compliance report outlined in condition 9.	There have been no potential or actual contraventions of conditions of this approval within the reporting period.	Compliant

Condition	Actions During the Reporting Period	Status
10. Upon the direction of the Minister, the approval holder must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	No directions for an independent audit of compliance with EPBC Ref: 2012/6637 have been received by Bulga Coal.	Not Applicable
11. If, at any time after five (5) years from the date of this approval, the approval holder has not commenced the action, then the approval holder must not commence the action without the written agreement of the Minister.	Action under EPBC Ref: 2012/6637 was commenced 3 December 2014.	Compliant
12. The approval holder may choose to revise a plan approved by the Minister under condition 4 without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the revised plan would not be likely to have a new or increased impact. If the approval holder makes this choice they must: i. notify the Department in writing that the approved plan has been revised and provide the Department with an electronic copy of the revised plan. ii. implement the revised plan from the date that the plan is submitted to the Department; and iii. for the life of this approval, maintain a record of the reasons the approval holder considers that taking the action in accordance with the revised plan would not be likely to have a new or increased impact.	The Water Management Plan (inclusive of the Erosion and Sediment Control Plan) and the Biodiversity Management Plan were revised in November 2025. The Department agreed that the revisions were administrative in nature and did not constitute a new or increased impact.	Compliant

Condition	Actions During the Reporting Period	Status
12A. The approval holder may revoke their choice under condition 12 at any time by notice to the Department. If the approval holder revokes the choice to implement a revised plan, without approval under section 143A of the Act, the plan approved by the Minister must be implemented.	This condition was not triggered during the reporting period.	Not Applicable
12B. Condition 12 does not apply if the revisions to the approved plan include changes to environmental offsets provided under the plan in relation to a matter protected by the controlling provision for the action, unless otherwise agreed by the Minister. This does not otherwise limit the circumstances in which the taking of the action in accordance with a revised plan would, or would not, be likely to have new or increased impacts.	This condition was not triggered during the reporting period.	Not Applicable
12c. If the Minister gives a notice to the approval holder that the Minister is satisfied that the taking of the action in accordance with the revised plan would be likely to have a new or increased impact, then: i. Condition 12 does not apply, or ceases to apply, in relation to the revised plan; and ii. The approval holder must implement the plan approved by the Minister. To avoid any doubt, this condition does not affect any operation of conditions 12, 12A and 12B in the period before the day the notice is given. At the time of giving the notice the Minister may also notify that for a specified period of time that condition 12 does not apply for one or more of the specified plans required under the approval.	This condition was not triggered during the reporting period.	Not Applicable

Condition	Actions During the Reporting Period	Status
12D. Conditions 12, 12A, 12B and 12C are not intended to limit the operation of section 143A of the EPBC Act which allows the approval holder to submit a revised plan, to the Minister for approval.	This condition was not triggered during the reporting period.	Not Applicable
13. Condition 13 has been revoked.	Noted.	Not Applicable
14. Unless otherwise agreed to in writing by the Minister, the Approval holder must publish all management plans referred to in these conditions of approval on their website. Each Management plan must be published on the website within 1 month of being approved by the minister or being submitted under condition 12i, and remain published for the duration of the action.	The Biodiversity Management Plan was approved by the Commonwealth DCCEEW in April 2017. A revised version of the Biodiversity Management Plan (following SSD-4960 Mod 3 approval) was submitted to DPHI in November 2020 and approved by DPHI on 14 October 2021. The revised BMP was then submitted to Commonwealth DCCEEW on 18 November 2021 and approved by Commonwealth DCCEEW on the 23 June 2022. A copy of the revised Water Management (previously approved by Commonwealth DCCEEW in February 2017) was provided to Commonwealth DCCEEW on 18 November 2021 for their records, in accordance with Condition 12. The revised WMP plan is available on the Bulga Coal website .	Compliant

Table A.2 EPBC Approval 2018/8300 Compliance Report

Condition	Actions During the Reporting Period	Status
1. The approval holder must comply with State development consent conditions 24, 24A, 25, 26, 27 and 28 of Schedule 3.	Bulga has been compliant with the relevant State development consent conditions during 2025.	Compliant
2. The approval holder must determine the extent and distribution of riparian vegetation (including EPBC Act listed ecological communities identified as being partially or wholly groundwater dependent, including the EPBC Act listed Warkworth Sands Woodland of the Hunter Valley) and potential for stygofauna within the alluvium that are likely to be affected by the action, through ground-truthing surveys. The approval holder must submit the findings of these surveys to the Department within 15 months of the date of this approval or prior to open cut mining below the Woodlands Hill Seam in the Modification Additional Coal Extraction Area (delineated by a blue boundary at Annexure 1).	Bulga Coal was granted a 3 month extension to the required timeframe to satisfy this condition, and the condition was varied on 9 September 2021. Bulga Coal submitted a Ecohydrological Assessment satisfying conditions 2 and 3 to the Commonwealth DCCEEW on 20 December 2021.	Compliant
3. To investigate how changes in the rate of water movement through the environment may impact water-dependent ecosystems, the approval holder must develop ecohydrological conceptual models for a. the potential impacts to ephemeral streams and the Wollombi Brook. b. the EPBC Act listed Warkworth Sands Woodland of the Hunter Valley ecological community to show how the perched aquifer and associated groundwater dependent ecosystems may be affected by the action. The ecohydrological conceptual models must include potential changes to flow regimes (frequency, duration and timing of low- and zero-flow periods) and how this could impact biota, including through changes in refugial pool persistence. The approval holder must submit the ecohydrological models to the Minister for approval within 15 months of the date of this approval. The approval holder must not commence	Bulga Coal was granted a 3-month extension to the required timeframe to satisfy this condition, and the condition was varied on 9 September 2021. Bulga Coal submitted a Ecohydrological Assessment satisfying conditions 2 and 3 to the Commonwealth DCCEEW on 20 December 2021.	Compliant

Condition	Actions During the Reporting Period	Status
mining below the Woodlands Hill Seam unless the Minister has approved the ecohydrological models in writing.		
4. Within the Modification Additional Disturbance Areas (delineated by a red boundary at Annexure 1), the approval holder must not clear more than: a. 16.4 hectares of Regent Honeyeater (<i>Anthochaera phrygia</i>) habitat, b. 16.4 hectares of Swift Parrot (<i>Lathamus discolor</i>) habitat, c. 16.4 hectares of the Central Hunter Valley Eucalypt Forest and Woodland EPBC Act listed ecological community.	A total of 7.15 ha of Central Hunter Valley Eucalypt Forest and Woodland has been cleared within the Modification additional disturbance area to date.	Compliant
5. The approval holder must comply with the State development consent conditions 29, 30, 33, 33A, 33B, 34 and 34A of Schedule 3.a. To compensate for the loss of the listed threatened species and ecological community habitat identified at condition 4, the approval holder must submit the Biodiversity Offset Strategy (specified at condition 29 of the State development consent) to the Minister for approval. i. The approval holder must not commence vegetation clearing within the modification additional disturbance area (delineated by a red boundary at Annexure 1) until the Biodiversity Offset Strategy has been approved by the Minister. ii. The approval holder must implement the Biodiversity Offset Strategy as approved by the Minister.	Noted. Bulga has been compliant with the relevant SSD-4960 State development consent conditions since EPBC Approval 2018/8300 was granted. The Biodiversity Offset Strategy is within the approved Biodiversity Management Plan. A revised version of the Biodiversity Management Plan (following SSD-4960 Mod 3 approval) was submitted to DPHI in November 2020 and approved by DPHI on 14 October 2021. The revised BMP was then submitted to Commonwealth DCCEEW on 18 November 2021 and approved by Commonwealth DCCEEW on the 23 June 2022.	Compliant
6. The approval holder must comply with the State development consent conditions 53, 54, 55 and 56.	Noted. Bulga Coal has been compliant with the relevant SSD-4960 State development consent conditions since EPBC Approval 2018/8300 was granted. The <i>Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021</i> (the Regulation) commenced on 2 July 2021, with a transition period of 2 July 2022. The Bulga Coal Rehabilitation Management Plan	Compliant

Condition	Actions During the Reporting Period	Status
	and associated works include rehabilitation outcomes documents. The Bulga Coal Rehabilitation Objectives Statement (ROBJs) and Final Landform Rehabilitation Plan (FLRP) were approved by the NSW Resource Regulator (NSW RR) on 18 October 2023. A copy of the Rehabilitation Management Plan is available on the Bulga Coal website .	
7. The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action.	Not applicable, occurred before the reporting period. Bulga Coal commenced the action on 22 September 2020 and notified the Commonwealth DCCEEW on 24 September 2020.	Not Applicable
8. If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister.	Not applicable, occurred before the reporting period. Bulga Coal commenced the action on 22 September 2020 and notified the Commonwealth DCCEEW on 24 September 2020.	Not Applicable
9. The approval holder must maintain accurate and complete compliance records.	Compliant. Accurate records substantiating all activities associated with conditions of approval are maintained in accordance with the Bulga Coal Environmental Management System. Results are also summarised in the Bulga Coal Annual Review.	Compliant
10. If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request. Note: Compliance records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act,	Noted. This has not been triggered to date. No requests have been received from the Department.	Not Applicable

Condition	Actions During the Reporting Period	Status
and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the Department's website or through the general media.		
11. The approval holder must: a. Submit the ecohydrological models required under condition 3 and the Biodiversity Offset Strategy required under condition 5. an electronically to the Department for approval by the Minister, b. publish the ecohydrological models on the website within 20 business days of the date the ecohydrological models are approved by the Minister, unless otherwise agreed to in writing by the Minister, c. publish the Biodiversity Offset Strategy on the website within 20 business days of the date the Biodiversity Offset Strategy is approved by the Minister, unless otherwise agreed to in writing by the Minister, d. exclude or redact sensitive ecological data from the Biodiversity Offset Strategy published on the website or provided to a member of the public, and e. keep the ecohydrological models and Biodiversity Offset Strategy published on the website until the end date of this approval.	On 20 December 2021 the ecohydrological models report was submitted to Commonwealth DCCEEW for approval. On 24 March 2023 Commonwealth DCCEEW approved the Bulga Ecohydrological Assessment. On 27 March 2023 the report was published on the public website. The revised BMP (inclusive of the Biodiversity Offset Strategy) was submitted to Commonwealth DCCEEW on 18 November 2021 and approval received on the 23 June 2022.	Compliant
12. The approval holder must prepare a compliance report addressing compliance with each of the conditions of this approval, including implementation of any management plans and strategies from the State development consent that are referred to in this approval, for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must: a. publish each compliance report on a website within 60 business days following the relevant 12 month period, b. notify the Department by email that a compliance report has been published on the website and provide the website's link for the compliance report within five business days of the date of publication, c. keep all compliance reports publicly available on	The 2024 Bulga Coal Annual Review (compliance report) was published on the website on 28 March 2025 and provided to Commonwealth DCCEEW on 28 March 2025. Approval was provided by Commonwealth DCCEEW on 21 April 2022 to allow the annual compliance reporting deadline to be changed to 31 March each year.	Compliant

Condition	Actions During the Reporting Period	Status
the website until this approval expires, d. exclude or redact sensitive ecological data from compliance reports published on the website, and e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication. Note: Compliance reports may be published on the Department's website.		
13. The approval holder must notify the Department in writing of any: incident, or non-compliance with the conditions, or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: a. any condition which is in breach, b. a short description of the incident and/or non-compliance, and c. the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.	There have not been any incidents or non-compliances with the conditions which have required notification within this reporting period.	Compliant
14. The approval holder must provide to the Department the details of any incident or noncompliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying: a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future, b. the potential impacts of the incident or non-compliance, and c. the method and timing of any remedial action that will be undertaken by the approval holder.	There have not been any incidents or non-compliances with the conditions which have required notification within this reporting period.	Compliant
15. The approval holder must ensure that independent audits of compliance with the conditions are conducted as requested in writing by the Minister.	This condition has not been triggered. No requests for an audit have been received by the Minister to date.	Not Applicable

Condition	Actions During the Reporting Period	Status
16. For each independent audit, the approval holder must: a. provide the name and qualifications of the independent auditor and the draft audit criteria to the Department, b. only commence the independent audit once the audit criteria have been approved in writing by the Department, and c. submit an audit report to the Department within the timeframe specified in the approved audit criteria.	This condition has not been triggered. No requests for an audit have been received by the Minister to date.	Not Applicable
17. The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval.	This condition has not been triggered. No requests for an audit have been received by the Minister to date.	Not Applicable
18. The approval holder must comply with the State development consent condition 5 in Schedule 2.	Noted. Condition 5 in Schedule 2 states that the Applicant may carry out mining operations on site until 31 December 2039.	Compliant
19. Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	This has not been triggered. The action has not been completed.	Not Applicable
20. The approval holder must notify the Department in writing of any proposed change to the State development consent conditions referred to in these conditions within 10 business days of formally proposing a change or becoming aware of any proposed change.	This condition has not been triggered. There has been no proposed changes to the relevant SSD-4960 consent conditions since EPBC Approval 2018/8300 was granted.	Not Applicable
21. The approval holder must notify the Department in writing of any change to the conditions of the State development consent referred to in these conditions, within 10 business days of a change to conditions being finalised.	This condition has not been triggered. There has been no changes to the relevant SSD-4960 consent conditions since EPBC Approval 2018/8300 was granted.	Not Applicable
22. The approval holder may, at any time, apply to the Minister for a variation to an action management plan approved by the Minister under conditions 3 and 5.a, or as subsequently revised in accordance with	The Water Management Plan (inclusive of the Erosion and Sediment Control Plan) and the Biodiversity Management Plan were revised in	Compliant

Condition	Actions During the Reporting Period	Status
these conditions, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised action management plan (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management plan.	November 2025. The Department agreed that the revisions were administrative in nature and did not constitute a new or increased impact.	
23. The approval holder may choose to revise an action management plan approved by the Minister under conditions 3 and 5.a, or as subsequently revised in accordance with these conditions, without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the RAMP would not be likely to have a new or increased impact.	The Water Management Plan (inclusive of the Erosion and Sediment Control Plan) and the Biodiversity Management Plan were revised in November 2025. The Department agreed that the revisions were administrative in nature and did not constitute a new or increased impact.	Compliant
24. If the approval holder makes the choice under condition 23 to revise an action management plan without submitting it for approval, the approval holder must: a. notify the Department in writing that the approved action management plan has been revised and provide the Department with: i. an electronic copy of the RAMP, ii. an electronic copy of the RAMP marked up with track changes to show the differences between the approved action management plan and the RAMP, iii. an explanation of the differences between the approved action management plan and the RAMP,1 Condition 5 in Schedule 2 states that the Applicant may carry out mining operations on the site until 31 December 2039.iv. the reasons the approval holder considers that taking the action in accordance with the RAMP would not be likely to have a new or increased impact, and written notice of the date on which the approval holder will implement the RAMP(RAMP implementation date), being at least 20 business days after the date of providing notice of the revision of the action management plan, or a date agreed to in	Notification of revisions to the Water Management Plan (inclusive of the Erosion and Sediment Control Plan) and the Biodiversity Management Plan was provided to the Department in December 2025. The Department agreed that the revisions were administrative in nature and did not constitute a new or increased impact.	Compliant

Condition	Actions During the Reporting Period	Status
writing with the Department. b. subject to condition 24, implement the RAMP from the RAMP implementation date.		
25. The approval holder may revoke their choice to implement a RAMP under condition 23 at anytime by giving written notice to the Department. If the approval holder revokes the choice under condition 23, the approval holder must implement the action management plan in force immediately prior to the revision undertaken under condition 23.	This condition has not been triggered during the reporting period.	Not Applicable
26. If the Minister gives a notice to the approval holder that the Minister is satisfied that the taking of the action in accordance with the RAMP would be likely to have a new or increased impact, then: a. condition 23 does not apply, or ceases to apply, in relation to the RAMP; and b. the approval holder must implement the action management plan specified by the Minister in the notice.	This condition has not been triggered during the reporting period.	Not Applicable
27. At the time of giving the notice under condition 26, the Minister may also notify that for a specified period of time, condition 21 does not apply for one or more specified action management plans. Note: conditions 23, 24, 25 and 26 are not intended to limit the operation of section 143A of the EPBC Act which allows the approval holder to submit a revised action management plan, at any time, to the Minister for approval.	This condition has not been triggered during the reporting period.	Not Applicable

Table A.3 EPBC Approval 2002/773 Compliance Report

Condition	Actions During the Reporting Period	Status
1. Prior to the commencement of the mine expansion, the person taking the action must submit for the Minister's approval a plan for managing the impacts of subsidence on the environment on Commonwealth land. The plan must include: i. a full description, including maps, of the area that may be impacted by mining activity, including areas of environmental and heritage sensitivity; ii. predictions of the expected extent of subsidence; iii. a detailed outline of the potential environmental, heritage, land use and other impacts of subsidence; iv. proposals to minimise the impacts of surface subsidence, particularly in areas of environmental and heritage sensitivity; v. measures for ground and surface water monitoring and management; vi. proposals for any necessary rehabilitation and repair of subsidence impacts; vii. a process of stakeholder consultation, and; viii. a detailed and ongoing Subsidence Monitoring and Reporting Program. The plan must be submitted for the approval of the Minister within four years and six months of the date of this approval. The approved plan must be implemented.	Not Applicable in reporting period. Longwall operations commenced in Commonwealth Land in November 2015. Following completion of mining in Blakefield South Longwall 8 on 28 July 2017, all mining within the Commonwealth land is now complete.	Not Applicable
2. Within one year of the Commencement of mining activities on Commonwealth land and at the completion of mining activities, the person taking the action must ensure that an independent audit of compliance with the plan referred to in paragraph 1 is conducted and a report submitted to	Not Applicable in reporting period. The initial audit was submitted on 9 March 2016 and was approved on 21 April 2017. The audit done upon completion of mining activities was submitted on the 15 March 2019	Not Applicable

Condition	Actions During the Reporting Period	Status
the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	and was approved on 18 July 2019.	
3 The person taking the action may choose to revise a management plan approved by the Minister under Condition 1 without submitting it for approval under section 143A of the EPBC Act, if the taking of the action is accordance with the revised plan would not be likely to have a new of increased impact, If the person taking the action makes this choice they must: • notify the Department in writing that the approved plan has been revised and provide the Department with an electronic copy of the revised plan; • implement the revised plan from the date that the plan is submitted to the Department; and • for the life of this approval, maintain a record of the reasons the person taking the action considers that taking the action in accordance with the revised plan would not be likely to have a new or increased impact.	This condition was not triggered during the reporting period.	Not Applicable
3A. The person taking the action may revoke their choice under condition 3 or any time by notice to the Department. If the person taking the action revokes the choice to implement a revised plan, without approval under section 143A of the Act, the plan approved by the Minister must be implemented.	This condition was not triggered during the reporting period.	Not Applicable
3B. If the Minister gives a notice to the person taking the action that the Minister is satisfied that the taking of the action in accordance with the revised plan would be likely to have a new of increased impact, then: • Condition 3 does not apply, or ceases to apply, in relation to the revised plan.	This condition was not triggered during the reporting period.	Not Applicable

Condition	Actions During the Reporting Period	Status
The person taking the action must implement the plan approved by the Minister. To avoid any doubt, the condition does not affect any operation of conditions 3L, 3A in the period before the date the notice is given. At the time of giving the notice the Minister may also notify that for a specified period of time that Condition 3 does not apply for one or more specified plans required under the approval.		
3C. Conditions 3, 3A and 3B are not intended to limit the operation of Section 143A of the EPBC Act which allows the person taking the action to submit a revised plan to the Minister for approval.	Noted. Conditions 3, 3A and 3B were not triggered during the reporting period.	Not Applicable
4. The Condition was revoked the day the Variation Notice was signed.	Noted.	Not Applicable
5. By 31 March each year, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval including implementation of the management plans covering the 12-month period up to 31 December of the previous calendar year, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time the compliance report is published.	The 2024 Bulga Coal Annual Review (compliance report) was published on the website on 28 March 2025 and provided to Commonwealth DCCEEW on 28 March 2025. Approval was provided by Commonwealth DCCEEW on 21 April 2022 to allow the annual compliance reporting deadline to be changed to 31 March each year.	Compliant

Appendix B

Air Quality Monitoring Data Review and Analysis at Bulga Complex 2025 (Todoroski, 2026)



AIR QUALITY MONITORING DATA REVIEW AND ANALYSIS AT BULGA COMPLEX 2025

Bulga Coal

6 February 2026

Job Number 14070348Z

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Air Quality Monitoring Data Review and Analysis at Bulga Complex 2025

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1 INTRODUCTION

This report has been prepared by Todoroski Air Sciences on behalf of Bulga Coal. The report presents a review and analysis of the dust monitoring data recorded at the Bulga Coal Complex and includes a comparison between the dust levels measured in 2025 with the modelled predictions for the approximate year ("Year 2026") per the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* (**Jacobs, 2019**) and a long-term trend analysis of air quality data from the beginning of monitoring to the end of 2025.

The review involved analysis of the monitoring data retrieved from:

- ✦ the Bulga Complex monitors including High Volume Air Samplers (HVAS), Tapered Element Oscillating Microbalances (TEOMs), Beta Attenuation Monitors (BAMs), E-BAMs and Dust Deposition Gauges; and,
- ✦ concurrent meteorological data from the Bulga Complex, Southern Extension and Flares weather stations collected over the same period.



2 PROJECT SETTING AND AIR QUALITY MONITORING NETWORK

Figure 2-1 presents the location of the Bulga Complex in the context of the Hunter Valley and the Upper Hunter Air Quality Monitoring Network (UHAQMN) monitoring locations.

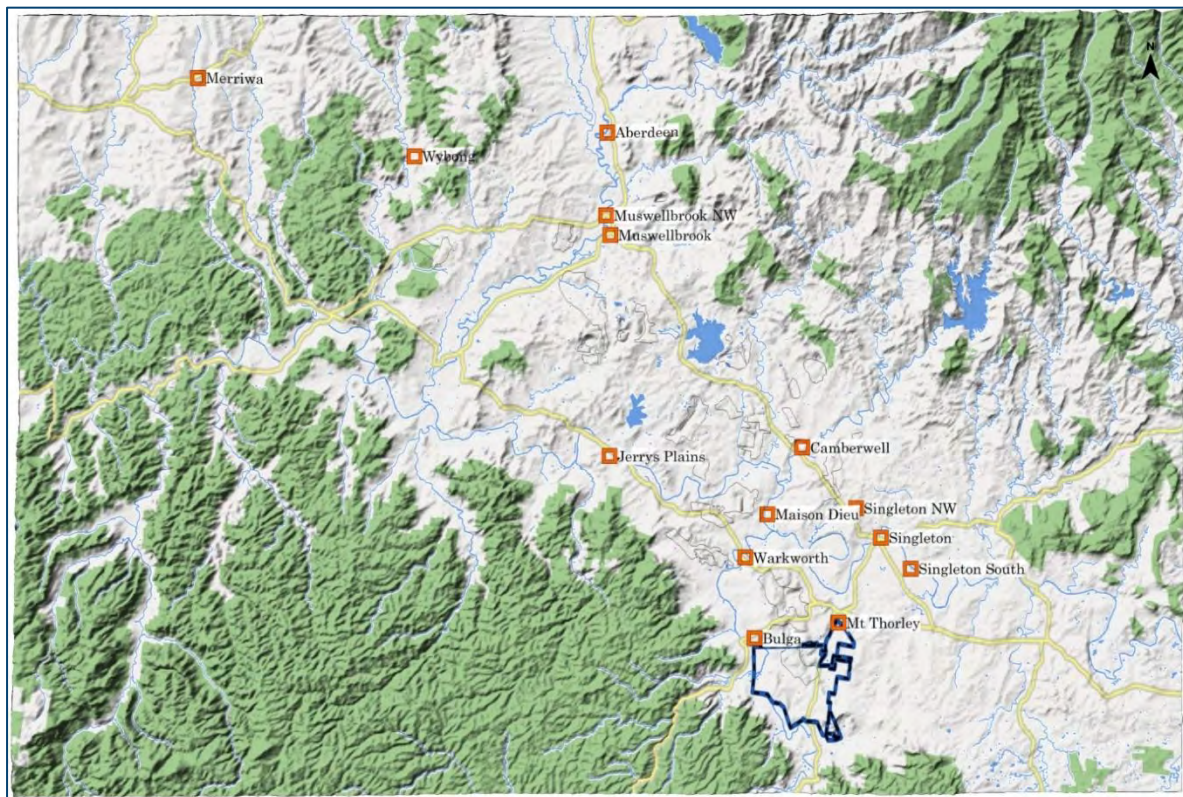


Figure 2-1: Site Location

Figure 2-2 presents the locations of the weather stations, HVAS, TEOM, BAM, E-BAM and deposited dust gauge monitors in the Bulga Coal Complex monitoring network during 2025.

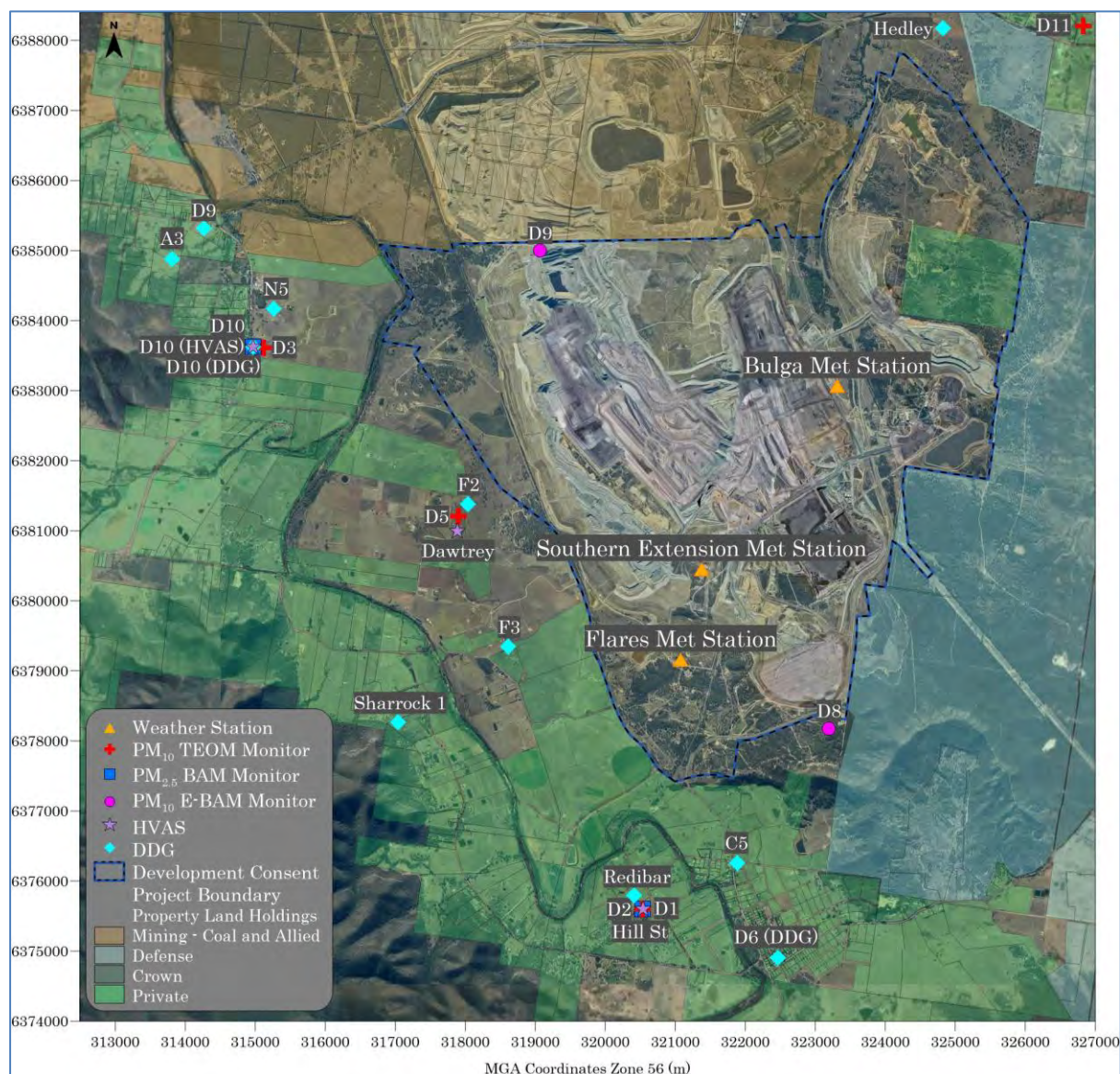


Figure 2-2: Air quality monitoring locations

3 METEOROLOGY

Figure 3-1 shows the locations of the weather stations at the Bulga Complex, together with the 2025 annual wind distributions at the weather stations (refer to **Appendix A** for how to read a windrose plot).

The weather stations experienced generally similar wind patterns with winds from the south dominating the annual distribution. All stations recorded very few winds from the northeast. The Flares weather station experienced lower wind speeds compared to the other stations.

Figure 3-2 shows the seasonal windroses at the weather stations for 2025. The weather stations generally experienced similar seasonal wind patterns. During winter and autumn the Bulga Met (Complex) weather station predominately recorded winds from the west-northwest while the Southern Extension and Flares weather stations recorded winds from the northwest and north-northwest. The Flares station recorded a higher percentage of light and calm winds compared to the other weather stations most likely due to sheltering from vegetation.

Appendix B provides a summary of the percentage data capture for each weather station during 2025.

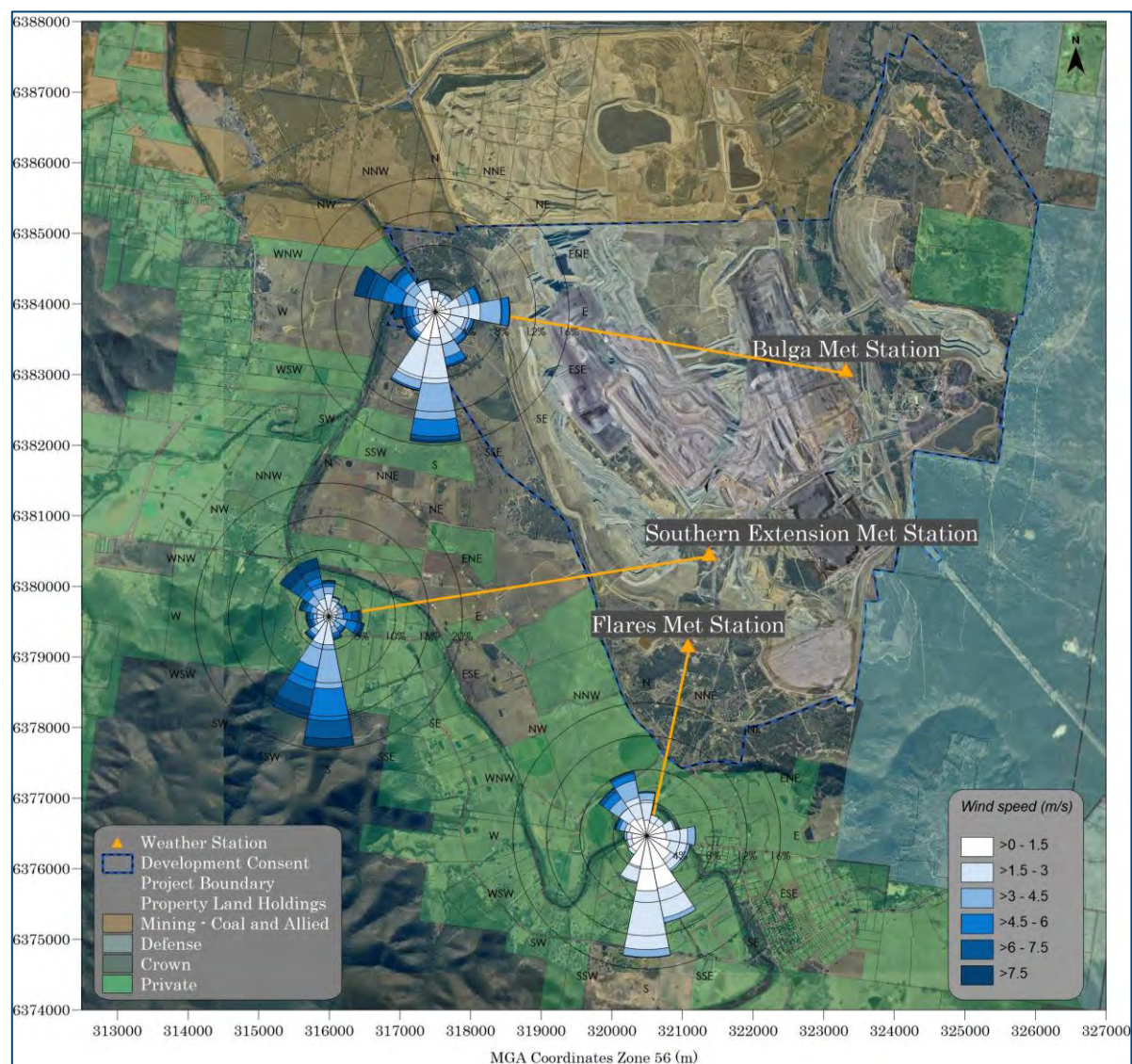


Figure 3-1: Annual windroses (2025)

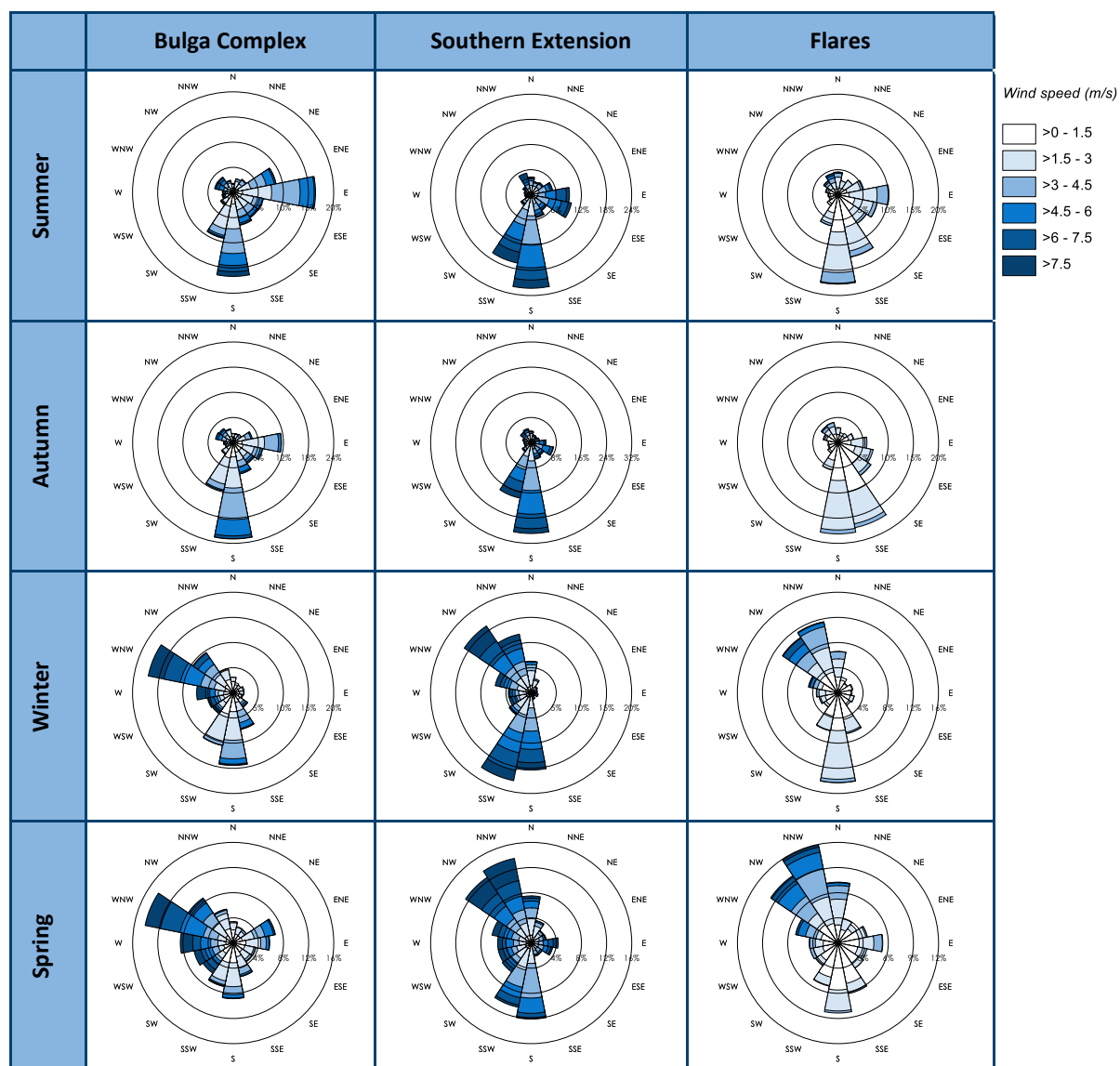


Figure 3-2: Windroses for each season of 2025 for the Bulga Complex, Southern Extension and Flares weather stations

4 AIR QUALITY CRITERIA

The sections below identify the key pollutants currently being monitored at the Bulga Coal Complex air quality monitoring sites and the applicable air quality criteria.

4.1 Particulate Matter

Particulate matter consists of particles of varying size and composition. The total mass of all particles suspended in air is defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (μm) as in practice particles larger than 30 to 50 μm will settle out of the atmosphere too quickly to be regarded as air pollutants.

The TSP is defined further into two sub-components. They are PM_{10} particles, particulate matter with aerodynamic diameters of 10 μm or less, and $\text{PM}_{2.5}$, particulate matter with aerodynamic diameters of 2.5 μm or less.

4.1.1 SSD-4960 air quality criteria

Table 4-1 to **Table 4-3** summarises the air quality goals that are relevant to particulate pollutants as outlined in the Bulga Coal Development Consent (SSD-4960).

The development consent outlines that the applicant shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the particulate emissions generated by the Bulga mine complex do not exceed the criteria listed in **Table 4-1** to **Table 4-3** at any residence on privately-owned land. As the E-BAM monitors are located within the mine site, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formally the Department of Planning and Environment) criteria are not directly applicable to these monitors.

Table 4-1: Long term criteria for particulate matter

Pollutant	Averaging Period	^{a,c} Criterion
Total suspended particulates (TSP)	Annual	90 $\mu\text{g}/\text{m}^3$
Particulate Matter < 10 μm (PM_{10})	Annual	25 $\mu\text{g}/\text{m}^3$
Particulate Matter < 2.5 μm ($\text{PM}_{2.5}$)	Annual	8 $\mu\text{g}/\text{m}^3$

Table 4-2: Short term criteria for particulate matter

Pollutant	Averaging Period	^b Criterion as per MOD 3
Particulate Matter < 10 μm (PM_{10})	24-hour	50 $\mu\text{g}/\text{m}^3$
Particulate Matter < 2.5 μm ($\text{PM}_{2.5}$)	24-hour	25 $\mu\text{g}/\text{m}^3$

Table 4-3: Long term criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
^d Deposited dust	Annual	^b 2g/m ² /month	^a 4g/m ² /month

Notes for **Table 4-1** to **Table 4-3**:

^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to other sources);

^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own);

^c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed to by the Secretary; and

^d Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.



5 LONG TERM REVIEW

Figure 5-1 to **Figure 5-9** show the long-term trends for PM_{2.5}, PM₁₀, TSP and deposited dust from the start of commissioning of the monitors up until the end of the 2025 calendar year. The data in the figures include extraordinary event days. These plots are discussed in more detail in the following sections.

Whilst there is some indication that smoke from bushfires and dust storms may have influenced the Bulga Complex monitoring sites to some extent in 2025, for the purpose of this assessment no extraordinary event days have been specifically identified for the Bulga Complex in 2025, and thus a single annual average for all days has been calculated for each monitor in 2025.

Appendix C presents a summary of the 24-hour average periods where there were less than 75% valid data for the TEOM and BAM monitors during the 2025 calendar year.

5.1 PM_{2.5} monitoring data

Table 5-1 presents a summary of the recorded PM_{2.5} levels at the BAM monitors.

The annual average PM_{2.5} concentrations at D2 and D10 were below the relevant criteria of 8µg/m³ in 2025. The maximum 24-hour average PM_{2.5} concentrations were below the relevant criterion of 25µg/m³ in 2025.

Table 5-1: Summary of recorded BAM PM_{2.5} levels

Year	Annual average PM _{2.5} (µg/m³)				Criterion
	D2		D10		
2012	5.9 (4%)		-		8
2013	6.1 (72%)		-		8
2014	5.5		5.4 (46%)		8
2015	5.0		5.1		8
2016	6.1 (52%)		5.7		8
2017	5.2		5.0		8
2018	5.5		5.5		8
2019	11.2	*5.1	15.4 (73%)	*6.7	8
2020	5.1	*4.1	9.5	*6.1	8
2021	3.7		4.5		8
2022	2.8 (65%)		3.4		8
2023	4.8		5.2		8
2024	4.2		4.8		8
2025	2.9		5.3		8
Year	Maximum 24-hour average PM _{2.5} (µg/m³) (No. of days > criterion)				Criterion
	D2		D10		
2012	10.2 (0)		-		25
2013	60.8 (6)		-		25
2014	25.3 (1)		21.3 (0)		25
2015	32.9 (2)		31.2 (1)		25
2016	22.5 (0)		19.4 (0)		25
2017	24.7 (0)		30.2 (1)		25
2018	46.5 (1)		23.9 (0)		25
2019	188.7 (32)	*25.3 (1)	212.2 (33)	*25.9 (1)	25
2020	37.4 (8)	*17.3 (0)	226.8 (11)	*29.0 (1)	25
2021	14.0 (0)		16.5 (0)		25

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2022	9.1 (0)	12.3 (0)	25
2023	18.1 (0)	19.8 (0)	25
2024	14.6 (0)	16.6 (0)	25
2025	24.6 (0)	24.2 (0)	25

(#%) The recorded data are less than 75% complete for the year, (data availability %)

*Excluding extraordinary events

The numbers in **red** are concentrations that are above the relevant criterion.

Figure 5-1 presents the 24-hour average PM_{2.5} concentrations at the D2 and D10 BAM monitors. The data shows that elevated 24-hour average PM_{2.5} levels were recorded during the 2019/2020 bushfire season. The 24-hour average PM_{2.5} levels recorded in 2025 were broadly consistent with the levels recorded in recent years and the levels prior to the end of 2019.

Figure 5-2 presents the annual average PM_{2.5} concentrations recorded at the BAM monitors including extraordinary events. The D2 and D10 monitors show generally similar annual average PM_{2.5} levels throughout the monitoring period until 2019 when the annual average at the D2 monitor is approximately double that of previous years. Note that there are insufficient data (less than 75%) for an annual average for the D10 monitor in 2019, however it would also have been elevated.

The annual average PM_{2.5} level at the D2 monitor in 2025 is lower than the previous year and is generally low when compared with the long-term data set. The annual average PM_{2.5} level at the D10 monitor in 2025 is slightly higher than the previous year and is generally consistent with the levels recorded prior to 2019.

Figure 5-3 presents the 31-day running averages for the 24-hour average PM_{2.5} concentrations, daily rainfall and mean daily temperature recorded by the Bulga Complex weather station. In general, the figure indicates a trend in dust levels being lower during significant rainfall and/or colder temperatures, or dust levels being higher in dry and hot conditions.



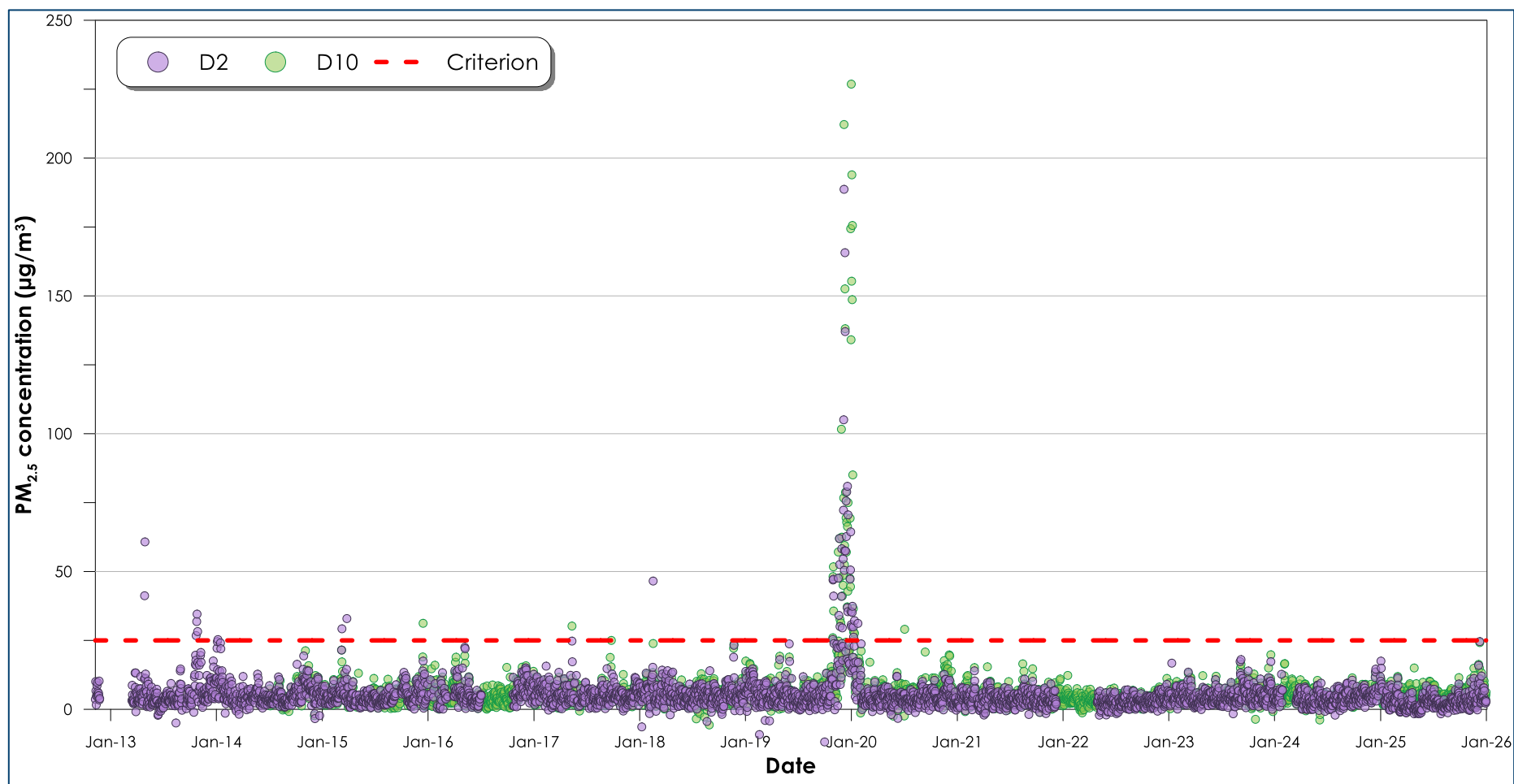


Figure 5-1: 24-hour average PM_{2.5} concentrations



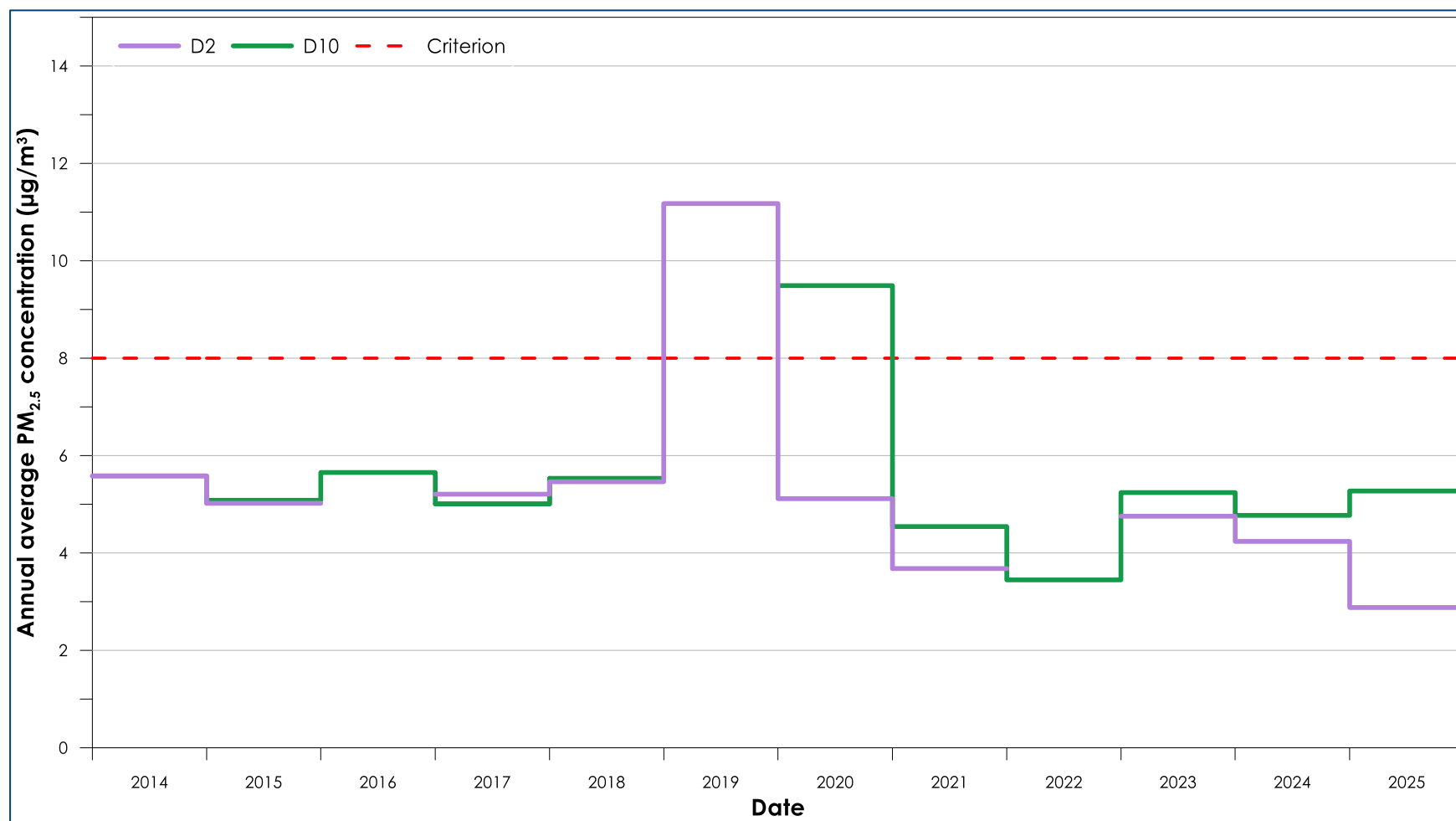


Figure 5-2: Annual average PM_{2.5} concentrations



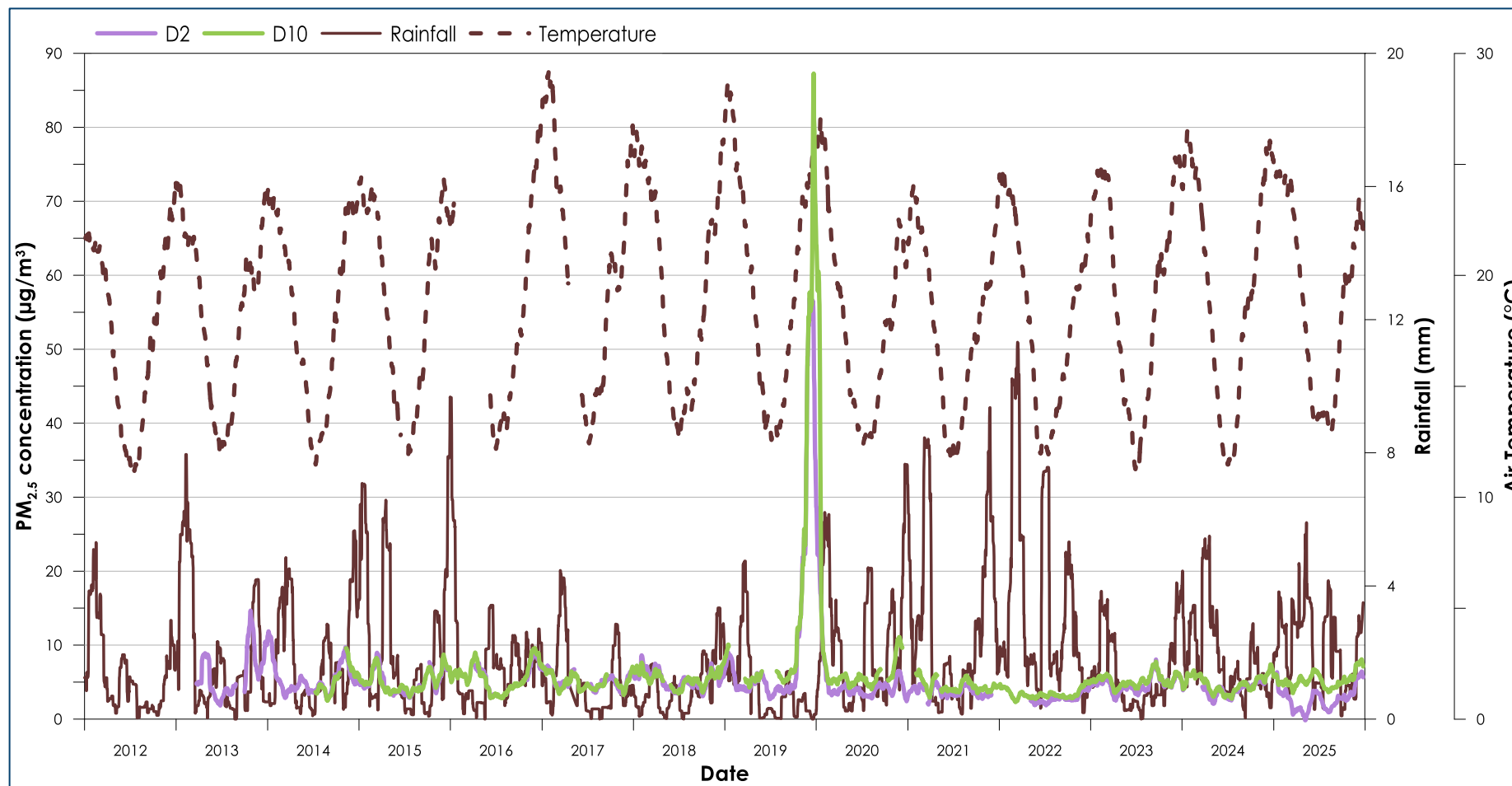


Figure 5-3: 31-day running average of the 24-hour average PM_{2.5} concentrations with the 31-day running average of daily rainfall and mean daily temperature



5.2 PM₁₀ monitoring data

Table 5-2 presents a summary of the recorded PM₁₀ levels at the TEOM monitors. Annual average PM₁₀ concentrations in 2025 were below the relevant criteria of 25µg/m³.

The maximum 24-hour average PM₁₀ concentrations at D1 and D3 were below the relevant criterion of 50µg/m³ in 2025. The D5 and D11 monitors recorded two days and four days respectively with elevated 24-hour average levels above the 50µg/m³. Investigations conducted into these events indicates that Bulga Complex did not contribute more than 50µg/m³ to the elevated PM₁₀ levels recorded at the D5 and D11 monitors and thus was compliant with the applicable criterion.

Table 5-2: Summary of the recorded TEOM PM₁₀ levels

Year	Annual average PM ₁₀ (µg/m ³)								
	D1		D3		D5		D11		Criteria
2011	-		12.1 (7%)		-		-		25 / 30
2012	21.8 (9%)		14.8		14.3 (73%)		-		25 / 30
2013	16.1		15.8		15.7		-		25 / 30
2014	15.9		15.3		13.1		-		25 / 30
2015	10.7		11.2		10.7		-		25 / 30
2016	11.5		10.8		11.7		18.8 (44%)		25 / 30
2017	12.7		12.2		11.5		20.0		25 / 30
2018	15.4		19.9		18.9		22.3		25 / 30
2019	22.1	*14.7	28.0	*19.0	25.3	*17.1	27.8	*22.2	25 / 30
2020	14.0	*12.4	16.5	*14.6	16.6	*15.2	19.3	*17.5	25
2021	11.2		12.4		13.2		15.5		25
2022	9.3		10.7		10.3		12.1		25
2023	13.6		16.2		16.2		18.4		25
2024	13.4		15.2		15.7		16.7		25
2025	13.5		15.2		16.0		18.5		25
Year	Maximum 24-hour average PM ₁₀ (µg/m ³) (No. of days > criterion)								
	D1		D3		D5		D11		Criterion
2011	-		17.7 (0)		-		-		50
2012	48.2 (0)		46.1 (0)		45.3 (0)		-		50
2013	70.0 (5)		75.3 (3)		65.0 (2)		-		50
2014	43.8 (0)		41.8 (0)		46.2 (0)		-		50
2015	61.2 (1)		59.3 (1)		61.6 (1)		-		50
2016	33.0 (0)		33.2 (0)		53.5 (2)		60.7 (1)		50
2017	36.4 (0)		37.1 (0)		37.7 (0)		67.5 (6)		50
2018	138.6 (5)		166.4 (7)		160.3 (7)		159.6 (15)		50
2019	172.1 (31)	*37.9 (0)	170.5 (44)	*60.4 (3)	177.4 (36)	*47.2 (0)	180.7 (33)	*53.8 (4)	50
2020	68.9 (4)	*37.2 (0)	94.9 (5)	*39.9 (0)	75.8 (4)	*41.0 (0)	105.9 (12)	*68.6 (4)	50
2021	34.3 (0)		33.6 (0)		34.1 (0)		65.4 (1)		50
2022	38.2 (0)		27.4 (0)		31.2 (0)		34.9 (0)		50
2023	42.0		45.2		61.9 (1)		60.3 (2)		50
2024	40.1		52.0 (1)		43.0		49.1		50
2025	43.2		46.7		53.1 (2)		63.8 (4)		50

(#%) The recorded data are less than 75% complete for the year, (data availability %)

*Excluding extraordinary events

The numbers in **red** are concentrations that are above the relevant criterion.



Figure 5-4 presents the 24-hour average PM₁₀ concentrations at the TEOM monitors. The data shows that elevated 24-hour average PM₁₀ levels were recorded during the 2019/2020 bushfire season. The 24-hour average PM₁₀ levels recorded in 2025 were broadly consistent with the levels recorded during recent years and the levels prior to the end of 2019.

Figure 5-5 presents the annual average PM₁₀ concentrations recorded at the TEOM monitors including extraordinary events. In 2025, the annual average PM₁₀ levels at the D1, D3, D5 and D11 monitors are broadly similar to the levels in the previous year.

Figure 5-6 shows the 31-day running averages of the 24-hour average PM₁₀ concentrations at the TEOM monitors including extraordinary events, together with the 31-day running averages of daily rainfall and mean daily temperature recorded by the Bulga Complex weather station. The figure indicates a general trend in dust levels being lower during significant rainfall and/or colder temperatures, or dust levels being higher in dry and hot conditions.

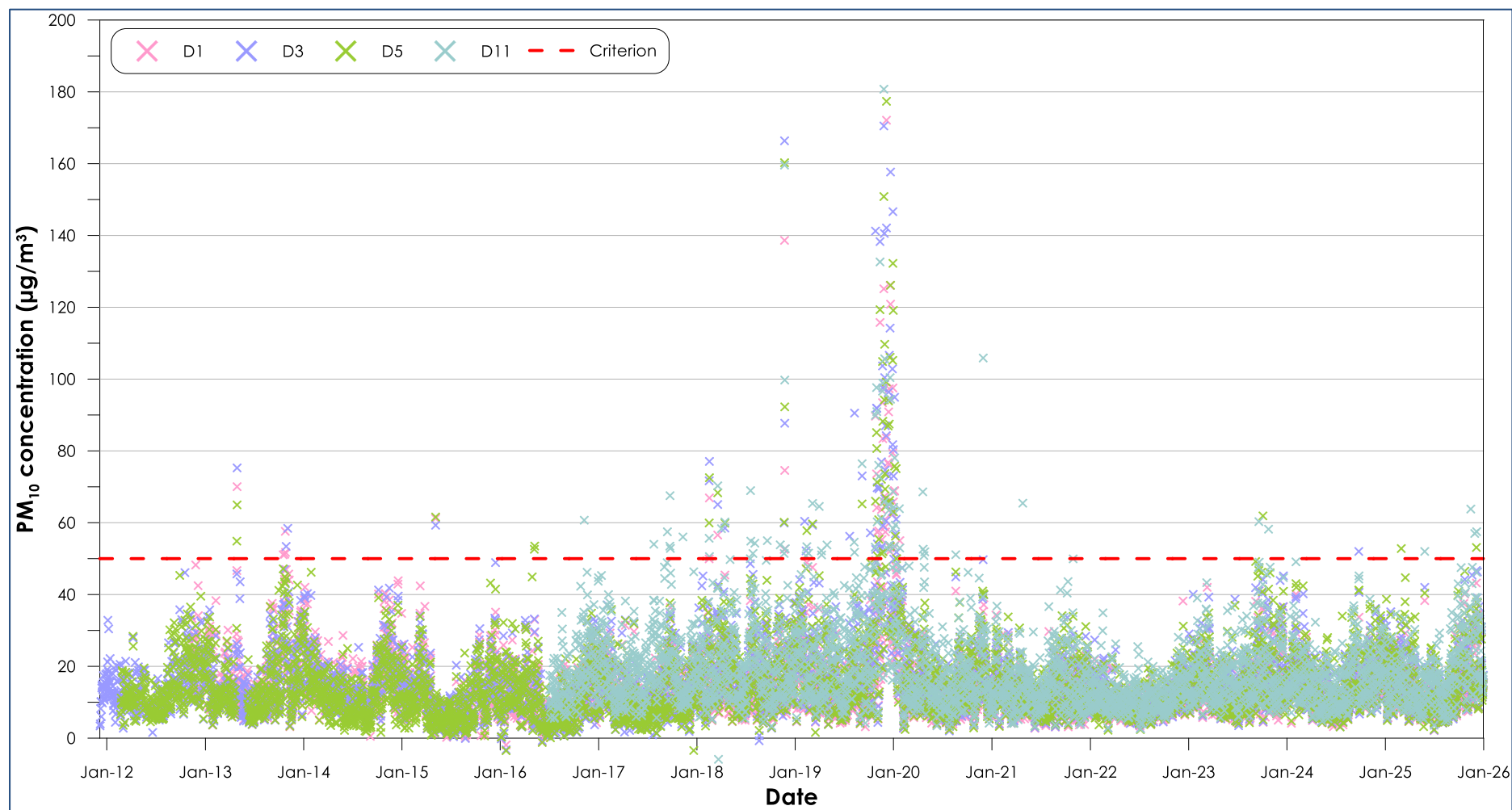


Figure 5-4: 24-hour average PM₁₀ concentrations at TEOM monitors

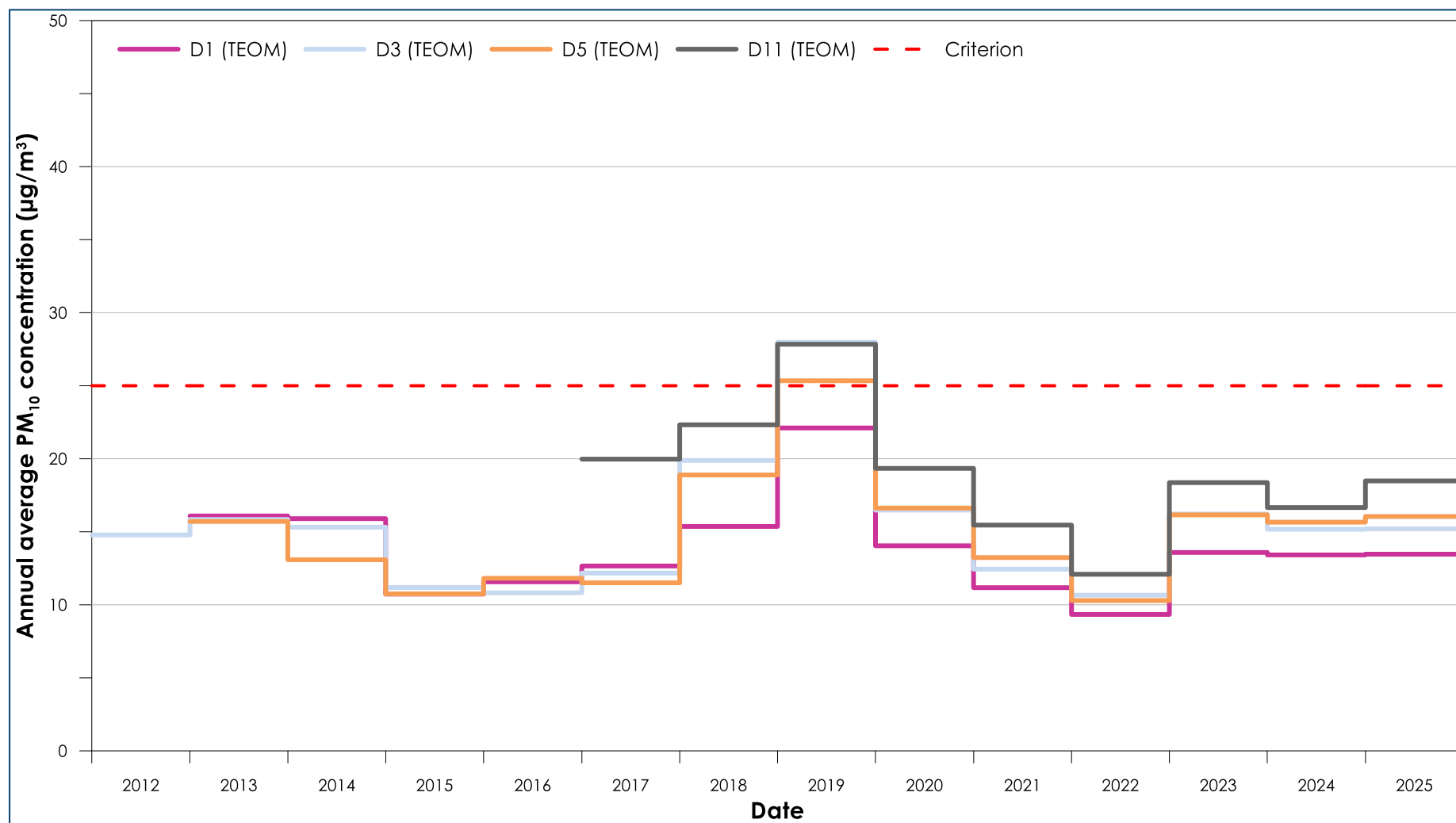


Figure 5-5: Annual average PM₁₀ concentrations at TEOM monitors



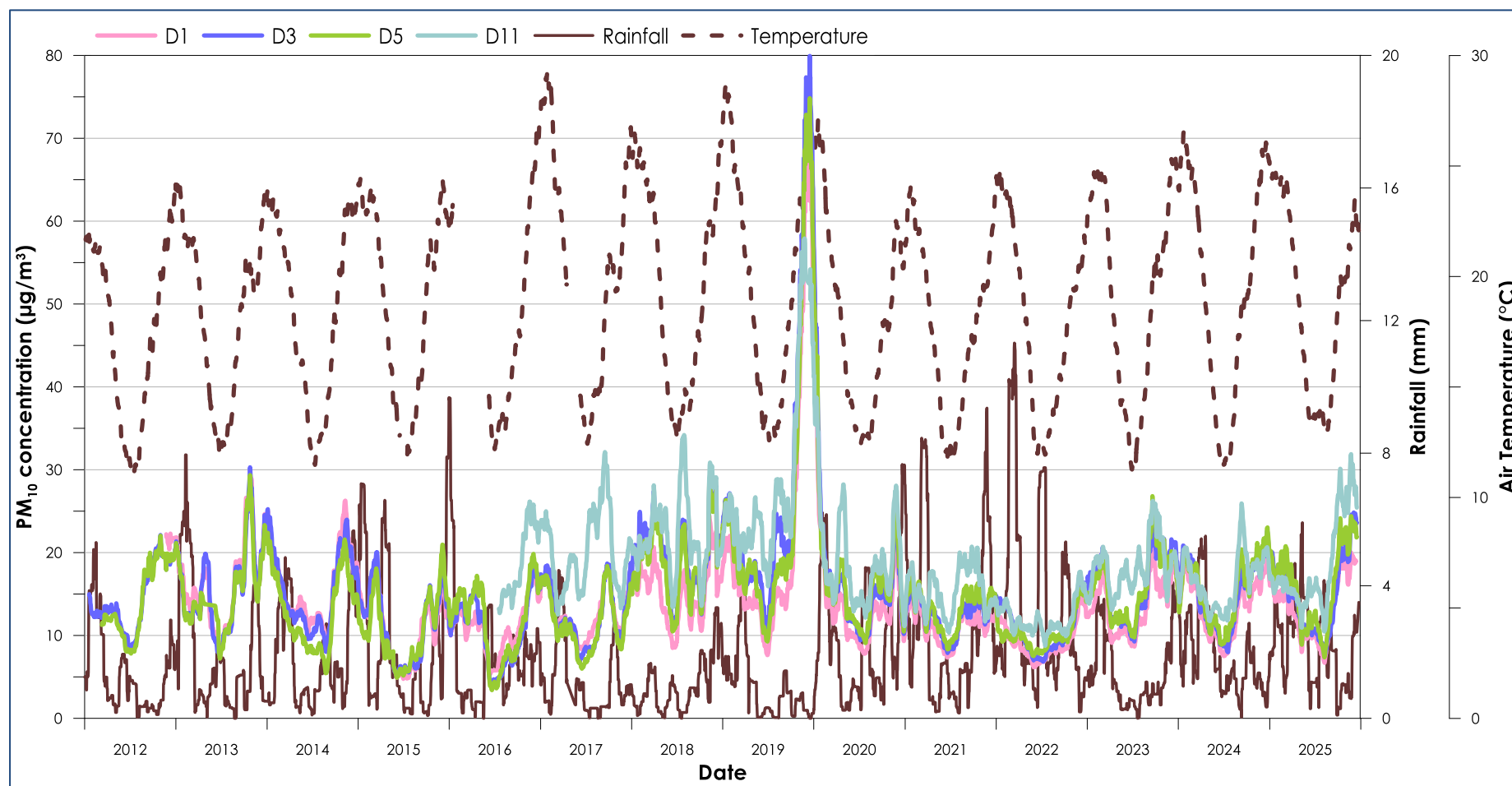


Figure 5-6: 31-day running average of the 24-hour average PM₁₀ concentrations at the TEOM monitors with the 31-day running average of daily rainfall and mean daily temperature



5.3 TSP monitoring data

Table 5-3 presents a summary of the recorded TSP levels at the HVAS monitors. Annual average TSP concentrations were below the relevant criterion of $90\mu\text{g}/\text{m}^3$ in 2025.

Table 5-3: Summary of the recorded HVAS TSP levels

Year	Annual average TSP (µg/m³)						
	Dawtrey		D10		Hill St		Criterion
2005	28.2 (74%)		32.3 (67%)		-		90
2006	35.0		36.2		-		90
2007	33.2		36.7		-		90
2008	33.3		34.8		-		90
2009	39.3		41.4		-		90
2010	26.9		29.2		-		90
2011	27.1		33.8		-		90
2012	26.2		34.5		-		90
2013	30.4		32.5		-		90
2014	34.5		40.0		-		90
2015	27.9		30.6		-		90
2016	31.7		36.9		23.3 (67%)		90
2017	29.8		36.5		26.0		90
2018	42.9		48.6		32.1		90
2019	56.0	*37.5	67.3	*46.3	50.7	*30.7	90
2020	38.5	*35.7	40.9	*36.3	31.8	*29.2	90
2021	22.6		21.0		18.9		90
2022	15.3		17.2		13.4		90
2023	30.5		31.8		22.2		90
2024	32.6		31.7		23.5		90
2025	38.1		34.5		25.2		90

(#%) The recorded data are less than 75% complete for the year, (data availability %)

*Annual average excluding extraordinary events

Figure 5-7 shows the 24-hour and annual average TSP concentrations including extraordinary events at the HVAS monitors. The data shows that elevated 24-hour average TSP levels were recorded during the 2019/2020 bushfire season. The annual average data from the TSP HVAS monitors show that the levels remained below the criterion of $90\mu\text{g}/\text{m}^3$ throughout the period. The levels at the monitors generally show relatively similar trends over time. The TSP levels during 2025 were slightly higher than the previous year.

Figure 5-8 shows the 30-day running average of the TSP concentrations including extraordinary events, rainfall readings and mean daily temperatures. The levels show a general trend of lower TSP concentrations during periods of higher rainfall and lower temperatures.

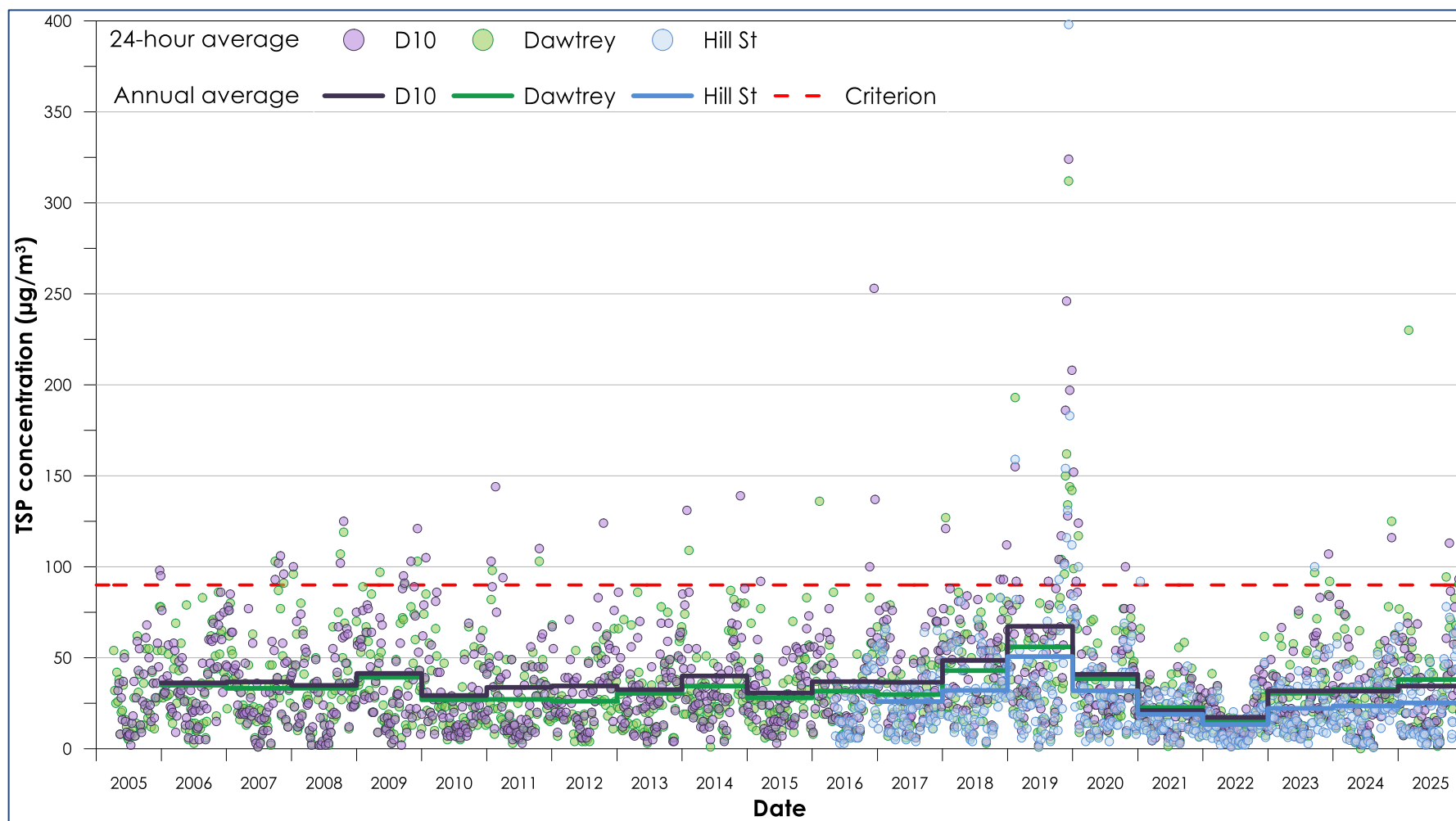


Figure 5-7: 24-hour and annual average TSP concentrations

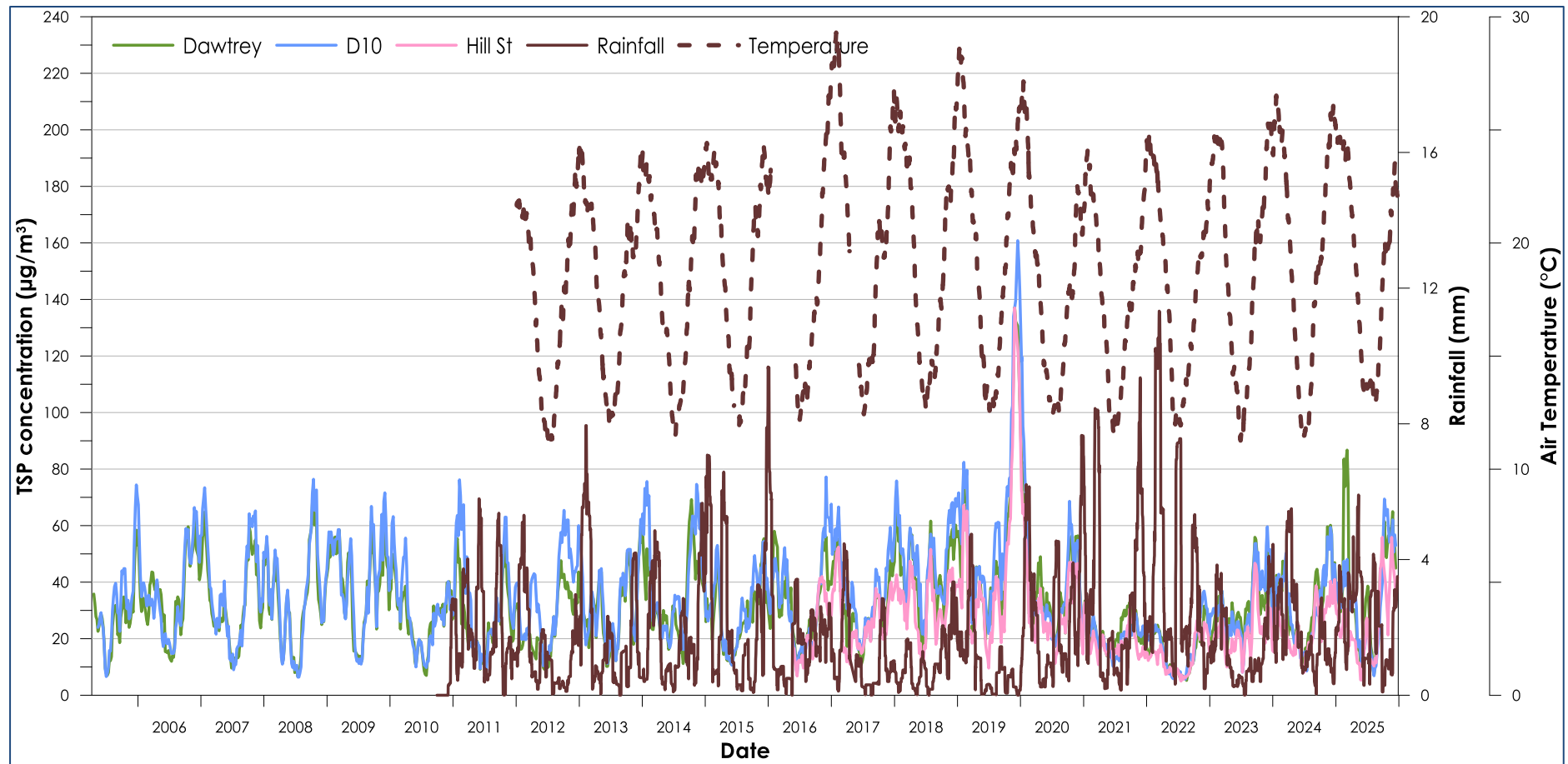


Figure 5-8: 30-day running average of the 24-hour average TSP concentrations with the 31-day running average of daily rainfall and mean daily temperature



5.4 Deposited dust data

Table 5-4 presents a summary of the annual average deposited dust levels at the statutory compliance dust gauges. The results show that in 2025 the deposited dust levels were below the annual average limit of 4g/m²/month at the compliance monitoring locations.

Table 5-4: Summary of the annual average deposited dust levels (g/m²/month)

Year	A3	C5	D6	D9	D10	N5	F2	F3	Redibar	Sharrock 1	Hedley	Criterion
2004	1.0	0.9	0.8	1.0	1.3	1.4	0.8	1.0	-	-	-	4
2005	1.0	1.0	0.8	0.8	0.9	1.1	0.7	0.9	-	-	-	4
2006	1.0	1.2	0.8	0.9	0.9	0.8	0.6	1.1	-	-	-	4
2007	5.5	1.9	1.4	1.9	1.3	1.3	1.9	1.9	-	4.1 (50%)	-	4
2008	1.7 (67%)	2.0	1.4	2.1	0.8	1.5	0.8	1.9	1.1 (25%)	1.4	-	4
2009	1.9	2.3	1.9	2.7	1.7	1.7	2.6	1.8	1.3	1.7	-	4
2010	1.6	1.7	1.7	1.6	1.5	1.2	1.9	1.2	1.0	0.9	-	4
2011	1.8 (67%)	1.5	1.4	1.6	1.6	1.0	2.0	1.4	1.2	1.3	-	4
2012	3.3	2.3 (58%)	1.4	2.6	1.6	1.5	1.7	1.3	1.5	1.3	-	4
2013	2.0	2.7	2.2	2.4	1.5	1.7	1.9	1.7	2.3	1.3	-	4
2014	1.7	1.8	2.3	1.7	1.6	2.0	2.0	2.2	1.9	1.3	-	4
2015	1.6	1.4	1.5	1.6	1.4	2.5	-	1.9	1.8	1.4	-	4
2016	1.1	1.5	1.4	1.2	1.3	2.0	-	1.6	1.5	1.4	-	4
2017	1.4	1.1	1.1	1.5	1.3	1.3	-	1.8	2.0	0.9	1.4	4
2018	2.2	1.2	2.1	1.9	1.7	2.4	-	1.8	1.3	1.1	1.5	4
2019	2.1	1.5	2.0	2.3	2.0	2.4	-	2.3	1.7	1.3	1.9	4
2020	2.3	1.6	1.5	1.8	2.9	1.7	-	2.9	1.8	1.5	1.7	4
2021	1.0	0.7	1.6	0.8	1.4	1.0	1.2	1.8	1.8	0.7	1.4	4
2022	0.8	0.5	1.5	0.6	1.5 (67%)	0.7	0.6	1.3	1.1	0.6	1.1	4
2023	1.7	0.9	1.7	1.4	1.7 (67%)	1.4	0.9	0.7	0.8	1.9	1.7	4
2024	1.1	0.9	1.3	1.2	2.2	1.2	1.0	1.2	1.1	0.6	1.1	4
2025	1.3	1.2	1.5	1.5	2.7	1.3	0.9	2.0	2.2	0.9	1.7	4

Contaminated samples were not included in the computation of the average.

(#%) The recorded data are less than 75% complete for the year, (data availability %)

Figure 5-9 shows the monthly and annual average deposited dust levels at the Bulga Complex dust gauges. The deposited dust levels at the A3 monitor exceeded the cumulative annual average deposited dust criteria of 4g/m²/month in 2007. No other exceedance was recorded from the onset of monitoring until the end of the 2025 calendar year. The levels at the monitors generally show relatively similar trends over time. The deposited dust levels recorded in 2025 were slightly higher than the previous year.

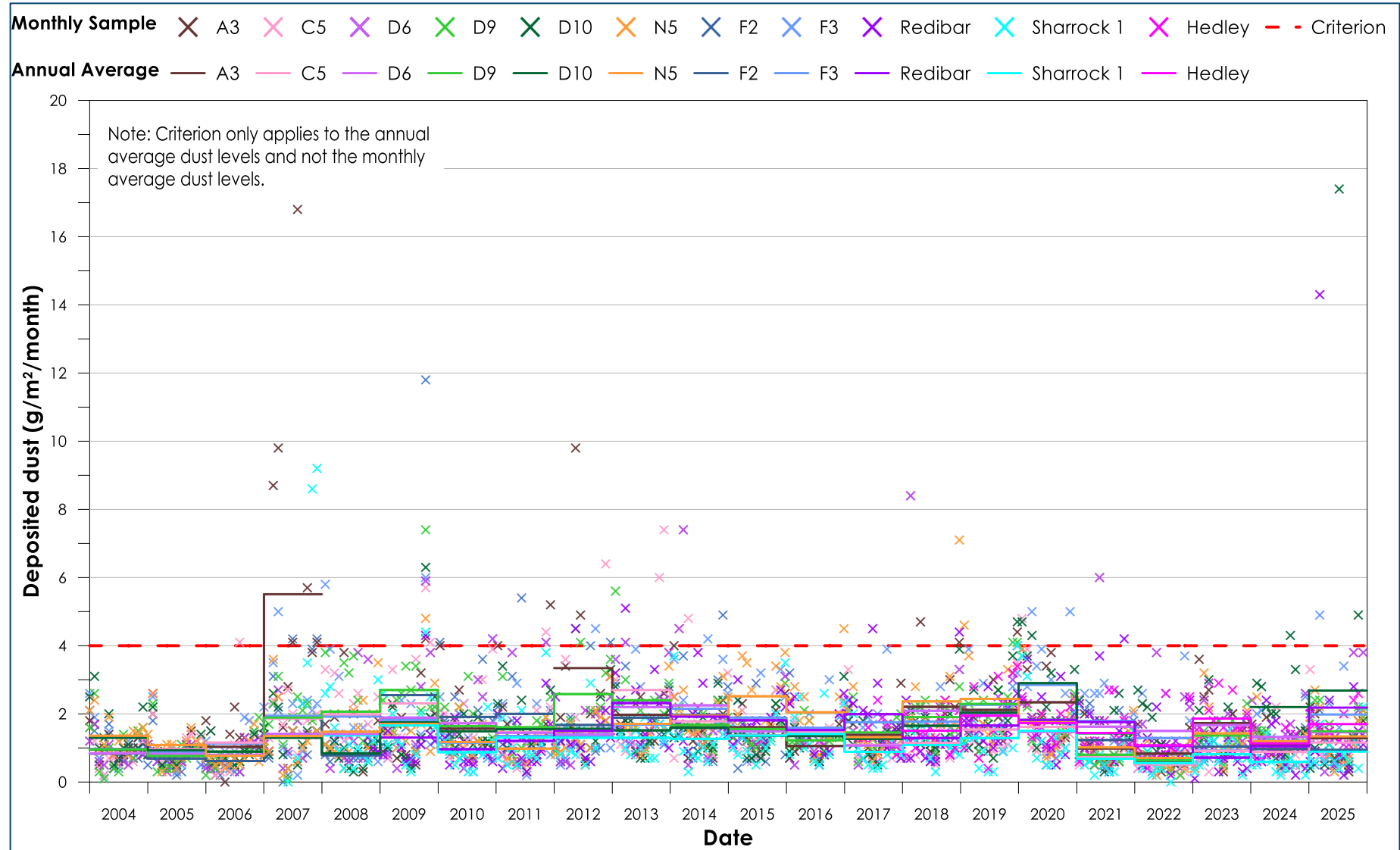


Figure 5-9: Annual and monthly averages deposited dust at the statutory compliance dust gauges



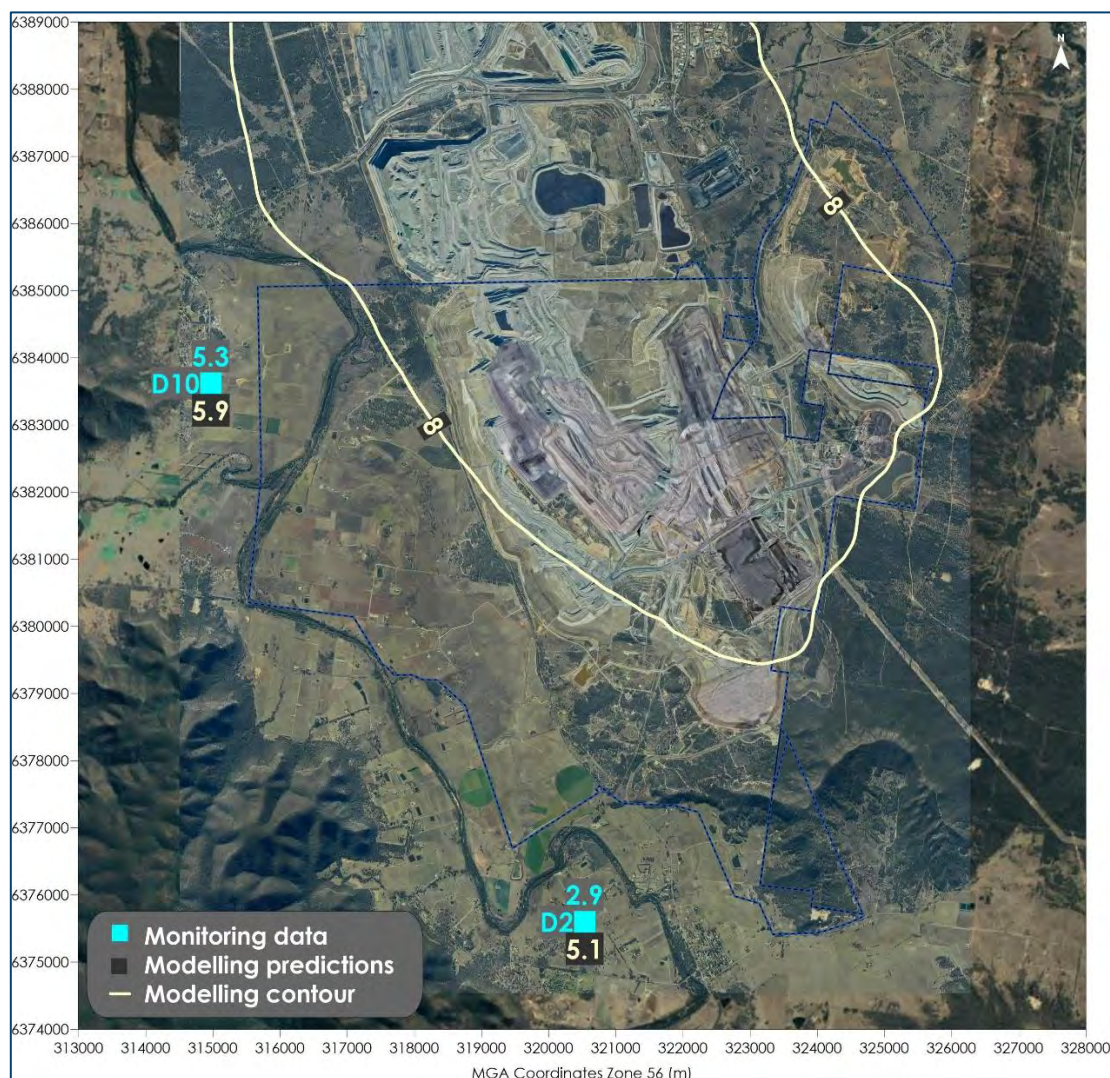
6 COMPARISON OF MEASURED 2025 DATA AND MODEL PREDICTIONS

Monitoring data collected at the Bulga Complex locations during 2025 were compared with modelling predictions for the approximate year ("Year 2026") per the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* (Jacobs, 2019).

6.1 Annual average PM_{2.5}

Figure 6-1 and **Table 6-1** present a comparison of the measured 2025 annual average PM_{2.5} data and the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* ("Year 2026") (Jacobs, 2019) dispersion modelling predictions. The measured and predicted data in the figures include dust levels from Bulga Complex and other sources.

The measured annual average PM_{2.5} concentrations in 2025 are below the 8µg/m³ as predicted for the "Year 2026" modelling scenario. The data indicates that the measured annual average PM_{2.5} levels in 2025 are lower than the predicted levels for the "Year 2026" modelling scenario.



Source: Jacobs, 2019

Figure 6-1: 2025 PM_{2.5} annual average monitoring data and the "Year 2026" cumulative modelling predictions (µg/m³)

Table 6-1: Measured versus modelled annual average PM_{2.5} concentrations (µg/m³)

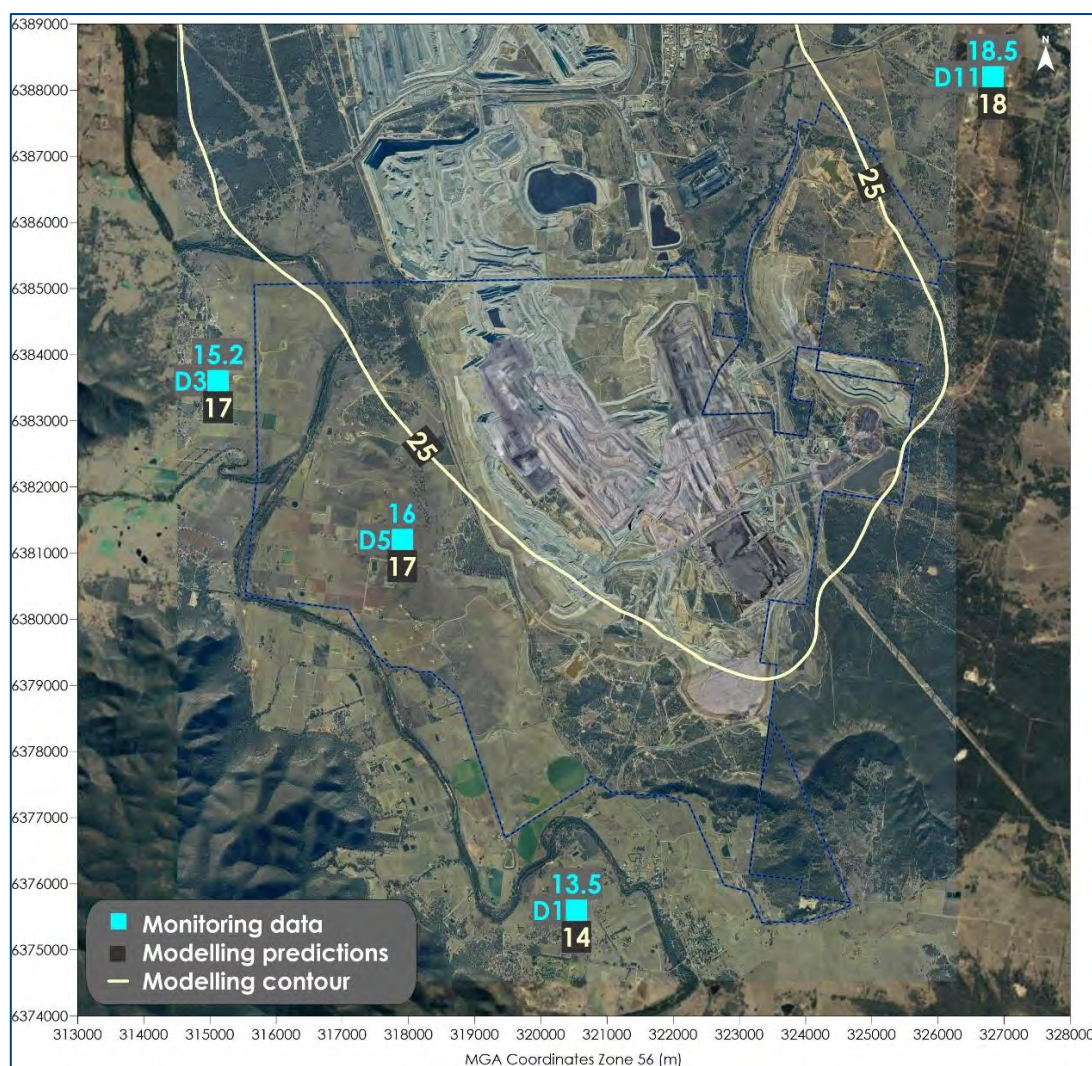
Monitor	Measured 2025 level	Predicted "Year 2026" level*
D2	2.9	5.1
D10	5.3	5.9

*Jacobs, 2019

6.2 Annual average PM₁₀

Figure 6-2 and **Table 6-2** present comparisons of the measured 2025 annual average PM₁₀ data and the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* ("Year 2026") (Jacobs, 2019) dispersion modelling predictions. The measured and predicted data in the figures include dust levels from Bulga Complex and other sources.

The measured annual average PM₁₀ concentrations in 2025 are below the 25µg/m³ contour as predicted for the "Year 2026" modelling scenario. The data indicates that the measured annual average PM₁₀ levels in 2025 are generally consistent with the predicted levels for the "Year 2026" modelling scenario.



Source: Jacobs, 2019

Figure 6-2: 2025 PM₁₀ annual average monitoring data and the "Year 2026" cumulative modelling predictions (µg/m³)

Table 6-2: Measured versus modelled annual average PM₁₀ (µg/m³)

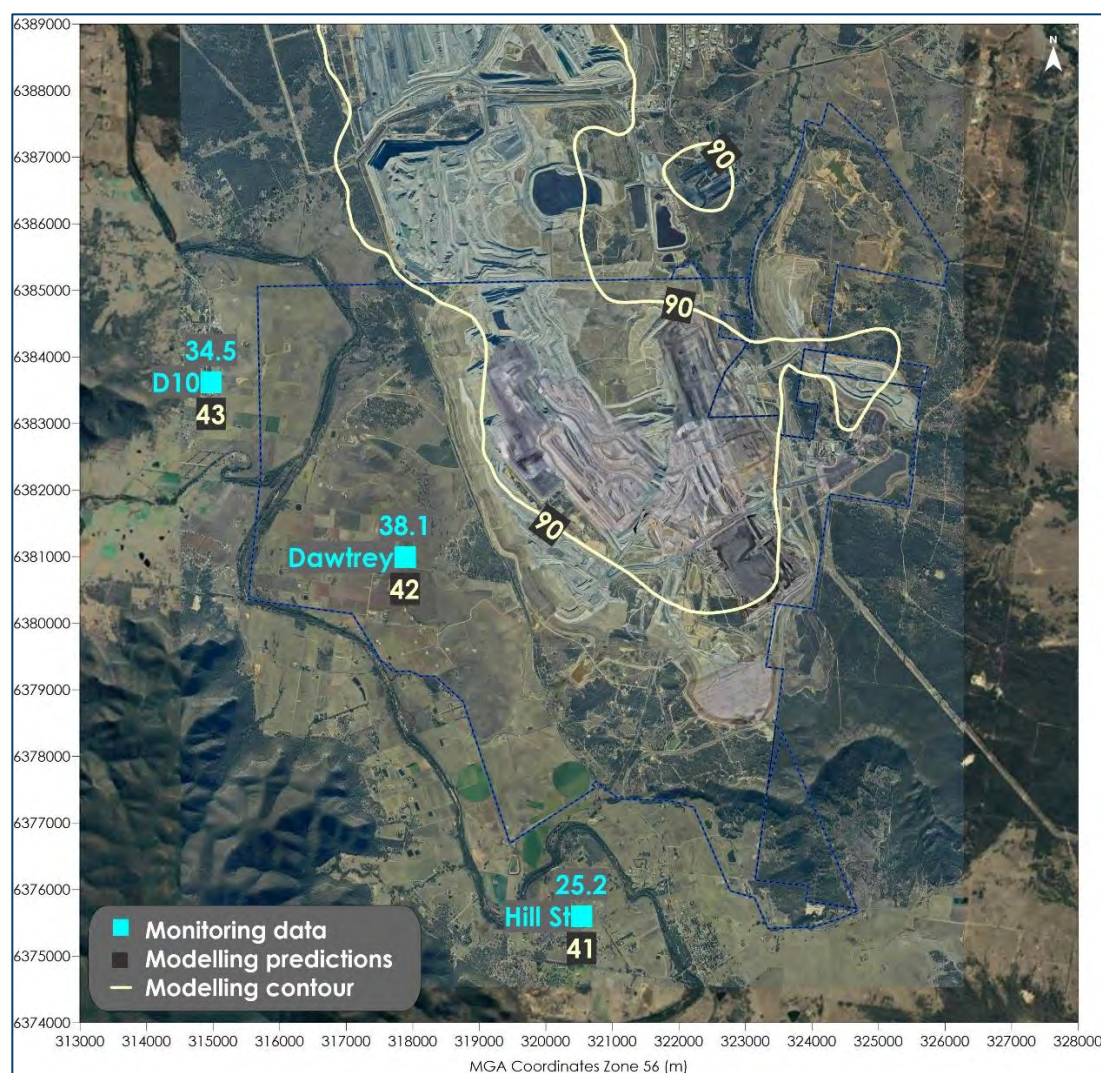
Monitor	Measured 2025 level	Predicted "Year 2026" level*
D1	13.5	14
D3	15.2	17
D5	16.0	17
D11	18.5	18

*Jacobs, 2019

6.3 Annual average TSP

Figure 6-3 and **Table 6-3** present comparisons of the measured 2025 annual average TSP data and the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* ("Year 2026") (Jacobs, 2019) dispersion modelling predictions. The measured and predicted data in the figures include dust levels from Bulga Complex and other sources.

The measured annual average TSP levels in 2025 are below the 90µg/m³ contour as predicted for the "Year 2026" modelling scenario. The data indicates that the measured annual average TSP levels in 2025 are generally lower than the predicted levels for the "Year 2026" modelling scenario.



Source: Jacobs, 2019

Figure 6-3: 2025 TSP annual average monitoring data and the "Year 2026" cumulative modelling predictions (µg/m³)

Table 6-3: Measured versus modelled annual average TSP ($\mu\text{g}/\text{m}^3$)

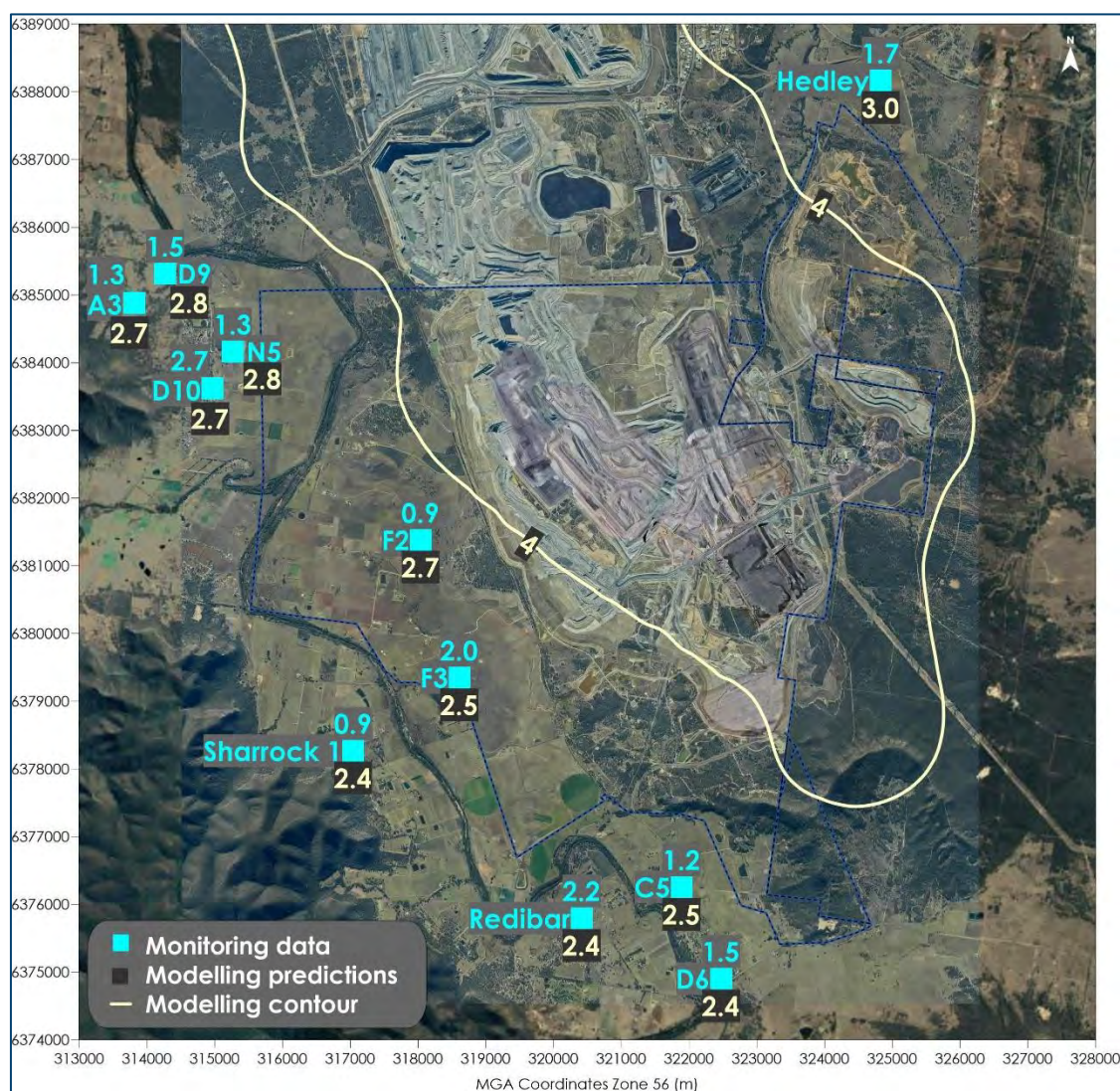
Monitor	Measured 2025 level	Predicted "Year 2026" level*
Dawtrey	38.1	42
D10	34.5	43
Hill St	25.2	41

*Jacobs, 2019

6.4 Annual average deposited dust

Figure 6-4 and **Table 6-4** present comparisons of the measured 2025 annual average deposited dust data and the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* ("Year 2026") (Jacobs, 2019) dispersion modelling predictions. The measured and predicted data in the figures include dust levels from Bulga Complex and other sources.

The measured levels in 2025 are all below the $4\text{g}/\text{m}^2/\text{month}$ contour as predicted for "Year 2026". The data indicates that the measured annual average deposited dust levels in 2025 are generally consistent with or lower than the predicted levels for the "Year 2026" modelling scenario.



Source: Jacobs, 2019

Figure 6-4: 2025 deposited dust annual average monitoring data and the "Year 2026" cumulative modelling predictions ($\text{g}/\text{m}^2/\text{month}$)

Table 6-4: Measured versus modelled annual average deposited dust (g/m²/month)

Monitor	Measured 2025 level	Predicted "Year 2026" level*
Hedley	1.7	3.0
Redibar	2.2	2.4
Sharrock 1	0.9	2.4
N5	1.3	2.8
F3	2.0	2.5
F2	0.9	2.7
D10	2.7	2.7
D9	1.5	2.8
D6	1.5	2.4
C5	1.2	2.5
A3	1.3	2.7

*Jacobs, 2019



7 POLLUTION ROSES

The following section presents an analysis of a hybrid of a pollution rose and back trajectory data for all PM_{2.5} and PM₁₀ data measured at the BAM, TEOM and E-BAM monitors for 2025. The meteorological data used in generating the figures are taken from the Bulga Complex weather station. Refer to **Appendix A** for guidance on how to interpret a pollution rose plot.

7.1 PM_{2.5} data

Figure 7-1 and **Figure 7-2** present the pollution roses for the D2 and D10 PM_{2.5} monitors respectively for 2025. Generally, the figures do not show a particular effect on PM_{2.5} levels from the direction of the Bulga Complex.

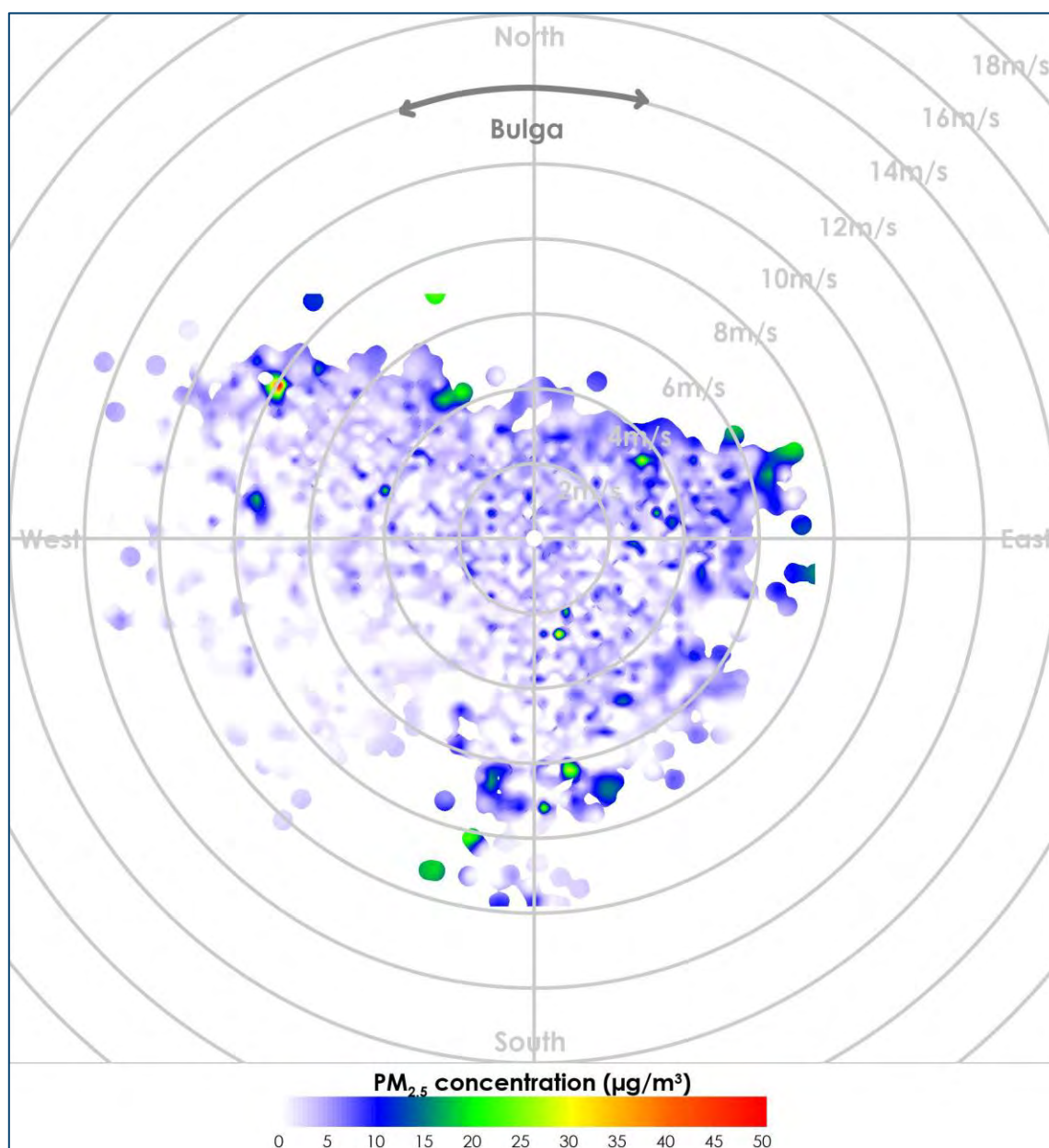


Figure 7-1: Pollution rose for D2 BAM PM_{2.5} data (2025)

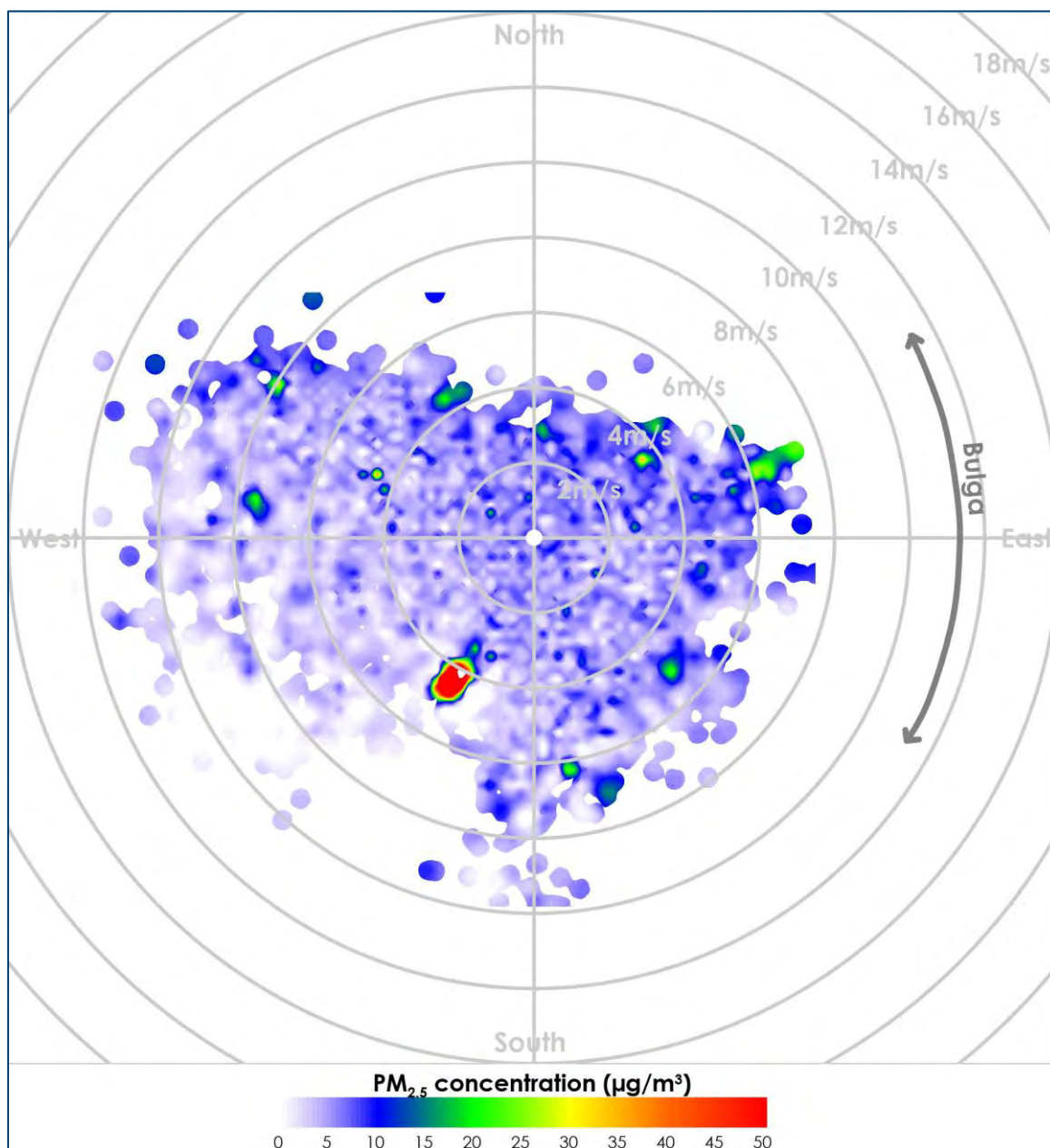


Figure 7-2: Pollution rose for D10 BAM PM_{2.5} data (2025)

7.2 PM₁₀ data

Figure 7-3 to **Figure 7-6** present the pollution roses for the D1, D3, D5 and D11 PM₁₀ TEOM monitors respectively for 2025. **Figure 7-7** and **Figure 7-8** present the pollution roses for the D8 and D9 PM₁₀ E-BAM monitors respectively for 2025.

Generally, the figures show a mild to moderate effect on PM₁₀ levels from the direction of the Bulga mine. The D3 and D5 pollution roses show high levels in the direction of Bulga mine, the D1 pollution rose shows a slight trend of higher levels in the direction of the Bulga mine but also from the northeast and the D11 appears to have recorded high levels from variable directions and does not show a clear signal from the direction of Bulga mine.

The E-BAM monitors are not compliance or reference standard monitors such as the TEOM and HVA monitors. They are located close to mining activities and are used to assist with mine operational management. As such the data may not be directly equivalent to the TEOM data. High levels occur in the direction of Bulga Mine at the D8 monitor. Some high levels occur in the direction of Bulga Complex at the D9 monitor however the monitor recorded a significantly greater proportion of high levels when winds were from the northwest quadrant during which the monitor would not have been downwind of Bulga Complex but would have been downwind of the neighbouring mining activities.

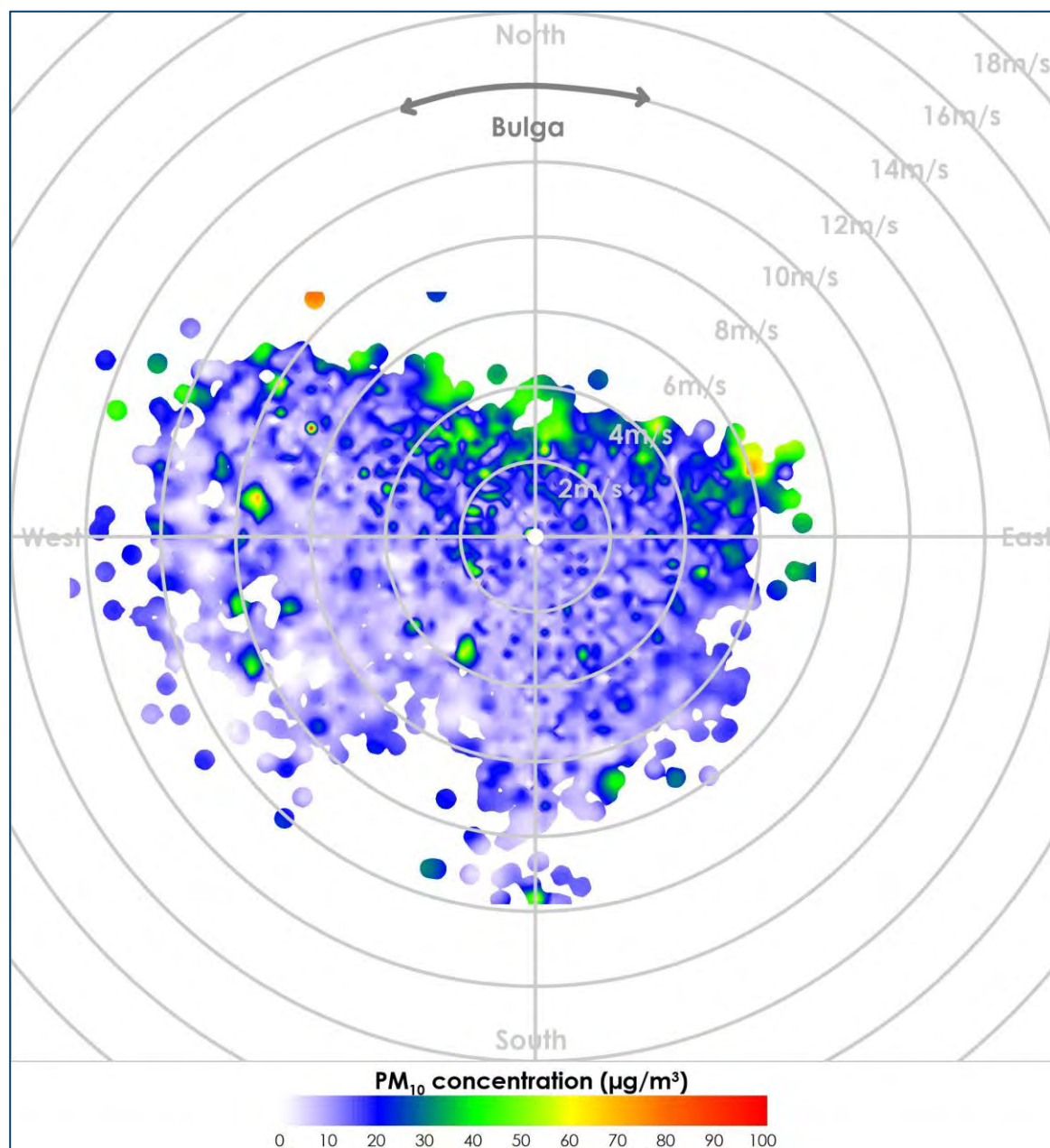


Figure 7-3: Pollution rose for D1 TEOM PM₁₀ data (2025)

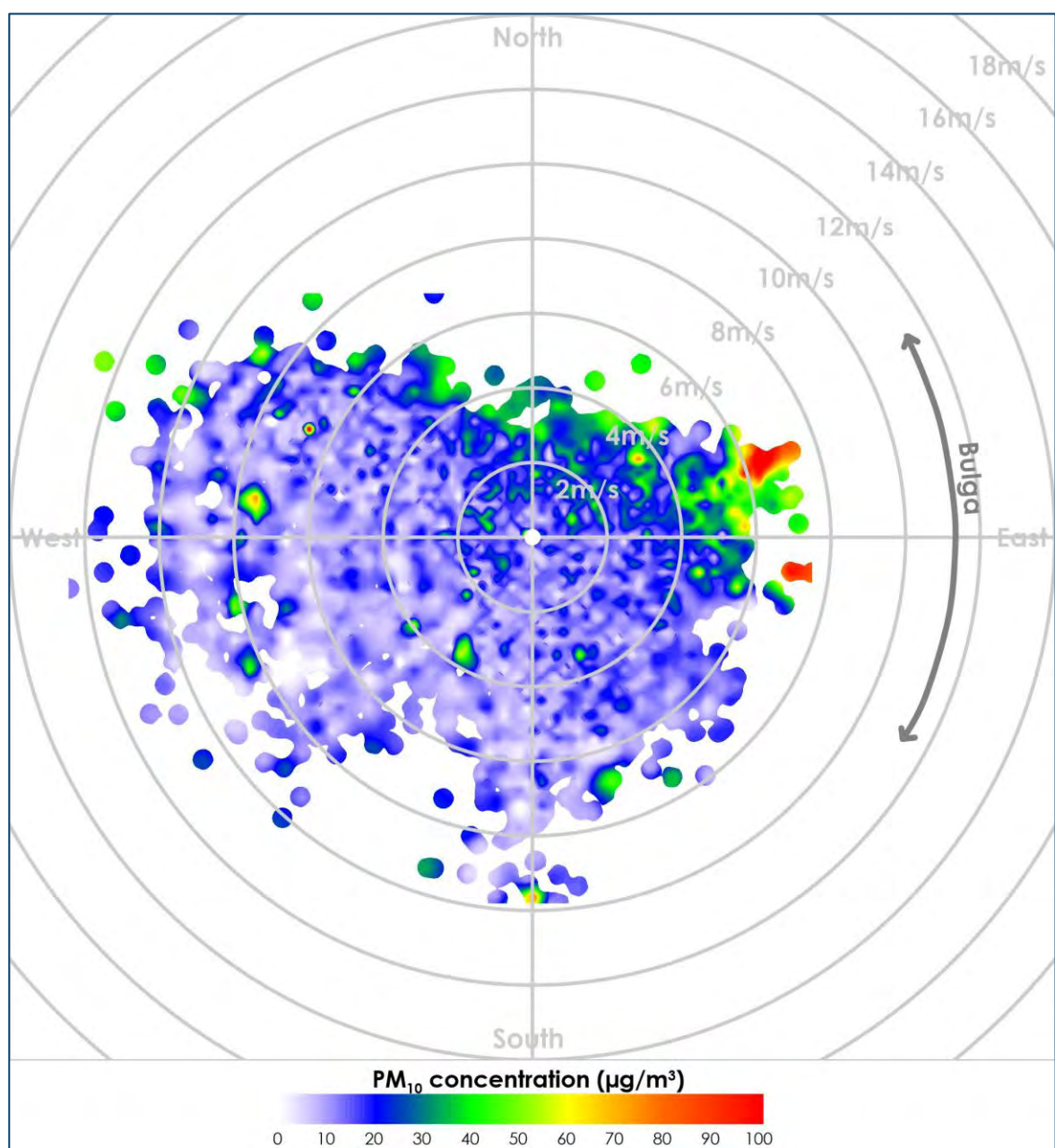


Figure 7-4: Pollution rose for D3 TEOM PM₁₀ data (2025)

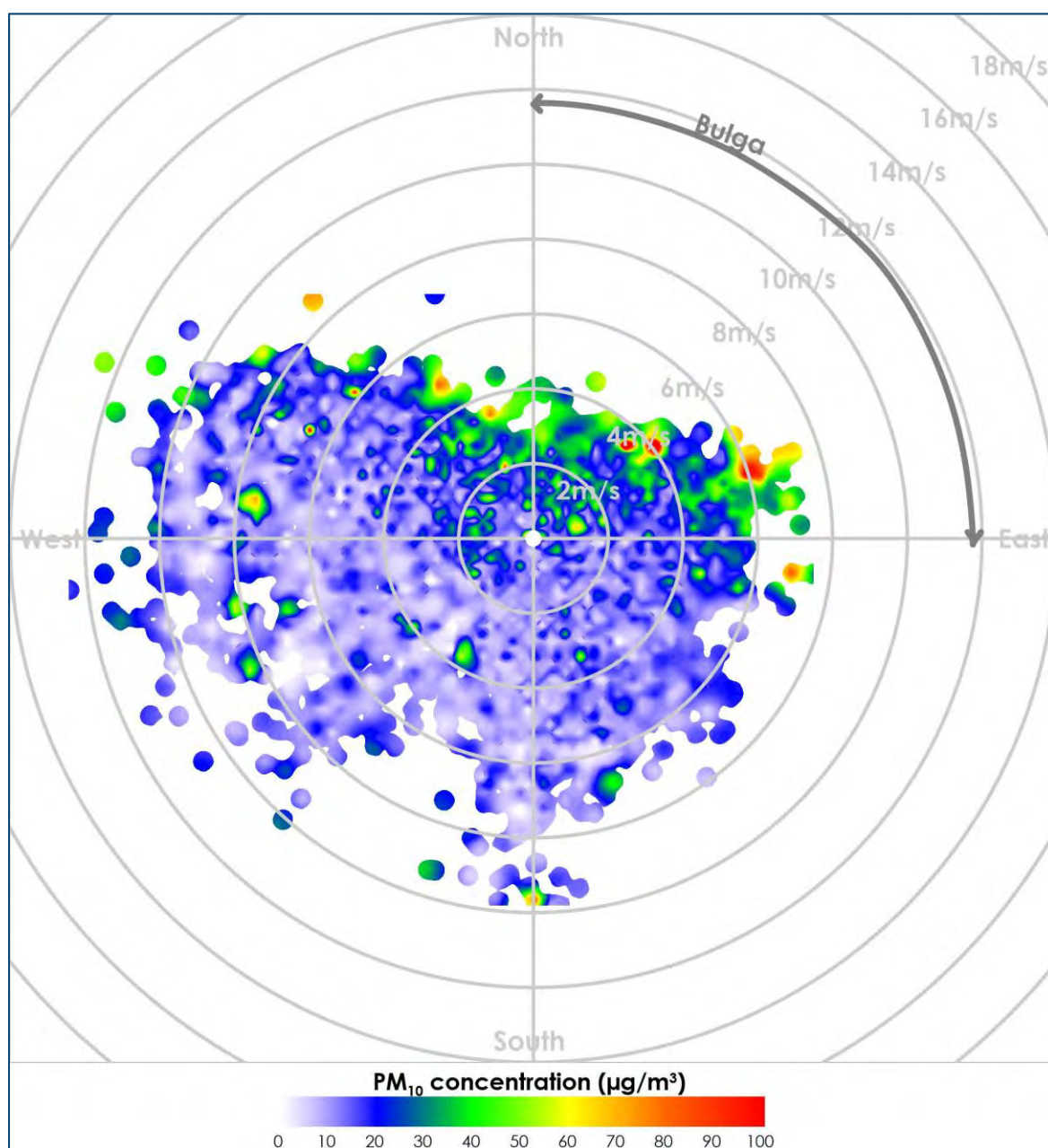


Figure 7-5: Pollution rose for D5 TEOM PM₁₀ data (2025)

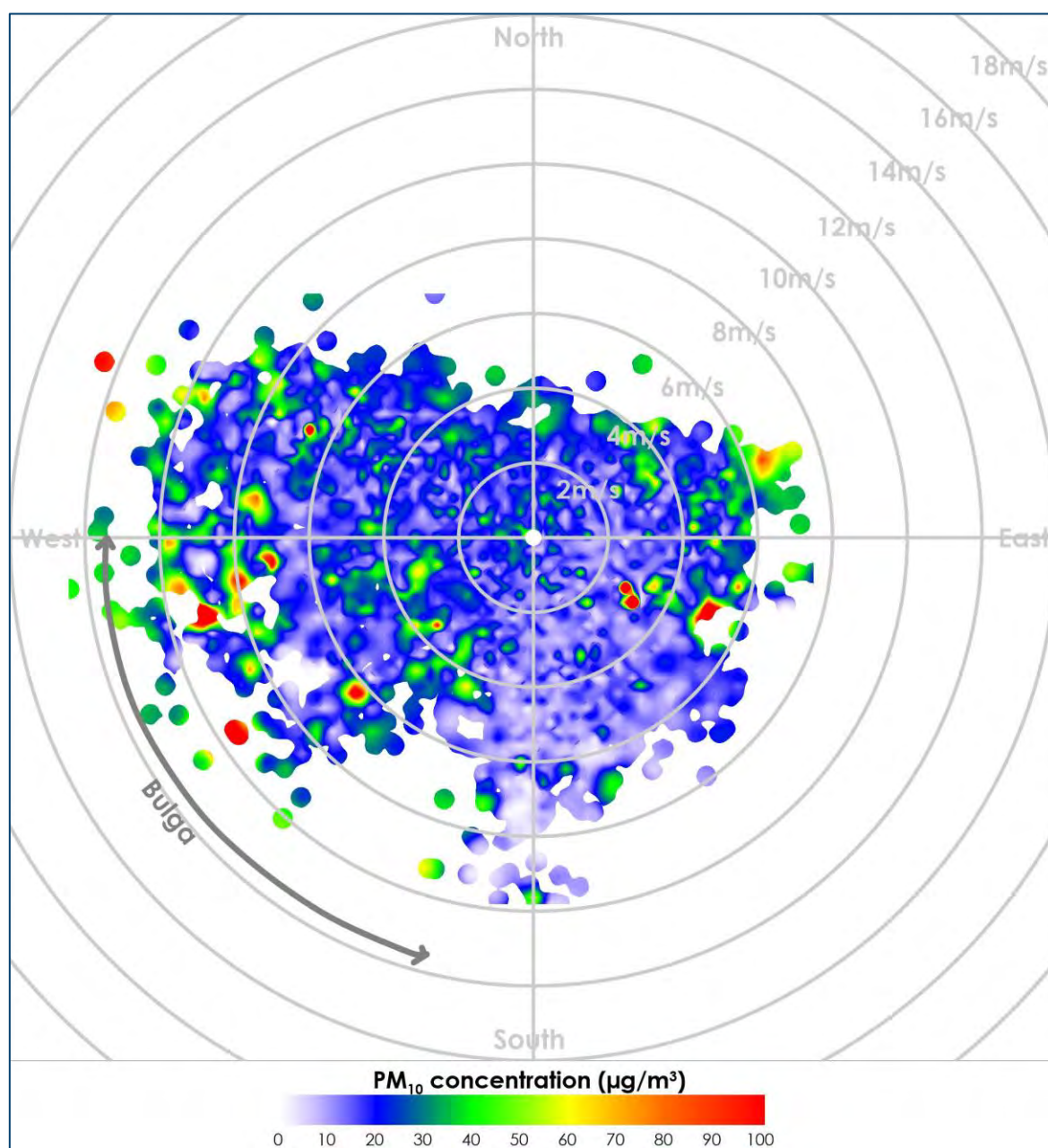


Figure 7-6: Pollution rose for D11 TEOM PM₁₀ data (2025)

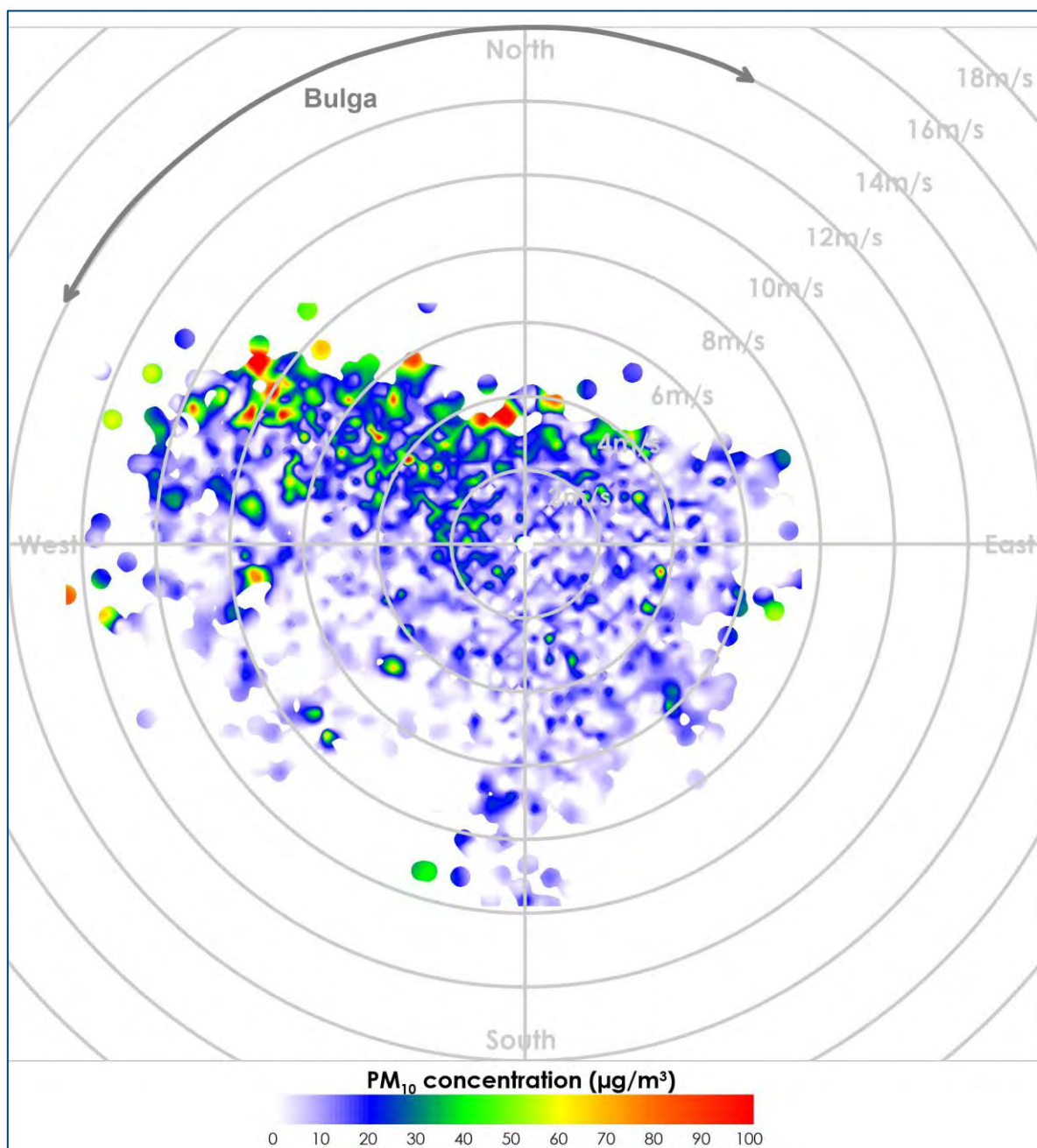


Figure 7-7: Pollution rose for D8 E-BAM PM₁₀ data (2025)

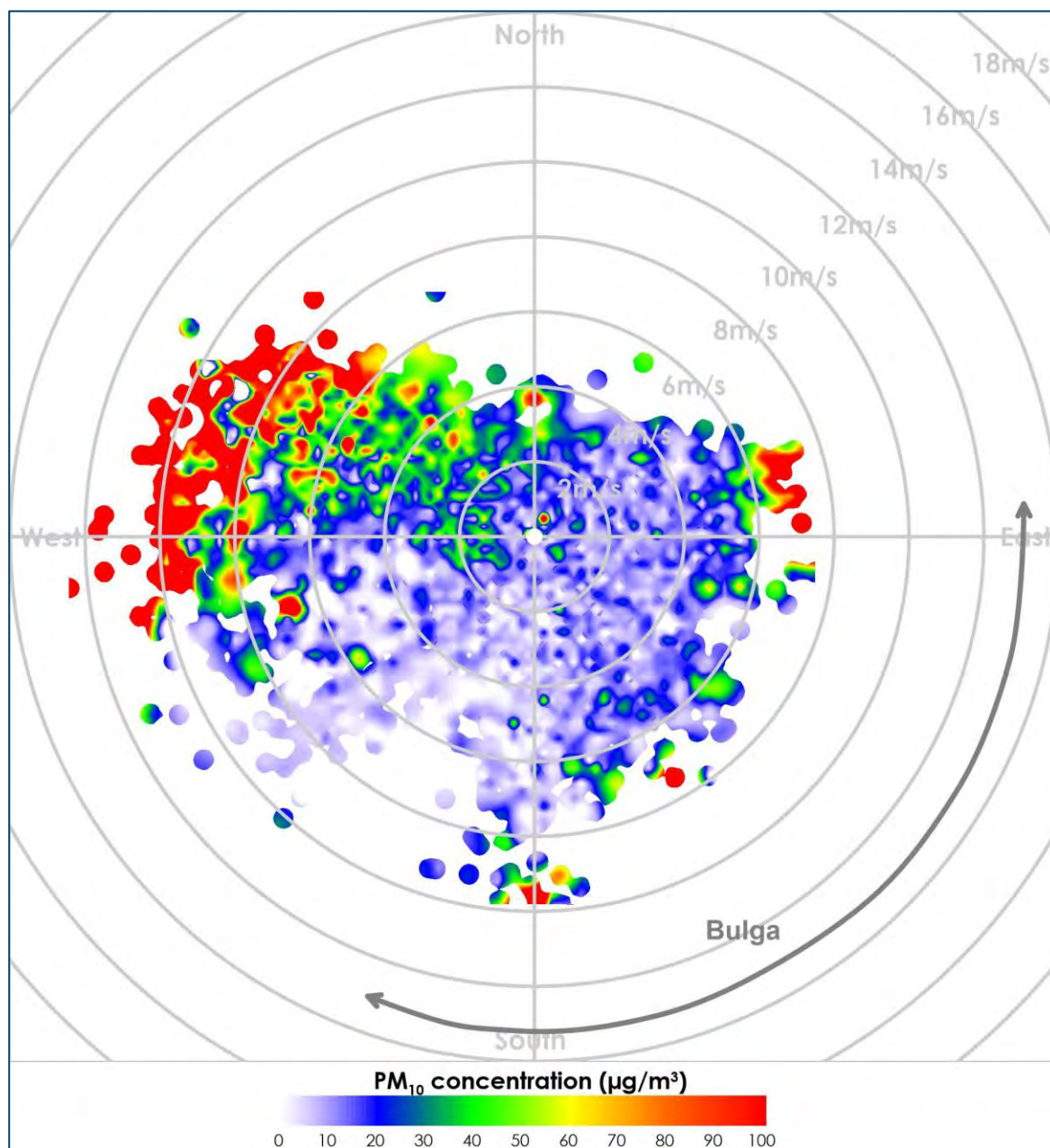


Figure 7-8: Pollution rose for D9 E-BAM PM₁₀ data (2025)

8 CONCLUSIONS

This report has analysed the dust monitoring data recorded at the Bulga Complex and provides a comparison between the dust levels measured in 2025 with the modelled predictions for that approximate year ("Year 2026") per the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* (Jacobs, 2019).

The analysis shows that the annual average measured levels in 2025 were generally consistent with or lower than the predictions for the representative modelling scenario.

This report has also presented a review and long-term trend analysis of air quality data from the beginning of monitoring to the end of 2025. The analysis shows that the annual average levels were below the relevant criteria and were broadly consistent with previous years.

An analysis of the pollution roses for 2025 generally shows minor to moderate effects from the direction of Bulga Complex on PM₁₀ levels and no significant trend for PM_{2.5} levels from the direction of the Bulga Complex.



9 REFERENCES

Jacobs (2019)

"Bulga Coal Complex Modification 3 Air Quality Impact Assessment", prepared by Jacobs Group (Australia) Pty Ltd for Bulga Coal Management Pty Ltd, June 2019.



Appendix A How to read a windrose and pollution rose

Windrose

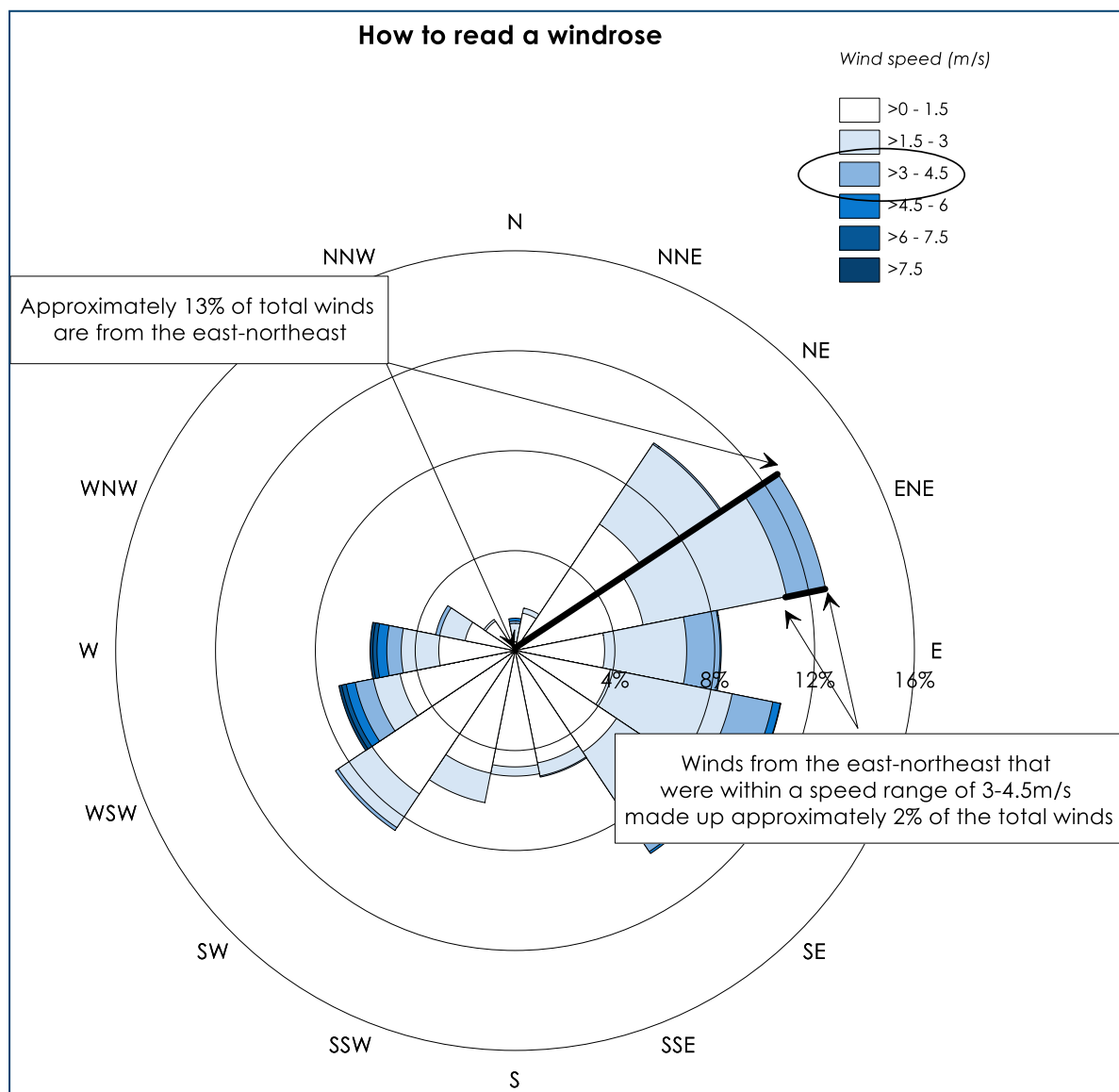


Figure A-1: How to read a windrose

Pollution rose

How to read a pollution rose:

- The colour indicates the pollutant concentration measured at the monitor.
- The position of pollutant concentration markings along the 360° axis indicate the corresponding direction from which pollutants arise from.
- The position of pollutant concentration markings relative to the banded rings indicate the wind speed for the corresponding hourly concentration.
- The arc labelled "Bulga" indicates the relative direction of Bulga Complex from the monitor.

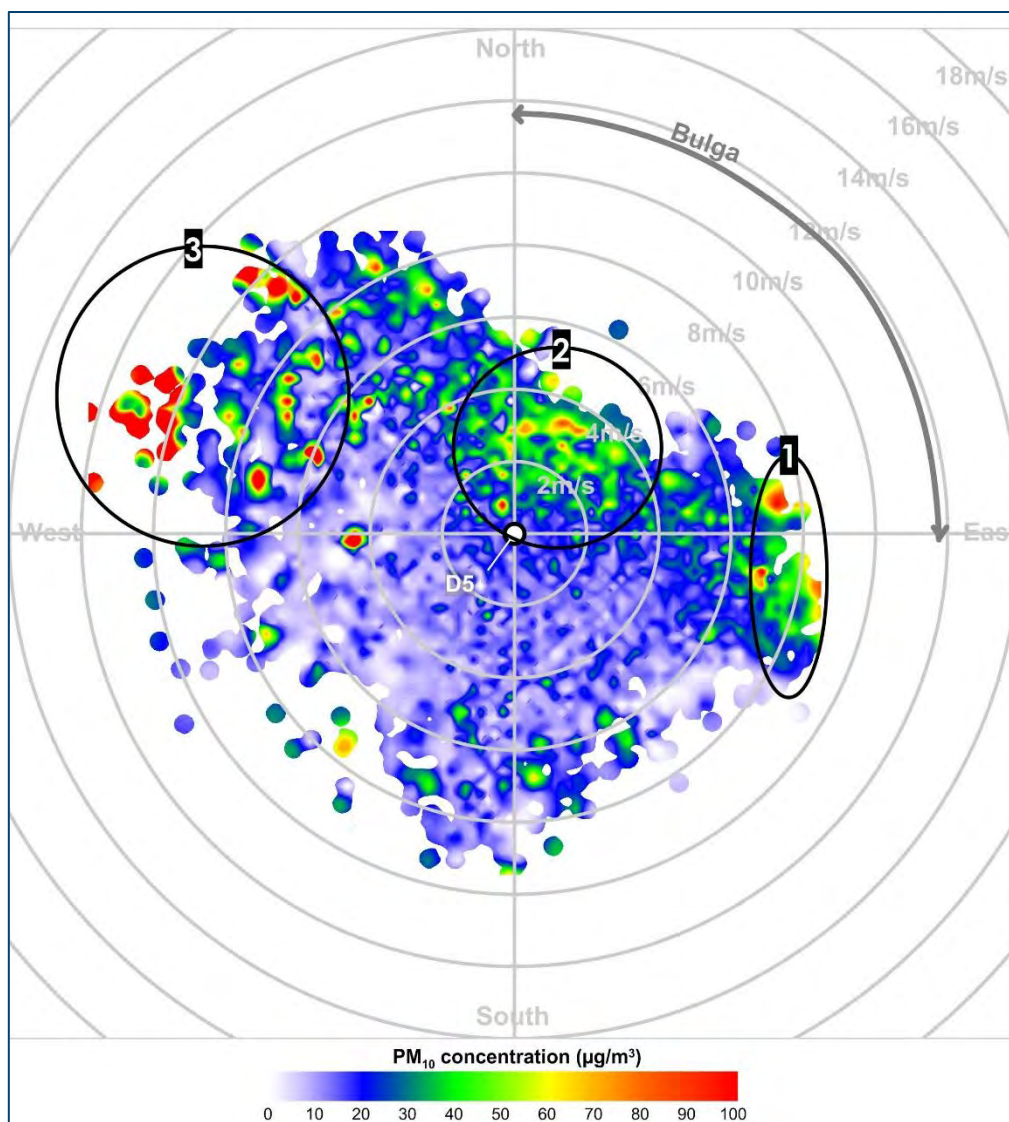


Figure A-2: Example Pollution Rose

- 1** - Moderate PM₁₀ levels tended to originate from the east under wind speeds around 8m/s.
- 2** - Moderate PM₁₀ levels were also recorded from the north and north-northeast direction under wind speeds generally between 2 m/s and 4 m/s.
- 3** - Some high levels were also recorded from the northwest under moderate wind speeds

Appendix B Meteorological data capture summary

This section presents a summary of the percentage data capture of the available 10-minute data from the Bulga Complex, Southern Extension and Flares meteorological stations for the 2025 calendar year.

There was generally high valid data capture for meteorological parameters during 2025. It is noted that the 2 metre temperature data recorded at the Bulga Complex weather station were considered to be erroneous for a period during 2025 when the guard was missing.

Table B-1: Bulga Complex Weather Station summary of 10-minute data

Parameter	Temperature at 2m	Temperature at 10m	Wind speed at 10m	Wind direction at 10m	Relative humidity	Sigma Theta	Rainfall
Total data capture	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Missing data	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Erroneous data	15.4%	0.0%	0.4%	0.4%	0.0%	0.4%	0.0%
Valid data	84.5%	100.0%	99.5%	99.6%	100.0%	99.6%	100.0%

Table B-2: Southern Extension Weather Station summary of 10-minute data

Parameter	Temperature at 2m	Temperature at 30m	Wind speed at 30m	Wind direction at 30m	Relative humidity	Sigma Theta	Rainfall
Total data capture	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Missing data	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Erroneous data	0.0%	0.0%	0.4%	0.4%	0.0%	0.4%	0.0%
Valid data	100.0%	100.0%	99.5%	99.5%	100.0%	99.5%	100.0%

Table B-3: Flares Weather Station summary of 10-minute data

Parameter	Temperature at 2m	Temperature at 10m	Wind speed at 10m	Wind direction at 10m	Relative humidity	Sigma Theta	Rainfall
Total data capture	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%
Missing data	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Erroneous data	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Valid data	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%



Appendix C TEOM, BAM and E-BAM 24-hour data capture summary

This section presents a summary of the 24-hour average periods where there were less than 75% valid data for the TEOM, BAM and E-BAM monitors during the 2025 calendar year.

Table C-1: Days with insufficient data (i.e. <75%) for a 24-hour average calculation - D1

Date	Cause/s	Action
15/01/2025	Disruption in the supply of local mains power	-
21/04/2025 to 23/04/2025	Tripped breaker	Operation restored
8/07/2025	Unexplained power outage	-
6/11/2025	6M PM	-
6/12/2025	Power interruption preceded by low bypass flow	-
9/12/2025	Power interruption preceded by low bypass flow	-
18/12/2025	Power interruption	-
19/12/2025	Power interruption	-
21/12/2025	Power interruption	-

Table C-2: Days with insufficient data (i.e. <75%) for a 24-hour average calculation – D3

Date	Cause/s	Action
7/04/2025	6M PM & DST clock change	-
18/10/2025	Unexplained power interruption	-
5/11/2025 & 6/11/2025	12M PM with zero noise filter overnight	-
7/11/2025	Unexplained power outage	-
26/11/2025	Power outage	-

Table C-3: Days with insufficient data (i.e. <75%) for a 24-hour average calculation – D5

Date	Cause/s	Action
15/01/2025	Disruption in the supply of local mains power	-
18/10/2025	Unexplained power interruption	-
5/11/2025 & 6/11/2025	12M PM with zero noise filter overnight	-
26/11/2025	Power outage	-

Table C-4: Days with insufficient data (i.e. <75%) for a 24-hour average calculation - D11

Date	Cause/s	Action
15/01/2025	2M PM and power outage	-
29/01/2025	Power outage	-
5/02/2025	Unexplained power interruption	-
29/03/2025 to 31/03/2025	Monitor failure	TEOM removed and returned to workshop
1/04/2025	Monitor failure	TEOM reinstalled
25/06/2025 & 26/06/2025	12M PM with zero noise filter	-
26/11/2025 & 27/11/2025	Flow failure and power outage	-



Table C-5: Days with insufficient data (i.e. <75%) for a 24-hour average calculation – D2

Date	Cause/s	Action
7/01/2025 & 8/01/2025	Tape System Errors	Moved BAM 5mm forward and 12mm left to position inlet tube perpendicular to BAM
10/01/2025	Tape broke	Cleaned nozzle and vane and replaced filter tape
11/01/2025 to 13/01/2025	No flow	Investigated broken and punctured filter tape. Heater relay box not plugged in and therefore never on. Settings FRH +35, low power +6
21/04/2025 to 23/04/2025	Tripped breaker	Operation restored
8/07/2025	Unexplained power outage	-

Table C-6: Days with insufficient data (i.e. <75%) for a 24-hour average calculation - D10

Date	Cause/s	Action
20/02/2025 & 21/02/2025	Tape alarm (zero flow)	2M PM
17/10/2025 & 18/10/2025	Unexplained power interruption	-

Table C-7: Days with insufficient data (i.e. <75%) for a 24-hour average calculation – D8

Date	Cause/s	Action
21/03/2025 to 24/03/2025	The logger had an error writing to CF card.	Device restarted by Novecom remotely.
21/05/2025 to 23/05/2025	Low battery charge due to poor solar conditions	-

Table C-8: Days with insufficient data (i.e. <75%) for a 24-hour average calculation – D9

Date	Cause/s	Action
7/04/2025 & 8/04/2025	12PM with zero noise filter	-
22/05/2025 & 23/05/2025	Low battery charge due to poor solar conditions	-
6/10/2025 to 8/10/2025	Beta count failure	Operation restored
22/10/2025 & 23/10/2025	Beta count failure	-
25/11/2025 & 26/11/2025	Beta count failure	-



Appendix C

Progress Against 2025 Performance Indicators – Offset Areas

Table C.1 Broke Road BOA

Number	Performance Indicator	Progress	Comments
1	Control of weeds in revegetation/regeneration areas – Weed control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Spot control of problem weeds is undertaken as required, focusing on high priority species (Table 3.2 in BOMP). However, Lantana is persisting and requires regular control.
2	Control of feral animals in revegetation/regeneration areas – Feral animal control works are completed, in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Feral animal activity as determined by field cameras was higher in 2025, based on number of days feral species were recorded. Evidence of fox and cat was high in 2025, whilst damage by feral pigs was widespread in 2025.
3	Confirmation of mapping of areas for regeneration, including appropriateness of target community – Completed prior to commencing 2020-2023 revegetation works.	Yes	Completed prior to revegetation.
4	Management of regeneration progress is responsive to monitoring outcomes – Monitoring of regeneration areas occurs. Management actions are implemented in response to monitoring.	Yes	Monitoring is completed annually and identifies required management actions.
5	Review the need for assisted generation where outcomes of natural regeneration is deemed lacking – 20 hectares of revegetation as per GSS (2017). Continue to monitor progress of natural regeneration and need for management intervention.	Yes	All assessed areas are regenerating naturally, as shown in annual monitoring. Inspections in 2025 revealed minimal areas suitable for additional infill planting.
6	Slaty Red Gum (<i>Eucalyptus glaucina</i>) – Stands of slaty red gum (<i>Eucalyptus glaucina</i>) are in good condition and natural recruitment of seedlings is evident.	Yes	Slaty Red Gum distribution has been previously mapped and is monitored annually. New recruitment has stabilised in concert with seasonal rainfall and grazing pressures.

Number	Performance Indicator	Progress	Comments
7	Develop detailed performance criteria for all management zone types – Detailed criteria developed based on annual monitoring of analogue sites (including target species diversities, coverage and abundance for different strata).	No	Yet to be developed, however, 9 years of baseline data is available for this.
8	Native flora species diversity – key indicator species present for target vegetation community.	Yes	All assessed areas support key indicator species of target communities.
9	Native flora species coverage – Native flora coverage is higher than introduced coverage in all strata.	Yes	Coverage of exotic species is <30% for all assessed areas.
10	Native canopy species abundance – Native canopy species present.	Yes	All assessed areas support native canopy species.
11	Formation of distinct vegetation strata – Native species are present that are capable of forming the strata of the target vegetation community.	Yes	All assessed areas support native species from canopy, shrub and ground, but this is limited in Grassland.
12	Log coverage – Treed vegetation is increasing in DBH from previous monitoring year.	Yes	There is an increasing trend in DBH across most transects, particularly in the smaller classes.
13	Implement revegetation program – Implementation of plan.	Yes	Revegetation commenced in 2018, monitored annually since 2018.
14	Positive feedback loop from monitoring results – Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Yes	Recommendations from monitoring are adopted in ongoing management.
15	Native fauna presence in rehabilitation/regeneration areas – Fauna monitoring completed. Native fauna utilising habitats present.	Yes	Monitoring of bird species in 2025 revealed increased diversity & abundance at 2 revegetation sites. Other revegetation sites were comparable to previous monitoring years.
16	Collate data on actions implemented and results of inspections and monitoring into the AR – AR completed annually.	Yes	Monitoring results reported annually.

Number	Performance Indicator	Progress	Comments
17	Weed inspections of remnant areas – Annual inspections are undertaken of vegetation to identify areas of weed infestation. Subsequent weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Yes	The <i>Operational Weed Management Action Plan 2024-2028</i> directs weed control activities, which are undertaken by a qualified contractor.

Table C.2 Condran BOA

Number	Performance Indicator	Progress	Comments
1	Control of weeds in revegetation / regeneration areas – Weed control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Spot control of problem weeds is undertaken as required, focusing on high priority species Coolatai Grass and Whisky Grass.
2	Control of feral animals in revegetation/regeneration areas – Feral animal control works are completed, in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Feral animal activity is considered low across Condran BOA. Baiting for feral predators is undertaken annually. Monitoring by cameras successful in detecting their presence and likely abundance.
3	Confirmation of mapping of areas for regeneration, including appropriateness of target community – Completed prior to commencing 2020–2023 revegetation works.	Yes	Completed prior to revegetation.
4	Management of regeneration progress is responsive to monitoring outcomes – Monitoring of regeneration areas occurs. Management actions are implemented in response to monitoring.	Yes	Monitoring is completed annually and identifies required management actions.
5	Review need for assisted regeneration where outcomes of natural regeneration is deemed lacking – Natural regeneration.	Yes	All assessed areas are regenerating naturally, as shown in annual monitoring.
6	Develop detailed performance criteria for all management zone types – Detailed criteria developed based on annual monitoring of analogue sites (including target species diversities, coverage and abundance for different strata).	No	Yet to be developed, however 12 years of baseline data available for this. Performance criteria for threatened fauna include annual detection.

Number	Performance Indicator	Progress	Comments
7	Native flora species diversity – Key indicator species present for target vegetation community.	Yes	All assessed areas support key indicator species of target communities.
8	Native flora species coverage – Native flora coverage is higher than introduced coverage in all strata.	Yes	Coverage of exotic species is <30% for all assessed areas.
9	Native canopy species abundance – Native canopy species present.	Yes	All assessed areas support native canopy species, although limited in grassland areas.
10	Formation of distinct vegetation strata – Native species are present that are capable of forming the strata of the target vegetation community.	Yes	All assessed areas support native species from canopy, shrub and ground, but this is limited in Grassland communities.
11	Log coverage – Treed vegetation is increasing in DBH from previous monitoring year.	Yes	There is an increasing trend in DBH across most transects, particularly in the smaller classes.
12	Implement revegetation program – Implementation of plan.	Yes	Revegetation commenced in 2016, monitored annually since 2018.
13	Positive feedback loop from monitoring results – Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Yes	Recommendations from monitoring are adopted in ongoing management.
14	Native fauna presence in rehabilitation/regeneration areas – Fauna monitoring completed. Native fauna utilising habitats present.	Yes	Annual monitoring since 2013 has recorded total of 95 bird species, 11 native non-flying mammals, 17 bat species, 12 reptiles and 10 amphibians present.
15	Collate data on actions implemented and results of inspections and monitoring into the AR – AR completed annually.	Yes	Monitoring results reported annually.
16	Weed inspections of remnant areas – Annual inspections are undertaken of vegetation to identify areas of weed infestation. Subsequent weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Yes	The <i>Operational Weed Management Action Plan 2024-2028</i> directs weed control activities, which are undertaken by a qualified contractor.

Table C.3 Wollombi Brook BOA

Number	Performance Indicator	Progress	Comments
1	Control of weeds in revegetation/regeneration areas – Weed control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Spot control of problem weeds is undertaken as required, focusing on high/medium priority species (Table 3.2 in BOMP). However, <i>Eragrostis curvula</i> and <i>Heliotrope amplexicaule</i> require increased control.
2	Control of feral animals in revegetation / regeneration areas – Feral animal control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Feral animal activity in 2025 was considered low based on field camera monitoring. The fox and cat were recorded less than 5 of 107 monitoring nights. Pig activity was widespread across the offset. Ongoing control measures by trapping and baiting continue to occur.
3	Management of Bulloak regeneration – Bulloak regeneration is actively managed to improve condition of existing Warkworth Sands Woodland EEC variants and ensure it does not inhibit successful regeneration of this community.	Yes	Thinning trials have been underway since 2016 to monitor and assess impacts.
4	Confirmation of mapping of areas for regeneration, including appropriateness of target community – Completed prior to commencing 2020-2023 revegetation works.	Yes	Completed prior to revegetation.
5	Management of regeneration progress is responsive to monitoring outcomes – Monitoring of regeneration areas occurs. Management actions are implemented in response to monitoring.	Yes	Monitoring is completed annually and identifies required management actions.
6	Review need for assisted regeneration where outcomes of natural regeneration is deemed lacking – Continue to monitor progress of natural regeneration and need for management intervention.	Yes	All assessed areas are regenerating naturally, as shown in annual monitoring.
7	Develop detailed performance criteria for all management zone types – Detailed criteria developed based on annual monitoring of analogue sites (including	No	Yet to be developed, however 11 years of baseline data is available for this.

Number	Performance Indicator	Progress	Comments
	target species diversities, coverage and abundance for different strata).		
8	Native flora species diversity – key indicator species present for target vegetation community.	Yes	All assessed areas support key indicator species of target communities.
9	Native flora species coverage – Native flora coverage is higher than introduced coverage in all strata.	Yes	Coverage of exotic species is <20% for all assessed areas.
10	Native canopy species abundance – Native canopy species present.	Yes	All assessed areas support native canopy species.
11	Formation of distinct vegetation strata – Native species are present that are capable of forming the strata of the target vegetation community.	Yes	All assessed areas support native species from canopy, shrub and ground, but this is limited in Grassland communities.
12	Log coverage – Treed vegetation is increasing in DBH from previous monitoring year.	Yes	There is an increasing trend in DBH across most transects, particularly in the smaller classes.
13	Implement revegetation program – Implementation of plan.	Yes	Revegetation commenced in 2019, monitored annually since then.
14	Positive feedback loop from monitoring results – Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Yes	Recommendations from monitoring are adopted in ongoing management.
15	Native fauna presence in rehabilitation/regeneration areas – Fauna monitoring completed. Native fauna utilising habitats present.	Yes	Monitoring in 2025 recorded 41 birds, 6 native terrestrial and arboreal mammals, 12 microbats, 2 reptiles and 4 frog species present. Bird species diversity scores for regeneration sites matched remnant woodland sites in 2025.
16	Collate data on actions implemented and results of inspections and monitoring into the AR – AR completed annually.	Yes	Monitoring results reported annually.
17	Weed inspections of remnant areas – Annual inspections are undertaken of vegetation to identify areas of weed infestation. Subsequent weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Yes	The <i>Operational Weed Management Action Plan 2024-2028</i> directs weed control activities, which are undertaken by a qualified contractor.

Table C.4 Reedy Valley BOA

Number	Performance Indicator	Progress	Comments
1	Control of weeds in revegetation/ regeneration areas – Weed control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Control of problem weeds is undertaken as required, focusing on high priority species (Table 3.2 in BOMP). However, effective weed control has been constrained in the recent past by access issues during wet weather.
2	Control of feral animals in revegetation/ regeneration areas - Feral animal control works are completed, in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Historically, there has been significant evidence of pest animal species at Reedy Valley BOA, with large numbers of Goat, Pig and Deer present. In 2025, these three species were abundant, and cattle and sheep were also present at low abundance. Ground shooting, 1080 baiting and trapping occurred within revegetation areas in 2025. Aerial shooting was scheduled for work in 2025 but delayed until early 2026.
3	Confirmation of mapping of areas for regeneration, including appropriateness of target community - Completed prior to commencing 2020-2023 revegetation works; (from 2022) to be revised in ongoing monitoring works.	Yes	Completed prior to revegetation.
4	Management of regeneration progress is responsive to monitoring outcomes – Monitoring of regeneration areas occurs. Management actions are implemented in response to monitoring.	Yes	Completed prior to revegetation.
5	Review need for assisted regeneration where outcomes of natural regeneration is deemed lacking – Assess progress/ outcomes of natural regeneration and assess need to implement assisted regeneration measures.	Yes	All assessed areas are regenerating naturally, as shown in annual monitoring. Some areas (grasslands) will require additional infill planting.
6	Develop detailed performance criteria for all management zone types - Detailed criteria updated based on annual monitoring of analogue sites.	No	Yet to be developed, however ~9-11 years of baseline data is available for this.

Number	Performance Indicator	Progress	Comments
7	Native flora species diversity – All key indicator species present. Vegetation comprises a native diversity within 60% of target vegetation as defined by relevant PCT. At least 50% of the native flora species are recognised as occurring in the target vegetation community (either based on PCT benchmarks or reference vegetation)	No	All assessed areas support key indicator species of target communities. However, not all transects comprise native species diversity within 60% according to benchmark.
8	Native flora species coverage - Native flora coverage is higher than introduced coverage in all strata.	Yes	Coverage of exotic species is <35% for all assessed areas.
9	Native canopy species abundance - Native canopy species present. Supplementary planting or thinning undertaken if density varies >40% of target vegetation community.	Yes	All assessed woodland areas support native canopy species. No planting or thinning yet undertaken.
10	Formation of distinct vegetation strata – Different strata are starting to distinguish.	Yes	All assessed areas support native species from canopy, shrub and ground, but this is limited in Grassland communities.
11	Log coverage - Treed vegetation is increasing in DBH from previous monitoring year.	Yes	There is an increasing trend in log coverage across most transects, but this is slow and dependent on tree death.
12	Implement revegetation program – Implementation of plan. Learnings from previous revegetation works implemented.	Yes	New revegetation commenced in 2023 and 2024; however, dry conditions in combination with grazing by feral animals has led to the death of many of these new plantings. Consideration could be given to securely fencing off planting areas until trees are of a size more resistant to grazing.
13	Positive feedback loop from monitoring results – Feedback from monitoring is incorporated into ongoing review and improvement of plan	Yes	Recommendations from monitoring are adopted in ongoing management.

Number	Performance Indicator	Progress	Comments
14	Native fauna presence in rehabilitation/ regeneration areas - Fauna monitoring completed. Native fauna utilising habitats present	Yes	Monitoring in 2025 showed that birds, mammals and reptiles are utilising regenerating areas. Diversity scores for birds reveal improved results in 2025, but yet to reach performance target scores for remnant woodland.
15	Collate data on actions implemented and results of inspections and monitoring into the AR – AR completed annually.	Yes	Monitoring results reported annually.
16	Weed inspections of remnant areas – Annual inspections are undertaken of vegetation to identify areas of weed infestation. Subsequent weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Yes	The <i>Operational Weed Management Action Plan 2024-2028</i> directs weed control activities, which are undertaken by a qualified contractor.

Table C.5 Vere BOA

Number	Performance Indicator	Progress	Comments
1	Control of weeds in revegetation/ regeneration areas – Weed control works are completed in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Intense program of weed control undertaken in recent years, focusing on high priority species.
2	Control of feral animals in revegetation/ regeneration areas - Feral animal control works are completed, in accordance with this BOMP and actions recommended from monitoring recommendations.	Yes	Feral animal activity as determined by field cameras. In 2025 6 pest species were detected in moderate numbers. Damage by feral pigs was evident in parts in 2025.
3	Confirmation of mapping of areas for regeneration, including appropriateness of target community - Revised in ongoing monitoring works.	Yes	Completed prior to revegetation.
4	Management of regeneration progress is responsive to monitoring outcomes – Monitoring of regeneration areas occurs. Management actions are implemented in response to monitoring.	Yes	Monitoring is completed annually and identifies required management actions.

Number	Performance Indicator	Progress	Comments
5	Review need for assisted regeneration where outcomes of natural regeneration is deemed lacking – Maintenance in revegetation areas in response to monitoring outcomes.	Yes	Natural regeneration is occurring in monitored areas.
6	Develop detailed performance criteria for all management zone types - Detailed criteria updated based on annual monitoring of analogue sites.	No	Yet to be developed.
7	Native flora species diversity – All key indicator species present. Vegetation comprises a native diversity within 40% of target vegetation as defined by relevant PCT. At least 80% of the native flora species are recognised as occurring in the target vegetation community (either based on PCT benchmarks or reference vegetation)	Yes	Not assessed in 2025, but previous assessments show areas support key indicator species of target communities.
8	Native flora species coverage - Native flora coverage is within 35% of that of target vegetation.	Yes	Not assessed in 2025, but previous assessments show coverage of exotic species is low.
9	Native canopy species abundance - Native canopy species present. Supplementary planting or thinning undertaken if density varies >30% of target vegetation community.	Yes	Not assessed in 2025, but previous assessments show most assessed areas support native canopy species, with the exception of some Zone 3 and Zone 4 grassland sites.
10	Formation of distinct vegetation strata – Different strata are readily defined.	Yes	Not assessed in 2025, but previous assessments show most assessed areas support native species from canopy, shrub and ground layers, with the exception of some Zone 3 and Zone 4 grassland sites.
11	Log coverage - Treed vegetation is increasing in DBH from previous monitoring year.	Yes	Not assessed in 2025, but previous assessments show increasing DBH from baseline (2018/19) data.
12	Implement revegetation program – Implementation of plan. Learnings from previous revegetation works implemented.	No	Active revegetation is not required until Year 2 of the BSA agreement; seed collection is currently occurring in readiness (July 2024-July 2025).

Number	Performance Indicator	Progress	Comments
13	Positive feedback loop from monitoring results – Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Yes	Recommendations from monitoring are adopted in ongoing management.
14	Native fauna presence in rehabilitation/ regeneration areas - Fauna monitoring completed. Native fauna utilising habitats present. Presence of some niche specialists. Native amphibian, reptile, bird and mammal species present.	Yes	Monitoring of bird species in 2025 reveal lower diversity / abundance in DNG vs remnant woodland and revegetation sites. The Revegetation sites recorded highest average scores to DNG and Remnant sites.
15	Collate data on actions implemented and results of inspections and monitoring into the AR – AR completed annually.	Yes	Monitoring results reported annually.
16	Weed inspections of remnant areas – Annual inspections are undertaken of vegetation to identify areas of weed infestation. Subsequent weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Yes	The <i>Vere Operational Weed Management Action Plan 2024–2028</i> directs weed control activities, which are undertaken by a qualified contractor.

Appendix D

Bulga Coal 2025 Groundwater and Surface Water Annual Review (Umwelt, 2026)



Bulga Annual Review Report

Groundwater and Surface Water

Final

March 2026

Bulga Annual Review Report

Groundwater and Surface Water

Final

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Bulga Coal

Project Director: K Cooksey
Project Manager: M Swann
Report No.: 31602 / R02
Date: March 2026



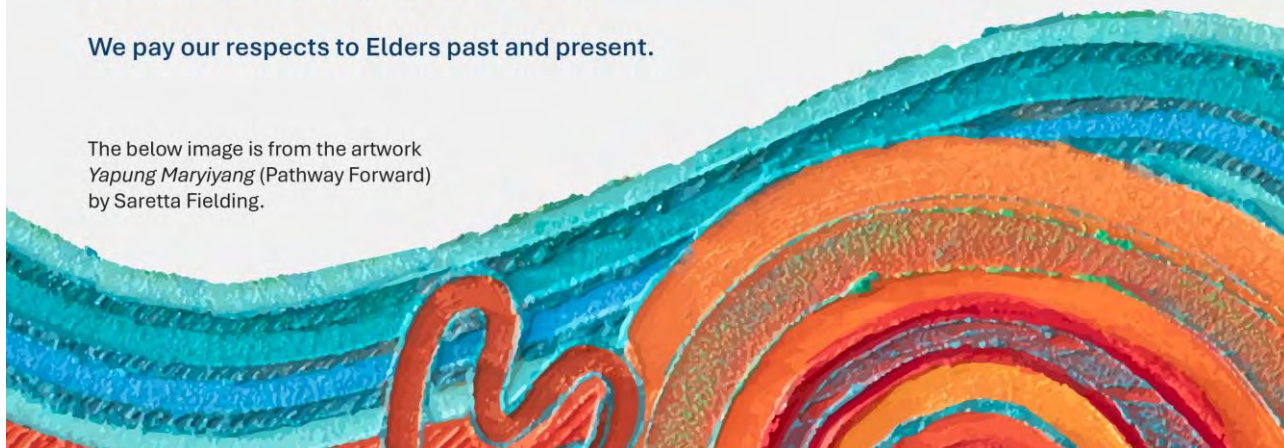
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Acknowledgement of Country

Umwelt acknowledges the Traditional Owners of Country throughout Australia and their continuing values, culture and connection to the land, waters and sky.

We pay our respects to Elders past and present.

The below image is from the artwork *Yapung Maryiyang* (Pathway Forward) by Saretta Fielding.



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1.0 Introduction

Bulga Coal Management Pty Ltd (Bulga Coal) operates the Bulga Coal Complex (BCC) on behalf of the Bulga Joint Venture, with Glencore as the majority shareholder. The complex is located 12 km south-west of Singleton, NSW. The complex consists of Bulga Open Cut (BOC) and Bulga Underground Operations (BUO), Coal Handling and Preparation Plant (CHPP) and rail loading facility.

BOC are approved under the Bulga Optimisation Project (BOP) (DA SSD-4960), and BUO operate under a separate development consent (DA 376-8-2003). In May 2018, BUO ceased mining and the mine was sealed in July 2018.

Umwelt has been engaged to undertake the annual review of the surface water and groundwater monitoring data collected during the reporting period (1 January to 31 December 2025). This report presents a summary of the surface water and groundwater data collected, discussion on observed trends, and recommendations (where relevant). This report has been developed in accordance with the approval conditions and requirements outlined within the Bulga Coal Water Management Plan (WMP) (BULCX-2103827161-4402, V4) (Bulga Coal, 2021).

The WMP (Bulga Coal, 2021) dated 15 October 2021 covers commitments for all site approvals, including:

- DA 376-8-2003 (Schedule 4, Conditions 15 and 16) for BUO.
- DA SSD-4960 (Schedule 3, Condition 28) for BOC.
- *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* approval 2012/6637.
- Conditions of Environment Protection Licence (EPL) 563.

This includes requirements for the monitoring of groundwater, surface water, assessment of potential impacts and reporting.

2.0 Bulga Coal Complex

Underground mining at Bulga started in 1994 with longwall extraction from the Whybrow and Blakefield seams. Underground mining ceased in May 2018 and the mine was completely sealed in July 2018, including all accesses and ventilation shafts (Umwelt, 2022).

During 2025, no mining activities were undertaken in the underground mine, other than the operation of gas drainage infrastructure to support BOC. Active mining was undertaken in BOC with mining continuing in East Pit and West Pit with mining continuing in a southerly direction.

Overburden was placed on the Eastern Emplacement Area and Southern Extension Dump. In-pit dumping took place in West Pit and East Pit. Truck/ shovel and excavators were used to strip overburden. Whilst, hydraulic excavators and trucks were used to mine the coal, which was transported to the Run of Mine (ROM) coal hopper via an overpass on Broke Road using dump trucks.

In addition, drilling of the Piercefield Surface to Inseam (SIS) depressurisation wells was completed in April 2025 in order to depressurise the seams which have higher in-situ gas pressures. This was to allow continuing safe mining operations in BOC. The wells flowed gas and water to the infrastructure system on 1 July 2025, with sufficient flow to run the flares by September 2025.

The mine areas across BCC, and activities undertaken over 2025, are summarised in **Table 2.1** and shown in **Figure 2.1**.

Table 2.1 BCC Activities

Mine Area		Mining	Seam	Activities in 2025
Bulga	South Bulga UG	1994 to 2002	Whybrow	Inactive
	Beltana UG	2003 to 2011	Whybrow	Inactive
	Blakefield UG	2010 to 2018	Blakefield	Inactive
	Bulga Open Cut Mod 3	1982 to 2039	Whybrow to Foybrook Formation	Continuation of mining at West Pit and East Pit

The tailings storage facilities (TSFs) are managed in accordance with the Integrated Water Management Strategy (IWMS) defined in the WMP (Bulga Coal, 2021), including maintaining sufficient water volumes to allow for tailings relocation.

Tailings were dredged from the Deep Pit TSF and relocated to the Northern Tailings Storage Facility (NTSF) throughout 2025 with a total of 2,948 kbcm being relocated. Deep Pit was split into North and South cells due to the exposure of the central barrier. The TSFs across the BCC are summarised in **Table 2.2**.

Table 2.2 BCC Approved Tailing Storage Facilities Summary

Mine Area	Location	Status
Deep Pit	South-east mine area	Tailings relocated to the NTSF. Deep Pit split into North and South.
Bayswater Tailings Void	South-east mine area	Zero operational capacity remaining.
Northern Tailings Storage Facility (NTSF)	North-west mine area	Tailings from CHPP and relocated from Deep Pit.

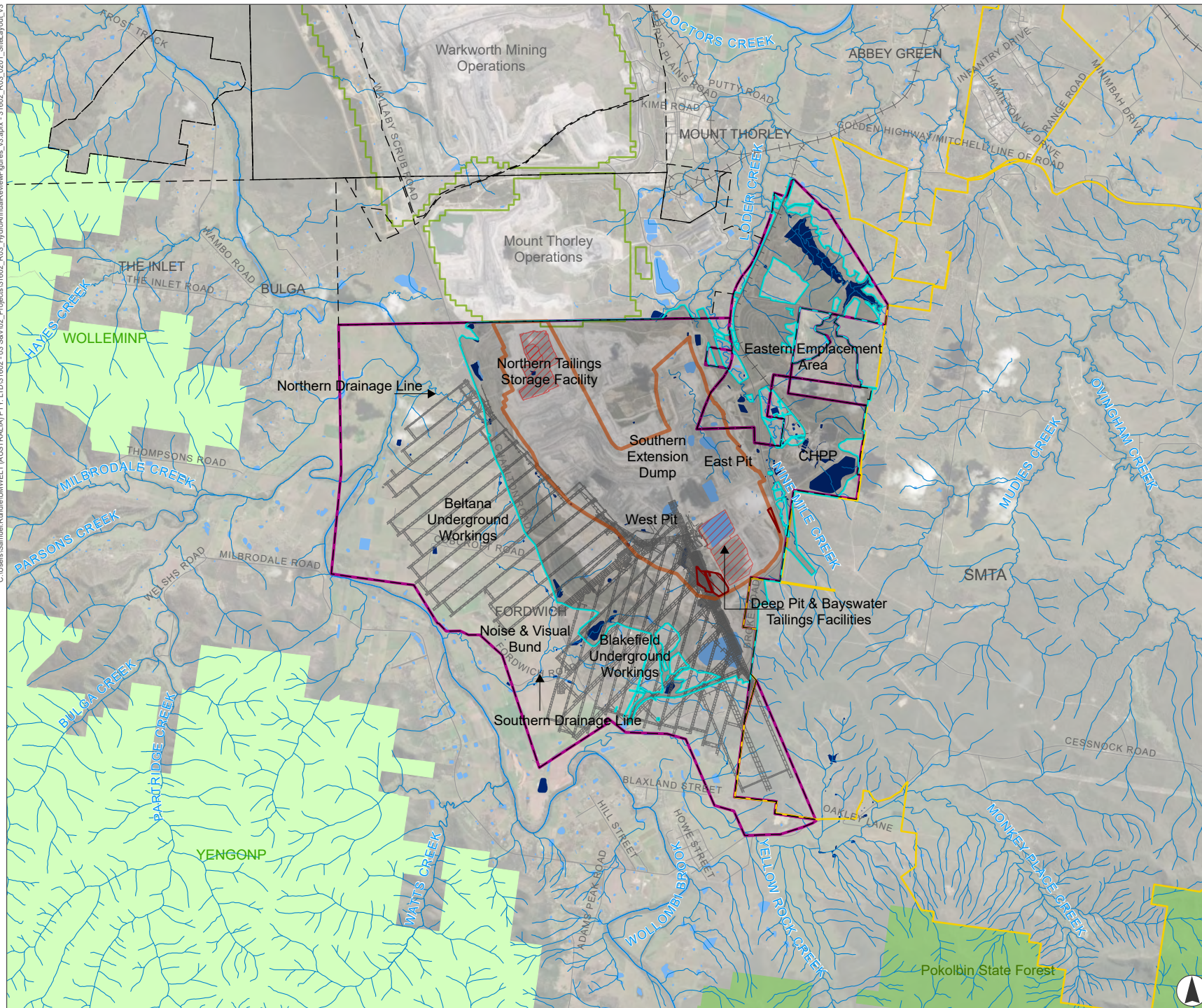


FIGURE 2.1
Site Layout

Legend

- Lease Boundary
- Mining Leases
- Approved Disturbance Extent
- Additional Disturbance Area
- BOP Approved Mining Area
- In-pit Tailings Emplacement
- Singleton Military Training Area
- Existing/Approved Mining Operations
- Existing Underground Workings
- Dams
- NSW State Forest
- National Parks (NPWS Estate)
- Waterbody
- Watercourses
- Rail Line
- Road



Kilometres

Scale 1:100,000 at A4
GDA 1994 MGA Zone 56



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APPROVED FOR AND ON BEHALF OF Umwelt

2.1 Existing Impact Predictions

The Statement of Environmental Effects prepared for the Bulga Optimisation Project Modification 3 included a groundwater impact assessment (GIA) completed by KCB (2019) and surface water impact assessment (SWIA) completed by Engeny (2019). The predicted changes in surface water and groundwater conditions associated with open cut mining included:

- Minimal changes to stream baseflow between the approved and proposed scenarios.
- Strong drainage effect towards the main pit void in both scenarios.
- No additional drawdown in the Permian formations directly below the Warkworth Sands and, therefore, no additional impacts to the woodland vegetation communities associated with the sands due to the proposed modification.
- Additional impacts to the Wollombi Creek Alluvial Water Source (including nearby private, registered water bores) would not cause exceedances under the NSW Aquifer Interference Policy Minimal Impact Considerations.
- An increase in the heads in the in-pit spoil dumps up to 80 mAHD would occur in the northern part of the mine. However, the heads would remain below the existing ground level. This increase results in the development of a predicted hydraulic gradient towards the Mount Thorley mine to the north. Despite the gradient development, flow rates are not predicted to exceed 1 L/s.

2.2 Groundwater and Surface Water Approval Conditions

In accordance with the development consent approval conditions, Bulga Coal are required to prepare and implement a WMP to the satisfaction of the Secretary. **Table 2.3** and **Table 2.4** present a summary of the relevant surface water and groundwater conditions, from the development consent and WMP. **Table 2.3** and **Table 2.4** identify where the conditions relating to routine groundwater monitoring for 2025 have been addressed.

Surface water and groundwater monitoring is conducted in accordance with the WMP Section 8 and Section 9, respectively. The programme outlines monitoring frequency, parameters to be tested and triggers. This annual review is based on the monitoring and reporting requirements documented within the Version 4 (October 2021) of the WMP. Further discussion on the groundwater and surface water monitoring programme and triggers is included in **Section 4.0** and **Section 6.0**, respectively.

Table 2.3 Surface Water Conditions Addressed Within the WMP

Approval Condition	Condition	Where Addressed
Sch. 4, Cond. 15 (DA 376-8-2003)	The Surface Water Monitoring Program must include:	
	• detailed baseline data on surface water flows and quality in the Wollombi Brook and Loder Creek;	See WMP
	• surface water impact assessment criteria;	See WMP and refer to Section 6.0
	• a program to monitor surface water flows and quality in the Wollombi Brook and Loder Creek; and	See WMP and refer to Section 6.0
	• a program to monitor the effectiveness of the Erosion and Sediment Control Plan.	See WMP

Approval Condition	Condition	Where Addressed
Sch. 3, Cond. 28 (c)(ii) (DA SSD-4960)	Surface Water Management Plan, that includes:	
	detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development;	See WMP
	- a detailed description of the water management system on site, including the: - clean water diversion systems; - erosion and sediment controls and works (mine water system); - dredging, extraction, reprocessing and redistribution of coal reject materials; and - mine water management systems including irrigation areas;	See WMP
	- detailed plans, including design objectives and performance criteria, for: - design and management of final voids; - design and management for the handling, transfer, emplacement and capping of coal reject materials; - reinstatement of drainage lines on the rehabilitated areas of the site; and - control of any potential water pollution from the rehabilitated areas of the site;	See WMP
	- performance criteria for the following, including trigger levels for investigating any potentially adverse impacts (or trends) associated with the development: - mine water management system; - surface water quality of Loder Creek and Wollombi Brook; - channel stability, stream and riparian vegetation health of Loder Creek and Wollombi Brook; and - post-mining water pollution from rehabilitated areas of the site;	See WMP Refer to Section 6.0 for water quality of Loder Creek and Wollombi Brook.
	- a program to monitor and report on: - the effectiveness of the mine water management system; and - surface water flows and quality, stream and riparian vegetation health in Loder Creek and Wollombi Brook potentially affected by the development;	See WMP
	a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the development; and	See WMP
Cond. 4 (b) (Section 130(1) and 133 of the EPBC Act 1999 approval 2012/6637)	Surface water monitoring programs to monitor the success of the management actions in the WMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on water resources. Management actions, mitigation measures and practices prescribed by the plan must be clear, measurable, auditable and time bound.	See WMP

Table 2.4 Groundwater Water Conditions Addressed Within WMP

Approval Condition	Condition	Where Addressed
Sch. 4, Cond. 16 (DA 376-8-2003)	The Groundwater Monitoring Program must include:	
	detailed baseline data on groundwater levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;	See WMP
	groundwater impact assessment criteria;	Refer to Section 4.0.
	a program to monitor the volume and quality of ground water seeping into the underground mine workings; and	See WMP
Sch. 3, Cond. 28 (c)(iii) (DA SSD-4960)	Groundwater Management Plan, which includes:	
	detailed baseline data on groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the development;	See WMP
	groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	Refer to Section 4.3.
	- a program to monitor and report on: - groundwater inflows to the open cut pits; - the seepage/leachate from water storages, tailings storage areas, emplacements, backfilled voids, and final voids; - the impacts of the development on: - regional and local (including alluvial) aquifers; - groundwater supply of potentially affected landowners; and - groundwater dependent ecosystems (GDEs) and riparian vegetation; and - base flows to Wollombi Brook;	See WMP and refer to Section 4.0 and Section 5.0
	a program to validate the groundwater model for the development, including an independent review of the model with every independent environmental audit, and compare the monitoring results with modelled predictions; and	See WMP and refer to Section 4.4
	a plan to respond to any exceedances of the groundwater assessment criteria.	See WMP and refer to Section 5.7 and Section 8.2
Cond. 4 (b) (Section 130(1) and 133 of the EPBC Act 1999 approval 2012/6637)	Groundwater monitoring programs to monitor the success of the management actions in the WMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on water resources. Management actions, mitigation measures and practices prescribed by the plan must be clear, measurable, auditable and time bound.	See WMP and refer to Section 4.0

2.3 Water Licensing

2.3.1 Surface Water

Bulga Coal has access to 865 ML of the Hunter River high security allocation through the Mt Thorley Water Supply Scheme (WAL 10543). In addition, Bulga Coal has a surface works approval (20WA211078) for the clean water diversion around the Surge Dam (Bulga Coal, 2021).

2.3.2 Groundwater

Under the *Water Act 1912* and *Water Management Act 2000*, sufficient water access licences (WAL) are required for approval of the mine developments. Bulga Coal holds sufficient licences for direct and indirect take associated with approved operations.

Bulga Coal holds 2,365 ML of hard rock WAL allocation from the Sydney Basin-North Coal Groundwater Source which covers take (flow) from the Permian coal measures to the Open Cut and Underground workings (Bulga Coal, 2021). In addition, Bulga Coal also holds 300 ML of Lower Wollombi Brook water source aquifer WAL to cover potential leakage from the alluvial aquifer to the underlying Permian aquifer in response to depressurisation (Bulga Coal, 2021). Groundwater take licenses held by Bulga Coal are outlined in **Table 2.5**. Bulga Coal also holds groundwater licences for monitoring bores as summarised in **Table 2.6**.

Table 2.5 Groundwater Take Licences Held by Bulga Coal

Licensed Number	Description	Water Source	Water Sharing Plan	Approved Extraction (ML)
WAL41687	Mining	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Source	500
WAL41546	Mining	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Source	365
WAL41543	Mining	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Source	500
WAL41544	Mining	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Source	500
WAL41545	Mining	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Source	500
WAL36221	Mining: Wollombi Brook Aquifer leakage to Permian coal measures	Lower Wollombi Brook Water Source	Hunter Unregulated and Alluvial Water Sources	300

Table 2.6 Groundwater Bore Licences Held by Bulga Coal

Licence Number	Description
20BL166867	Monitoring (mining bore): GW1 – GW10. Total of 16 bores for monitoring purposes.
20BL167776	Monitoring: P1 – P3, P4A, P4B, P5 – P8 and V3. Licence for total of 9 bores for monitoring purposes.
20BL169204	Monitoring: V1, V2, F1 and F2.
20BL169246	Monitoring: Bore – ACARP Project.
20BL167777	Monitoring: Bore – ACARP Project.
20BL172659	Monitoring: WBR180 and WBR181.
20BL172660	Monitoring: WBR182 and WBR183.
20BL173014	Monitoring: SBD194, SBD196.
20BL173617	Monitoring: Lot 61/755264.
20BL173618	Monitoring: Lot 34/755264.
20BL173619	Monitoring: Lot 33/755264.
20BL173620	Monitoring: Lot 23/755264.
20BL173621	Monitoring: Lot 24/755264.
20BL173640	Monitoring Bore – 25//755264.
20BL173657	Monitoring Bore – 22//755264.
20BL173708	Monitoring Bore – 11//730762.

3.0 Environmental Setting

3.1 Climate

The climate within the Bulga area is sub-tropical, with temperatures, rainfall and evaporation highest over the summer months.

Daily rainfall data is collected at the Bulga Complex Weather Station. **Table 3.1** presents the site monthly site rainfall data for 2025, with an average annual rainfall of 735.8 mm. Based on the site data, rainfall over 2025 was above average with 812.0 mm recorded.

The rainfall data from the Bureau of Meteorology (BoM) site 061100 (Broke) was obtained for the period 01/01/2010 to 31/12/2025. Site 061100 is located approximately 3.5 km south of the BCC weather station. A summary of rainfall data for BoM site 061100 is presented in **Table 3.1**. Based on the BoM 061100 dataset, the average annual rainfall between 2010 and 2025 was 672.6 mm. Rainfall over 2025 was below average, with 563.0 mm recorded. However, it is noted that in some months between 2010 and 2025, BoM 061100 did not record any data.

The data for the BoM site has been used in previous annual reviews; however, the data from SILO is the most similar to the site dataset and has a continuous data record. The SILO dataset has been used for comparison to groundwater levels recorded at BCC in this report.

Climate data was also obtained from the Scientific Information for Land Owners (SILO) database of historical climate records for Australia hosted by the Department of Environment and Science (DES). This service interpolates raw rainfall and evaporation records obtained from the BoM, with data gaps addressed through data processing in order to provide a spatially and temporally complete climate dataset. Climate data was obtained for SILO grid point (Latitude -32.65, Longitude 151.00) at Bulga between 01/01/1900 and 31/12/2025. A summary of rainfall data for SILO is presented in **Table 3.1**.

The SILO rainfall data indicate that overall rainfall was above average; however, only February, April, May, June, and August recorded above-average rainfall. In March, April, May, and August, rainfall was significantly higher than the historical average. Based on the SILO dataset, the average annual rainfall was 642.1 mm (1900-2025). Rainfall in 2025 was above average, with 790.0 mm recorded from January to December.

Table 3.1 Monthly Rainfall (mm)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Site Historical Average	75.6	75.3	113.1	52.6	37.9	50.4	40.7	36.9	42.6	60.1	72.4	78.3	735.8
Site 2025	65.5	79.5	110.5	86.5	112.5	13.5	29.5	120.0	63.0	26.5	24.5	80.5	812.0
SILO Historical Average	74.5	72.5	68.5	46.3	39.0	45.8	40.1	34.5	40.4	50.1	62.3	68.0	642.1
SILO 2025	68.3	50.1	133.6	75.0	106.5	20.0	44.9	114.0	69.3	39.7	27.6	41.0	790.0
BoM 061100 Historical Average (2010-2025)	68.5	82.5	124.0	54.9	38.8	50.8	45.0	27.5	31.0	43.0	59.0	47.6	672.6
BoM 061100 2025	61.0	48.0	89.0	88.0	99.0	6.0	36.0	21.0	41.0	21.0	26.0	27.0	563.0

Long term climate trends in the SILO rainfall data are displayed using a cumulative rainfall departure (CRD) rainfall plot in **Figure 3.1**. The CRD is calculated based on all long-term data (from 1900 to 2025), with the graph focused on trends since 2000. The CRD graphically shows trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions. The area generally experienced above average rainfall from 2007 to the end of 2016 followed by below average rainfall until the end of 2020. Above average rainfall was recorded from January 2020 to December 2022 followed by generally average rainfall since 2022, with slightly above average rainfall over 2025.

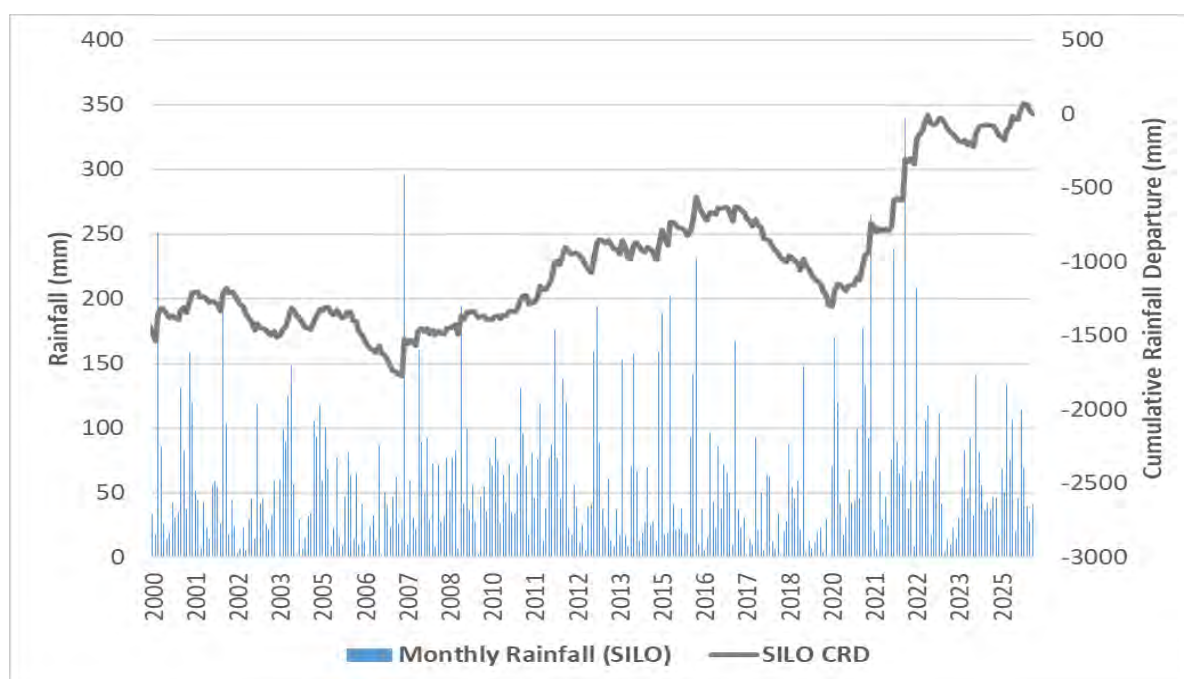


Figure 3.1 SILO Cumulative Rainfall Departure and Monthly Rainfall

3.2 Streamflow

BCC is located within the Wollombi Brook and Loder Creek catchment areas. A gentle topographic high runs through the BCC area from south-east to north-west leading to runoff water in the area surrounding BCC to flow either to the west towards Wollombi Brook or east towards Loder Creek (refer to **Figure 2.1**).

Surface water elevations and discharge volumes are recorded at the WaterNSW Wollombi Brook-Bulga gauge (210028) as shown in **Figure 3.2**. Gauge 210028 is located adjacent to BCC at the Putty Road crossing as shown on **Figure 3.3**.

Figure 3.2 shows that during the reporting period, water levels ranged from 57.14 mAHD to 61.51 mAHD and that discharge ranged from 0.09 ML/day and 2,0361.8 ML/day. The gauge elevation is 56.50 mAHD, therefore, even during periods recorded as no flow, the creek was not completely dry. Stream flows in Wollombi Brook remained relatively stable over 2025 in response to average rainfall with an increase in flow corresponding to the significant rainfall events in May, August, and September 2025.

As discussed further in **Section 6.0**, surface water monitoring is conducted by BCC along Wollombi Brook (LR1, LR5, W2, and W4), Monkey Place Creek (LR2), Nine Mile Creek (NMC1) and Loder Creek (W9 and W10), Southern Drainage Line (SDL1), and Northern Drainage Line (SDL1).

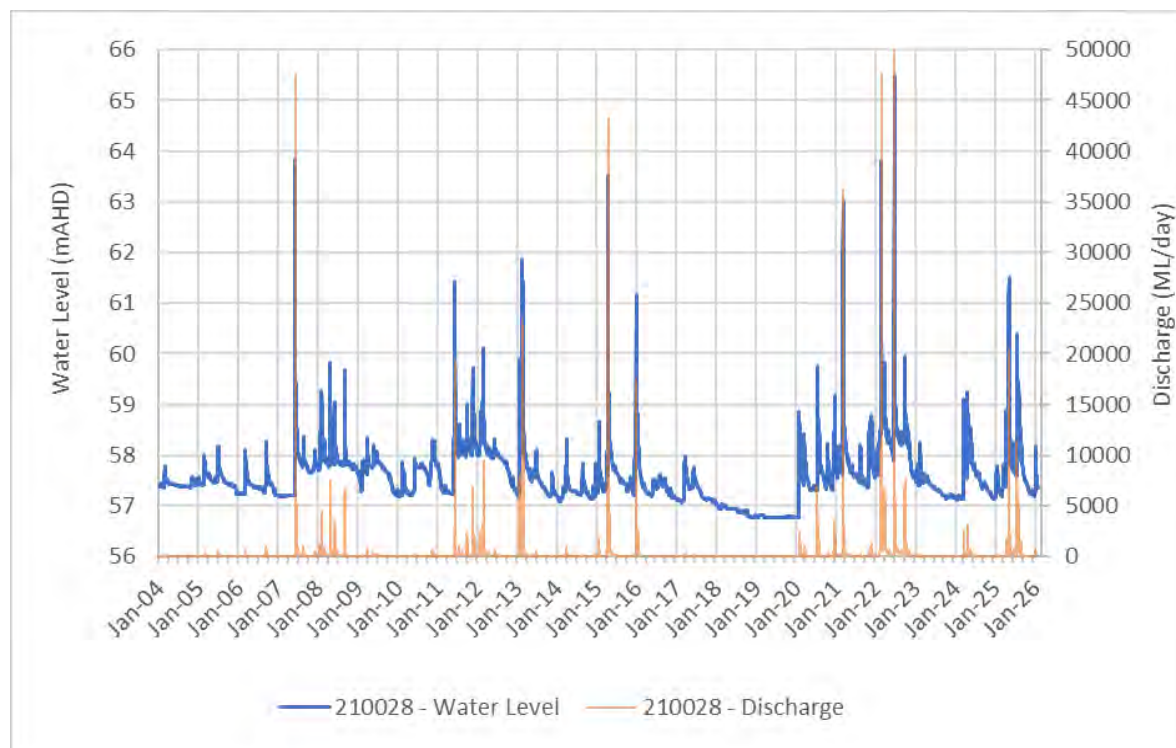


Figure 3.2 Water Levels and Discharge at Wollombi Brook-Bulga Gauge (210028)

3.3 Geology and Hydrogeology

BCC is situated in the Hunter Coalfields which is in the northern area of the Sydney Basin. As shown in **Figure 3.3**, the dominant geology within the mine area is the Permian coal measures. The coal measures are unconformably overlain by Quaternary age alluvium in localised areas along creeks and the Warkworth Sands aeolian dunes in an area to the north-west. Volcanics are also present, intruded through the Permian strata to the west of the BCC. Further details on the main site geology are included in the sections below.

3.3.1 Quaternary Alluvium

Quaternary alluvium is localised in the channels and floodplains of the Hunter River and Wollombi Brook and their tributaries, such as Monkey Place Creek. Monkey Place Creek and Wollombi Brook flow along the southern and western edges of the mine area. The sediments range from 5 m to 15 m in thickness, with a zone of coarse sand or gravel at the base immediately overlying the weathered coal measures. The alluvial aquifers are typically overlain by silty and clayey sands (with some clean sands). Groundwater in the alluvium is unconfined, with recharge from rainfall, streamflow and potential for upward seepage from underlying coal measures. The quality of the groundwater is variable, from fresh to brackish.

3.3.2 Warkworth Sands

The Warkworth Sands are aeolian sand deposits formed from windblown sand originating from Wollombi Brook alluvium and erosion from the nearby Wollemi and Yengo National Parks (Rio Tinto, 2017). The sands overlie low permeability Permian strata. The sand deposits are likely perched aquifers, recharged by rainfall with only minor hydraulic connection to the deeper Permian aquifers. The Warkworth Sands are very limited in extent and form unique ecological communities (KCB, 2019).

3.3.3 Palaeogene Volcanics

Palaeogene volcanics occur to the south-west of the BCC where a basaltic sill caps an elongated and irregularly shaped ridge.

3.3.4 Permian Coal Measures

The Permian coal measures are composed of the Newcastle Coal Measures and the Wittingham Coal Measures. Groundwater occurrence within the Permian coal measures is largely associated with the coal seams and where the stratigraphy is weathered near surface (regolith).

3.3.4.1 Newcastle (formerly Wollombi) Coal Measures

The Newcastle Coal Measures have a north-north-west to south-south-east strike, with a 2° to 5° dip toward the west. They have an overall thickness of around 230 m and were deposited in an alluvial plain environment: upper delta plain, lower delta plain and lagoon (KCB, 2019; DPIRD, 2024). The Alcheringa Seam, which is monitored as part of the groundwater network, forms part of the Newcastle Coal Measures and is a distinctive coal-rich sequence with tuffaceous claystone beds (Geoscience Australia, 2017). The Newcastle Coal Measures are comprised of (KCB, 2019):

- Clast and matrix supported conglomerates.
- Coarse to medium grained, cross bedded sandstones.
- Grey, laminated siltstone with thin coals.
- Variable grade coal with some fracturing and lenticular to massive volcanic tuff.

3.3.4.2 Wittingham Coal Measures

The Wittingham Coal Measures also have a strike north-north-west to south-south-east strike with a 2° to 5° dip. They have an overall thickness of more than 700 m (KCB, 2019). They were laid down in a range of depositional environments: tide/current dominated, river-dominated lower delta plain; wave/current dominated upper and lower delta plain; lower and upper delta plain; marine shelf incursion and delta front (DPIRD, 2024). The Wittingham Coal Measures comprise:

- Quartz-rich to lithic-rich sandstone which are fine to medium grained and with weak bioturbation.
- Dark grey, laminated siltstone with bands of siderite and tuff. Bioturbation increases with depth.
- Polymict, matrix-supported conglomerate. These are mainly associated with sandstone units and have clasts of pebble to cobble size.
- Coal of variable grade; occasionally fractured.

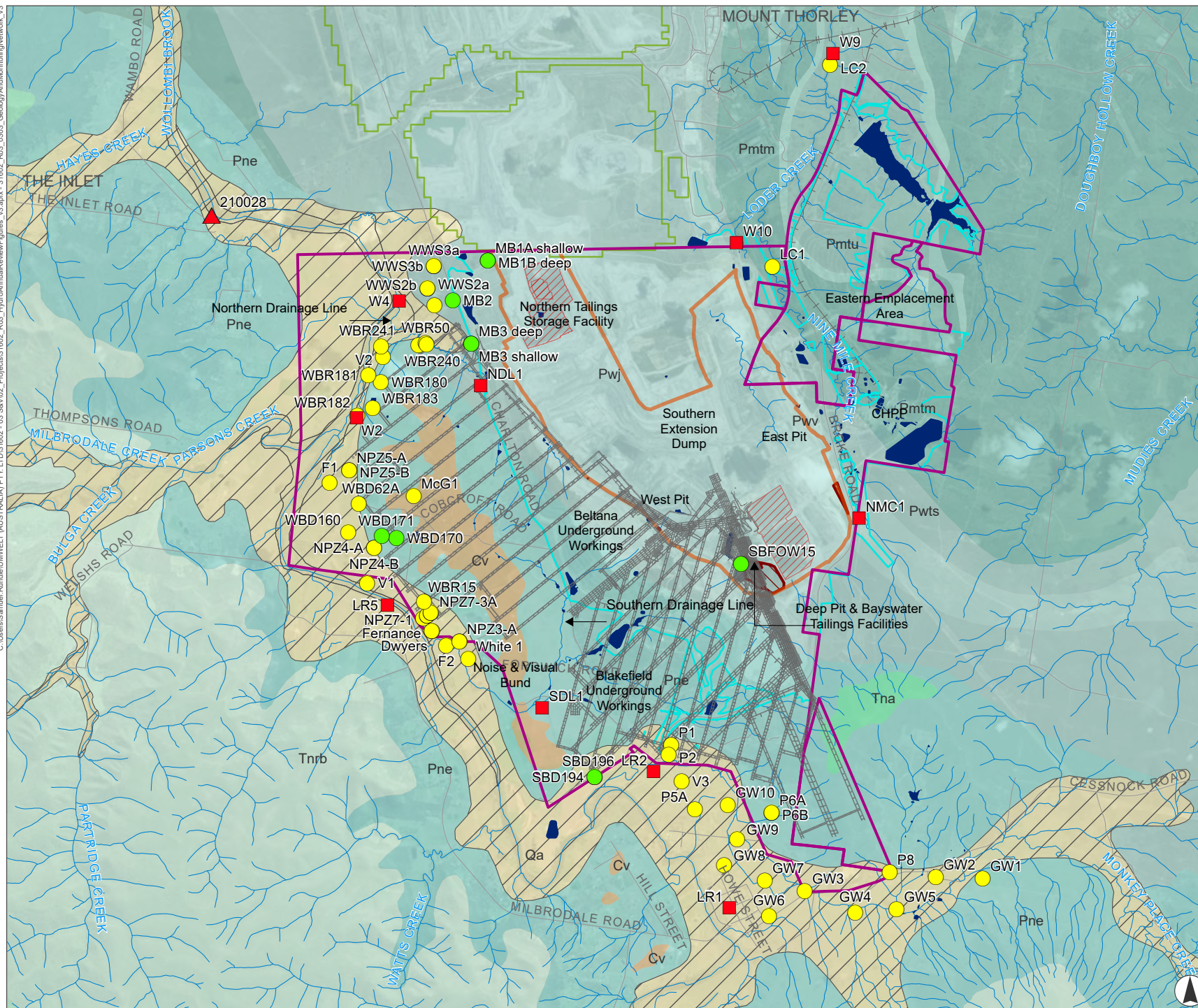


FIGURE 3.3
Site Geology and Monitoring Network

- Legend**
- Lease Boundary
 - Approved Disturbance Extent
 - In-pit Tailings Emplacement
 - BOP Approved Mining Area
 - Additional Disturbance Area
 - Existing/Approved Mining Operations
 - Dams
 - Existing Underground Workings
 - Drainage Line
 - Rail Line
 - Road
 - Inferred Extent of Alluvium
 - Surface Water Monitoring Site
 - WaterNSW Wollombi Brook Stream Gauge
- Groundwater Monitoring Type**
- MB
 - VWP
- Geology**
- Qa - Quaternary Alluvium
 - Cv - Cenozoic Volcanics
 - Tna - Narrabeen Group Quartzose Sandstone
 - Tnrb - Narrabeen Group
 - Pihw - Watts Sandstone
 - Pmtb - Braxton Formation
 - Pmtm - Mulbring Siltstone
 - Pmtu - Muree Sandstone
 - Pne - Newcastle Coal Measures
 - Pwj - Jerrys Plains Subgroup
 - Pwts - Wittingham Coal Measures
 - Pww - Vane Subgroup



Scale 1:80,000 at A4
GDA 1994 MGA Zone 56



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APPROVED FOR AND ON BEHALF OF Umwelt

4.0 Groundwater Monitoring

4.1 Groundwater Monitoring Program

Groundwater monitoring is conducted at the BCC in accordance with the WMP (Bulga Coal, 2021), which includes details on the Groundwater Management Plan and Groundwater Monitoring Program. The groundwater monitoring network is presented in **Figure 3.3** and detailed in **Appendix A**.

Monitoring of groundwater levels and groundwater quality undertaken at the bores is detailed in the WMP (Bulga Coal, 2021), and defined below:

- Groundwater Level:
 - Manual groundwater elevation/depth to groundwater measurements at a two-monthly frequency.
 - Monitoring bore data logger/VWP sensors download every two months, and verification and validation of instrument drift and correction.
- Groundwater Quality Analysis – Standard:
 - Two Monthly: field readings of water temperature, pH and electrical conductivity (EC), turbidity and colour.
- Groundwater Quality Analysis – Comprehensive:
 - Six Monthly: standard analysis plus laboratory analysis of pH, EC, total dissolved solids (TDS), total suspended solids (TSS), alkalinity, dissolved major ions: Ca, Mg, Na, K, Cl, HCO₃, CO₃ and SO₄, total metals: Al, As, Be, Ba, Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn, B, Fe, Hg, Fluoride, Nitrate and Phosphorous.

Groundwater quality sampling is undertaken quarterly by external contractors CBased Environmental Pty Ltd (CBased) in accordance with AS/NZS 5667.1:1998 (R2016) *Guidance on the design of sampling programs, sampling techniques and the prevention and handling of samples* and AS/NZ 5667.11:1998 (R2016) *Guidance on sampling of groundwater*. Field sheets, detailing the sample location, date, time, field EC, field pH and water level below top of casing, are completed by CBased during each monitoring round. The field sheets compiled by CBased and the monitoring data is stored in the BCC EMD have been reviewed by Umwelt for this report. Sample analysis is undertaken at a NATA-accredited laboratory.

4.2 Data Recovery

Groundwater level and quality data, along with field and lab sheets, were downloaded from the BCC site database (EMD) by Umwelt. As per the WMP (Bulga Coal, 2021), groundwater level monitoring and sampling is carried out at 42 monitoring bores. Monitoring bores with a data capture rate of less than 100 per cent are summarised in **Table 4.1**.

As shown in **Table 4.1**, there was no monitoring data collected for three monitoring bores (GW3, NPZ3-A, and P1) and one VWP (SBD194) over 2025. In addition, two monitoring bores (P8 and V1) could not be accessed in August and December. From the information provided by Bulga Coal, Umwelt understands that the casing within bore GW3 is deformed and no longer able to be monitored, bores NPZ3-A and P1 are blocked, and the logger unit in SBD194 was damaged.

It is noted that GW3 and NPZ3-A have been removed from the draft WMP, which is awaiting approval. The condition of bore P1 should be checked. If unable to be used as a monitoring bore, investigate whether the bore should be replaced or removed from the monitoring programme in the WMP. The logger unit in VWP SBD194 should be fixed so that monitoring can continue.

Table 4.1 Groundwater Monitoring Data Recovery

Bore ID	Type Not Measured	Data Recovery	Comments
GW3	SWL/WQ	0%	Bore deformed - unable to sample or measure water level
NPZ3-A	SWL/WQ	0%	Bore not measured since 2015
P1	SWL/WQ	0%	Bore blocked since 2015
P8	SWL/WQ	66%	No access in August and December 2025 while land access agreement being established with new land owner, finalised in 2026
SBD194	SWL	0%	Logger unit broken due to water damage
V1	SWL/WQ	83%	No safe access in December 2025

4.3 Groundwater Triggers

Trigger levels in the WMP have been established by a statistical analysis of baseline data from 1998 to 2020 (Bulga Coal, 2021). It is noted that the WMP states that the groundwater trigger levels will be revised every five years or following a consent modification that has reassessed impacts to groundwater (Bulga Coal, 2021). The triggers values within the WMP have been reviewed by Bulga Coal in 2025 and the draft WMP is with Department of Climate Change, Energy, the Environment and Water (DCCEEW) awaiting approval.

Trigger values for pH are based on the 20th and 80th percentile of baseline data and the trigger value for EC is based on the 80th percentile.

The trigger for water levels for bores installed within lithology other than the confined Permian coal measures, are based on a 5% reduction of saturated thickness, based on the minimum of historical baseline monitoring. There are no trigger values for bores screened within the confined Permian coal measures as they are predicted to be depressurised due to mining (Bulga Coal, 2021).

A trigger exceedance is defined as measurements of EC, pH or water level that exceed trigger values specified in the WMP (Bulga Coal, 2021). An exceedance will trigger a site-specific investigation of results and trends, which will determine the source and risk of impact on water quality, impacts to Groundwater Dependent Ecosystems (GDEs) (Bulga Coal, 2021). If the trigger exceedances are potentially attributable to mining activities at BCC, the Department of Planning, Industry and Environment (DPIE) (now DCCEEW) and the Natural Resources Access Regulator (NRAR) will be notified within three months of the exceedance. If regular exceedances occur BCC will notify and determine corrective actions in consultation with relevant stakeholders (Bulga Coal, 2021).

The trigger values are summarised in **Table 4.2**. Groundwater quality data from the monitoring bores have been compared to these trigger values and discussed in **Section 5.7**.

Table 4.2 Groundwater Trigger Values

Bore ID	Water Level (mAHD)	pH		EC (µS/cm)
	Lowest depth	20 th Percentile	80 th Percentile	80 th Percentile
Broke Area Alluvials				
GW1	NA ²	6.7	7.3	3634
GW3	74.0	6.7	7.2	6010
GW6	72.2	7.3	7.8	7900
GW7	63.3	6.7	7.4	3946
GW8	70.0	6.6	7.0	5936
GW9	70.3	6.7	7.2	4458
GW10	69.1	7.1	7.6	10252
V3	65.0	7.1	7.6	1744
Broke Area Wollombi Seam				
P2	NA ¹	7.4	8.0	12834
P5A	NA ¹	7.5	8.2	6242
P6A	NA ¹	7.0	8.1	2740
Northern Area Shallow Alluvials				
F1	60.8	7.2	7.6	1025
F2	62.9	7.1	7.4	1720
WBR50A	NA ¹	7.1	7.7	14000
V1	62.5	7.3	7.7	1570
V2	58.7	6.4	7.1	922
SBC/Broke Area Lower Whybrow Seam				
P1	NA ¹	7.4	7.9	14274
P6B	NA ¹	6.7	7.3	1353
P8	NA ¹	7.3	9.3	5076
Northern Area Lower Whybrow Seam				
WBR50	NA ¹	6.7	8.0	8382
Beltana Area Miscellaneous Bores & Wells				
Dwyers	60.5	7.3	7.6	1476
Fernance	59.3	7.3	8.0	1473
McG1	NA ²	7.5	8.0	918
White 1	62.2	7.0	7.4	2444
WBR15	62.2	6.8	7.3	924
Beltana Area NPZ				
NPZ3-A	NA ¹	7.3	7.7	1362
NPZ3-B	NA ¹	7.3	7.5	921
NPZ4-A	NA ¹	6.9	7.3	729
NPZ4-B	NA ¹	7.3	7.8	1342
NPZ5-A	NA ¹	6.9	7.3	886

Bore ID	Water Level (mAHD)	pH		EC (µS/cm)
	Lowest depth	20 th Percentile	80 th Percentile	80 th Percentile
NPZ5-B	NA ¹	7.1	7.6	2760
NPZ7-1	NA ¹	6.7	7.7	1240
NPZ7-2A	NA ¹	7.1	7.6	2250
NPZ7-2B	NA ¹	6.8	7.8	1307
NPZ7-3A	NA ¹	7.0	7.5	2540
NPZ7-3B	NA ¹	7.4	7.8	1316
Wollombi Alluvials and Shallow Coal Measures				
WBD160	NA ²	6.9	7.3	1310
WBR180	NA ¹	7.1	7.5	20850
WBR181	59.7	7.2	7.5	2670
WBR182	62.2	7.3	8.3	1512
WBR183	NA ¹	7.0	7.4	3484
WBR240	NA ¹	7.0	7.5	26800
WBR241	60.2	6.4	6.9	435

Note: NA¹ Trigger values are not set for Permian Coal measures due to depressurisation resulting from seam extraction.

NA² Trigger values are not defined as depth of bore is unknown.

ND Not determined - insufficient data available to trigger value assessment.

4.4 Groundwater Model

As noted in the WMP (Bulga Coal, 2021), the BCC groundwater model is required to be validated using observed groundwater data collected since the last model review. If the observed results differ markedly from the calibrated model, recalibration may be required (Bulga Coal, 2021). A groundwater model review is required every three years to coincide with the independent environmental audit and in consultation with NRAR. The groundwater model review is required to be undertaken by an independent suitably qualified hydrogeologist in accordance with the groundwater modelling guidelines specified by Barnett *et. al.* (2012) (Bulga Coal, 2021). The current groundwater model was last updated by KCB in 2019 as part of Mod 3.

A groundwater model review was completed by Umwelt (2025b) to assess the performance and suitability of the numerical groundwater model originally developed by KCB (2019). The review confirmed that the overall model structure, developed using MODFLOW-SURFACT, remains broadly appropriate and consistent with industry practice. However, several limitations were identified that may influence the reliability of the model predictions.

The review noted that the representation of mining within the model does not fully reflect actual mine progression since 2018. In particular, underground mining components remain represented beyond the period where they should have been excluded, which may result in conservative or over-predicted groundwater impacts. Updates to the Drain (DRN) and Time-Variant Material (TVM) packages were recommended to better align model inputs with the current mine plan.

Calibration performance remains within acceptable bounds; however, the scaled SRMS error increased from 10.1% in the earlier model version to approximately 13.3% in the updated model. While simulated groundwater heads and trends generally align with observed data, some discrepancies were identified, particularly for bores screened within the Permian coal measures.

The review also identified limitations associated with the representation of climatic inputs. Recharge continues to be represented using long-term average rainfall and evapotranspiration conditions beyond 2018, which reduces the model's ability to reproduce groundwater responses to actual climatic variability observed during recent monitoring periods. This limitation is most evident in hydrographs from shallow alluvial monitoring bores.

Hydrological boundary conditions were also identified as an area for improvement. The Drain Package currently removes water from drainage features but does not allow inflows during rainfall events, and the River Package applied to Wollombi Brook uses a constant stage height, which does not reflect observed variability in streamflow conditions.

Based on the findings of the 2025 review, updates to the model inputs and configuration were recommended, including alignment of mine progression with actual operations and revision of the recharge representation using observed climatic data between 2018 and 2025. These updates are intended to improve predictive reliability while maintaining consistency with the existing conceptual model framework. Updates to the groundwater model are currently in progress.

5.0 Groundwater Monitoring Results

A summary of the water level and water quality results is provided in the sections below for each of the main water-bearing units:

- Alluvium associated with Wollombi Brook, Monkey Place Creek, and Loder Creek.
- Warkworth Sands.
- Regolith and shallow coal measures.
- Permian coal measures (Wittingham Coal Measures and Wollombi Coal Measures).

Water level readings for 2025 are presented in **Appendix B** and historical trends are presented in **Appendix C** and pH readings for 2025 and historical trends are presented in **Appendix D** and **Appendix E**, respectively. The graphed data is grouped based on location as defined in the WMP (Bulga Coal, 2021).

It is noted that in previous groundwater annual reviews that laboratory pH and EC results have been used for comparison to trigger levels. The laboratory analysis of pH exceeds the holding time; therefore, field pH readings are considered more representative. For the purposes of this annual review, the field readings for pH and laboratory readings of EC were used for comparison to trigger levels. Where lab EC was missing, the field EC results were used for comparison to trigger values.

A summary of the water quality data is presented in **Table 5.10**.

5.1 Alluvium

Discussion of groundwater level and quality trends within the alluvium is included for the Wollombi Brook alluvium, Monkey Place Creek alluvium, and Loder Creek alluvium from **Section 5.1.1** to **Section 5.1.3**.

Over 2025, groundwater within the alluvium recorded a stable trend in response to above average rainfall throughout the year. Most bores recorded an increase in groundwater levels in the alluvium by June, following the significant rainfall recorded by the site rainfall gauge between March and May 2025. Groundwater levels remained stable from August to December 2025. Groundwater levels within the alluvium generally show a response to rainfall and streamflow over the same period.

Groundwater quality in the alluvium remained relatively stable and within historical levels but fluctuated slightly over 2025.

5.1.1 Wollombi Brook Alluvium

There are 12 groundwater bores monitoring the Wollombi Brook alluvium. Trends in groundwater levels and quality over 2025 are discussed below.

5.1.1.1 Groundwater Level Trends

During 2025, groundwater elevations ranged between 61.1 mAHD (6.15 m below ground level (mbgl)) at bore V2 and 69.83 mAHD (5.62 mbgl) at bore V3. These levels were generally higher than those observed in 2024. With the exception of bore WBD160, groundwater levels remained relatively stable, with a slight overall increase across the monitoring network during 2025. This increase is considered consistent with recharge response to above-average rainfall experienced during the reporting period.

Groundwater levels at bore WBD160 exhibited some variability, with April 2025 measurements indicating a decline of approximately 2.3 m, followed by a recovery in June 2025. Thereafter, groundwater levels remained around 66 mAHD. The short-term fluctuation at this bore may reflect localised hydraulic influences such as variable recharge distribution, proximity to surface water features, or site-specific hydraulic connectivity within the alluvial sediments. However, for the remainder of the year, the water levels were stable, suggesting that the April results could be anomalous.

No groundwater level trigger exceedances were recorded for the Wollombi Brook alluvium monitoring bores during 2025. Groundwater levels for the twelve Wollombi Brook alluvium bores are presented in **Figure 5.1**.

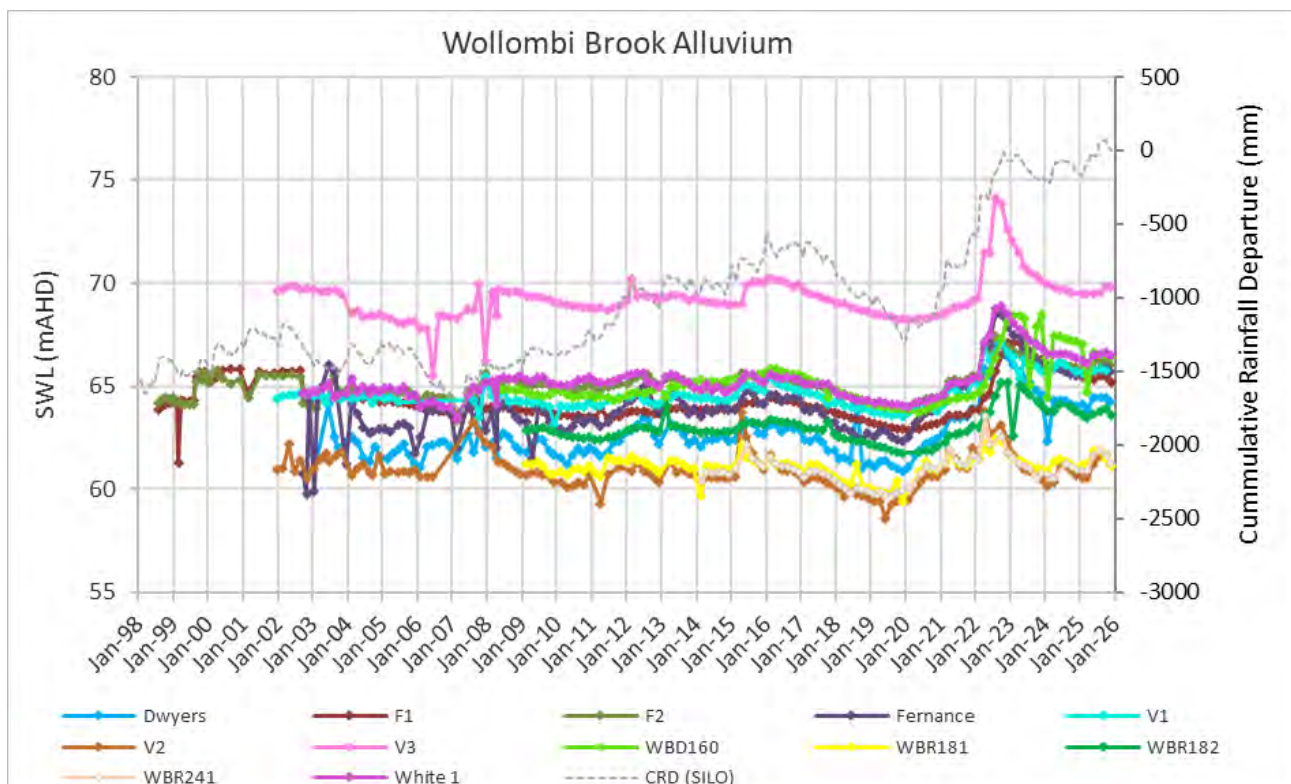


Figure 5.1 Groundwater Levels – Wollombi Brook Alluvium

5.1.1.2 Groundwater Quality Trends

Umwelt (2022) noted that water quality within the Wollombi Brook alluvium varies temporally and spatially, dependent on recharge processes.

Over 2025, groundwater quality trends within the alluvium remained spatially variable but broadly consistent with historical trends. Fluctuating pH trends were observed across the monitoring network. Unlike 2024, groundwater levels remained relatively stable throughout 2025 and did not show a progressive decline across the monitoring network. The pH variability observed is therefore more likely attributable to localised recharge and mixing within the alluvial sediments rather than reduced sampling column effects.

EC levels during 2025 remained spatially variable but did not indicate the emergence of new salinity trends. Elevated EC continued to be recorded at bores V3, White 1 and WBR182, consistent with historical trends. These bores have historically exhibited higher salinity, likely reflecting localised hydraulic connectivity with weathered Permian coal measures or variations in alluvial thickness and recharge pathways.

Bore V3 recorded EC levels ranging from 2,260 $\mu\text{S}/\text{cm}$ to 3,410 $\mu\text{S}/\text{cm}$ during 2025, remaining elevated relative to other alluvial bores but consistent with historical trends. Similarly, White 1 recorded EC values between 2,220 $\mu\text{S}/\text{cm}$ and 2,970 $\mu\text{S}/\text{cm}$, reflecting ongoing higher salinity conditions at this location.

Bore WBR182 recorded EC values between 1,540 $\mu\text{S}/\text{cm}$ and 1,940 $\mu\text{S}/\text{cm}$ during 2025. These values are consistent with previous monitoring results and reflect the known spatial variability in groundwater salinity within the northern portion of the alluvium.

Bores F2, Dwyers and Fernance recorded moderate EC variability during 2025, with values remaining within the broader historical ranges previously documented. No sharp change in EC levels was observed at these locations relative to 2024.

Lower EC values were recorded at V2 and WBD160 throughout 2025, consistent with historical levels as lower salinity alluvial bores.

Overall, groundwater quality within the Wollombi Brook alluvium during 2025 reflects ongoing spatial and temporal variability consistent with recharge-driven processes. The 2025 results do not indicate a material change in hydrogeochemical behaviour relative to the historical water quality observed previously at these bores.

The pH and EC readings recorded over 2025 are summarised in **Table 5.1**, with data since monitoring began presented in **Figure 5.2** and **Figure 5.3**.

Table 5.1 Summary of pH and EC Recorded Over 2025 – Wollombi Brook Alluvium

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Alluvium	6.17–8.21	102–3,650	All bores except F1 monitoring the Wollombi Brook alluvium recorded pH exceedances over 2025. All bores, except V1 and V2, within the Wollombi Brook alluvium recorded one or more EC exceedances over 2025.

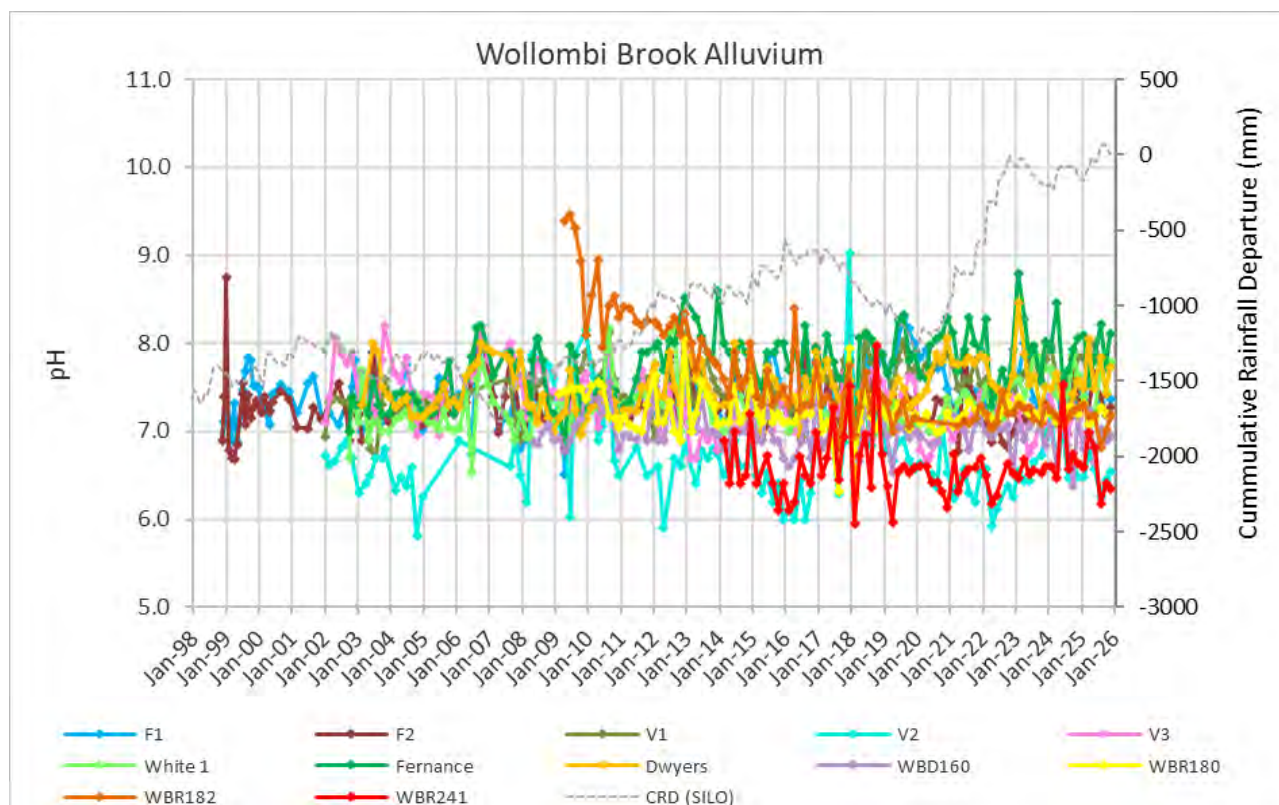


Figure 5.2 Wollombi Brook Alluvium – pH

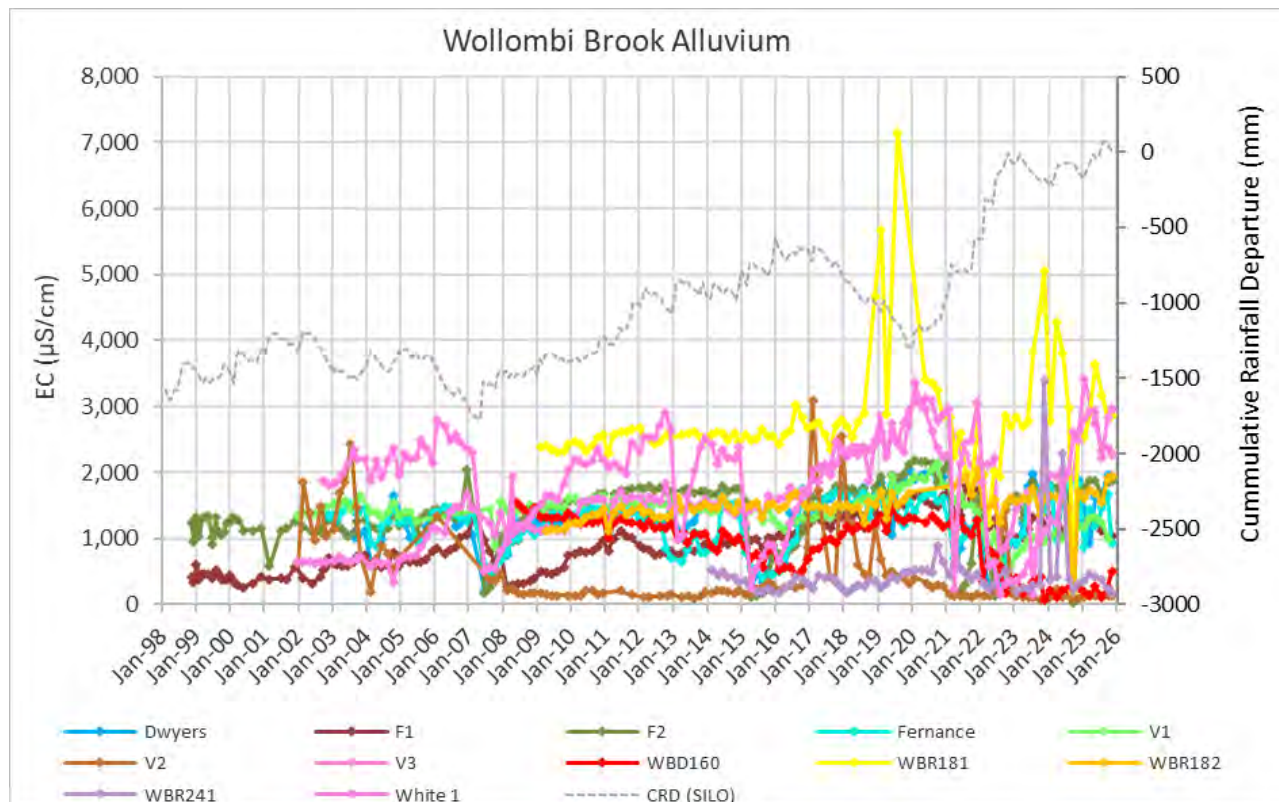


Figure 5.3 Wollombi Brook Alluvium - EC

5.1.2 Monkey Place Creek Alluvium

There are ten groundwater bores monitoring the Monkey Place Creek alluvium. Trends in groundwater levels and quality over 2025 are discussed below.

5.1.2.1 Groundwater Levels

During 2025, groundwater elevations ranged between 90.06 mAHD (2.07 mbgl) at bore GW1 and 72.04 mAHD (3.01 mbgl) at bore GW8. Groundwater levels remained relatively stable across the monitoring network over the reporting period, with a slight overall increasing trend observed. This response is consistent with recharge-driven behaviour associated with above-average rainfall during 2025.

The groundwater level range observed in 2025 was marginally higher than that recorded in 2024, which is also considered attributable to the increased rainfall experienced during the reporting period. The relatively shallow depth to groundwater and limited variability suggest that the alluvial system remains hydraulically responsive to climatic conditions and does not indicate anomalous drawdown or site-related impacts.

No groundwater level trigger exceedances were recorded for the Monkey Place Creek alluvium monitoring bores during 2025. Groundwater levels for the ten Monkey Creek Place alluvium bores are presented in **Figure 5.4**.

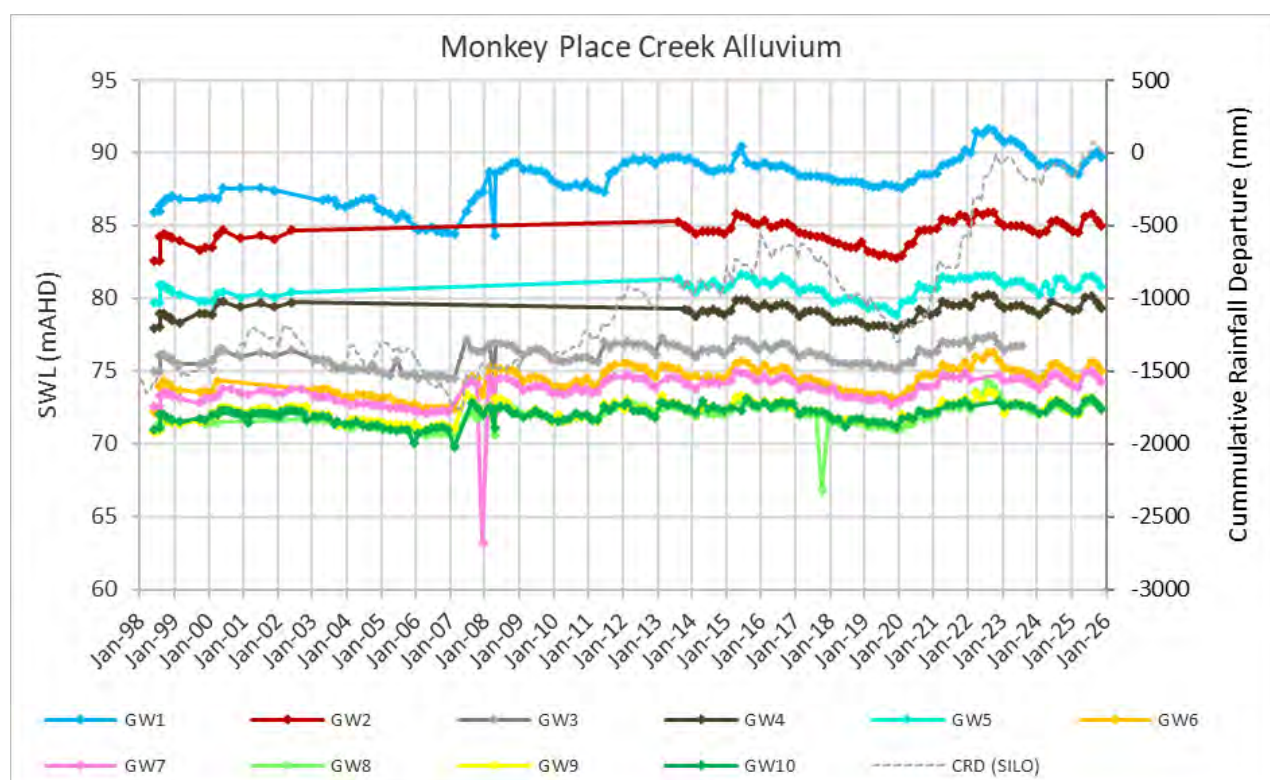


Figure 5.4 Groundwater Levels – Monkey Place Creek Alluvium

5.1.2.2 Groundwater Quality Trends

Over 2025 water quality trends within the Monkey Place Creek alluvium remained relatively stable, consistent with the trends observed over 2024. All bores recorded a fluctuating pH trend over the reporting period.

Field pH values recorded in 2025 ranged from 6.71 to 8.35 across the monitoring network. This range is comparable to 2024 (6.50 to 8.33), and what was observed historically at these bores. Similar to 2024 and historical observations, several bores recorded isolated elevated pH readings above their respective upper trigger values. The highest pH recorded during 2025 was 8.35 at bore GW9 in August 2025. The elevated levels occurred as short-duration spike events, with subsequent readings returning to within or closer to the historical range. No sustained upward trend in pH was observed across the network. As recommended in 2024, consideration should be given to reviewing the trigger criteria approach to determine whether consecutive-exceedance criteria are more appropriate than single-event triggers.

EC levels recorded over 2025 ranged from 247 $\mu\text{S}/\text{cm}$ to 8,020 $\mu\text{S}/\text{cm}$. This range is broadly consistent with the variability observed over 2024 (521–7,380 $\mu\text{S}/\text{cm}$), with the 2025 maximum exceeding the 2024 maximum. Overall, the 2025 results are consistent not only with 2024 but also with the broader historical range, and that the observed variability reflects natural hydrological responses rather than a site-related impact.

Overall, EC levels recorded in the Monkey Place Creek alluvium monitoring bores remained relatively stable across 2025. Bore GW6 continued to record the highest EC levels within the network, ranging from 7,530 $\mu\text{S}/\text{cm}$ to 8,020 $\mu\text{S}/\text{cm}$, which is consistent with historical trends and similar to trends noted in 2024. Bore GW7 recorded notable short-term variability, including a value of 7,580 $\mu\text{S}/\text{cm}$ in April 2025; however, this was not sustained in subsequent monitoring rounds. Bores GW8 and GW10 also recorded moderate fluctuations through the year but remained within their historical range.

As described in 2024, spatial variability in EC is likely influenced by local hydrogeological conditions and land use factors rather than mine-related impacts.

The pH and EC readings recorded over 2025 are summarised in **Table 5.2**, with data since monitoring began presented in **Figure 5.5** and **Figure 5.6**.

Table 5.2 Summary of pH and EC Recorded Over 2025 – Monkey Place Creek Alluvium

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Alluvium	6.71–8.35	247–8,020	Five bores (GW1, GW6, GW8, GW9 and GW10) monitoring the Monkey Place Creek alluvium recorded pH exceedances over 2025. Bore GW6 and GW7 recorded EC exceedances over 2025.

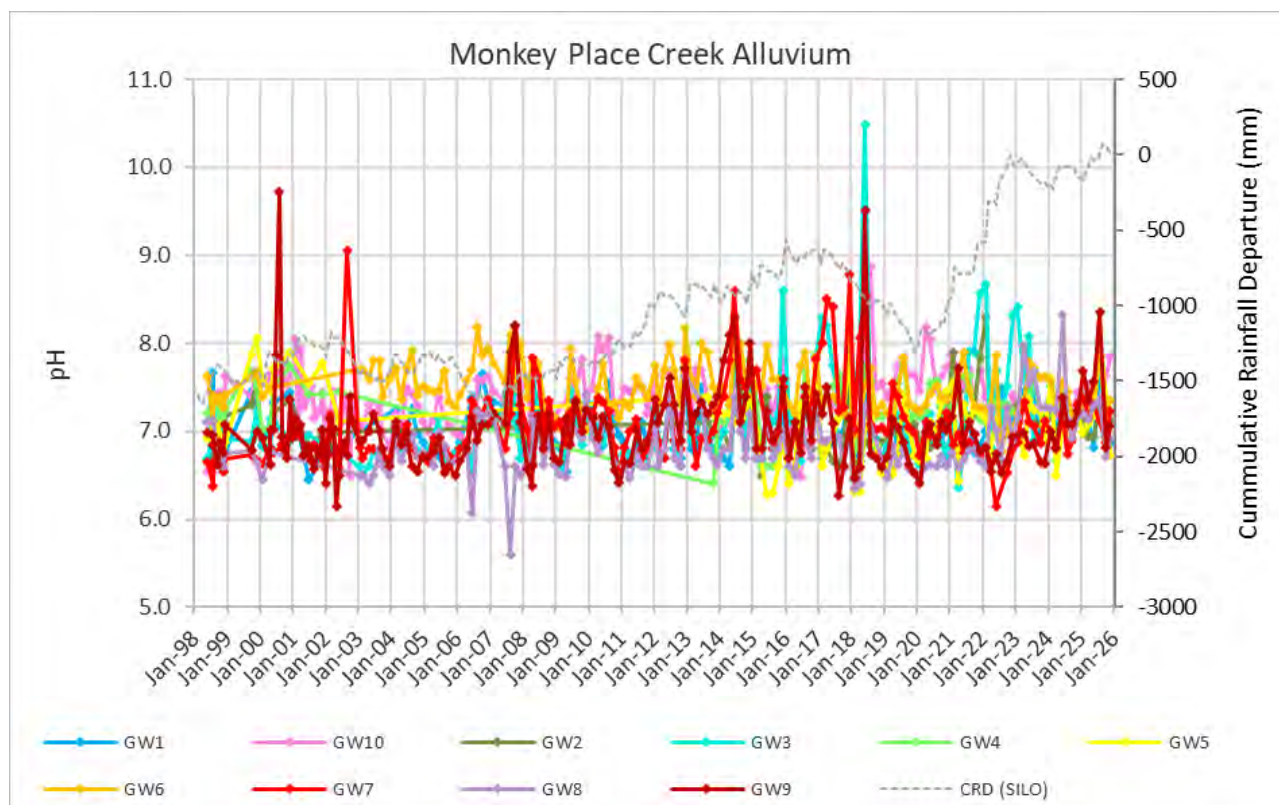


Figure 5.5 Monkey Place Creek Alluvium – pH

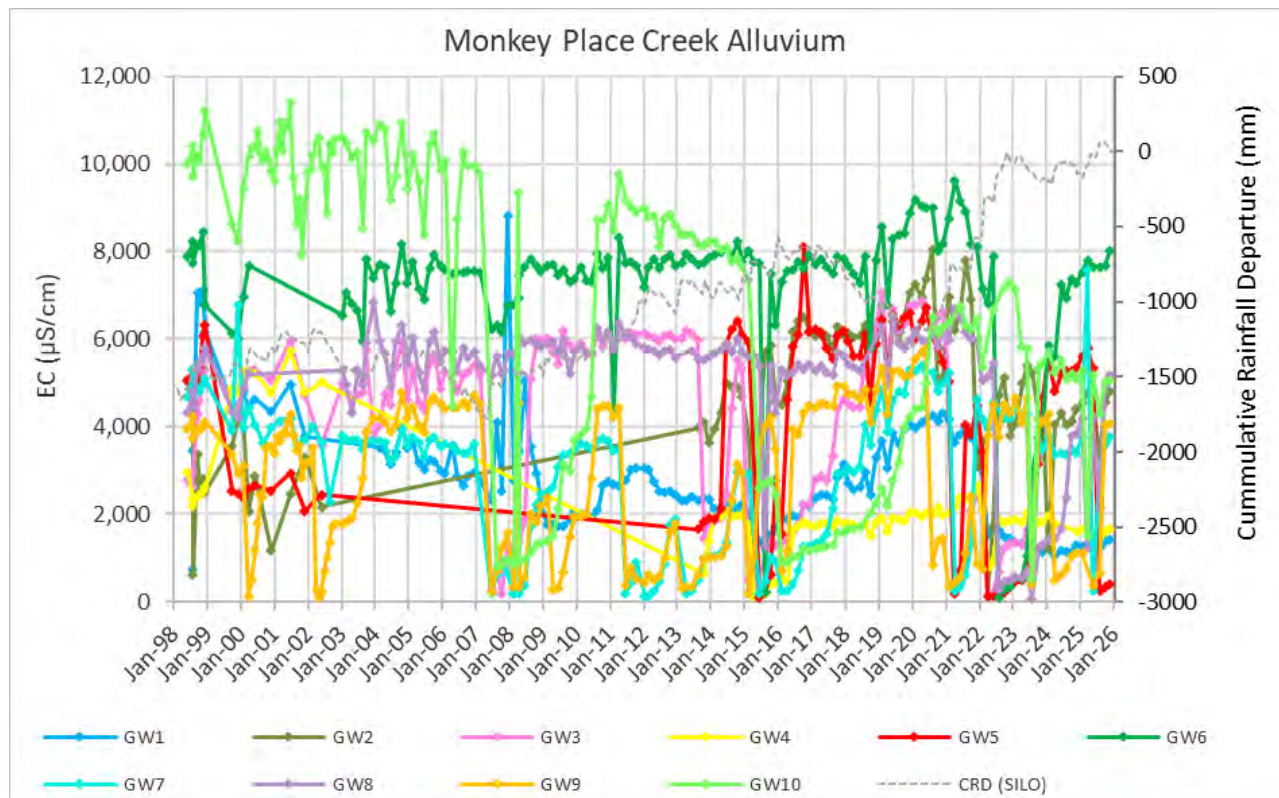


Figure 5.6 Monkey Place Creek Alluvium - EC

5.1.3 Loder Creek Alluvium

Two groundwater monitoring bores were installed in 2019 to monitor the alluvium near Loder Creek and provide detection of baseflow contributions to Loder Creek (Jacobs, 2024).

Bore LC1 intersected 3.2 m of mixed alluvial sediments before tagging into weathered Permian and was drilled and constructed to a depth of 5 m. Bore LC2 intersected 7.5 m of mixed alluvial sediments before tagging into Permian coal and was drilled and constructed to a depth of 7.6 m.

Trends in groundwater levels and quality over 2025 are discussed in the sections below.

5.1.3.1 Groundwater Levels

During 2025, groundwater levels in bore LC2 ranged between 42.75 mAHD (1.72 mbgl) and 43.31 mAHD (1.16 mbgl), representing a fluctuation of approximately 0.6 m over the reporting period. This limited variation suggests relatively stable shallow groundwater conditions, likely influenced by local recharge and surface water interaction with Loder Creek.

Bore LC1 has remained predominantly dry since installation, with only minimal water observed in 2023 following peak rainfall events. The absence of sustained groundwater at LC1 indicates either limited saturated thickness within the shallow alluvium at that location or disconnection from persistent creek baseflow conditions.

Groundwater levels recorded at LC2 during 2025 are consistent with those observed in 2024, indicating no material change in shallow groundwater behaviour in the vicinity of Loder Creek.

Groundwater levels for the two bores near Loder Creek are presented in **Figure 5.7**.

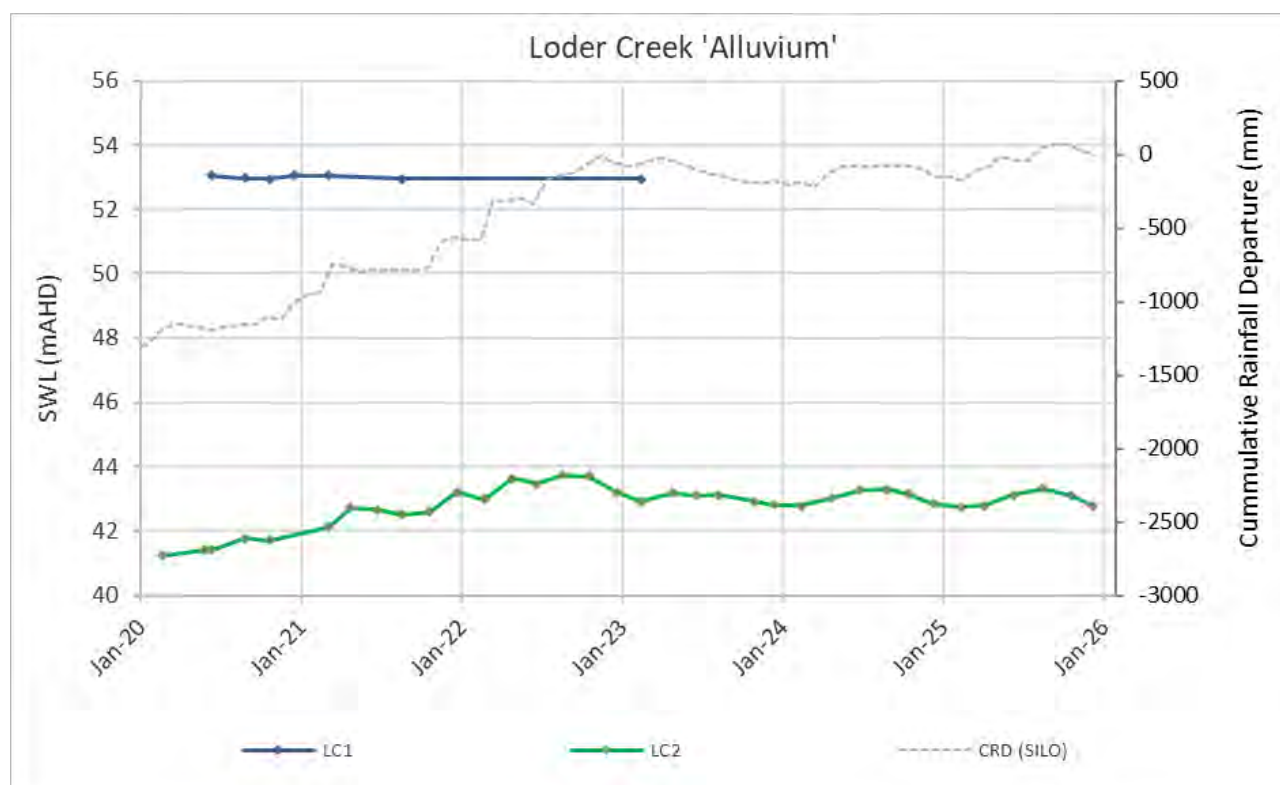


Figure 5.7 Groundwater Levels – Loder Creek Alluvium

5.1.3.2 Water Quality

Over 2025, pH and EC were recorded in bore LC2; however, bore LC1 was dry during all monitoring events. This is consistent with 2024, when LC1 was also dry.

The pH recorded in LC2 ranged from 7.21 to 7.83 over 2025, compared to 2024 (6.85–7.74). pH remained relatively stable, although the maximum recorded pH in 2025 (7.83 in June 2025) was marginally higher than the 2024 maximum. No sustained increasing or decreasing was observed across the reporting period.

EC values recorded in LC2 over 2025 ranged from 3,230 $\mu\text{S}/\text{cm}$ to 4,060 $\mu\text{S}/\text{cm}$. In comparison, EC over 2024 ranged from 3,050 $\mu\text{S}/\text{cm}$ to 3,710 $\mu\text{S}/\text{cm}$. While EC values in 2025 were slightly higher at the upper end of the range, the fluctuations remain within the historical range for the bore.

The pH and EC readings recorded over 2025 are summarised in **Table 5.3**, with data since monitoring began, presented in **Figure 5.8** and **Figure 5.9**.

Table 5.3 Summary of pH and EC Recorded Over 2025 – Loder Creek Alluvium

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Alluvium	7.21-7.83	3,230-4,060	The Loder Creek alluvium bores do not have any water quality triggers set in the WMP.

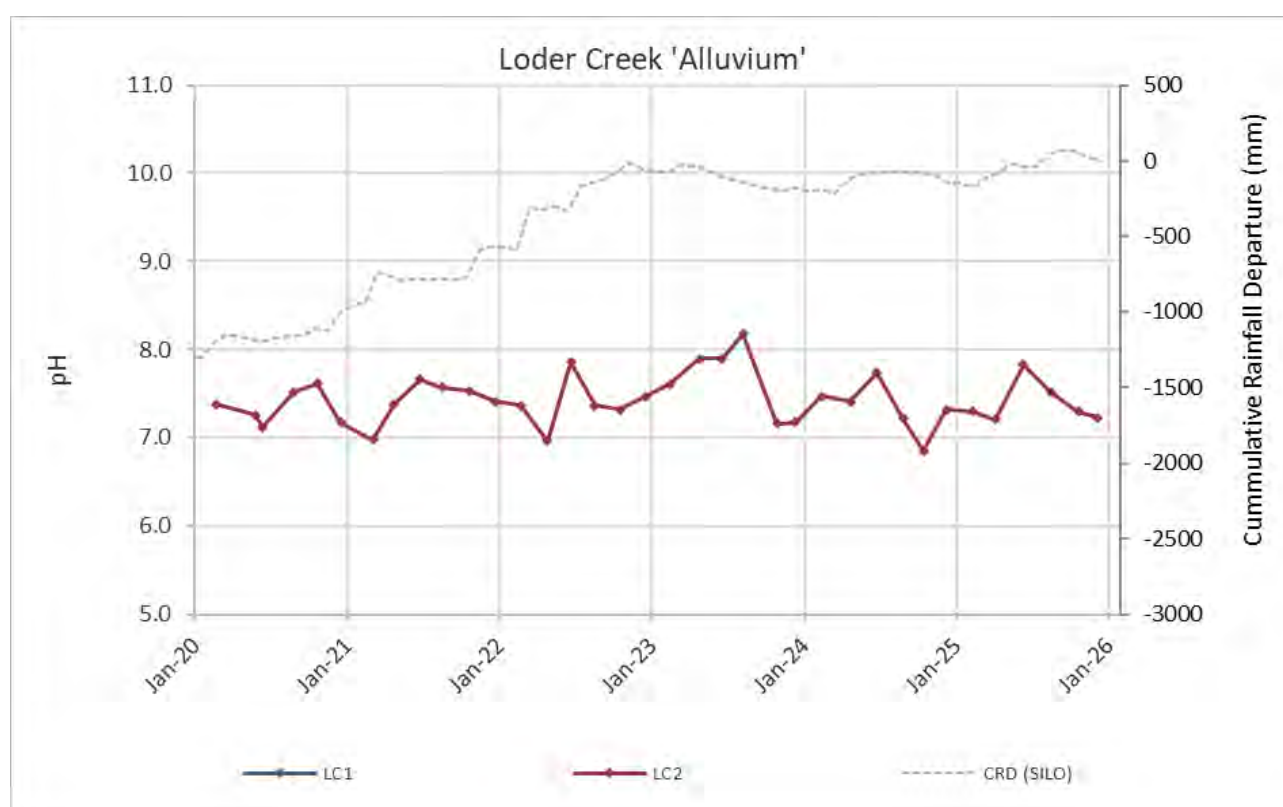


Figure 5.8 Loder Creek Alluvium - pH

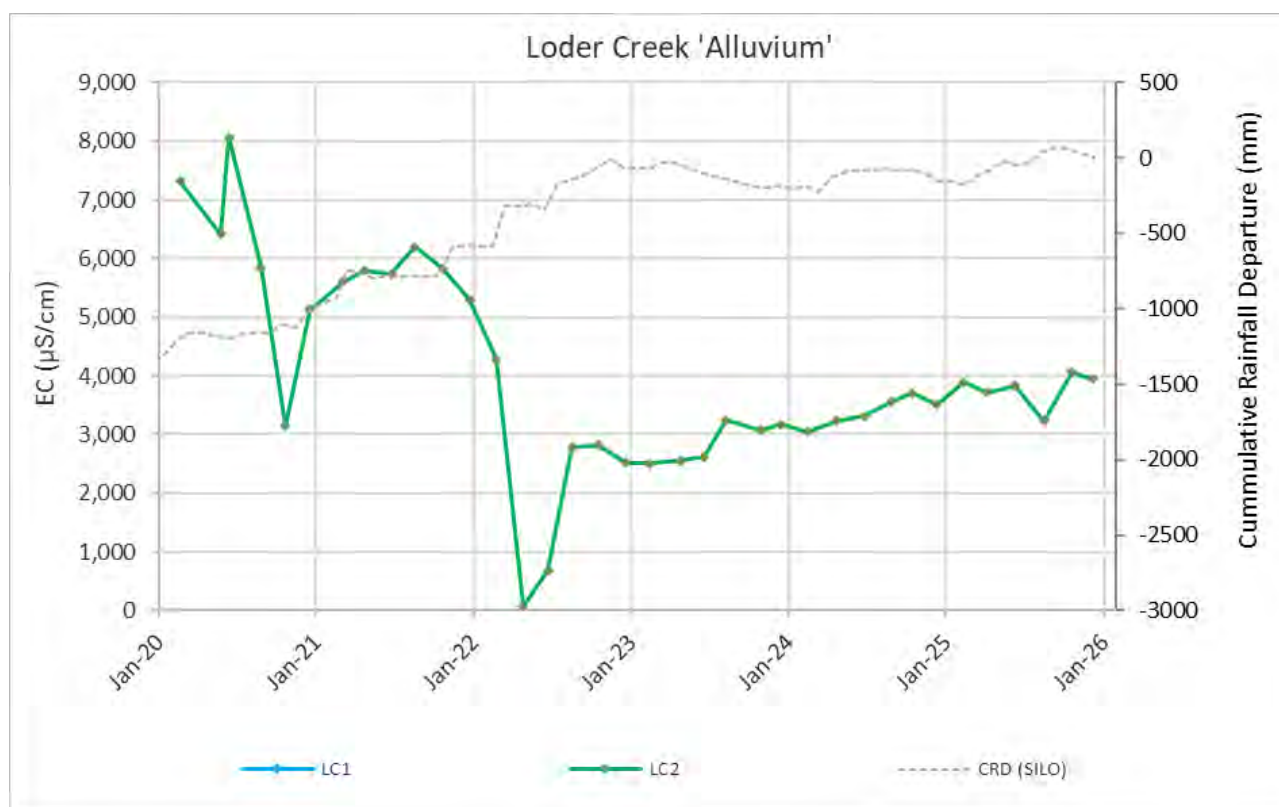


Figure 5.9 Loder Creek Alluvium - EC

5.2 Warkworth Sands

Five bores were installed to monitor the Warkworth Sands in 2021 within the northwest area of BCC, to the north of the Beltana underground workings and northwest of the open-cut pit. The presence of groundwater in bore WWS2B was detected only in 2022, early 2023, and late 2024. In 2025, groundwater was detected once in October at WWS1 and WWS3A, whereas it was detected in June, August, and October at bore WWS2B and WWS3B. Trends in groundwater levels and quality over 2025 are discussed in the sections below.

5.2.1 Groundwater Levels

During 2025, groundwater elevations recorded in the WWS monitoring bores ranged between 94.15 mAHD (2.31 mbgl) at WWS2B and 83.18 mAHD (2.22 mbgl) at WWS3B. However, with the exception of June, August and October 2025, bores WWS2B and WWS3B were dry for the majority of the year. Bores WWS1 and WWS3A were also dry except in October 2025, while WWS2A remained dry throughout 2025.

The intermittent presence of groundwater in these bores is likely attributable to slightly above-average rainfall experienced during 2025. Given the shallow screened intervals and limited saturated thickness in the area, groundwater occurrence is likely controlled by episodic recharge events and localised infiltration rather than sustained regional groundwater flow. Such behaviour is consistent with shallow, discontinuous or perched systems commonly observed in alluvial units, where water levels respond rapidly to rainfall events and subsequently decline during dry periods. Groundwater levels for the five Warkworth Sands bores are presented in **Figure 5.10**.

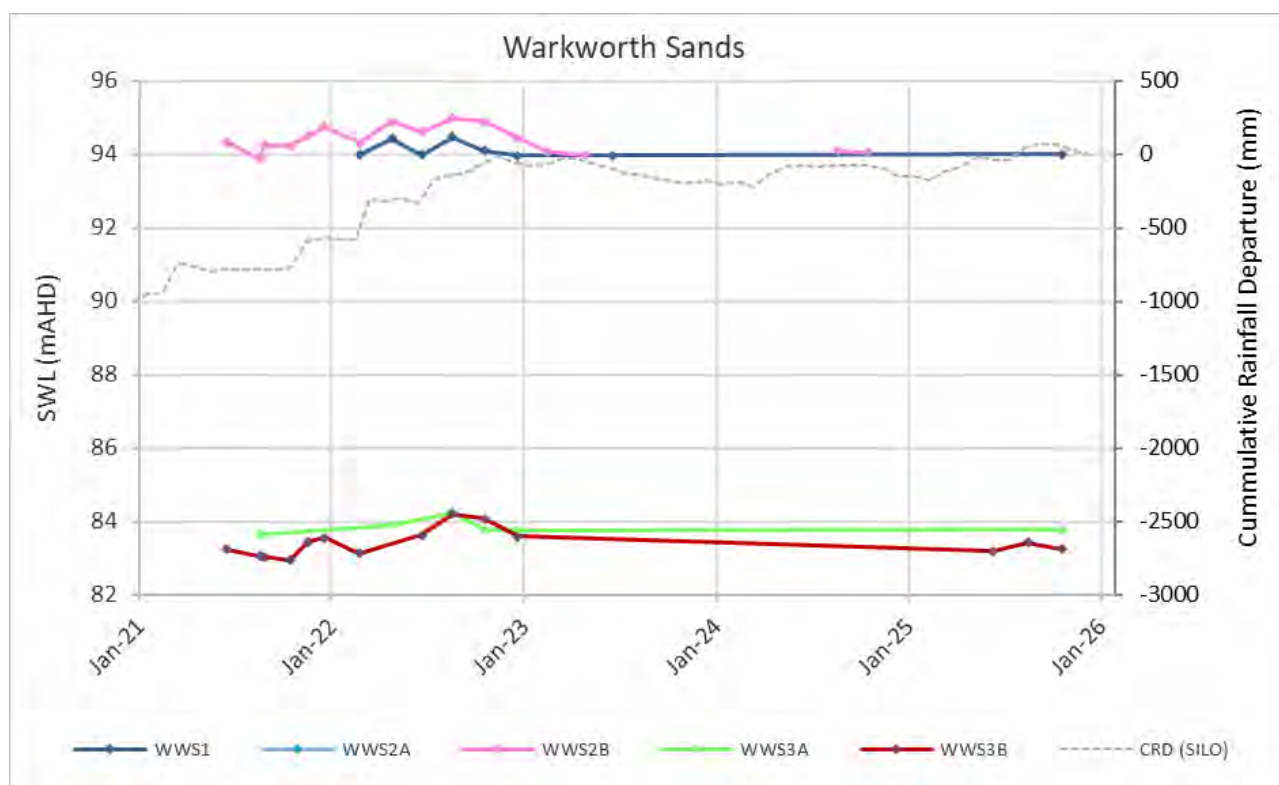


Figure 5.10 Groundwater Levels – Warkworth Sands

5.2.2 Water Quality

Over 2025, there was insufficient water available to collect water quality samples from bores within the Warkworth Sands. The pH and EC readings are summarised in **Table 5.4** and data since monitoring began presented in **Figure 5.11** and **Figure 5.12**.

Table 5.4 Summary of pH and EC Recorded Over 2025 – Warkworth Sands

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Warkworth Sands	N/A	N/A	The Warkworth Sands bores do not have any water quality triggers set in the WMP.

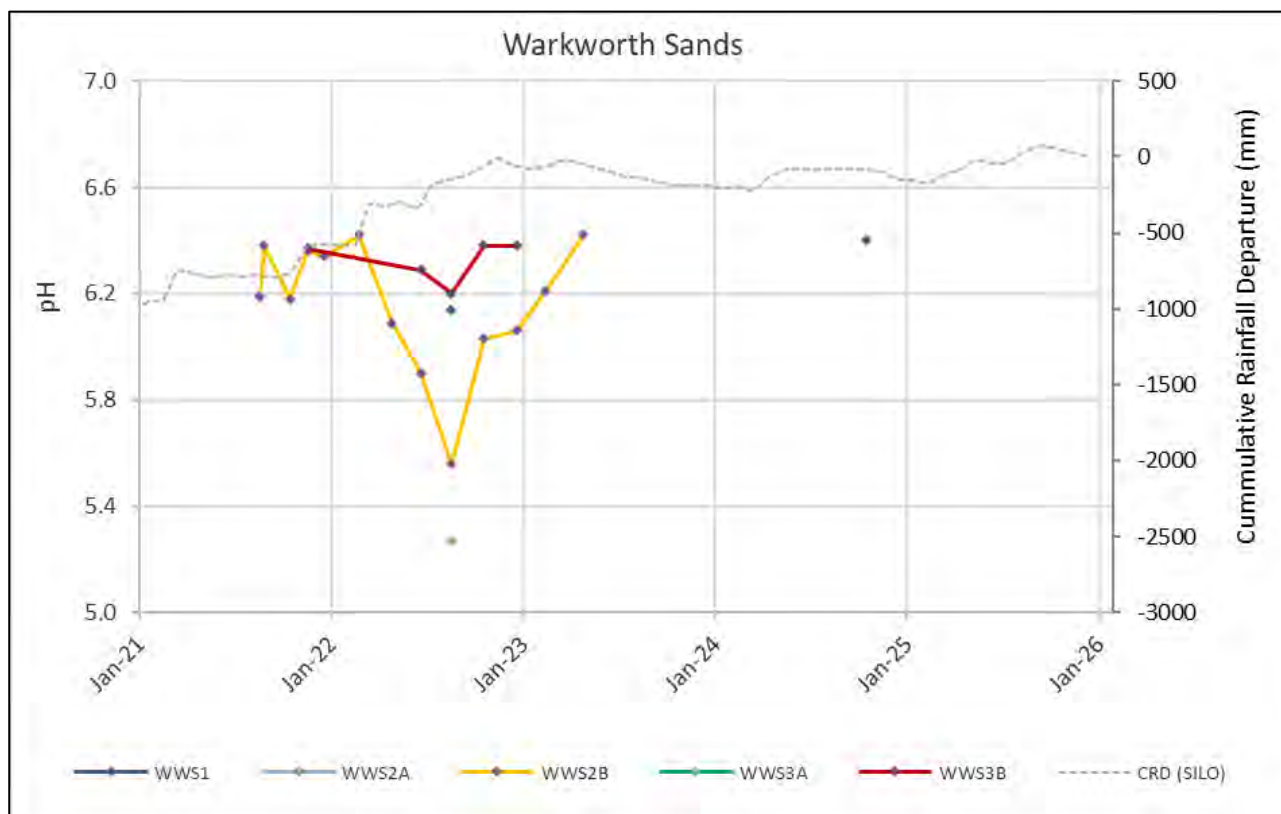


Figure 5.11 Warkworth Sands - pH

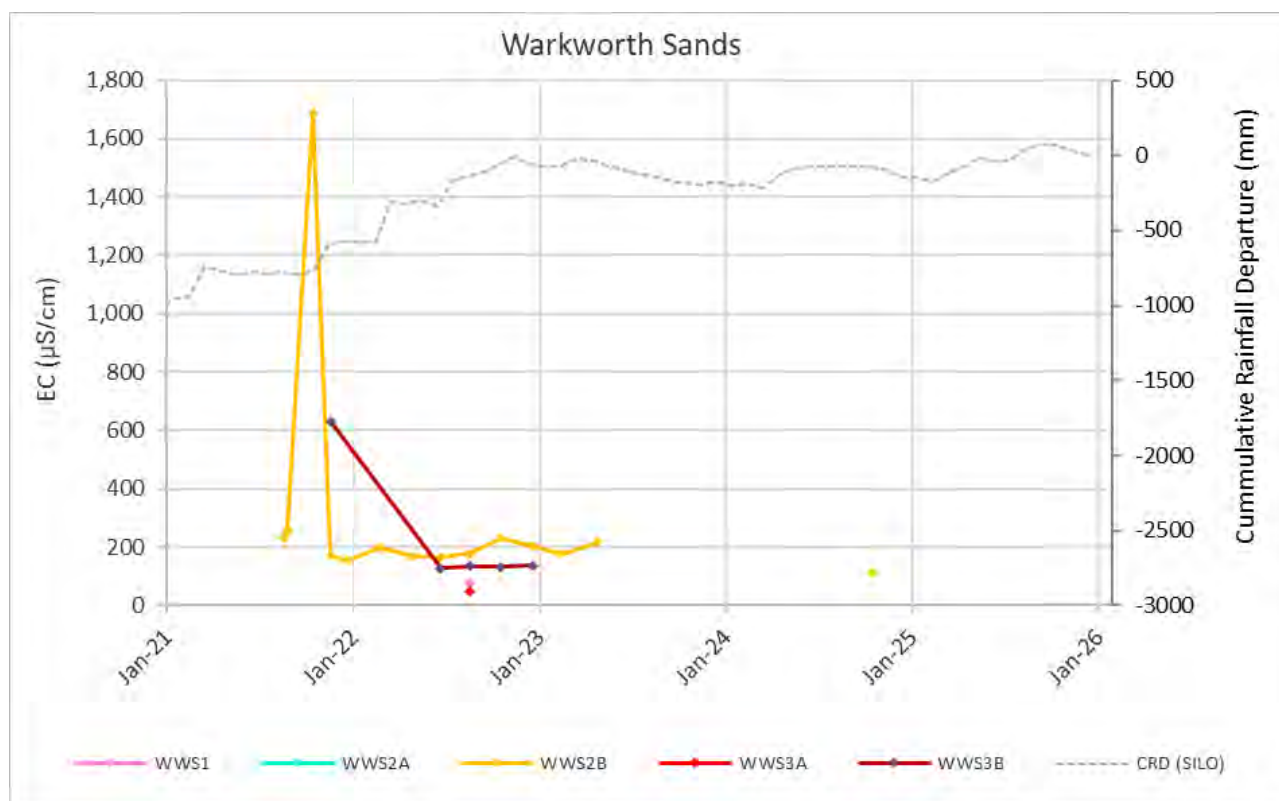


Figure 5.12 Warkworth Sands - EC

5.3 Regolith and Shallow Permian Coal Measures

Discussion of groundwater level and quality trends within the regolith and shallow Permian coal measures is discussed in the sections below.

5.3.1 Regolith

There are two bores monitoring lithology described as ‘regolith/volcanic sills/alluvium’. For this report, the two bores are considered to be monitoring regolith. Trends in groundwater levels and quality over 2025 are discussed in the sections below.

During 2025, groundwater conditions within the regolith monitoring bores were broadly consistent with trends observed in 2023 and 2024. Groundwater levels remained generally stable, showing a gradual increase from the beginning of the year until approximately June 2025 at both bores, followed by a slight decline and subsequent stabilisation over the remainder of the reporting period. This pattern is consistent with recharge-driven seasonal response within shallow regolith materials.

Groundwater quality within the regolith remained relatively stable and within historical ranges during 2025, although minor fluctuations were observed throughout the year. These fluctuations are considered consistent with natural variability associated with seasonal recharge and shallow groundwater dynamics.

5.3.1.1 Groundwater Levels

During 2025, groundwater elevations ranged between 66.02 mAHD (11.74 mbgl) at bore WBR15 and 93.69 mAHD (18.44 mbgl) at bore McG1. The substantial difference in absolute groundwater elevation reflects differences in topographic position and regolith thickness rather than hydraulic connectivity between the two locations.

No groundwater level trigger exceedances were recorded for the regolith monitoring bores during 2025. Groundwater levels for the two bores are presented in **Figure 5.13**.

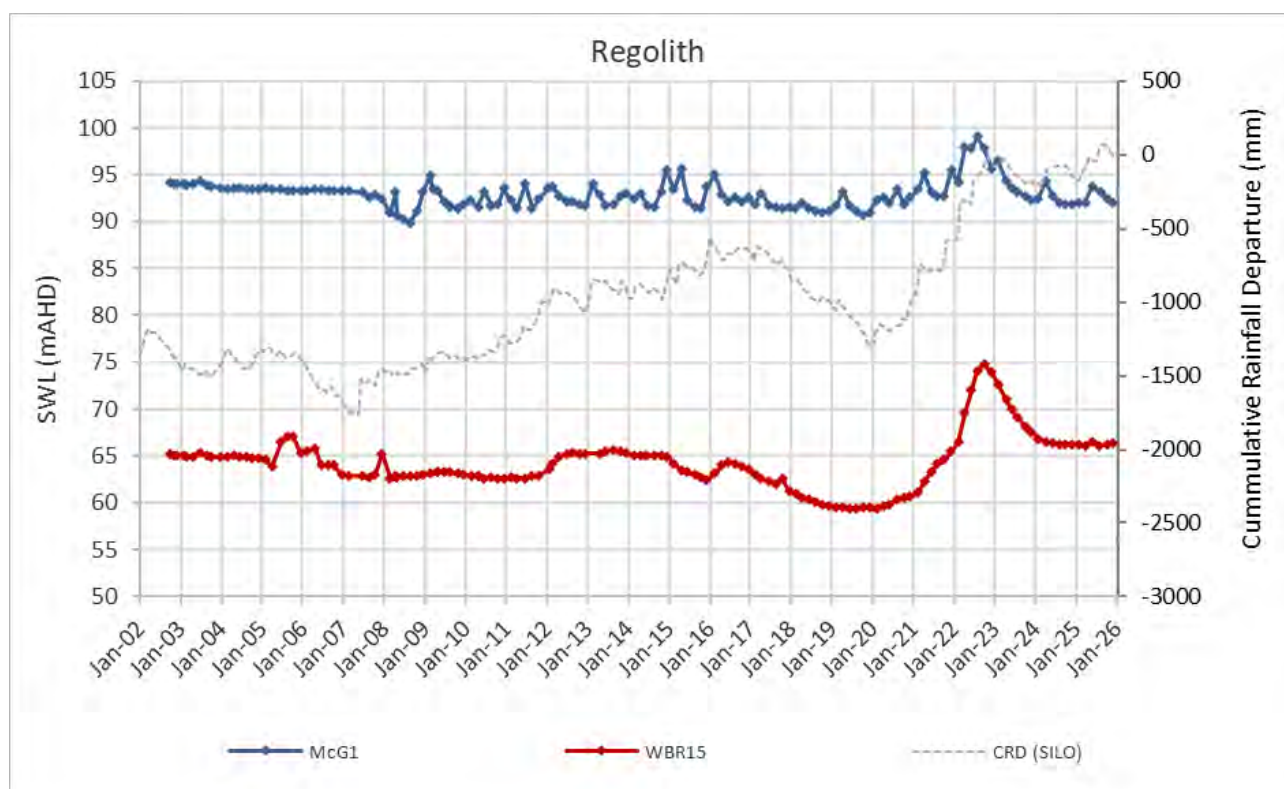


Figure 5.13 Groundwater Levels – Regolith

5.3.1.2 Water Quality

Over 2025, pH and EC fluctuated in both bores monitoring groundwater quality within the regolith. Similar to 2024, bore McG1 overall remained relatively stable, while bore WBR15 did not demonstrate the declining trend observed in 2024. Instead, WBR15 showed moderate fluctuation throughout the reporting period.

Field pH values recorded over 2025 ranged from 7.34 to 8.15 across the two bores. This represents a slightly wider range than 2024 (7.15–7.89), with the highest value recorded at McG1 in August 2025 (8.15). Bore WBR15 recorded pH values ranging from 7.34 to 7.93 and continued to record pH exceedances above the upper trigger level of 7.3 during multiple monitoring rounds. McG1 recorded pH values between 7.58 and 8.15, remaining within its trigger range (7.5–8.0) for most readings, with isolated exceedances above the upper trigger.

EC levels recorded over 2025 ranged from 287 $\mu\text{S}/\text{cm}$ to 766 $\mu\text{S}/\text{cm}$. This is comparable to 2024 (253–847 $\mu\text{S}/\text{cm}$), with overall EC values remaining within historical ranges. Bore WBR15 recorded EC levels between 667 $\mu\text{S}/\text{cm}$ and 766 $\mu\text{S}/\text{cm}$, while McG1 recorded lower EC levels ranging from 287 $\mu\text{S}/\text{cm}$ to 557 $\mu\text{S}/\text{cm}$. No EC exceedances were recorded over 2025, consistent with 2024.

The pH and EC readings recorded over 2025 are summarised in **Table 5.5**, with all data collected since monitoring began presented in **Figure 5.14** and **Figure 5.15**.

Table 5.5 Summary of pH and EC Recorded Over 2025 – Regolith

Screened Lithology	Field pH Range	EC Range (µS/cm)	Comment
Regolith~	7.34–8.15	287–766	Both bores monitoring the regolith recorded pH exceedances over 2025. There were no EC exceedances recorded over 2025.

Note: ~Assumed to be regolith for this report, bore log required to determine screened lithology.

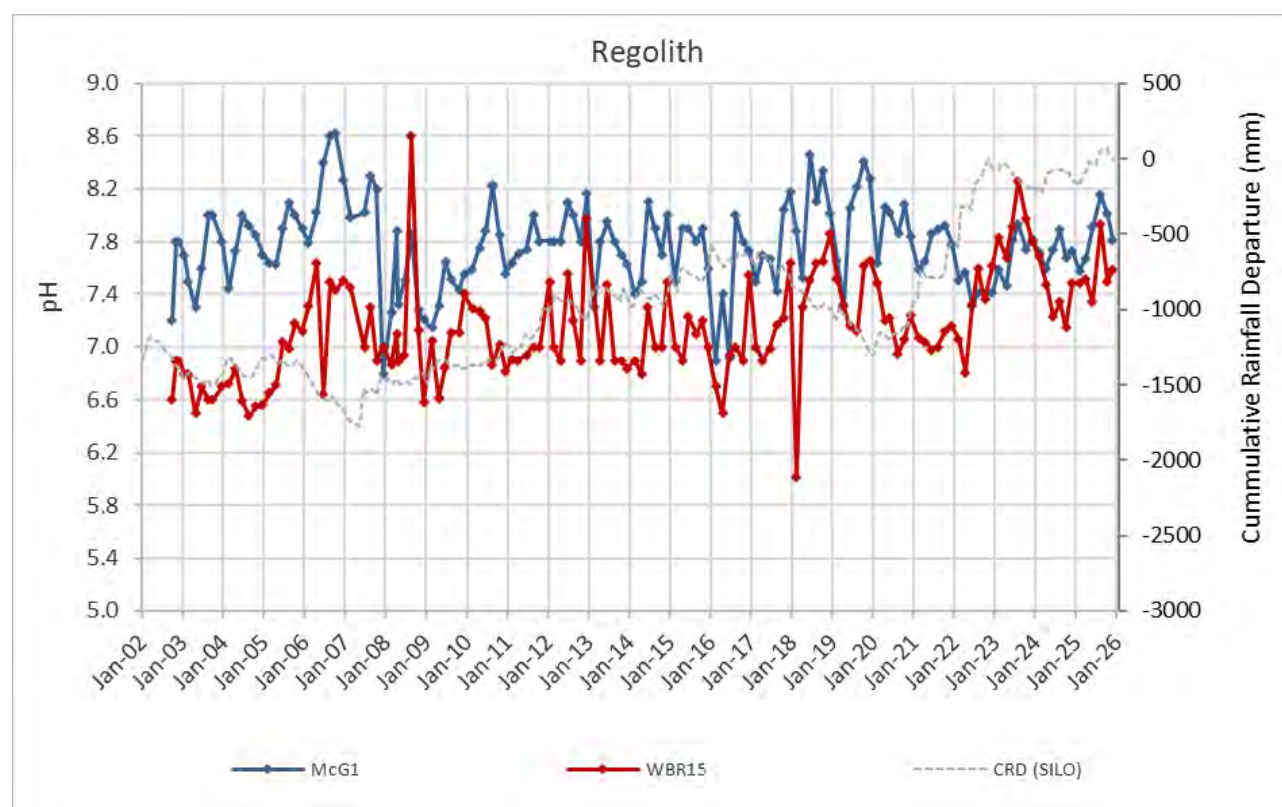


Figure 5.14 Regolith – pH

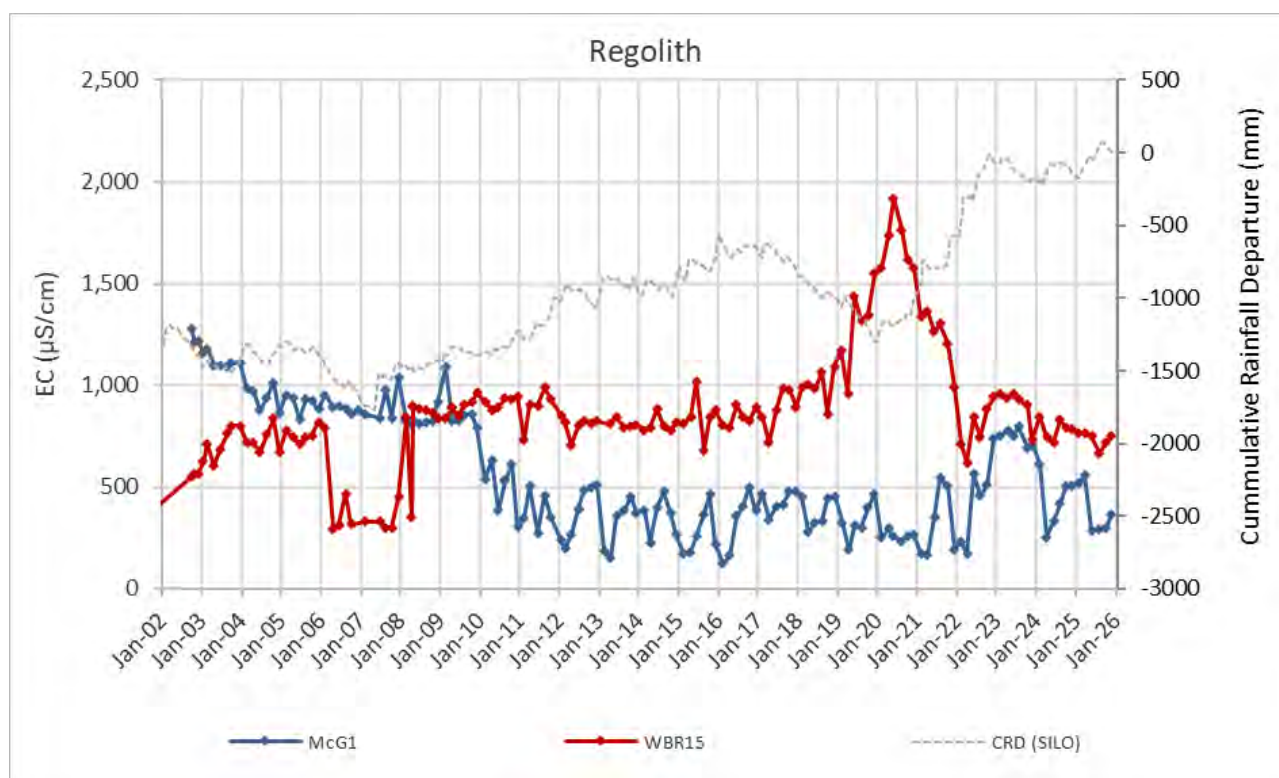


Figure 5.15 Regolith – EC

5.3.2 Shallow Permian Coal Measures

There are eight groundwater bores monitoring the shallow Permian coal measures. Trends in groundwater levels and quality over 2025 are discussed in the sections below.

5.3.2.1 Groundwater Levels

Over 2025, groundwater elevations within the bores ranged between 72.19 mAHD (3.96 mbgl) and 35.91 mAHD (33.29 mbgl), in bores P5A and WBR180, respectively. This is similar to levels observed in 2024.

There were no groundwater level trigger exceedances recorded for monitoring bores monitoring the shallow Permian coal measures over 2025.

Groundwater levels for the eight shallow Permian coal measures bores are presented in **Figure 5.16**.

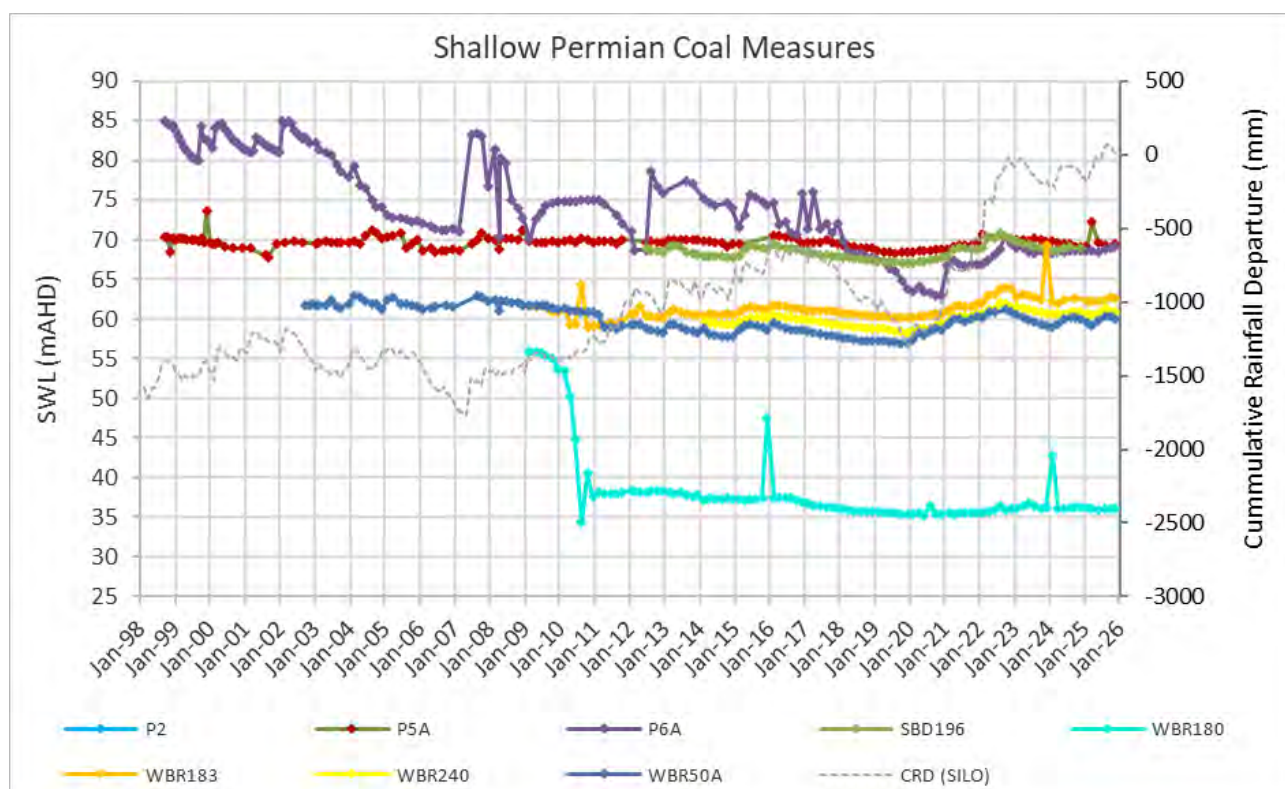


Figure 5.16 Groundwater Levels – Shallow Permian Coal Measures

5.3.2.2 Water Quality

Over 2025, pH and EC within the shallow Permian coal measures fluctuated but remained relatively stable across the monitoring network. In contrast to 2024, bores WBR240 and WBR50A did not demonstrate a consistent increasing pH trend. Instead, both bores showed moderate variability throughout the reporting period.

Field pH values recorded over 2025 ranged from 6.79 to 7.95 across the shallow Permian coal measures bores. This range is slightly narrower than that recorded in 2024 (6.40–8.05). Several bores recorded pH exceedances during 2025, including P2, WBR240, WBR50A and WBR183. Bore WBR180 did not record any pH exceedances over 2025.

EC levels recorded over 2025 ranged from 614 $\mu\text{S}/\text{cm}$ to 20,900 $\mu\text{S}/\text{cm}$. This is comparable to 2024 (157–20,800 $\mu\text{S}/\text{cm}$). EC levels across the WBR series remained within the historical range. Bore WBR183 recorded EC exceedances over 2025, with EC levels ranging from 2,850 $\mu\text{S}/\text{cm}$ to 3,820 $\mu\text{S}/\text{cm}$, which are comparable to those observed in 2024 and remain within the historical range. Bore WBR180 recorded elevated EC levels up to 20,900 $\mu\text{S}/\text{cm}$ in April 2025, slightly above its trigger level of 20,850 $\mu\text{S}/\text{cm}$; however, levels were consistent with previous monitoring data.

Overall, EC trends across the shallow Permian coal measures did not indicate a sustained increasing or decreasing trend during 2025.

The pH and EC readings recorded over 2025 are summarised in **Table 5.6**, with all data collected since monitoring began presented in **Figure 5.17** and **Figure 5.18**.

Table 5.6 Summary of pH and EC Recorded Over 2025 – Shallow Permian Coal Measures

Screened Lithology	Field pH Range	EC Range (µS/cm)	Comment
Sandstone	6.79–7.95	614–20,900	Four bores (P2, WBR183, WBR240 and WBR50A) monitoring the shallow Permian coal measures recorded pH exceedances over 2025. Bores P5A, P6A, WBR180, and WBR183, and recorded EC exceedances over 2025.

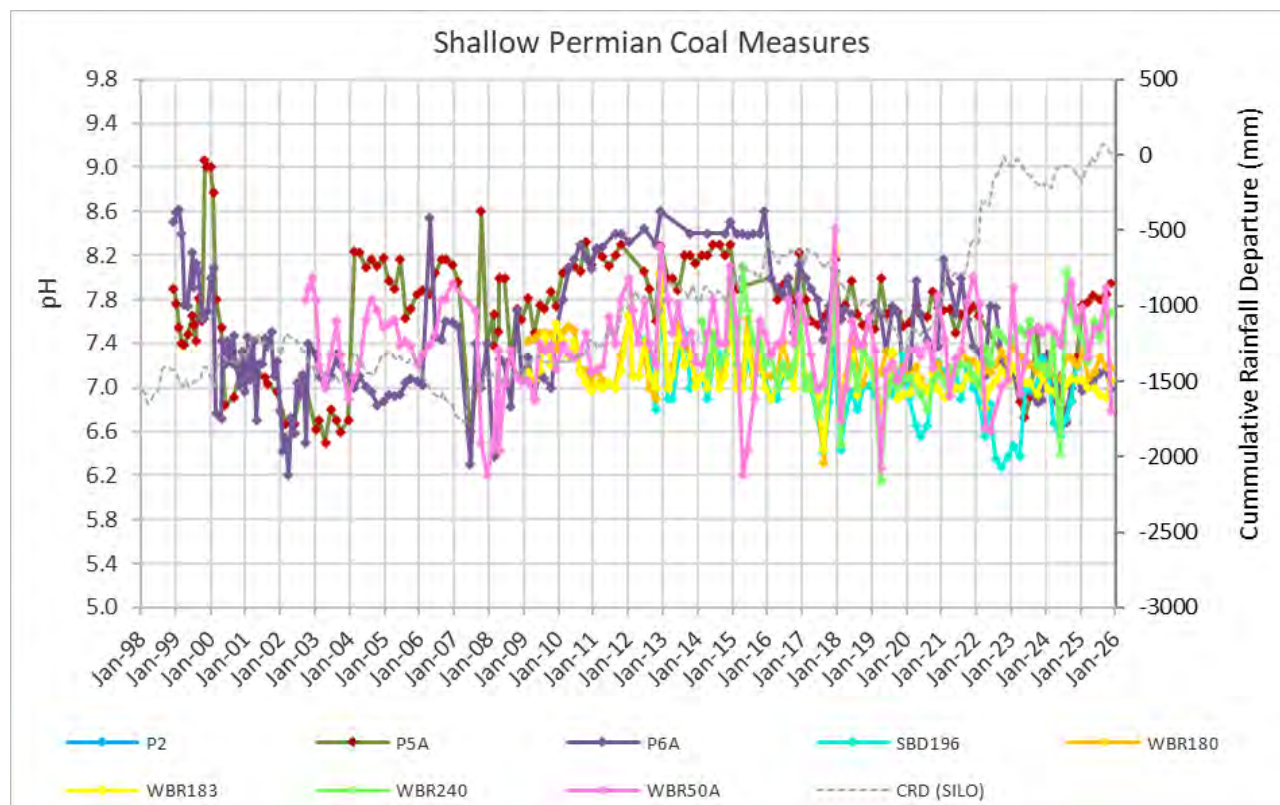


Figure 5.17 Shallow Permian Coal Measures – pH

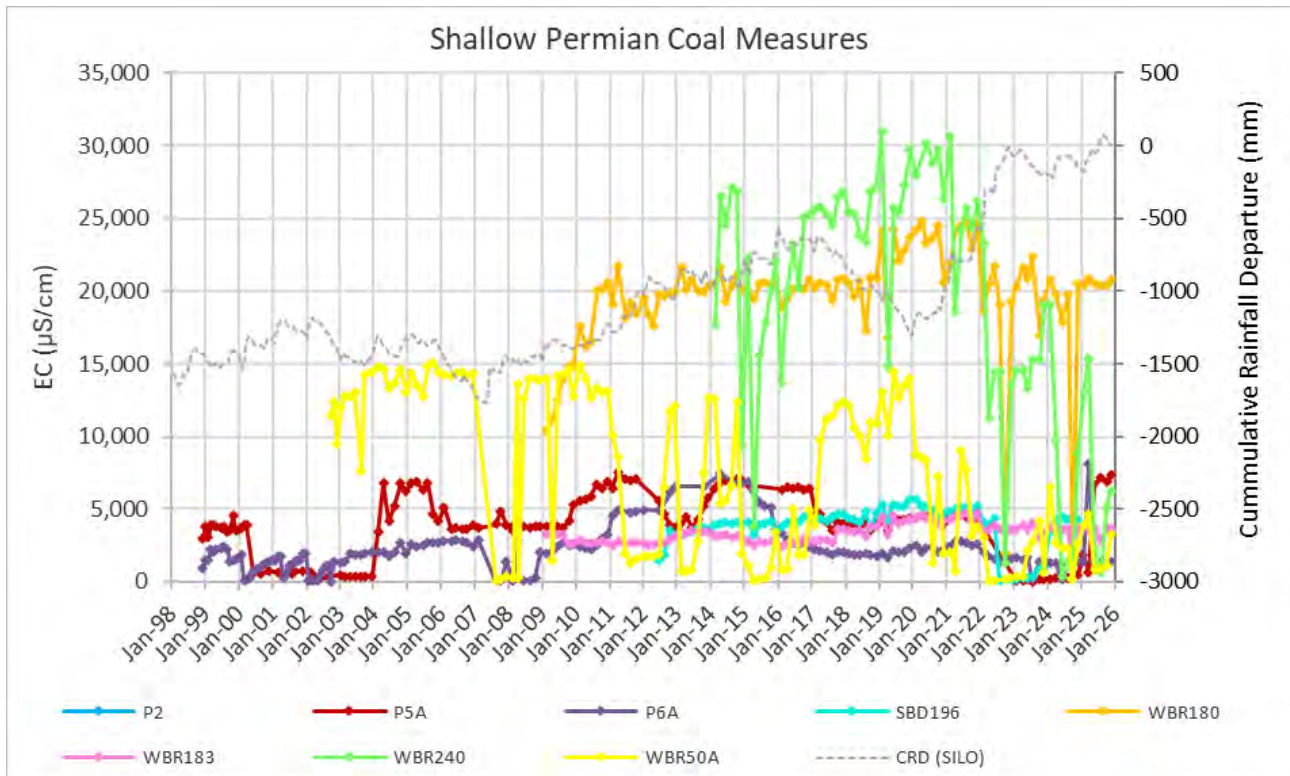


Figure 5.18 Shallow Permian Coal Measures – EC

5.4 Permian Coal Measures

Discussion of groundwater level and quality trends within the fractured rock aquifers associated with the Permian coal measures are included in the sections below.

5.4.1 Newcastle Coal Measures

Trends in groundwater levels and quality over 2025 are discussed in **Section 5.4.1.1** and **Section 5.4.1.2** below. The vertical hydraulic gradient between interburden (sandstone) and the Alcheringa Seam are monitored via a series five sets of nested bores:

- Bores NPZ3-A, NPZ4-A, NPZ5-A, NPZ7-2A, NPZ7-3A monitor the Alcheringa Seam. It is noted that monitoring ceased in NPZ3-A in 2015.
- Bores NPZ3-B, NPZ4-B, NPZ5-B, NPZ7-2B, NPZ7-3B monitor the underlying interburden sandstone to the west of BCC.

The hydraulic gradient trend is discussed in **Section 5.4.2.3**.

5.4.1.1 Alcheringa Seam

Groundwater Levels

During 2025, groundwater elevations ranged between 65.13 mAHD (8.79 mbgl) at bore NPZ5-A and 67.66 mAHD (12.09 mbgl) at bore WBD62A. Across the monitoring network, groundwater levels fluctuated modestly throughout the year, with total variation was generally less than 1 m at each location.

Groundwater levels in 2025 showed a gradual decline towards historical baseline conditions following the substantial recharge event experienced during 2021 and 2022. The Alcheringa Seam monitoring network reflects semi-confined to confined groundwater pressures associated with the Permian coal measures to the west of the Beltana Whybrow goaf, where underground mining ceased in 2011. Minor seasonal fluctuations observed during 2025 are considered consistent with recharge variability and hydraulic connectivity within the coal measure unit.

Groundwater levels for the five bores monitoring the Alcheringa Seam are presented in **Figure 5.19**.

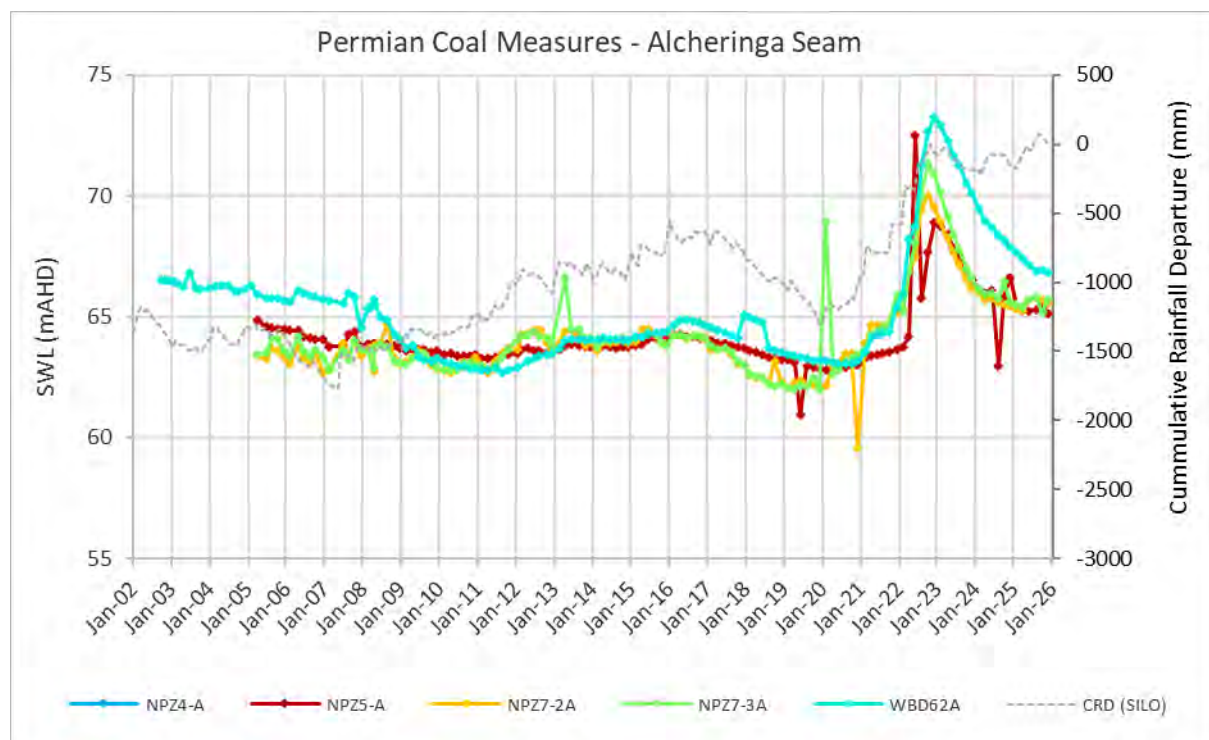


Figure 5.19 Groundwater Levels – Permian Coal Measures – Alcheringa Seam

Water Quality

During 2025, pH values across the Alcheringa Seam bores ranged between 6.82 (NPZ5-A, April 2025) and 7.93 (NPZ7-3A, February 2025).

Overall, pH values fluctuated within a relatively narrow range around neutral conditions and remained broadly consistent with the historical range for the seam. The exceedances observed during 2025 were generally marginal and do not indicate a sustained shift in groundwater chemistry.

In 2025, EC levels ranged from 347 $\mu\text{S}/\text{cm}$ (WBD62A, February 2025) to 2100 $\mu\text{S}/\text{cm}$ (NPZ7-2A, October 2025). EC exceedances were recorded at NPZ5-A in October and December 2025. All other bores remained within their respective EC trigger thresholds throughout the reporting period.

EC levels remained relatively stable across the seam monitoring network, with moderate seasonal variability observed. Slight increases in EC during the latter part of the year at some bores may reflect reduced dilution during drier periods rather than a change in groundwater source or quality.

The exceedances recorded during 2025 appear marginal and episodic rather than systematic. There is no evidence of a progressive shift in groundwater chemistry within the Alcheringa Seam when compared to historical data observed at these bores.

The stabilised groundwater levels and absence of systematic EC increases are consistent with the previously documented hydraulic recovery and do not suggest changes in vertical hydraulic connectivity between the seam and adjacent stratigraphic units. Observed variations during 2025 are considered consistent with climatic recharge influence rather than structural or operational impacts.

The pH and EC readings recorded over 2025 are summarised in **Table 5.7**, with all data collected since monitoring began presented in **Figure 5.20** and **Figure 5.21**.

Table 5.7 Summary of pH and EC Recorded Over 2025 – Alcheringa Seam

Screened Lithology	Field pH Range	EC Range (µS/cm)	Comment
Coal	6.82–7.93	347– 2,100	All four bores (NPZ4-A, NPZ5-A, NPZ7-2A and NPZ7-3A) monitoring the Permian coal measures – Alcheringa Seam, recorded pH exceedances over 2025. Bore NPZ5-A recorded EC exceedances over 2025.

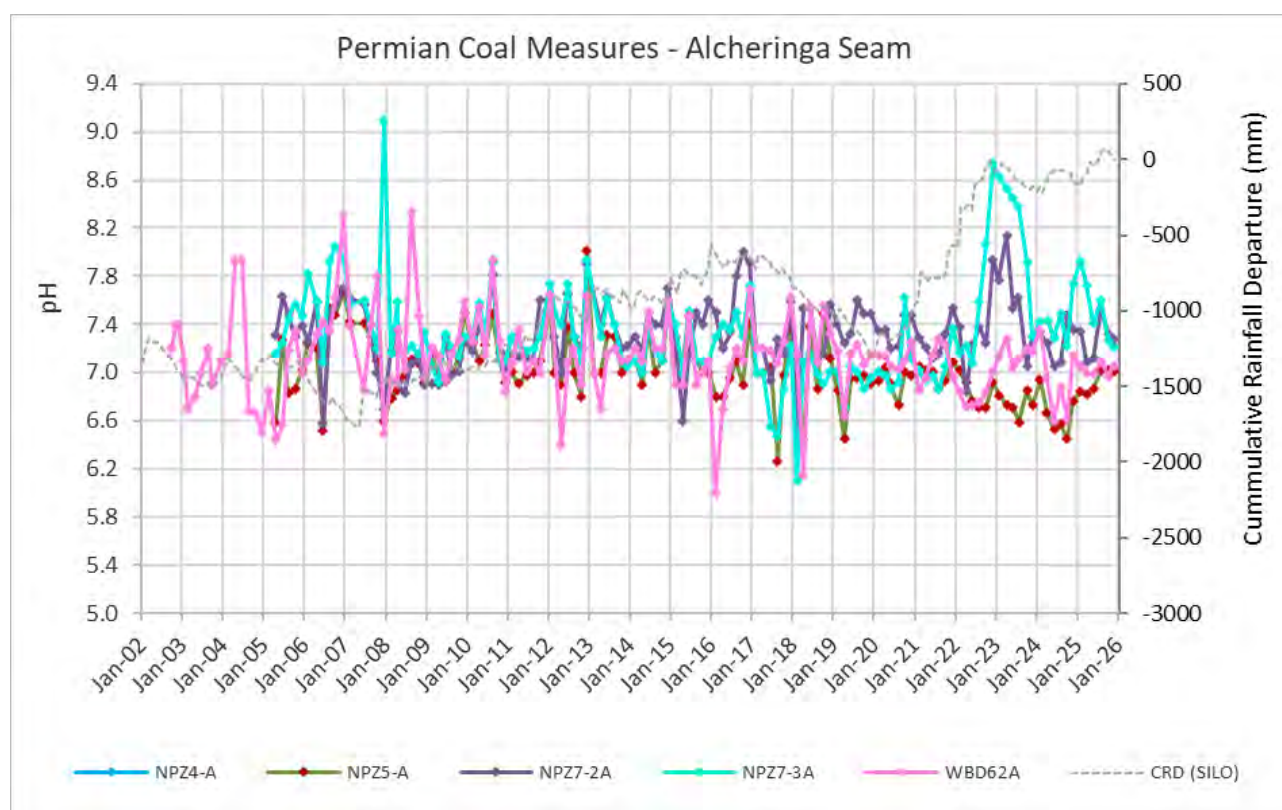


Figure 5.20 Alcheringa Seam – pH

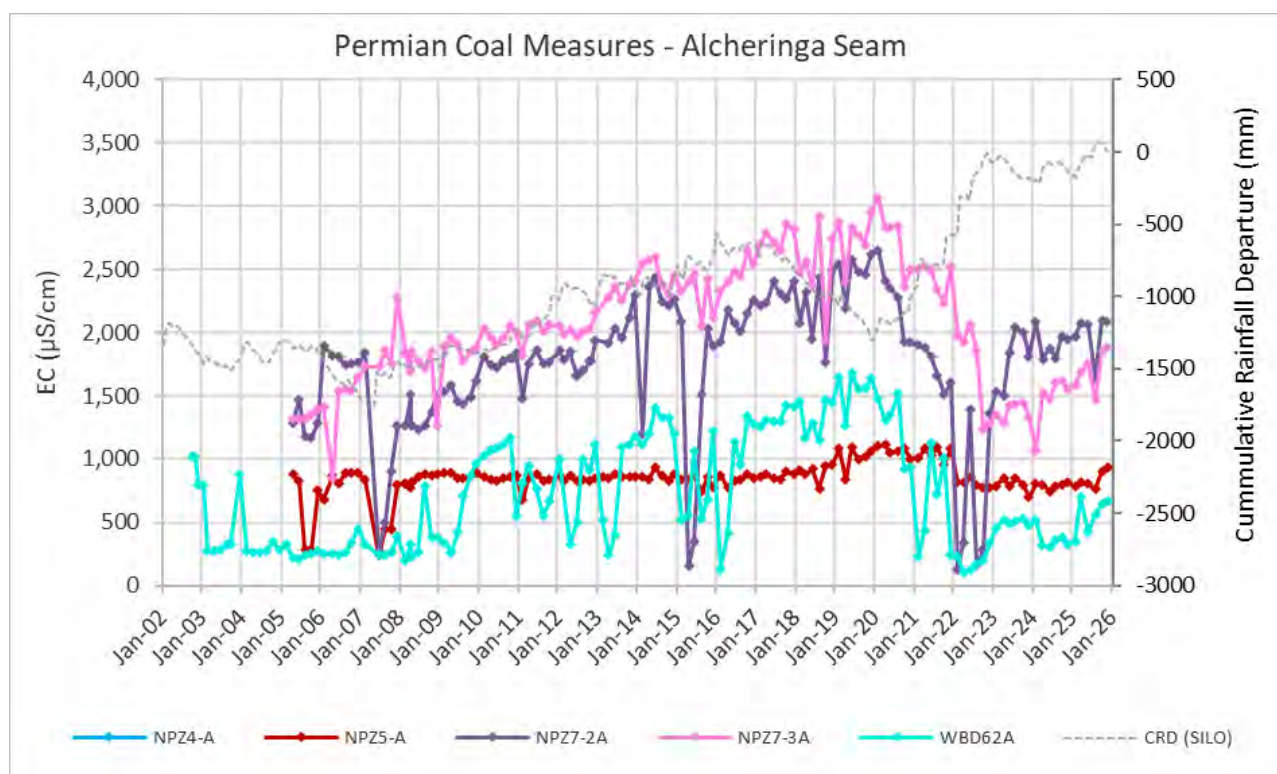


Figure 5.21 Alcheringa Seam – EC

5.4.1.2 Interburden (Sandstone)

There are six groundwater bores monitoring the interburden sandstone. Trends in groundwater levels and quality over 2025 are discussed in the sections below.

Groundwater Levels

During 2025, groundwater elevations ranged between 67.01 mAHD (6.61 mbgl) at bore NPZ7-3B (June–2025) and 49.48 mAHD (24.42 mbgl) at bore NPZ5-B (April 2025). Across the monitoring network, groundwater levels fluctuated modestly throughout the year, with changes typically within approximately 1–2 m at each bore. The overall behaviour is consistent with the relatively stable hydraulic conditions reported in 2024.

Groundwater levels for the six interburden (sandstone) bores are presented in **Figure 5.22**.

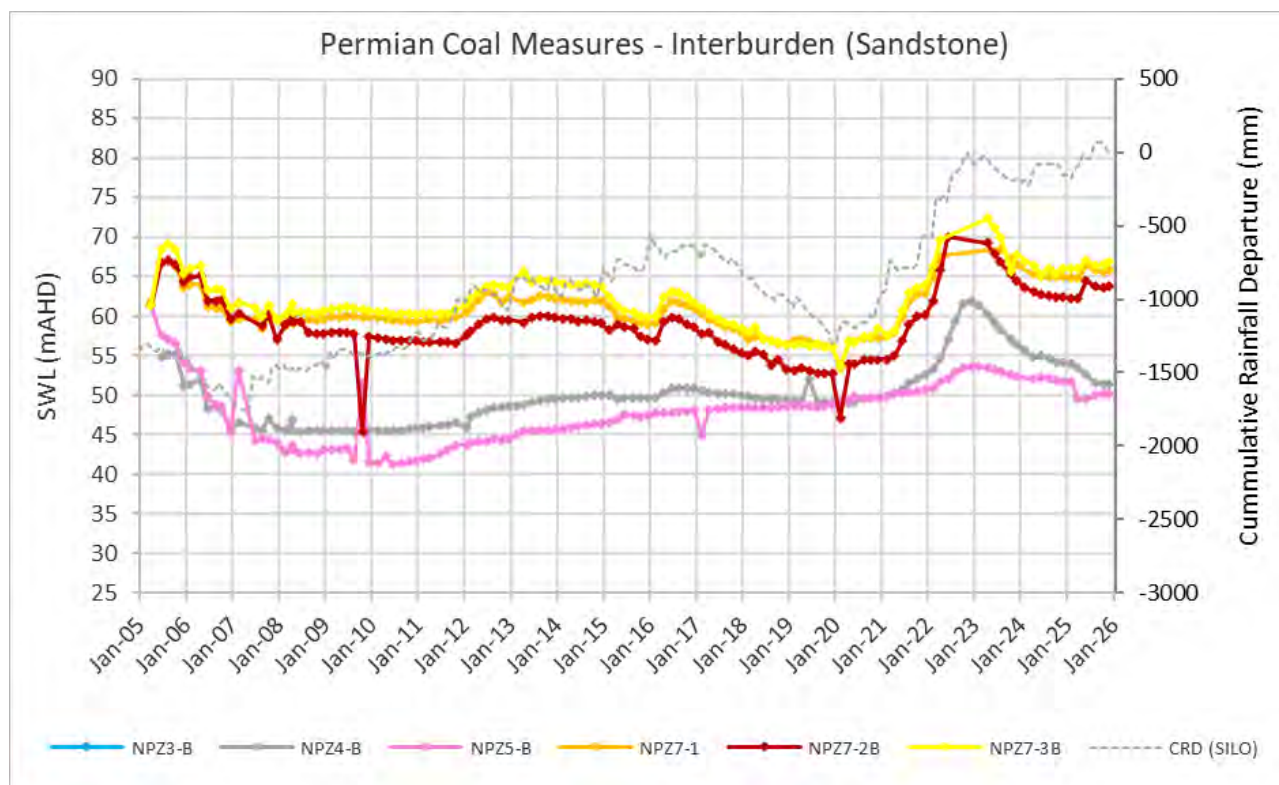


Figure 5.22 Groundwater Levels – Interburden (Sandstone)

5.4.1.3 Water Quality

During 2025, pH values ranged between 7.11 (NPZ4-B, February and April 2025) and 8.24 (NPZ7-1, August 2025).

Based on the trigger values provided, the following trigger exceedances were recorded:

- Upper pH trigger exceedances:
 - NPZ3-B: February (7.52), August (7.68), December (7.59).
 - NPZ7-1: February (7.80), August (8.24), October (7.95).
- Lower pH trigger exceedances:
 - NPZ4-B: February (7.11), April (7.11), June (7.20), August (7.14), October (7.28).

The pH trends in 2025 indicates that exceedances are concentrated at specific bores (NPZ4-B for low pH and NPZ7-1 for elevated pH), rather than reflecting a consistent network-wide shift. This is consistent with local hydrogeochemical variability within the interburden sandstone and does not, on its own, indicate a progressive deterioration in groundwater quality across the unit.

During 2025, EC levels ranged between 777 $\mu\text{S}/\text{cm}$ (NPZ3-B, August 2025) and 2,790 $\mu\text{S}/\text{cm}$ (NPZ5-B, February 2025).

EC trigger exceedances were recorded at:

- NPZ4-B: February (1420), April (1480), June (1460), August (1370), October (1450), December (1460). All rounds exceeded the trigger value of 1342 $\mu\text{S}/\text{cm}$.
- NPZ7-2B: April (1320), June (1310), October (1310), December (1310). Exceeded the trigger of 1307 $\mu\text{S}/\text{cm}$.

- NPZ5-B: February (2790). Exceeded the trigger of 2760 $\mu\text{S}/\text{cm}$.

All other bores remained within their respective EC trigger thresholds during 2025.

The persistence of EC exceedances at NPZ4-B (and repeated exceedances at NPZ7-2B) suggests that the current EC triggers at these locations should be reviewed to confirm that they remain representative of baseline conditions and beneficial use protection, consistent with the approach applied in the 2024 assessment.

The pH and EC readings recorded over 2025 are summarised in **Table 5.8**, with all data collected since monitoring began presented in **Figure 5.23** and **Figure 5.24**.

Table 5.8 Summary of pH and EC Recorded Over 2025 – Interburden (Sandstone)

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Sandstone	7.11-8.24	777–2,790	Three bores (NPZ3-B, NPZ4-B, and NPZ7-1) monitoring the interburden (sandstone) recorded pH exceedances over 2025. Three bores (NPZ4-B, NPZ7-B, and NPZ5-B) recorded EC exceedances over 2025.

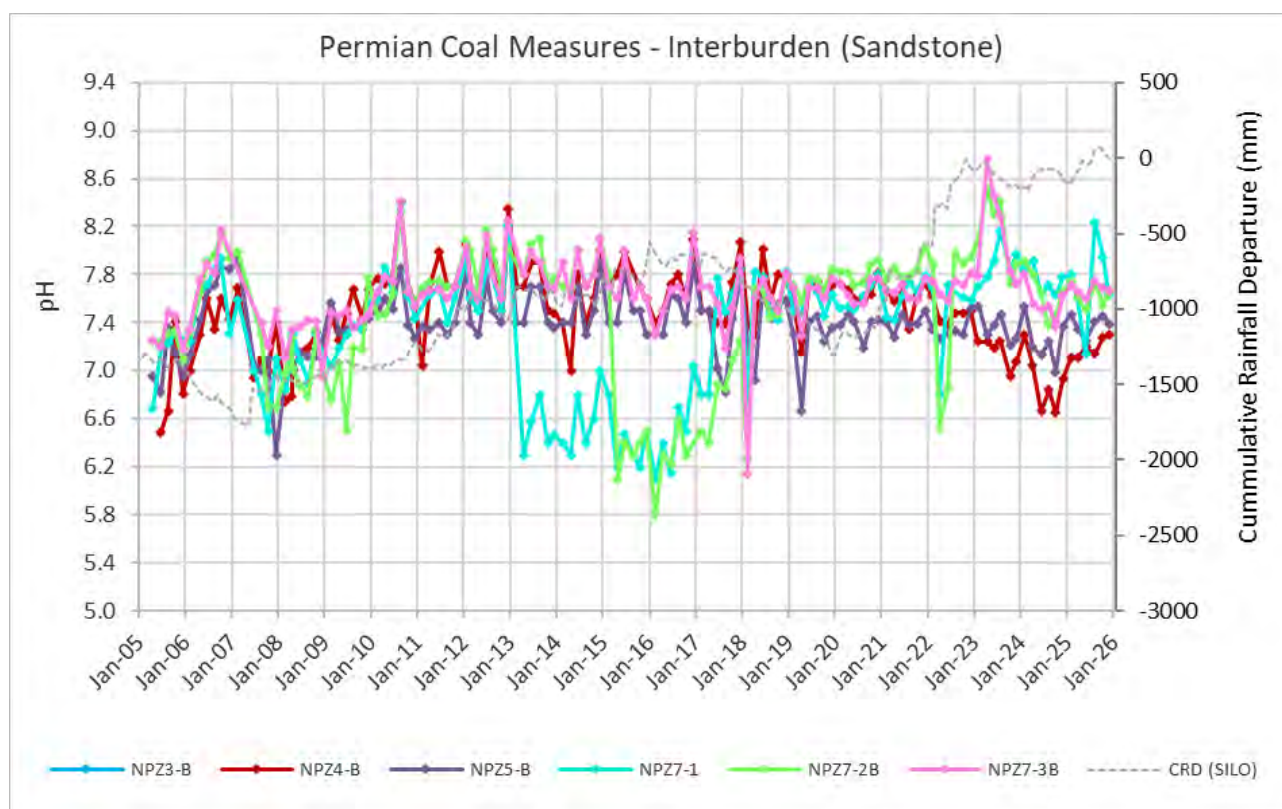


Figure 5.23 Interburden - pH

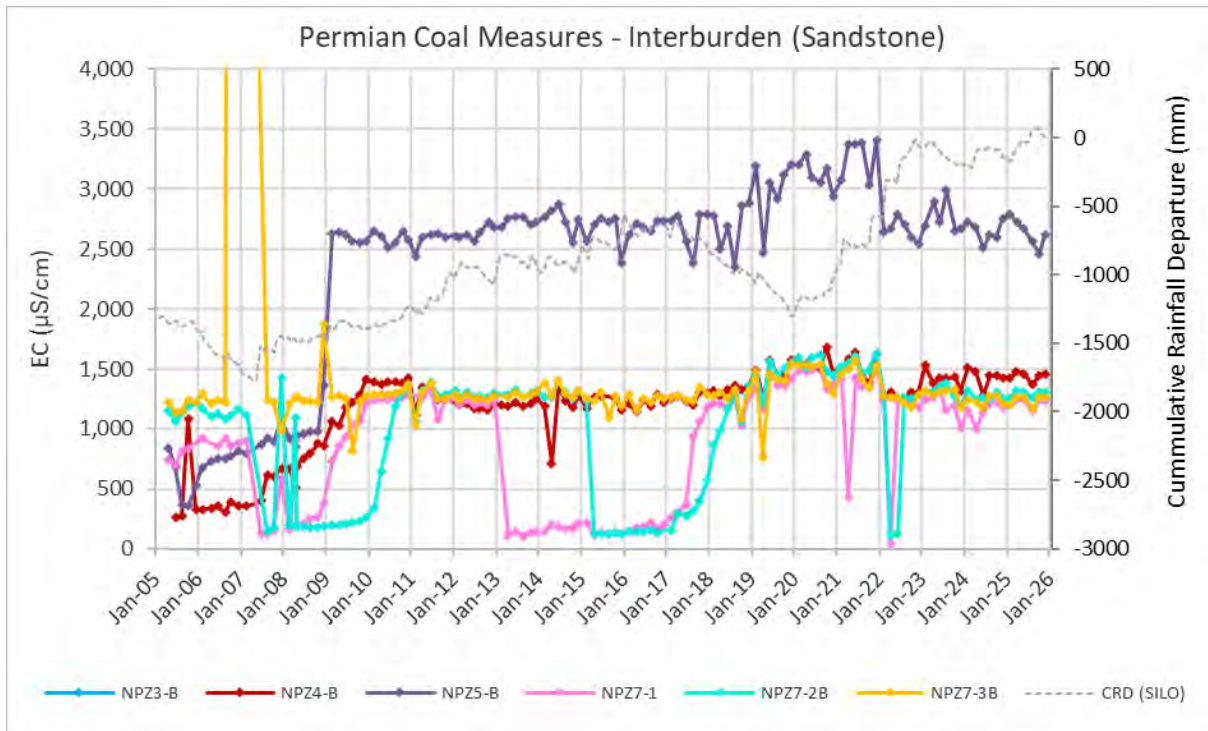


Figure 5.24 Interburden – EC

5.4.1.4 Alcheringa Seam and Interburden Connectivity

Groundwater level data collected since monitoring commenced are presented for each set of nested bores in **Figure 5.25** to **Figure 5.29**. A review of the data recorded indicates:

- NPZ3 – Groundwater levels within the interburden (NPZ3-B) ranged between 65.98 mAHD and 66.73 mAHD over 2025 and fluctuated modestly in response to seasonal climatic conditions. Monitoring of the overlying Alcheringa Seam via bore NPZ3-A ceased in 2015. Conditions in 2025 are consistent with those described in 2024, with the sandstone continuing to reflect rainfall-driven recharge.
- NPZ4 – During 2025, groundwater levels in the Alcheringa Seam (NPZ4-A) ranged between 66.17 mAHD and 67.07 mAHD, while groundwater levels in the underlying interburden sandstone (NPZ4-B) ranged between 51.42 mAHD and 54.03 mAHD. Groundwater levels in the Alcheringa Seam remained consistently above those in the sandstone throughout 2025, indicating a persistent downward vertical hydraulic gradient. The magnitude of the gradient remained significant, with differences generally greater than 12 m. This trend is consistent with that described in 2024, where a downward gradient was present and both units reflected climatic trends.
- NPZ5 – During 2025, groundwater levels in the Alcheringa Seam (NPZ5-A) ranged between 65.13 mAHD and 65.41 mAHD, while groundwater levels in the underlying sandstone (NPZ5-B) ranged between 49.48 mAHD and 51.75 mAHD. Groundwater levels in the seam remained above those in the sandstone in all monitoring events during 2025, indicating a continued downward vertical hydraulic gradient. The difference between units remained in the order of approximately 14 m to 16 m. This is consistent with the conditions described in 2024, where the seam remained hydraulically above the sandstone and the downward gradient persisted. No reversal of the gradient was observed during 2025.

- NPZ7-2 – During 2025, groundwater levels in the Alcheringa Seam (NPZ7-2A) ranged between 65.22 mAHD and 65.77 mAHD, while groundwater levels in the sandstone (NPZ7-2B) ranged between 62.16 mAHD and 64.52 mAHD. Groundwater levels in the seam remained above those in the sandstone throughout 2025, indicating a downward vertical hydraulic gradient for the reporting period. The magnitude of the gradient was smaller than that observed at NPZ4 and NPZ5, generally in the order of 1 m to 3 m. This is consistent with the 2024 observation that a downward gradient had returned following previous periods of upward gradient. No upward gradient was observed at NPZ7-2 during 2025. Bore NPZ7-1, screened within the interburden approximately 70 m southwest of NPZ7-2, recorded groundwater levels between 64.77 mAHD and 66.49 mAHD over 2025. These levels are comparable to those observed at NPZ7-2B and reflect similar climatic influences.
- NPZ7-3 – During 2025, groundwater levels in the Alcheringa Seam (NPZ7-3A) ranged between 65.16 mAHD and 65.82 mAHD, while groundwater levels in the sandstone (NPZ7-3B) ranged between 66.00 mAHD and 67.01 mAHD. Throughout 2025, groundwater levels in the sandstone remained above those in the Alcheringa Seam, indicating a persistent upward vertical hydraulic gradient at this location. The difference between units was generally in the order of approximately 0.5 m to 1.5 m. This is consistent with the 2024 findings, where an upward vertical hydraulic gradient was present from 2022 onwards. Both units fluctuated in response to climatic conditions during 2025. However, no reversal of the upward gradient was observed during the reporting period. A downward vertical hydraulic gradient was recorded from 2006 to 2012 and again between 2014 to 2022. Between 2012 and 2014 groundwater levels were virtually identical in the Alcheringa Seam and the sandstone.

Summary:

- The vertical hydraulic gradients observed during 2025 are consistent with those described in 2024:
 - Downward vertical hydraulic gradient at NPZ4, NPZ5 and NPZ7-2.
 - Upward vertical hydraulic gradient at NPZ7-3.
 - Overall, the 2025 data indicate that vertical hydraulic relationships between the Alcheringa Seam and the interburden sandstone remain stable and broadly consistent with historical observations.

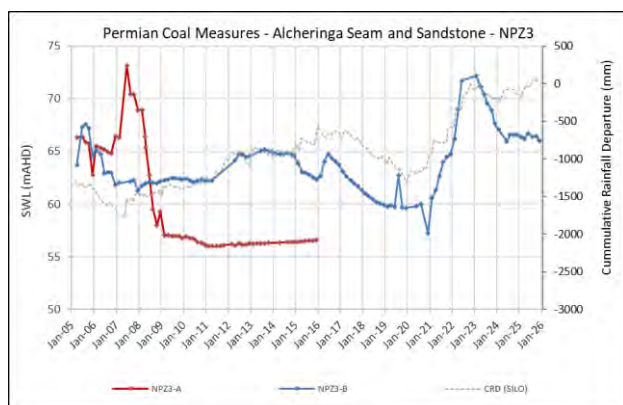


Figure 5.25 NPZ3-A and NPZ3-B

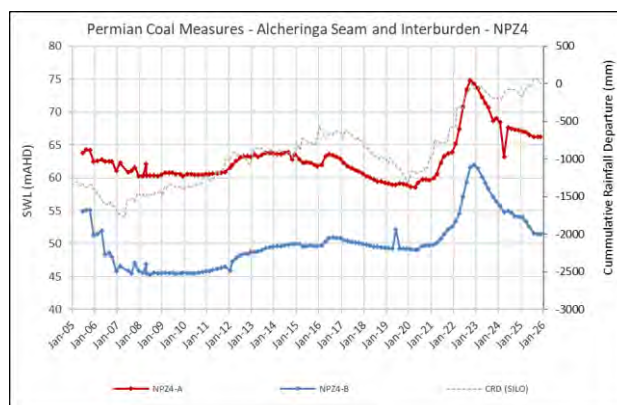


Figure 5.26 NPZ4-A and NPZ4B

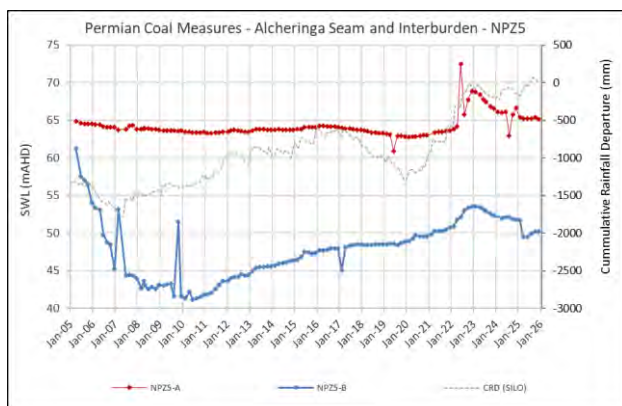


Figure 5.27 NPZ5-A and NPZ5-B

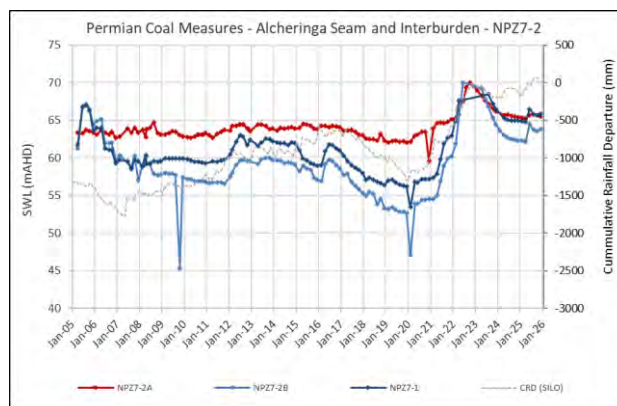


Figure 5.28 NPZ1, NPZ7-2A and NPZ7-2B

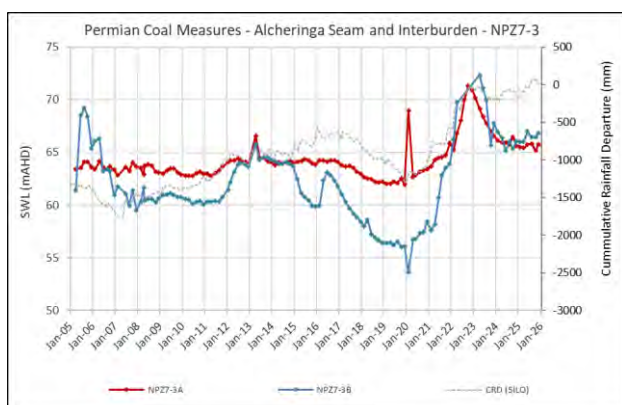


Figure 5.29 NPZ7-3A and NPZ7-3B

5.4.2 Wittingham Coal Measures

There are four bores monitoring the Lower Whybrow Seam which forms part of the Wittingham Coal Measures. Trends in groundwater levels and quality over 2025 are discussed in the sections below.

The vertical hydraulic gradient between the shallow Permian coal measures and the Lower Whybrow Seam are monitored via two sets of nested bores:

- Bores P6A and P6B monitor the shallow Permian coal measures and Lower Whybrow Seam.
- Bores WB50A and WBR50 are installed northwest of BCC and the Beltana underground workings. WBR50A monitors the shallow Permian coal measures and WBR50 monitors the Lower Whybrow Seam.

The hydraulic gradient trend is discussed in **Section 5.4.2.3**.

5.4.2.1 Groundwater Levels

Over 2025, groundwater elevations within the bores ranged between 77.21 mAHD (10.17 mbgl) in bore P8 (October 2025) and -30.09 mAHD (115.19 mbgl) in bore P6B (April 2025).

Groundwater levels in P8 remained relatively stable throughout 2025, ranging between 75.73 mAHD and 77.21 mAHD. Groundwater levels in WBR50 ranged between 28.63 mAHD and 30.83 mAHD and showed modest seasonal fluctuations.

Groundwater levels in P6B remained significantly lower than the other bores, ranging between -30.09 mAHD and -20.67 mAHD. Fluctuations of approximately 9 m were recorded over 2025. This behaviour is consistent with ongoing recovery dynamics within the Lower Whybrow Seam following cessation of underground mining in 2018.

Groundwater levels for the Permian coal measures bores are presented in **Figure 5.30**.

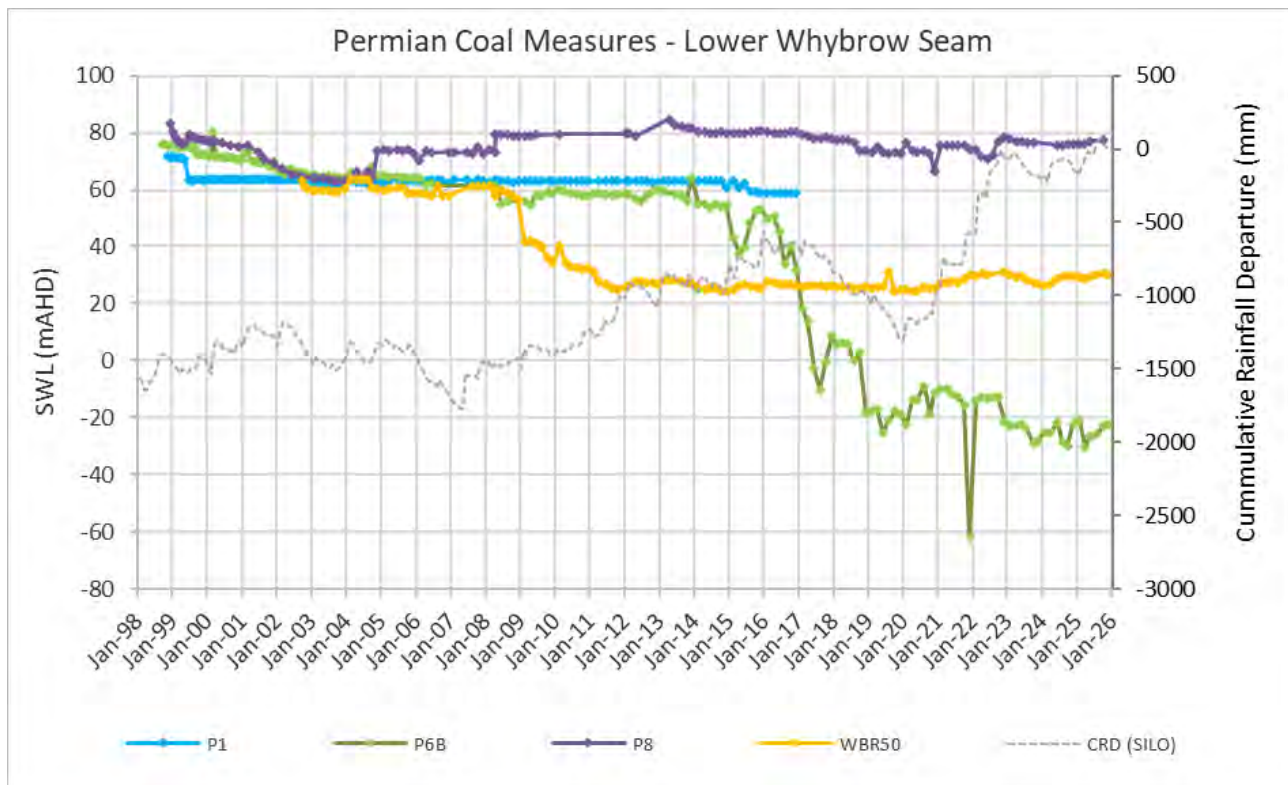


Figure 5.30 Groundwater Levels – Permian Coal Measures – Lower Whybrow Seam

5.4.2.2 Water Quality

Over 2025, pH and EC in P8 and WBR50 remained relatively stable and within historical ranges. P6B recorded pH values between 8.25 and 8.81 over 2025, exceeding the upper trigger value of 7.3 in all monitoring events.

WBR50 recorded two pH values below the lower trigger of 6.7 (6.59 in February and 6.41 in June 2025). All other WBR50 pH values remained within trigger limits.

P8 recorded pH values between 6.75 and 7.48. Values in February (6.97), April (6.75) and October (7.09) were below the lower trigger of 7.3. The June value (7.48) remained within the trigger values, indicating no exceedance.

EC levels over 2025 ranged between 191 $\mu\text{S}/\text{cm}$ (P8, April 2025) and 6,830 $\mu\text{S}/\text{cm}$ (P6B, April 2025). P6B recorded EC levels between 2,700 $\mu\text{S}/\text{cm}$ and 6,830 $\mu\text{S}/\text{cm}$ during 2025. All readings exceeded the trigger value of 1,353 $\mu\text{S}/\text{cm}$. EC levels in P8 ranged between 191 $\mu\text{S}/\text{cm}$ and 505 $\mu\text{S}/\text{cm}$ and remained below the trigger value of 5,076 $\mu\text{S}/\text{cm}$ throughout 2025. EC levels in WBR50 ranged between 715 $\mu\text{S}/\text{cm}$ and 1,410 $\mu\text{S}/\text{cm}$ and remained below the trigger value of 8,382 $\mu\text{S}/\text{cm}$.

The elevated EC levels at P6B are consistent with those reported in 2024, where EC ranged between 5,900 $\mu\text{S}/\text{cm}$ and 6,930 $\mu\text{S}/\text{cm}$ and exceeded the trigger value. P6B is located approximately 5 km south of active mining and above the underground workings. As underground mining ceased in 2018, the elevated EC may reflect changes in groundwater chemistry associated with recovery of water levels within the workings and redistribution of saline waters within the seam.

It is recommended that groundwater quality trends at P6B continue to be monitored to assess long-term recovery behaviour. The suitability of the EC trigger value for this bore should be reviewed, consistent with the approach recommended in 2024.

The pH and EC readings recorded over 2025 are summarised in **Table 5.9**, with all data collected since monitoring began presented in **Figure 5.31** and **Figure 5.32**.

Table 5.9 Summary of pH and EC Recorded Over 2025 – Lower Whybrow Seam

Screened Lithology	Field pH Range	EC Range ($\mu\text{S}/\text{cm}$)	Comment
Coal	6.41-8.81	191-6830	Three bores (P6B, P8 and WBR50) monitoring the Permian coal measures – Lower Whybrow Seam, recorded pH exceedances over 2025. Bore P6B recorded EC exceedances over 2025.

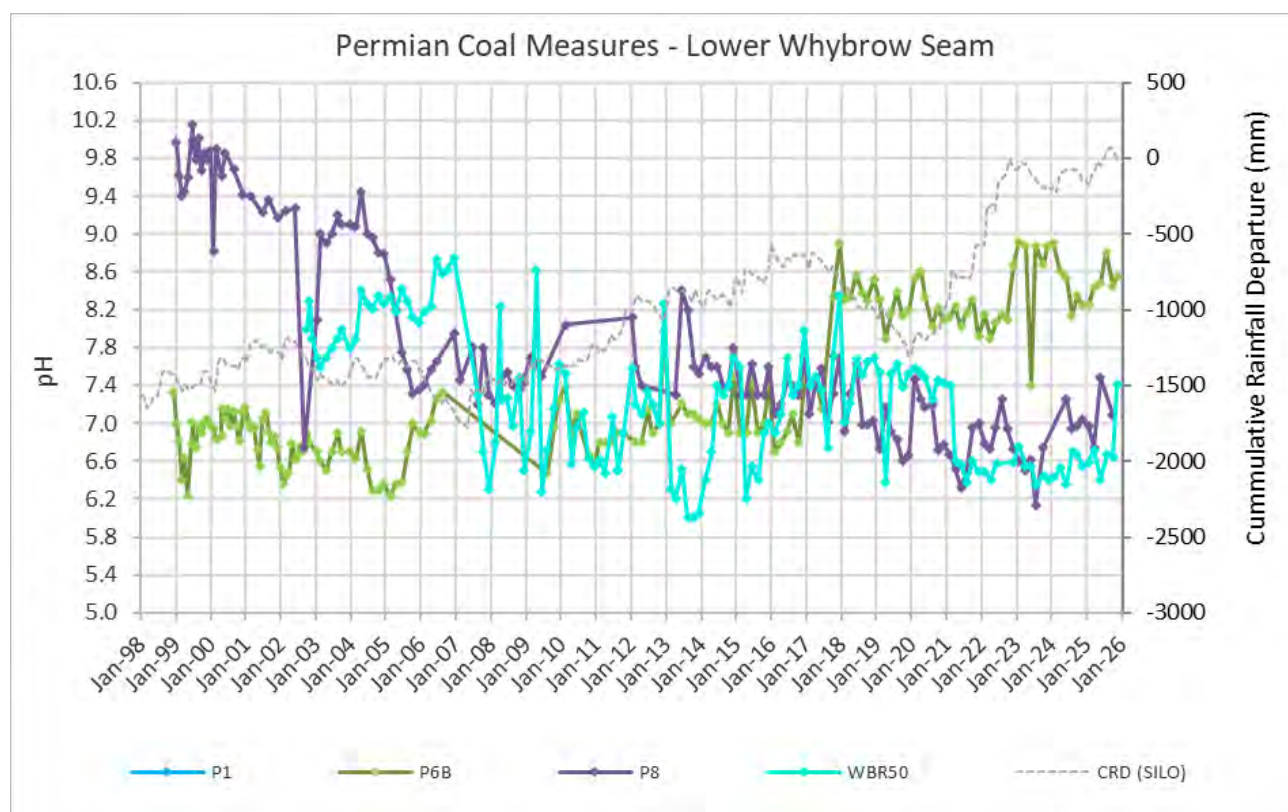


Figure 5.31 Lower Whybrow Seam – pH

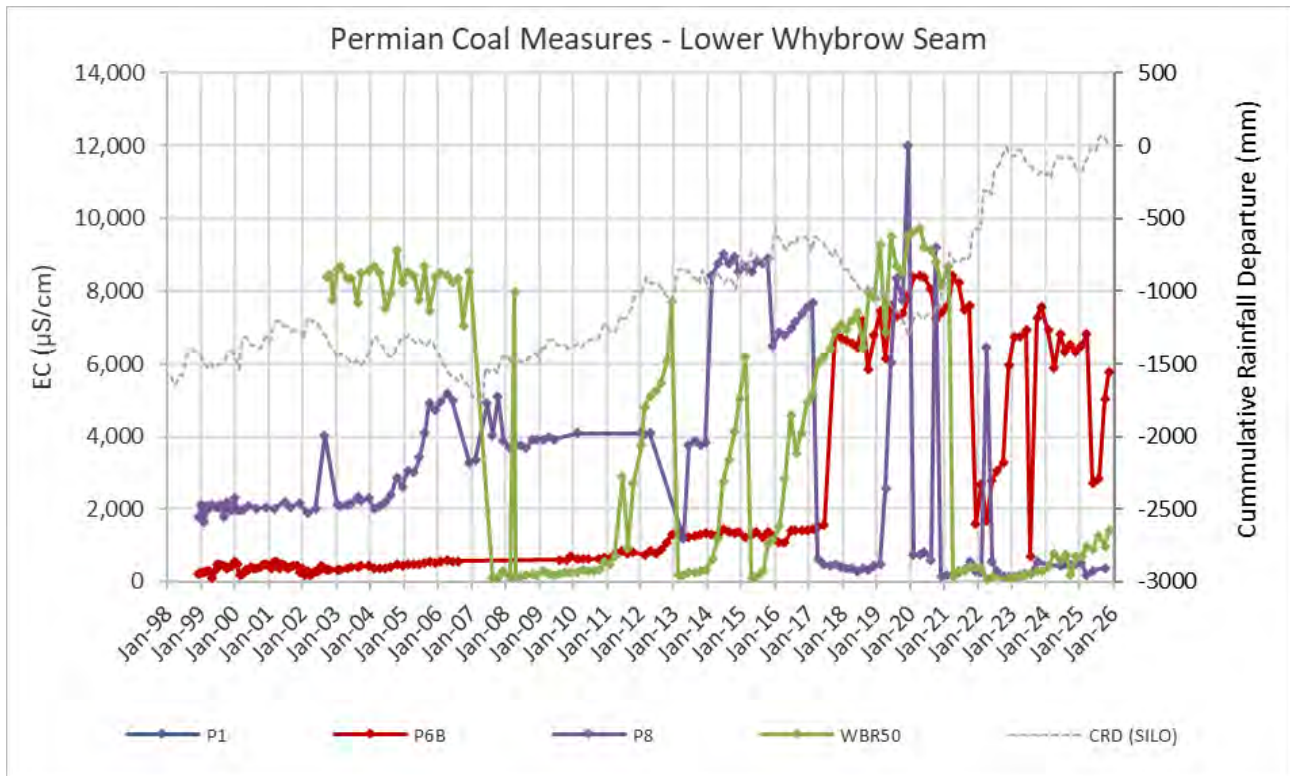


Figure 5.32 Lower Whybrow Seam – EC

5.4.2.3 Shallow Permian Coal Measures and Lowery Whybrow Seam Connectivity

Groundwater level data collected since monitoring commenced are presented for each set of nested bores in **Figure 5.33** and **Figure 5.34**. A review of the data recorded indicates:

- P6 – A downward vertical hydraulic gradient from the shallow Permian coal measures to the underlying Lower Whybrow Seam has been maintained since monitoring began in 1998. The hydraulic gradient began to increase from 2016 onwards. Jacobs (2024) considered the change in gradient to be due to the depressurisation of the Blakefield Seam to the north. Neither unit shows a response to changing climatic conditions.
- WBR50 – Between 2008 and 2011 groundwater levels in the Lower Whybrow Seam (WBR50) declined to 25 mAHD during the period of depressurisation of the Whybrow Seam. Levels have remained stable from when mining ceased in the Beltana Underground in 2011 to present, with a minimal response to climatic conditions from 2020 to present. During 2025, the groundwater level at WBR50 was observed to be approximately 30 mAHD. The seam has not recovered following cessation of underground mining in 2011. In comparison, groundwater levels in the overlying shallow Permian coal measures have remained relatively stable since 2002, with no response to mining in the Beltana Underground and only a minimal response to climatic trends from 2020 to the present. Since 2008 a downward vertical hydraulic gradient has been recorded and the difference between the two units has remained relatively constant.

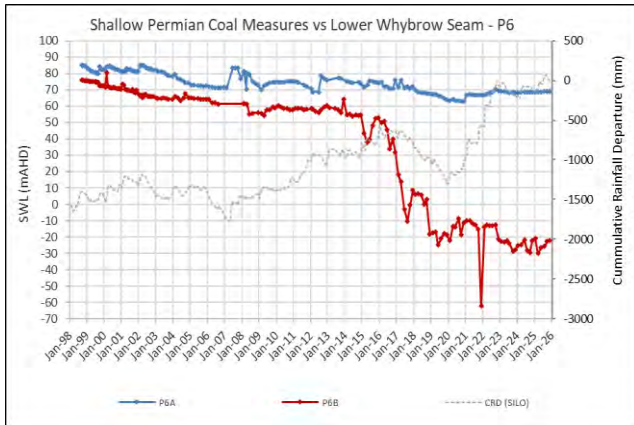


Figure 5.33 P6A and P6B

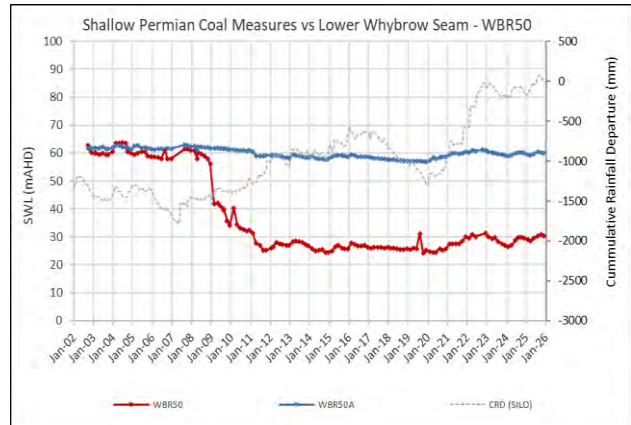


Figure 5.34 WBR50 and WBR50A

5.5 Vibrating Wire Piezometers

There are eight VWP that form part of the groundwater network, including MB1, MB2A, MB2B, MB3A, MB3B, SBD194, WBD-170 and WBD-171. The MB series VWPs are located to the west and north of the Northern Tailings Emplacement Facility. The remaining three VWPs are installed to the west, northwest and east of the underground workings. The location of the VWPs is shown in **Figure 3.3** and detailed in **Appendix A**. The VWP graphs are presented in **Appendix C**.

5.5.1 Permian Coal Measures

Groundwater trends of the three VWPs monitoring the Permian coal measures near the underground workings are summarised below:

- VWP SBD194 monitors the depressurisation of the shallow coal measures, Watts Sandstone, Whybrow, Redbank Creek, Wambo, Blakefield, Glen Munro, Woodlands Hill and Piercefield A and B seams. The VWP is located above the southwestern side of the underground workings, and to the east of Wollombi Brook. Groundwater levels in the shallow coal measures, Woodlands Hill and Piercefield A and B seams have remained relatively stable since monitoring began. Groundwater levels in the Watts Sandstone recorded a declining trend while levels in the Redbank Creek Seam recorded an increasing trend since monitoring began. Groundwater levels in the Blakefield and Glen Munro seams declined until 2016 and then remained relatively stable. Groundwater levels in the Whybrow and Wambo seams declined until 2022 before recording an increase in water levels from October 2022 to December 2024. Over 2025 data was unable to be recorded due to damage to the logger unit which is currently being fixed.
- VWP WBD170 monitors groundwater levels within the undifferentiated coal measures and the Whybrow Seam. The VWP is located along the western edge of the underground workings, immediately east of Wollombi Brook. The three upper sensors installed within the undifferentiated coal measures recorded relatively stable groundwater levels from the commencement of monitoring until 2021. Between 2021 and 2024, groundwater levels fluctuated in response to climatic conditions. Groundwater levels within the Whybrow Seam increased from the commencement of monitoring in 2010 until the end of 2022, followed by a decline through to 2024. In 2025, groundwater levels fluctuated across all sensors. Sensors 1 and 2 recorded greater variability and higher water-level readings than in 2024, which may be attributable to above-

average rainfall in 2025. Sensors 3 and 4 also exhibited wider fluctuations, with the lowest water level recorded in 2025 being lower than that observed in 2024. This may be due to the decline in groundwater levels within the Whybrow Seam observed in 2024.

- VWP WBD171 also monitors groundwater levels in the undifferentiated coal measures and the Whybrow Seam. The VWP is located along the western edge of the underground workings and just to the east of Wollombi Brook, and approximately 225 m to the west of WBD170. Groundwater levels recorded in WBD171 in 2025 were almost stable, with minimal fluctuations, and matched the trends recorded in 2024.

5.5.2 Northern Tailings Emplacement Facility

Five VWPs (MB1, MB2A, MB2B, MB3A, and MB3B) were installed to the west and north of the Northern Tailings Emplacement Facility in June 2020 to monitor the potentiometric response to the TSF (Umwelt, 2022). The data has been reviewed, and the graphs are presented in **Appendix C**. The data indicates:

- MB1 – Located to the north of the TSF. The shallow sensor (MB1A), which monitors groundwater levels in the shallow Permian coal measures, recorded relatively stable groundwater levels from June 2020 to present. The deep sensor (MB1B), monitoring groundwater within the deep Permian coal measures, recorded a slight decline in levels between June 2020 and June 2023, followed by an increasing trend from July 2023 onwards. The deep sensor is intended to monitor the response of the Permian coal measures to open-cut and underground mining activities. In 2025, the shallow sensor (MB1A) continued to record relatively stable groundwater levels, with a slight increasing trend observed over the year. The deep sensor (MB1B) recorded greater fluctuations in groundwater levels during 2025, with a more pronounced increasing trend towards the end of the reporting period.
- MB2 – The VWP monitors groundwater levels within the Whybrow Seam and is located to the west of the TSF. Groundwater levels have fluctuated since monitoring began, but have remained relatively stable overall. Umwelt (2022) noted that the potentiometric level responds to water levels in Dam 69, where the Whybrow Seam is exposed. During 2025, groundwater levels remained stable, fluctuating by approximately 1 m.
- MB3 – Located to the south of the TSF. The shallow sensor (MB3A), which monitors groundwater levels within the shallow Permian coal measures, has remained stable since monitoring began. During 2025, groundwater levels also remained stable, fluctuating within approximately 0.2 m. The deep sensor (MB3B), monitoring groundwater within the deep Permian coal measures, has recorded a slight decline since monitoring commenced. The deep sensor is intended to monitor the response of the Permian coal measures to open-cut and underground mining activities. The sensors were installed within a chain pillar of the underground workings (Umwelt, 2022). In 2025, groundwater levels recorded by the deep sensor also remained stable, consistent with the trend recorded by the shallow sensor.

5.6 Groundwater Chemistry

Comprehensive water quality samples are collected from all groundwater monitoring bores every six months. The samples are analysed at a NATA accredited laboratory. The comprehensive analysis includes major ion chemistry (Ca, Mg, Na, K, Cl, HCO₃, CO₃ and SO₄).

Major ion results collected since 2008 for bores screened within the alluvium, regolith, sandstone, and coal seams is presented in **Figure 5.35**. Major ion results for the December 2025 sampling round are presented in **Figure 5.36**. The Piper diagrams indicate:

- Alluvium – has a predominantly sodium-chloride water type and has remained the same water type since monitoring began.
- Sandstone – has a predominantly sodium-bicarbonate water type, indicating a recharge source of the sandstone is likely from another groundwater unit and not from rainfall.
- Coal seams – have a predominantly sodium-bicarbonate-chloride water type.

The water chemistry recorded in December 2025 is similar to the water types defined by the data from 2008 to 2024.

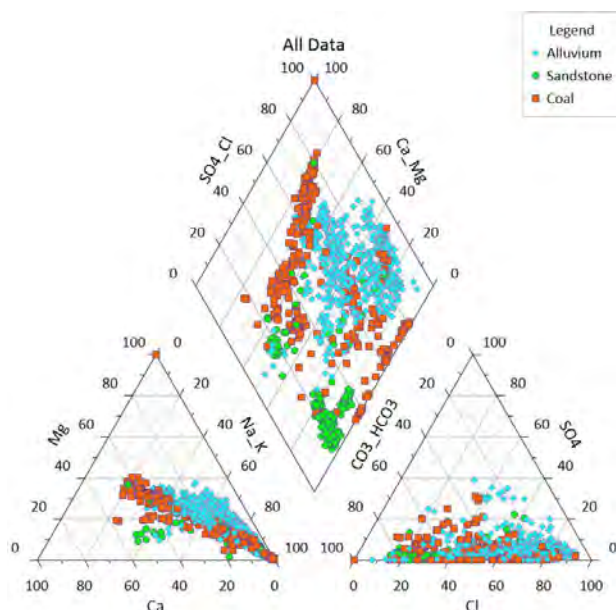


Figure 5.35 Piper Diagram – 2008 to 2024

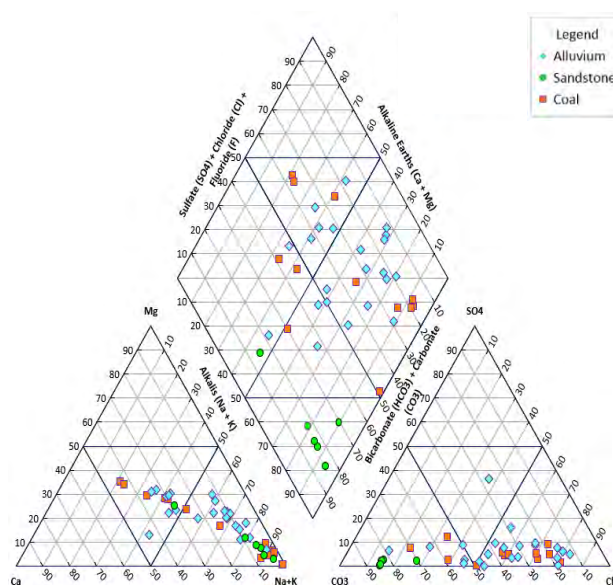


Figure 5.36 Piper Diagram – December 2025

5.7 Groundwater Exceedances

5.7.1 Groundwater Levels

Groundwater level data collected over 2025 have been compared to the trigger values for monitoring bores, which have trigger levels assigned as outlined in the WMP (Bulga Coal, 2021).

There were no groundwater level exceedances recorded over 2025.

5.7.2 Groundwater Quality

Water quality data collected over 2025 have been compared to the trigger values outlined in the WMP (Bulga Coal, 2021). Bores where pH or EC levels were outside the trigger value are summarised in **Table 5.10**. Trigger exceedances have been reviewed by comparing the data to groundwater levels and climate indicated by the CRD plot. An analysis of the trigger exceedances is summarised in **Table 5.10** and the locations shown on **Figure 5.37**.

Given that most of the monitoring bores have exceeded the pH trigger values over 2025, irrespective of lithology or location, it is recommended that the trigger values be reviewed. This is also required on a five-year basis as specified in the WMP (Bulga Coal, 2021). It is noted that this was undertaken by Bulga Coal in 2025 and that the draft WMP with updated trigger values is currently with DCCEW for review.

Discussion on the isolated trigger level readings was included in **Section 5.1** to **Section 5.6**.

Table 5.10 Summary of Water Quality Readings Outside of Trigger Values Over 2025

Location	WMP Lithology	Bore ID	Monitoring Period	Outside pH Trigger Values	Above EC Trigger Value
Broke Area Alluvials	Monkey Place Creek alluvium	GW1	Q3	✓	
	Monkey Place Creek alluvium	GW6	Q3/Q4	✓	✓
	Monkey Place Creek alluvium	GW7	Q2		✓
	Monkey Place Creek alluvium	GW8	Q1/Q2/Q3	✓	
	Monkey Place Creek alluvium	GW9	Q1/Q2/Q3	✓	
	Monkey Place Creek alluvium	GW10	Q4	✓	
	Wollombi Creek alluvium	V3	Q1/Q2/Q3/Q4	✓	✓
Broke Area Wollombi Seam	Shallow Permian coal measures	P2	Q1/Q2/Q3/Q4	✓	
	Shallow Permian coal measures	P5A	Q2/Q3/Q4		✓
	Shallow Permian coal measures	P6A	Q2		✓
Northern Area Shallow Alluvials	Wollombi Alluvium	F1	Q1/Q2/Q3/Q4		✓
	Wollombi Alluvium	F2	Q1/Q2/Q4	✓	✓
	Shallow Permian	WBR50A	Q1/Q4	✓	
	Wollombi Alluvium	V1	Q1/Q2/Q3/Q4	✓	
	Wollombi Alluvium	V2	Q3	✓	
SBC/Broke Area Lower Whybrow Seam	Lower Whybrow Seam	P6B	Q1/Q2/Q3/Q4	✓	✓
	Lower Whybrow Seam	P8	Q1/Q2/Q4	✓	
Northern Area Lower Whybrow Seam	Lower Whybrow Seam	WBR50	Q1/Q2	✓	
Beltana Area Miscellaneous Bores & Wells	Wollombi Alluvium	Dwyers	Q2/Q3/Q4	✓	✓
	Wollombi Alluvium	Fernance	Q1/Q3/Q4	✓	✓
	Wollombi Alluvium	McG1	Q3	✓	
	Wollombi Alluvium	White 1	Q1/Q2/Q3/Q4	✓	✓

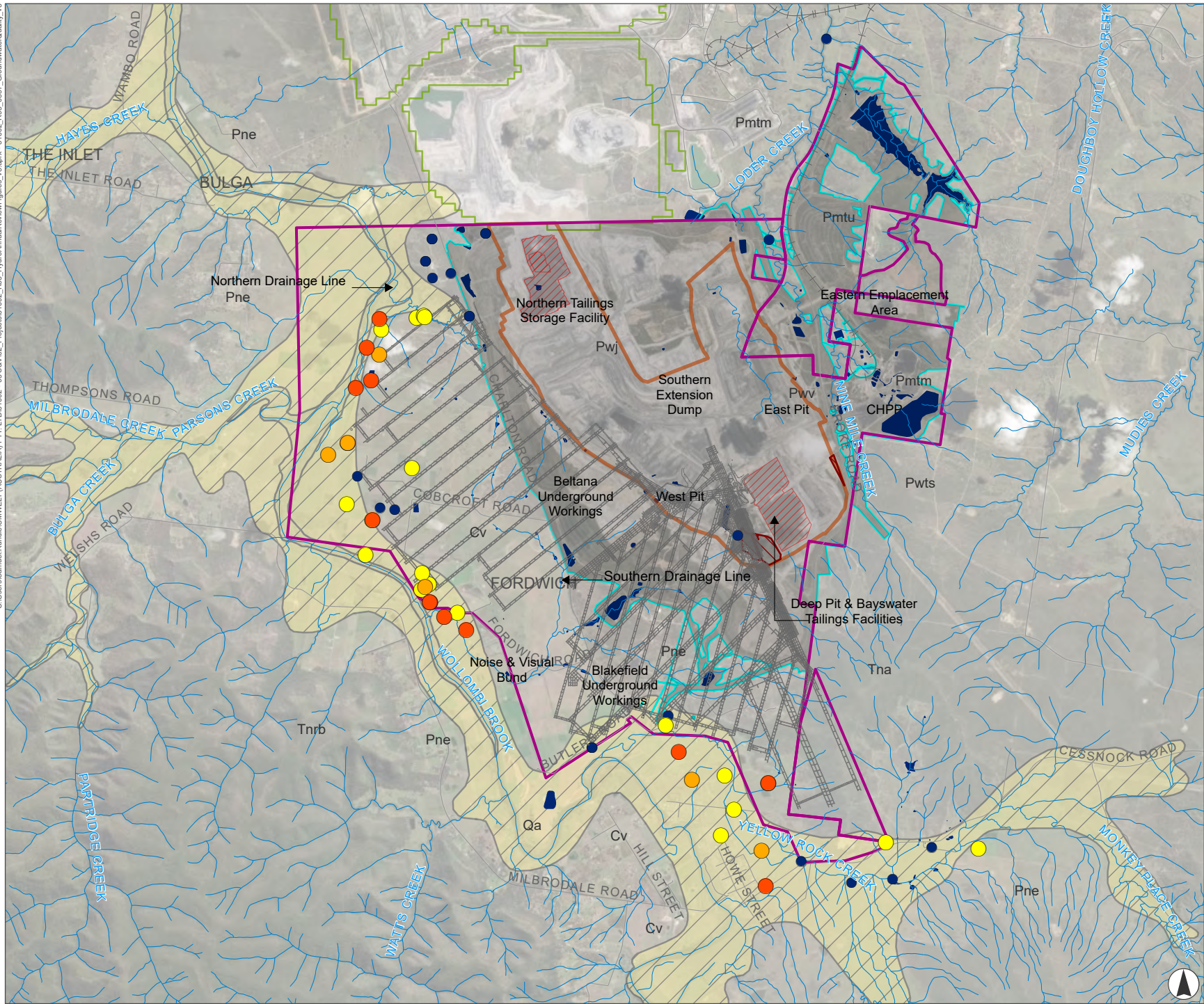
Location	WMP Lithology	Bore ID	Monitoring Period	Outside pH Trigger Values	Above EC Trigger Value
	Regolith /sill/ alluvium	WBR15	Q1/Q2/Q4	✓	
Beltana Area NPZ	Interburden Sandstone	NPZ3-B	Q1/Q3/Q4	✓	
	Alcheringa Seam	NPZ4-A	Q1/Q3	✓	
	Interburden Sandstone	NPZ4-B	Q1/Q2/Q3/Q4	✓	✓
	Alcheringa Seam	NPZ5-A	Q1/Q2/Q4	✓	✓
	Interburden Sandstone	NPZ5-B	Q1		✓
	Interburden Sandstone	NPZ7-1	Q1/Q3/Q4	✓	
	Interburden Sandstone	NPZ7-2B	Q1/Q2/Q4		✓
	Alcheringa Seam	NPZ7-3A	Q1/Q2/Q3	✓	
Wollombi Alluvials and Shallow Coal Measures	Wollombi Alluvium	WBD160	Q1/Q2/Q4	✓	
	Shallow Coal Measure	WBD180	Q2		✓
	Wollombi Alluvium	WBR181	Q2/Q3/Q4	✓	✓
	Wollombi Alluvium	WBR182	Q1/Q2/Q3/Q4	✓	✓
	Shallow coal measures	WBR183	Q1/Q2/Q3/Q4	✓	✓
	Shallow Permian	WBR240	Q2/Q4	✓	
	Wollombi Alluvium	WBR241	Q2/Q3	✓	✓

Legend

-  Lease Boundary
-  In-pit Tailings Emplacement
-  Additional Disturbance Area
-  Approved Disturbance Extent
-  BOP Approved Mining Area
-  Existing/Approved Mining Operations
-  Dams
-  Inferred Extent of Alluvium
-  Existing Underground Workings
-  Drainage Line
-  Rail Line
-  Road

Groundwater Exceedance Type

-  No Exceedance
-  Water Quality (pH only) Exceedance
-  Water Quality (EC only) Exceedance
-  Water Quality (pH & EC) Exceedance



Scale 1:80,000 at A4
GDA 1994 MGA Zone 56



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6.0 Surface Water Monitoring

6.1 Monitoring Programme

As per the WMP (Bulga Coal, 2021) surface water quality monitoring is undertaken monthly to assist in detecting if any significant off-site impacts are occurring as a result of mining and to trigger response plans to address any adverse impacts or trends.

Water is collected monthly using an extendible water sampler (or swing sampler) and is transferred to bottles for analysis. Some water quality parameters are measured on site (such as water depth and temperature), while the following analytes are measured by a NATA accredited Laboratory:

- Electrical conductivity (EC).
- pH.
- Total Suspended Solids (TSS).

Surface waters are sampled in accordance with Australian Standards AS5667.4 (1998) *Water Quality Sampling – Guidance on sampling from lakes, natural and man-made* and AS5667.6 (1998) *Water Quality Sampling – Guidance on sampling of rivers and streams*.

It is noted in **Section 5.0** that field pH data is preferable over lab pH due to long holding times potentially impacting results. However, only field pH data is currently available for surface water quality monitoring sites from July 2025 onwards and as such lab pH has been presented in this annual review for analysis. It is recommended that field pH continue to be recorded in the EMD in future monitoring for surface water monitoring sites.

Sampling is undertaken at ten selected points along waterways in the vicinity of the BCC. The water quality monitoring network is described in **Section 6.2**.

6.2 Monitoring Network

Surface water quality monitoring is undertaken monthly along the following watercourses:

- Wollombi Brook (W2, W4, LR1 and LR5).
- Loder Creek (W9 and W10).
- Monkey Place Creek (LR2).
- Southern Drainage Line (SDL1).
- Norther Drainage Line (NDL1).
- Nine Mile Creek (NMC1).

Monitoring locations LR1 and LR5 are considered representative of water quality upstream of the BCC mining operations, while W4 is downstream. NDL1 represents the Northern Drainage Line and SDL1 represents the Southern Drainage Line. The specific details of the surface water monitoring sites, including location, description and availability of data is presented in **Table 6.1**. The surface water monitoring network is displayed in **Figure 3.3**.

Table 6.1 Summary of Surface Water Monitoring Sites

Site Name	Easting (MGA56)	Northing (MGA 56)	Watercourse	Location Description	Data Available Since
LR1	322199.6	6375169.6	Wollombi Brook	Wollombi Brook upstream of the village of Broke	January 2004
LR5	317026.5	6379753.0	Wollombi Brook	Wollombi Brook downstream of the confluence with the Southern Drainage Line	January 2004
LR2	321055.5	6377232.7	Monkey Place Creek	Monkey Place Creek at Broke Road	January 2004
W2	316561.4	6382591.4	Wollombi Brook	Wollombi Brook downstream of LR5, and upstream of W4	January 2004
W4	317205.1	6384357.9	Wollombi Brook	Wollombi Brook downstream of the confluence with Northern Drainage Line	January 2004
SDL1	319368.5	6378195.8	Southern Drainage Line	Southern Drainage line west of BOC – tributary of Wollombi Brook	July 2018
NDL1	318437.7	6383072.8	Northern Drainage Line	Northern Drainage Line west of BOC – tributary of Wollombi Brook	July 2018
W9	323769.7	6388099.2	Loder Creek	Loder Creek upstream of the New England highway	July 2018
W10	322311.4	6385238.3	Loder Creek	Loder Creek upstream of confluence with Nine Mile Creek and just upstream of Mining Lease Boundary	July 2018
NMC1	324166.3	6381069.8	Nine Mile Creek	Nine Mile Creek adjacent to Broke Road	July 2018

7.0 Surface Water Monitoring Results

7.1 Surface Water Monitoring Results

The 2025 surface water quality monitoring trends are presented in the following sections, while an analysis of the trigger exceedances for surface water quality at the surface water monitoring locations is presented in **Section 7.4**.

7.2 Historical Trends

Historical surface water quality monitoring results (as a rolling 12 month average) are presented in **Figure 7.1** to **Figure 7.3**.

Historically, water quality in Wollombi Brook is generally good with low salinity and neutral pH (Jacobs, 2024). Monkey place Creek, Loder Creek, Nine Mile Creek and the minor ephemeral drainage lines within the mining lease typically have poorer water quality, which is alkaline and saline, except during high rainfall events (Jacobs, 2024). In the 1980 EIS, the salinity was attributed to seepage from the Saltwater Creek coal measures, which subcrop in areas of Loder Creek (Jacobs, 2024).

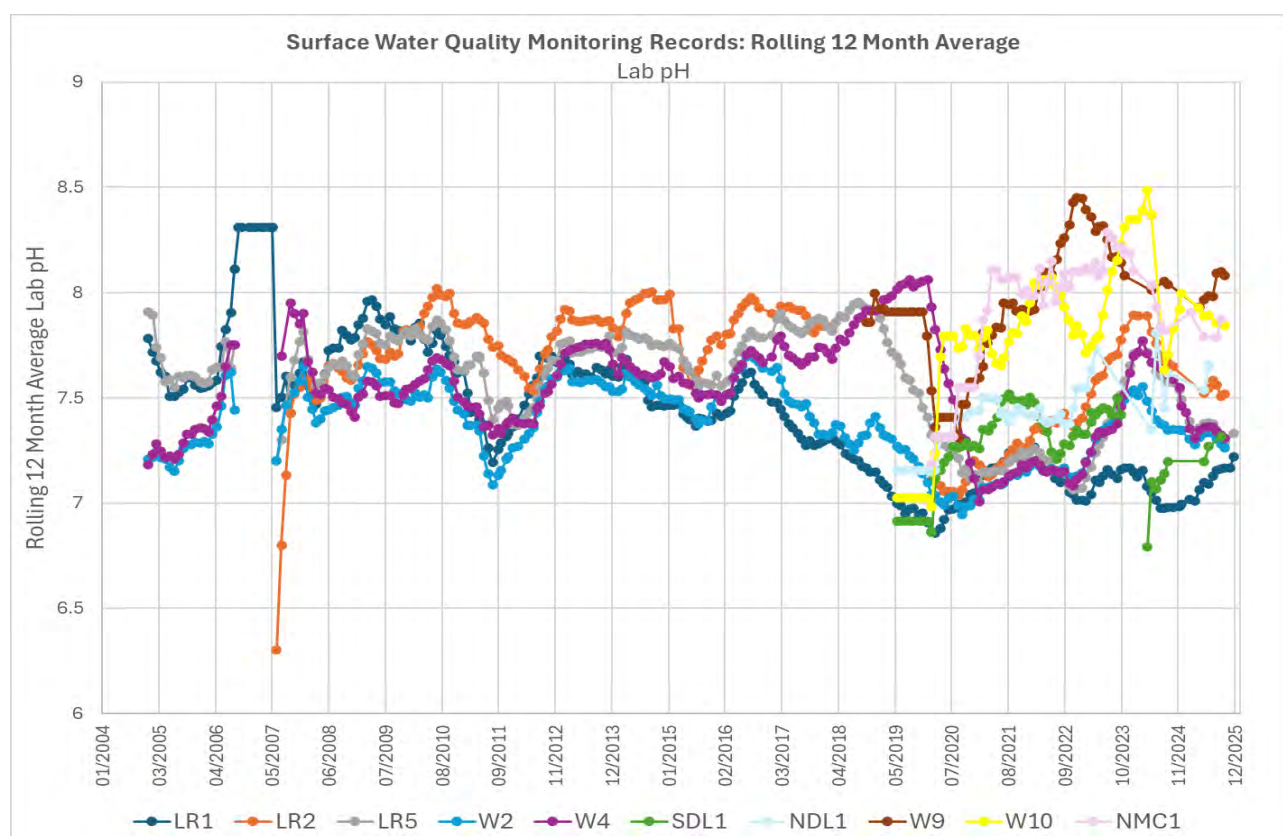


Figure 7.1 Historical Surface Water Monitoring Results: 12 Month Average – Lab pH

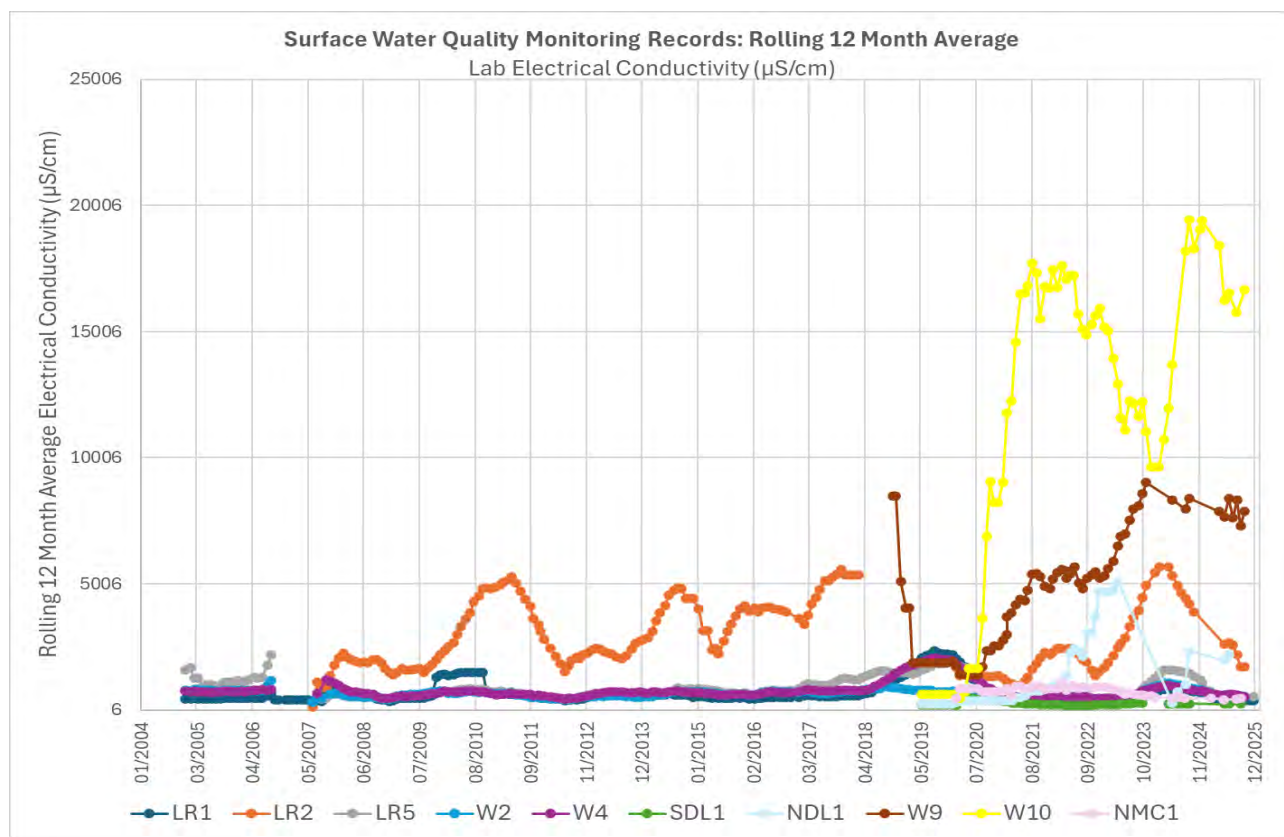


Figure 7.2 Historical Surface Water Monitoring Results: 12 Month Average – Lab EC

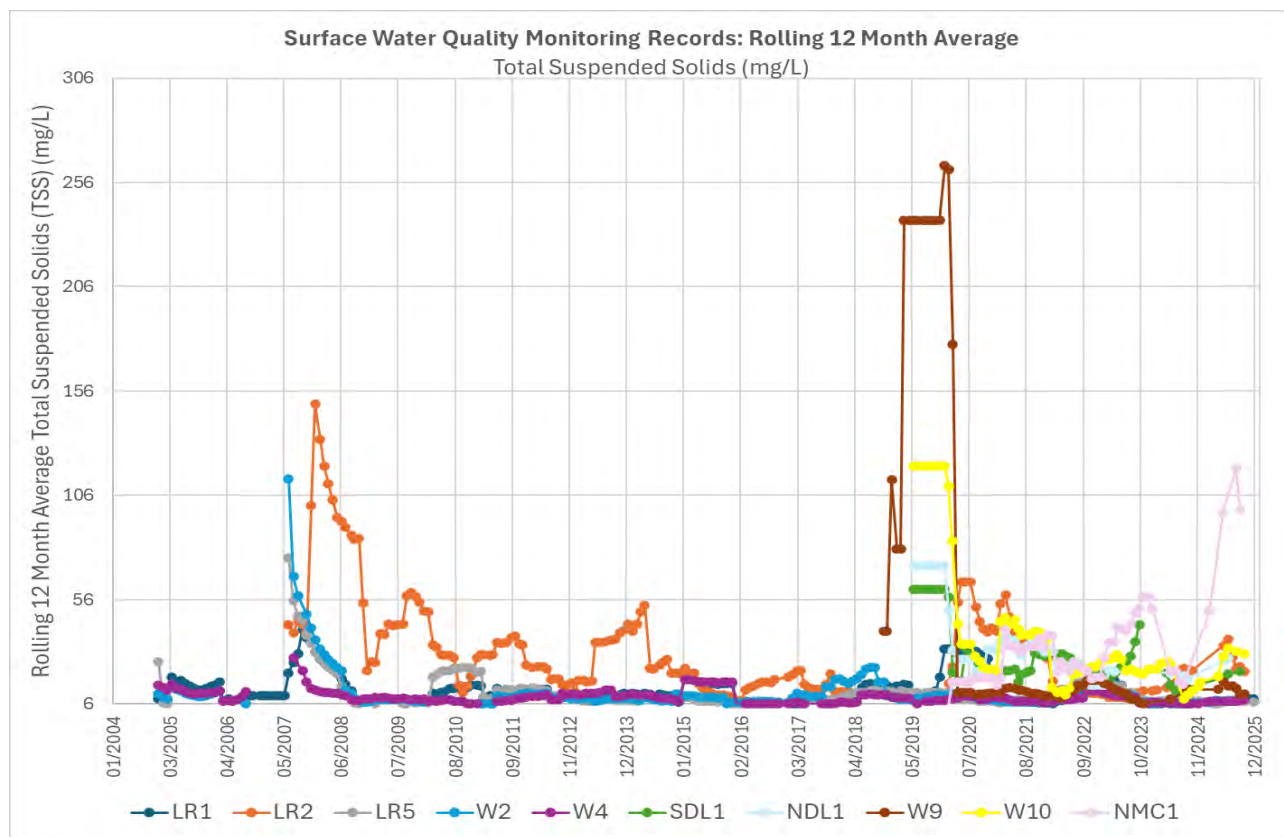


Figure 7.3 Historical Surface Water Monitoring Results: 12 Month Average - TSS

7.3 2025 Surface Water Monitoring Results Trends

7.3.1 Electrical Conductivity Trends

Historic surface water EC trends mostly continued into 2025 with all sites showing significant variability in EC over the 2025 monitoring period. Measured EC ranged from a minimum of 157 $\mu\text{S}/\text{cm}$ at SDL1 on the Southern Drainage line west of BOC to a maximum of 21,200 $\mu\text{S}/\text{cm}$ at W10 at Loder Creek upstream of confluence with Nine Mile Creek and just upstream of mining lease boundary. The elevated readings at Loder Creek are likely due to sampling in concentrated ponds where there is no inflow or outflow. Graphs of the EC trends, compared to the CRD, are presented in **Figure 7.4** to **Figure 7.9** below.

Many of the monitored watercourses were dry or too low to sample throughout 2025. As shown in the graphs, the CRD indicates that rainfall conditions in early 2025 were generally below the long-term average, followed by a sustained period of above-average rainfall from March to May. Rainfall conditions were briefly below average in June before returning to above-average conditions through late winter, with the CRD becoming positive in August–September. Rainfall during spring was generally below average, resulting in a declining CRD, before returning to approximately average conditions overall by mid-December 2025. EC for Wollombi Brook tended to match this trend. EC increased during the drier months when salts concentrate in water due to evaporation and then dropping again during wetter months. EC within the other watercourses was typically not able to be sampled during the drier months, with flows returning during the autumn and spring. A discussion of the EC results as it relates to the site-specific trigger values is included in **Section 7.4**.

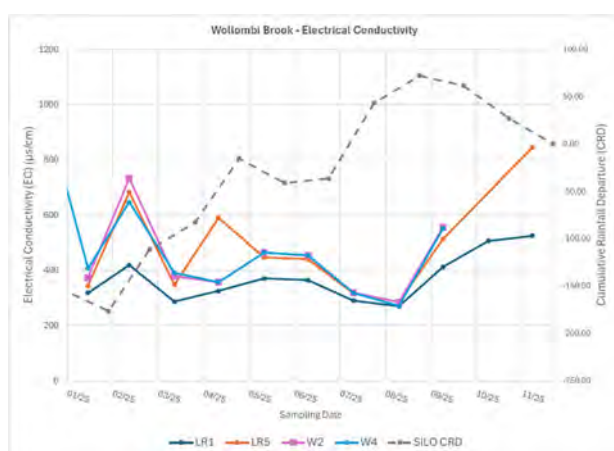


Figure 7.4 Wollombi Brook - EC

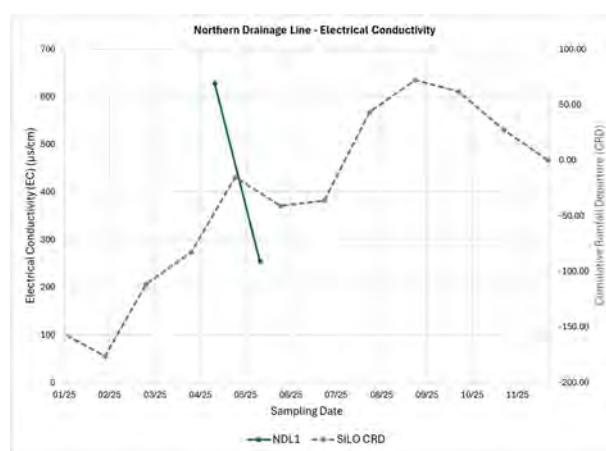


Figure 7.5 Northern Drainage Line – EC

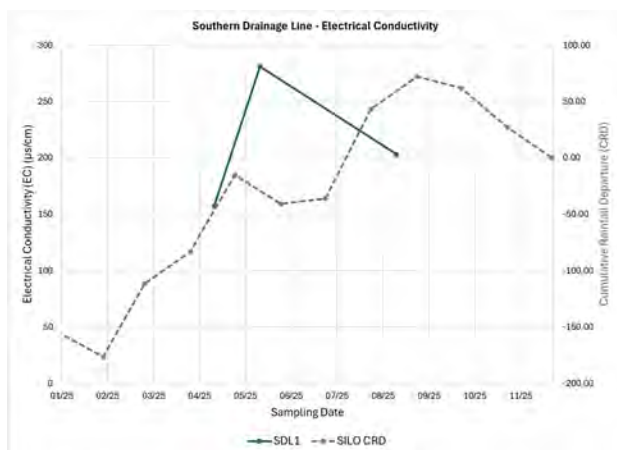


Figure 7.6 Southern Drainage Line - EC

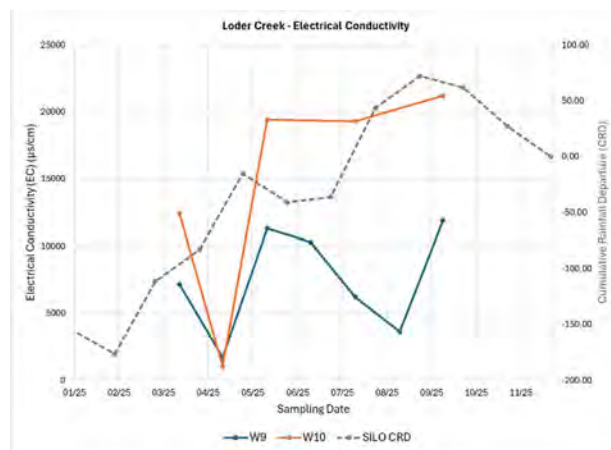


Figure 7.7 Loder Creek – EC

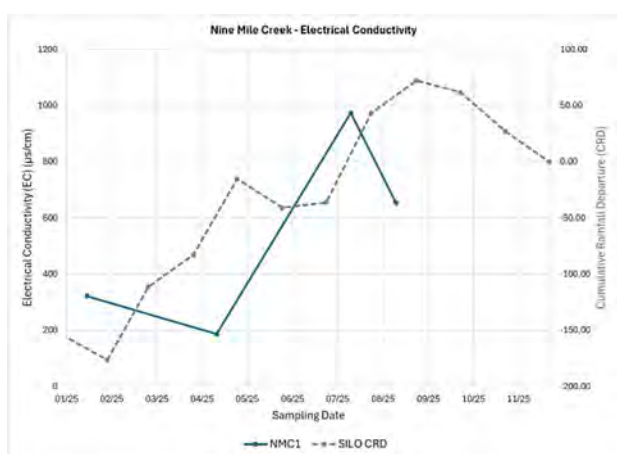


Figure 7.8 Nine Mile Creek - EC

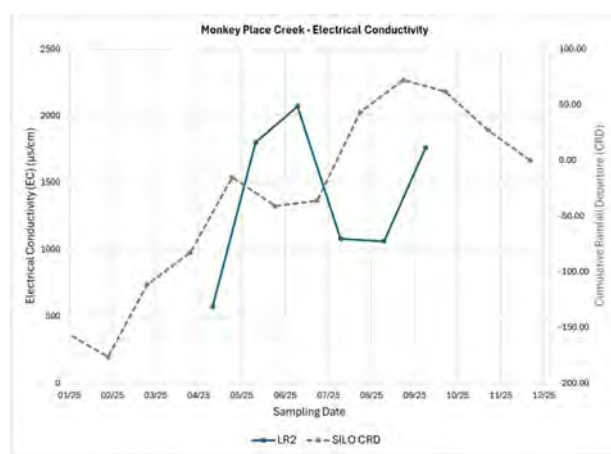


Figure 7.9 Monkey Place Creek – EC

7.3.2 pH Trends

Figure 7.10 to Figure 7.15 below provide the 2025 pH monitoring results for each of the watercourses surrounding the site. In 2025 pH tended to follow historical trends across the watercourses. Measured pH ranged from a minimum of 7.02 at W4 in Wollombi Brook downstream of the confluence with Northern Drainage Line in August and maximum of 8.63 at W9 in August on Loder Creek upstream of the New England highway.

As mentioned in **Section 7.3.1** many of the monitored watercourses were dry or unable to be sampled at various times throughout 2025. Watercourses were more likely to be able to be sampled during the autumn to spring months when the CRD was average to above average. A discussion of the pH results as it relates to the site-specific trigger levels is included in **Section 7.4**.

Field pH and lab pH generally correlated well throughout the reporting period, where data was available. Notable exceptions include a 1.17 difference at LR2 in August and a 0.97 difference at LR1 in August. There were two instances where the lab results triggered an exceedance, but the field pH results did not, W9 in July had a lab value of 8.09 while field pH was measured at 7.7 and again in October the lab result was 7.95 while field pH was measured at 7.77. Additionally, there were five (5) instances where an exceedance was triggered by the field pH value but not the lab pH result, these exceedances occurred for LR1 in July and August and for LR2 in July, August and September. In all of these cases the pH was lower than the lower trigger value for the respective monitoring location.

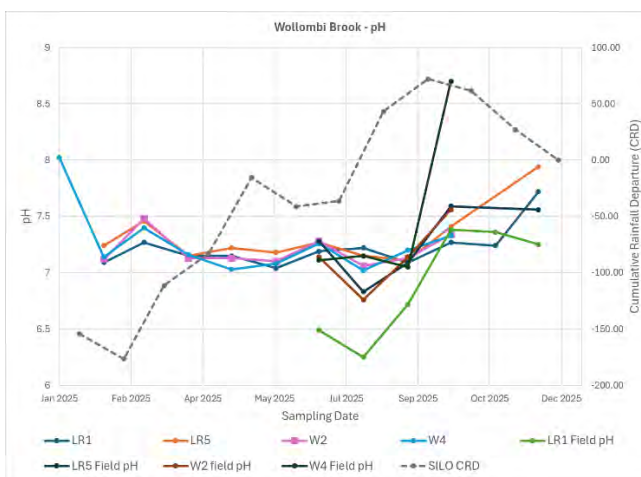


Figure 7.10 Wollombi Brook - pH

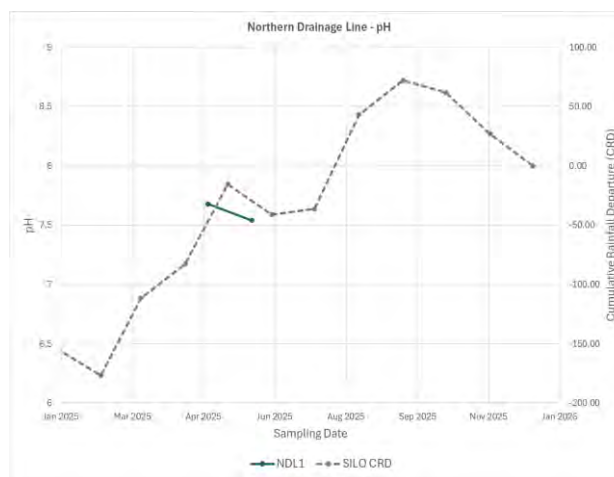


Figure 7.11 Northern Drainage Line - pH

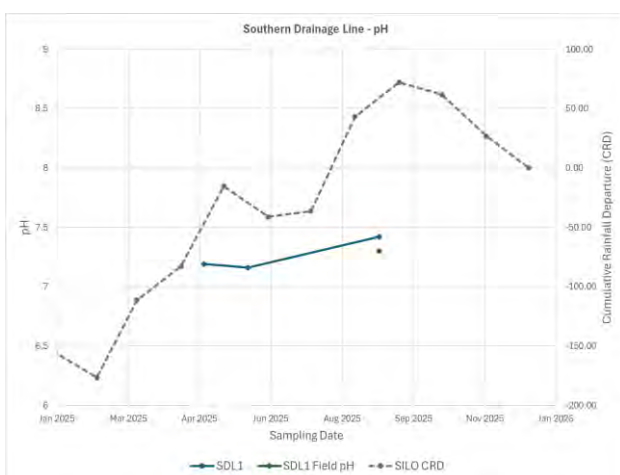


Figure 7.12 Southern Drainage Line - pH

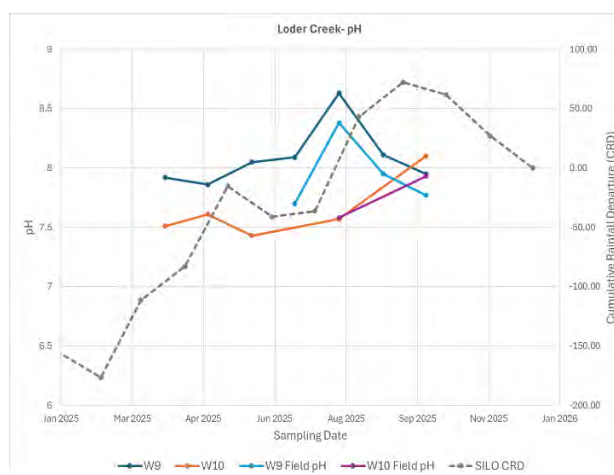


Figure 7.13 Loder Creek - pH

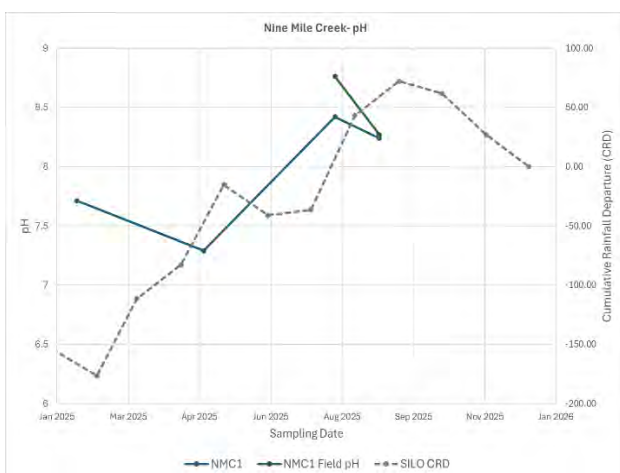


Figure 7.14 Nine Mile Creek - pH

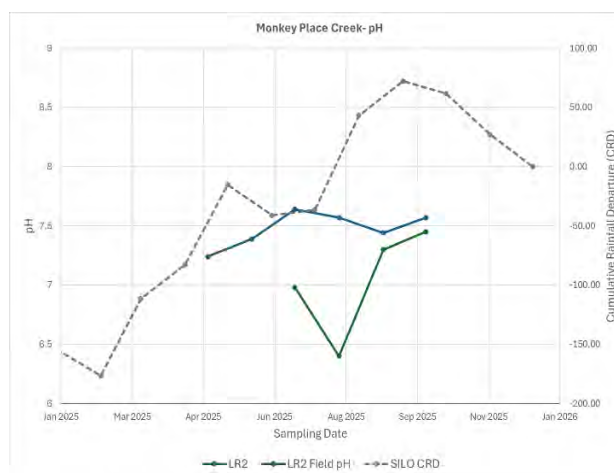


Figure 7.15 Monkey Place Creek - pH

7.3.3 Total Suspended Solids Trends

Figure 7.16 to Figure 7.21 below provide the 2025 TSS monitoring results for each of the watercourses surrounding the site. In 2025 TSS typically followed historical trends with all sites showing similar variability in TSS values.

TSS in Wollombi Brook was typically low except for two events, one in May at LR1 and LR5 and one in September at LR1. These exceedances were preceded by significant rainfall events, and in the case of the May exceedances, rainfall was also recorded on the day of sampling. TSS tended to be higher in autumn and spring when rainfall was average to above average and lower in summer and winter. As mentioned in **Section 7.3.1** many of the monitored watercourses were dry or unable to be sampled throughout 2025. Following historic trends, TSS measurements at most other sites were higher than Wollombi Brook, which likely corresponds with lower flow depths in the other watercourses relating to their ephemeral nature and as evidenced by them only being able to be sampled during periods of average to higher-than-average rainfall.

TSS tended to range from below the limit of reading (<5 mg/L) along Wollombi Brook, Loder Creek, Nine Mile Creek and Monkey Place Creek to a maximum of 254 mg/L at NMC1 located on Nine Mile Creek in May. A discussion of the TSS results as they relate to the site-specific trigger levels is included in **Section 7.4**.

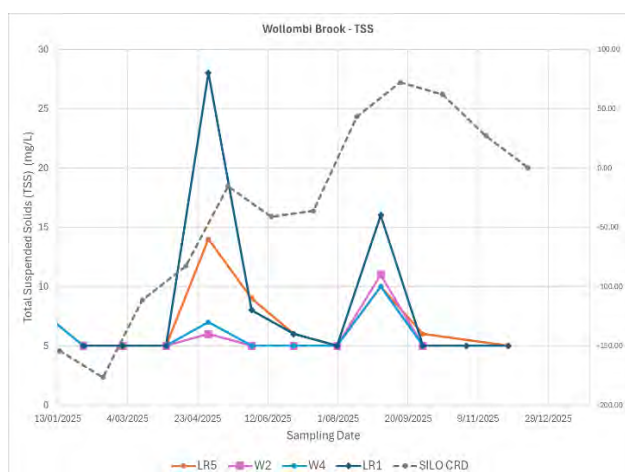


Figure 7.16 Wollombi Brook - TSS

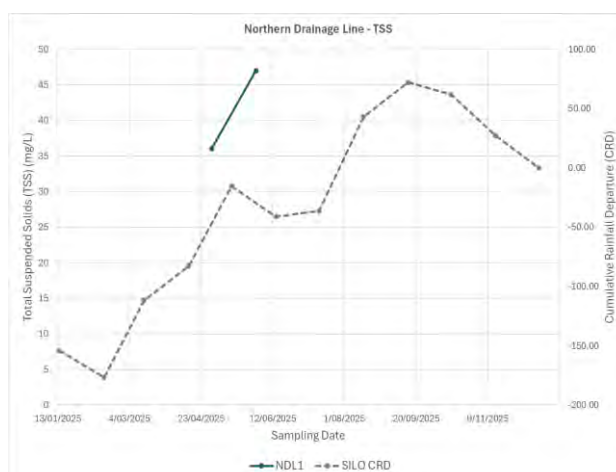


Figure 7.17 Northern Drainage Line – TSS

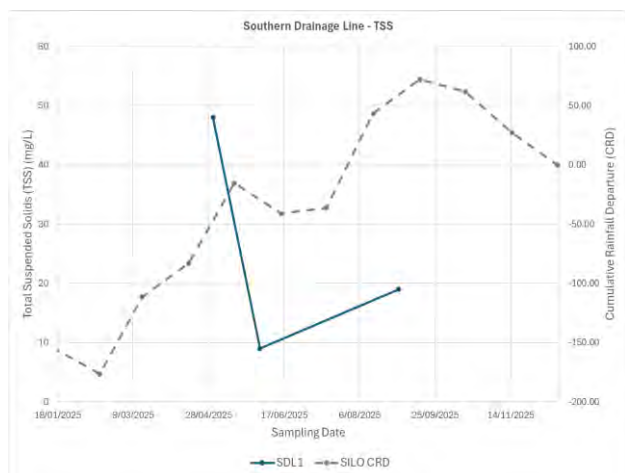


Figure 7.18 Southern Drainage Line - TSS

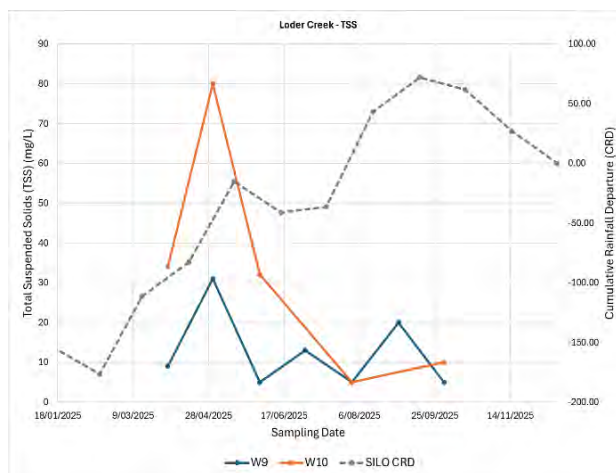


Figure 7.19 Loder Creek – TSS

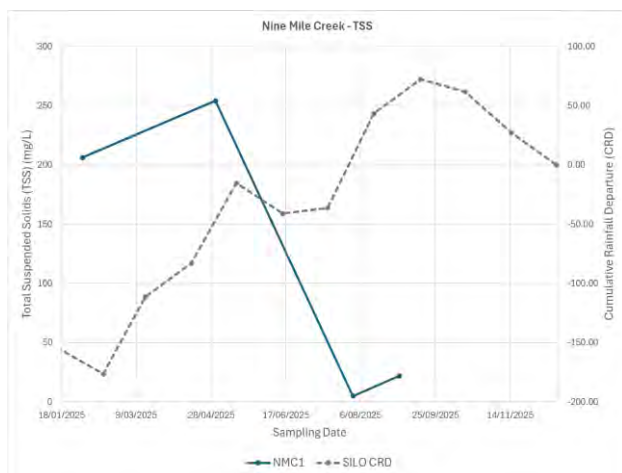


Figure 7.20 Nine Mile Creek - TSS

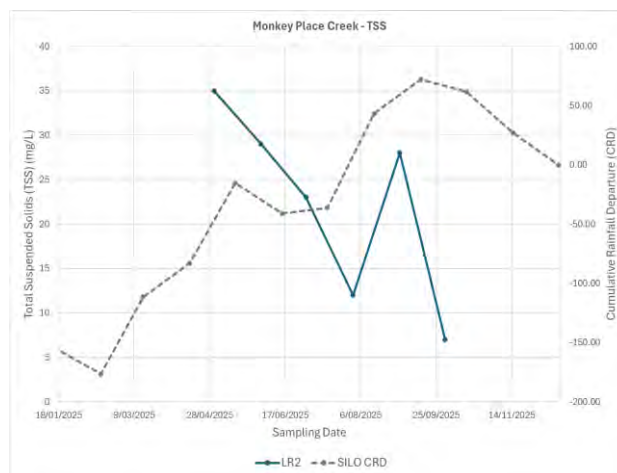


Figure 7.21 Monkey Place Creek – TSS

7.4 Surface Water Exceedances

Surface water impact assessment criteria are outlined in the WMP (Bulga Coal, 2021). Site specific trigger values have been derived using water level and water quality data, including EC, pH and TSS in accordance with ANZECC (2000) guidelines. The trigger values are not assessment criteria but are used to initiate investigations into surface water quality as reported by the monitoring program (Bulga Coal, 2021). It is noted that the WMP states that the surface water trigger values will be revised every five years or subsequent to a consent modification that has reassessed the surface water impacts (Bulga Coal, 2021). It is noted that Bulga Coal undertook this assessment in 2025 and the draft WMP is with DCCEEW for review.

Surface water conditions across the site were compared against the WMP (Bulga Coal, 2021) trigger values, and the findings are described in detail below.

7.4.1 Electrical Conductivity

Surface water EC has been compared to trigger values from the adopted WMP (Bulga Coal, 2021). The results of this comparison are included in **Table 7.1**. Four of the ten monitored sites exceeded the adopted trigger level during sampling events in 2025. Site W4 located in the Wollombi Brook, the Northern Drainage Line, and both sites located in Loder Creek (W9 & W10) all had exceedances of EC trigger values in 2025. NMC1 (Nine Mile Creek) did not exceed an adopted trigger value as there has been insufficient data available to date to develop trigger values in accordance with the ANZECC (2000) guidelines due to the ephemeral nature of Nine Mile Creek.

EC levels at most sites tended to peak in March, then decrease across the autumn and winter months before increasing again from October through December. This likely reflects an increase in salt concentrations through evaporation at the start and end of the year due to drier than average conditions. The drier than average conditions resulted in all six of the waterways drying up or being too low to sample for at least one location in January and then again in the second half of the year towards October through December.

Generally, the surface water locations with exceedances are likely attributed to the climate and the elevated levels are unlikely to be due to mining impacts. Notwithstanding this, the EC results for Loder Creek (W9 and W10), from April to October are elevated. TSS for the same period did not exceed the TSS trigger value; however, the levels were also elevated. W9 is located upstream of the New England Highway and W10 is located on a refugial pool in Loder Creek upstream of confluence with Nine Mile Creek and just upstream of the mining lease boundary. W10 can become saline quickly after flow has stopped due to evaporation and salts deposited in the associated sediments. Monitoring along Loder Creek at both locations was often unable to be completed with the creek too low to sample or dry.

Table 7.1 Surface Water Electrical Conductivity Exceedances

Site ID	Surface Water EC Level (µs/cm)												
	EC Trigger (µs/cm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wollombi Brook													
LR1	944	TLS	318	418	286	325	370	364	290	269	412	506	525
LR5	1350	TLS	344	683	348	590	446	440	316	285	513	TLS	845
W2	836	TLS	373	733	379	357	464	453	319	285	555	TLS	TLS
W4	947	1020	407	647	390	357	464	454	317	271	552	TLS	TLS
Northern Drainage Line													
NDL1	399	Dry	Dry	Dry	Dry	628	254	Dry	Dry	Dry	TLS	TLS	TLS
Southern Drainage Line													
SDL1	285	Dry	Dry	Dry	TLS	157	281	TLS	TLS	203	Dry	Dry	Dry
Loder Creek													
W9	1970	TLS	TLS	Dry	7150	1720	11300	10300	6220	3620	11900	TLS	TLS
W10	691	TLS	TLS	Dry	12400	1030	19400	TLS	19300	TLS	21200	TLS	TLS
Nine Mile Creek													
NMC1	Insufficient data	TLS	322	Dry	Dry	186	TLS	TLS	973	654	Dry	TLS	Dry
Monkey Place Creek													
LR2	4924	TLS	TLS	TLS	Dry	571	1800	2070	1080	1060	1760	Dry	TLS

Note: Red values indicate exceedance of triggers

TLS – too low to sample

*Due to the ephemeral nature of the watercourse there is insufficient data to develop triggers in accordance with guidelines for the site

~LR1 is upstream of the operations and is used as a reference site

7.4.2 pH

Surface water pH has been compared to trigger values from the WMP (Bulga Coal, 2021). Trigger values for pH have been determined using the 20th and 80th percentile of previously recorded values and are summarised in the WMP (Bulga Coal, 2021). Nine of the ten sample locations recorded levels outside of respective surface water pH trigger values throughout the year with the tenth sample location not having trigger values to due to previous insufficient data.

The exceedances are outlined in **Table 7.2** along with site specific surface water pH triggers from the WMP (Bulga Coal, 2021) and measured surface water pH from respective waterway sites.

Surface water pH in all waterways varied slightly from acceptable ranges at some point during 2025. Most sites exceeded trigger values for the majority of 2025; however, they are within historical ranges. Deviance from the trigger ranges is attributed to natural variations in watercourse conditions throughout the year, many of which dried up at some point in 2025.

Table 7.2 Surface Water pH Exceedances (Lab pH)

Site ID	Surface Water pH		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	pH Trigger													
	20 th %ile	80 th %ile												
Wollombi Brook														
LR1	7.12	7.81	TLS	7.09	7.27	7.15	7.15	7.04	7.19	7.22	7.09	7.27	7.24	7.72
LR5	7.41	7.98	TLS	7.24	7.46	7.15	7.22	7.18	7.27	7.15	7.11	7.41	Dry	7.94
W2	7.13	7.67	TLS	7.12	7.48	7.13	7.13	7.1	7.28	7.06	7.13	7.34	TLS	TLS
W4	7.33	7.87	8.02	7.14	7.4	7.16	7.03	7.08	7.26	7.02	7.2	7.33	TLS	TLS
Northern Drainage Line														
NDL1	7.14	7.26	Dry	Dry	Dry	Dry	7.68	7.54	Dry	Dry	Dry	TLS	TLS	TLS
Southern Drainage Line														
SDL1	6.70	7.24	Dry	Dry	Dry	TLS	7.19	7.16	TLS	TLS	7.42	Dry	Dry	Dry
Loder Creek														
W9	7.36	7.92	TLS	TLS	Dry	7.92	7.86	8.05	8.09	8.63	8.11	7.95	TLS	TLS
W10	7.00	7.64	TLS	TLS	Dry	7.51	7.61	7.43	TLS	7.57	TLS	8.1	TLS	TLS
Nine Mile Creek														
NMC1	Insufficient data		TLS	TLS	7.71	Dry	Dry	7.29	TLS	TLS	8.42	8.24	Dry	TLS
Monkey Place Creek														
LR2	7.39	7.91	TLS	TLS	TLS	Dry	7.24	7.39	7.64	7.57	7.44	7.57	Dry	TLS

Note: Red values indicate exceedance of triggers

TLS – too low to sample

*Due to the ephemeral nature of the watercourse there is insufficient data to develop triggers in accordance with guidelines for the site

~LR1 is upstream of the operations and is used as a reference site

7.4.3 Total Suspended Solids

Surface water TSS has been compared to trigger values from the WMP (Bulga Coal, 2021) and the results are presented in **Table 7.3**.

All monitoring locations remained within trigger ranges and historical ranges during the year, except for LR1, LR5, and SDL1 in May and LR1 in September. The nearby SILO rainfall gauge recorded 14.2 mm of rainfall in the four (4) days before the sampling event in May, including 12.1 mm on the day of sampling, and the exceedance could reflect that sampling was affected by recent rainfall. Additionally, ten days prior to the sampling event in September the site received 66 mm of rain on the 10th and 11th of September. It is noted that the TSS reduced in subsequent months, apart from September, below the assigned trigger value.

Table 7.3 Surface Water Total Suspended Solids Exceedances

Site ID	Surface Water TSS Level (mg/L)												
	TSS Trigger (mg/L)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wollombi Brook													
LR1	12	TLS	<5	<5	<5	28	8	6	5	16	<5	<5	<5
LR5	12	TLS	<5	<5	<5	14	9	6	<5	10	6	Dry	<5
W2	12	TLS	<5	<5	<5	6	<5	<5	<5	11	<5	TLS	TLS
W4	10	8	<5	<5	<5	7	<5	<5	<5	10	<5	TLS	TLS
Northern Drainage Line													
NDL1	70	Dry	Dry	Dry	Dry	36	47	Dry	Dry	Dry	TLS	TLS	TLS
Southern Drainage Line													
SDL1	39	Dry	Dry	Dry	TLS	48	9	TLS	TLS	19	Dry	Dry	Dry
Loder Creek													
W9	157	TLS	TLS	Dry	9	31	<5	13	5	20	<5	TLS	TLS
W10	102	TLS	TLS	Dry	34	80	32	TLS	<5	TLS	10	TLS	TLS
Nine Mile Creek													
NMC1	Insufficient data*	TLS	206	Dry	Dry	254	TLS	TLS	<5	22	Dry	TLS	Dry
Monkey Place Creek													
LR2	40	TLS	TLS	TLS	Dry	35	29	23	12	28	7	Dry	TLS

Note: Red values indicate exceedance of triggers

TLS – too low to sample

*Due to the ephemeral nature of the watercourse there is insufficient data to develop triggers in accordance with guidelines for the site

~LR1 is upstream of the operations and is used as a reference site

8.0 Summary and Recommendations

8.1 Summary

This annual groundwater review covers data collected from 1 January to 31 December 2025 and was completed in compliance with:

- DA 376-8-2003 (Schedule 4, Conditions 15 and 16) for BUO.
- DA SSD-4960 (Schedule 3, Condition 28) for BOC.
- Environment Protection and *Biodiversity Conservation Act 1999* (EPBC Act) approval 2012/6637.
- Conditions of Environment Protection Licence (EPL) 563.

Over 2025 operations at the BCC included active mining within the East and West Pits. A total of 2,948 kbcm of tailings were dredged from the Deep Pit TSF and relocated to the NTSF throughout 2025.

During 2025 calendar year, 2,760 ML of water was drawn from the Beltana goaf storage to support mining operations. The Beltana goaf has a calculated storage capacity of approximately 7.5 GL and was holding approximately 3,939 ML of water at the end of 2025.

Total predicted hard rock groundwater inflows for the 2024/2025 water year of 1,589 ML, is interpreted to be consistent with predictions and within the combined Sydney Basin WAL allocation of 2,365 units per year.

8.1.1 Groundwater

Groundwater monitoring was largely undertaken in accordance with the monitoring programme outlined in the WMP (Bulga Coal, 2021). However, water level and water quality readings were not obtained from three monitoring bores (GW3, NPZ3-A, and P1) due to dry or blocked bore conditions and access restrictions. In addition, two monitoring bores (P8 and V3) had partial data gaps, likely due to similar access limitations or intermittent dry conditions.

Review of groundwater level trends indicates that, where bores were saturated, groundwater levels within the alluvium remained relatively stable, with slight increases observed in response to rainfall and streamflow trends. Above-average rainfall occurred over the reporting period. No groundwater level exceedances were recorded during 2025.

Groundwater levels in paired bores and VWPs monitoring the interburden (sandstone), shallow Permian coal measures and coal seams indicate that a downward vertical hydraulic gradient is generally present. Groundwater levels in the Alcheringa Seam continue to recover following the cessation of underground mining in 2011 and the above-average rainfall recorded between 2020 and 2022, and 2025

Review of water quality data and comparison against trigger values for EC and pH identified several EC exceedances and widespread pH exceedances across the monitoring network. However, the 2025 results are generally consistent with historical trends for the respective bores.

Comparison of major ion chemistry (water type) for December 2025 with the full historical dataset indicates that water types have remained broadly consistent across all bores with available data.

Based on the groundwater level and water quality data, there is no evidence of measurable impact to the alluvial aquifers attributable to mining activities during 2025.

8.1.2 Surface Water

Review of climate data indicates the region generally experienced above average rainfall over the majority of 2025, with significant rainfall events recorded in March, May, August and September 2025. Similar trends are reflected in stream flow for Wollombi Brook from WaterNSW gauge 210028. Stream flows in Wollombi Brook were higher over 2025 compared to 2024, in response to above average rainfall. As expected, increases in flow correlated with significant rainfall events in May, August and September.

Water monitoring was conducted in accordance with the monitoring programme outlined within the WMP (Bulga Coal, 2021). In 2025, TSS, EC and pH levels typically followed historical trends for all sites.

It was identified that the WMP (Bulga Coal, 2021) states that the surface water trigger values will be revised every five years or subsequent to a consent modification that has reassessed the surface water impacts (Bulga Coal, 2021). It is noted that this has been undertaken and the draft WMP is with DCCEEW for review.

Four of the ten monitored sites exceeded the EC trigger value during sampling events in 2025. Surface water locations with exceedances are generally attributed to the climate and the elevated values are unlikely to be due to mining impacts. The EC results for W9 and W10, particularly from April to October are elevated compared to 2023; however, they are comparable in general to 2024.

Surface water pH in all waterways varied slightly from trigger value ranges at some point during 2025. Most sites exceeded trigger values for the majority of 2025; however, they are within historical ranges. Deviance from the trigger ranges is attributed to natural variations in watercourse conditions throughout the year, many of which dried up at some point in 2025.

All monitoring locations for TSS remained within trigger ranges and historical ranges during the year, with the exception of Wollombi Brook and the Southern Drainage Line during May and Wollombi Brook (LR1) in September which was likely due to high rainfall in the preceding days.

8.2 Recommendations

Based on review of the available data for 2025, recommendations for specific bores are summarised in **Table 8.1**. General recommendations include:

- Continue to include field pH monitoring results into the site EMD for all surface water monitoring locations, as it is noted that field pH data is preferable over lab pH due to long holding times potentially impacting results.
- Given that most of the monitoring bores have exceeded pH trigger values over 2025, irrespective of lithology or location, similar to 2023 and 2024, it is recommended that the trigger values be reviewed. It is noted that Bulga Coal have undertaken this assessment in 2025 and the draft WMP is with DCCEEW for review.

- The trigger criteria approach should be reviewed, with application of field pH and EC and consideration of applying a trigger threshold based on consecutive readings above the trigger level to help exclude natural variability.
- The monitoring approach should be reviewed to ensure representative samples are being collected. For example, confirm field pH and EC readings have stabilised before being recorded.

Table 8.1 Summary of Recommendations

Site ID	Recommendation
GW3	The field sheets note that the bore is deformed and will be removed from the next iteration of the WMP.
NPZ3-A	Due to the condition of the bore it will be removed from the next iteration of the WMP.
P1	The condition of bore P1 should be checked. If unable to be used as a monitoring bore, investigate whether the bore should be replaced or removed from the monitoring programme in the WMP.
P6B	It is recommended that groundwater quality trends at P6B continue to be monitored to assess long-term recovery behaviour. The suitability of the EC trigger value for this bore should be reviewed, consistent with the approach recommended in 2024.
SBD194	Fix VWP logger unit so that monitoring can continue.

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Appendix A

Groundwater Monitoring Network and Programme



Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
Dwyers	MB	Beltana Area Miscellaneous Bores & Wells	Wollombi Alluvium	317704.52	6379357.94	70.09	Unknown	70.09	<30	Unknown	-	2M	2M	2M	6M	SWL & WQ
F1	MB	Northern Area Shallow Alluvials	Wollombi Alluvium	316152.00	6381601.00	70.15	1.06	69.09	17.40	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
F2	MB	Northern Area Shallow Alluvials	Wollombi Alluvium	317916.00	6379142.00	70.09	0.37	69.72	14.00	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
Fernance	MB	Beltana Area Miscellaneous Bores & Wells	Wollombi Alluvium	317697.38	6379366.74	71.63	Unknown	71.63	Unknown	Unknown	-	2M	2M	2M	6M	SWL & WQ
GW1	MB	Broke Area Alluvials	Monkey Place Creek alluvium	326035.56	6375616.55	92.28	0.15	92.13	Unknown	Unknown	Y	D / 2M	2M	2M	6M	WQ
GW2	MB	Broke Area Alluvials	Monkey Place Creek alluvium	325328.77	6375636.40	86.34	Unknown	86.34	Unknown	Unknown	Y	D / 2M	2M	2M	6M	-
GW3	MB	Broke Area Alluvials	Monkey Place Creek alluvium	323342.37	6375423.79	77.98	0.1	77.88	13.20	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
GW4	MB	Broke Area Alluvials	Monkey Place Creek alluvium	324107.37	6375104.12	80.59	Unknown	80.59	Unknown	Unknown	Y	D / 2M	2M	2M	6M	-
GW5	MB	Broke Area Alluvials	Monkey Place Creek alluvium	324731.96	6375152.53	82.00	Unknown	82.00	Unknown	Unknown	Y	D / 2M	2M	2M	6M	-
GW6	MB	Broke Area Alluvials	Monkey Place Creek alluvium	322800.98	6375050.58	77.04	Unknown	77.04	13.30	Unknown	-	2M	2M	2M	6M	SWL & WQ
GW7	MB	Broke Area Alluvials	Monkey Place Creek alluvium	322738.39	6375581.53	75.11	0.11	75.00	10.00	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
GW8	MB	Broke Area Alluvials	Monkey Place Creek alluvium	322120.98	6375817.87	75.15	0.1	75.05	16.00	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
GW9	MB	Broke Area Alluvials	Monkey Place Creek alluvium	322319.08	6376212.93	73.78	0.25	73.53	13.00	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
GW10	MB	Broke Area Alluvials	Monkey Place Creek alluvium	322177.66	6376728.28	73.32	0.42	72.90	16.00	Unknown	D / 2M	2M	2M	6M	SWL & WQ	GW10

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
LC1	MB	Loder Creek Alluvials/ <i>Mulbring Siltstone (regolith)</i>	Loder Creek Alluvium	322855.00	6384876.00	58.46	57.99	0.47	5.00	Unknown	-	2M	2M	2M	6M	-
LC2	MB	Loder Creek Alluvials/ <i>Branxton Formation (regolith)</i>	Loder Creek Alluvium	323727.00	6387928.00	44.97	44.47	0.50	7.60	Unknown	-	2M	2M	2M	6M	-
McG1	MB	Beltana Area Miscellaneous Bores & Wells	Regolith /sill/ alluvium	317425.87	6381405.39	112.41	0.28	112.13	Unknown	Unknown	-	2M	2M	2M	6M	WQ
NPZ3-A	MB	Beltana Area NPZ	Alcheringa Seam	318117.71	6379200.51	73.11	0.5	72.61	17.00	Unknown	-	2M	2M	2M	6M	WQ
NPZ3-B	MB	Beltana Area NPZ	Interburden Sandstone	318116.79	6379199.73	72.76	Unknown	72.76	51.40	Unknown	-	2M	2M	2M	6M	WQ
NPZ4-A	MB	Beltana Area NPZ	Alcheringa Seam	316820.60	6380615.83	82.67	0.57	82.10	42.40	Unknown	Y	D / 2M	2M	2M	6M	WQ
NPZ4-B	MB	Beltana Area NPZ	Interburden Sandstone	316824.26	6380615.32	82.04	Unknown	82.04	63.30	Unknown	-	2M	2M	2M	6M	WQ
NPZ5-A	MB	Beltana Area NPZ	Alcheringa Seam	316448.35	6381790.37	74.48	0.56	73.92	15.70	Unknown	Y	D / 2M	2M	2M	6M	WQ
NPZ5-B	MB	Beltana Area NPZ	Interburden Sandstone	316448.35	6381790.37	73.90	Unknown	73.90	51.30	Unknown	-	2M	2M	2M	6M	WQ
NPZ7-1	MB	Beltana Area NPZ	Interburden Sandstone	317566.20	6379556.28	68.99	0.41	68.58	50.00	Unknown	-	2M	2M	2M	6M	WQ
NPZ7-2A	MB	Beltana Area NPZ	Alcheringa Seam	317623.98	6379598.15	70.55	0.56	69.99	10.00	Unknown	Y	D / 2M	2M	2M	6M	WQ
NPZ7-2B	MB	Beltana Area NPZ	Interburden Sandstone	317623.98	6379598.15	70.26	Unknown	70.26	57.50	Unknown	-	2M	2M	2M	6M	WQ

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
NPZ7-3A	MB	Beltana Area NPZ	Alcheringa Seam	317680.71	6379639.51	73.95	0.55	73.40	17.00	Unknown	Y	D / 2M	2M	2M	6M	WQ
NPZ7-3B	MB	Beltana Area NPZ	Interburden Sandstone	317680.71	6379639.51	73.62	Unknown	73.62	54.00	Unknown	-	2M	2M	2M	6M	WQ
P1	MB	SBC/Broke Area Lower Whybrow Seam	Lower Whybrow Seam	321321.00	6377637.00	82.00	Unknown	82.00	Unknown	Unknown	-	2M	2M	2M	6M	WQ
P2	MB	Broke Area Wollombi Seam	Shallow coal measures	321283.35	6377492.59	74.60	Unknown	74.60	52.00	Unknown	-	2M	2M	2M	6M	WQ
P5A	MB	Broke Area Wollombi Seam	Shallow coal measures	321682.07	6376660.68	76.15	Unknown	76.15	<100	Unknown	-	2M	2M	2M	6M	WQ
P6A	MB	Broke Area Wollombi Seam	Shallow coal measures	322839.83	6376615.27	85.10	Unknown	85.10	<100	Unknown	-	2M	2M	2M	6M	WQ
P6B	MB	SBC/Broke Area Lower Whybrow Seam	Lower Whybrow Seam	322839.83	6376615.27	85.10	Unknown	85.10	390.00	Unknown	-	2M	2M	2M	6M	WQ
P7B	MB	SBC/Broke Area Lower Whybrow Seam	Lower Whybrow Seam	Unknown	Unknown	74.79	Unknown	74.79	Unknown	Unknown	-	2M	2M	2M	6M	-
P8	MB	SBC/Broke Area Lower Whybrow Seam	Lower Whybrow Seam	324628.23	6375708.24	88.18	0.8	87.38	392.40	Unknown	-	2M	2M	2M	6M	WQ
SBD196	MB	Wollombi Alluvials and Shallow Coal Measures	Shallow coal measures	320164.75	6377155.89	73.00	Unknown	73.00	Unknown	Unknown	-	2M	2M	2M	6M	-

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
V1	MB	Northern Area Shallow Alluvials	Wollombi Alluvium	316720.30	6380086.18	71.04	Unknown	71.04	<30	Unknown	-	2M	2M	2M	6M	SWL & WQ
V2	MB	Northern Area Shallow Alluvials	Wollombi Alluvium	316959.49	6383505.26	67.25	Unknown	67.25	<30	Unknown	-	2M	2M	2M	6M	SWL & WQ
V3	MB	Broke Area Alluvials	Wollombi Alluvium	321479.59	6377087.42	75.45	Unknown	75.45	<30	Unknown	-	2M	2M	2M	6M	SWL & WQ
WBD160	MB	Wollombi Alluvials and Shallow Coal Measures	Wollombi Alluvium	316435.00	6380857.00	73.83	Unknown	73.83	18.00	Unknown	-	2M	2M	2M	6M	WQ
WBD62A	MB	Northern Alcheringa Seam	Alcheringa Seam	316593.58	6381282.77	80.20	0.45	79.75	24.68	Unknown	Y	D / 2M	2M	2M	6M	-
WBR15	MB	Beltana Area Miscellaneous Bores & Wells	Regolith /sill/ alluvium	317578.48	6379805.69	78.11	0.35	77.76	24.00	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
WBR180	MB	Wollombi Alluvials and Shallow Coal Measures	Shallow coal measures	316926.13	6383123.84	69.90	0.7	69.20	46.00	Unknown	-	2M	2M	2M	6M	WQ
WBR181	MB	Wollombi Alluvials and Shallow Coal Measures	Wollombi Alluvium	316735.26	6383229.55	68.54	0.88	67.66	9.00	Unknown	-	2M	2M	2M	6M	SWL & WQ
WBR182	MB	Wollombi Alluvials and Shallow Coal Measures	Wollombi Alluvium	316570.50	6382623.04	69.62	0.62	69.00	11.50	Unknown	-	2M	2M	2M	6M	SWL & WQ
WBR183	MB	Wollombi Alluvials and	Shallow coal measures	316802.50	6382733.61	74.64	0.73	73.91	30.60	Unknown	-	2M	2M	2M	6M	WQ

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
			Shallow Coal Measures													
WBR240	MB	Wollombi Alluvials and Shallow Coal Measures	Shallow Permian	317495.00	6383685.00	65.42	0.4	65.02	9.00	Unknown	Y	D / 2M	2M	2M	6M	WQ
WBR241	MB	Wollombi Alluvials and Shallow Coal Measures	Wollombi Alluvium	316931.63	6383671.92	68.25	0.5	67.75	13.50	Unknown	Y	D / 2M	2M	2M	6M	SWL & WQ
WBR50	MB	Northern Area Lower Whybrow Seam	Lower Whybrow Seam	317604.50	6383719.60	64.57	0.25	64.32	125.00	Unknown	Y	D / 2M	2M	2M	6M	WQ
WBR50A	MB	Northern Area Shallow Alluvials	Shallow Permian	317619.47	6383700.52	65.10	0.55	64.55	18.00	Unknown	Y	D / 2M	2M	2M	6M	WQ
White 1	MB	Beltana Area Miscellaneous Bores & Wells	Wollombi Alluvium	318248.90	6378942.98	70.55	Unknown	70.55	Unknown	Unknown	-	2M	2M	2M	6M	SWL & WQ
WWS1	MB	Warkworth Sands	Warkworth Sands	317737.27	6384291.33	96.96	Unknown	96.96	2.15	Unknown	-	2M	2M	2M	6M	-
WWS2a	MB	Warkworth Sands	Warkworth Sands	317632.00	6384549.00	96.52	Unknown	96.52	1.50	Unknown	-	2M	2M	2M	6M	-
WWS2b	MB	Warkworth Sands	Warkworth Sands	317632.00	6384550.00	96.46	Unknown	96.46	2.60	Unknown	-	2M	2M	2M	6M	-
WWS3a	MB	Warkworth Sands	Warkworth Sands	317728.96	6384886.79	85.52	Unknown	85.52	1.40	Unknown	-	2M	2M	2M	6M	-
WWS3b	MB	Warkworth Sands	Warkworth Sands	317728.96	6384886.79	85.40	Unknown	85.40	2.00	Unknown	-	2M	2M	2M	6M	-
MB1A shallow	VWP	Northern Tailings	Shallow Permian	318544.83	6384967.25	-	-	78.69	146.0	25.5	Y	D / 2M	-	-	-	-

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
			Emplacement Facility													
MB1B deep	VWP	Northern Tailings Emplacement Facility	Deep Permian	318544.83	6384967.25	-	-	78.69	146.0	136.0	Y	D / 2M	-	-	-	-
MB2	VWP	Northern Tailings Emplacement Facility	Whybrow Seam	318017.67	6384363.33	-	-	89.62	72.5	43.0	Y	D / 2M	-	-	-	-
MB3A shallow	VWP	Northern Tailings Emplacement Facility	Shallow Permian	318297.20	6383709.03	-	-	78.14	212.0	23.5	Y	D / 2M	-	-	-	-
MB3B deep	VWP	Northern Tailings Emplacement Facility	Deep Permian	318297.20	6383709.03	-	-	78.14	212.0	192	Y	D / 2M	-	-	-	-
SBD194	VWP	-	Shallow Coal	320162.10	6377154.60	-	-	73.00	367.60	35.30	Y	D / 2M	-	-	-	-
			Watts Sandstone							90.80	Y	D / 2M	-	-	-	-
			Whybrow Seam							171.40	Y	D / 2M	-	-	-	-
			Redbank Creek Seam							197.30	Y	D / 2M	-	-	-	-
			Wambo Seam							227.00	Y	D / 2M	-	-	-	-
			300/301 (Blakefield) Seam							265.90	Y	D / 2M	-	-	-	-
			Glen Munro Seam							278.80	Y	D / 2M	-	-	-	-
			Woodlands Hill Seam							321.30	Y	D / 2M	-	-	-	-

Bore ID	Type	WMP Group	WMP Lithology	Easting (m)*	Northing (m)*	Top of Casing Elevation (mAHD)	Top of Casing (magl)	Ground Level (mAHD)	Bore Depth (mbgl)	Screened Interval / VWP Sensor Depth (mbgl)	Logger Installed	Groundwater Monitoring Programme				
												SWL	EC	pH	Comprehensive Analysis	Trigger in WMP
			Piercefield A and B Seam							367.70	Y	D / 2M	-	-	-	-
SBFOW15	VWP	-	Redbank Creek Seam	322380.20	6380379.10	-	-	89.14	38.00	96.00	Y	D / 2M	-	-	-	-
			Wambo Seam							122.00	Y	D / 2M	-	-	-	-
			Blakefield Seam							158.00	Y	D / 2M	-	-	-	-
			Glen Munro Seam							184.00	Y	D / 2M	-	-	-	-
			Woodlands Hill Seam							224.00	Y	D / 2M	-	-	-	-
			Piercefield C Seam							334.00	Y	D / 2M	-	-	-	-
WBD170	VWP	-	Undifferentiated coal measures	317164.30	6380768.30	-	-	93.90	220.00	60.00	Y	D / 2M	-	-	-	-
			Undifferentiated coal measures							110.00	Y	D / 2M	-	-	-	-
			Undifferentiated coal measures							160.00	Y	D / 2M	-	-	-	-
			Whybrow Seam							220.00	Y	D / 2M	-	-	-	-
WBD171	VWP	-	Undifferentiated coal measures	316939.80	6380797.60	-	-	85.30	223.00	60.00	Y	D / 2M	-	-	-	-
			Undifferentiated coal measures							110.00	Y	D / 2M	-	-	-	-
			Undifferentiated coal measures							160.00	Y	D / 2M	-	-	-	-
			Whybrow Seam							223.00	Y	D / 2M	-	-	-	-

Note:

MB – Monitoring Bore

D - Daily

VWP – Vibrating Wire Piezometer

2M – Every Two Months

SWL – Standing Water Level

6M – Every Six Months

*MGA56

Appendix B

Groundwater Level Data



Table B.1 Groundwater Level Data - Bores in WMP

Bore ID	Lithology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	SWL Trigger Level (Lowest Depth) (mAHD)	Q1 SWL (mAHD)	Q2 SWL (mAHD)			Q3 SWL (mAHD)	Q4 SWL (mAHD)	
						Feb	Apr	Jun	Aug	Oct	Dec	
Broke Area Alluvials												
GW1	Monkey Place Creek alluvium	92.13	Unknown	Unknown	NA	88.71	88.54	89.30	89.82	90.06	89.71	
GW3	Monkey Place Creek alluvium	77.88	Unknown	Unknown	73.99	Bore Deformed - Unable to Measure SWL						
GW6	Monkey Place Creek alluvium	77.04	Unknown	Unknown	72.19	74.62	74.55	75.58	75.71	75.48	75.00	
GW7	Monkey Place Creek alluvium	75.00	Unknown	Unknown	63.29	73.93	73.88	74.85	74.96	74.60	74.21	
GW8	Monkey Place Creek alluvium	75.05	Unknown	Unknown	70.00	72.08	72.04	72.73	72.95	72.79	72.45	
GW9	Monkey Place Creek alluvium	73.53	Unknown	Unknown	70.34	72.22	72.00	73.15	73.26	72.80	72.42	
GW10	Monkey Place Creek alluvium	72.90	Unknown	Unknown	69.14	72.20	72.20	72.94	73.09	72.80	72.38	
V3	Wollombi Alluvium	75.45	Unknown	Unknown	64.99	69.46	69.47	69.46	69.56	69.86	69.83	
Broke Area Wollombi Seam												
P2	Shallow coal measures	74.60	Unknown	Unknown	NA	68.88	68.87	68.84	69.09	69.07	68.84	
P5A	Shallow coal measures	76.15	Unknown	Unknown	NA	69.06	72.19	69.68	69.36	68.95	69.41	
P6A	Shallow coal measures	85.10	Unknown	Unknown	NA	68.57	68.60	68.39	68.84	68.92	69.10	
Northern Area Shallow Alluvials												
F1	Wollombi Alluvium	69.09	Unknown	Unknown	60.83	65.44	65.27	65.31	65.47	65.43	65.14	
F2	Wollombi Alluvium	69.72	Unknown	Unknown	62.93	65.85	65.77	66.18	66.19	66.18	66.00	
V1	Wollombi Alluvium	71.04	Unknown	Unknown	62.53	65.61	65.54	65.76	65.80	65.74	nm	
V2	Wollombi Alluvium	67.25	Unknown	Unknown	58.70	60.53	60.53	61.20	61.57	61.63	61.10	
WBR50A	Shallow Permian	64.55	Unknown	Unknown	NA	59.52	59.22	59.80	60.38	60.33	60.07	
SBC/Broke Area Lower Whybrow Seam												
P1	Lower Whybrow Seam	82.00	Unknown	Unknown	NA	Bore Not Located						
P6B	Lower Whybrow Seam	85.10	Unknown	Unknown	NA	-20.67	-30.09	-26.68	-25.67	-22.79	-22.27	
P8	Lower Whybrow Seam	87.38	Unknown	Unknown	NA	75.73	75.88	76.93	nm	77.21	nm	
Northern Area Lower Whybrow Seam												
WBR50	Lower Whybrow Seam	64.32	Unknown	Unknown	NA	29.07	28.63	29.57	30.28	30.83	30.45	
Beltana Area Miscellaneous Bores & Wells												
Dwyers	Wollombi Alluvium	70.09	Unknown	Unknown	60.54	64.10	63.82	64.42	64.43	64.44	64.21	
Fernance	Wollombi Alluvium	71.63	Unknown	Unknown	59.27	65.56	65.44	65.77	65.89	65.91	65.67	
McG1	Regolith /sill/ alluvium	112.13	Unknown	Unknown	NA	91.98	92.03	93.69	93.19	92.51	91.98	
White 1	Wollombi Alluvium	70.55	Unknown	Unknown	62.22	66.24	66.12	66.47	66.55	66.64	66.46	
WBR15	Regolith /sill/ alluvium	77.76	Unknown	Unknown	62.16	66.16	66.02	66.53	66.10	66.28	66.37	
Beltana Area NPZ												
NPZ3-A	Alcheringa Seam	72.61	Unknown	Unknown	NA	NM Since 2015						
NPZ3-B	Interburden Sandstone	72.76	Unknown	Unknown	NA	66.38	66.22	66.73	66.39	66.45	65.98	
NPZ4-A	Alcheringa Seam	82.10	Unknown	Unknown	NA	67.07	66.88	66.52	66.22	66.17	66.19	
NPZ4-B	Interburden Sandstone	82.04	Unknown	Unknown	NA	54.03	53.38	52.53	51.60	51.42	51.43	
NPZ5-A	Alcheringa Seam	73.92	Unknown	Unknown	NA	65.41	65.24	65.26	65.27	65.38	65.13	

Bore ID	Lithology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	SWL Trigger Level (Lowest Depth) (mAHD)	Q1 SWL (mAHD)	Q2 SWL (mAHD)		Q3 SWL (mAHD)	Q4 SWL (mAHD)	
						Feb	Apr	Jun	Aug	Oct	Dec
NPZ5-B	Interburden Sandstone	73.90	Unknown	Unknown	NA	51.75	49.48	49.54	49.95	50.18	50.25
NPZ7-1	Interburden Sandstone	68.58	Unknown	Unknown	NA	64.86	64.77	66.49	65.79	65.64	65.86
NPZ7-2A	Alcheringa Seam	69.99	Unknown	Unknown	NA	65.33	65.22	65.69	65.77	65.70	65.53
NPZ7-2B	Interburden Sandstone	70.26	Unknown	Unknown	NA	62.29	62.16	64.52	63.71	63.54	63.79
NPZ7-3A	Alcheringa Seam	73.40	Unknown	Unknown	NA	65.50	65.41	65.74	65.82	65.16	65.73
NPZ7-3B	Interburden Sandstone	73.62	Unknown	Unknown	NA	66.00	66.03	67.01	66.44	66.46	66.83
Wollombi Alluvials and Shallow Coal Measures											
WBD160	Wollombi Alluvium	73.83	Unknown	Unknown	NA	67.02	64.70	66.64	66.52	66.50	66.43
WBR180	Shallow coal measures	69.20	Unknown	Unknown	NA	36.21	36.02	35.91	36.13	36.15	36.16
WBR181	Wollombi Alluvium	67.66	Unknown	Unknown	59.65	61.22	61.23	61.85	61.86	61.47	61.13
WBR182	Wollombi Alluvium	69.00	Unknown	Unknown	62.16	63.60	63.46	63.64	63.75	63.88	63.60
WBR183	Shallow coal measures	73.91	Unknown	Unknown	NA	62.28	62.23	62.28	62.50	62.70	62.54
WBR240	Shallow Permian	65.02	Unknown	Unknown	NA	60.71	60.54	60.62	61.34	60.95	60.86
WBR241	Wollombi Alluvium	67.75	Unknown	Unknown	60.20	60.90	60.91	61.62	61.86	61.60	61.24

Note: NA - no trigger set as either bore depth unknown or depressurisation in Permian coal seam

NM - not measured

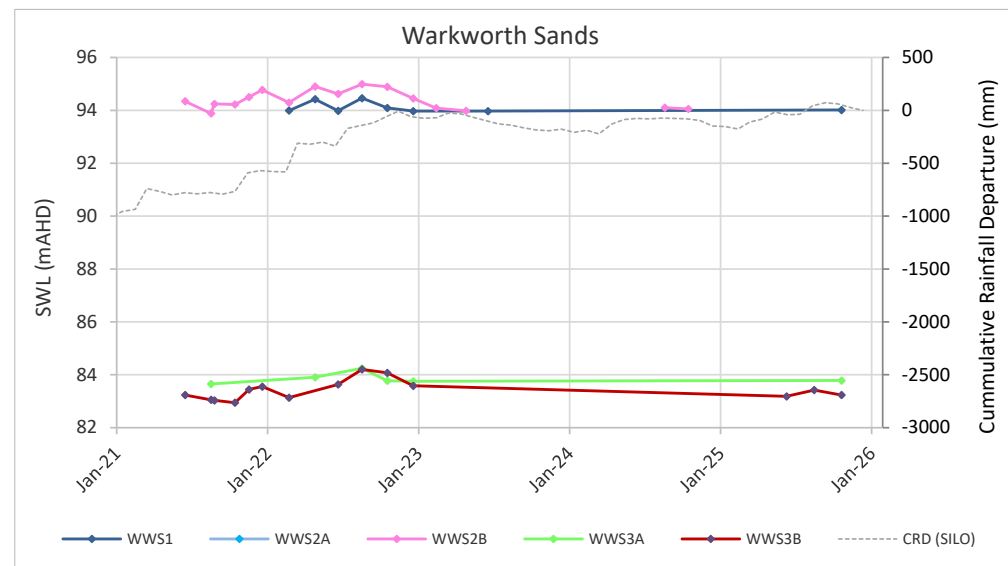
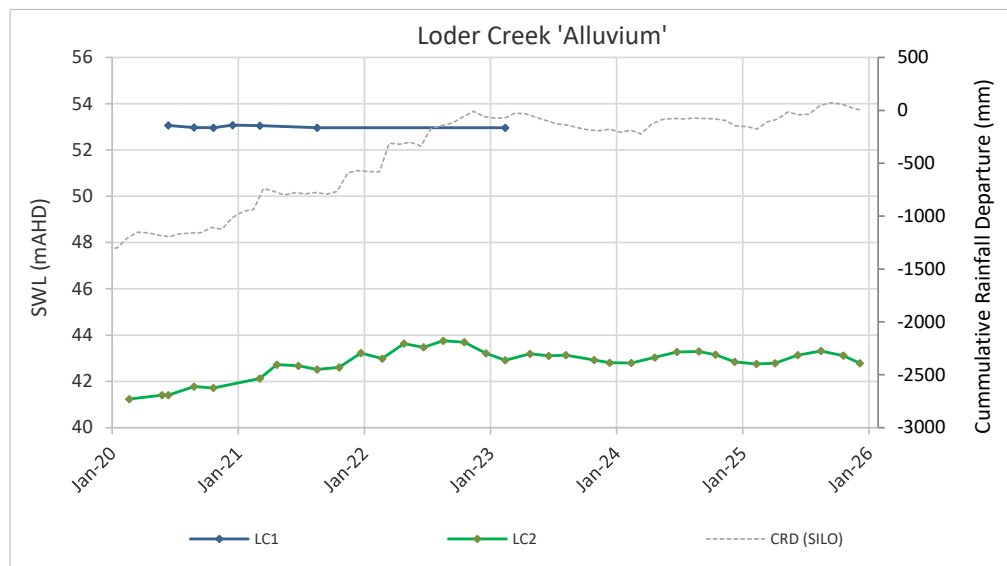
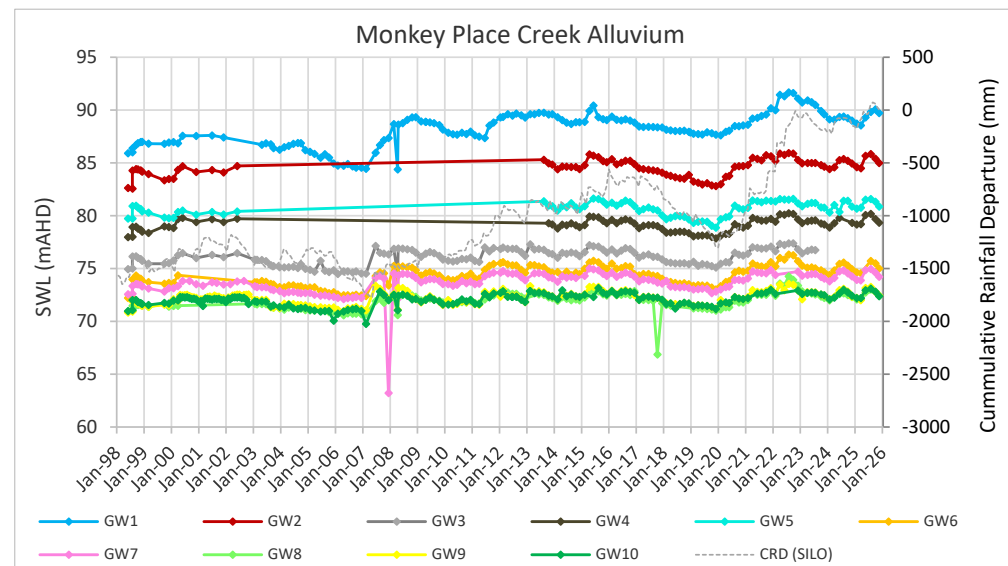
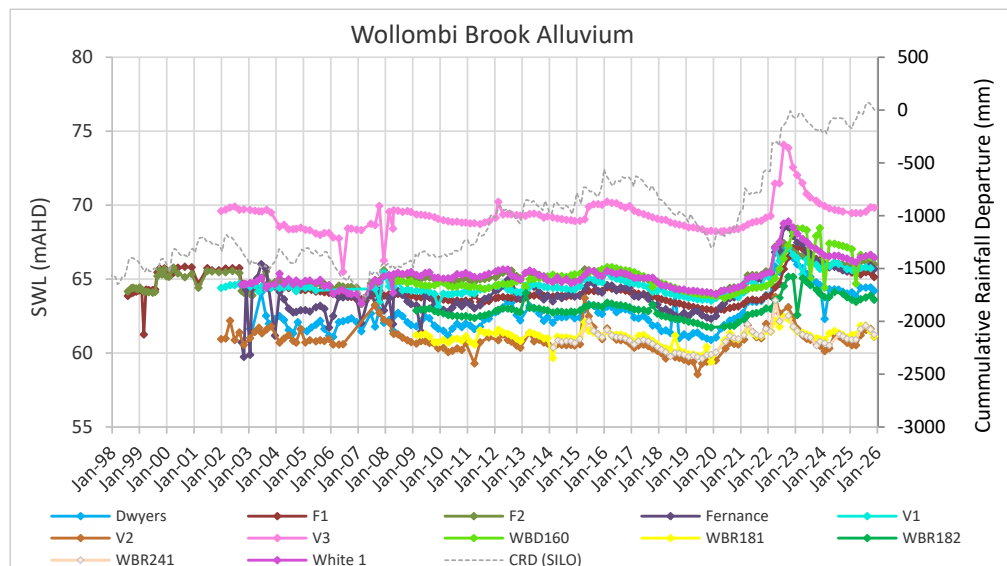
Table B.2 Groundwater Level Data

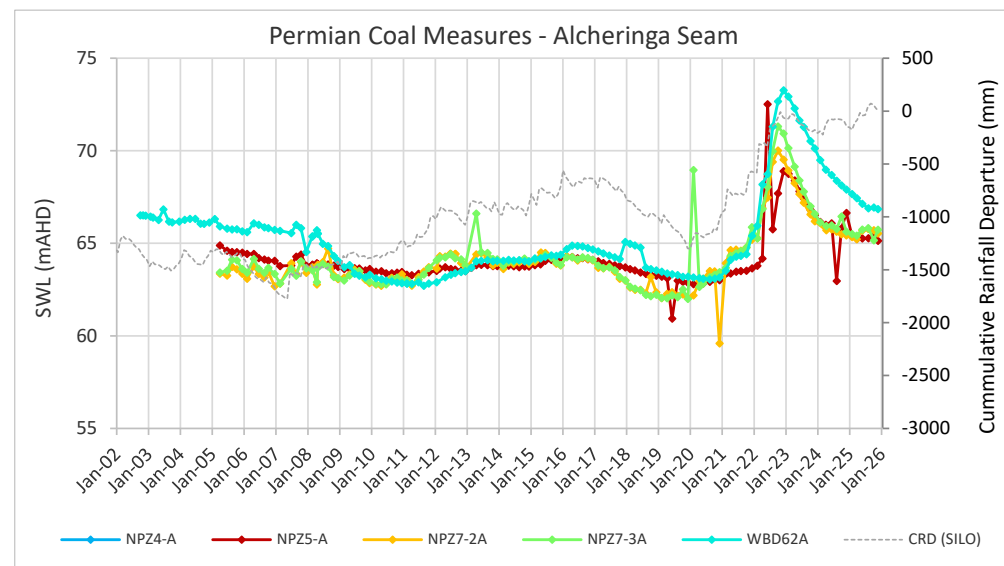
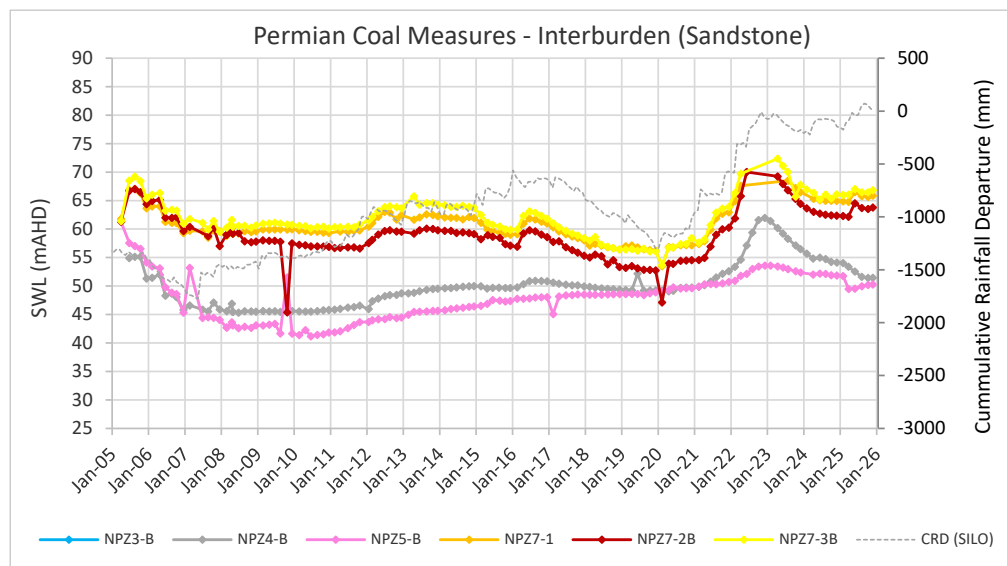
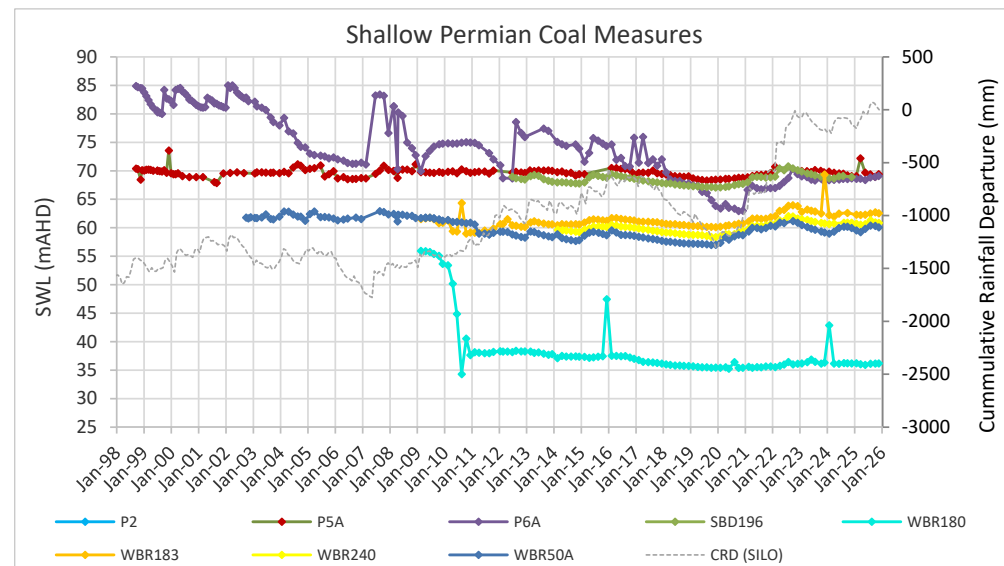
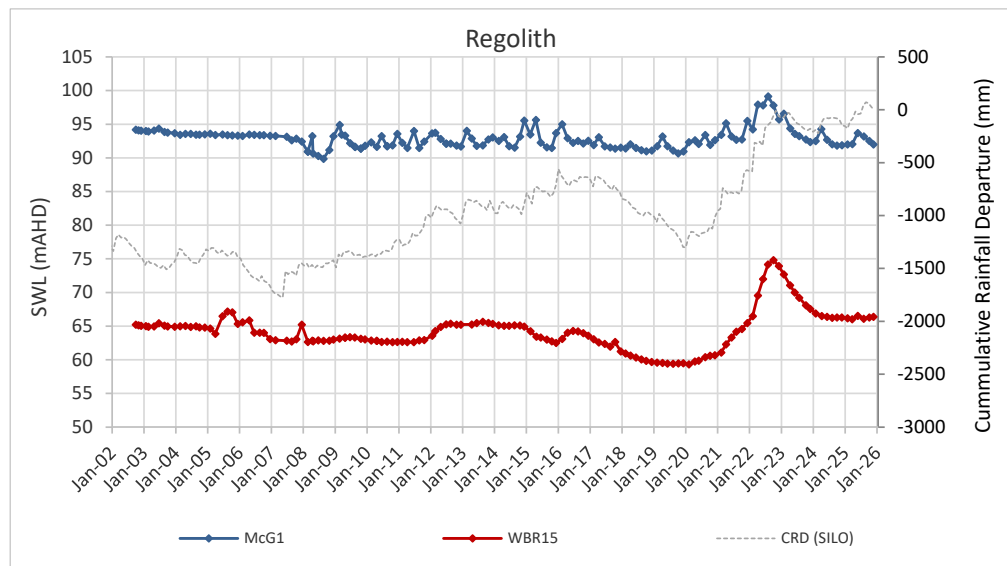
Bore ID	Lithology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	Q1 SWL (mAHD)	Q2 SWL (mAHD)		Q3 SWL (mAHD)	Q4 SWL (mAHD)	
					Feb	Apr	Jun	Aug	Oct	Dec
Broke Area Alluvials										
GW2	Monkey Place Creek alluvium	86.34	Unknown	Unknown	84.59	84.49	85.66	85.83	85.39	84.98
GW4	Monkey Place Creek alluvium	80.59	Unknown	Unknown	79.16	79.20	80.06	80.17	79.68	79.33
GW5	Monkey Place Creek alluvium	82.00	Unknown	Unknown	80.66	80.75	81.51	81.57	81.32	80.86
Loder Creek Alluvials										
LC1	Loder Creek Alluvium	0.47	Unknown	Unknown	Dry					
LC2	Loder Creek Alluvium	0.50	Unknown	Unknown	42.75	42.78	43.13	43.31	43.11	42.78
Northern Area Lower Whybrow Seam										
WBD62A	Alcheringa Seam	79.75	Unknown	Unknown	67.66	67.43	67.13	66.89	66.93	66.85
SBC/Broke Area Lower Whybrow Seam										
P7B	Lower Whybrow Seam	74.79	Unknown	Unknown	NM Since 2012 (not accessible)					
Warkworth Sands										
WWS1	Warkworth Sands	96.96	Unknown	Unknown	Dry	Dry	Dry	Dry	94.01	Dry
WWS2b	Warkworth Sands	96.46	Unknown	Unknown	Dry	Dry	93.71	94.15	93.91	Dry
WWS2a	Warkworth Sands	96.52	Unknown	Unknown	Dry	Dry	Dry	Dry	Dry	Dry
WWS3a	Warkworth Sands	85.52	Unknown	Unknown	Dry	Dry	Dry	Dry	83.78	Dry
WWS3b	Warkworth Sands	85.40	Unknown	Unknown	Dry	Dry	83.18	83.42	83.23	Dry
Wollombi Alluvials and Shallow Coal Measures										
SBD196	Shallow coal measures	73.00	Unknown	Unknown	68.81	68.74	69.27	69.43	69.54	69.04

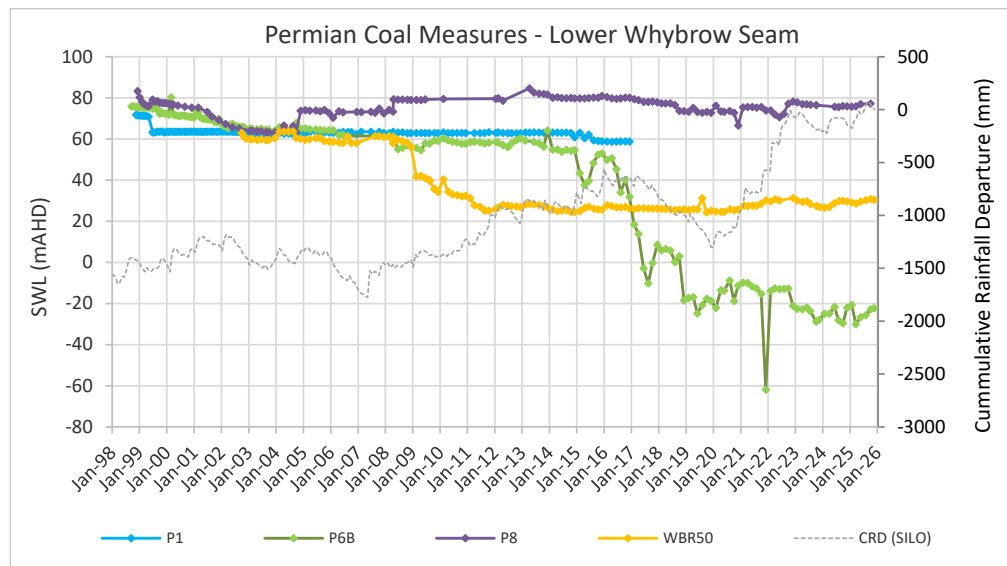
Appendix C

Groundwater Level Graphs

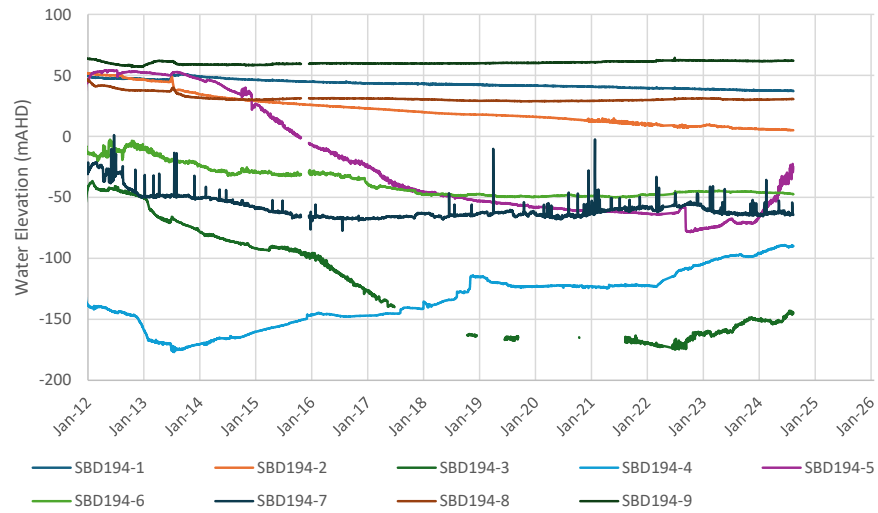




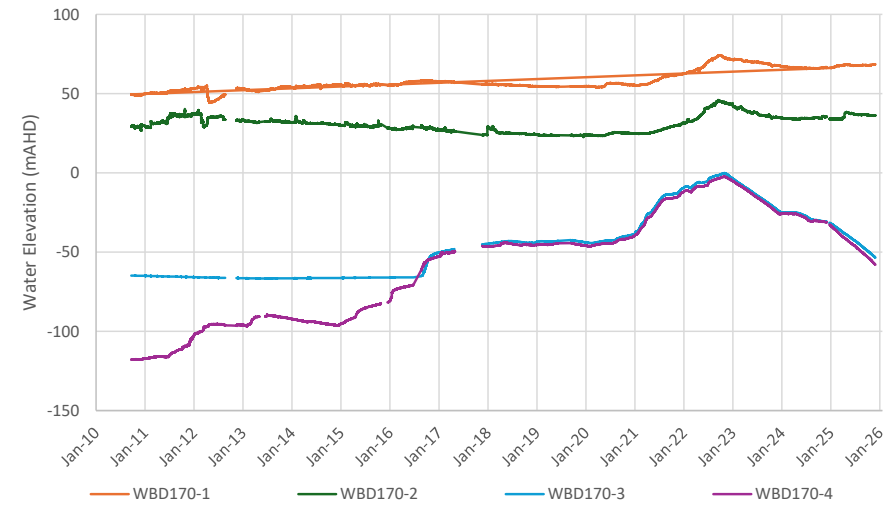




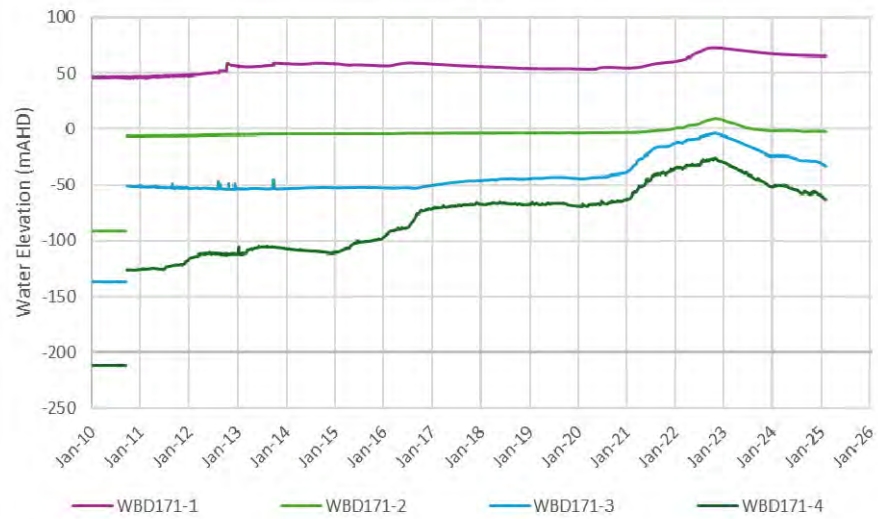
VWP - SBD194



VWP - WBD170



VWP - WBD171



Appendix D

Groundwater Quality Data



Table D.1 Groundwater Quality Data - Bores in WMP

Bore ID	Lithology	pH Trigger Level		Field pH Q1	Field pH Q2		Field pH Q3	Field pH Q4		EC Trigger Level (80th Percentile) (µS/cm)	Field EC Q1 (µS/cm)	Field EC Q2 (µS/cm)		Field EC Q3 (µS/cm)	Field EC Q4 (µS/cm)	
		20th Percentile	80th Percentile	Feb	Apr	Jun	Aug	Oct	Dec		Feb	Apr	Jun	Aug	Oct	Dec
Broke Area Alluvials																
GW1	Monkey Place Creek alluvium	6.7	7.3	7.1	7.2	6.8	7.8	7.0	6.9	3634	1270	1340	1290	1240	1390	1430
GW3	Monkey Place Creek alluvium	6.7	7.2	Bore Deformed - Unable to Sample						6010	Bore Deformed - Unable to Sample					
GW6	Monkey Place Creek alluvium	7.3	7.8	7.3	7.3	7.5	7.9	7.2	7.4	7900	7530	7810	7580	7660	7680	8020
GW7	Monkey Place Creek alluvium	6.7	7.4	7.4	7.2	7.3	7.1	6.9	7.2	3946	3780	7580	247	2950	3600	3760
GW8	Monkey Place Creek alluvium	6.6	7.0	7.2	7.1	7.3	7.4	6.7	6.9	5936	4200	1218	4220	3580	4950	5180
GW9	Monkey Place Creek alluvium	6.7	7.2	7.7	7.4	7.6	8.4	6.8	7.1	4458	1120	nm	389	663	4030	4070
GW10	Monkey Place Creek alluvium	7.1	7.6	7.4	7.5	7.4	7.3	7.6	7.9	10252	5270	1514	5190	4300	5040	5070
V3	Wollombi Alluvium	7.1	7.6	6.9	6.9	6.8	6.9	7.0	7.2	1744	3410	nm	2730	2320	2360	2260
Broke Area Wollombi Seam																
P2	Shallow coal measures	7.4	8.0	7.1	7.2	7.0	7.3	7.0	7.4	12834	11000	10600	11200	11400	10700	10200
P5A	Shallow coal measures	7.5	8.2	7.8	7.8	7.8	7.8	7.9	8.0	6242	1840	690	6700	7170	6900	7320
P6A	Shallow coal measures	7.0	8.1	7.0	7.0	7.1	7.1	7.2	7.0	2740	1360	8110	1370	1270	1340	1380
Northern Area Shallow Alluvials																
F1	Wollombi Alluvium	7.2	7.6	7.4	7.2	7.2	7.3	7.4	7.4	1025	1190	1218	1240	1120	1020	1040
F2	Wollombi Alluvium	7.1	7.4	7.3	7.2	7.7	7.4	7.2	7.3	1720	1780	1880	1880	1640	1860	1880
V1	Wollombi Alluvium	7.3	7.7	7.8	7.5	8.0	7.7	7.7		1570	1180	1300	1330	1240	1000	
V2	Wollombi Alluvium	6.4	7.1	6.5	6.8	6.6	6.3	6.5	6.5	922	108	147	123	125	126	130
WBR50A	Shallow Permian	7.1	7.7	7.7	7.3	7.5	7.5	7.9	6.8	14000	3940	4610	875	898	1080	3290
SBC/Broke Area Lower Whybrow Seam																
P1	Lower Whybrow Seam	7.4	7.9	Bore Not Located						14274	Bore Not Located					
P6B	Lower Whybrow Seam	6.7	7.3	8.3	8.4	8.5	8.8	8.5	8.6	1353	6500	6830	2700	2840	5020	5770
P8	Lower Whybrow Seam	7.3	9.3	7.0	6.8	7.5	0.0	7.1	7.1	5076	505	191	300	nm	373	373
Northern Area Lower Whybrow Seam																
WBR50	Lower Whybrow Seam	6.7	8.0	6.6	6.7	6.4	6.7	6.7	7.4	8382	715	955	905	1280	983	1410
Beltana Area Miscellaneous Bores & Wells																
Dwyers	Wollombi Alluvium	7.3	7.6	7.5	8.1	7.5	7.8	7.4	7.7	1476	1440	928	1630	1670	1960	1890
Fernance	Wollombi Alluvium	7.3	8.0	8.1	7.6	7.8	8.2	7.7	8.1	1473	867	1440	1190	1514	1680	923
McG1	Regolith /sill/ alluvium	7.5	8.0	7.6	7.7	7.9	8.2	8.0	7.8	918	521	557	287	295	298	366
White 1	Wollombi Alluvium	7.0	7.4	7.4	7.2	7.1	7.7	7.5	7.8	2444	2820	2920	2930	2220	2850	2970
WBR15	Regolith /sill/ alluvium	6.8	7.3	7.5	7.5	7.3	7.9	7.5	7.6	924	763	766	750	667	717	750
Beltana Area NPZ																
NPZ3-A	Alcheringa Seam	7.3	7.7	NM Since 2015						1362	NM Since 2015					
NPZ3-B	Interburden Sandstone	7.3	7.5	7.5	7.4	7.5	7.7	7.5	7.6	921	783	828	810	777	802	822
NPZ4-A	Alcheringa Seam	6.9	7.3	7.3	7.2	7.3	6.9	7.2	7.3	729	663	688	679	625	649	674
NPZ4-B	Interburden Sandstone	7.3	7.8	7.1	7.1	7.2	7.1	7.3	7.3	1342	1420	1480	1460	1370	1450	1460
NPZ5-A	Alcheringa Seam	6.9	7.3	6.8	6.8	6.9	7.0	7.0	7.0	886	783	815	803	763	904	937
NPZ5-B	Interburden Sandstone	7.1	7.6	7.5	7.4	7.3	7.4	7.5	7.4	2760	2790	2720	2670	2560	2460	2620
NPZ7-1	Interburden Sandstone	6.7	7.7	7.8	7.6	7.1	8.2	8.0	7.6	1240	1200	1240	1240	1150	1240	1230
NPZ7-2A	Alcheringa Seam	7.1	7.6	7.4	7.1	7.1	7.5	7.3	7.3	2250	1970	2070	2060	1640	2100	2090
NPZ7-2B	Interburden Sandstone	6.8	7.8	7.8	7.6	7.5	7.7	7.6	7.7	1307	1250	1320	1310	1260	1310	1310
NPZ7-3A	Alcheringa Seam	7.0	7.5	7.9	7.7	7.4	7.6	7.3	7.2	2540	1580	1690	1750	1470	1850	1880
NPZ7-3B	Interburden Sandstone	7.4	7.8	7.7	7.7	7.6	7.8	7.7	7.7	1316	1200	1270	1260	1170	1260	1270
Wollombi Alluvials and Shallow Coal Measures																
WBD160	Wollombi Alluvium	6.9	7.3	6.8	7.2	6.7	7.0	6.9	6.9	1310	201	122	271	102	261	506
WBR180	Shallow coal measures	7.1	7.5	7.3	7.1	7.1	7.3	7.2	7.2	20850	20400	20900	20500	20400	20400	20800
WBR181	Wollombi Alluvium	7.2	7.5	7.3	7.1	7.2	7.3	7.2	7.2	2670	2530	2910	3650	3170	2840	2860
WBR182	Wollombi Alluvium	7.3	8.3	7.3	7.2	7.2	6.8	7.0	7.2	1512	1610	1730	1700	1540	1920	1940
WBR183	Shallow coal measures	7.0	7.4	7.1	7.0	7.0	6.9	6.9	7.1	3484	3820	3650	3630	2850	3720	3630

Bore ID	Lithology	pH Trigger Level		Field pH Q1	Field pH Q2		Field pH Q3	Field pH Q4		EC Trigger Level (80th Percentile) (µS/cm)	Field EC Q1 (µS/cm)	Field EC Q2 (µS/cm)		Field EC Q3 (µS/cm)	Field EC Q4 (µS/cm)	
		20th Percentile	80th Percentile	Feb	Apr	Jun	Aug	Oct	Dec		Feb	Apr	Jun	Aug	Oct	Dec
WBR240	Shallow Permian	7.0	7.5	7.5	7.2	7.6	7.5	7.7	7.7	26800	13000	15400	2110	614	5160	6280
WBR241	Wollombi Alluvium	6.4	6.9	6.6	7.0	6.8	6.2	6.4	6.4	435	364	454	423	371	235	180

Note: NM - not measured

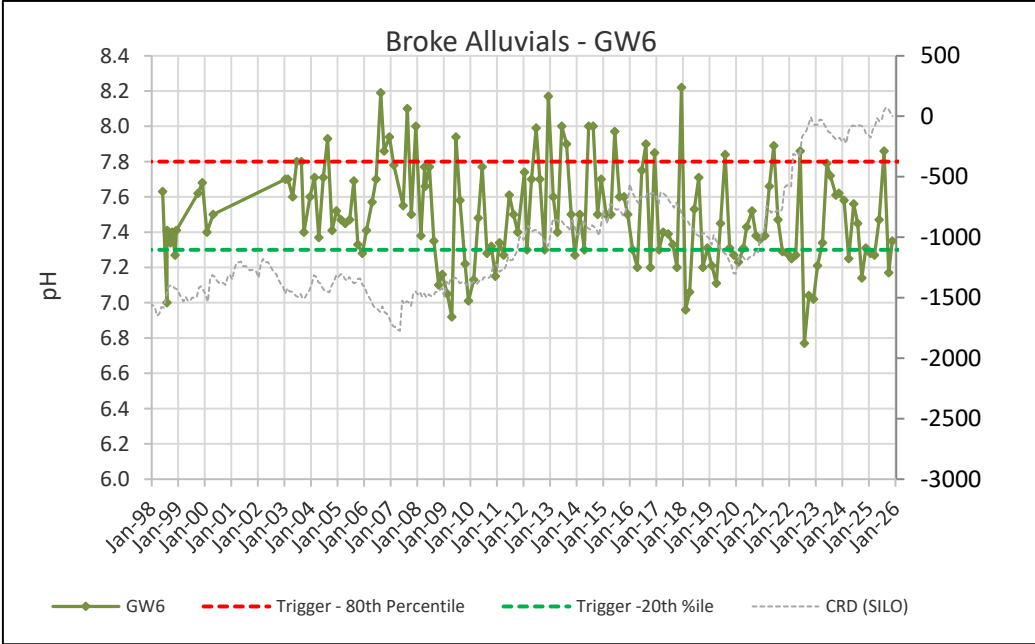
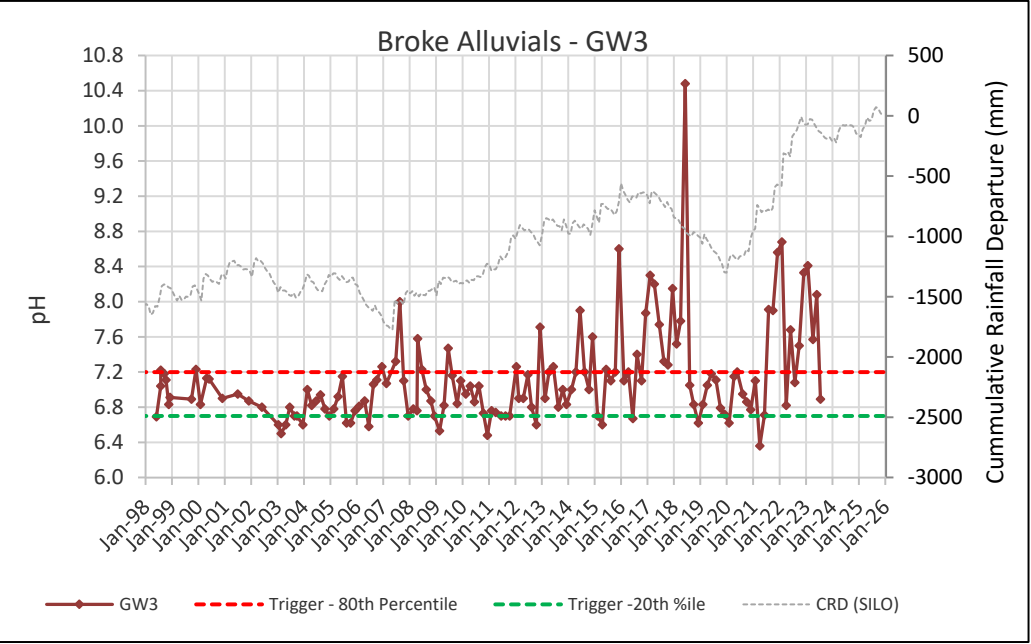
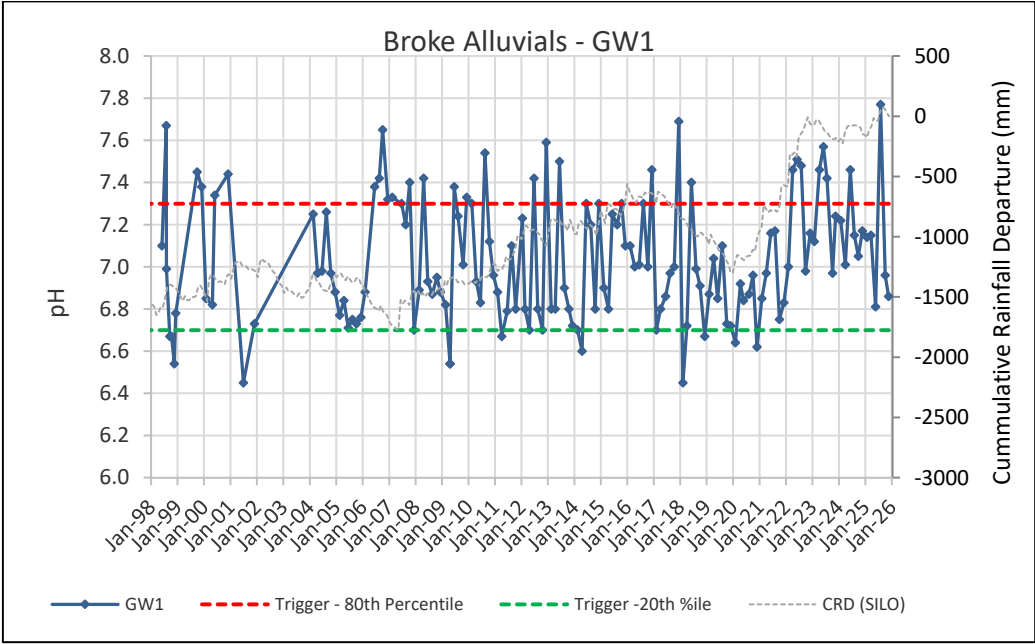
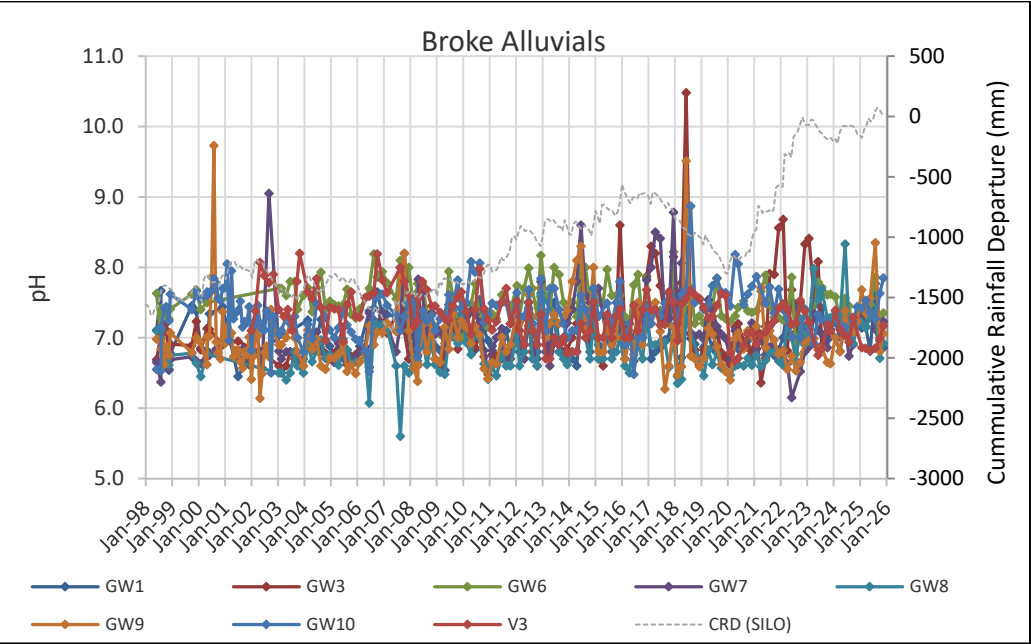
Table D.2 Groundwater Quality Data

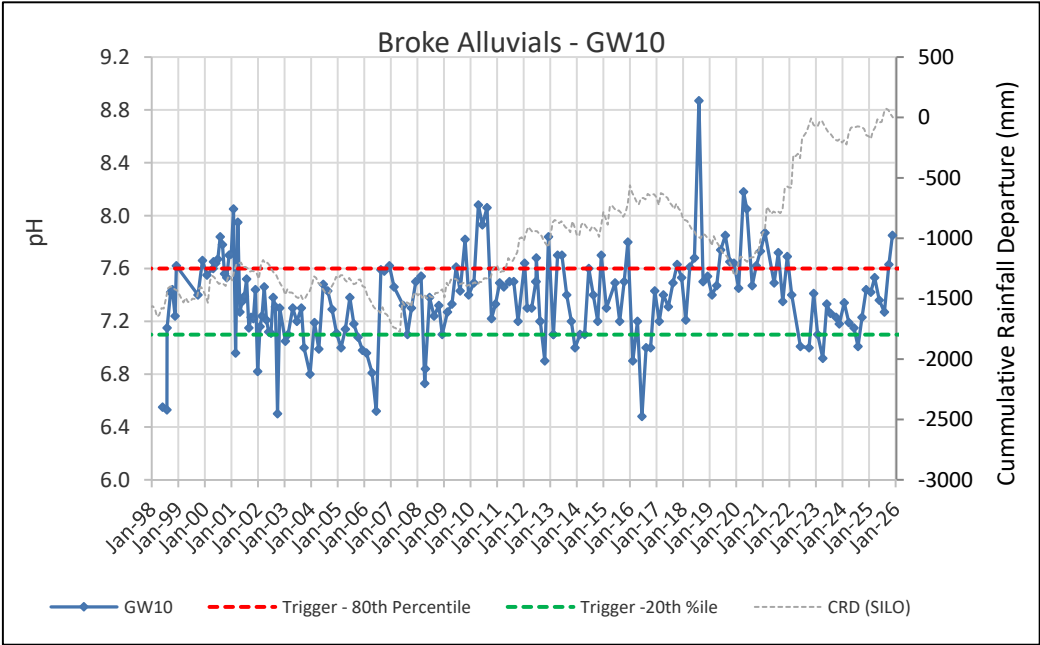
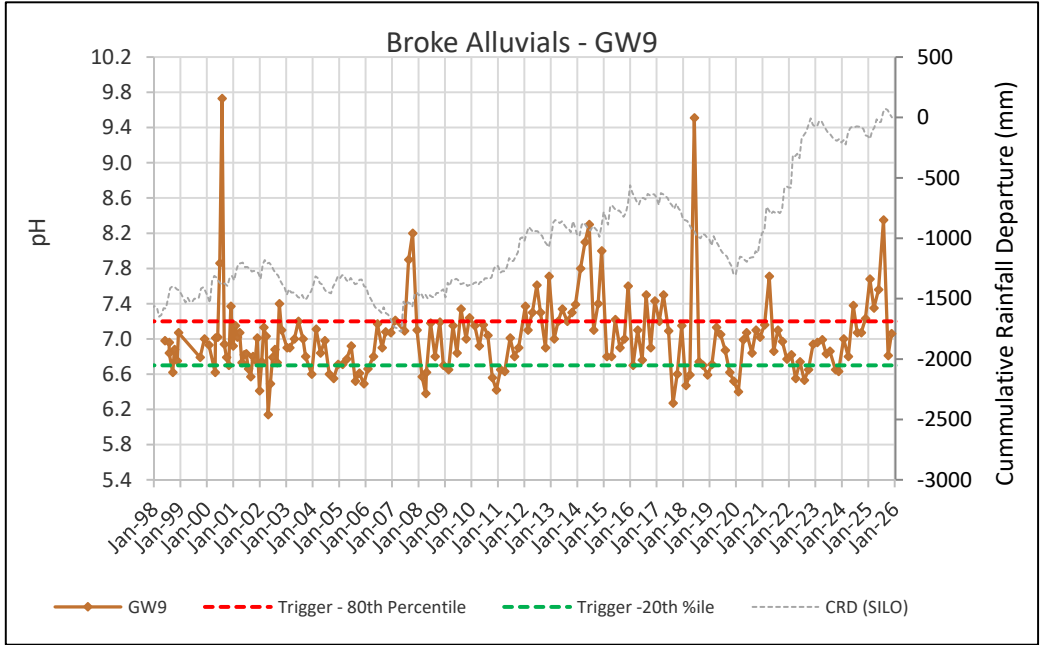
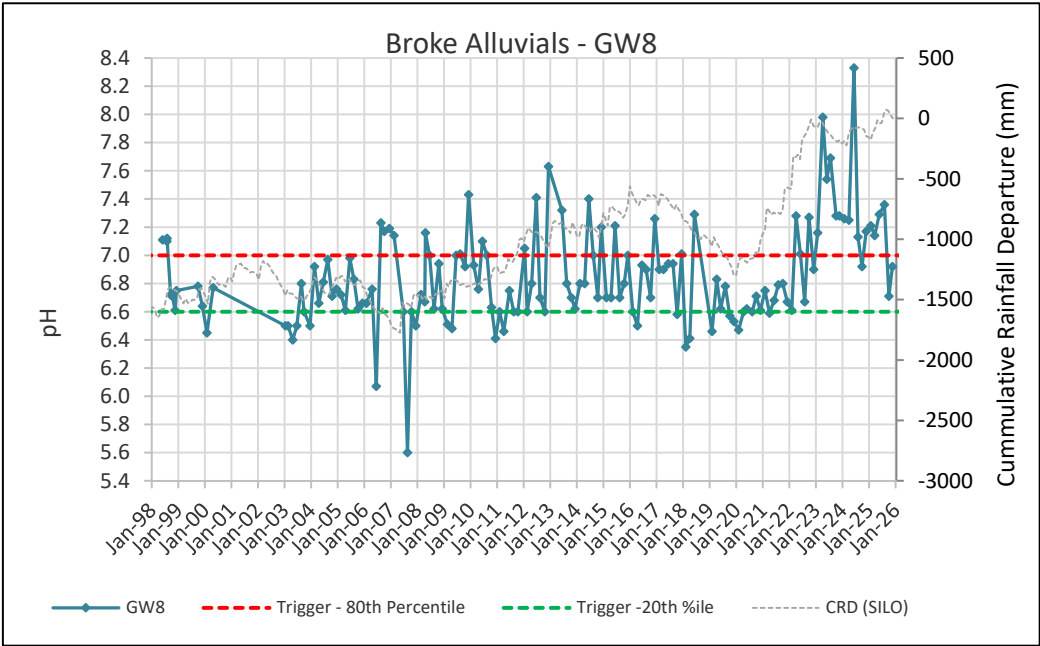
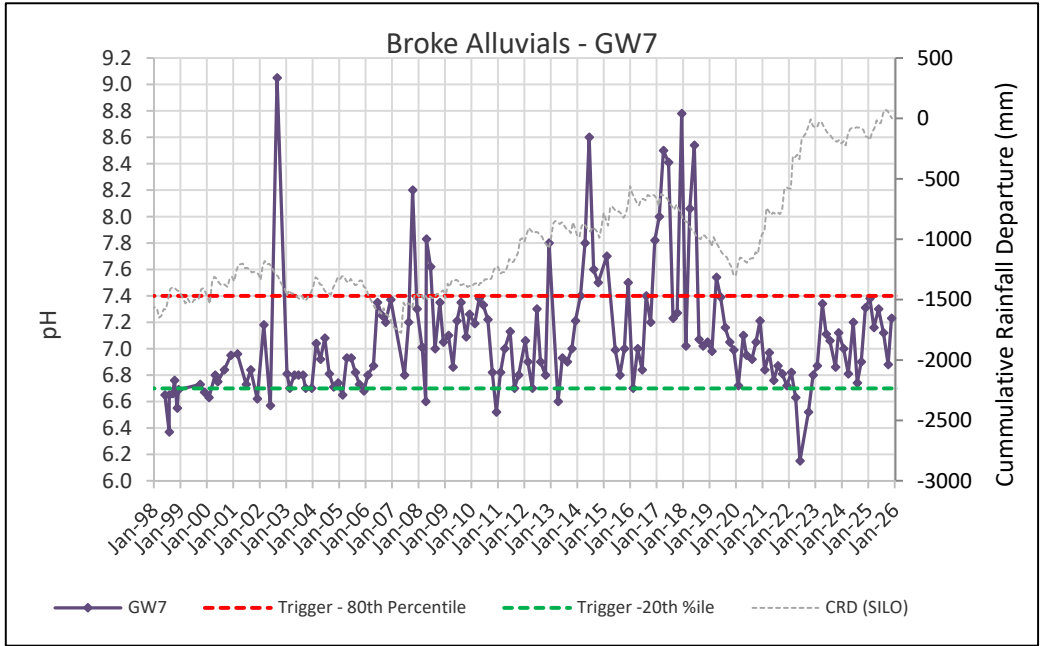
Bore ID	Lithology	Field pH Q1	Field pH Q2		Field pH Q3	Field pH Q4		Field EC Q1 (µS/cm)	Field EC Q2 (µS/cm)		Field EC Q3 (µS/cm)	Field EC Q4 (µS/cm)	
		Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec
Broke Area Alluvials													
GW2	Monkey Place Creek alluvium	7.1	6.9	6.9	7.3	6.9	7.1	4530	4790	4680	3320	4560	4820
GW4	Monkey Place Creek alluvium	7.4	7.3	7.5	7.8	7.1	7.2	1680	1700	1600	1480	1620	1660
GW5	Monkey Place Creek alluvium	7.0	7.1	7.2	8.2	7.4	6.7	5610	5790	5340	245	355	425
Loder Creek Alluvials													
LC1	Loder Creek Alluvium	Dry											
LC2	Loder Creek Alluvium	7.3	7.2	7.8	7.5	7.3	7.2	3890	3720	3830	3230	4060	3950
Northern Area Lower Whybrow Seam													
WBD62A	Alcheringa Seam	7.1	7.0	7.0	7.1	7.0	7.1	347	699	421	567	645	665
SBC/Broke Area Lower Whybrow Seam													
P7B	Lower Whybrow Seam	NM Since 2012 (not accessible)											
Warkworth Sands													
WWS1	Warkworth Sands	Dry											
WWS2b	Warkworth Sands	Dry	Dry	Dry	nm	nm	Dry	Dry	Dry	Dry	nm	nm	Dry
WWS2a	Warkworth Sands	Dry											
WWS3a	Warkworth Sands	Dry											
WWS3b	Warkworth Sands	Dry											
Wollombi Alluvials and Shallow Coal Measures													
SBD196	Shallow coal measures	7.1	6.9	6.7	7.2	6.9	7.1	4490	4380	4250	4150	4270	4150

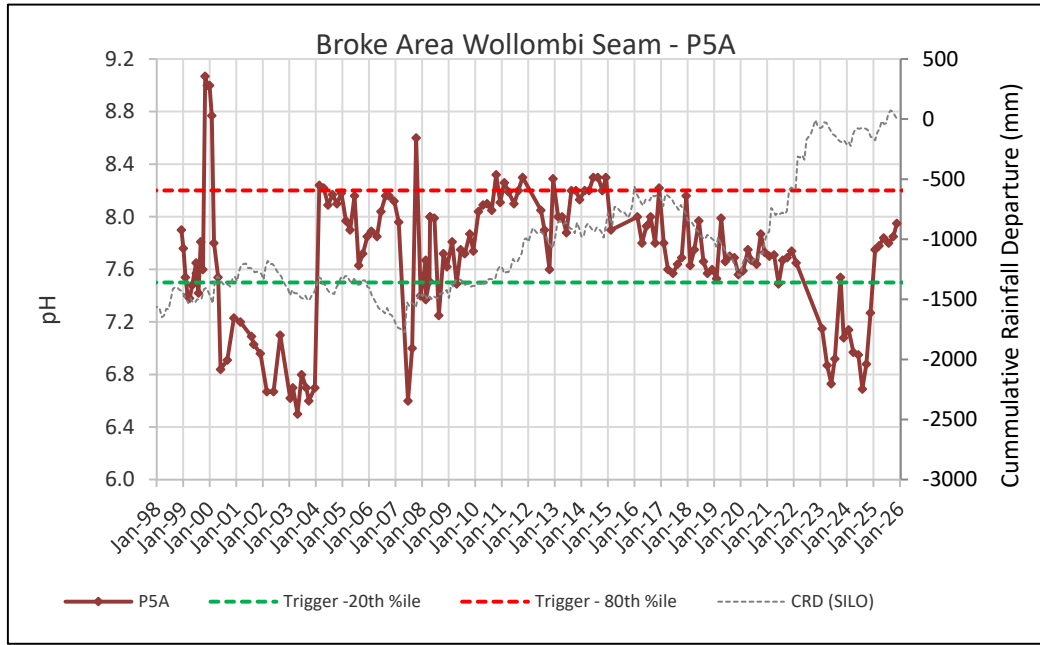
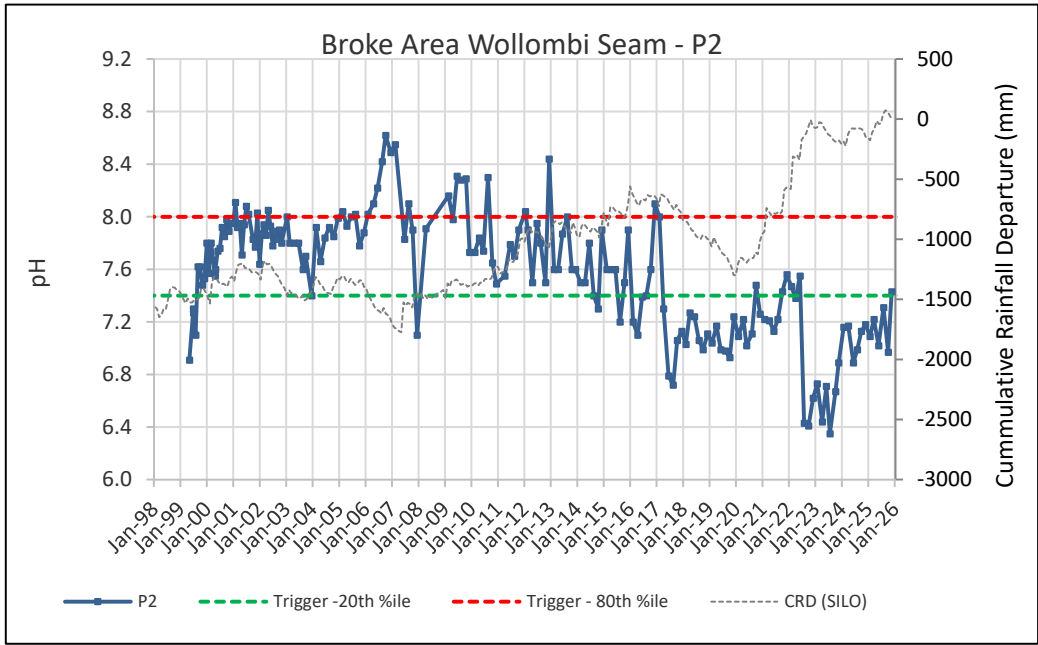
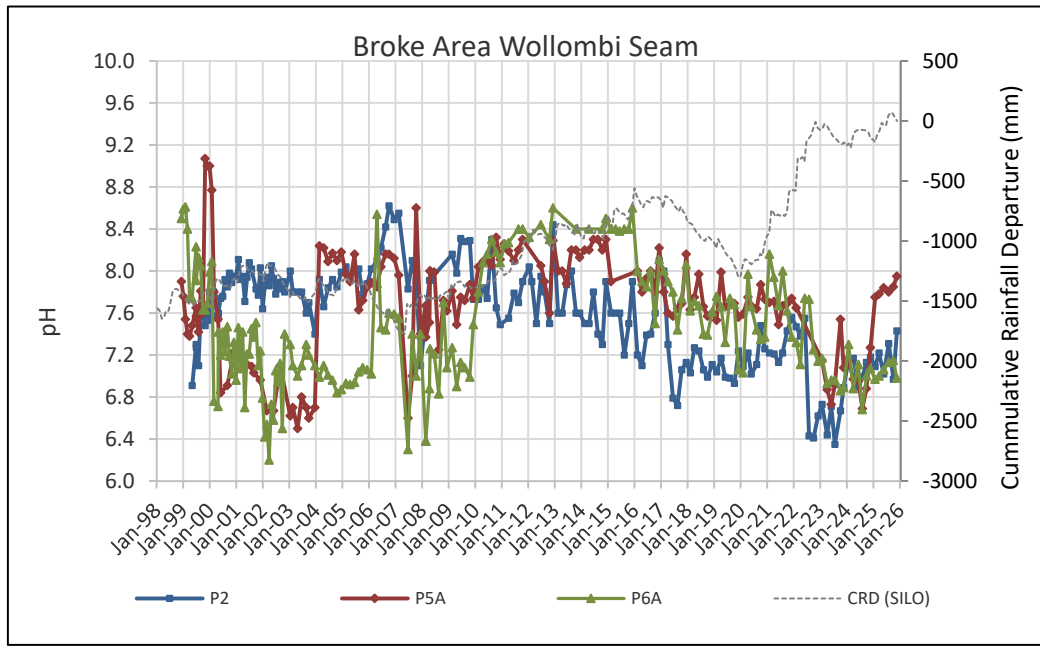
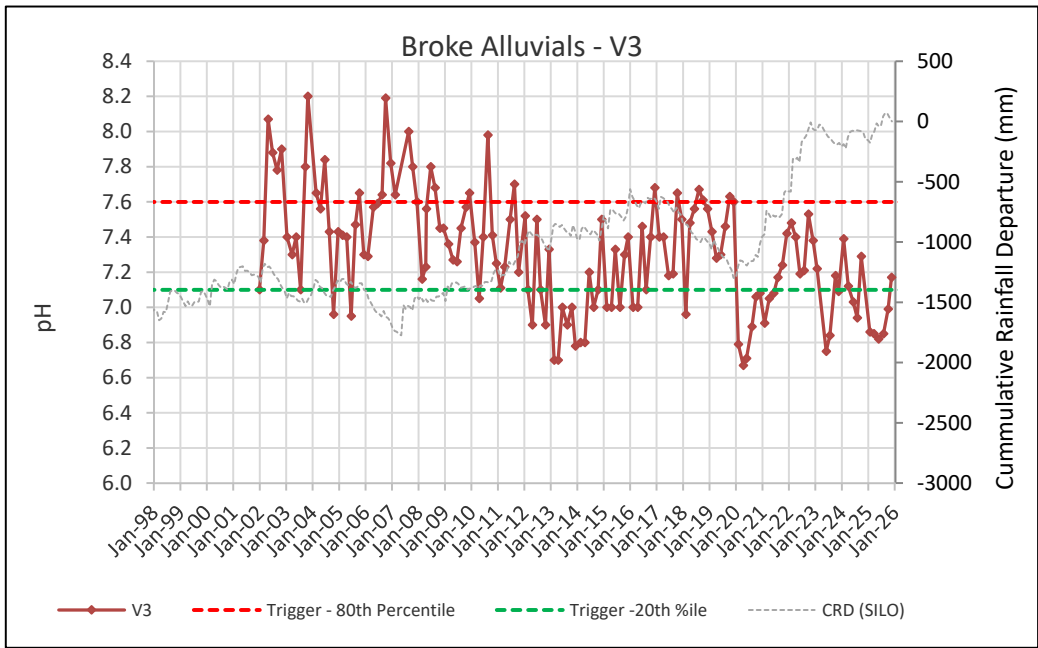
Appendix E

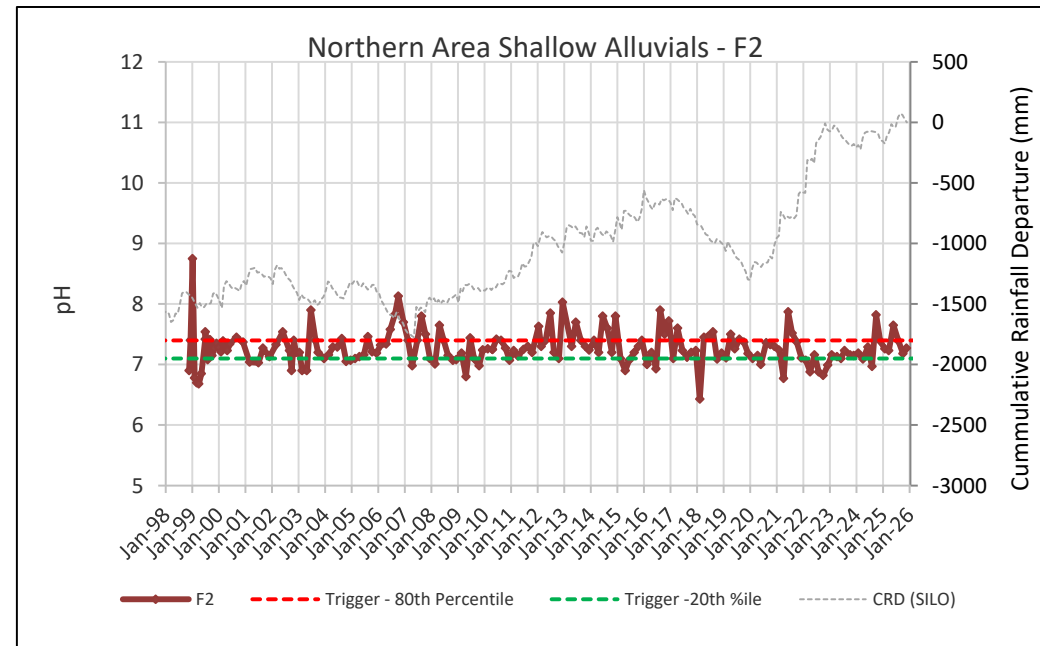
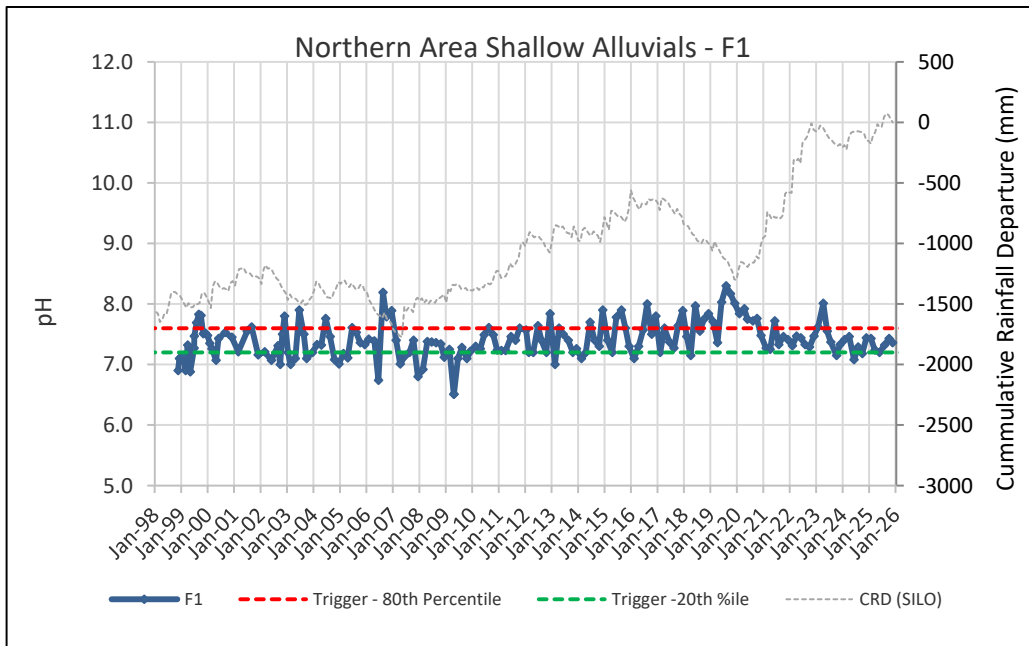
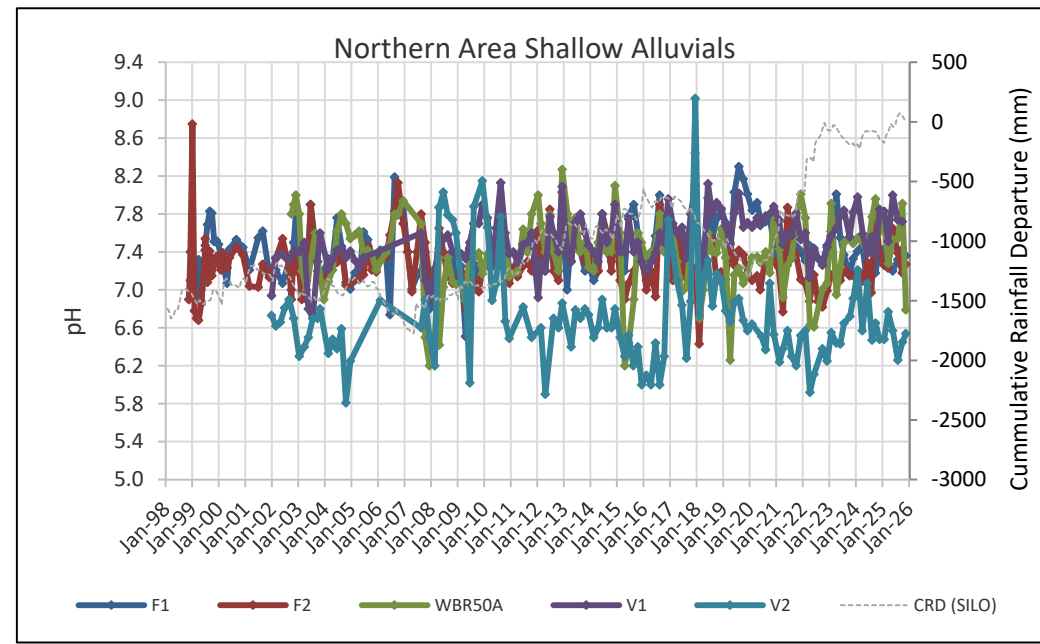
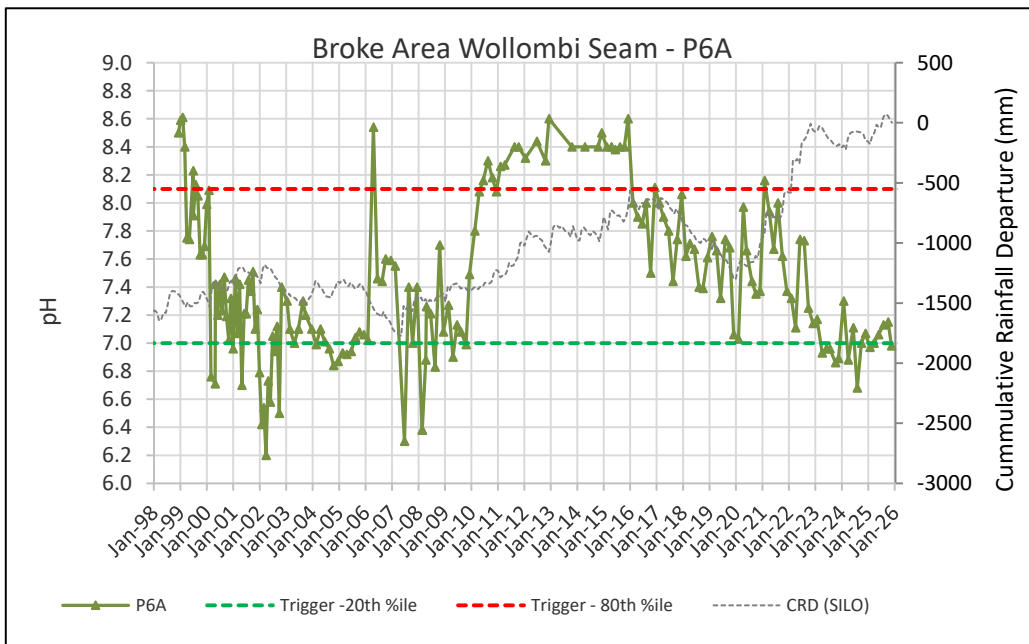
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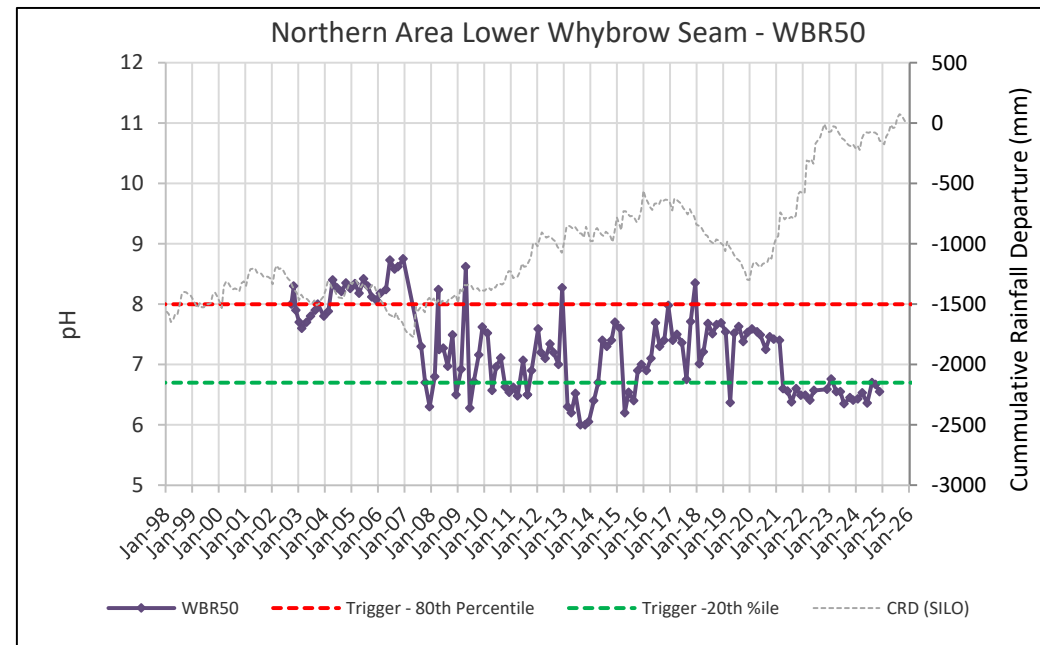
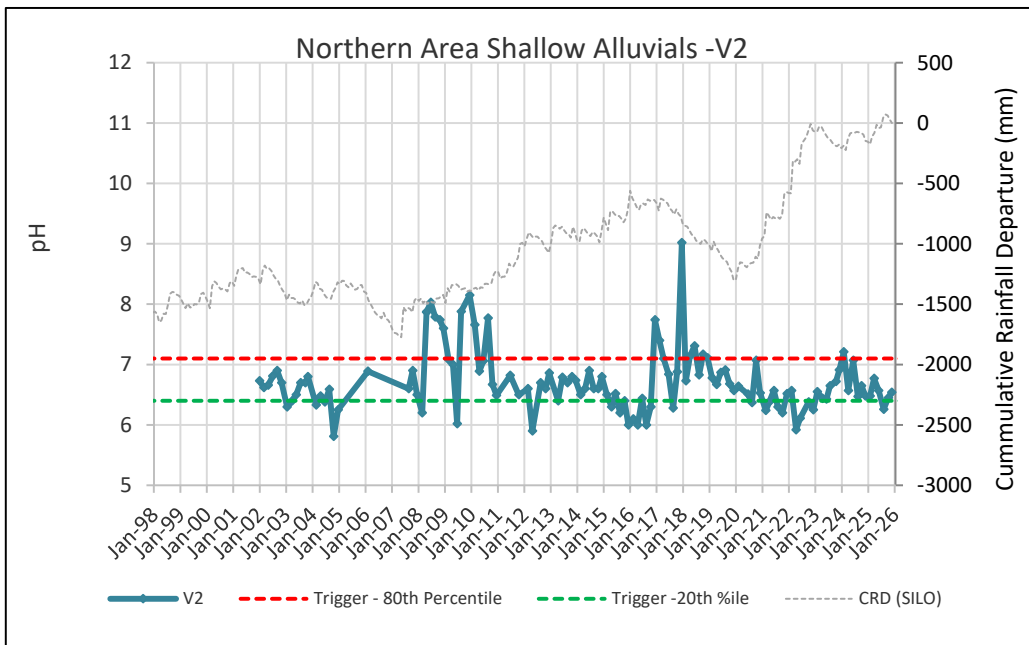
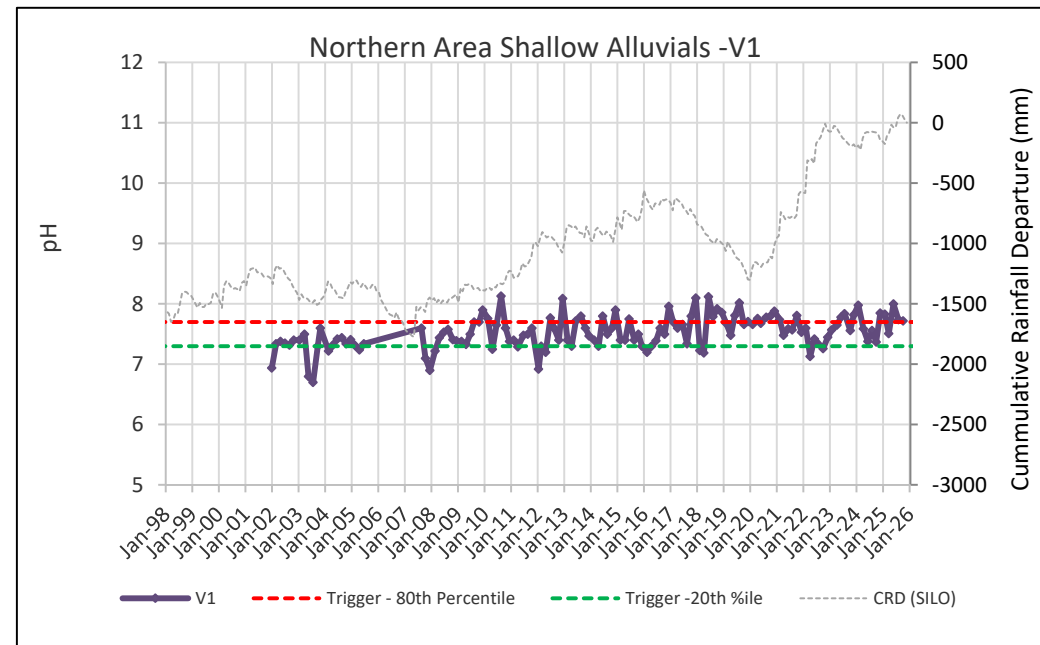
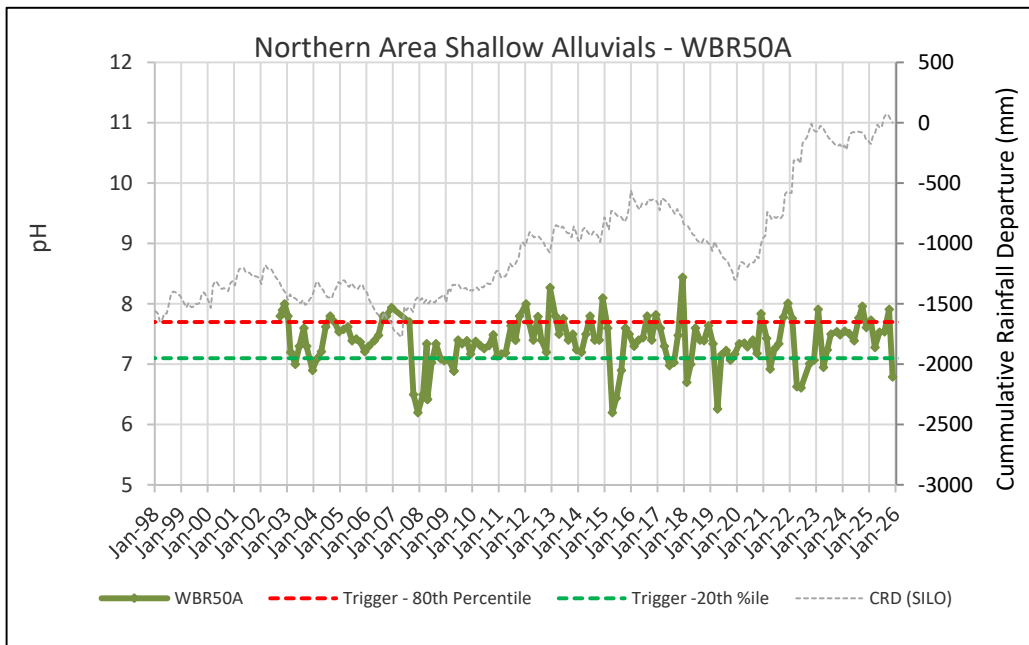


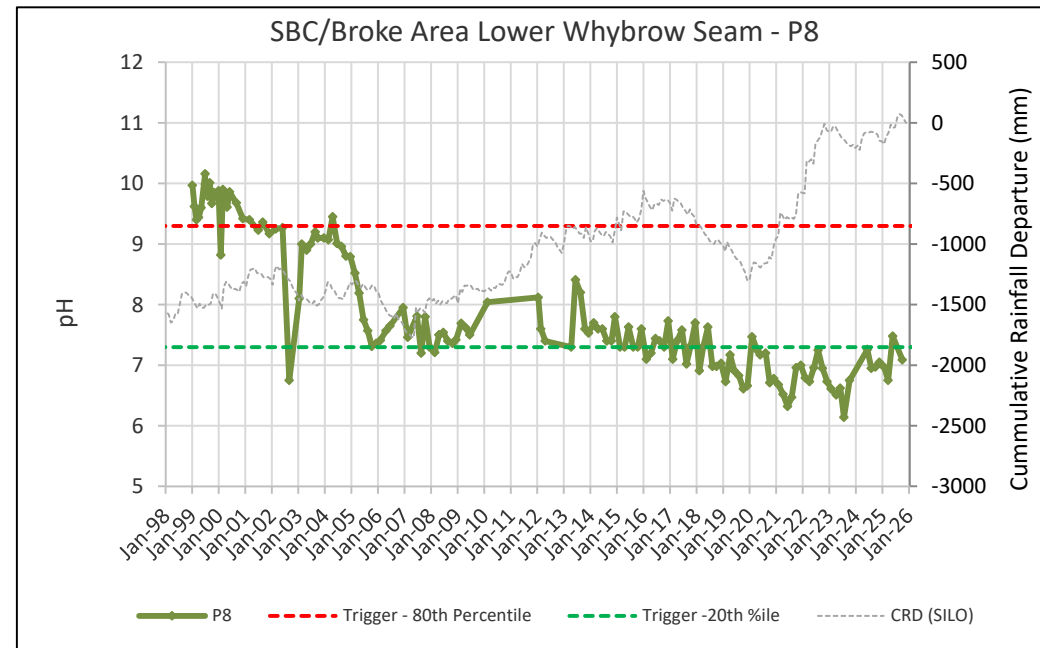
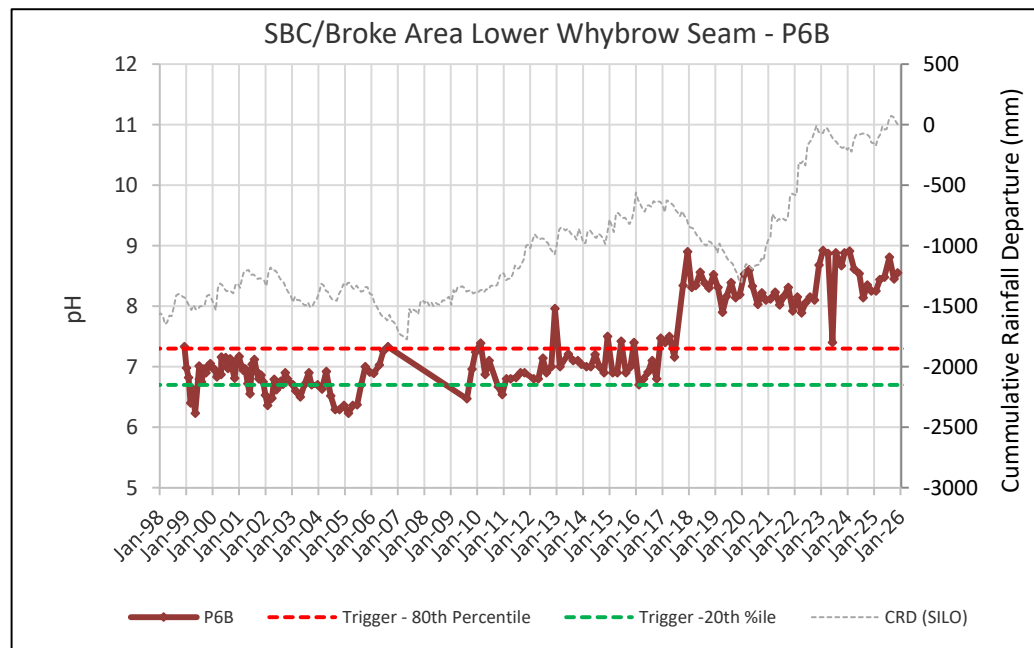
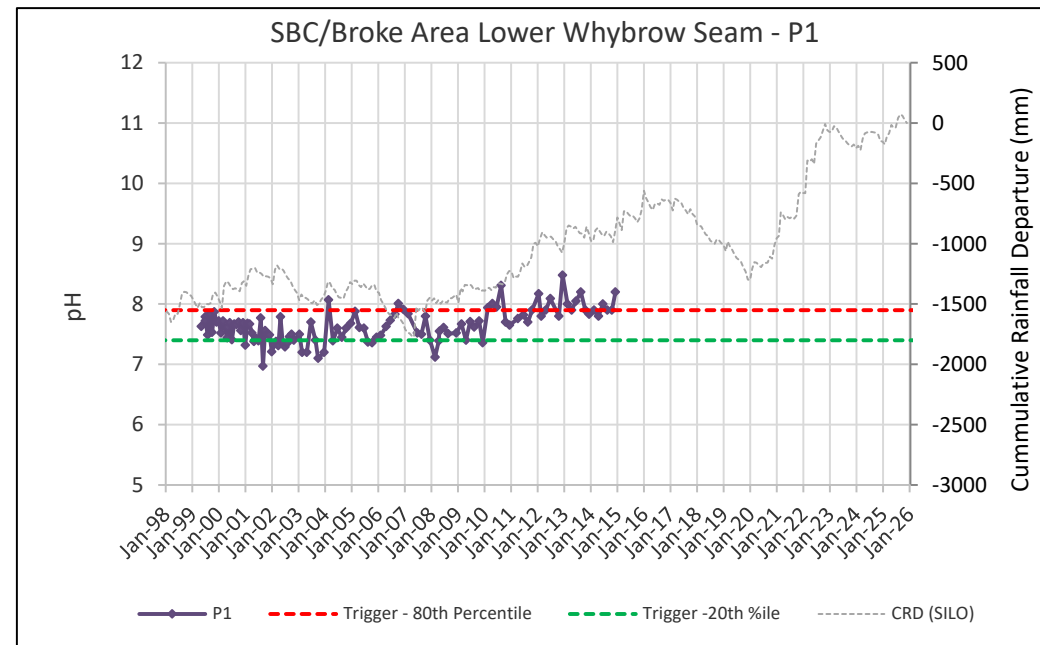
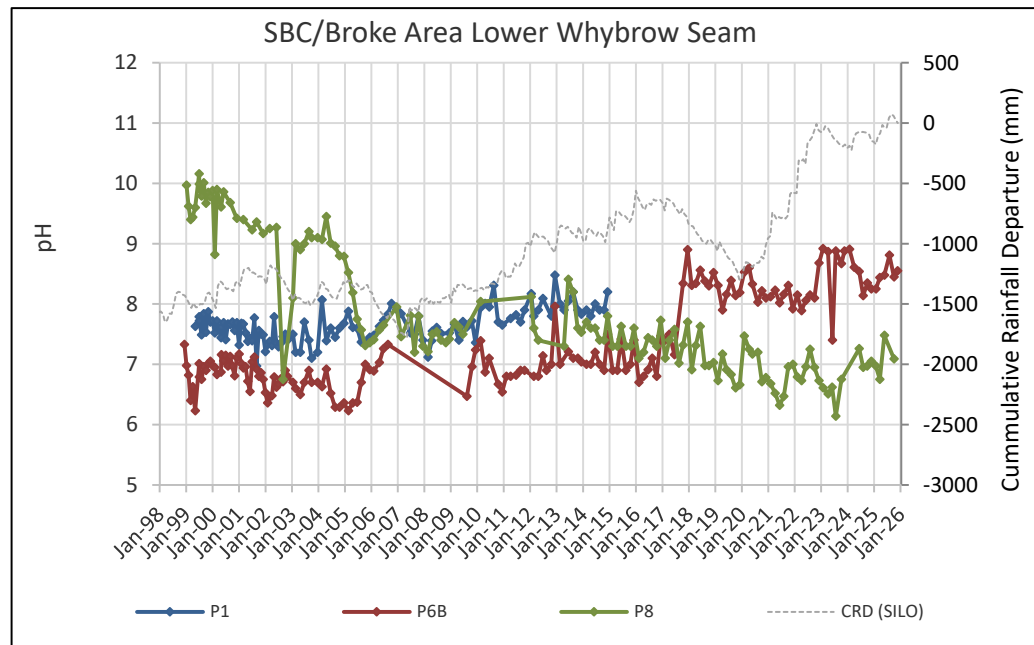


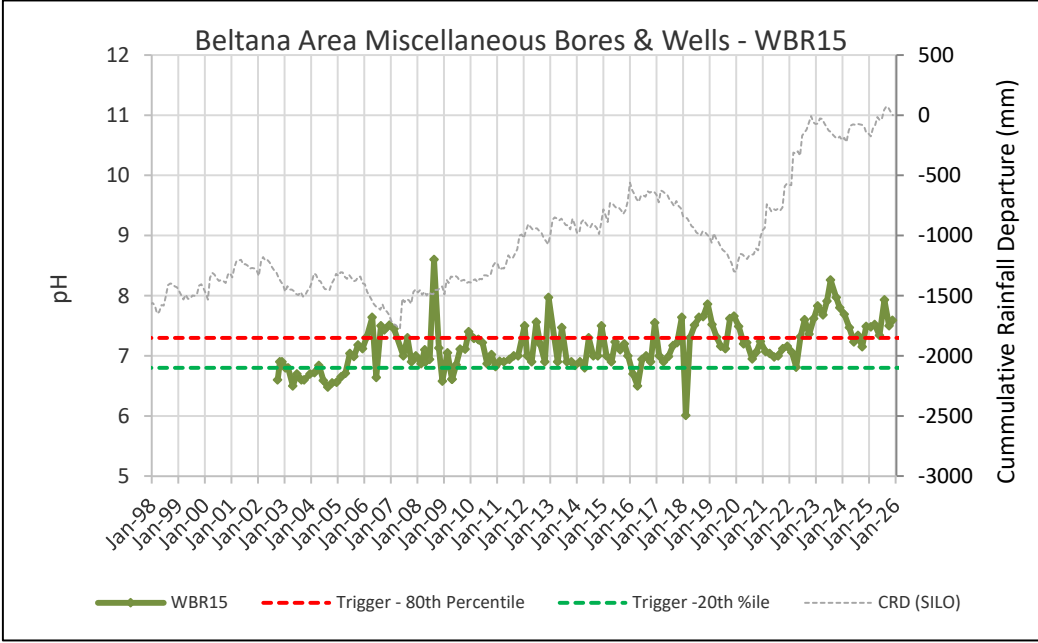
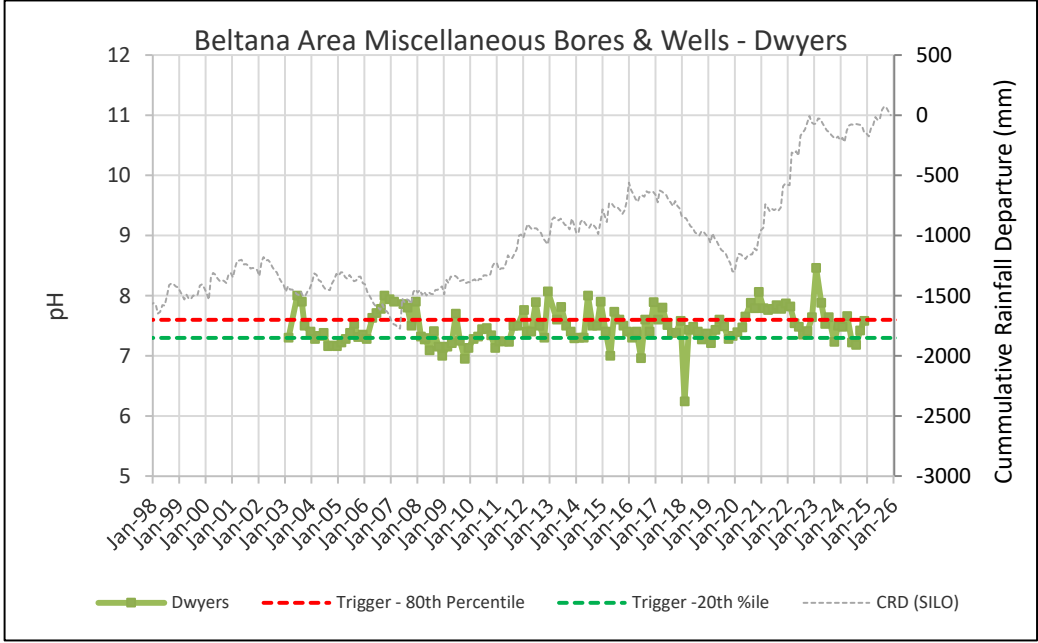
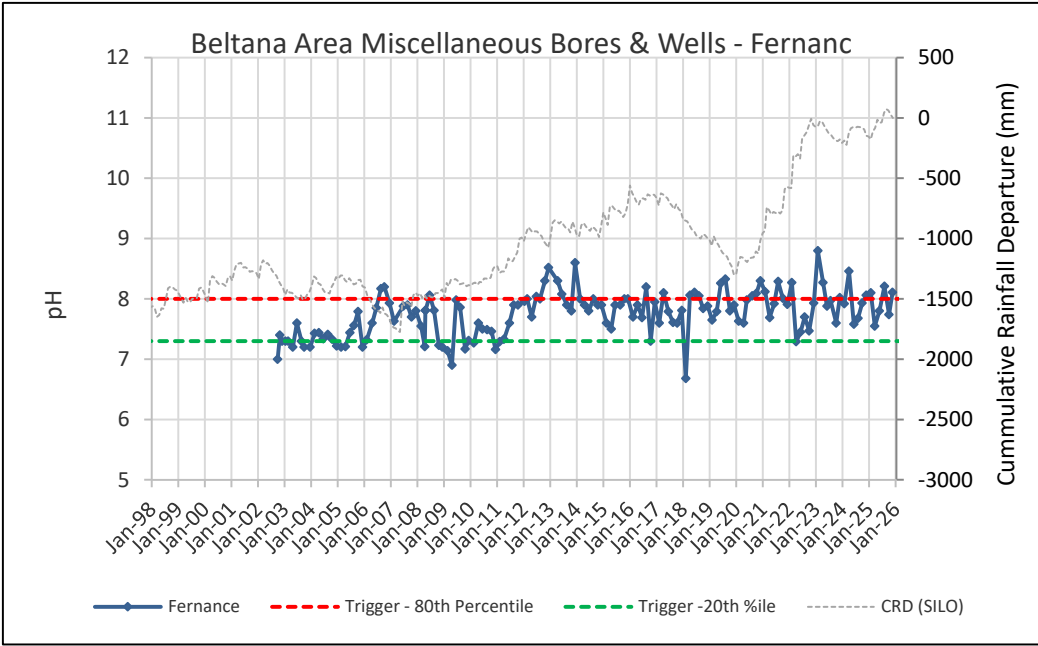
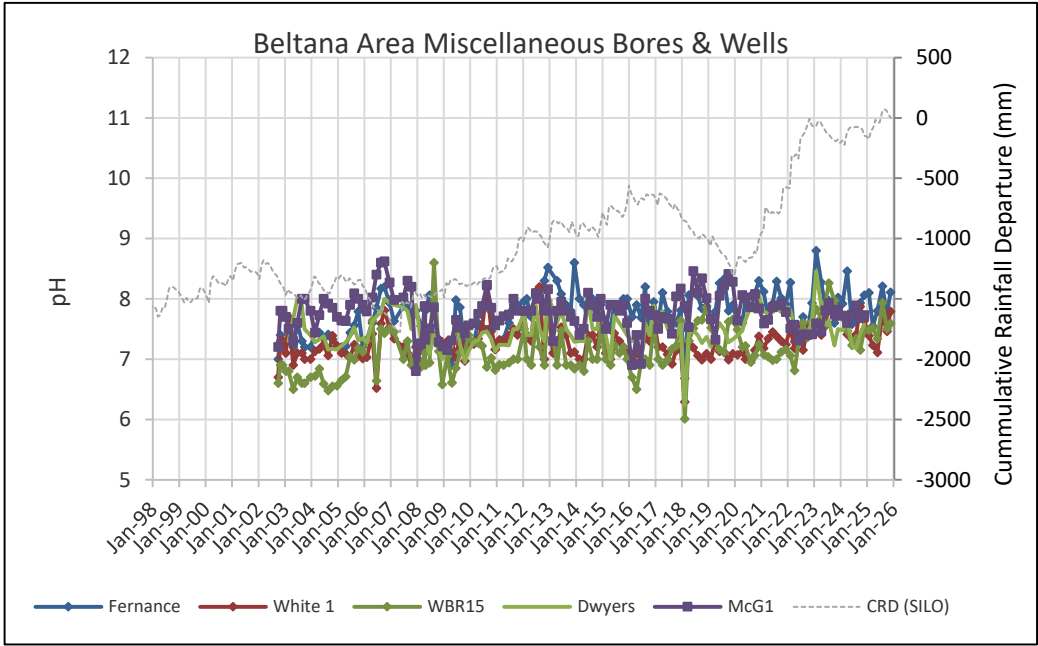


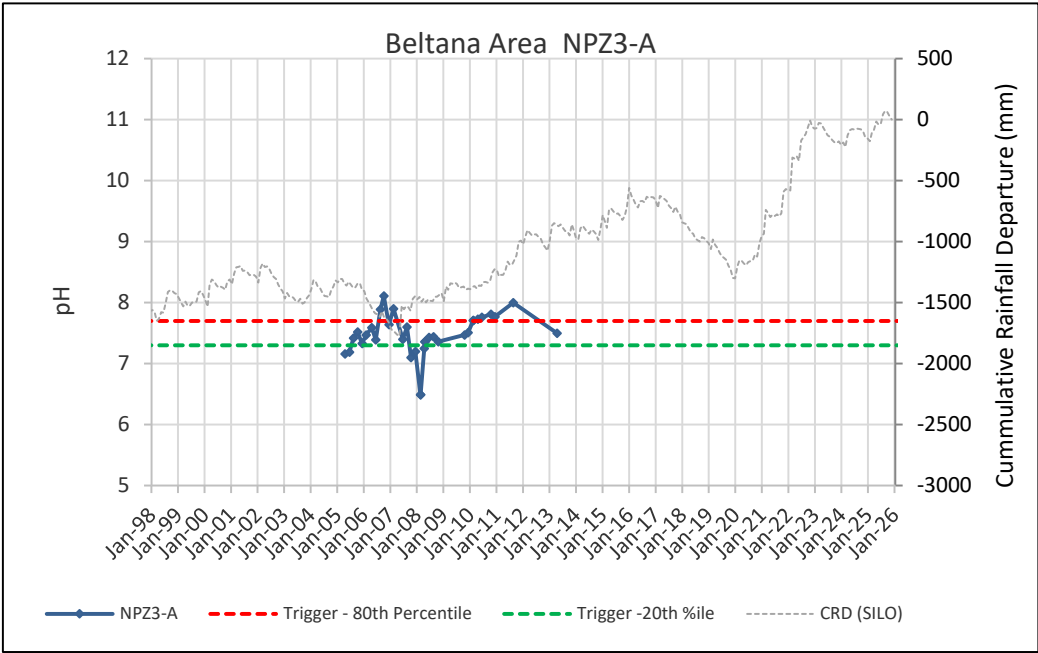
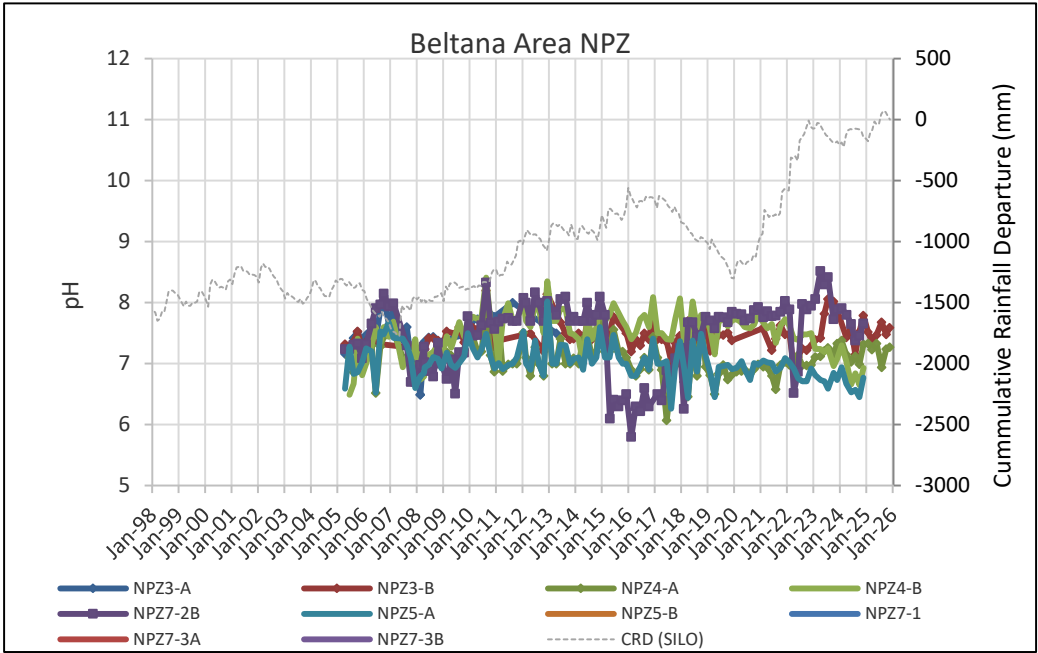
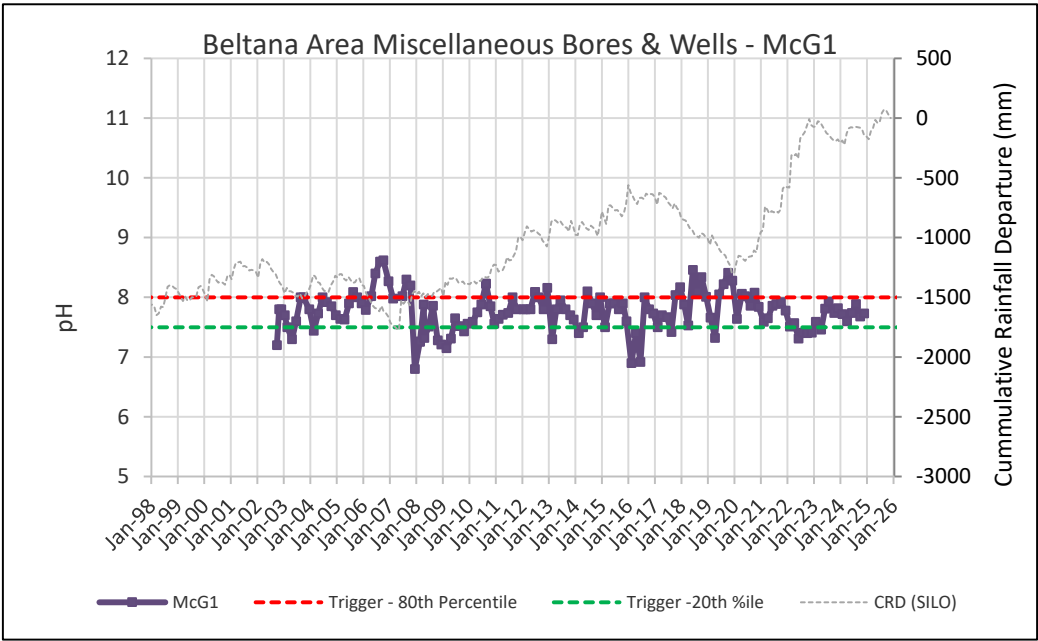
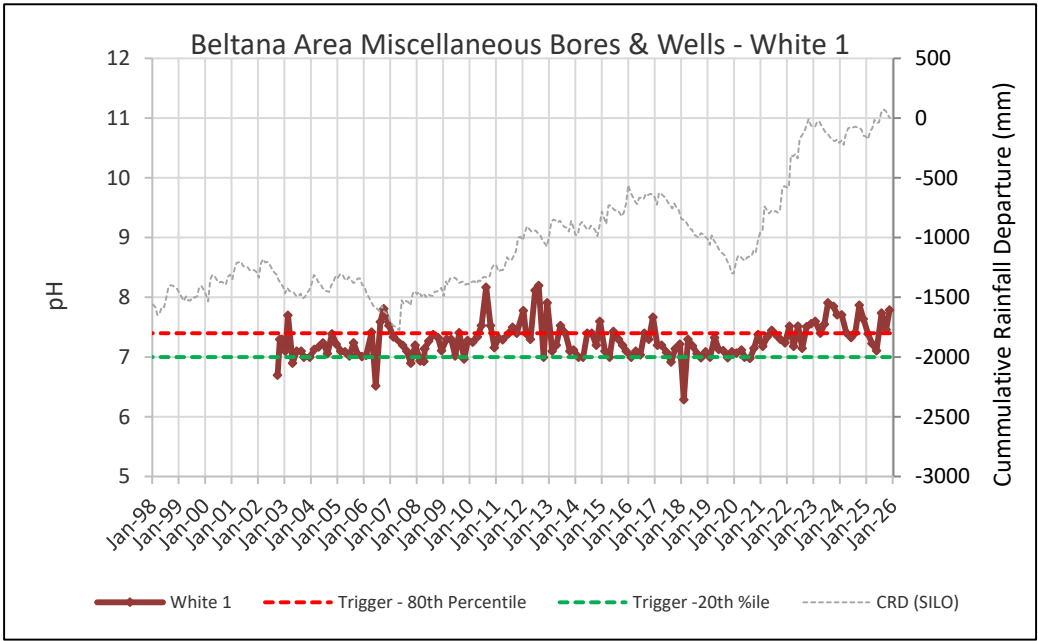


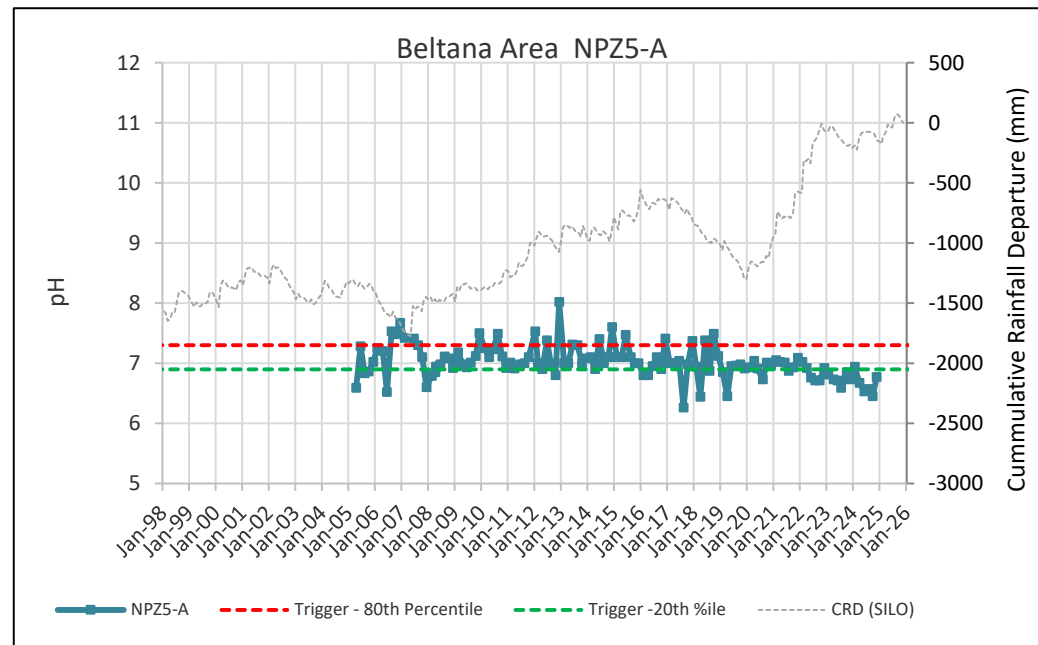
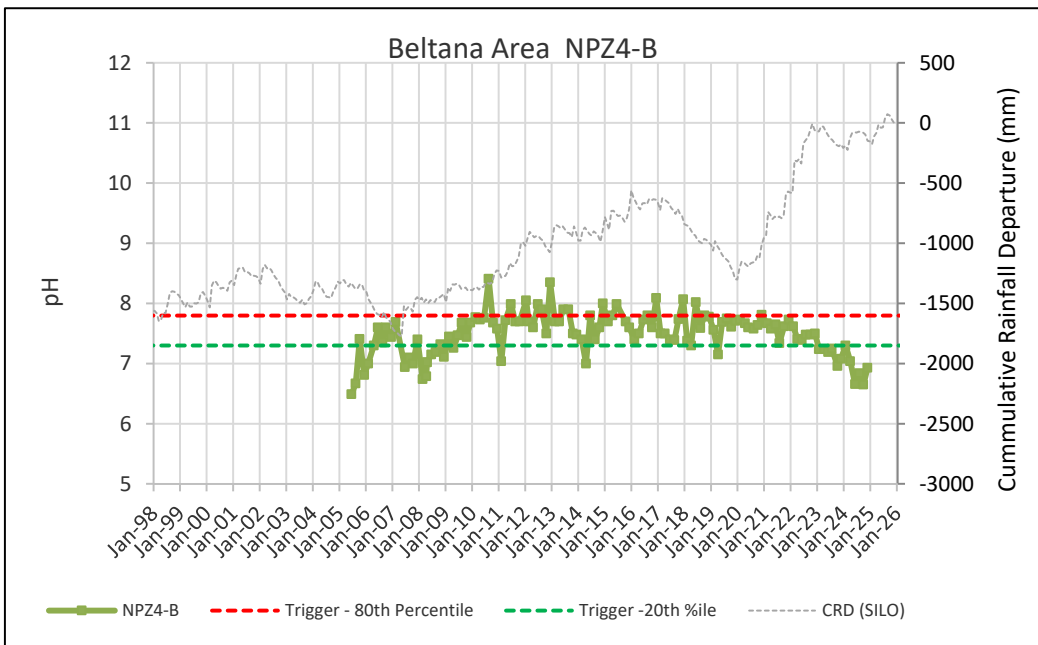
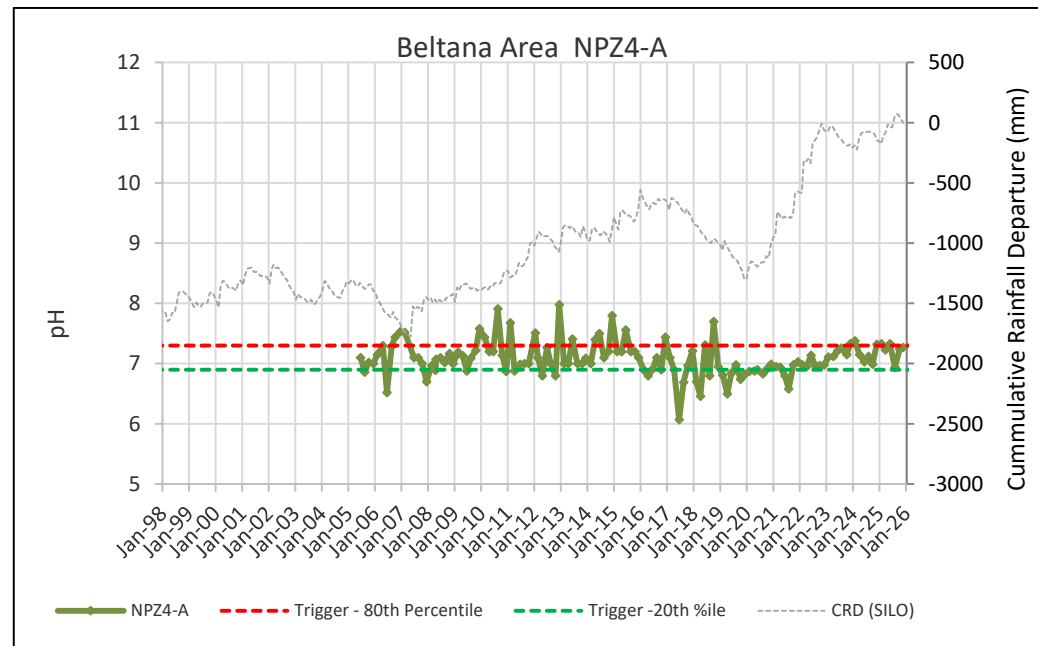
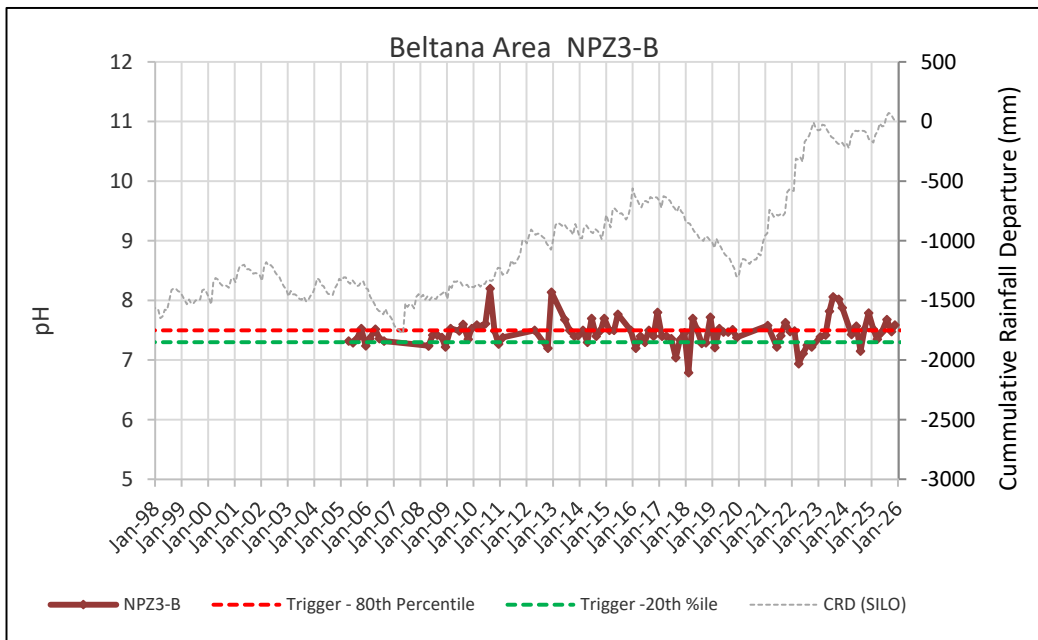


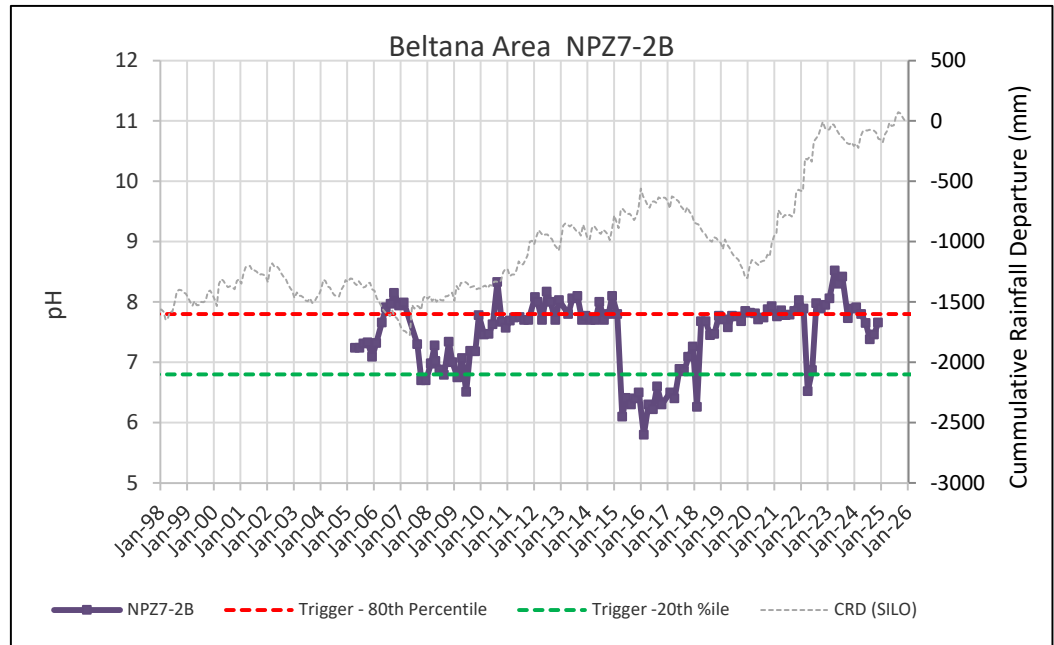
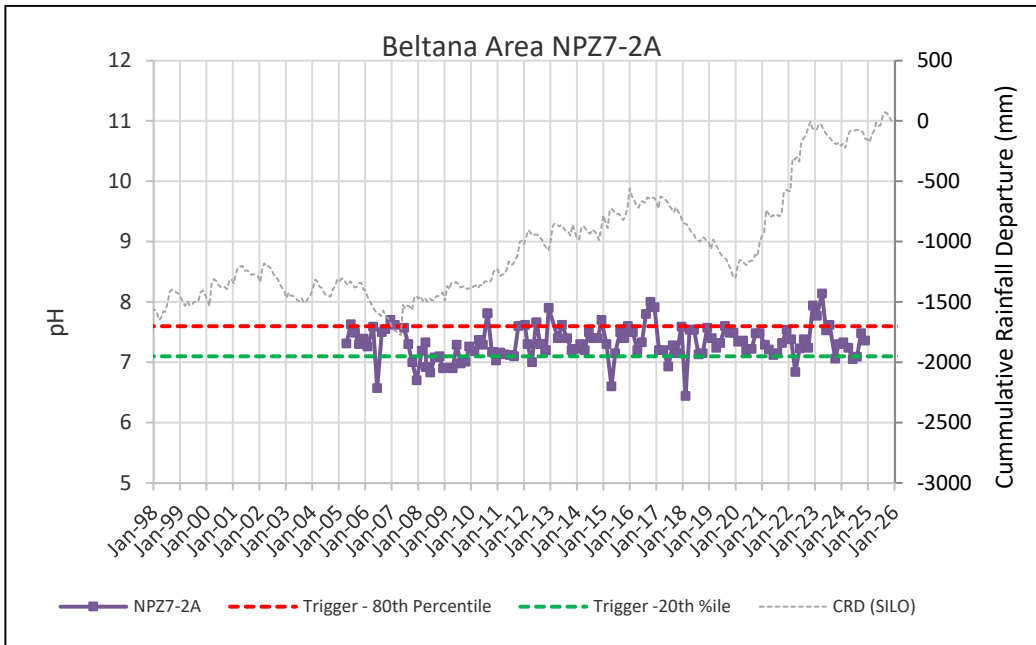
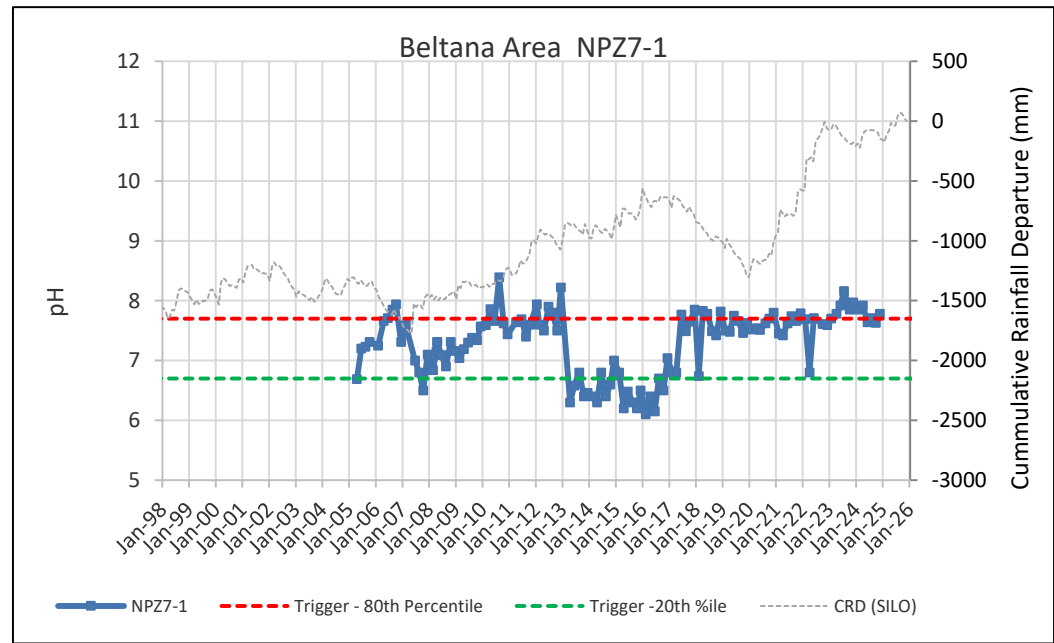
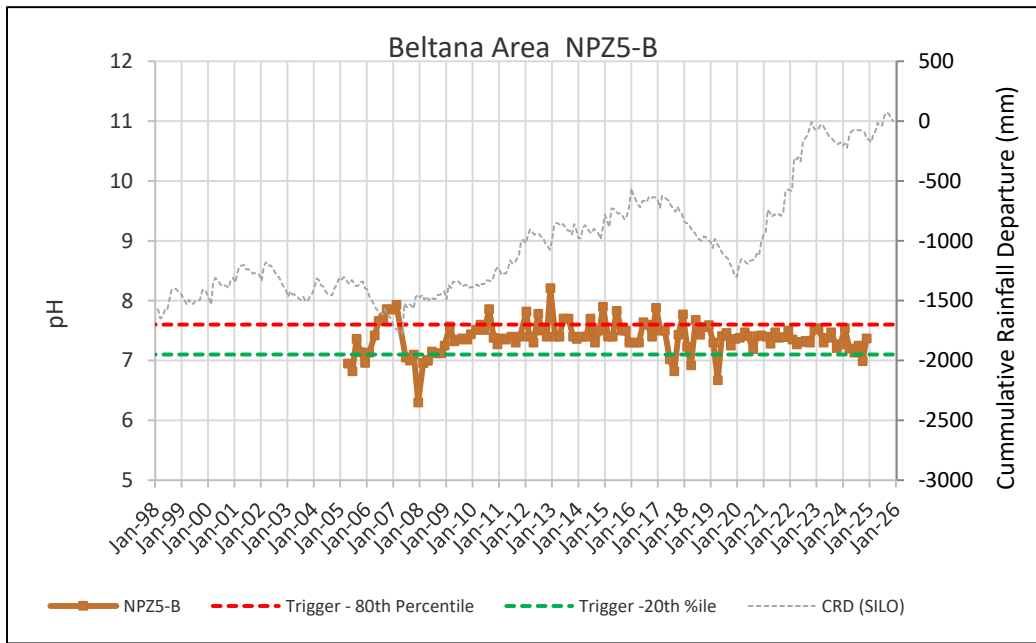


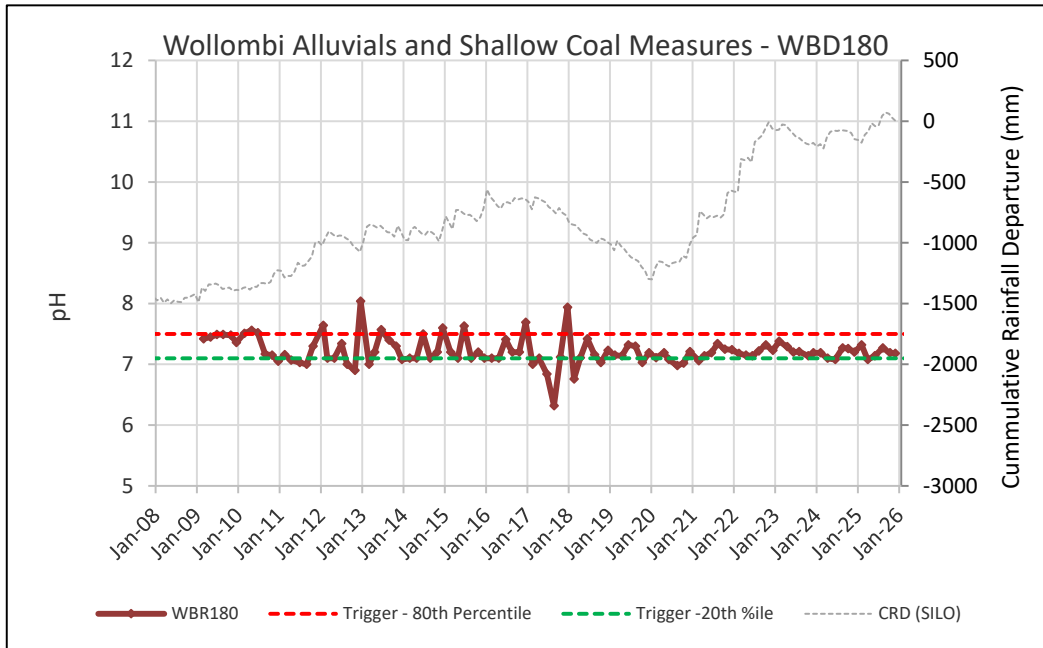
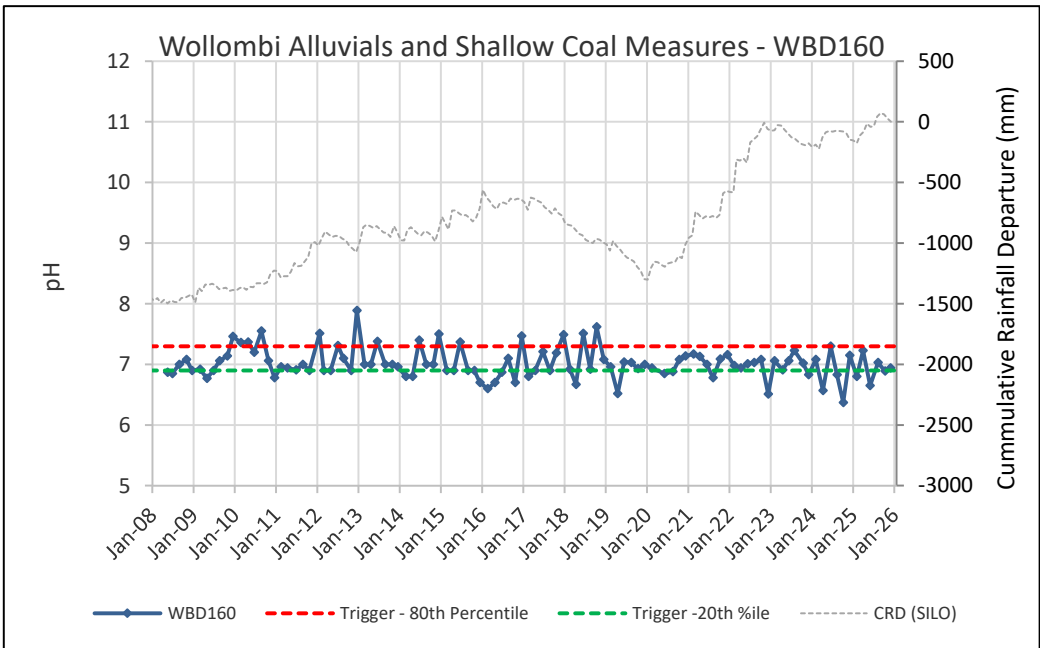
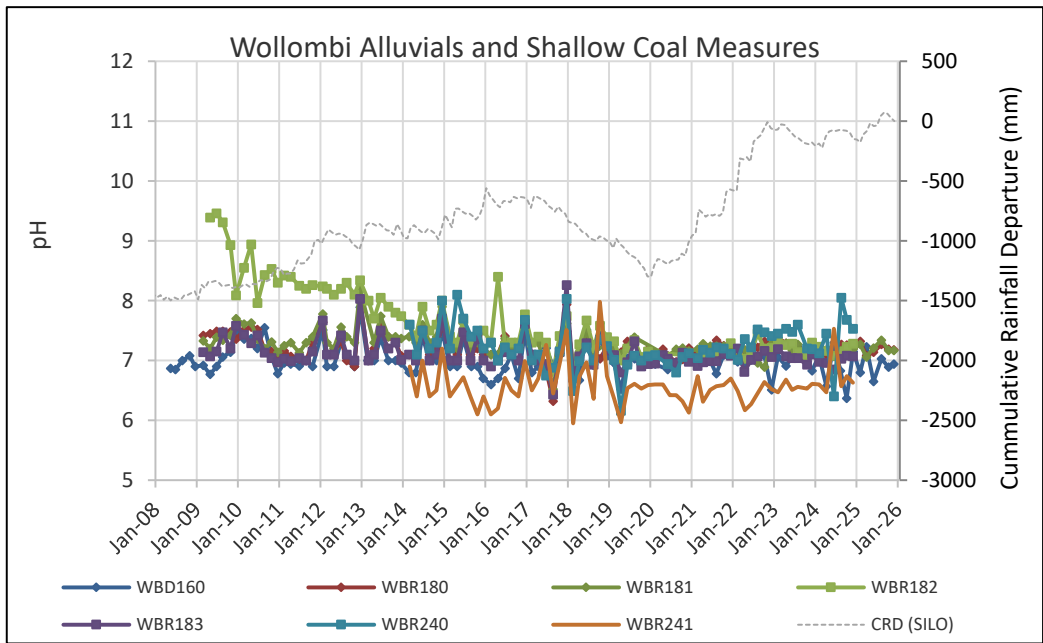
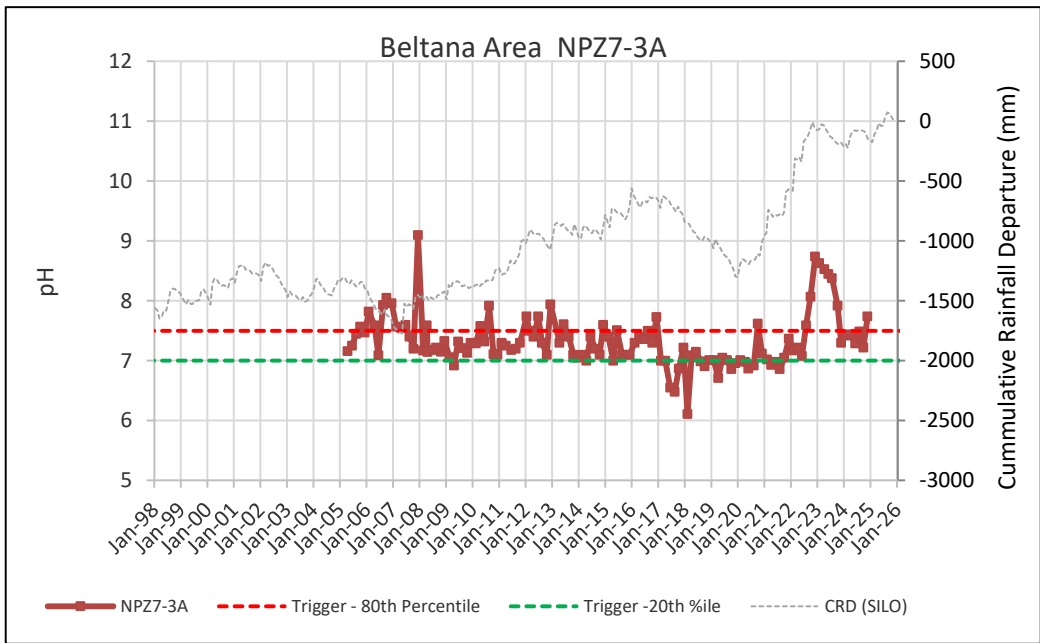


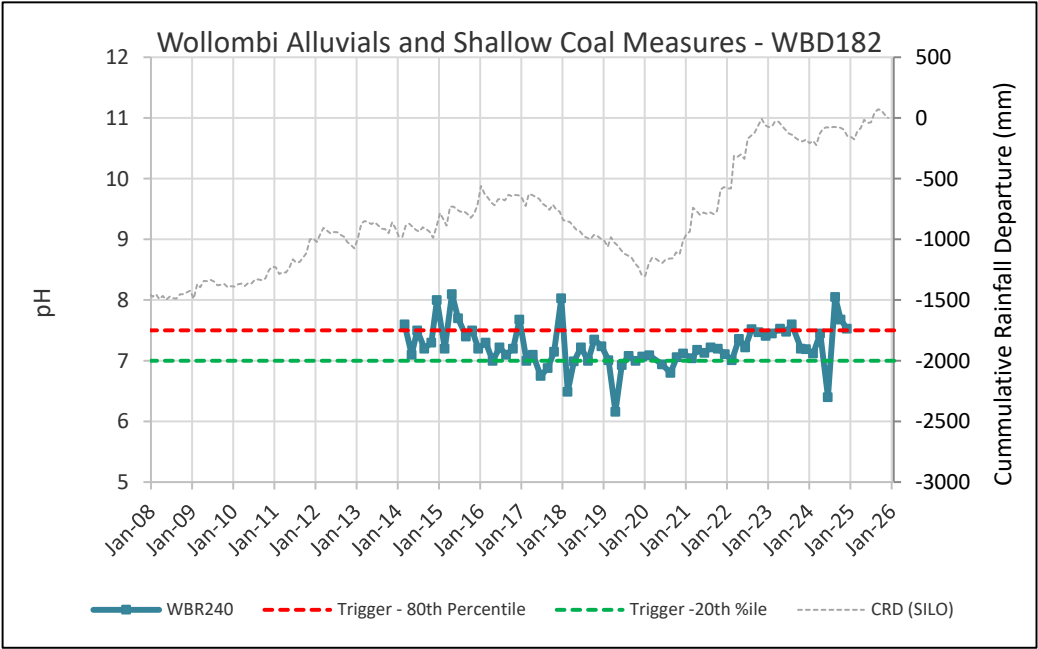
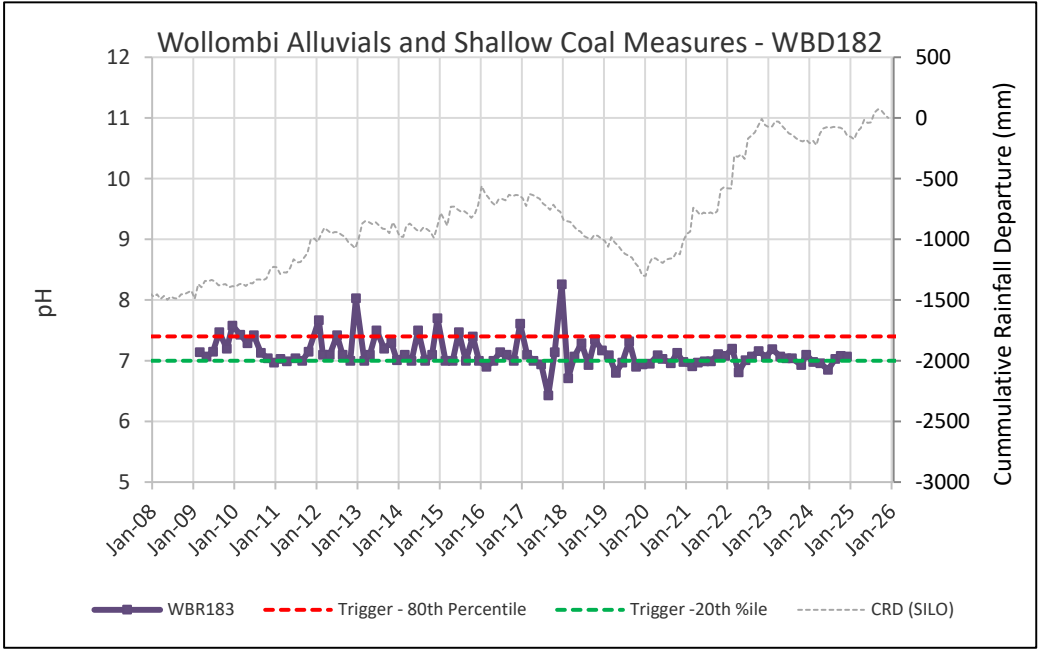
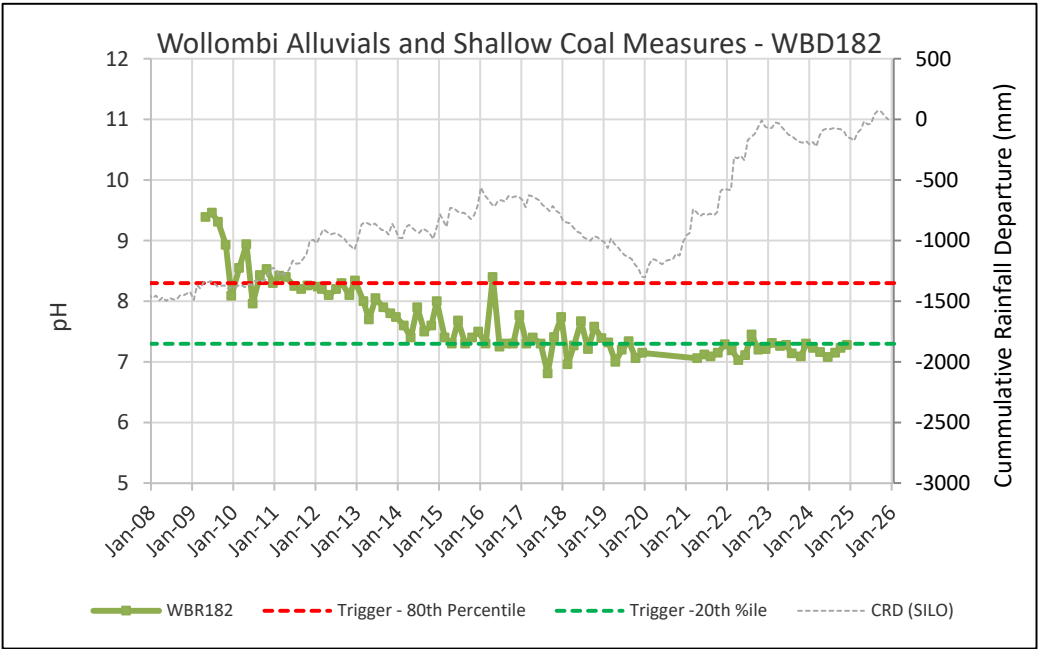
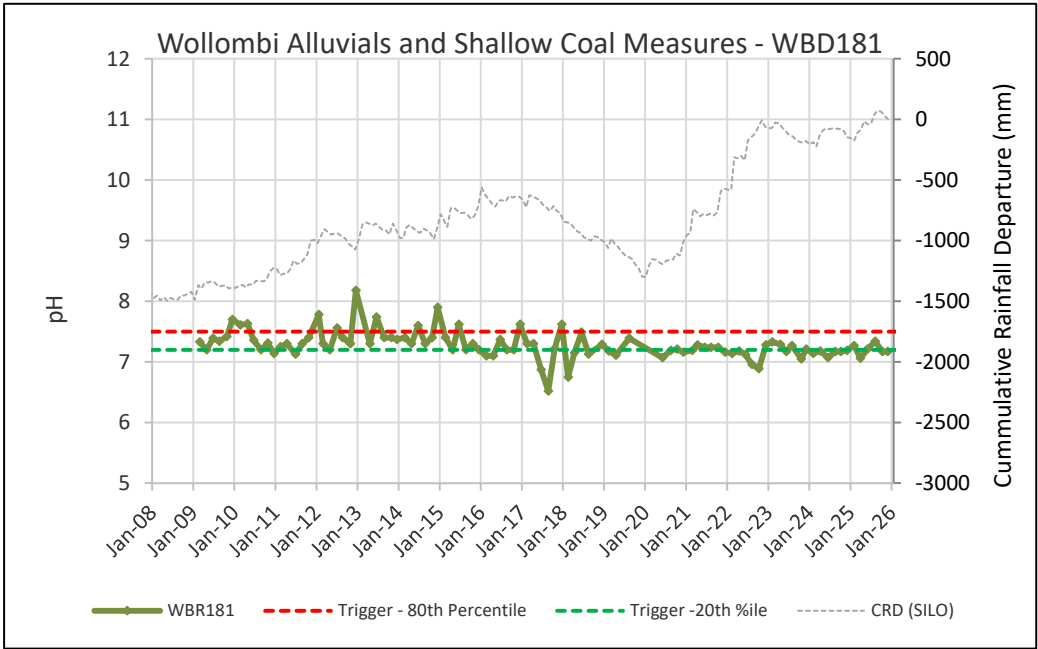


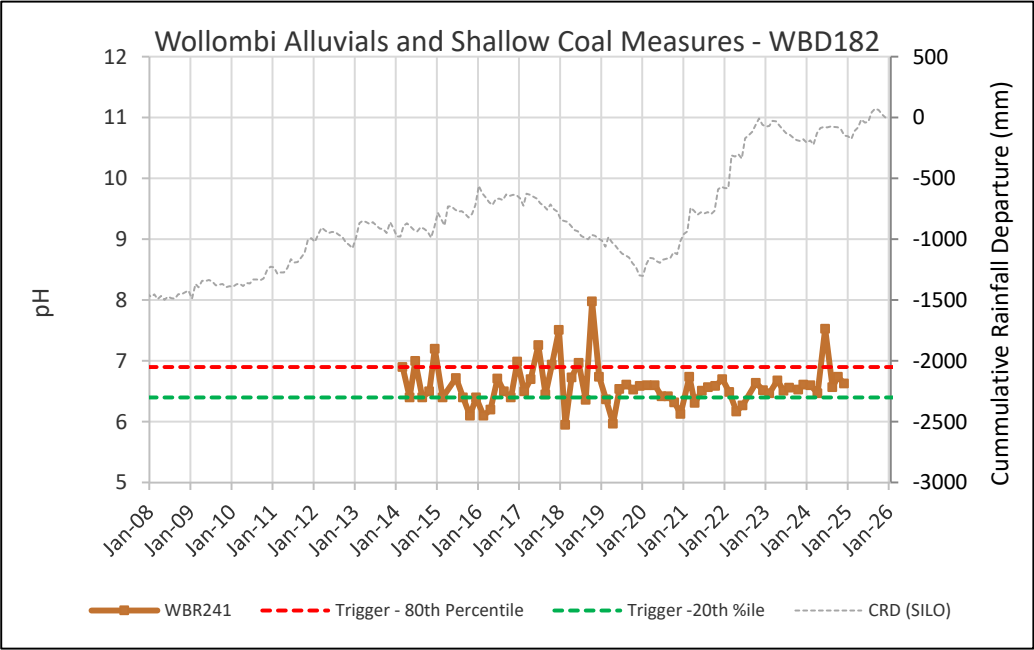


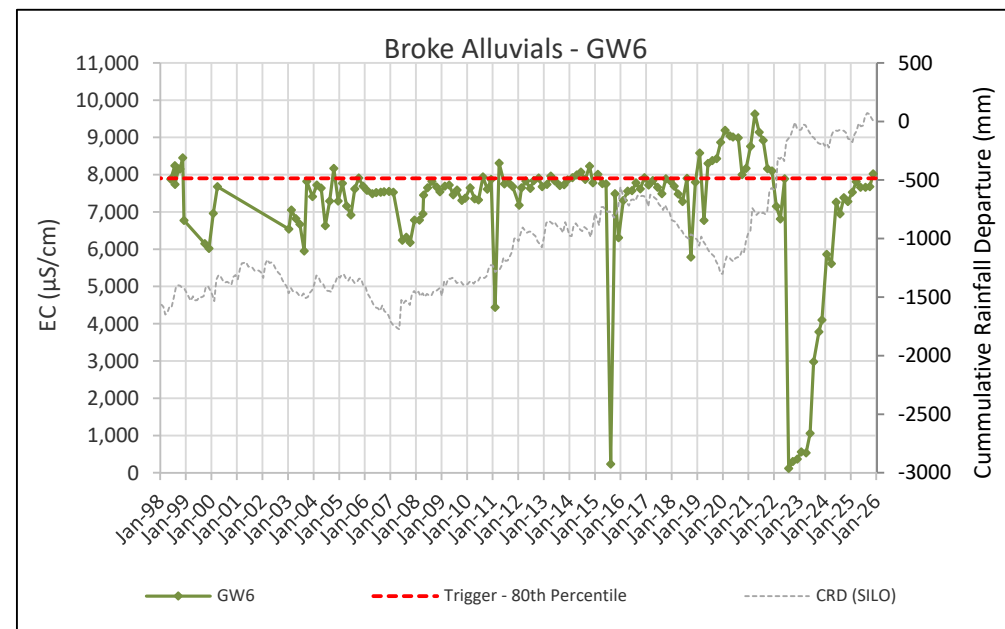
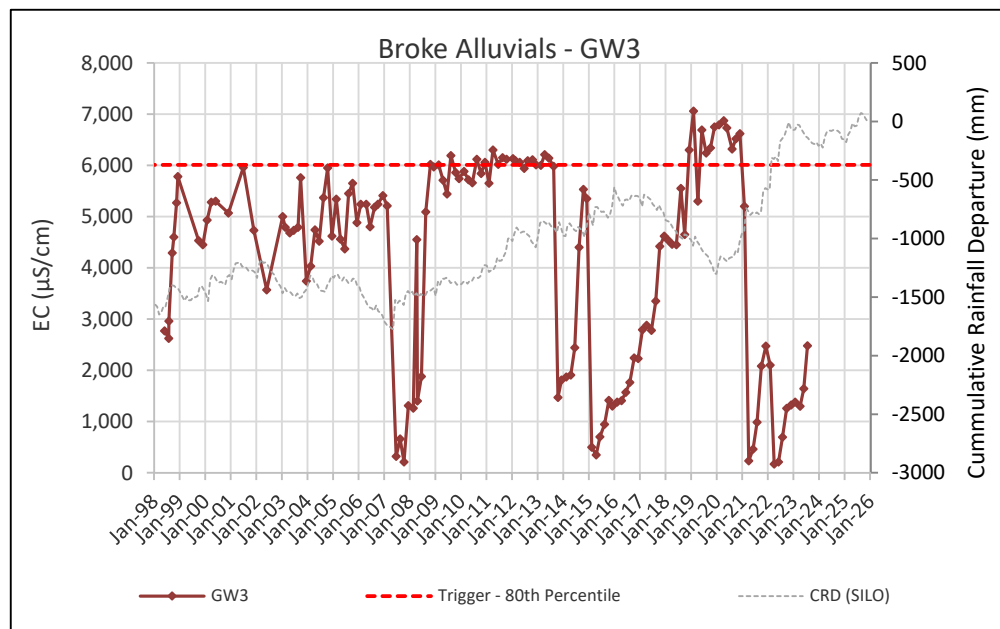
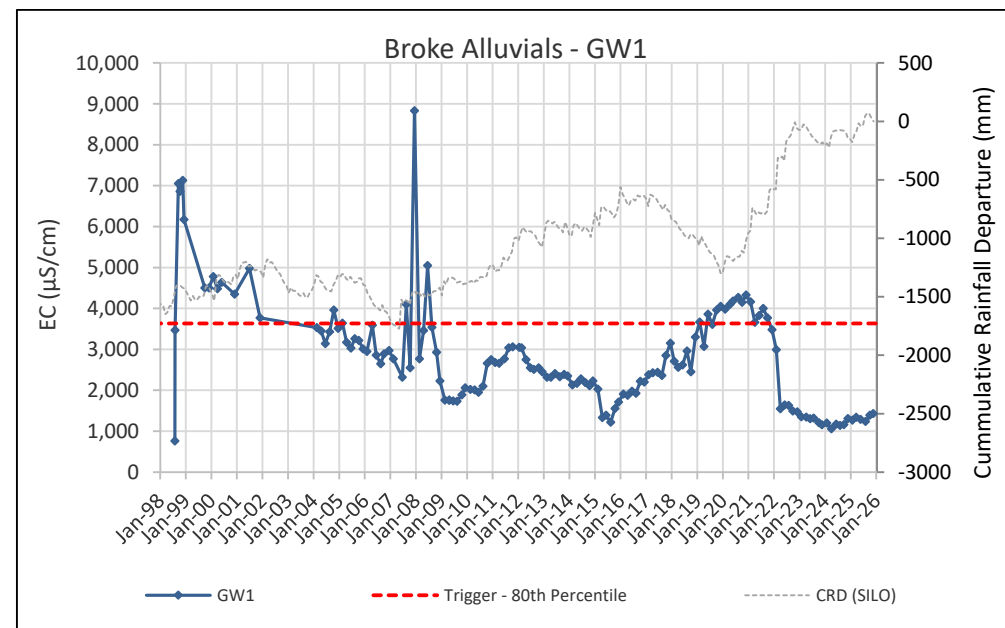
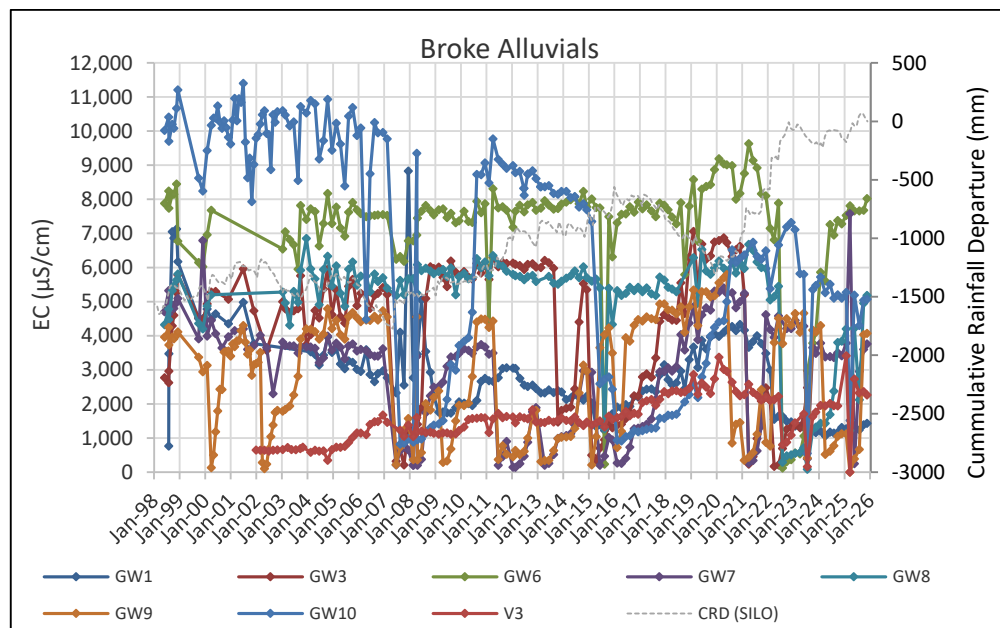


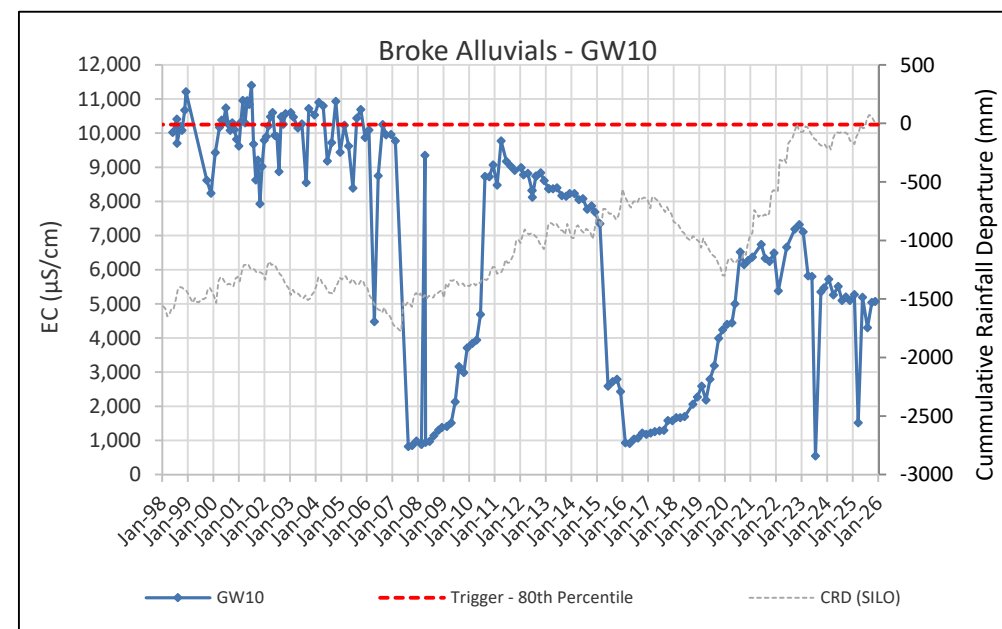
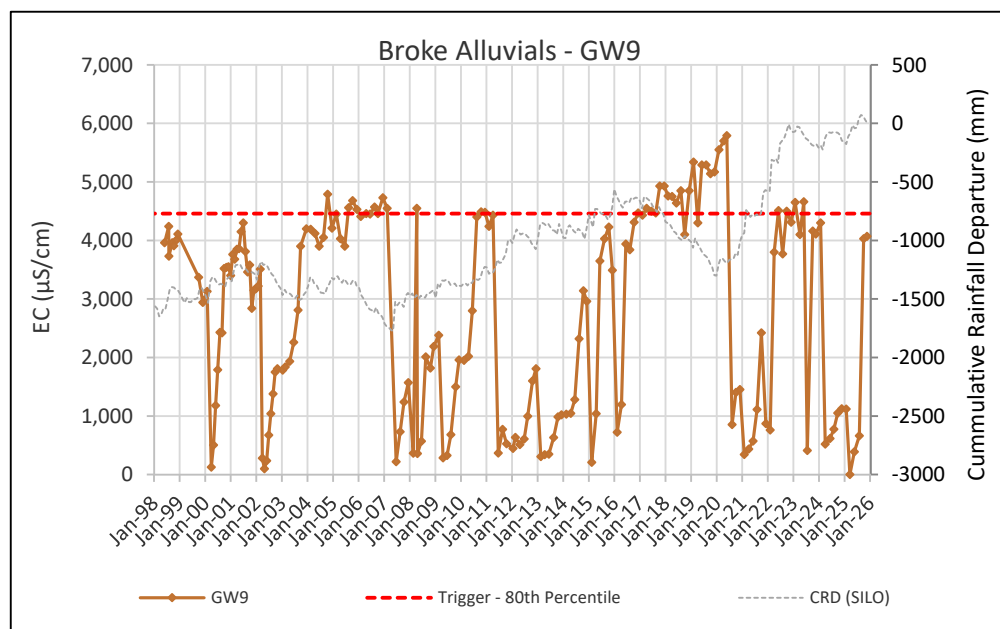
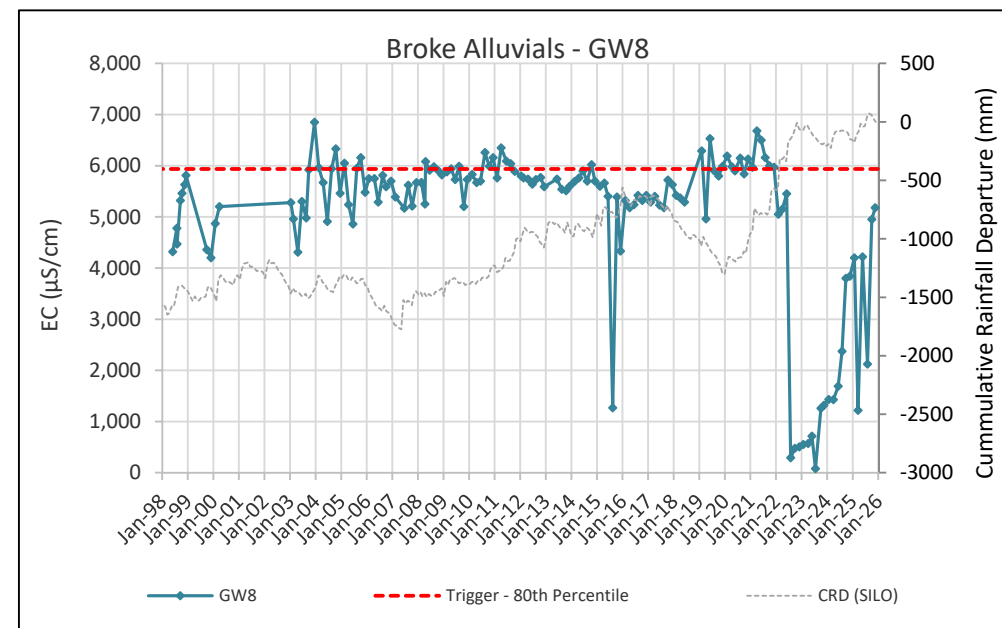
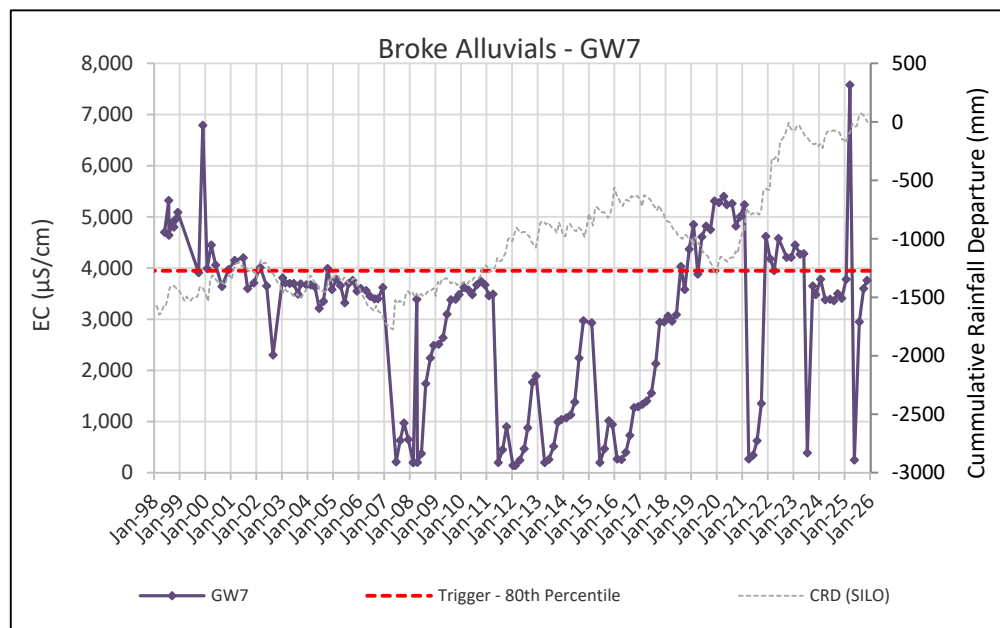


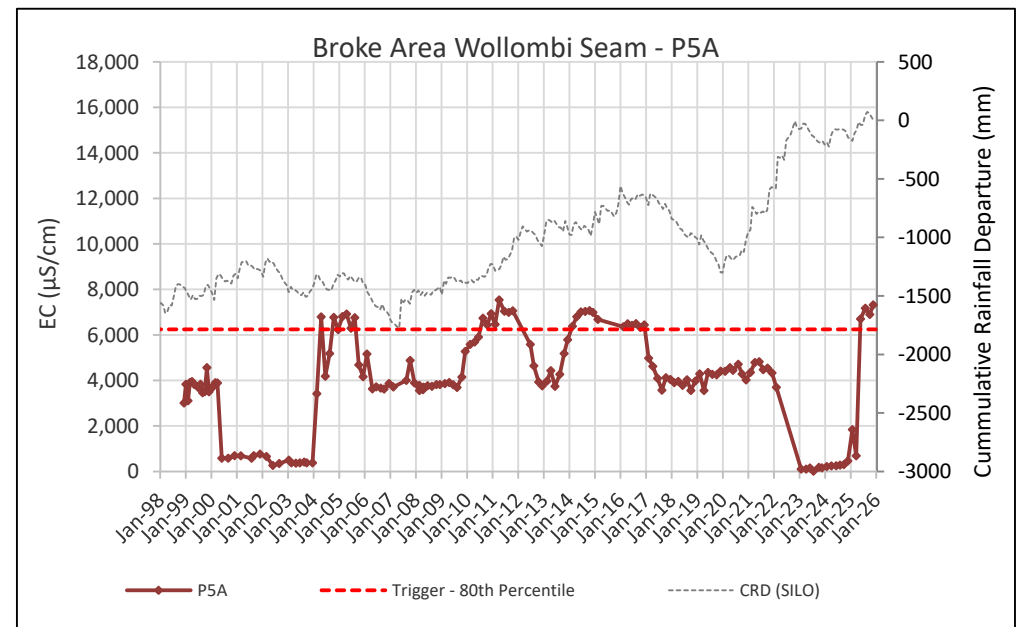
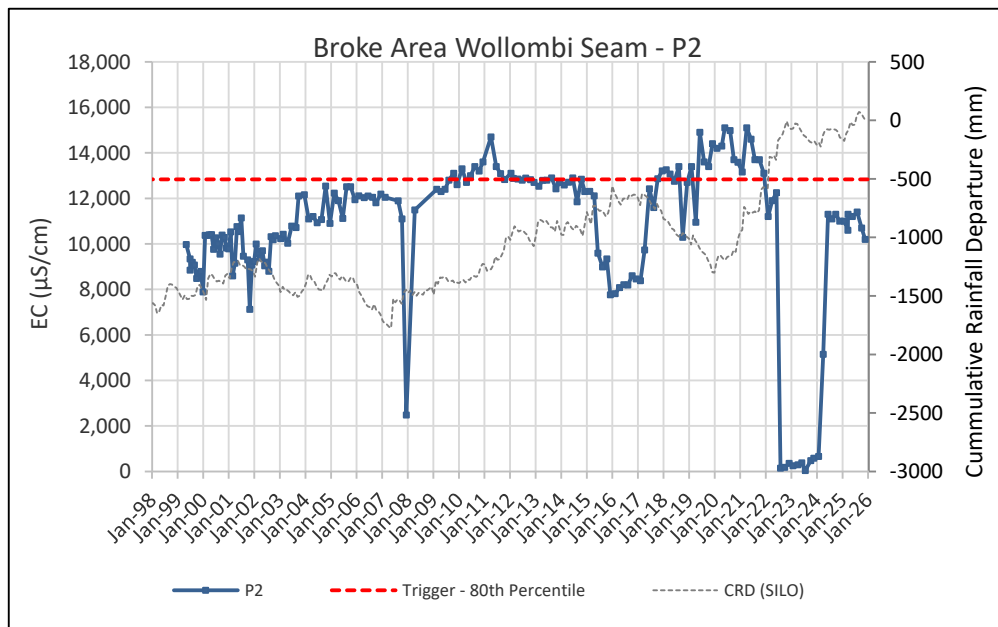
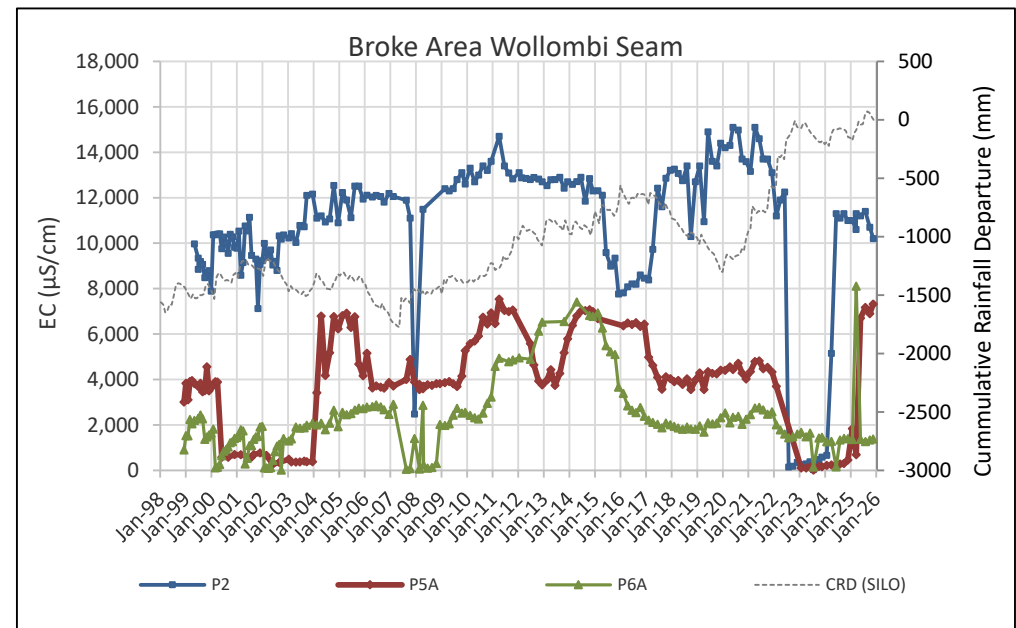
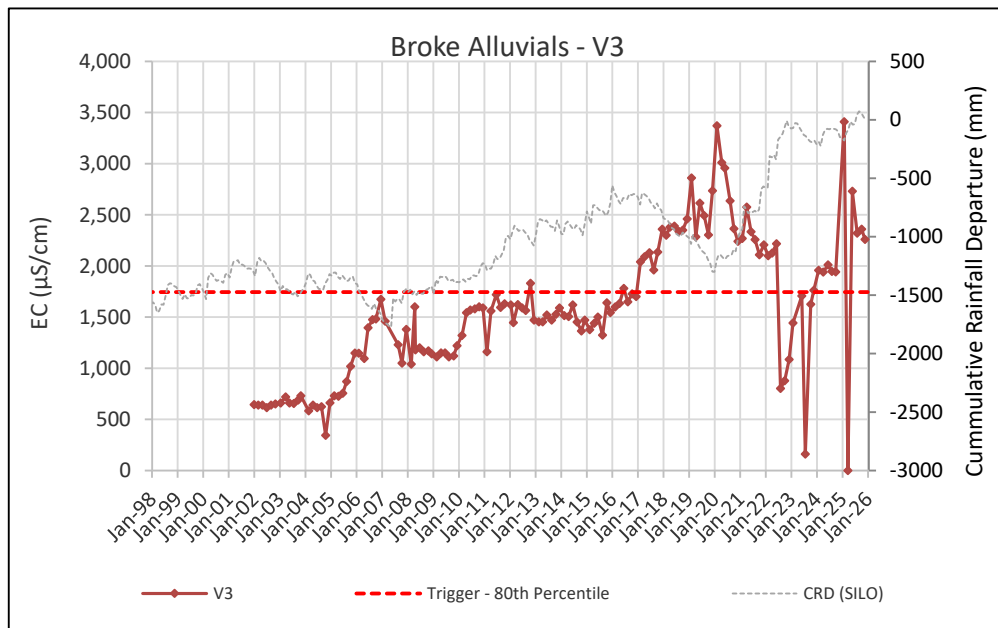


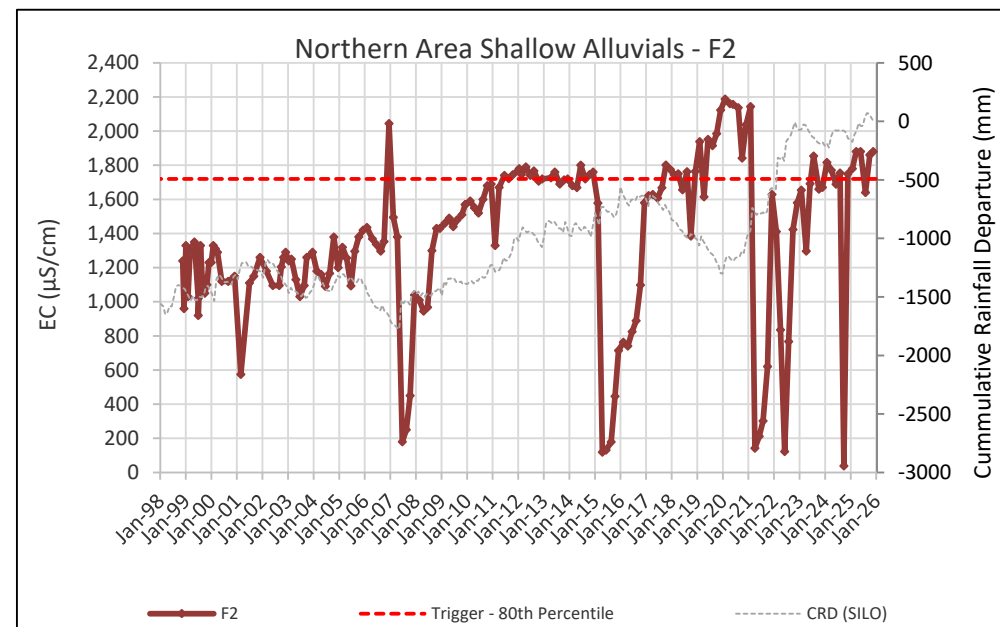
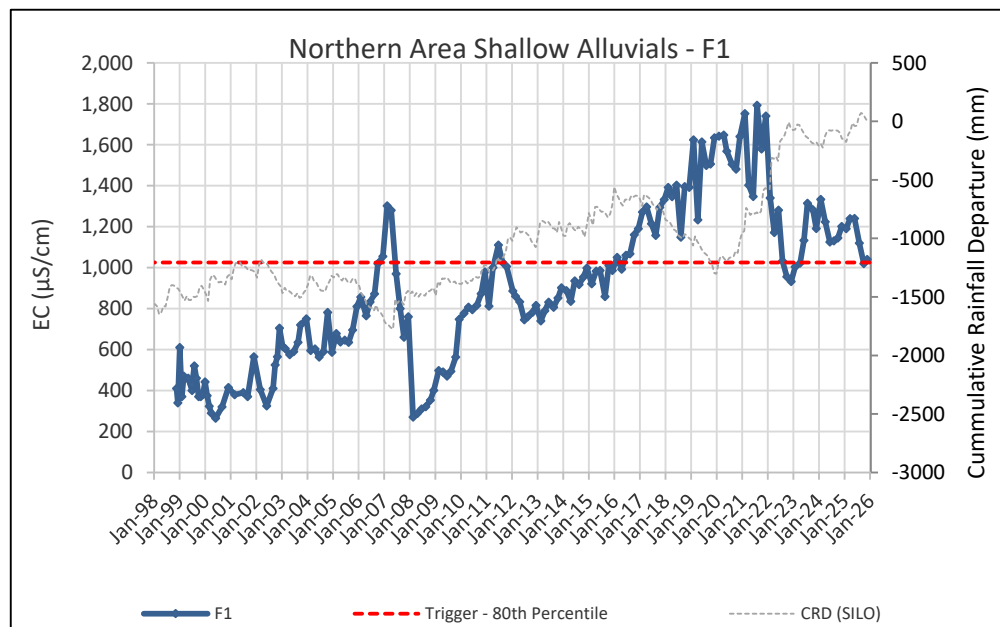
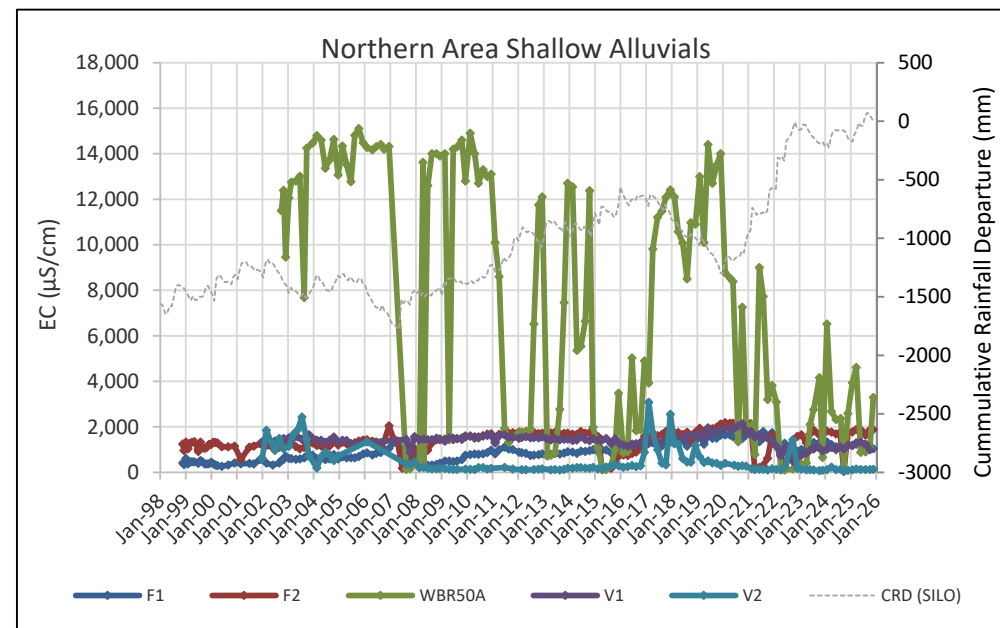
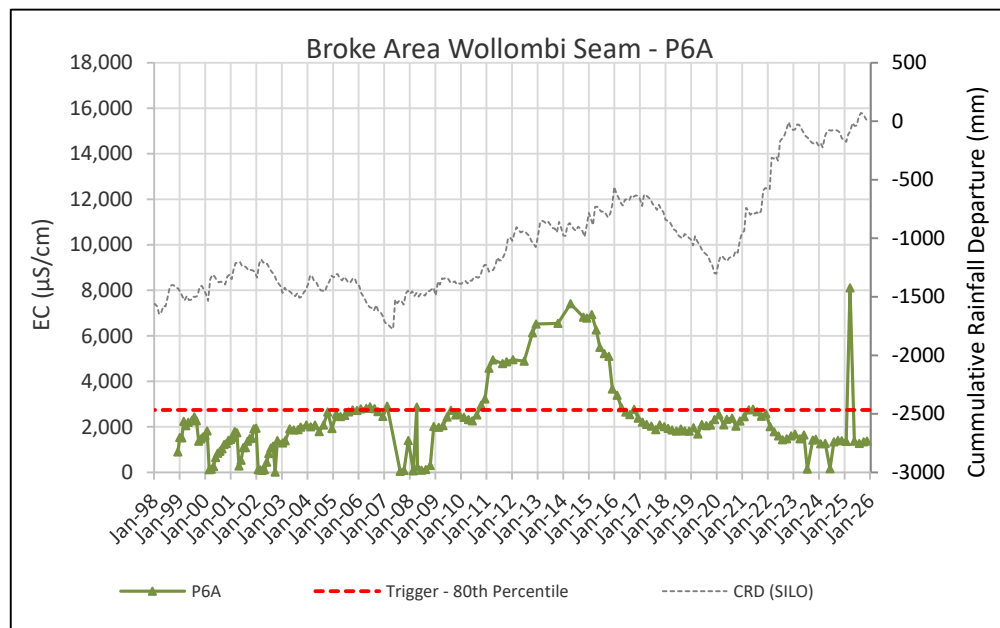


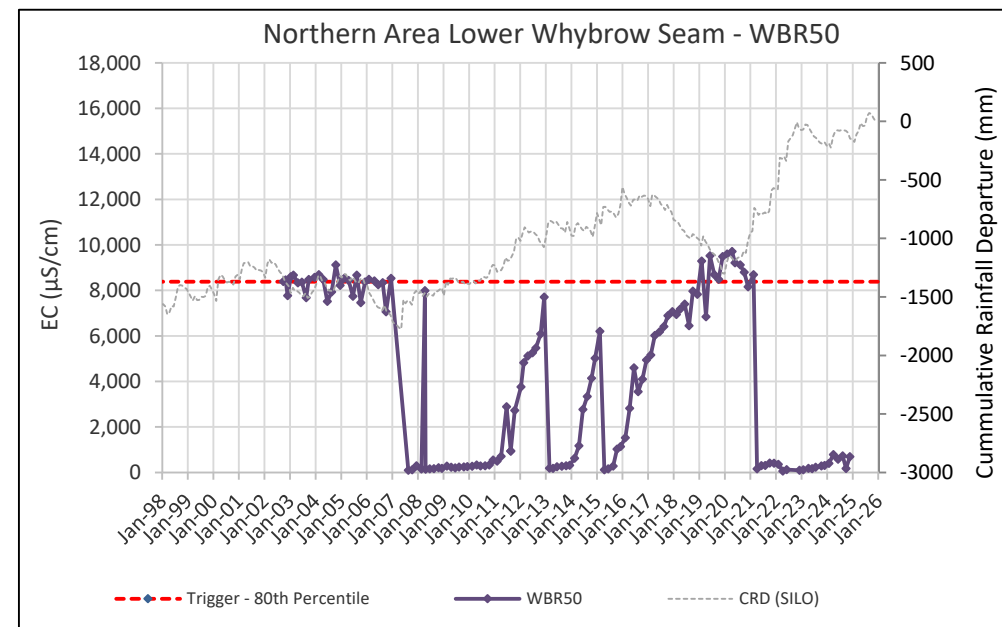
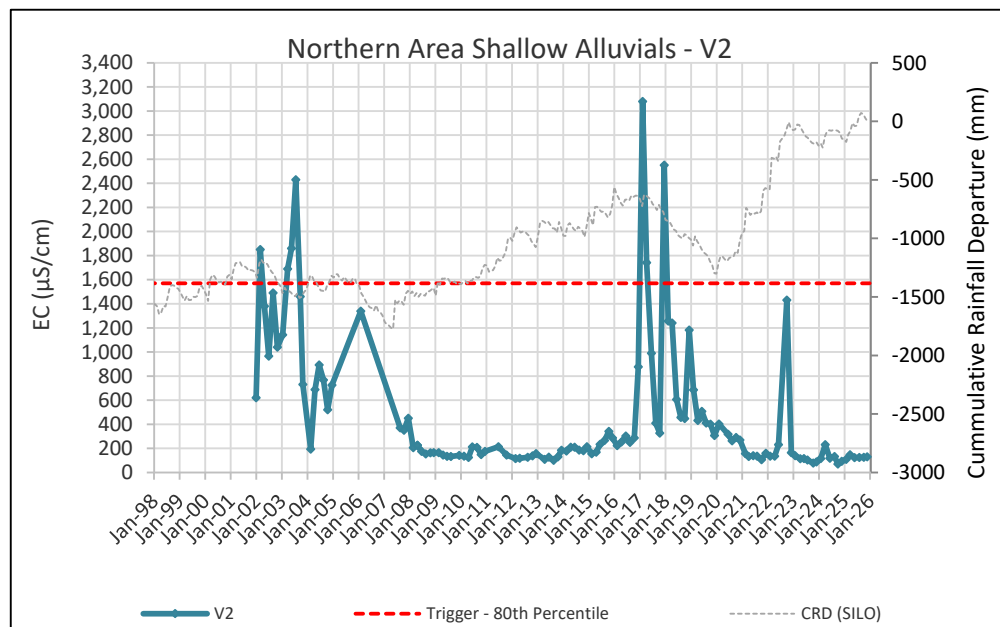
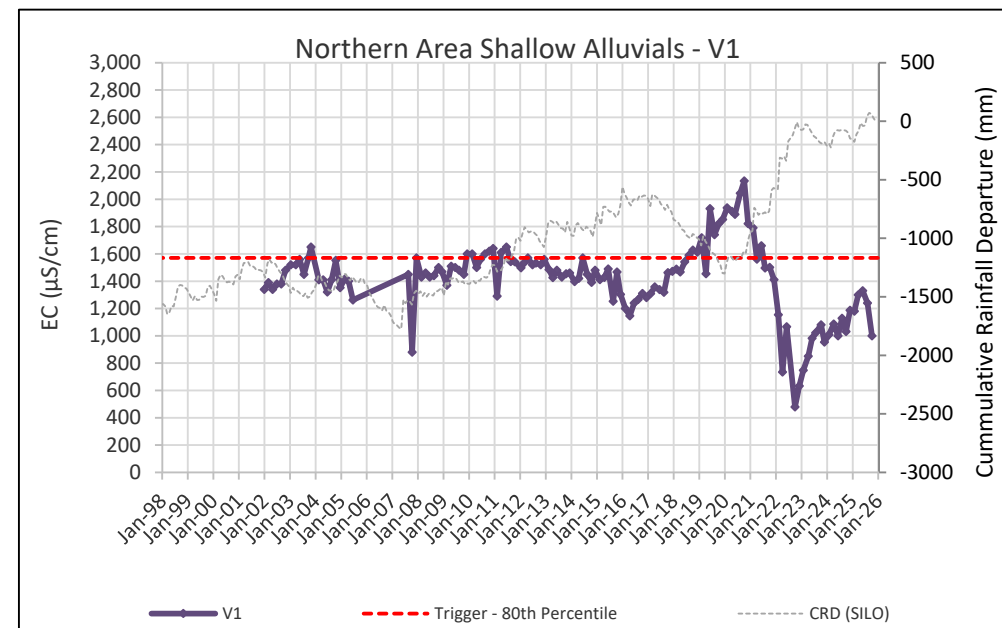
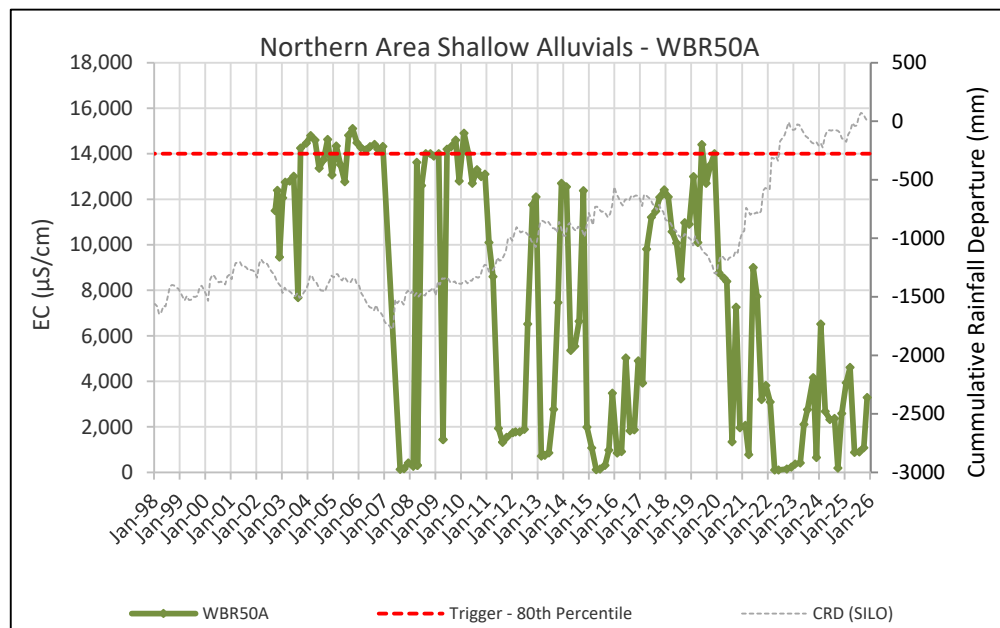


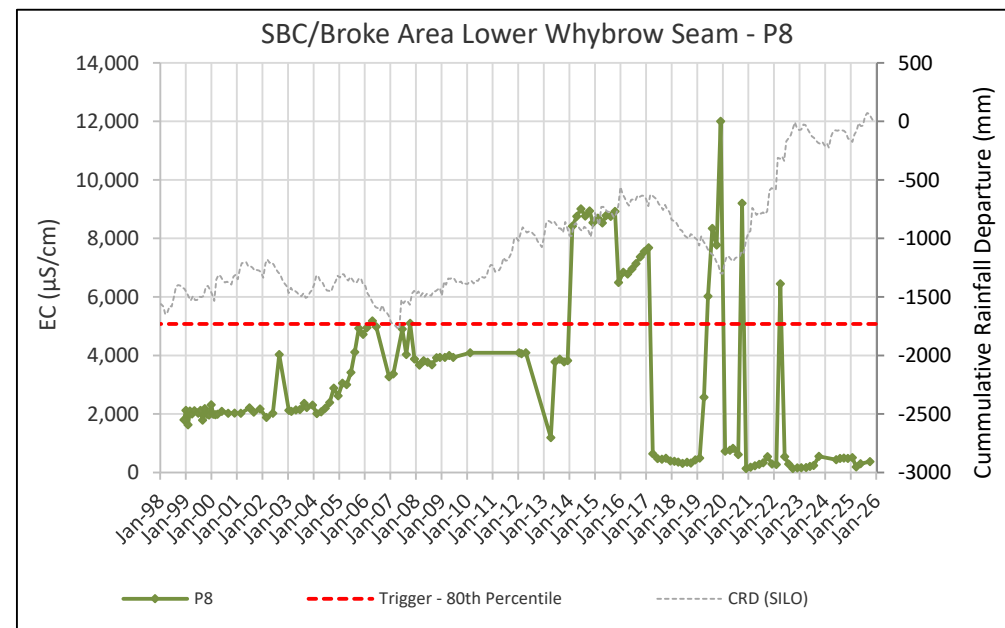
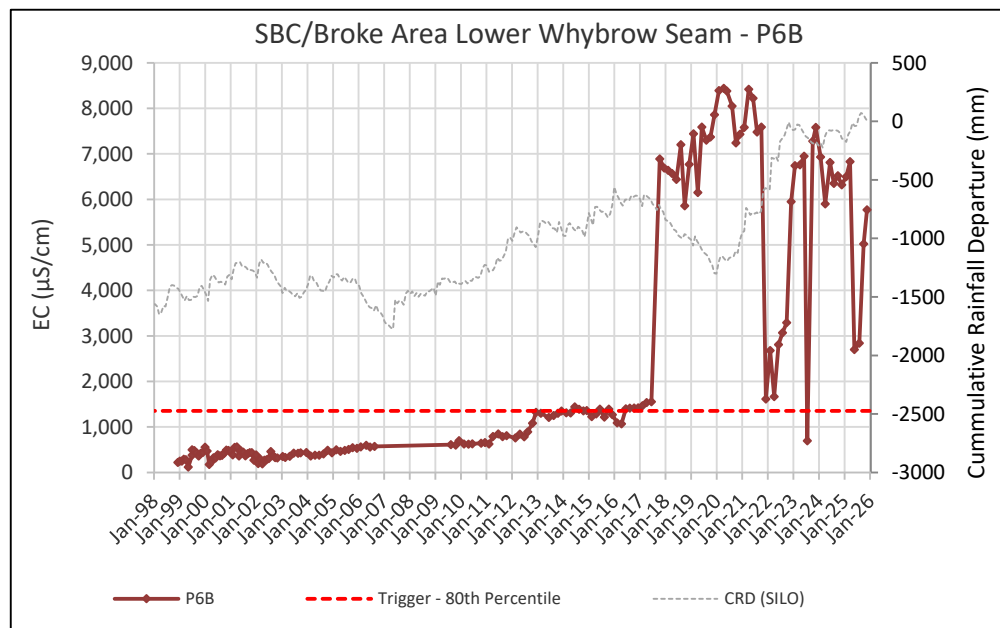
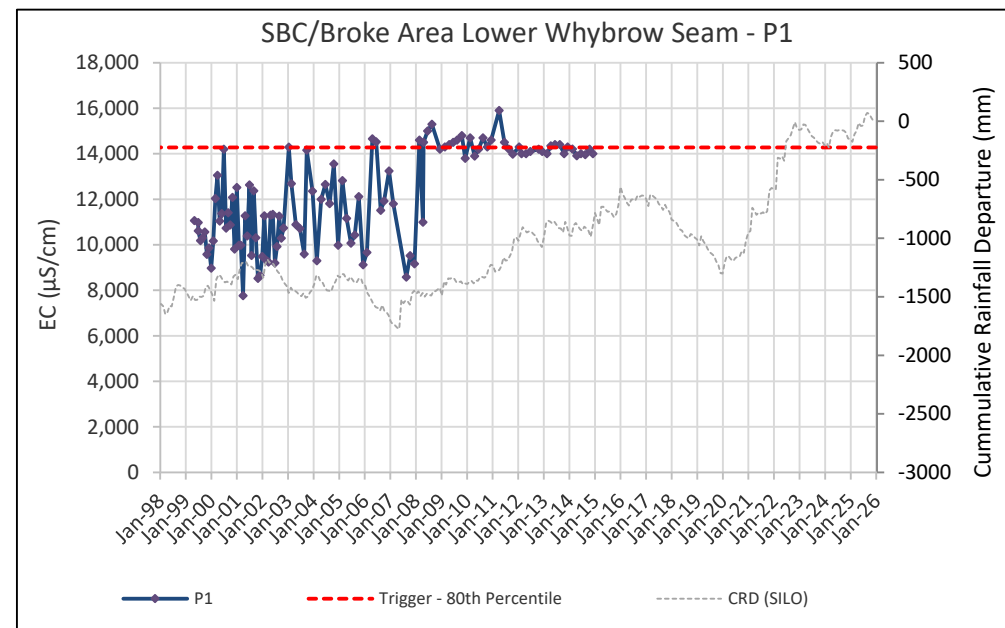
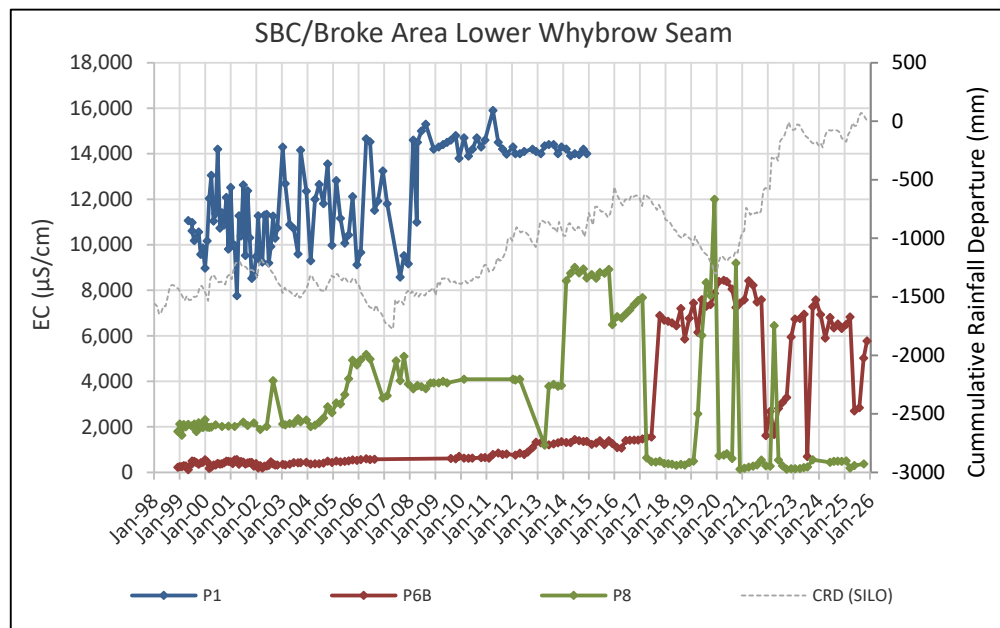


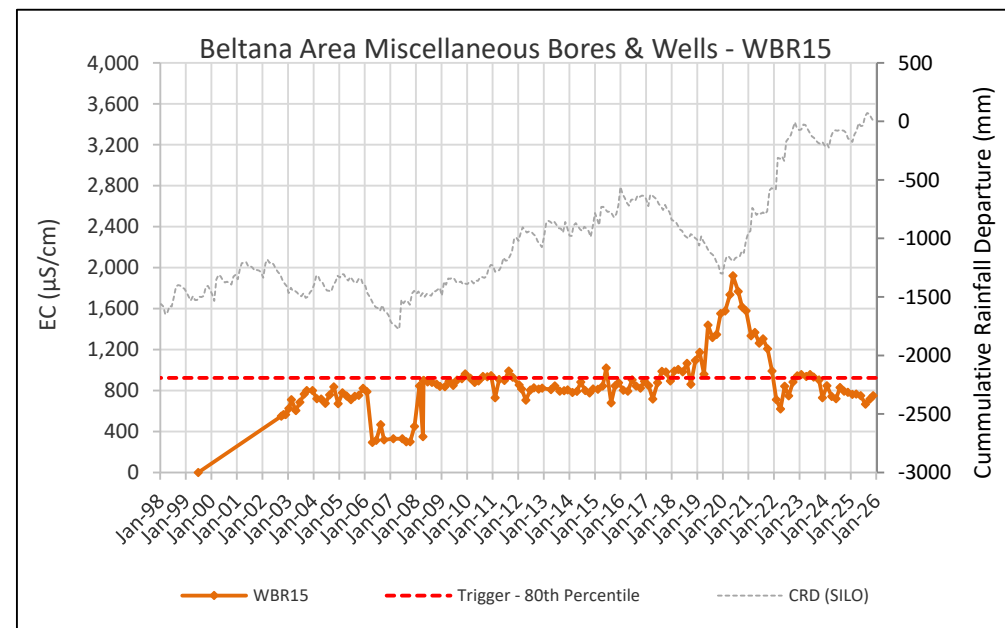
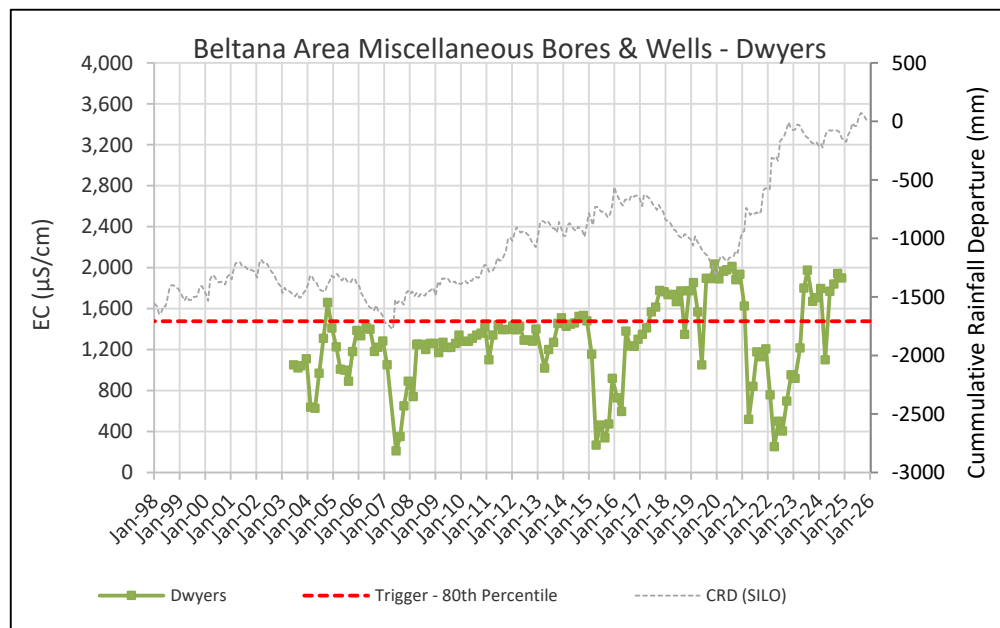
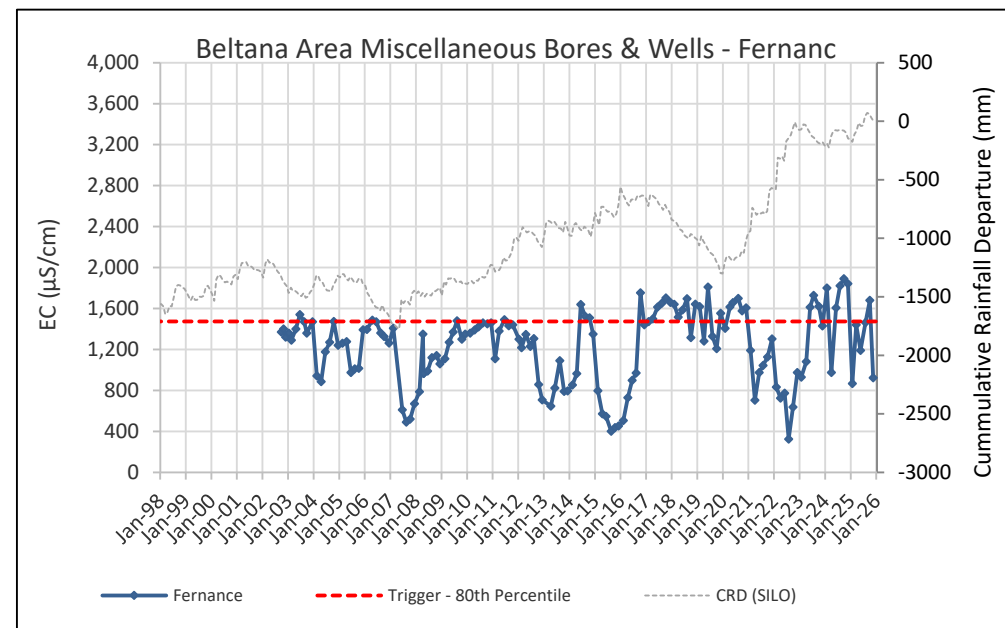
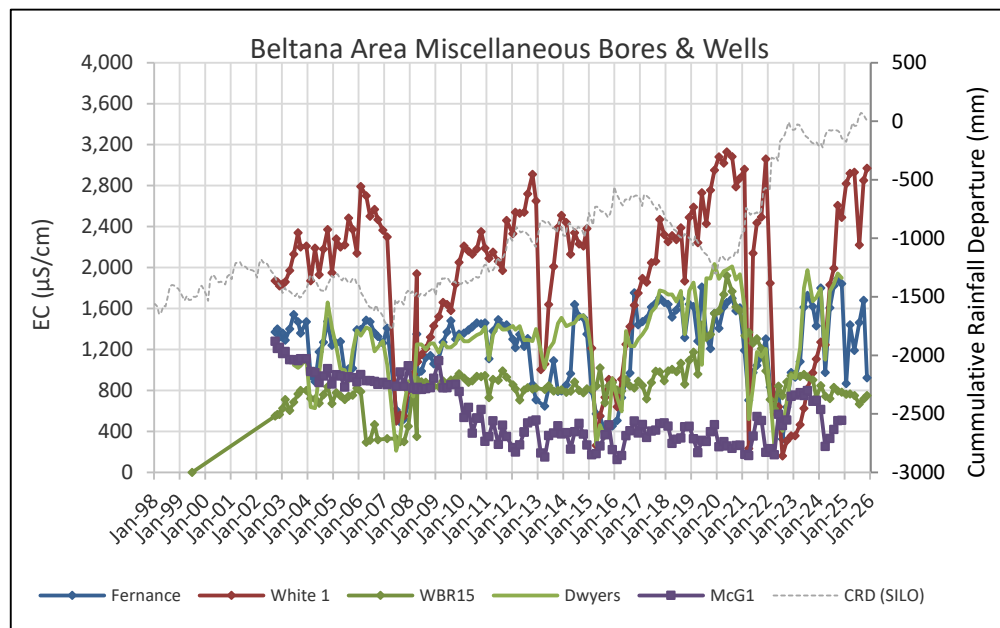


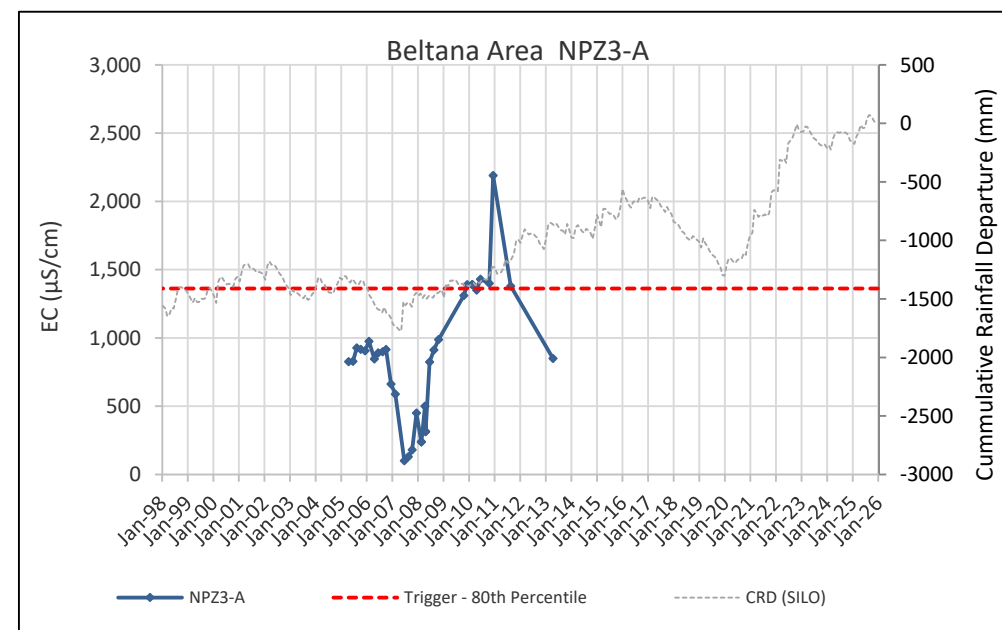
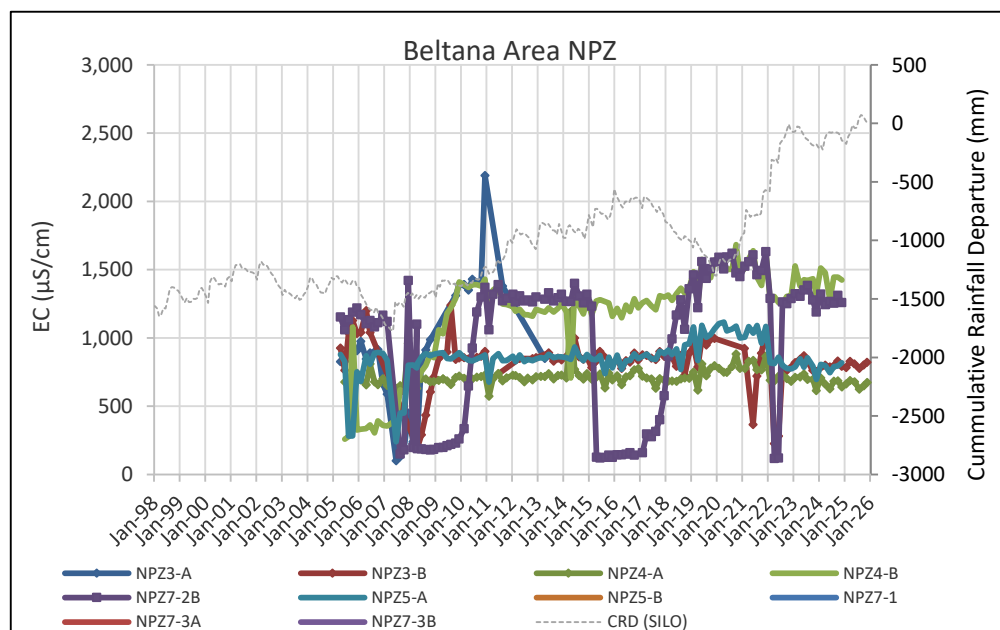
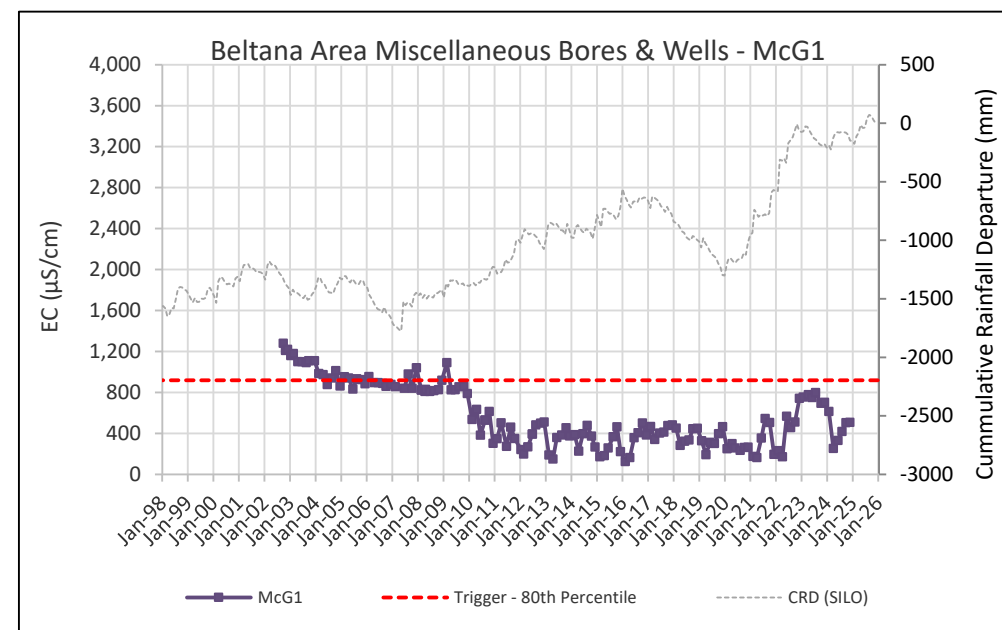
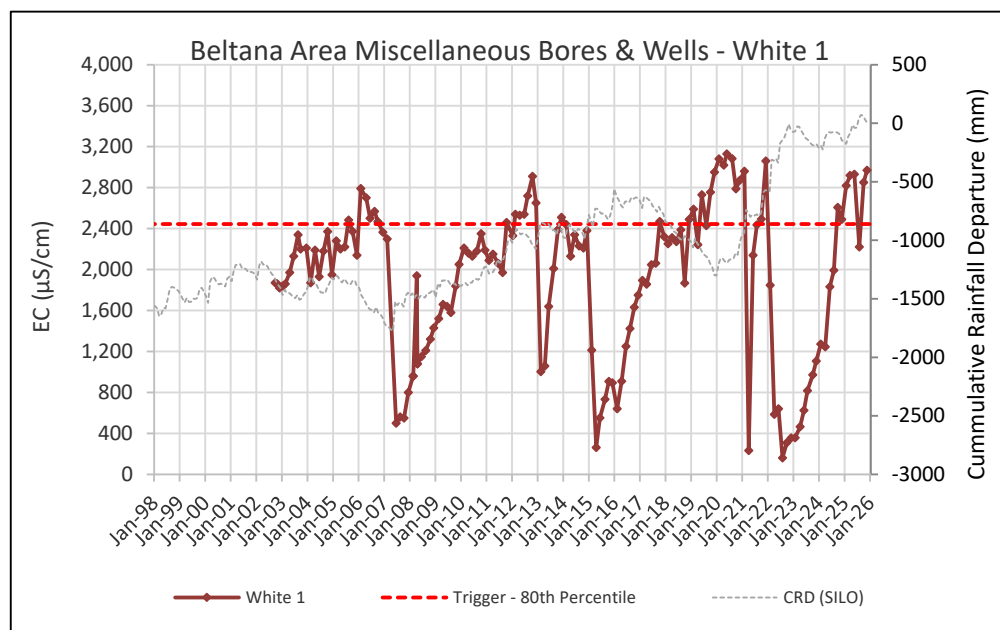


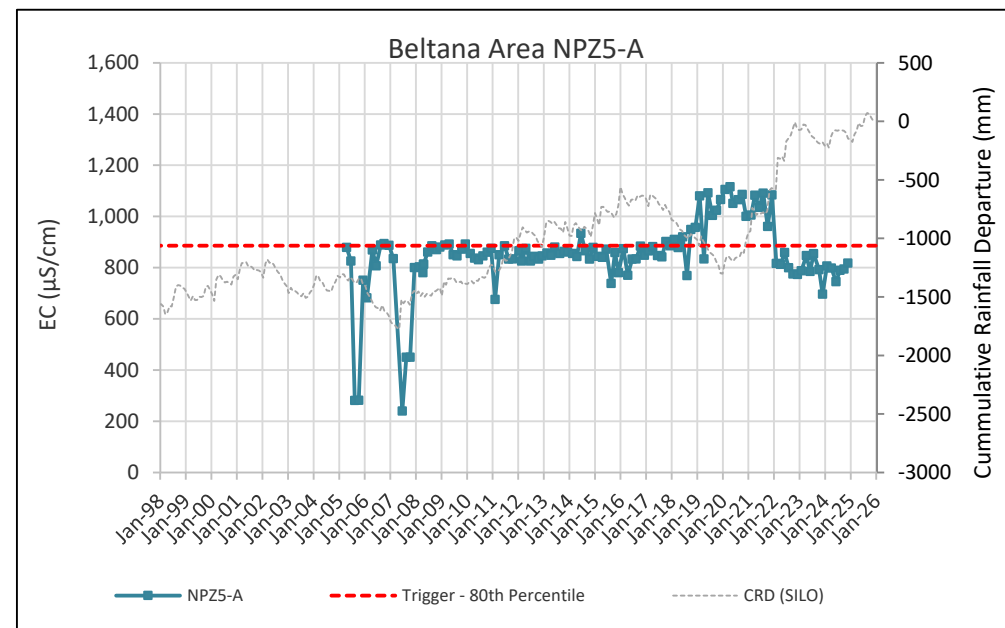
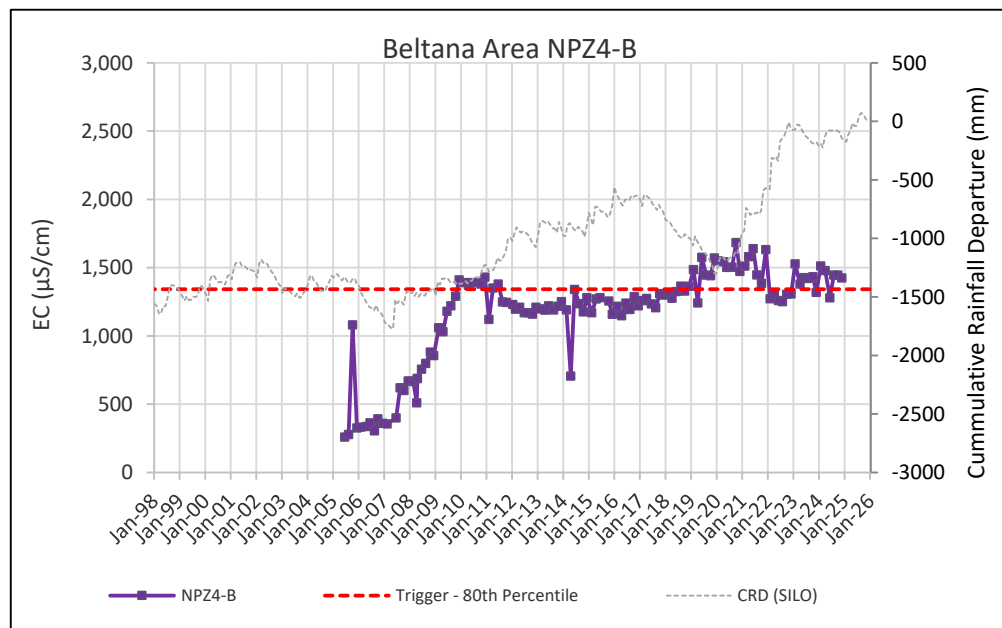
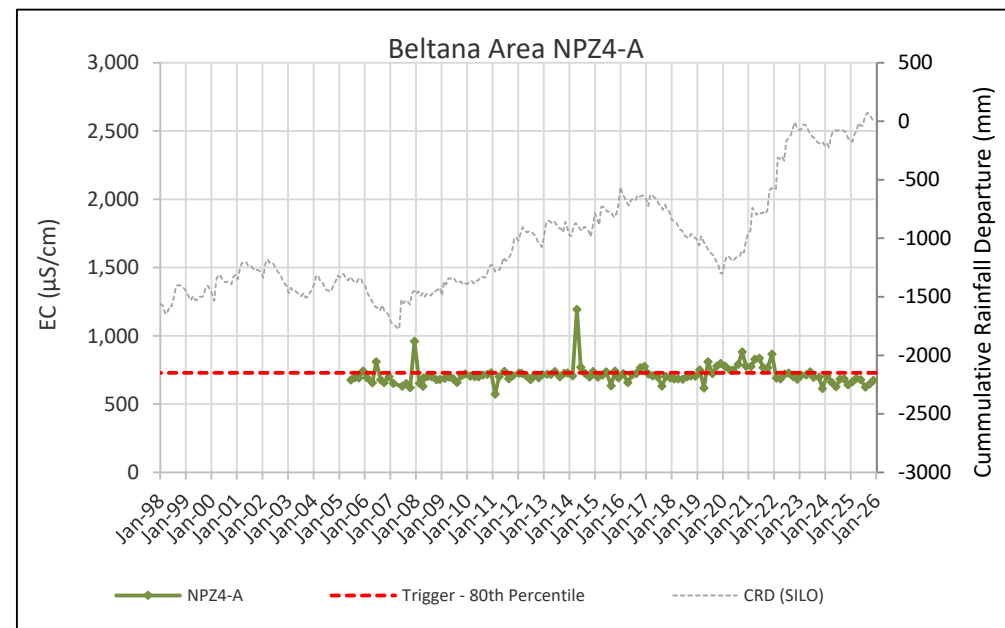
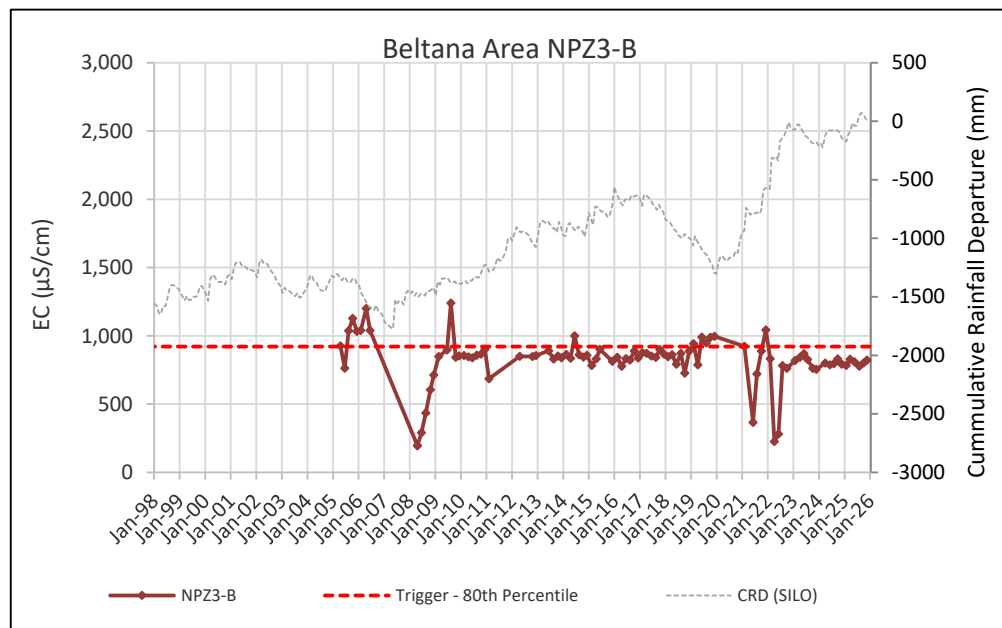


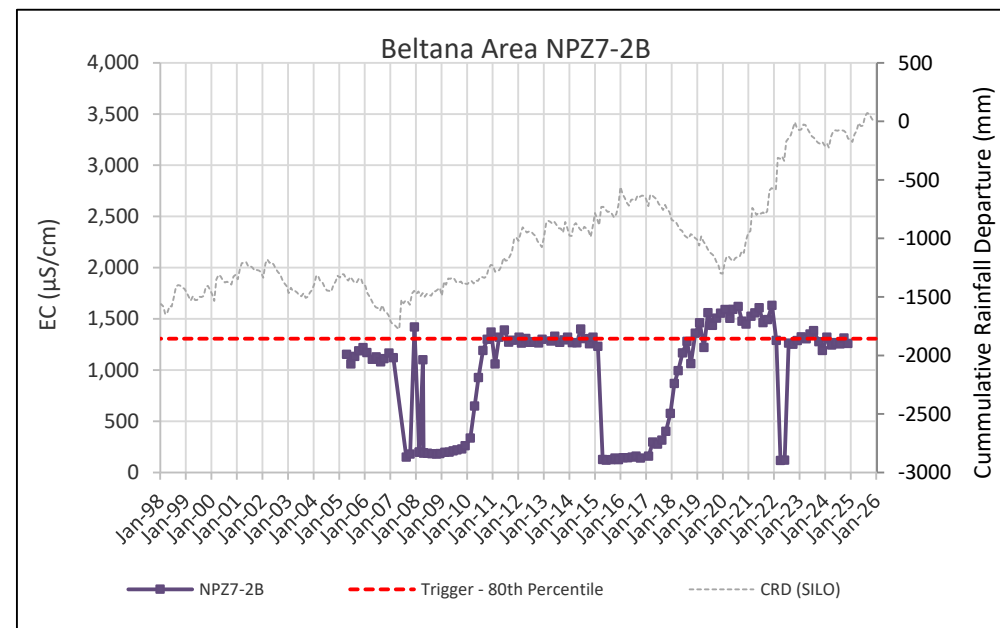
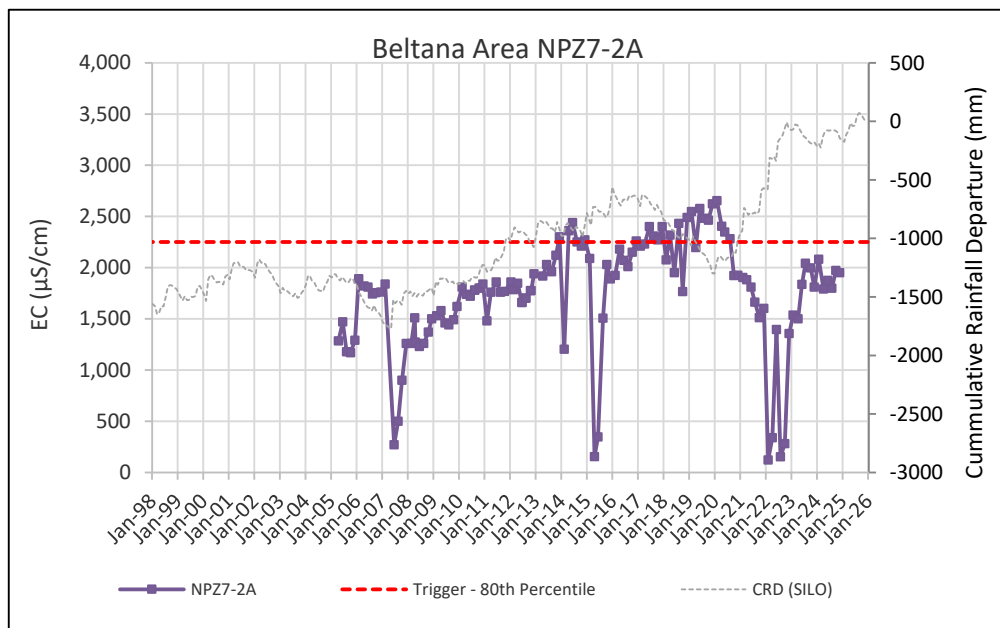
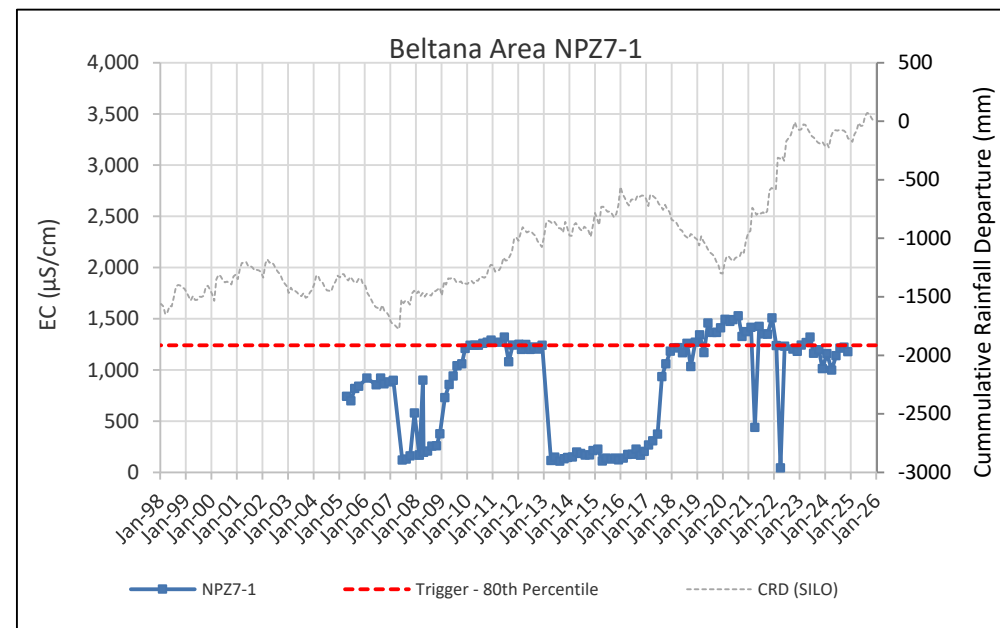
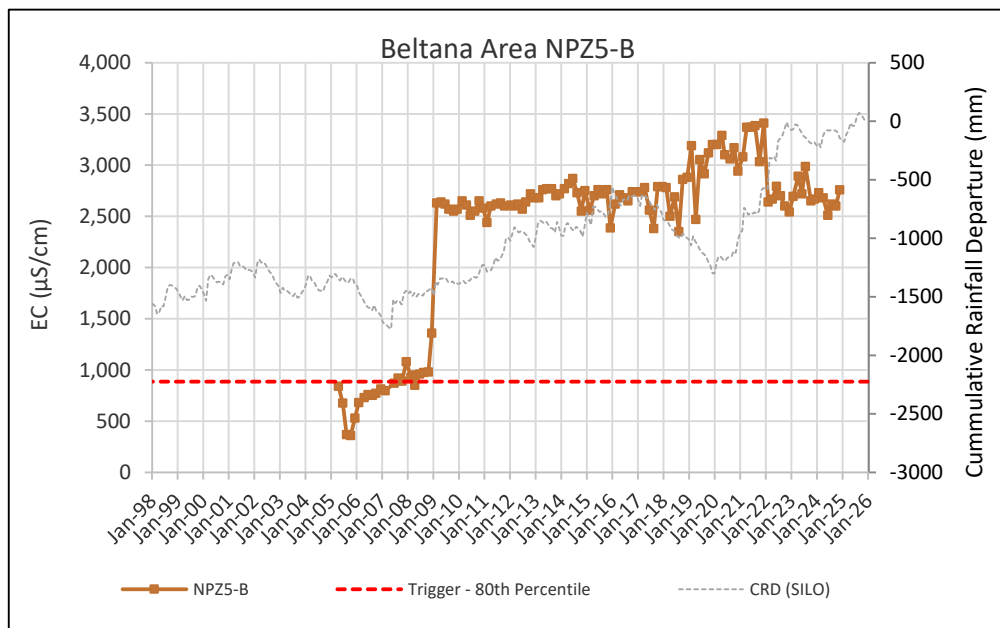


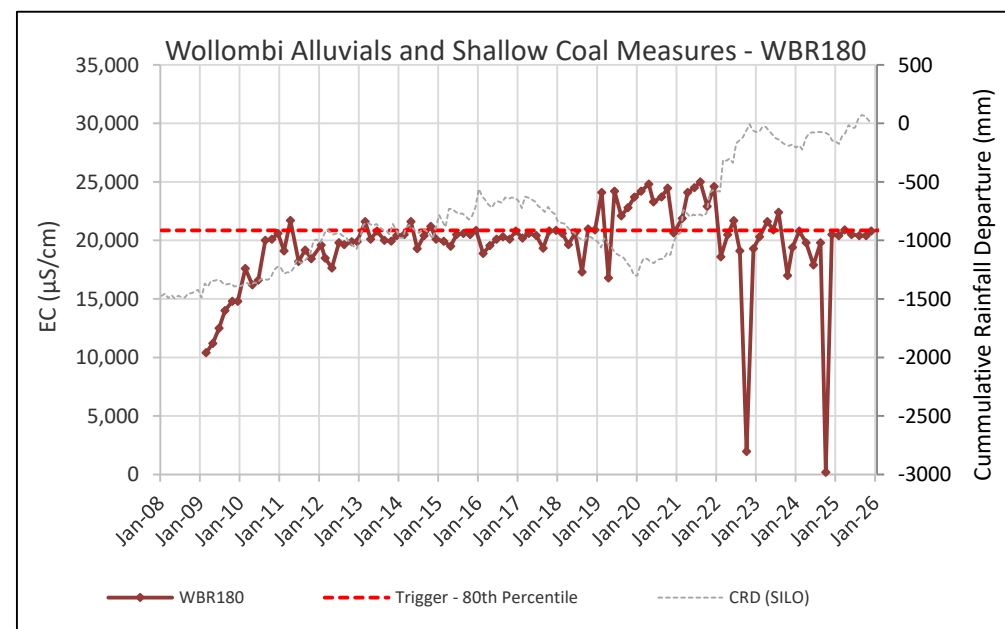
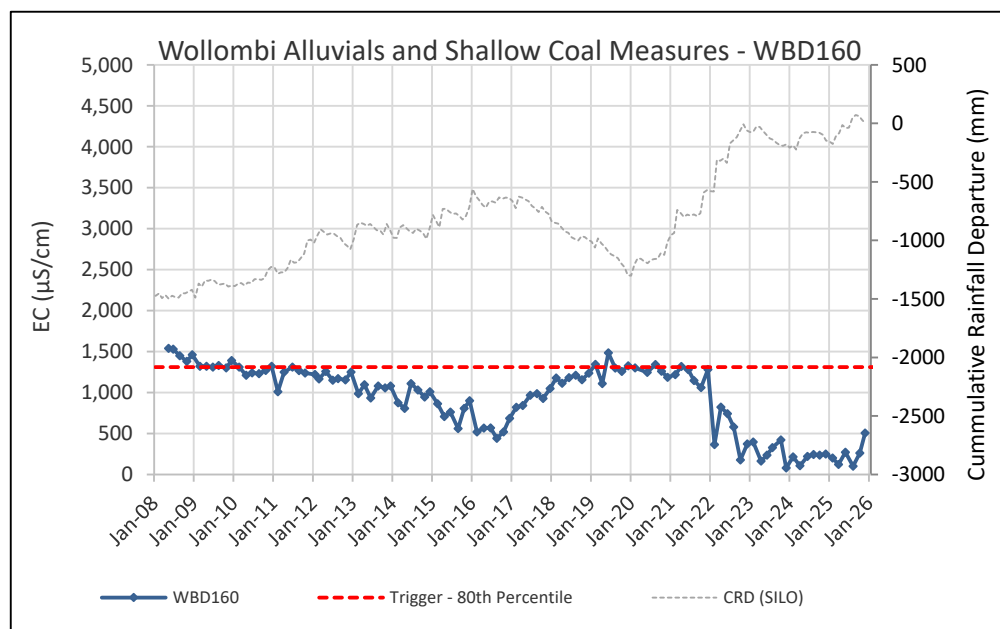
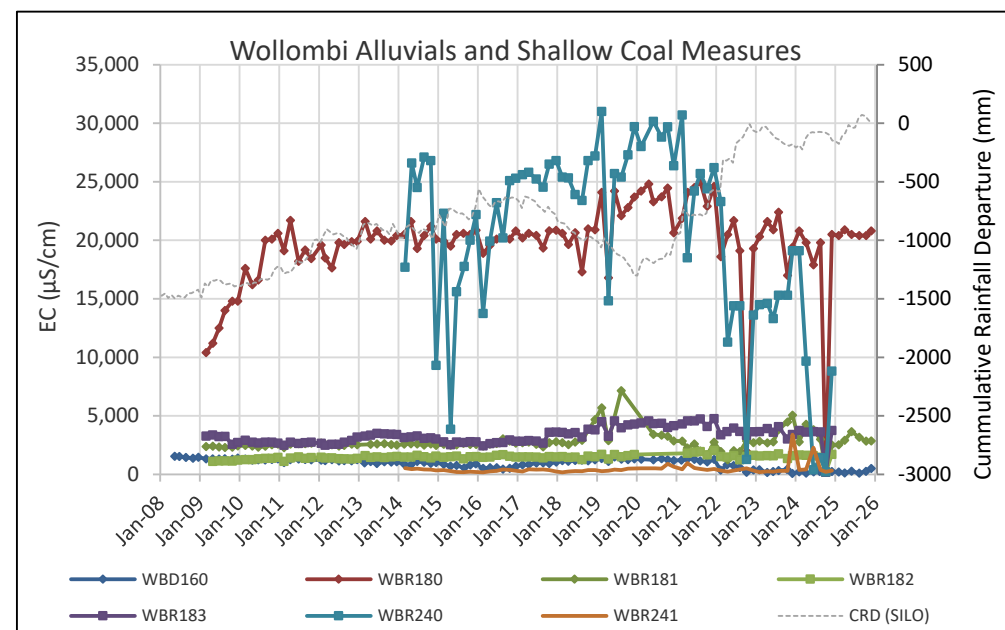
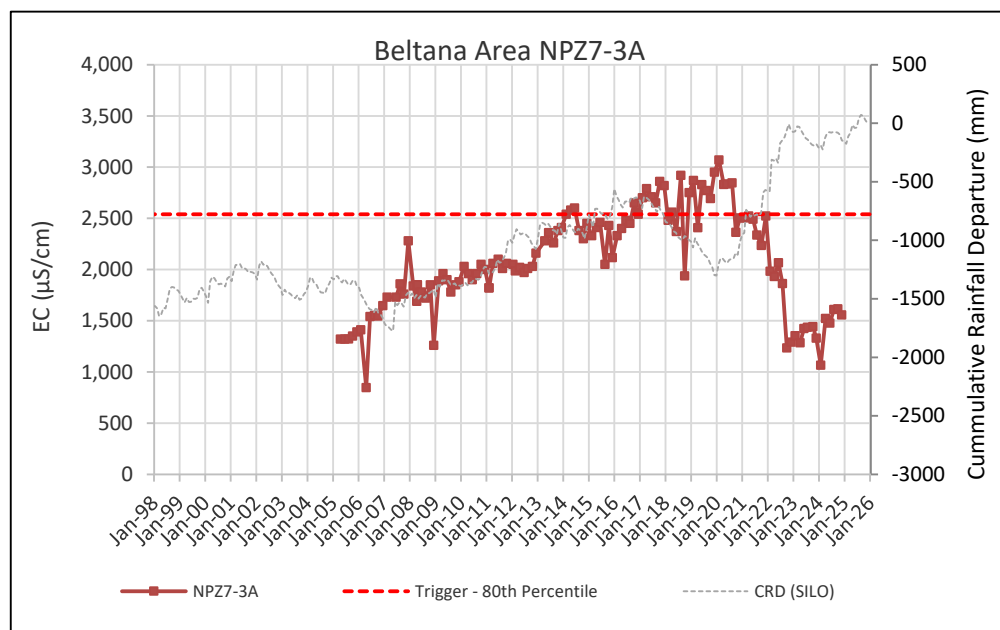


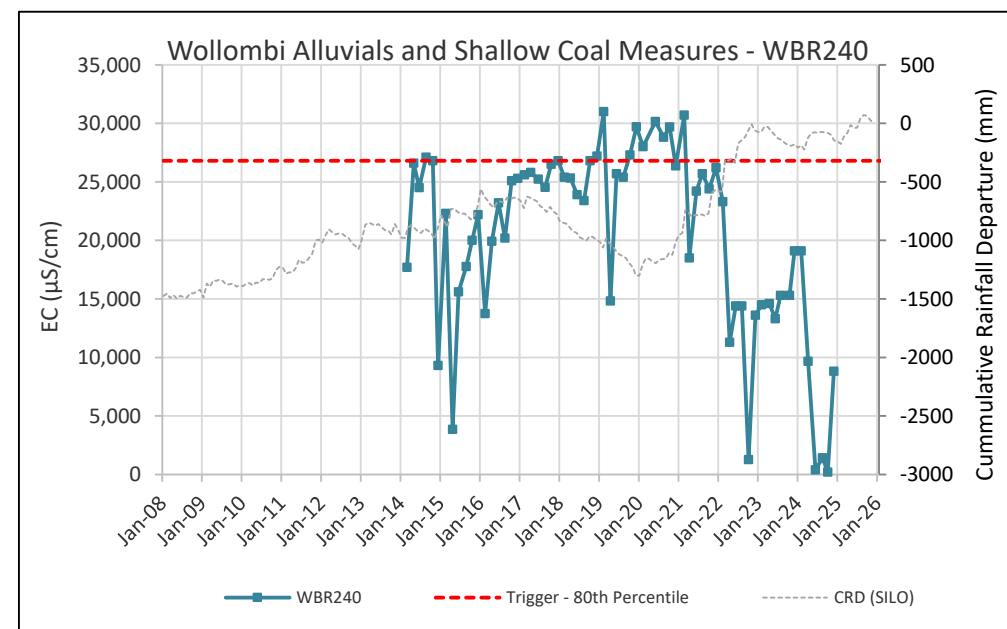
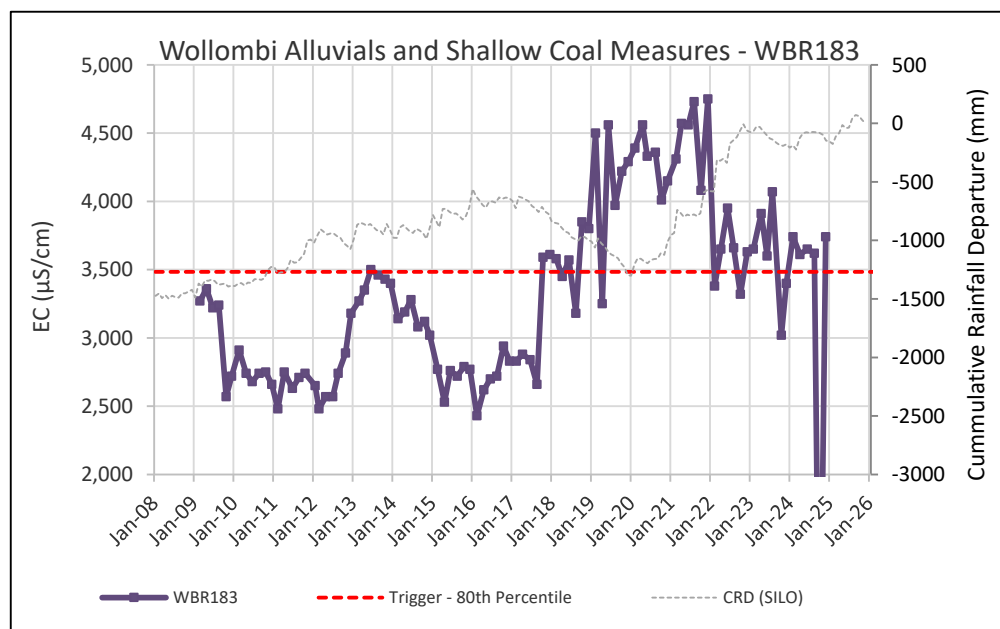
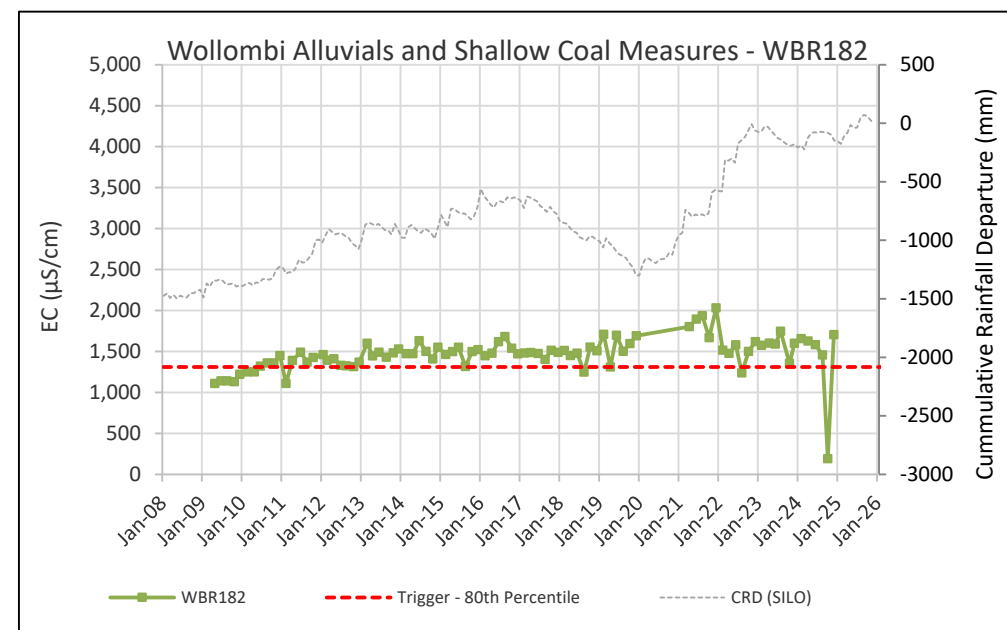
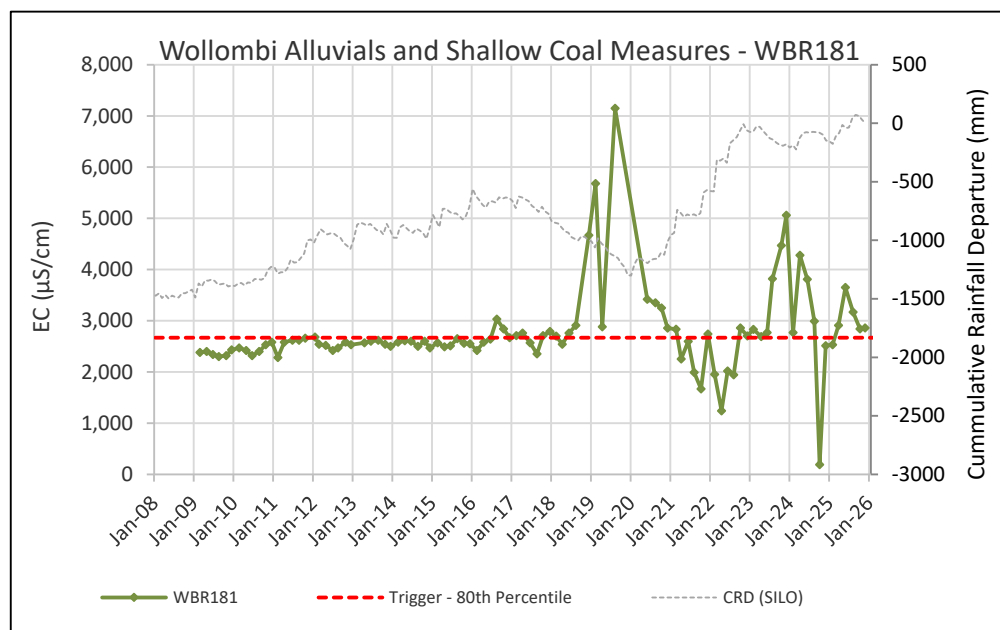


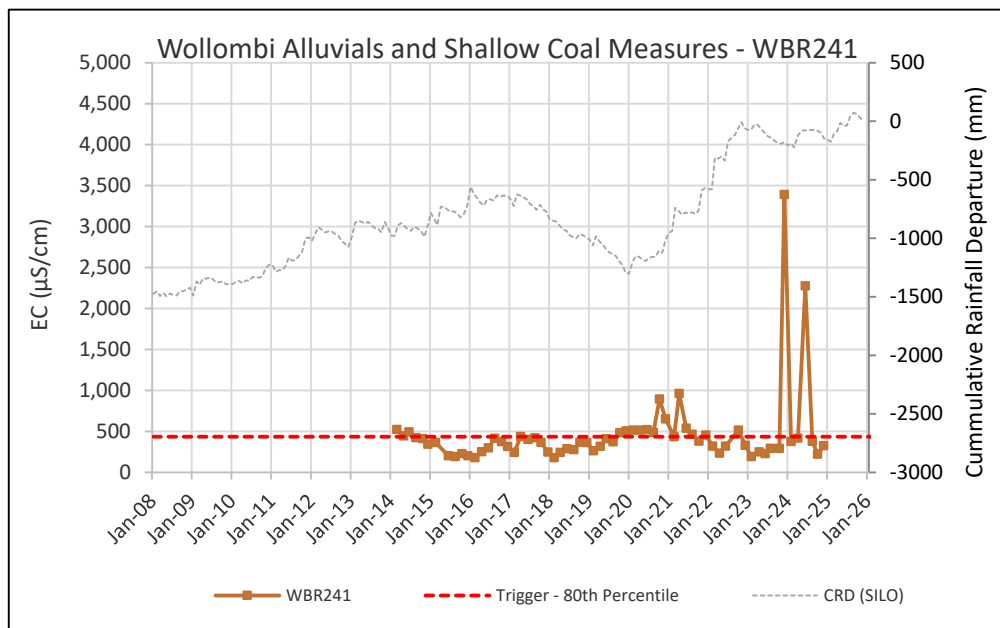












Appendix E

Annual Photographic Monitoring of Loders Creek Grinding Grooves Relocation Area



LODERS CREEK GRINDING GROOVES CONSERVATION AREA

PHOTOGRAPHIC MONITORING REPORT 2025



VIEW OF THE LCGGCA IN 2025.

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1 BACKGROUND

The BCC Bulga Coal Complex (BCC), in conjunction with Registered Aboriginal Parties (RAPs) and an OzArk Environment & Heritage (OzArk) archaeologist, undertake a program of annual monitoring at the Loders Creek Grinding Grooves Conservation Area (LCGGCA).

The aim of the program is to monitor the condition of the rock slabs containing the grinding grooves, to record any changes to the grooves themselves, and to ensure that the general area is being maintained.

An interpretation sign has been installed at an agreed location overlooking the grinding grooves.

The monitoring at the LCGGCA took place on Tuesday 18 March 2025.

The monitoring program was conducted by BCC Environment and Community Coordinator, Fabio Perezortiz, OzArk archaeologist Ben Churcher, and RAP representatives Aaron Taylor and Michelle Taylor. This monitoring report is written by Dr. Bernadette Drabsch (OzArk Environment & Heritage).

The following checklist records the result of the 2025 inspection. The checklist has been completed in accordance with the *Loders Creek Grinding Grooves Relocation Site Conservation Area Agreement*.

Loders Creek Grinding Grooves Annual Monitoring Data Sheet			
Location	LCGGCA		
Inspected by	Ben Churcher		
Date	18 March 2025		
Inspection Checklist			
Aspect	Notes for inspector	Compliant	Issue/Action Required/Comment
Overall condition of the grinding grooves	Review previous inspection report and undertake comparison.	Yes	The monitoring of the grinding grooves has occurred annually since 2017. This has allowed the condition of the grooves to be examined closely. There has been no noticeable change to the integrity of the rock slabs containing the grooves and the grooves themselves remain clearly visible; albeit with some gradual and expected weathering of the grooves.
	Has there been any visible decline in condition of grinding grooves.	No	
Condition of the boundary and fences	Is the fence in good stock-proof condition?	Yes	There is no fence around the grinding grooves conservation boundary because it is within a stockproof larger boundary fence. Property fence in good repair and the grinding grooves are clearly demarcated with signage and a log barrier to prevent vehicle entry. Slashing outside the fence is not required.
	Is slashing required outside the fence?	No	
Placement and condition of signage around the conservation area	Are all signs legible?	Yes	Interpretative sign installed and additional small sign advising the site is an archaeological area and entry is not permitted without authorisation. No requirement for further signage
	Is additional signage required?	No	
Presence of weeds	Has there been any visible increase in weeds in the area or near the boundary?	No	Area of grinding grooves is well-maintained. Although there is some recent weed growth, planned maintenance was about to be undertaken.

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Presence of erosion	Is there any erosion evident in the Conservation Area?	No	No erosion near the grinding grooves. Minor impact associated with flooding in 2022 has been remediated.
	Does the erosion represent a threat to the grinding grooves?	No	Erosion is not threatening the integrity of the grooves
	Are there any erosion controls required?	No	No erosion controls required
Presence of feral animal activity	Is there evidence of recent scratching, tracks or droppings?	NO	Past pig damage near the grinding grooves has been rectified by trapping and removing pigs from the area. No evidence of recent pig damage.
Unauthorised Access	Are there any vehicle tracks within the boundary of the Conservation Area?	No	No evidence visible. Access to the area of the grinding grooves is prevented by a series of logs that have been placed at the end of the track leading to the LCGGRA.

2 PHOTOGRAPHIC MONITORING PROGRAM 2025

2.1 BACKGROUND

The BCC undertakes to conduct annual photographic monitoring at the LCGGCA in accordance with the *Loders Creek Grinding Grooves Conservation Area Management Plan* (Section 5) so that the condition of the slabs containing grinding grooves, as well as the general area, can be regularly monitored.

Photographic monitoring of the LCGGCA has occurred in September 2015, February 2017, February 2018, April 2019, April 2020, March 2021, March 2021, March 2022, May 2023, March 2024, and March 2025. This has enabled the grinding grooves to be monitored during the past nine and a half years.

2.2 LANDSCAPE PHOTOGRAPHIC MONITORING POINTS (PHOTO POINTS 1–4)

The 2017 monitoring program established four fixed photo points to enable an accurate on-going photographic record of the LCGGCA landscape to be assembled. These photo points have been marked with wooden pegs hammered to just above ground level and the tops painted white and were used again in 2025.

These four landscape photographic points are intended to monitor the general landscape of the grinding grooves.

The following protocol is followed for the four landscape photographic recordings at LCGGCA:

- All photographs are to be taken at:
 - o Standing height (camera height is approximately 1.5 m)
 - o 28 mm focal length
 - o 200 ISO.
- Photographs should be taken in raw image format (digital negative)
- A one metre staff should be placed 10 m from the camera so that consistent scale in the photos can be ascertained

- **Photo Point 1:** Located on the upper terrace to the northeast of the grooves. Two photographs should be taken: one at 240°; and the other at 260°
- **Photo Point 2:** Located on the upper terrace to the southeast of the grooves. Two photographs should be taken: one at 300°; and the other at 320°
- **Photo Point 3:** Located on the lower terrace to the north of the grooves. One photograph should be taken at 220°
- **Photo Point 4:** Located on the lower terrace to the south of the grooves. One photograph should be taken at 35°

The locations of the four landscape photographic recording locations are shown in **Table 2-1**.

Table 2-1: Location of landscape photographic points.

Photo point	GDA2020 Zone 56
Photo point 1	323517E; 6386872N
Photo point 2	323505E; 6386859N
Photo point 3	323504E; 6386881N
Photo point 4	323487E; 6386861N

Figure 2-1 shows two aerial (drone) views of the site and the location of the four landscape photographic points and are shown on **Figure 2-2**. **Figure 2-3** provides an example of the 2017 to 2025 photographs taken from the four landscape photographic monitoring points.

Figure 2-1. Overhead views of the LCGGCA.

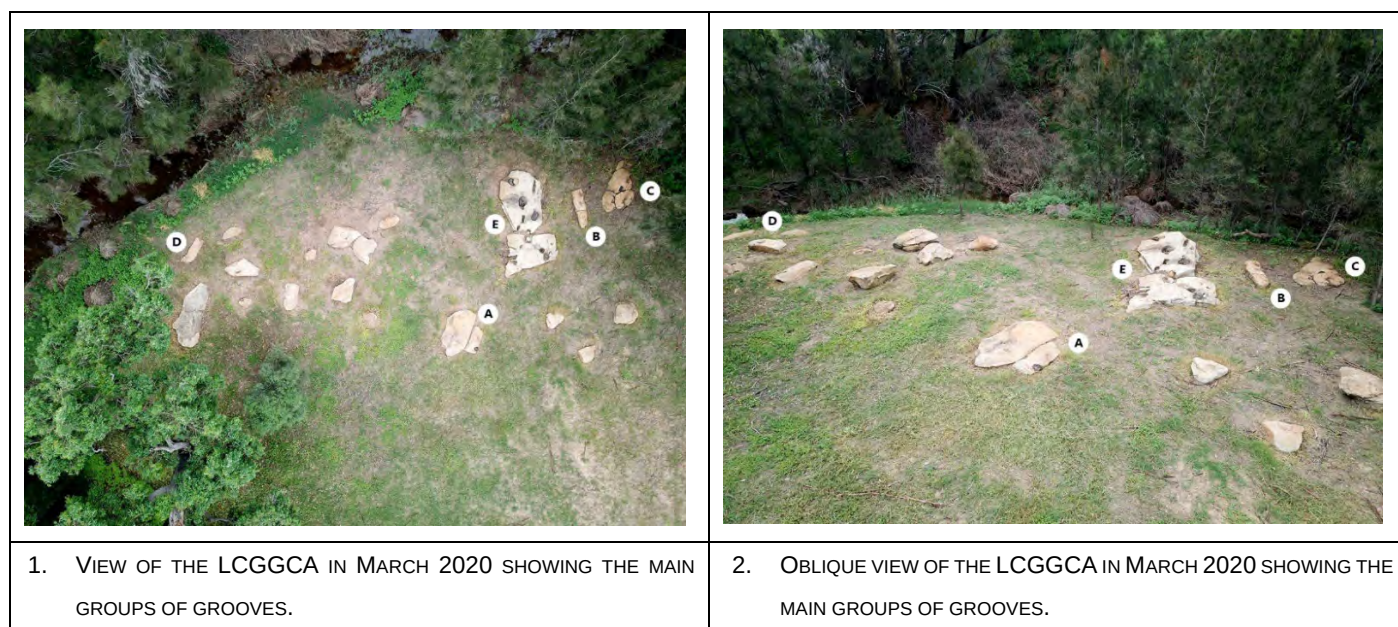


Figure 2-2. Plan of the LCGGCA showing the approximate location of the landscape photographic points.

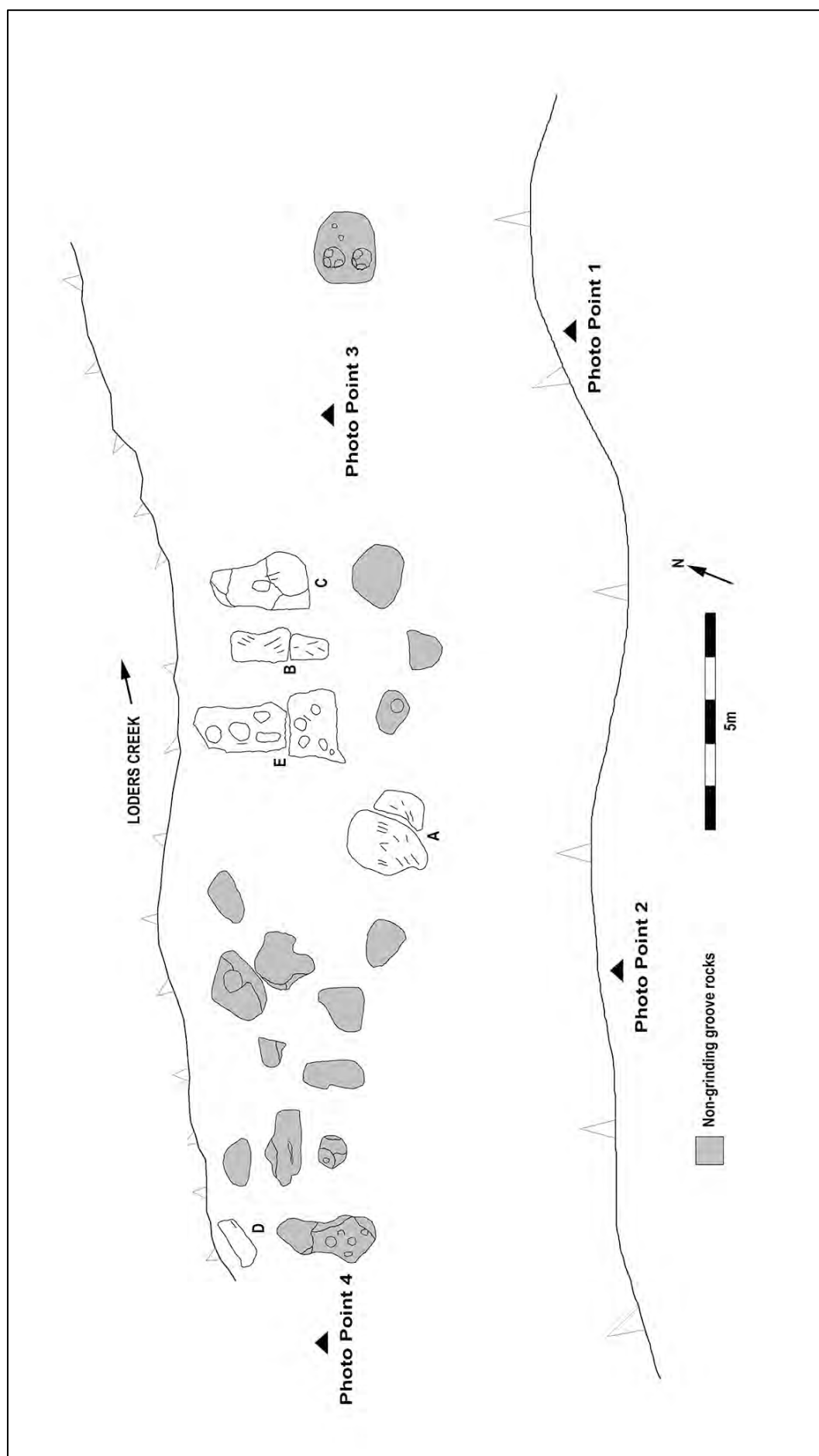


Figure 2-3. 2017–2025 photographic record of the four landscape photographic points.

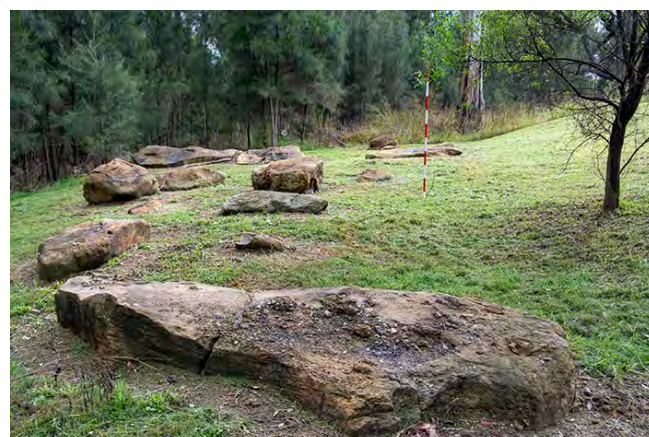
PHOTO POINT 1: 2017–2025	
	
2017 VIEW FROM PHOTO POINT 1: 240°	2022 VIEW FROM PHOTO POINT 1: 240°
	
2024 VIEW FROM PHOTO POINT 1: 240°	2025 VIEW FROM PHOTO POINT 1: 240°
PHOTO POINT 2: 2017–2025	
	
2017 VIEW FROM PHOTO POINT 2: 320°	2022 VIEW FROM PHOTO POINT 2: 320°

	
2024 VIEW FROM PHOTO POINT 2: 320°	2025 VIEW FROM PHOTO POINT 2: 320°
PHOTO POINT 3: 2017–2025	
	
2017 VIEW FROM PHOTO POINT 3: 220°	2022 VIEW FROM PHOTO POINT 3: 220°
	
2024 VIEW FROM PHOTO POINT 3: 220°	2025 VIEW FROM PHOTO POINT 3: 220°

PHOTO POINT 4: 2017–2025



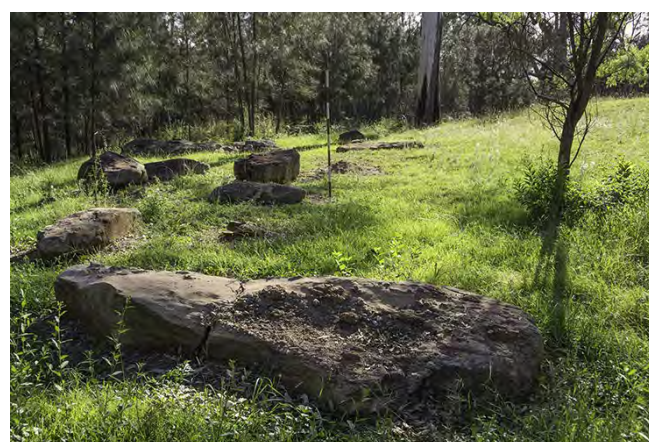
2017 VIEW FROM PHOTO POINT 4: 35°



2022 VIEW FROM PHOTO POINT 4: 35°



2024 VIEW FROM PHOTO POINT 4: 35°



2025 VIEW FROM PHOTO POINT 4: 35°

2.3 GRINDING GROOVE PHOTOGRAPHIC MONITORING

Details of all five rock slab groups (A–E) containing grooves will also be captured. Each photo will have a scale and a north arrow included. The locations of the additional six grinding groove photographic recording locations are shown in **Table 2-2**.

Table 2-2: Location of grinding groove photo points.

Photo point	GDA2020 Zone 56	Grinding groove group
Photo point 5	323501E; 6386870N	Group A (Figure 2-4 , Figure 2-5)
Photo point 6	323500E; 6386879N	Group B (Figure 2-6)
Photo point 7	323501E; 6386881N	Group C (Figure 2-7)
Photo point 8	323487E; 6386864N	Group D (Figure 2-8)
Photo point 9	323497E; 6386874N	Group E East (Figure 2-9)
Photo point 10	323496E; 6386875N	Group E (West) (Figure 2-9)

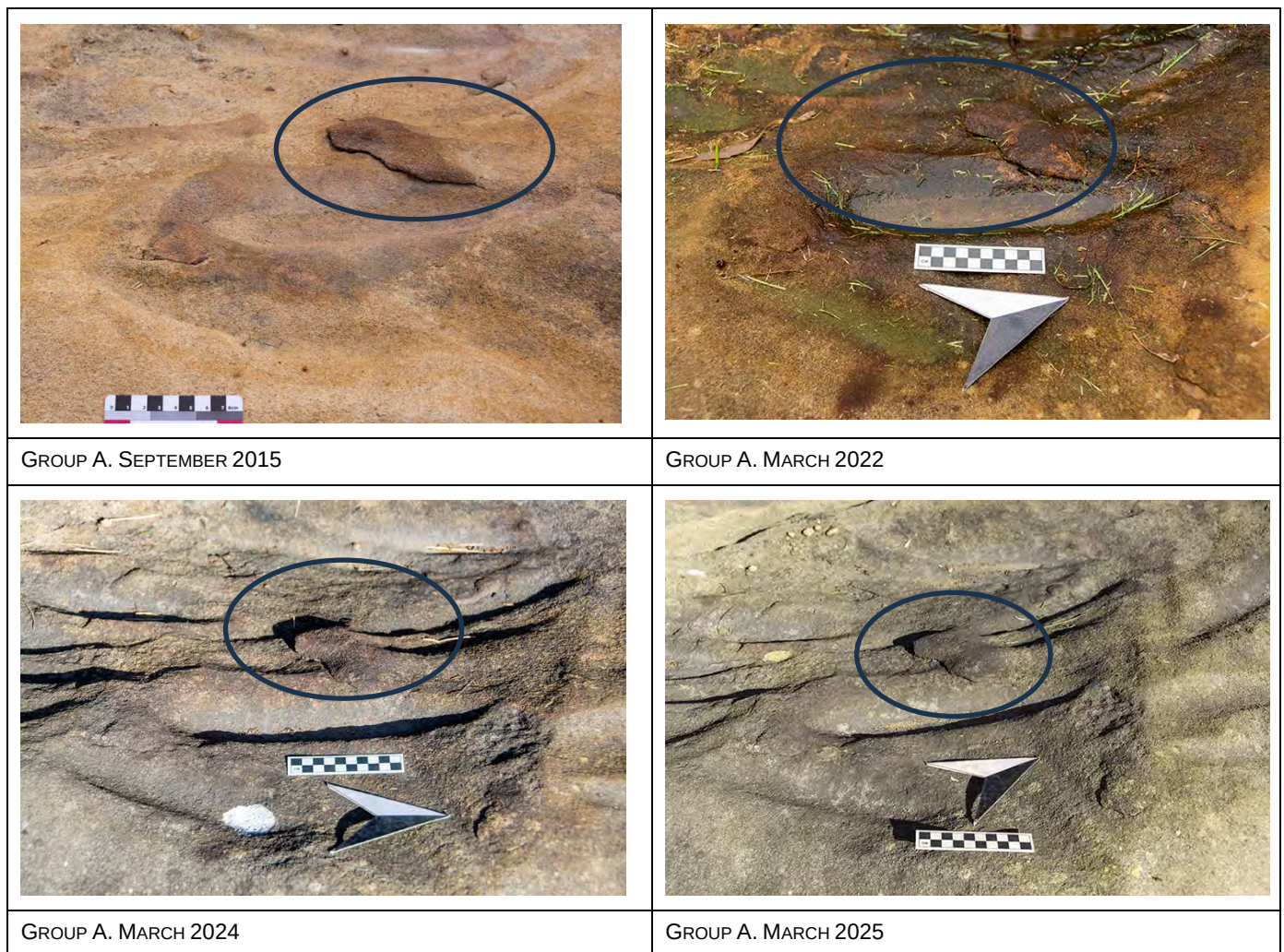
Figure 2-4 to Figure 2-9 provide details of the slabs containing grooves to assess whether there has been any change in their condition between 2015 and 2025. Notes on any observable changes are provided in these figures.

2.3.1 Photo Point 5

Group A consists of the greatest number of grooves that are divided across two separate slabs, as they were when *in situ*. The slabs are stable apart from one area where a layer of sandstone is exfoliating. After nine and a half years of observation, this portion of the slab appears not to be detaching further but is becoming more weathered (**Figure 2-4**). Generally, the grooves are slowly becoming less distinct although this remains a marginal change at this stage.

In 2025, staining on the rock slabs noted in 2023 has become less pronounced.

Figure 2-4. Comparison between the 2015–2025 condition of Group A at the LCGGCA.



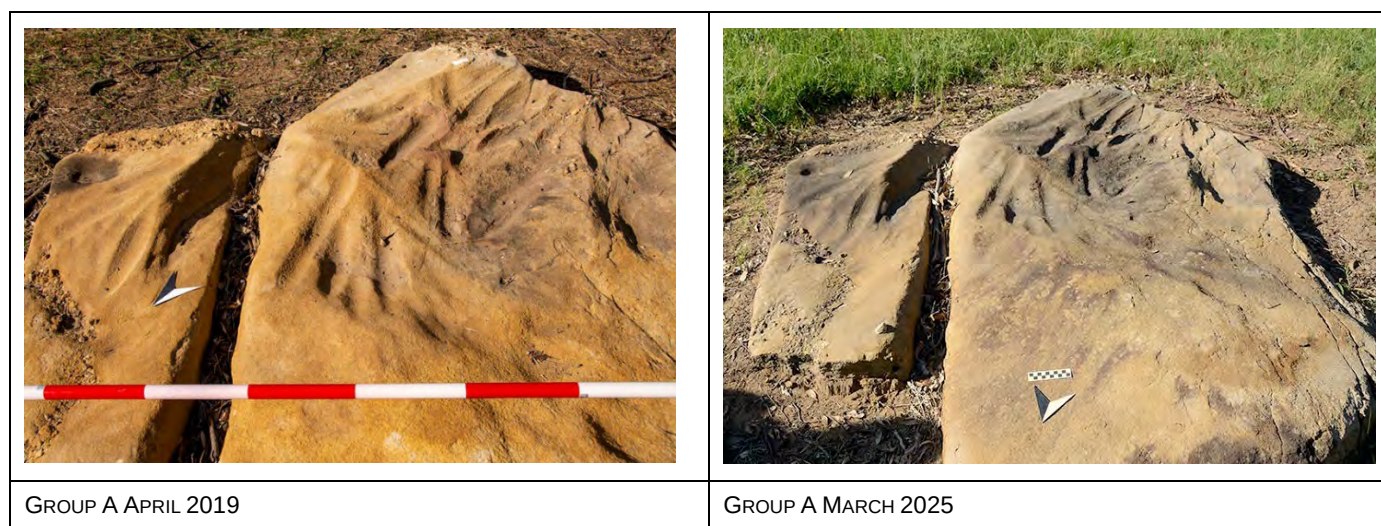
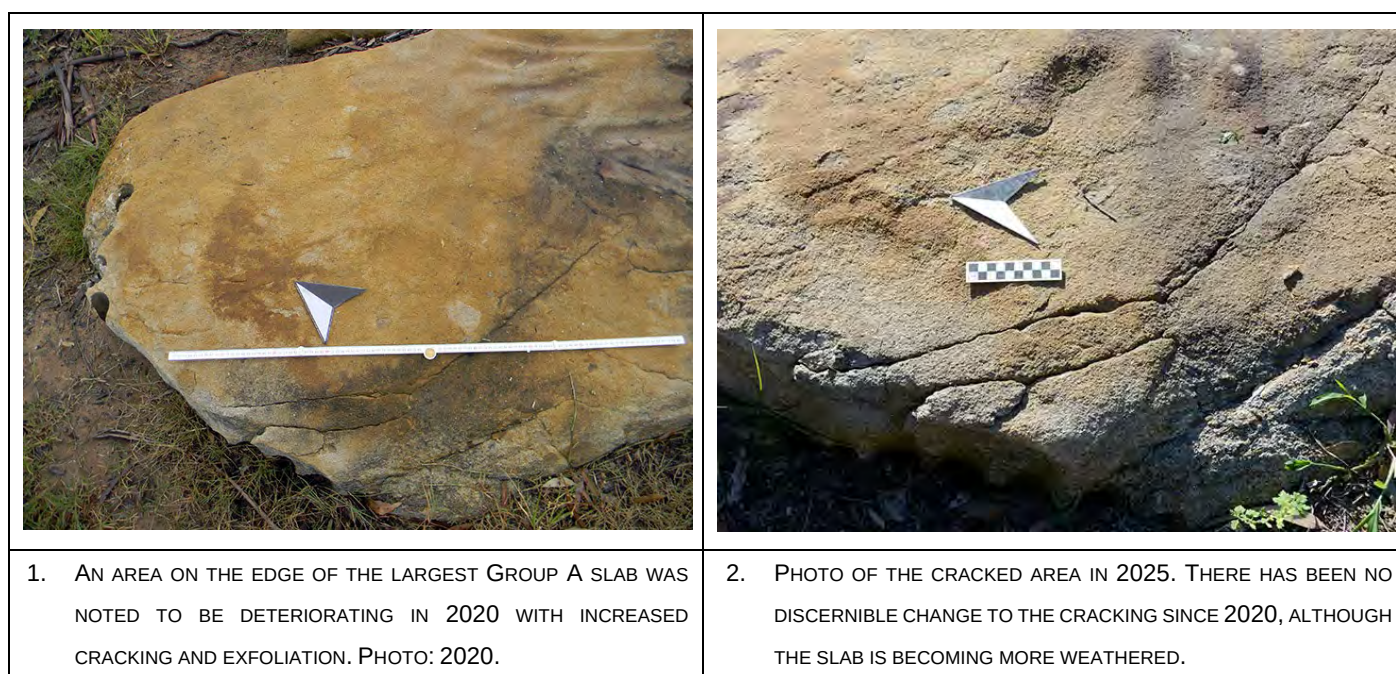


Figure 2-5. Areas of concern with the condition of Group A.



2.3.2 Photo point 6

Group B consists of two separate slabs that had broken apart prior to the removal of the grooves. As the western portion of this group was covered by other boulders prior to removal, the grooves in the western portion are more distinct when compared to the grooves on the eastern portion. The slabs are stable apart from cracks within the slabs. There has been no discernible increase in the width of the cracks in the nine and a half years separating the monitoring events.

Figure 2-6. Comparison between the 2015–2025 condition of Group B at the LCGGCA.



2.3.3 Photo Point 7

Group C consists of several slabs that had broken apart prior to the removal of the grooves. The slabs are stable apart from the pre-existing cracks between the slabs. There has been no discernible increase in the width of the cracks in the nine and a half years separating the photographic monitoring events. The groove seen clearly in the 2015 photograph still remains distinct, albeit slightly weathered, in 2025.

Figure 2-7. Comparison between the 2015–2025 condition of Group C at the LCGGCA.



2.3.4 Photo point 8

Group D consists of a single groove contained within a single slab. The slab is stable with no sign of exfoliation or cracking. There has been no discernible weathering of the area surrounding the groove in the nine and a half years separating the photographic monitoring events, although the single groove is becoming less obvious.

Figure 2-8. Comparison between the 2015–2025 condition of Group D at the LCGGCA.

	
GROUP D. SEPTEMBER 2015	GROUP D. MARCH 2022
	
GROUP D. MARCH 2024	GROUP D. MARCH 2025
	
GROUP D. APRIL 2019	GROUP D. MARCH 2025

2.3.5 Photo Points 9 and 10

Group E consists of a number of slabs that had to be cut and split from the rock shelving when the grooves were being removed. There has been no discernible weathering of the areas surrounding the grooves in the nine and a half years separating the photographic monitoring events. In 2019 some exfoliation of small

portions of rock from the edge of the slab was noticed. These portions were away from the grinding grooves and do not appear have worsened in the intervening years.

Figure 2-9. Comparison between the 2015–2025 condition of Group E at the LCGGCA.

	
GROUP E. SEPTEMBER 2015	GROUP E. MARCH 2022
	
GROUP E. MARCH 2024	GROUP E. MARCH 2025
	
GROUP E. APRIL 2019	GROUP E. MARCH 2025



GROUP E. APRIL 2019



GROUP E. MARCH 2025



VIEW OF THE SECOND GROOVE AT GROUP E IN 2022.



VIEW OF THE SECOND GROOVE AT GROUP E IN 2025.



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