

ENSHAM LIFE OF MINE EXTENSION PROJECT

Groundwater Impact Assessment

Prepared for:

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Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006

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BASIS OF REPORT

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EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) was engaged by AECOM Australia Pty Ltd (AECOM), on behalf of Ensham Resources Pty Ltd (Ensham) to assess the potential impacts of the proposed Ensham Life of Mine Extension Project (the Project) on groundwater values, in support of the impact assessment for the Project.

The scope of this groundwater impact assessment is limited to the underground mining operations proposed within the Project Area. The impacts were assessed in two ways, that is incremental (change from existing mining operations) and cumulative (change from a hypothetical no underground mining scenario).

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres (km) east of Emerald in Queensland (Figure 1). The Project proposes to increase the life of the existing underground operations by extending the underground bord and pillar mine into an area identified as the Project Area (zones 1, 2 and 3) commencing from within Mining Lease (ML) 7459, ML 70326, ML 70365, and ML 70366 to an area west of ML 70365 within part of Mineral Development Licence (MDL) 217 (Figure 2). The Project will produce at up to approximately 4.5 million tonnes per annum and would extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The extension of the underground operation using existing infrastructure means that no surface construction or surface disturbance will be required to facilitate the Project.

The hydrogeological setting of the Project Area comprises of two groundwater bearing units, the Quaternary aged alluvium and the Permian aged Rangal Coal Measures. These two key units are separated by a low permeability unit, the Rewan Group.

The Quaternary aged alluvium comprises shallow sequences of clay, silty sand and sand, underlain by basal sands and gravel. The groundwater in the alluvium shows high salinity, which makes it unsuitable for groundwater uses such as stock watering and irrigation. The alluvium is not well connected with Nogoa River, which can be concluded by the difference in salinity between the more saline alluvial groundwater and the fresher river water. Furthermore, some bores installed in the alluvium are sporadically dry, also indicating that there is no continuous recharge from Nogoa River.

The Rangal Coal Measures comprise economic coal seams interbedded with low permeability siltstone, sandstone and shale. The coal seams contain groundwater that is generally saline and not suitable for stock water supply or irrigation.

A review of potential sensitive receptors showed that there are 19 landholder bores within a 15 km radius from the Project Area. Nine are currently used for stock watering, one for irrigation and one for stock and domestic use. The remaining eight are currently not in use. Mapped groundwater dependent ecosystems (GDEs) were visualised in the vicinity of the Project Area; there are low confidence GDEs identified along the Nogoa River and a wetland south of the open-cut area of Ensham Mine. No springs were identified within a 50 km radius of the Project Area. The closest intake area for the Great Artesian Basin (GAB) is located 50 km south-east of the Project Area, which means the mine will have no impact on the recharge to the GAB.

A recent peer reviewed groundwater model for the Ensham Mine was used as the base for the groundwater model used for the groundwater impact assessment. This previous groundwater model represented both the existing underground mining and the above-ground open pit operations. The groundwater model domain extends 43 km from north to south and 35 km from east to west. The stratigraphy is discretised into 12 model layers. The groundwater model was updated with the most recent groundwater observations and the proposed mine plan for the Project was added. The model was validated against the new observation data and deemed fit for purpose to assess the Project.

Predictive groundwater modelling showed that the Project will result in additional groundwater inflow compared to the existing operations due to the proposed extended life of mine. However, the order of magnitude of inflow after the year 2028 remains similar (3 to 12 ML/day, compared to 5 to 20 ML/day for the existing operations before 2028). Modelling also showed that the incremental alluvial flux (alluvial water seeping into lower formations) is limited at approximately 0.01 ML/day, which is considered immeasurable. The Nogoa River loss into the alluvium is not predicted to change between the Null run, the existing operations and the Project.

The predicted incremental groundwater drawdown in the target coal seams at end of mining extends 5 km to the north-west and 7 km to the west and the south-west. The drawdown is limited to the extent of the coal seams in the east where the coal seams outcrop or subcrop. The cumulative drawdown extends a kilometre further, i.e. around 6 km to the north-west and 8 km to the west and south-west.

The post-mining equilibrium was calculated over a timeframe of 220 years (compared to the 17-year mine life). Some permanent reduction in water levels is predicted for the water levels in the target coal seams.

A sensitivity analysis approach was adopted to assess the model uncertainty. Nine selected model parameters were assessed, and the changes in the predictions, both from a water balance and drawdown perspective, were assessed. Parameters sensitive for the underground mine inflow predictions included coal seam hydraulic conductivity, the alluvium hydraulic conductivity, and the streambed conductance. Parameters sensitive for the Nogoa River baseflow changes are the alluvium hydraulic conductivity (horizontal and vertical) and the streambed conductance. The predicted drawdown contours are most sensitive to the coal seam horizontal hydraulic conductivity. Recharge and storage parameters were found not to be sensitive for the model predictions.

The groundwater model was then used to assess potential impacts on groundwater users. The impact assessment was carried out as incremental and cumulative for the Project only and the existing operations and Project combined, respectively. There was no predicted incremental groundwater level drawdown within the alluvium in the Project Area. However, some incremental drawdown is observed in the wider study area, specifically east of the open-cut voids. There are no predicted water levels reductions of greater than 2 m in any of the landholder bores. Jamar and Winton Creek bores show the largest incremental drawdown of 10 cm and cumulative drawdown of 17 cm. The identified GDEs and the identified wetland are not predicted to be impacted by the additional groundwater extraction and drawdown. There are no additional impacts predicted on groundwater quality. There are no predicted impacts from predicted subsidence on groundwater. There were no predicted changes to Nogoa River stream losses and no leakage from the coal seams into the alluvium has been predicted.

A comprehensive groundwater monitoring program is currently in place for the existing operations at Ensham Mine. This study recommends including five additional monitoring bores into the monitoring program after Project approval, two of which have already been installed in October / November 2019.

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Appendix N	Alluvial bore reports

1 Introduction

1.1 Overview

SLR Consulting Australia Pty Ltd (SLR) was engaged by AECOM Australia Pty Ltd (AECOM), on behalf of Ensham Resources Pty Ltd (Ensham) to assess the potential impacts of the proposed Ensham Life of Mine Extension Project (the Project) on groundwater values, in support of the impact assessment for the Project.

The scope of this study is to:

- describe the existing hydrogeological environment of the Project Area and surrounds
- assess the potential impacts of the proposed extension of underground mining on the groundwater related environment
- propose measures to manage or mitigate impacts on groundwater environmental values.

The study area for the purpose of this assessment is the extent of the groundwater model domain, which includes the Project Area and surrounds. The scope of this groundwater impact assessment is limited to the underground mining operations proposed within the Project Area.

1.2 Project background

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres (km) east of Emerald in Queensland (Figure 1). The Project proposes to increase the life of the existing underground operations by extending the underground bord and pillar mine into an area identified as the Project Area (zones 1, 2 and 3) commencing from within Mining Lease (ML) 7459, ML 70326, ML 70365, and ML 70366 to an area west of ML 70365 within part of Mineral Development Licence (MDL) 217 (Figure 2). The Project will produce up to approximately 4.5 million tonnes of coal per annum and would extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The extension of the underground operation using existing infrastructure means that no surface construction or surface disturbance will be required to facilitate the Project.

1.3 Existing infrastructure and mining operations

The Ensham Mine currently produces up to 5.2 million tonnes per annum (Mtpa) of coal for both the open-cut and underground operations. The open-cut operation is scheduled to continue to approximately 2024, followed by further rehabilitation of the open-cut mine. Current approved underground operations are due to cease in 2028. The existing underground operations within the currently approved MLs will be referred to as the “existing operations” in this report. The Project proposes to extend the underground operations into the Project Area, commencing in 2021 and operating concurrently with the existing operations until 2028.

The existing mine has been operating since 1993 and covers a strike length of over 20 km, from Pit A in the south to Pit Y (Yongala) in the north. Pit A South, A North and B are located south of the Nogoa River, with pits C, D, E, F and Y all located north of the Nogoa River (Figure 3).

Open-cut operations are decreasing due to increasing strip ratios, as the coal seams have been followed down-dip to increasing depths. Underground operations commenced in 2011, as a small trial bord and pillar mine. The main working seam followed through a portal from Pit C, progressing in a westerly direction underneath the Nogo River floodplain. The current bord and pillar underground operation is located on ML 7459 and ML 70365 and targets the combined Aries / Castor seam plies.

1.4 Proposed mining operations

The proposed Project is an extension of current underground operations utilising existing underground and surface infrastructure and processes. The Project will continue to produce at current production rates up to approximately 4.5 Mtpa. This will extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The Project is proposed to commence in 2021. The use of conventional underground mining equipment would be expected to continue for the Project.

This study assessed the potential impacts of bord and pillar mining, including the depressurisation of groundwater (i.e. the dewatering of the coal seam during mining).

Other activities associated with the development of the Project, but not assessed in this groundwater assessment are:

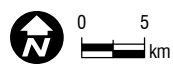
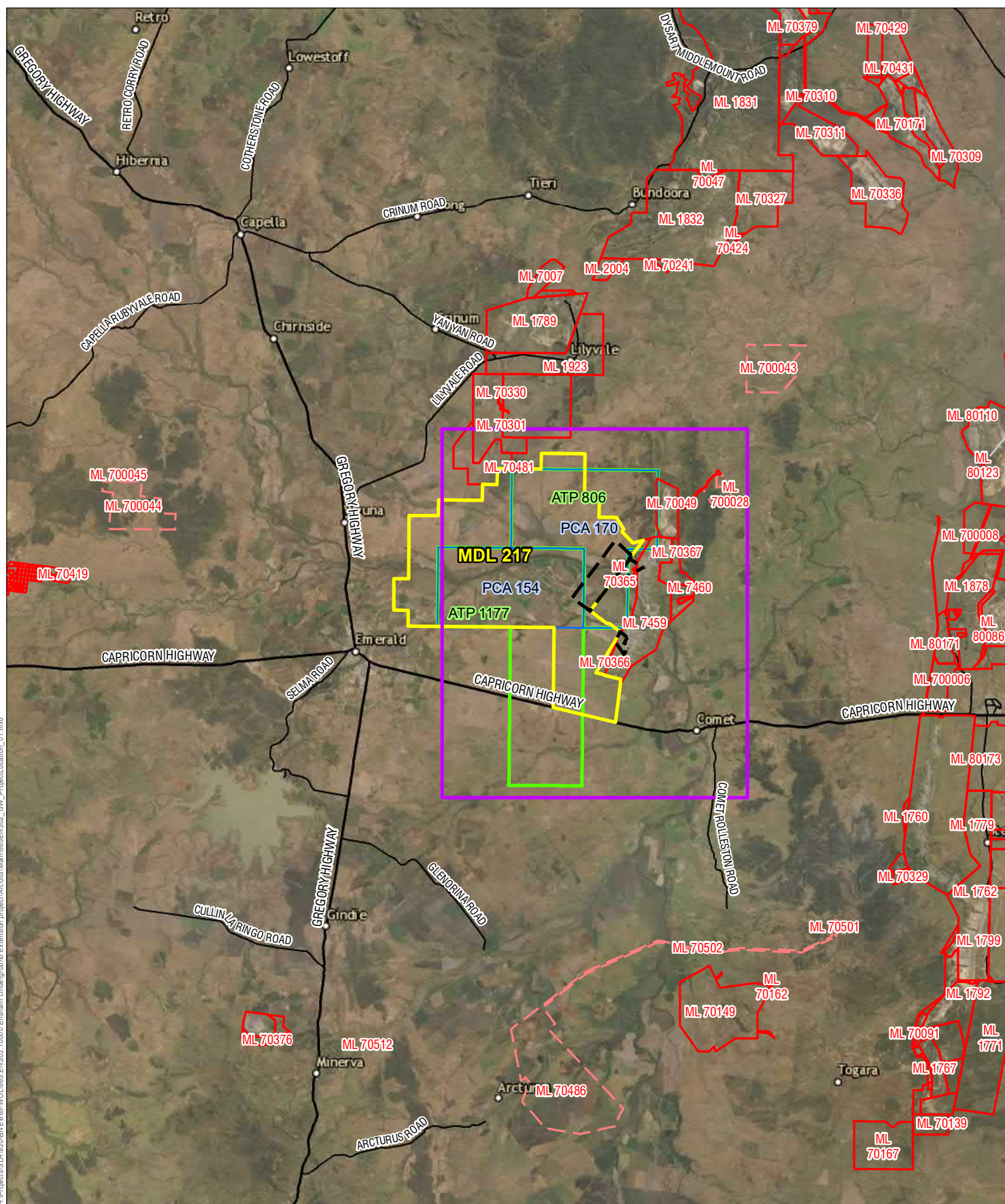
- further infill drilling activities
- transfer of coal from the Project Area from the existing underground portal in C pit to the existing run of mine (ROM) stockpile using existing overland conveyors and haul roads
- reclaiming of the ROM coal by loaders and transporting by road trains as per the current arrangements to the existing crushing plant (all located onsite)
- wastewater and sewage treatment using existing infrastructure
- ventilation supplied to the underground workings via the existing ventilation fans and associated infrastructure
- the existing rail loop and spur would be used to transport product coal via the Blackwater rail corridor to the Port of Gladstone for export.

1.5 Study objectives

The groundwater assessment was undertaken in accordance with the Queensland government requirements under Chapter 3 of the Water Act 2000 (Qld) (Water Act) and the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act), (specifically the Water Trigger, refer to Section 2.2)

To achieve the requirements of these regulatory requirements, the groundwater assessment comprised two parts:

- (i) a description of the existing hydrogeological environment
- (ii) an assessment of the potential impacts of mining on the groundwater related environment.



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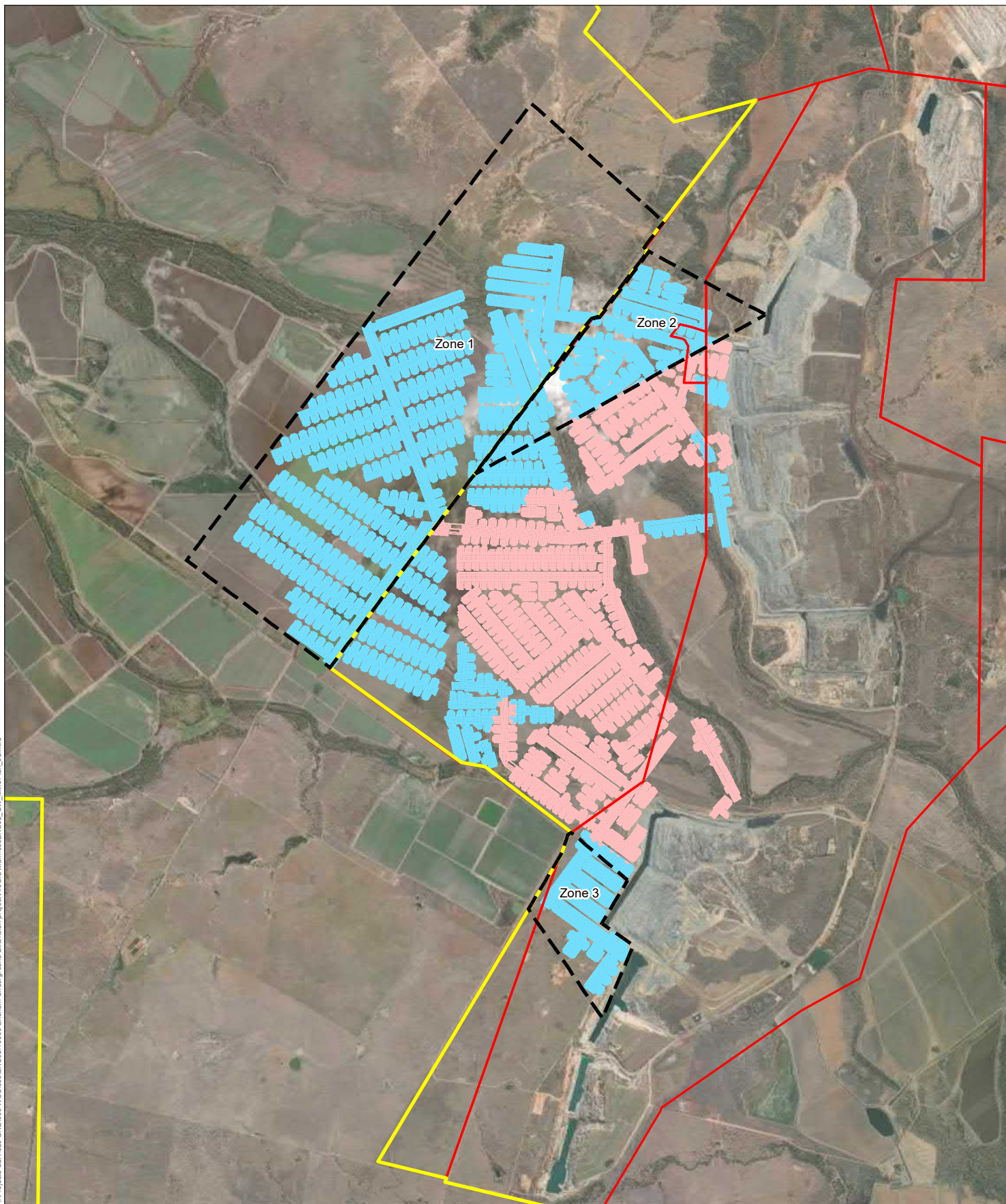
GROUNDWATER IMPACT ASSESSMENT

Project location and surrounding mine tenements

Legend

-  Mining Lease (Granted)
 Mining Lease (Application not related to the Project)
 Potential Commerical Area
 Exploration Permit for Petroleum

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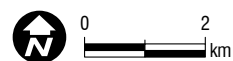
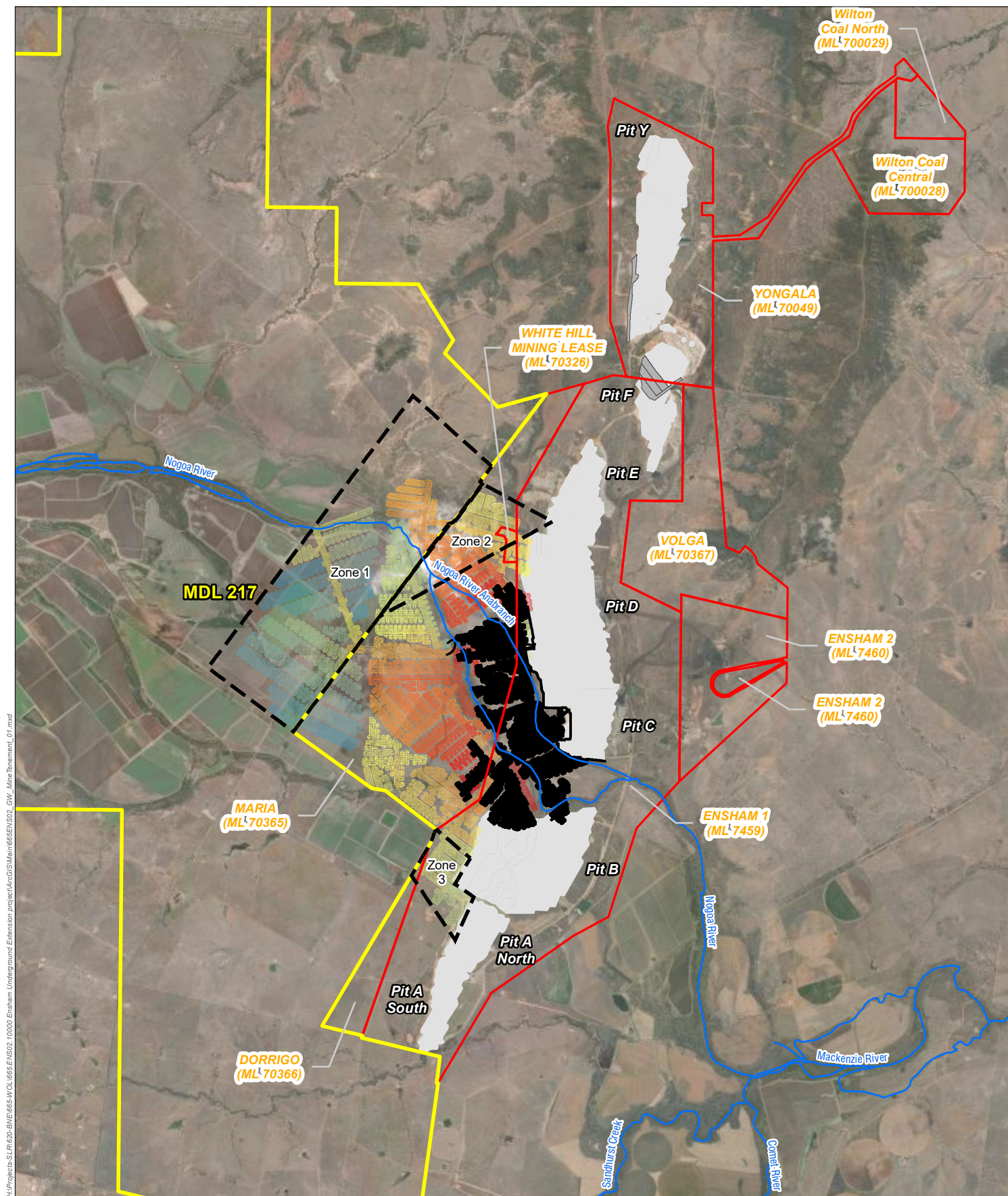
Legend

- Project Area
- Mineral Development Licence (MDL) 217
- Mining Lease
- Underground Mining Operations**
 - Existing operations
 - Project

GROUNDWATER IMPACT ASSESSMENT

Underground mine plan (Existing operations and the Project)

Figure 2



Projection: GDA 1994 MGA Zone 55
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Legend

Watercourses

Project Area

Mineral Development Licence (MDL) 217

Mining Lease

Underground Mining - Historic (2011 - 2018)

Underground Mining

2019

2020

2021

2022

2023

2024

2025

2026

2027

2028

2029

2030

2031

2032

2033

2034

2035

2036

2037

Historical Underground Mining

Open Cut to date

Open Cut future

GROUNDWATER IMPACT ASSESSMENT

Project mine tenements pit shell boundaries and underground mining areas

Figure 3

2 Regulatory Framework

The following sections summarise Commonwealth and Queensland governments' groundwater legislation and policies relevant to the Project.

2.1 Queensland regulatory framework

2.1.1 Water Act 2000

The Water Act 2000, supported by the subordinate Water Regulation 2016, is the primary legislation regulating groundwater resources in Queensland. The purpose of the Water Act is to advance sustainable management and efficient use of water resources by establishing a system for the planning, allocation and use of water. The Water Act is enacted under a framework of catchment specific Water Plans (WPs). Water resources within the Project Area are captured under the Water Plan (Fitzroy Basin) 2011 (DEHP, 2011). This WP covers the surface water (zone WQ1303) associated with lower Nogoa River and groundwaters (zone WQ1310 – Fitzroy Basin groundwaters). Further, the study area is covered by the Highlands Groundwater Management Area under the Water Plan (Fitzroy Basin) 2011.

As part of the Project, Ensham is proposing to exercise underground water rights during the period in which resource activities will be carried out in the Project Area.

2.1.2 Environmental Protection Act

In addition, minimum reporting requirements for groundwater impact assessments are outlined within the Environmental Protection Act 1994 (Qld) (EP Act) guideline requirements for site-specific and amendment applications - underground water rights. A summary of the guideline requirements and where they have been addressed within this report is provided in Table 1.

Table 1 Requirement for site-specific and amendment applications – underground water rights

Part	Detail	Section in report
Part A	A statement that the applicant proposes to exercise underground water rights.	Section 2.1.1
Part B	A description of the area/s in which underground water rights are proposed to be exercised.	Sections 3, 4 and 5
Part C	A description of the aquifer/s affected or likely to be affected	Section 5
	Aquifer type (confined, unconfined, fractured etc)	Section 5
	Geology/ stratigraphy for each aquifer	Section 4
	Depth to and thickness of the aquifers	Section 4 and Appendix B
	Physical integrity of the aquifer, fluvial processes and morphology.	Section 4

Part	Detail	Section in report
	Depth to water level and seasonal changes in levels	Section 5.2 and Appendix F
	Hydrogeological cross sections	Section 5.6
	Maps (spatial extent)	Extent of the units in Appendix B and Appendix H
Part D	An analysis of the movement of underground water to and from the aquifer	Sections 5.2
	Inputs (i.e. recharge) and outputs (i.e. baseflow and abstraction)	Section 5.2
	Underground water elevations (i.e. mapped groundwater flow directions)	Section 5.2.1
	Connectivity between aquifers and hydraulic properties	Sections 5.2 and 5.3
	Preferential flow pathways (i.e. faults)	Section 5.3.2
	Springs	Section 5.5.2
Part E	A description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights	Section 7
	Predictions should: - be made for the life of the resource project and for post resource tenure closure - be made about the timing, spatial extent and magnitude of maximum water level declines in affected aquifers - be made about the timing and magnitude of groundwater level equilibrium in affected aquifers.	Section 7 and Appendix I Appendix J Appendix K
	Produce potentiometric contour maps showing maximum predicted water level decline for each affected aquifer.	Section 6.4.3
	Modelling methodology, including: - model type (e.g. numerical or analytical) - modelling platform - model inputs - model boundary conditions - model assumptions and limitations - sensitivity analysis and calibration results.	Section 6
Part F	The predicted quantities of water to be taken or interfered with because of the exercise of underground water rights.	Section 6.4.2
	Details on the methodology used for measuring extraction volumes and developing the extraction schedule.	Section 6.3.3
Part G	Information on predicted impacts to the quality of groundwater that will, or may, happen because of the exercise of underground water rights.	Section 7

Part	Detail	Section in report
	Identify the quality of the groundwater prior to the resource activity commencing.	Section 5.4
	Explain the variation of chemical concentrations as a result of chemical reactions over the life of the Project due to the exercise of underground water rights (i.e. changes in salinity and concentration of dissolved gas).	Section 7.5
	Estimate extent and likelihood of groundwater quality impacts, with justification based on potential sources of contamination.	Section 7
Part H	Identifying and describing environmental values: - information on the environmental values (EV) that will, or may, be affected by the exercise of underground water rights - describe and define environmental value of aquifers, presenting available raw data used. Document groundwater use, including details on operating bores within the areas predicted to be affected by the exercise of underground water rights.	Section 5.5
	Nature and extent of the impacts on the EVs (risk assessment): - the magnitude, relative size or actual extent of any impact in relation to the environmental value being affected - the vulnerability or resilience of the environmental value (severity and duration) - uncertainty of impacts and any assumptions.	Section 7
	Surface subsidence impacts	Section 8.2
Part I	Information on strategies for avoiding, mitigating or managing the predicted impacts on the EVs or predicted impacts on the quality of groundwater. Strategies for avoiding, mitigating and managing the predicted impacts on both EVs and predicted changes in groundwater quality should include: - objectives which define the outcomes that are intended to be achieved (i.e. avoiding, mitigating and managing the predicted impacts) and a description of unavoidable impacts to environmental values - measures (specific methods/procedures/tools) to be implemented to demonstrate how the objectives will be achieved - indicators relevant to protection of the EVs (i.e. indicators are the values that are to be measured to gauge whether the objectives are being achieved and are used to be used in auditing the performance of measures) - a program for monitoring the indicators - a reporting program which includes triggers for the review of the strategies, and identifies additional data, assessment, analysis and reporting requirements	Section 8

2.1.3 Current Environmental Authority

The current Environmental Authority (EA), EPML00732813, for the existing mine is effective from 19 March 2020 for the following mining leases: ML 7459, ML 7460, ML 70326, ML 70049, ML 70365, ML 70366, and ML 70367 (Figure 3).

The EA conditions relevant to groundwater include C39 to C46 and Tables C10 and C11. These conditions detail monitoring and reporting requirements pertinent to groundwater level and quality. Quarterly groundwater monitoring is to be carried out for all bores included in Table C10 of the EA (refer to Table 8 for a list of EA bores) and for all parameters included in Table C11 of the EA. The monitoring network comprises site-based and regional observation bores, among which are included private landholder bores local to the mining area. The monitoring network is presented in more detail in Section 5.1.

2.2 Commonwealth

The EPBC Act outlines that where proposed large coal mining project, will have, or is likely to have, a significant impact on a matter of national environmental significance (MNES), the proposal needs to be referred to the Department of Agriculture, Water and Environment (DAWE) for assessment and approval.

MNES include:

- world heritage properties
- national heritage places
- wetlands of international importance (Ramsar wetlands)
- Nationally threatened species and ecological communities
- migratory species
- commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions including uranium mining
- a water resource in relation to coal seam gas development and large coal mining development.

The MNES of relevance to the Project are water resources. They will be assessed for a potential significant impact. In the Department of the Environment (DoE) 2013 guidelines, a significant impact is defined as follows:

“A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on the environment.”

The Project will be referred to the Commonwealth under the EPBC Act. The EPBC Act is administered by DAWE with advice from the Independent Expert Scientific Committee (IESC). The IESC is a statutory body established under the EPBC Act that provides scientific advice to the Commonwealth Environment Minister.

Due to the Bilateral Agreement between the Commonwealth of Australia and the State of Queensland (2004), only one impact assessment is required, which must meet both the State requirements and Commonwealth requirements. The impact assessment is reviewed by the State on behalf of the Commonwealth.

The IESC information requirements checklist is presented in Table 2, with details on where aspects have been addressed and documented within the report. The checklist is based on the information guidelines for proposals relating to the development of coal seam gas and large coal mines where there is a significant impact on water resources (IESC, 2015).

Table 2 IESC information requirements checklist

Detail		Section in report
1	Description of the proposal: • purpose • location • scale • proposal's status within the regulatory assessment process • character • duration • means by which a significant impact on water resources is likely • water management policies or regulations applicable to the proposal	Sections 1 and Section 2
2	Does the contextual information include details of the:	
	Water resources of the site and region	Sections 3.2 and Section 5
	Geological sequence of the area, including names and descriptions of the formations	Section 4
	Hydraulic characteristics for each hydrogeological unit	Section 5.3
	Likely recharge sources, direction of discharge and discharge pathways for all hydrogeological units	Section 5.2
	Assessments of the frequency, volume and direction of interactions between water sources	Section 5.2
	Relevant information generated by a bioregional assessment, or best available information	This report
	Geology and hydrogeology at an appropriate level of spatial and vertical resolution	Sections 4 and Section 5
	Geological structures and their influence on groundwater	Section 5.4 and 5.3.2
	Depths to the hydrogeological units and associated standing water levels or potentiometric heads, including contours maps and hydrochemical characteristics	Section 4, Section 5, Appendix B
	Descriptions of hydrology, water quality data and geomorphology for all watercourses across the site	Section 3.2
	Water related assets	Section 3.2
	Conceptual modelling	Section 5.6

Detail		Section in report
3	Model-data analysis builds on background data and conceptual modelling to enable an analysis. The information provided should include:	
	Surface water and groundwater assessments and modelling, including detailed hydrology and water quality assessments	This report and surface water report
	Quality of and risks and uncertainty inherent in the data and modelling	Section 6.5
	Has a groundwater model that is calibrated to baseline conditions and enables a probabilistic evaluation of potential future scenarios been provided? Does the groundwater modelling include:	
	The model conceptualisation of the hydrogeological system or systems, including key assumptions and model limitations	Sections 6.3 and Section 6.7
	The various stages of the proposed development and predictions of water level / pressure declines in each hydrogeological unit	Sections 6.3.4 and Section 7
	The volumes predicted to be dewatered with an indication of the proportion supplied from each a hydrogeological unit	Section 0
	Consider a variety of boundary conditions for stream across model domain	Section 6.3.3 and Section 6.5.2.2
	Be undertaken in accordance with the Australian groundwater modelling Guidelines, including being peer reviewed	Section 6.6
	Each hydrogeological unit, including storage and flow characteristics, their existing recharge / discharge pathways and any linkages between units	Sections 5 and 5.2
	Maximum drawdown and the time for post development drawdown equilibrium to be reached	Sections 6.4.3 and Section 6.4.5
	Potential water level recovery rates and timeframes for each hydrogeological unit	Section 6.4.5
	Include a sensitivity analysis of stream boundary conditions and justification of the conditions applied in the final model	Section 6.5.2.2
	Recommendations and a program for review and update of the model	Section 8
	Do the water and salt balances provide details on specific flows and changes, including:	
	Any changes that occur to the salt loads of the groundwater and surface water systems	See surface water assessment
	Water infiltration from surface stores	See surface water assessment
	Waste water from the operation	See surface water assessment
	Volumes and quality of water used during mining	See surface water assessment
	All interactions and flows that exist that are part of the background (baseline) water flows	Section 5.2

Detail		Section in report
	Hydrogeological unit storage properties and groundwater flows and pressures resulting from depressurisation	Section 5.3
	An estimation of flow / exchange of water between hydrogeological units and the target coal measure	Section 6.4.4.1
	All volumes and quality of water intended for injection	Not applicable
	Any water that must be imported from elsewhere	Not applicable
	Estimates of water use in transpiration by vegetation, and the predicted changes to vegetation water use	Sections 5.2 and 7.2
4	Does the assessment of impacts include details of:	
	Likely changes to water and salt balances	See surface water assessment
	The hydrogeological units that will be directly impacted by mining operations	Section 7
	Impacts on hydrological interactions between water resources	Section 6.4.4
	Impacts associated with surface water diversions	See surface water assessment
	Impacts on hydraulic properties of hydrogeological units	See subsidence report and Section 8.2
	Effects of depressurisation due to gas extraction	Not applicable
	The quality and quantity of operational discharges of water	See surface water assessment
	Landscape modifications	Not applicable
	The cumulative impacts (see section titled Assessment of cumulative impacts):	
	Cumulative impacts with other existing or planned major projects were addressed qualitatively. No cumulative impacts were expected due to distance or target coal seam.	Section 3.3.2 (qualitative)
	Cumulative impacts of existing operations plus the Project were address quantitatively. All results in Section 6 and onwards labelled as “cumulative” refer to the impacts due to the existing operations plus the Project compared to a hypothetical “no underground mining after September 2018” case	Section 6.4 and 7 (quantitative)
	Proposed mitigation actions for each identified impact	Section 8
	Subsidence and effects from dewatering and depressurisation	Section 8.2 and Subsidence report
	The hydrogeological units that will be dewatered or indirectly impacted by dewatering	Section 6.4
	The extent of the cone of depression and consequential impacts on water resources	Section 6.4.3 and Section 6.4.4
	Direct and indirect impacts on water related assets	Section 8

Detail		Section in report
	Potential for physical transmission of water within and between hydrogeological units	Section 6
	Estimates of likelihood of leakage of contaminants from coal beds through geological formations	Not addressed as part of this study
	Vulnerability to contamination and likely impacts of contamination on water related assets	Not addressed as part of this study
	Long term impacts from final landform design	Section 6.4.5
	Measures taken to avoid and minimise impacts	Section 8
5	Does the assessment of cumulative impacts include:	
	A summary of coal seam gas and large coal mining developments within the region	Section 3.3.2
	Existing and planned water entitlements, and the actual take of water for consumptive, industrial and agricultural purposes	Section 5.5
	The proportional increase in water resource use	Section 6.4.4
	Catchment and regional scale information (from bioregional / other relevant assessments)	This report
	Existing water quality guidelines, targets, environmental flow objectives and requirements for the surface catchment and groundwater basin	Section 2.1.1 and Appendix D
	The overall level of risk to water related assets	Section 7
6	Does the assessment of risk identify:	
	Water related assets in the area	Section 7
	The likelihood and consequence of impacts occurring	Section 7
	The overall level of risk to assets that combine probability of occurrence with consequence or severity of impact	Section 7
	Potential impacts to water related assets	Section 7
	The magnitude or severity of impact in the event that the impact was to occur	Section 7
	The residual risk following the application of mitigation measures	Section 7
7	Does ongoing management and monitoring (groundwater) include:	
	A robust monitoring plan to inform management and mitigation of all impacts identified through the assessment	Section 8
	Comprehensive baseline monitoring dataset prior to commencement of the development	Section 5.4 and Appendix C, D, E and F
	The hypotheses to be tested	Section 8
	The analytical methods to be used	Section 8
	Water quality monitoring that is managed in accordance with the relevant National Water Quality Management Strategy (NWQMS) guideline	Section 8

Detail		Section in report
	Regular reviews and revisions of the monitoring program	Section 8
	Clearly defined monitoring objectives and performance indicators	Section 8
	Maps and coordinates of monitoring locations	Section 8, Figure 56
	The ability to capture seasonal and inter-annual variability and enable valid statistical analysis of results	Section 8
	Groundwater, surface water and associated ecological attributes and be capable of tracking changes from pre-development conditions	Section 8 and Surface water and ecology assessment
	The rationale and design for the monitoring program	Section 8
	The temporal and spatial frequency of monitoring and the potential indicators to be monitored	Section 8
	The identified triggers and threshold and proposed management actions if levels are reached and exceeded	To be merged with existing WMP
	A commitment to regular reporting of findings from monitoring programs, including raw data, analysis of data, and the results and conclusions	Section 8
	An adaptive management approach to manage changes in the predicted impacts	Section 8
	A description of local and regional surface water regime/s and detailed historical baseline data against which monitoring results can be assessed	Existing GWMP
	The number and spatial distribution of monitoring sites and monitoring frequency	Section 8
	A monitoring network that extends beyond the predicted impact area	Section 8.4.1
	A network to collect sufficient physical aquifer parameters and hydrogeochemical data to establish pre-development (baseline) conditions	Section 8.4.1
	Dedicated groundwater monitoring wells	Section 8.4.1
	Information on the groundwater regime, recharge and discharge processes and identify changes over time in the groundwater system	Section 8.4.1
	A comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events	Section 8.4.2
	Specific aquifers for monitoring and management	Section 8
	Appropriate management responses to mitigate impacts to groundwater resources	Section 8

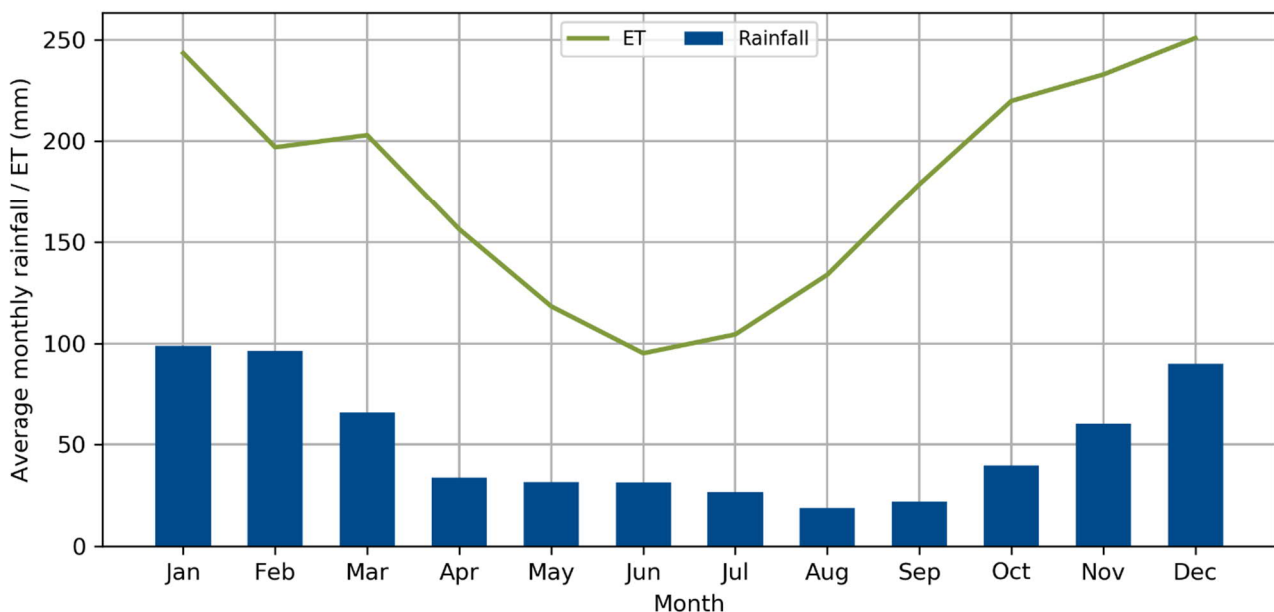
3 Existing conditions

3.1 Climate

The Central Highlands region has a sub-humid, sub-tropical climate, with distinct wet and dry seasons. Long-term rainfall, evaporation and temperature data sourced from Emerald Post Office (Bureau of Meteorology (BoM) station 35027) shows a long-term mean annual rainfall of approximately 650 mm with most of the precipitation occurring during the summer months of December, January and February. The Scientific Information for Land Owners (SILO) data (Jefferey, 2001) for rainfall and pan evaporation at this station (patched with surrounding stations after station closure in 1991) is presented on Figure 4.

For each month, evaporation is approximately two to three times greater than the average monthly rainfall (Figure 4). Evapotranspiration takes place where water table is close to ground surface and / or within root zone depths (typically 1-2 m away from creek lines). Within the study area the highest rates of potential evapotranspiration are along creek and river lines, in particular Nogoa River, Winton Creek and Boggy Creek, where the water table is closer to ground surface and deeper rooting vegetation exists.

Figure 4 Average monthly rainfall and evaporation at Emerald Post office (1900-2019)



Long-term annual rainfall data (1900-2019) and cumulative rainfall departure (CRD) calculated from 1900 to 2019 are presented on Figure 5. The CRD is used in the discussion of the observed groundwater levels (refer to Section 5.2) as a means to characterise climatic conditions (e.g. dry and wet climatic conditions).

Site data are also available from 2007 onward. A comparison between monthly rainfall recorded at the Ensham Mine and monthly rainfall sourced from SILO for Emerald Post office is presented on (Figure 6). The data are reasonably consistent between the two data sets, with some local events being captured at one of the two sites only. Examples are January 2008 (Emerald Post office higher than site) and December 2010 (site rainfall higher than Emerald Post office). The highest monthly rainfall recorded at the site are, in a decreasing order: December 2010, March 2019, February 2010, March 2011 and March 2017.

Figure 5 Long-term annual rainfall statistics and CRD for Emerald Post office (1900-2019)

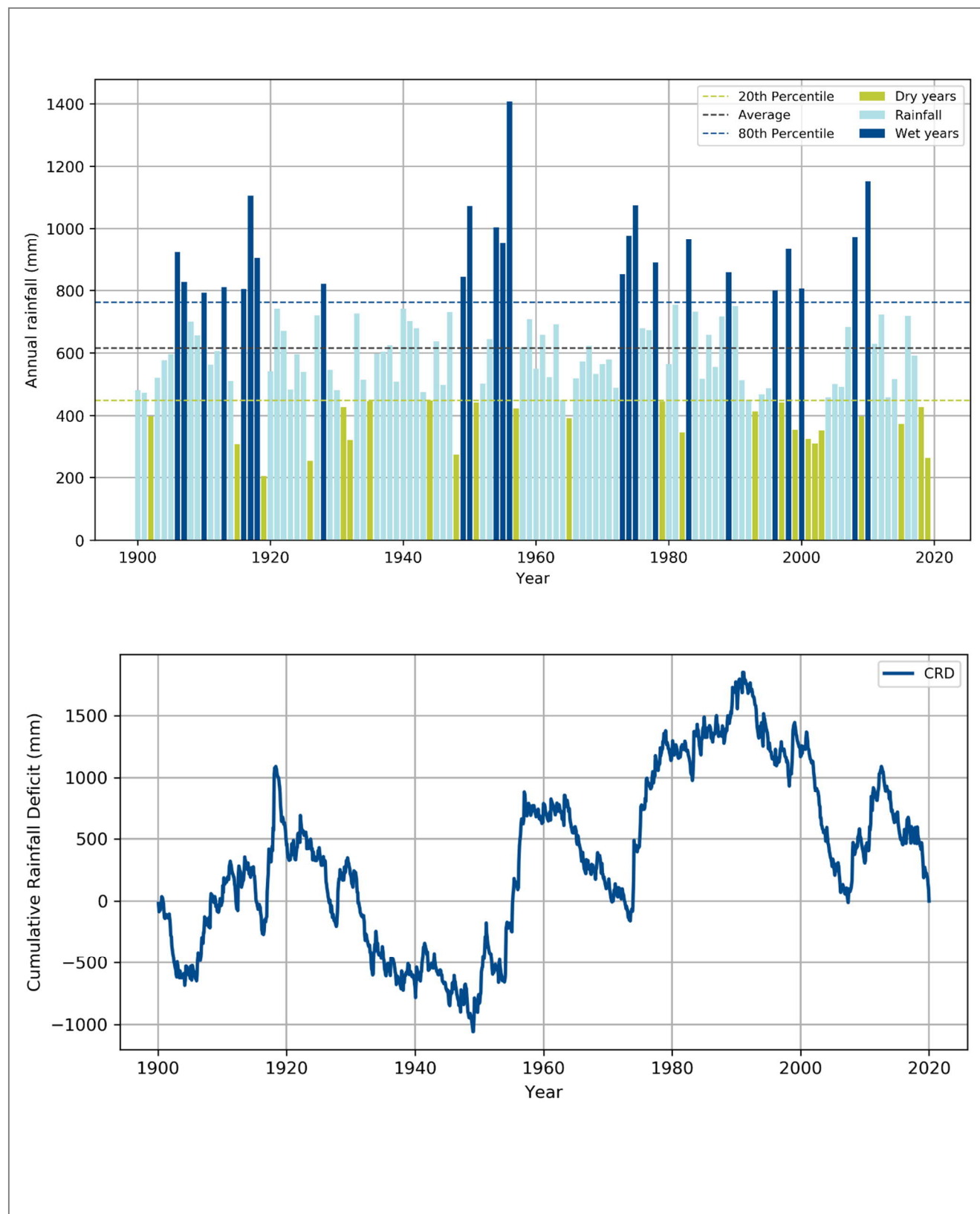
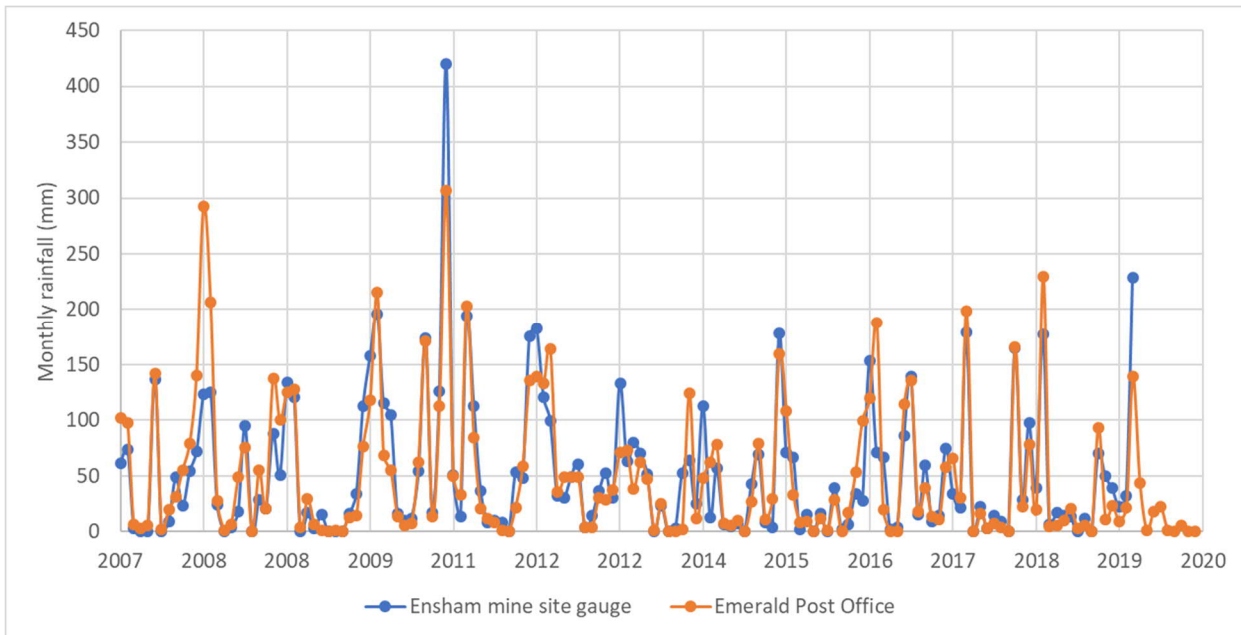


Figure 6 Monthly rainfall at Ensham Mine and Emerald Post office (2007-2019)



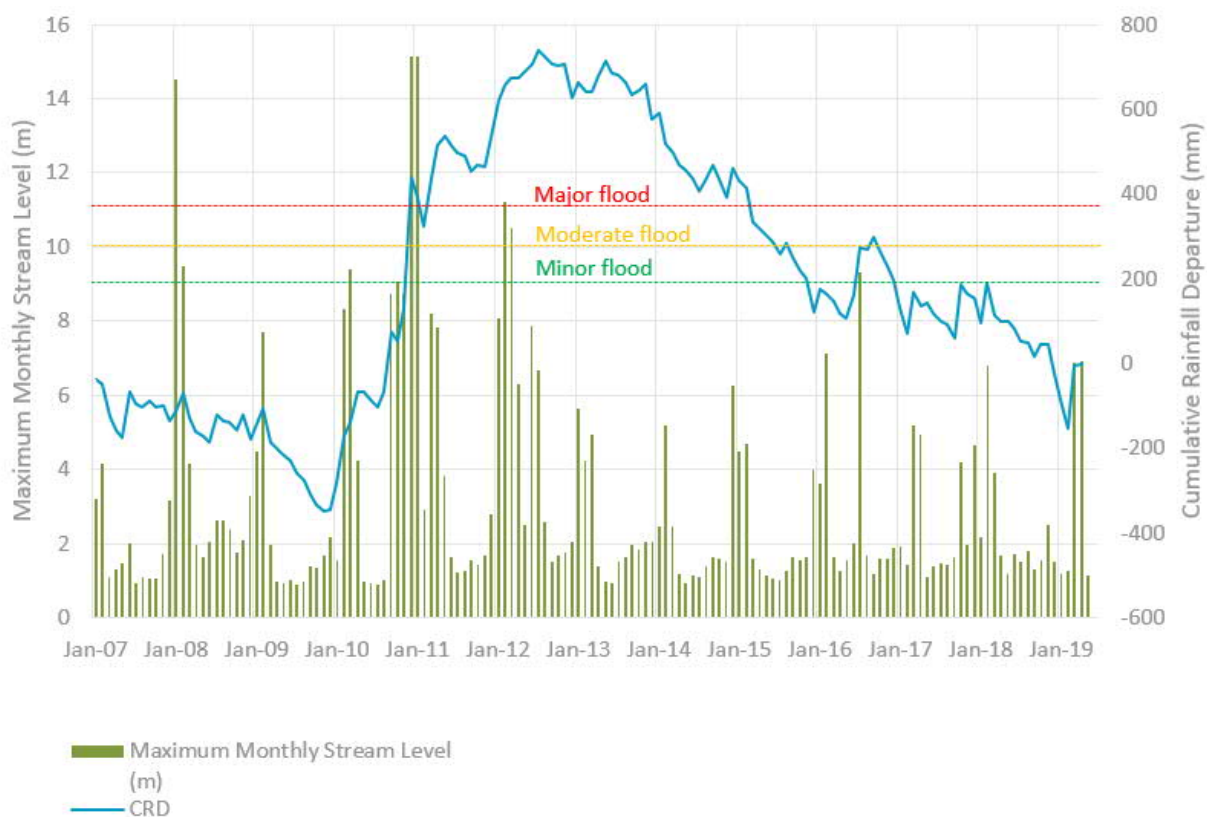
3.2 Topography and drainage

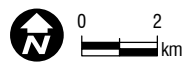
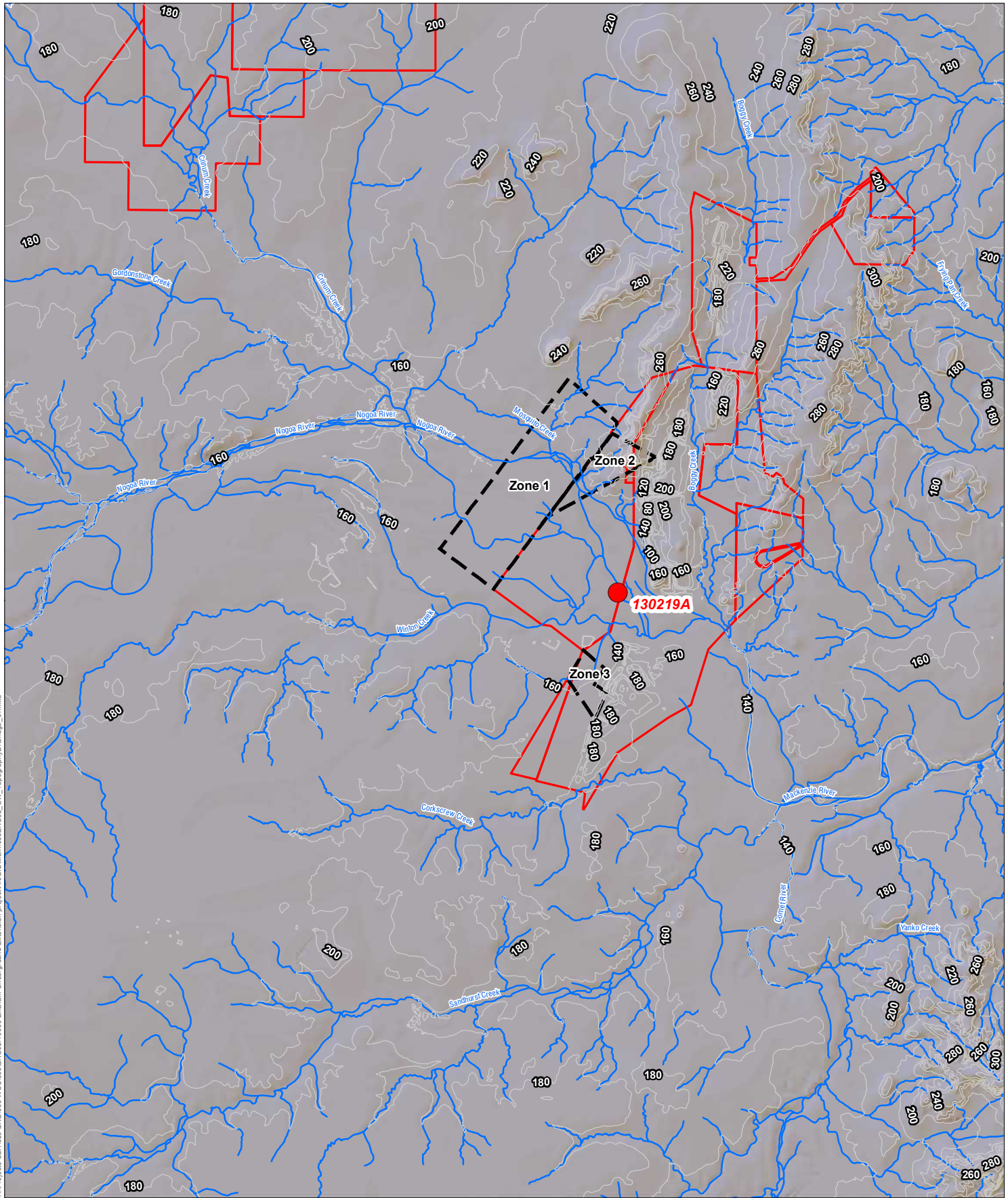
The terrain in the study area is generally low-lying, and the few hills within the area are capped by duricrusts. The main drainage of the area is via the Nogoa River, which flows in an easterly and south-easterly direction through the Ensham mining leases before joining the Mackenzie River near the town of Comet. In the study area, the elevation of the Nogoa River banks average 150 mAHD. The Nogoa River is used for irrigation and stock water supply, with flow maintained by releases from Fairbairn Dam south of Emerald. The low-lying area includes floodplains and riparian zones along the Nogoa River and an anabranch which runs to the north of the Nogoa River (Figure 8).

Stream flow data for the Nogoa River is collected at Department of Natural Resources, Mines and Energy (DNRME) Nogoa River stream station 130219A (Duck Ponds) on a daily basis. Figure 7 shows the monthly mean of maximum river level recorded at Duck Ponds compared against the CRD which is based on rainfall measured on site. As shown on Figure 7, between 2009 and 2012 the Project Area experienced above average rainfall and stream levels, followed by a gradual decline in rainfall to below average conditions between 2014 and 2016. Above average rainfall events between 2016 and 2018 were driven by peak flows associated with events of 1:10 annual exceedance probability and these correspond to multiple stream level peaks. Low maximum stream levels since the beginning of 2018 have been the result of relatively low rainfall conditions and regulation of releases from Fairbairn Dam. The recent positive trend in CRD is caused by rain events recorded during March 2019.

Bureau of Meteorology (BoM) (2018) classifies flood levels for station 130219A as minor, moderate and major for water level at respectively 9, 10 and 11 m above the riverbed. According to this classification, January 2008 and December 2010 have been two major flood events and January 2012 has been a moderate flood event. The latest flood event was minor in July 2016 (Figure 7).

Figure 7 Maximum monthly level for Nogoa River plotted against CRD





Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS002.10000
Date: 26/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- DNRME Gauge Station #130219A (Nogoa River at Duck Ponds)
- Contour (mAHD)
- Watercourses
- Project Area
- Mining Lease

GROUNDWATER IMPACT ASSESSMENT Topography and drainage

Figure 8

3.3 Land use

Land use in the greater surrounding of the study area is predominately agricultural and mining. In addition, there are a number of coal seam gas (CSG) developments proposed in the area. These land uses are discussed in the sections below.

3.3.1 Agriculture

Agricultural activities include dry land cropping, cattle grazing and cropping (mainly irrigated cotton growing).

In the vicinity of the Project, two areas of regional interest from the Regional Planning Interests Act 2014 (Qld) area applicable:

- priority agricultural areas (PAAs)
- strategic cropping areas (SCAs).

A PAA is an area of regionally significant agricultural production in which at least one area must be used for priority agricultural land use (PALU). PALUs applicable to the area are summarised in Table 3. PAAs and SCAs located in the Project Area are mapped on Figure 9.

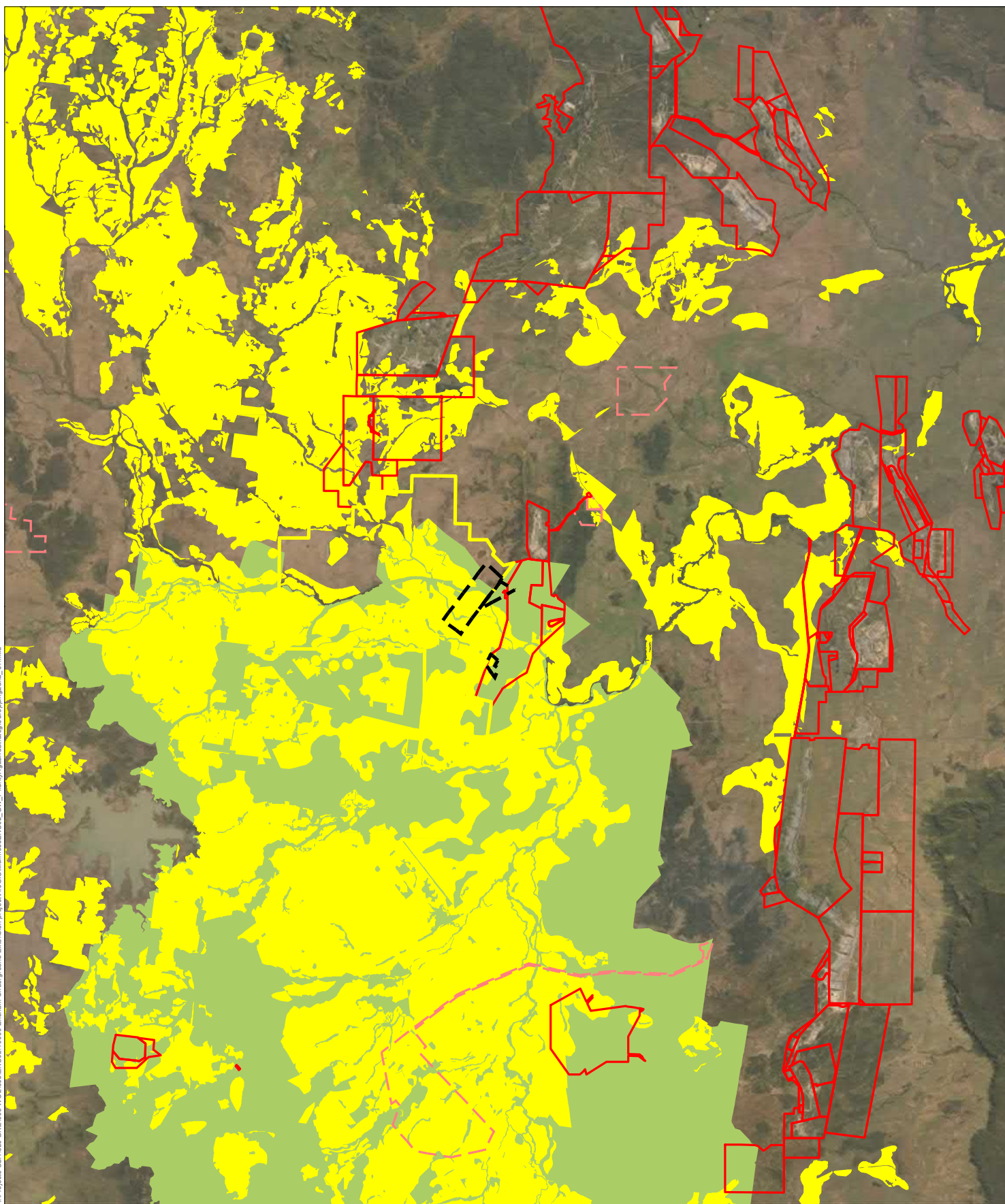
Table 3 Priority agricultural land use in the Central Queensland regional plan area

3 Production from dryland agriculture and plantations	4. Production from irrigated agriculture and plantations	5. Intensive uses
3.3.0 Cropping	4.1.0 Irrigated plantation forestry	5.1.0 Intensive horticulture
3.4.0 Perennial horticulture	4.2.0 Grazing irrigated modified pastures	
3.5.0 Seasonal horticulture	4.3.0 Irrigated cropping	
	4.4.0 Irrigated perennial horticulture	
	4.5.0 Irrigated seasonal horticulture	
	4.6.0 Irrigated land in transition	

In addition to the PAA, the Project Area is located within the SCA Western Cropping zone. SCAs are land that are deemed highly suitable for cropping because of a combination of the land's soil, climate and landscape features (DILPG, 2014).

The Project is an underground mine with no above-ground disturbance within the Project Area. Potential groundwater-related impacts will be discussed by assessing the indirect take from the alluvium and potential impacts on landholder bores.

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02-10000-Ensham Underground Extension project\ArcGIS\Main\665ENS02_GW_PriorityAgriculturalCropping_and_01.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:600,000

Project No.: 665.ENS02.10000
Date: 26/02/2020
Drawn by: SLR Consulting
Sheet Size: A4

Legend

- Project Area
- Mineral Development Licence (MDL) 217
- Mining Lease (Granted)
- Mining Lease (Application, not related to the Project)
- Strategic Cropping Land
- Priority Agricultural Land

GROUNDWATER IMPACT ASSESSMENT

Priority Agricultural Areas and Strategic Cropping Land in the vicinity of the project

Figure 9

3.3.2 Mining

The Project Area is located in an existing mining precinct with several coal mines operating nearby. Table 4 lists operating and proposed mines in a radius of 50 km from the Project Area. Mine operations located within 30 km from the site are detailed in Section 3.3.2.1 to Section 3.3.2.3. All of these mines target different coal seams than those targeted by the Project, such that cumulative impacts are not expected due to the interbedded low permeability layer (aquifers) separating the coal seams (also refer to Section 4.4).

The mines located further than 30 km from the Project Area are listed in Table 4 but have not been discussed further. Of the six mines further than 30 km away, five are targeting the Rangal Coal Measures (same Coal Measures as the Project), however, the distance makes it unlikely that cumulative impacts from other coal mines in the region will occur. Hence, the groundwater model did not include any other mining operations. The cumulative impacts quantified in this report refer to the impacts from existing underground operations and the Project.

Table 4 Proposed and current mining operations within 50 km from the Project

Mine	Status	Type	Planned Start	Planned End	Distance from Project (km)	Target Coal	Surface water Catchment
Wilton	Proposed	Open-cut	2019	TBD	15	Fairhill Coal Measures	Upper Mackenzie
Kestrel	Operating	Underground	1992	2032	20	German Creek Coal Measures	Nogoa
Gregory Crinum	Operating	Open-cut and underground	1979	TBD	25	German Creek Coal Measures	Nogoa
Fairhill	Proposed	Open-cut	2019	TBD	25	Fairhill Coal Measures	Upper Mackenzie
Oaky Creek	Operating	Open-cut and underground	1982	2033	35	German Creek Coal Measures	Upper Mackenzie
Curragh	Operating	Open-cut	1983	2025	40	Rangal Coal Measures	Upper Mackenzie
Jellinbah	Operating	Open-cut	1989	TBD	45	Rangal Coal Measures	Upper Mackenzie
Blackwater	Operating	Open-cut	1967	2040	40	Rangal Coal Measures	Upper Mackenzie
Yarrabee	Operating	Open-cut	1982	TBD	40	Rangal Coal Measures	Upper Mackenzie
Grasstree	Operating	Underground	2002	2047	45	German Creek Coal Measures	Upper Mackenzie
Foxleigh	Operating	Open-cut	1999	2028	50	Rangal Coal Measures	Upper Mackenzie

3.3.2.1 Gregory Crinum and Kestrel

The Gregory Crinum and Kestrel mines are located 25 km and 20 km north-west of the Project, respectively. Both operations target the German Creek Coal Measures that underlie the Rangal Coal Measures targeted at Ensham Mine.

Sojitz recently acquired the Gregory Crinum Mine (GCM), previously owned and operated by BHP Mitsubishi Alliance (BMA). Gregory open-cut mining operations commenced in 1979 while the Crinum underground mining operation started in 1997. The mine ceased production and was placed on care and maintenance by BMA in November 2015. Sojitz has resumed operations in October 2019.

The Kestrel Mine, owned by Kestrel Coal Resources and Mitsui Investments, is an underground coal mine which currently produces 7-8 Mtpa of predominantly hard coking and some thermal coal and more than 5 Mtpa of product. Mine life is currently estimated at 35 years with 2017 reserves of 146 Mt and resources of 241 Mt (QRC, 2019).

Both GCM and Kestrel share the same numerical groundwater flow model. According to the 2015 model update by AGE (2015), the maximum extent of drawdown in all hydrogeological units was predicted to be less than 15 km from the two mines. Therefore, as the mines are located over 20 km from the Project and are mining the Coal Seams in the German Creek Coal measures, there is limited potential for cumulative impacts.

3.3.2.2 Wilton

The Wilton Coal Project (WCP) is a proposed open-cut coal mine located 15 km north-east of the Project. WCP aims to excavate the high ash coal of the Burngrove Formation (Burngrove Seam), which will be trucked to established mining facilities at the Gregory Crinum Mine for processing. Approximately 1.65 Mtpa of export quality thermal and coking coal products is expected to be produced from the WCP.

An analytical model developed by Northern Resources Consultant (NRC, 2018) predicted that some private bores intersecting the Burngrove Formation could be impacted by the WCP (Table 5).

Table 5 Predicted drawdown at private bores from the Wilton Coal Project

Registered RN (ID)	Bore name	Easting (mMGA)	Northing (mMGA)	Bore depth (m)	Use	Geology	Predicted drawdown from WCP (m)
89383	Yongala	657586	7415693	74	Stock	Burngrove Formation	1.9
89382	-	657253	7415184	74	Stock	Burngrove Formation	1.4
89384	-	657691	7416083	78	Stock	Burngrove Formation	2.6

The WCP targets the Burngrove Formation, which underlies the Rangal Coal Measures targeted at the Ensham Mine. Due to the structural geology, discussed further in Section 4, the Rangal Coal Measures are absent at the WCP. Therefore, there is limited potential for cumulative impacts between the WCP and the Project.

3.3.2.3 Fairhill

The Fairhill Coal Project (FHCP) is located 25 km north-east of the Project. The FHCP tenement covers a total exploration area of approximately 3,045 ha. The FHCP is a proposed open-cut mine, proposed to produce a maximum of 1.7 Mtpa of primarily coking coal extracted from coal seams of the Fairhill Formation, which underlies the Burngrove Formation.

Mining operations proposed at the FHCP site are scheduled to last for seven years and will include the development of a shallow greenfield open-cut mine targeting coal from the Fairhill 1 and 2 coal seams. The operation will be by cut and fill method with the mine excavation progressing from east to west. The pit will reach a minimum elevation of 130 mAHD, leaving a final void 20 m to 30 m deep.

A 2D numerical groundwater flow model was developed by SLR for the FHCP (SLR, 2019a). The model predicts a drawdown radius of 4.5 km from the open-cut pit. The groundwater assessment findings for FHCP and the geology of the site indicates there is no potential for cumulative impacts between the FHCP and the Project.

3.3.3 Petroleum

A number of exploration permits of varying types were identified within the Project Area. Table 6 identifies the allocation type, permit number, and holder of these existing permits. The location of those permits is also shown on Figure 1.

The target coal seams for ATP 806 and associated PCA 170 are the Rangal Coal Measures, the same as targeted by the Project (Golder, 2017). The exact location of the potential CSG extraction wells is unknown.

For ATP 1177 and associated PCA 154, two well completion and abandonment reports were identified on GeoResGlobe (GeoResGlobe, 2020). These reports showed that two exploration wells were drilled into the Bandanna Formation (an equivalent for the Rangal Coal Measures), where they ended. As these coal measures are the shallowest of the Blackwater Group, it is interpreted that the potential future CSG wells would target the same coal seams as the Project.

Table 6 Exploration permits across the Project Area

Allocation type	Permit Number	Purpose	Expiry date	Holder
Authority to Prospect	ATP 806	Petroleum	16 July 2022	Ome Resources Australia Pty Ltd (75%) and CNOOC Coal Seam Gas Company Pty Ltd (25%)
Potential Commercial Area - Petroleum	PCA 170	Petroleum	16 July 2022	Ome Resources Australia Pty Ltd (75%) and CNOOC Coal Seam Gas Company Pty Ltd (25%)
Authority to Prospect	ATP 1177	Petroleum	30 November 2021	Denison Gas (Queensland) Pty Ltd
Potential Commercial Area – Petroleum	PCA 154	Petroleum	25 June 2029	Denison Gas (Queensland) Pty Ltd

4 Geology

The Project is located in the geological western Bowen Basin, which is one of five major foreland sedimentary basins formed along the eastern side of Australia during the Permian period. The Bowen Basin is the largest productive coal basin in the country. The Bowen Basin stretches from Townsville to south of the Queensland-New South Wales border in a north to south direction. In the southern parts, the extent of the Bowen Basin and the hydrogeological GAB overlap. The Rewan Formation is recognised as the base aquitard of the GAB (Habermehl, 1980 and 1998). An aquitard is defined as a geologic formation or stratum that lies adjacent to an aquifer and that allows only a small amount of liquid to pass. In the study area, the Rewan Group is present at subcrop. The Clematis Sandstone, an aquifer of the GAB is not present. The closest intake area (i.e. outcrop of the Clematis Sandstone) is located 50 km southeast of the study area.

The stratigraphic sequence across the study area comprises unconsolidated Quaternary aged sediments unconformably overlying consolidated Permian and Triassic aged sequences (Figure 10). The Permian and Triassic strata form regular layered fluvio-deltaic sedimentary sequences, while the Quaternary sediments are more complex and irregular. The coal deposits mined at Ensham Mine are found within the Rangal Coal Measures, which is the uppermost Permian unit (Figure 11).

The surface geology of the Project Area is dominated by the Nogoa River alluvium to the south and the Tertiary Sediment to the south and the north (Figure 10).

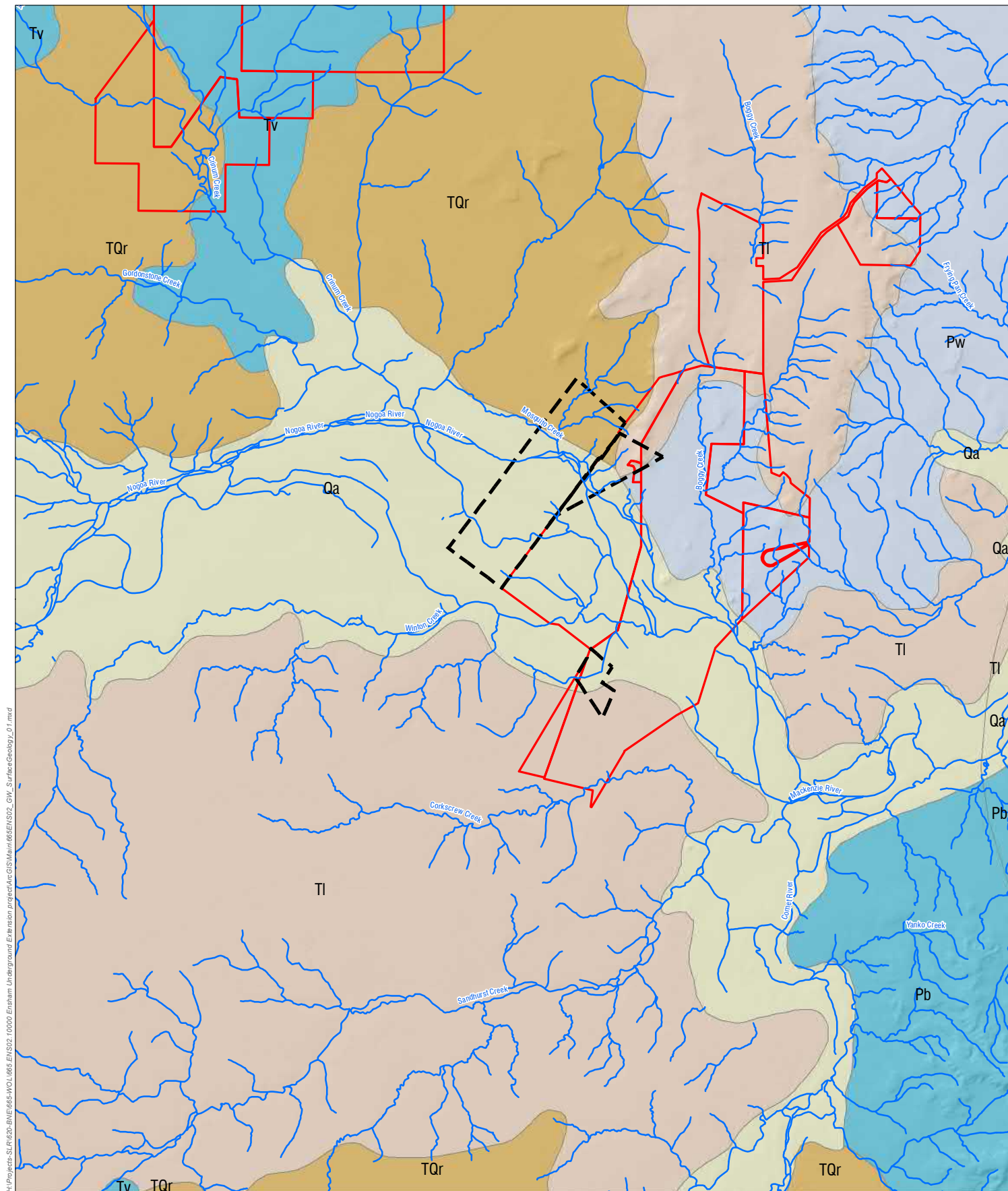
Table 7 provides a summary of the stratigraphy encountered in the study Area. Discussion on each of the main stratigraphic units relevant to the Project is included in Section 4.1 and Section 4.4, and details on the structural geology provided in Section 4.5. Appendix B presents the interpolated extent and thickness of all formations as well as the elevation of the base of each layer for the greater Ensham Mine area.

Table 7 Summary of stratigraphy in the study area

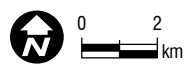
Age	Unit	Max Thickness ¹ (m)	Description
Quaternary	-	25	Alluvium - silt, clay, sand and gravel
Tertiary	-	ND	Duricrusted palaeosols at the top of deep weathering profiles, including ferricrete and silcrete; duricrusted old land surfaces
	Emerald Formation	50	Fluvatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt; all deeply weathered in outcrop
	Basalt	ND	Tertiary volcanics (basalt) mapped as being present over 10 km west of the site
Triassic	Rewan Group	200	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base); deposited in a fluvial-lacustrine environment.
Permian	Rangal Coal Measures	125	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams. Coal seams include the Aries, Castor, Pollux and Orion seams. The main economic seams at Ensham are the Aries 2 and Castor seams. Deeper seams include the Pollux and Orion seams.
	Burngrove Formation	200	Sandstones, siltstones and mudstones, and banded coal seams frequently interbedded with tuff and tuffaceous mudstones - coal seams include the Virgo and Leo seams.
	Fair Hill Formation	150	Lithic and feldspathic labile sandstone, siltstone, mudstone and conglomerate
	Macmillan Formation	100	Lithic and feldspathic sublabile mudstone, siltstone and sandstone

¹ Approximate maximum thickness based on available exploration holes and/or relevant literature

ND: not defined, not enough data available



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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 630.11929
Date: 26/02/2020
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Legend

- Watercourses
- Mining Lease
- Project Area

Quaternary

- Quaternary alluvium (Qa)
- Tertiary**
- Paleocene-Oligocene sediments (TI)
- TQr-QLD (TQr)
- Td-QLD (Td)

Triassic

- Rewan Group (Rr)
- Permian**
- Blackwater Group (Pw)
- Back Creek Group (Pb)

GROUNDWATER IMPACT ASSESSMENT

Surface Geology

Figure 10

4.1 Quaternary alluvium

The Quaternary age alluvial sediments unconformably overlie the Triassic age Rewan Group and Permian age coal measures. A weathering surface is evident at the unconformable contact.

Within the Nogoa River floodplain, the alluvial sequence comprises silt and clay underlain by a basal unit of sand and gravel. The alluvium is itself overlain by a deep clay-rich black soil, which tends to be highly absorbent during rainfall events. The alluvial sequence varies in thickness, with a maximum observed depth of 25 m.

4.2 Tertiary age sediments

Tertiary formations include the duricrusted paleosols on top of deep weathering profiles (labelled as “Tertiary QLD” in the state geology database, accessed via QLD Globe) and the Emerald Formation. The Emerald Formation primarily consists of fluvial and lacustrine claystone, siltstone, sandstone and mudstone, all deeply weathered in outcrop. Tertiary age volcanics (basalt) are mapped as being present over 10 km west from the site (HydroSimulations, 2018).

4.3 Triassic age Rewan Group

The Rewan Group overlies the Permian coal measures and occurs as in-fill material, thickening to the west with the dip of the coal measures and thin to the east where the coal measures occur at outcrop (Figure 38). Where present, the Rewan Group has a distinct greenish tint (non-marine deposits containing glauconite) in colour and is composed of siltstone and mudstone, with interbeds of lithic and volcanic sandstones.

Based on exploration holes and groundwater bore holes, the Rewan Group is not expected to be more than 200 m thick in study area. In the Project Area it is around 50 m to 150 m thick. In the Project Area, the Rewan Group forms an aquitard between the coal and the alluvium and is the basal aquitard of the Great Artesian Basin.

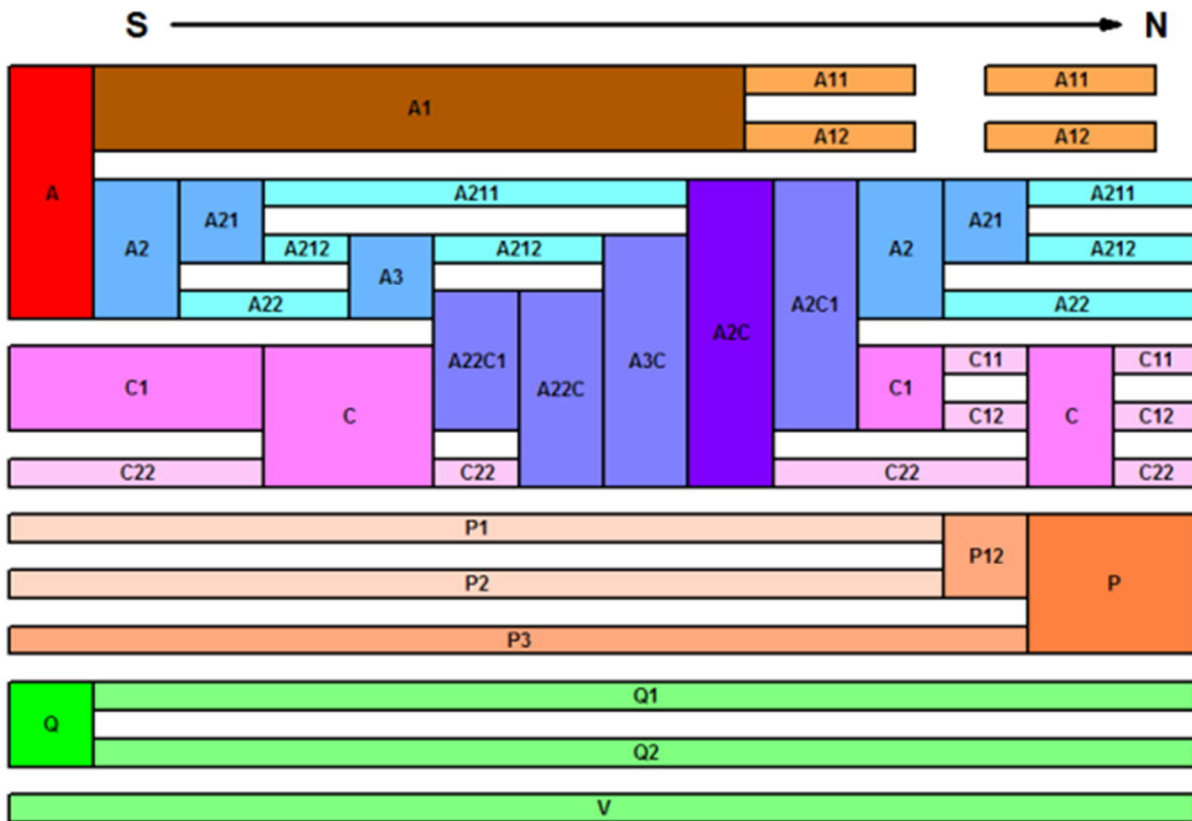
4.4 Permian Rangal Coal Measures

The Rangal Coal Measures consist of interbedded sandstone, siltstone, mudstone, and coal with tuff (towards the base) and have a thickness of up to 100 m in the study area. The coal seams outcrop / subcrop over a strike length of about 80 km in north-south direction at the Ensham Mine to the east of the Project Area. To the north of Project Area, the outcrop / subcrop changes direction and is showing east to west. The shape of the outcrop / subcrop can be seen on Figure 11. It forms part of the syncline basin plunging to the south-west.

The coal seams targeted at Ensham Mine include the Aries A1 Seam, Aries 2-Castor Seam (A2C) which has combined average thickness of 4.3 m, and the Castor Seam Lower Split (C22) which is between 0.2 m and 0.4 m thick. The seams are separated by a mudstone parting that varies between 0.1 m and 0.4 m in thickness. The Pollux Seam is a banded seam and is only mined within the Yongala (Y Pit) where it is close to the C22 Seam (AGE, 2006).

The targeted seams for the Project are the thickest Aries and Castor Seams (A2C1, A2C, A3C, A22C and A22C1) and Castor Seam (where the Aries seams thin out). A schematic representation of the coal seam stratigraphy across the area studied by (Gordon Geotechniques, 2016) is presented on Figure 12.

Figure 12 Coal seam stratigraphy of the Rangal Coal Measures



4.5 Structural geology

The structural geology of the Bowen Basin includes major north-west to south-east trending faults, like the Jellinbah Fault and Yarrabee Fault located over 40 km east of the Project. However, no regional-scale faults have been mapped within the study area.

The Permian age lithostratigraphy at Ensham Mine outcrops on the eastern side of a syncline structure that is plunging to the south-west (Figure 38). The Permian and Triassic sediments, intersected within the Ensham open-cut, dip in a westerly direction at generally less than five degrees towards the synclinal axis.

There is limited mapped information available with regards to faults in the region. AGE (2006) reported that, where present, faulting is generally normal, trending east to west, to south-east to north-west, with throws of less than 10 m, although occasional low angle thrust faulting has been noted. The local faults are presented on Figure 23 in Section 5.3.2.

5 Hydrogeology

The principal groundwater bearing strata in the study area are associated with the Permian coal seams and the Quaternary alluvium. The siltstones and sandstones that make up the majority of the overburden are considered aquitards.

This section discusses each of the hydrogeological units relevant to the Project, describing groundwater hydrology (groundwater occurrence, hydraulic gradients, recharge and discharge), hydraulic properties, groundwater quality and groundwater use and management. The existing conceptual model (HydroSimulations, 2020) for the study area refined with the most recent groundwater monitoring dataset with a focus on the Project Area.

5.1 Current groundwater monitoring

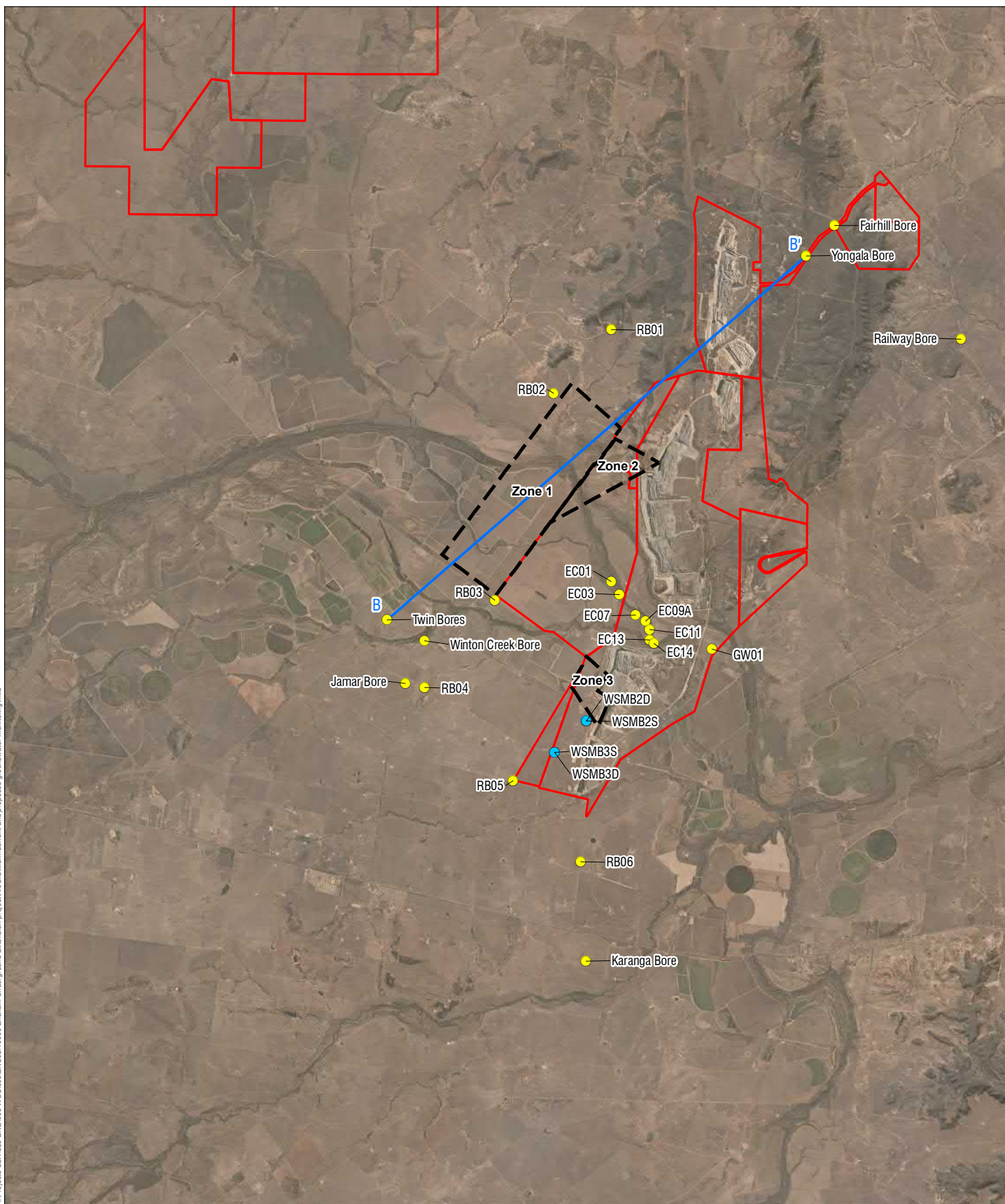
The existing mining activity at Ensham Mine is operating under EA permit EPML00732813, which specifies a groundwater monitoring program. This groundwater monitoring program is presented in Table C8b of the EA and reproduced in Table 8. All bores are monitored on a quarterly basis, including private landholder bores (dependent on landholder access). An additional four bores (WSMB bores) on the western edge of Pit A and Pit B are also monitored but are not included within the EA conditions. The location of the bores listed in Table 8 is presented on Figure 13. The current EA trigger levels are presented in Appendix A.

Table 8 Monitoring network

EA location	Monitoring point	Easting (GDA94)	Northing (GDA94)	Ground elevation (mAHD)	Screen Interval (mBGL)	Aquifer
Nogoa River Alluvium	EC01	650018	7403059	154.3	14-17	Alluvium
Nogoa River Alluvium	EC03	650338	7402547	153.2	12.3-15.3	Alluvium
Nogoa River Alluvium	EC07	650973	7401746	153.9	12.6-15.6	Alluvium
Nogoa River Alluvium	EC09A	651354	7401504	153.5	15.1-18.1	Alluvium
Nogoa River Alluvium	EC11	651517	7401192	152.7	14.3-17.3	Alluvium
Nogoa River Alluvium	EC13	651517	7400776	152	12.2-15.2	Alluvium
Nogoa River Alluvium	EC14	651676	7400653	146.1	8.7-11.7	Alluvium
Nogoa River Alluvium	GW01	653934	7400423	~153	To 19.8	Alluvium
Regional bores (Ensham Mine)	RB01	650018	7412835	187.73	95.5 – 97.0	Rangal Coal Measures – Coal (A2C)
Regional bores (Ensham Mine)	RB02	647787	7410365	160.6	137.5 – 143.5	Rangal Coal Measures – Coal
Regional bores (Ensham Mine)	RB03	645503	7402324	156.49	205.25 – 208.25	Rangal Coal Measures – Coal (A2C)
Regional bores (Ensham Mine)	RB04	642784	7398932	175.89	237.1 – 240.1	Rangal Coal Measures – Coal (A21)
Regional bores (Ensham Mine)	RB05	646209	7395311	173.35	227.3 – 230.3	Rangal Coal Measures – Coal (A21)

EA location	Monitoring point	Easting (GDA94)	Northing (GDA94)	Ground elevation (mAHD)	Screen Interval (mBGL)	Aquifer
Regional bores (Ensham Mine)	RB06	648836	7392168	177.06	54 – 59	Rangal Coal Measures – Coal (A2C)
Additional (not in EA)	WSMB2S	649062	7397630	173	43 - 49	Rangal Coal Measures – Overburden
Additional (not in EA)	WSMB2D	649059	7397630	173	97 - 107	Rangal Coal Measures – Coal
Additional (not in EA)	WSMB3S	647826	7396413	174	6.0-21.0	Rangal Coal Measures – Overburden
Additional (not in EA)	WSMB3D	647826	7396410	174	60 - 72	Rangal Coal Measures – Overburden
Regional bores (Private Property)	Karanga (Bore A)	649043	7388304	172.97	0 - 50	Coal Measures (not specified)
Regional bores (Private Property)	Winton Creek (Bore 4)	642771	7400758	157.31	To 60	Rewan Group
Regional bores (Private Property)	Twin (Bore 5)	641319	7401567	158.39	To 18	Basal Alluvium
Regional bores (Private Property)	Jamar (Bore 7)	642025	7399084	183.43	To 90	Rewan Group
Regional bores (Private Property)	Yongala (RN89383)	657586	7415693	266	65 - 71	Burngrove Formation
Regional bores (Private Property)	Fairhills (RN89380)	658696	7416877	265	42 - 54	Burngrove Formation
Regional bores (Private Property)	Railway (RN90140)	663591	7412470	181	18 - 61	Fair Hill Formation

mBGL – metres below ground level



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
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Legend

- Existing EA monitoring network
- Existing Ensham Mine monitoring bores
- Cross section B-B'
- Project Area
- Mining Lease

GROUNDWATER IMPACT ASSESSMENT

Current groundwater monitoring

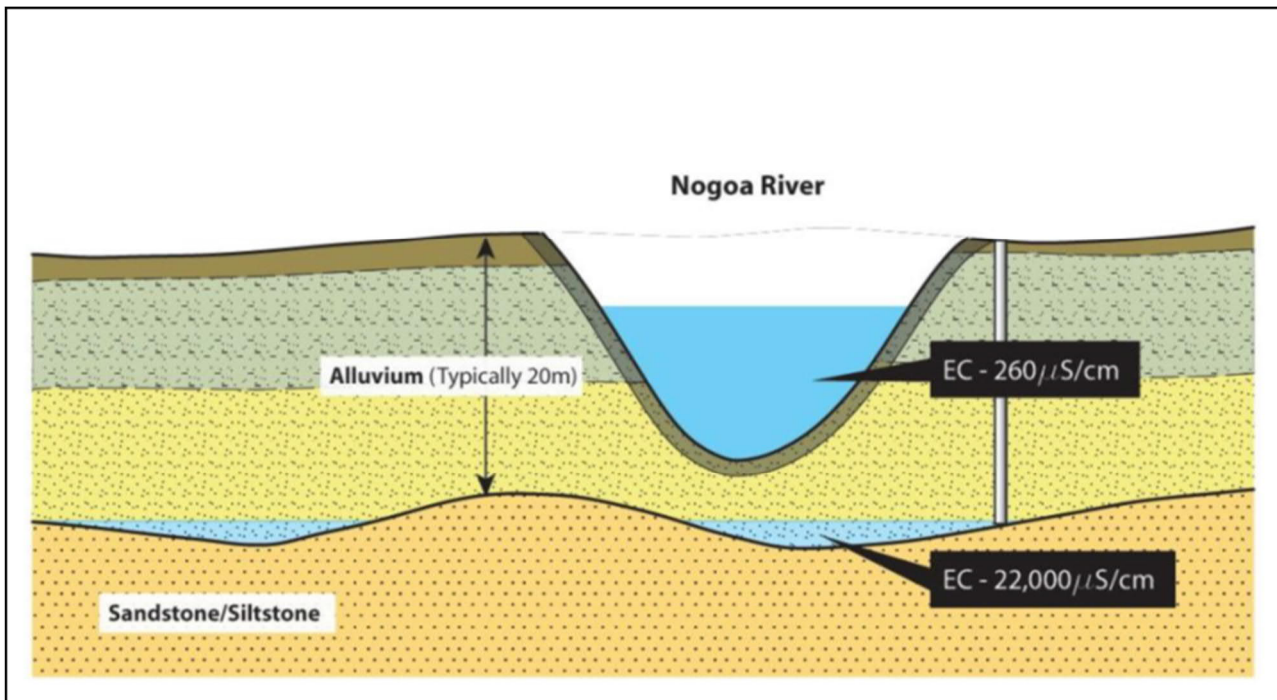
Figure 13

5.2 Groundwater levels, flow, recharge and discharge

5.2.1 Quaternary sediments (alluvium)

Figure 14 shows a conceptual cross section of the alluvium around the Nogoa River (AGE, 2006). The upper part of the alluvium comprises silts and clay and may limit recharge. The silts and clays are underlain by a more permeable layer of sands and gravels (referred as basal gravel or basal alluvium). The shallow silts and clays are anticipated to be partially isolating the Nogoa River, limiting leakage from the river into the basal sands and gravels. It is possible that leakage may occur where these clays are absent or where the basal sands are exposed within the river. However, there is no data conforming or rejecting this hypothesis. This hydraulic separation of the alluvium from the Nogoa River means that whilst the water in the river is fresh, the underlying alluvium can be brackish to highly saline (Figure 14). The updated historical groundwater quality dataset (as discussed in Section 5.4) confirms the poor quality of the groundwater in the alluvium, which is generally brackish to highly saline.

Figure 14 Conceptual cross section through Nogoa River and quaternary sediments (Source: AGE 2006)

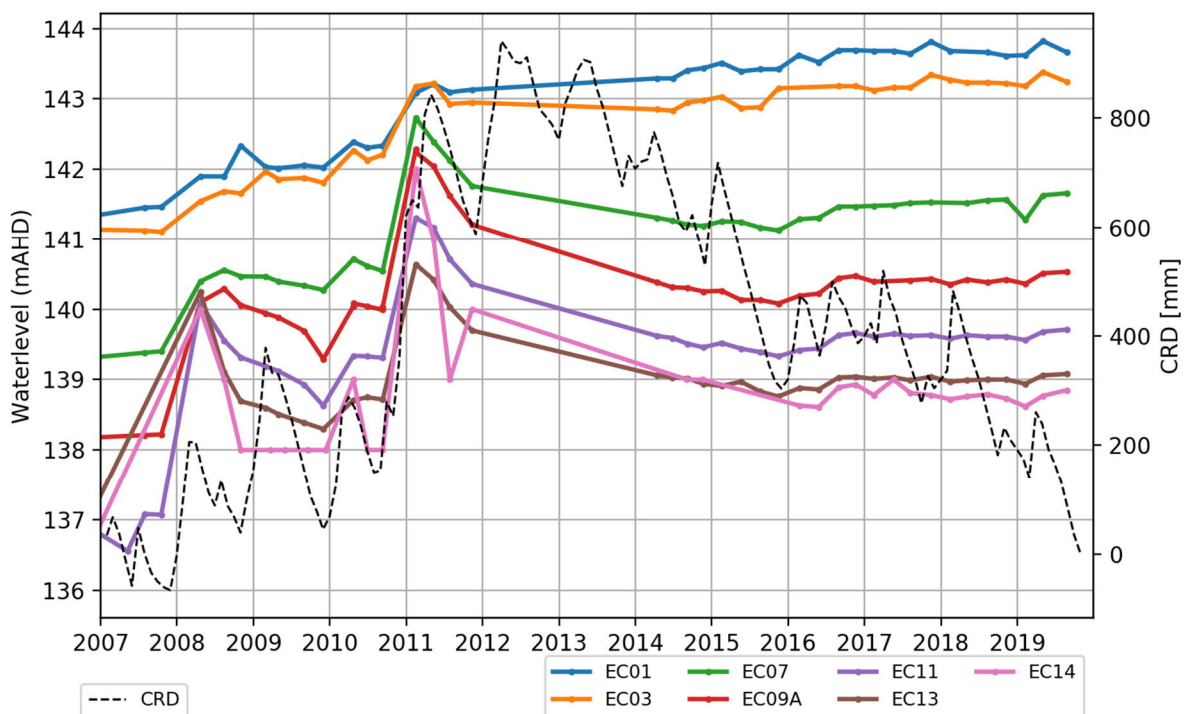


An investigation in the study area in 2004 (AGE 2006) found that groundwater occurrence in the alluvium was highly variable with thin saturated zones of poor-quality water in deeper sections of an otherwise largely unsaturated formation. As part of the investigation, 23 shallow alluvial bores were drilled in the alluvium, of which nine were dry at the time of drilling. Water levels in the remaining bores ranged from 7.2 metres below ground level (mBGL) to 17.9 mBGL, with an average of 13.8 mBGL. Some bores of the EC series that were found to be dry have been removed from the regular monitoring program. In the most recent groundwater monitoring round (August 2019), the water level in the EC-bores series (where water was encountered) was between 7.25 mBGL and 15.02 mBGL, with an average of 11.74 mBGL.

Groundwater level trends for the site alluvial bores are presented on Figure 15. The hydrograph shows groundwater level response in the alluvium to a flood in late 2010 and a slight decline in groundwater levels with periods of below average rainfall, as indicated by the CRD in the figure. The results show potential recharge to the alluvium from rainfall and streamflow in localised areas where the surficial clays are absent or under peak flood events.

The area south-east and west of the Ensham Mine, on the floodplain and to the south of the floodplain, is also dominated by intense agricultural activity and associated irrigation, sourced from the Nogoa River and channel water from Fairbairn Dam. The effect of irrigation is limited. The only example of a probable irrigation effects are the trends for bores EC01 and EC03, as shown on Figure 15. Both bores record a slight rising trend in groundwater levels from 2015 irrespective of climate and streamflow trends. This trend is not visible in bores further to the east and away from irrigation areas.

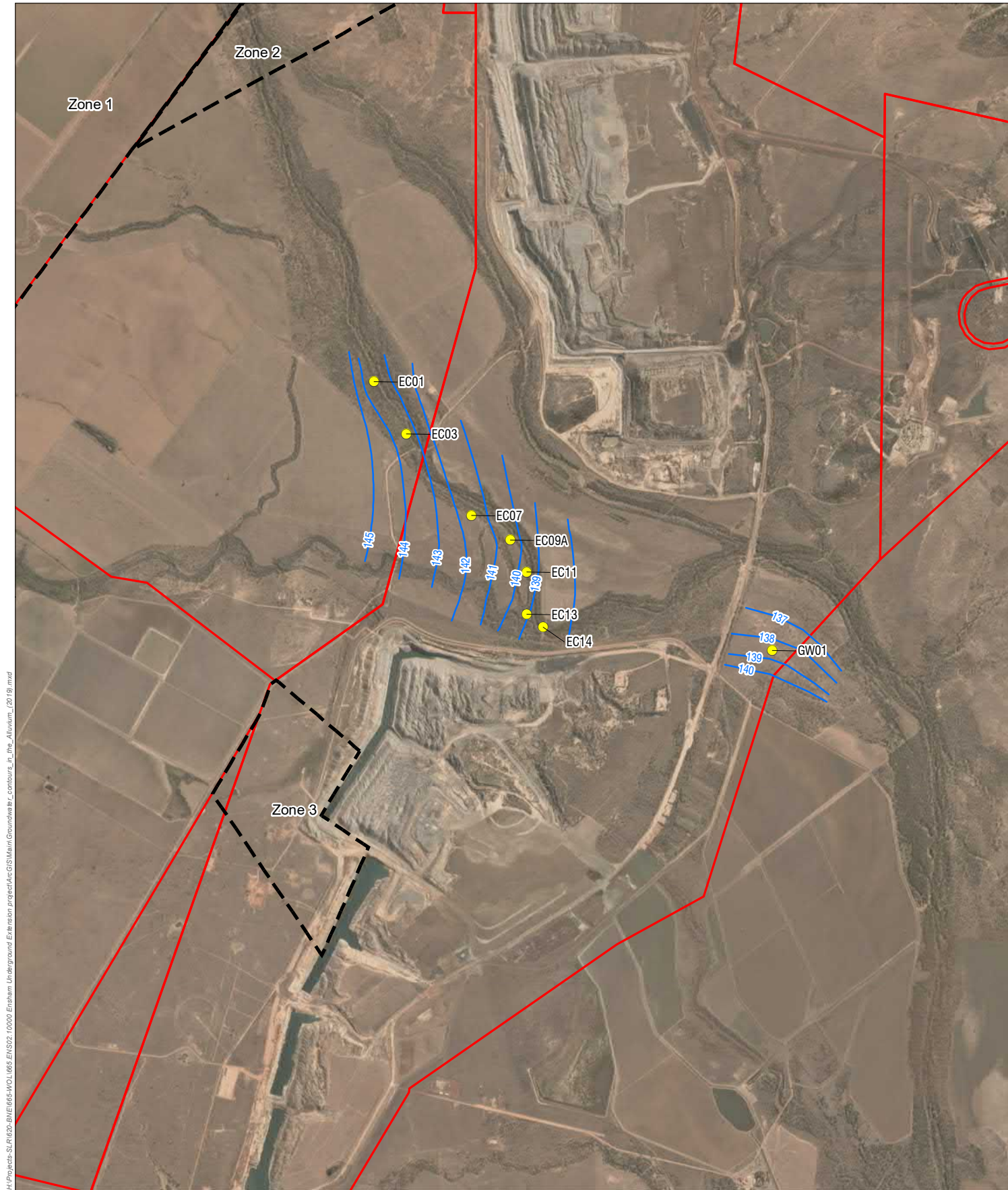
Figure 15 Hydrographs for EC bores showing groundwater level in bore and CRD



AGE (2017) and HydroSimulations (2020) stated that recharge to the alluvium may also include potential upward seepage from the underlying Rewan Group and Permian aged Coal Measures (where present). There are currently no bores that can provide evidence of this potential upward seepage. A Vibrating Wire Piezometer has been installed in November 2019 in the Project Area to monitor the vertical gradients at one location.

Groundwater–surface water connectivity is discussed in more detailed in Section 5.2.4.

Groundwater flow in the alluvium follows topographical gradients, which is from north-west to south-east in the vicinity of the Project. To visualise the groundwater contours, the water level data from August 2019 (SLR, 2019b) of alluvial bores was interpolated using the kriging method. The resulting contours are presented on Figure 16. The groundwater flow direction in the alluvium is from north-west to south-east and follows the Nogoa River flow direction. As noted earlier, the alluvium might not be saturated continuously; the interpolated contours are the best approximation; however, the alluvial groundwater might not be connected, but rather form stagnant lenses with unsaturated regions (indicated by dry bores), as reflected in Section 5.4.1.1.



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Projection: GDA 1994 MGA Zone 55
Scale: 1:50,000

Project No.: 665.ENS02.10000
Date: 26/02/2020
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Legend

- Water Level Contours (mAHd)
- Existing EA monitoring network
- Project Area
- Mining Lease (Granted)

GROUNDWATER IMPACT ASSESSMENT

Groundwater contours in the Alluvium (2019)

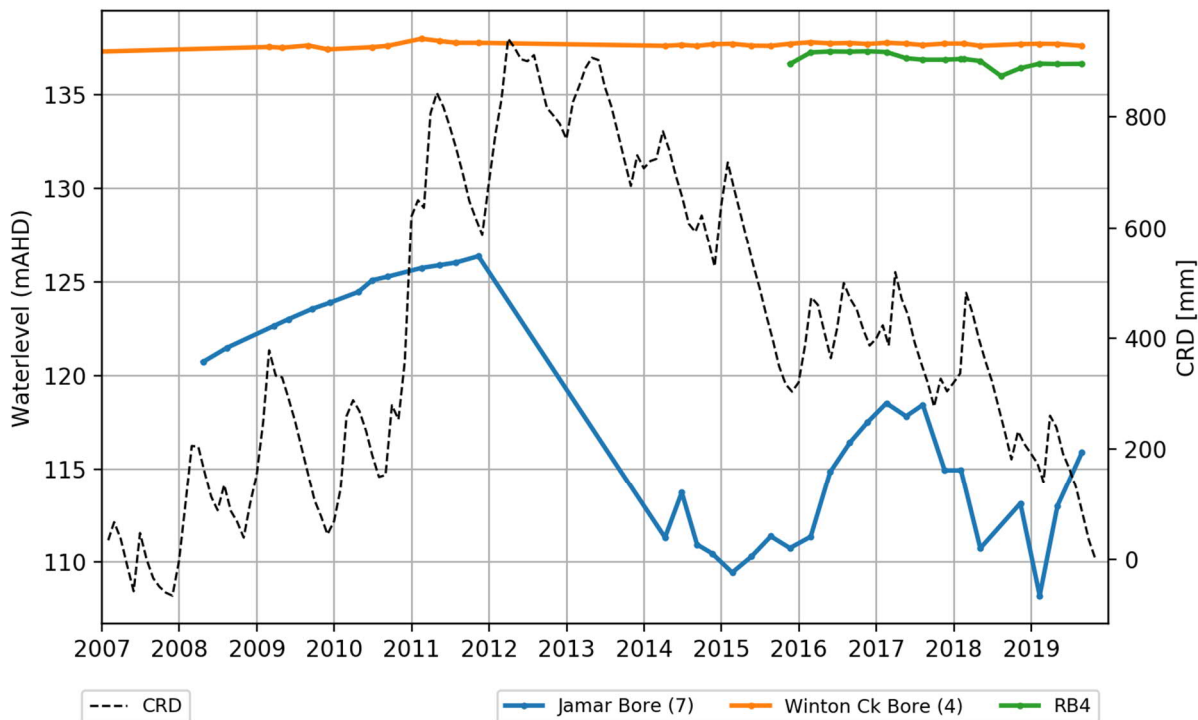
Figure 16

5.2.2 Rewan Group

The Rewan Group comprises low permeability siltstones, mudstones and lithic sandstones and is recognised to be a regional scale aquitard. Private landholder bores Jamar Bore and Winton Creek Bore are, based on limited available data, screened in the Rewan Group based on the nearby regional bore RB04.

Groundwater level trends within the Rewan Group at Jamar bore and Winton Creek bore compared to groundwater level trends within the Aries Seam (RB04) are presented on Figure 17. The hydrograph shows groundwater elevations within the Rewan Group at Winton Creek bore are relatively stable, at around 137 mAHD, while levels within Jamar Bore are highly variable between 108 mAHD and 126 mAHD. Routine monitoring and reporting at the Ensham Mine indicates that this relates to private bore usage with localised drawdown and slow recovery of groundwater levels within the low permeability Rewan Group. In contrast, groundwater levels within the Aries Seam of the Rangal Coal Measures (RB04) records stable to slightly declining groundwater levels between 136 mAHD and 137 mAHD.

Figure 17 Hydrographs for Rewan bores compared with RB04 (Coal measures)



5.2.3 Permian Coal Measures

The most permeable lithological units at the Ensham Mine are the coal seams within the Rangal Coal Measures. The coal seams form aquifers that generally exhibit low transmissivities and are confined by overlying and underlying shales and mudstones (AGE, 2017). Groundwater storage and movement largely occurs within the coal seams, along cleats and occasionally within minor fault zones that intercept the seams. The other lithologies present in the overburden and interburden sequence are considered to form aquitards.

The Permian strata can be categorised into the following hydrogeological units:

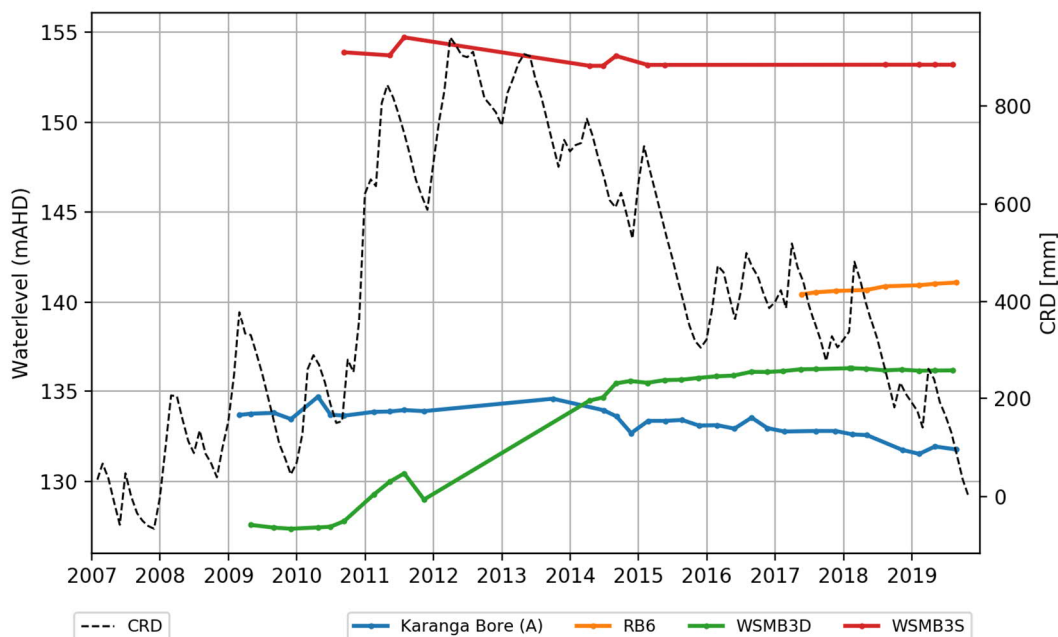
- very low to low permeability sediments that comprise the majority of the Permian age interburden and overburden within the coal measures
- low to moderately permeable coal seams, of varying degrees of competency (and therefore fracturing).

The Rangal Coal Measures (and of the Blackwater Group) along a portion of the eastern edge of the Ensham Mine), where recharge would occur from direct rainfall on the ground surface, infiltrating into the underlying formations through the thin soil cover, weathered profile, as well as through the spoil at site. The coal measures also subcrop in localised zones beneath alluvium associated with the Nogoa River, where the unit may be recharged by downward seepage where there is an absence of clay and silt layers.

Limited recharge may also occur via downward leakage from the Triassic age Rewan Group and Tertiary sediments, as well as from areas of site surface water storage (i.e. in-pit water storages from open-cut mining at the Ensham Mine). The coal seams are connected with the open-cut pits (which are the mined-out areas of the outcropping coal seams). If the pit voids fill up with water, this can create flow into the coal seams.

Bore RB06 and Private landholder bore Karanga Bore intersect the shallow Rangal Coal Measures 2.5 km and 6.5 km south of the Ensham Mine open-cut, respectively. Groundwater level trends for the bores are presented on Figure 18. Water levels in the Karanga Bore show some response to rainfall trends. Karanga Bore, which is located further from the existing mine also shows influence from localised private bore usage. RB06 shows a slight increasing trend over the observation period of around 1 m, when the CRD indicates drier than normal climatic conditions (Figure 18). On Figure 18, the hydrographs for WSMB3S and WSMB3D are plotted to compare with the trend in RB06. The water level in WSMB3D (monitoring the coal seam downdip of Pit A) is below the water level of RB06, whereas the water level in WSMB3S (monitoring the overburden downdip of Pit A) is higher than in RB06. There is potential for the water level in RB06 being influenced by the water level in Pit A, however, the limited number of data points is insufficient to assess trends at this time.

Figure 18 Hydrograph for Karanga Bore, RB06, WSMB3D and WSMB3S



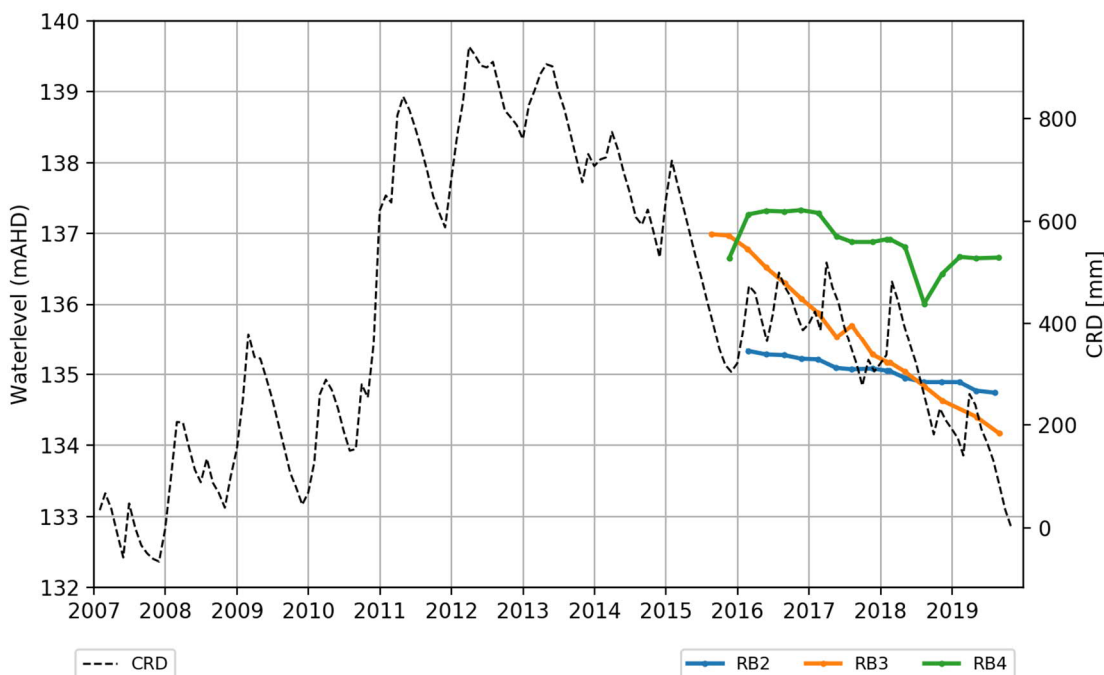
Groundwater in the Rangal Coal Measures flows primarily towards the Ensham underground mine area (mine dewatering and depressurisation). Groundwater level trends within the Rangal Coal Measures west of Ensham Mine (RB02 and RB03 and RB04) are presented on Figure 19. Groundwater level trends for all bores are slightly declining, with groundwater elevations ranging between 135 mAHD (RB02 in the north) to 137 mAHD (RB04 in the south).

Bore RB03 is located within 3 km of active underground mining and records a general decline in groundwater levels of around 3 m from 2016 to 2019. This trend is in line with predicted depressurisation of the Permian coal seams with existing operations (HydroSimulations, 2020). It is anticipated that the influence of the underground workings will transmit readily through the coal seams; however, vertical impediments (such as the Rewan Group and the Permian aquitards above and between the coal seams) would restrict the dewatering of bounding lithologies.

The water levels in the RB04 area are generally considered depressed relative to what is anticipated under natural conditions, lending weight to the prevalence of an abstraction signal in this area. The RB04 borehole has a comparatively low groundwater level of 136 mAHD (40 m unsaturated zone thickness) relative to the unsaturated zone thickness of 25 m at RB02 (on the floodplain to the north).

Recharge to the unit is likely to occur from slow infiltration through overlying formations, and discharge from bore abstraction and possible upward leakage where gradients enable this to occur.

Figure 19 Hydrographs for bores RB02, RB03 and RB04



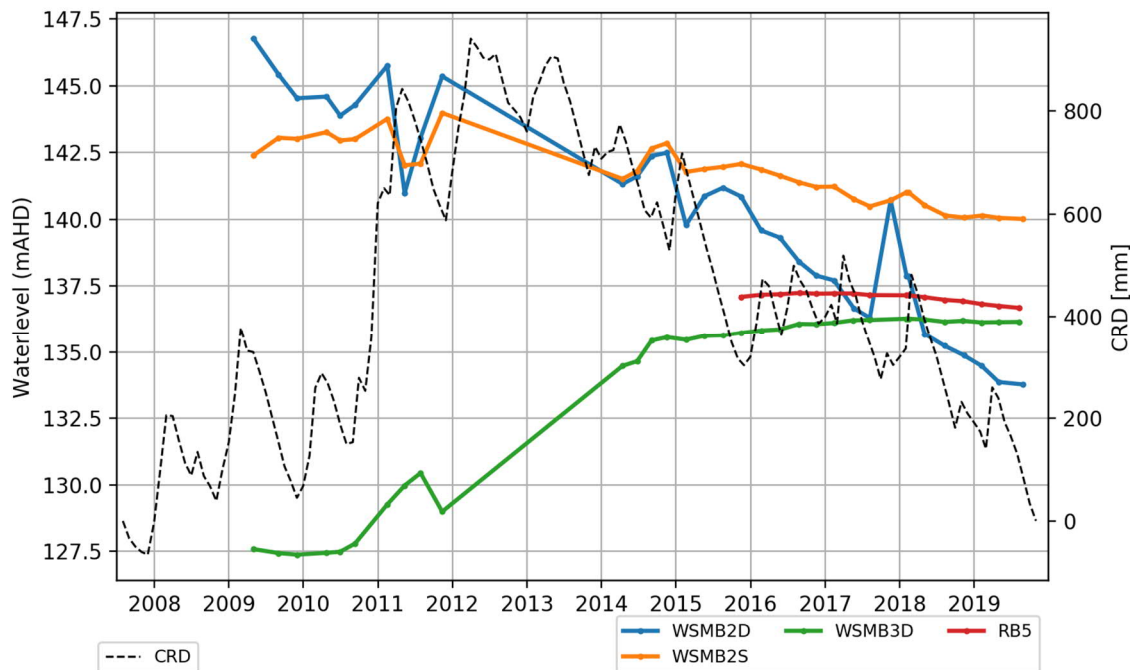
Groundwater level trends are also influenced by rehabilitation and water storage activities at the Ensham Mine open-cut, in addition to depressurisation from existing underground mining. Groundwater level trends for bores within the shallow Permian coal measures within 2 km west of A Pit and B Pit are shown on Figure 20, along with trends for deeper bore RB05 located over 2 km west of the open-cut. The WSMB series are installed in “Coal Measures Overburden” [S] or “Coal Seams” [D].

Bores WSMB2S and WSMB2D are within 400 m of B Pit and overlying the existing operations mining area. Figure 20 shows WSMB2 recorded a generally upward gradient with higher groundwater elevations within the deeper bore until around 2013, after which time a downward gradient is visible. This coincides with progression of B Pit towards the bore. The deeper bore shows a more pronounced response to mining activities than the shallow one. This may also indicate rainfall recharge to shallower strata. In general, this also indicates low vertical hydraulic connectivity within the Rangal Coal Measures. WSMB3S and WSMB3D intersect Permian overburden and are located approximately 1 km west of A Pit Ramp 20 and Ramp 21. Bore WSMB3S has been screened to 21 m depth and has been recorded as dry since mid-2015. Groundwater levels within WSMB3D have gradually risen since 2009, which coincides with cessation of mining at A Pit and commencement of water storage within the pit.

Limited hydraulic connection between the A and B Pits and underground is implied by the presence of retained surface water in these pits and local elevated groundwater conditions. Fracture flow and flow through seams is likely. This would have the effect of prolonged drainage of the southern and central pits into the underground void until underground mining is completed and groundwater levels recover towards the levels associated with the final voids.

Recharge to spoil is also observed to influence the underground pumping rates. The definition of what areas are dewatered and the magnitude of that volume at any given time are unclear and therefore this dataset is considered indicative only. From this data set, both prolonged rainfall events and dry periods are evident in the pumping requirements. Conversely, singular sub-day duration high intensity rainfall events are rarely noted in the pumping record, either on the day of the rainfall or the subsequent period. Collectively these rainfall-response data imply indirect transmission of water to the underground with a short (days duration) transit time. This is in keeping with the previously conceptualised spoil infiltration and drain-down mechanism (HydroSimulations, 2020).

Figure 20 Hydrographs for bores WSMB2D, WSMB2S, WSMB3D and RB05



5.2.4 Groundwater–surface water interactions

The limited connectivity between the Nogoa River and the groundwater is apparent when looking at water level and salinity data (EC) between the Nogoa River stream level at stations 130219A, EC03 (located upgradient, 200 m north west of station 130219A) and EC04 (located downstream, 140 m south east of station 130219A). Groundwater levels at EC03 have been slowly rising since the bore was drilled, from 141 mAHD in 2004 to 143 mAHD in 2019. Similarly, water levels at EC04 have increased from 139 mAHD in 2008 to 141 mAHD in 2014 (last measurement). At the time of drilling, both EC03 and EC04 were below the river stage. Since 2012, the standing water level (SWL) at EC04 have been generally below the river stage while the SWL at EC03 have been generally above the river stage (Figure 21).

Changes in SWL in both bores are correlated with natural variations in rainfall patterns. EC04 is the most responsive bore and SWLs have rarely exceeded the river stage (Figure 21). At EC04, the salinity has been consistently brackish but well below regionally measured EC from 2008 to 2015 (Figure 27). Although fluctuation in water level and EC at this bore are likely to be primarily due to recharge from rainfall infiltration, the data indicate that some connectivity between the groundwater monitored at EC04 and the Nogoa River is possible. However, the consistently greater salinity measured at EC04 (in average three to four times higher) compared to the Nogoa River indicates that the hydraulic connectivity between the groundwater and the Nogoa River at EC04 is limited.

At EC03, from 2004 to 2008, while the groundwater levels were below the river stage elevation (hydraulic gradient is favourable for water flow from the Nogoa River toward EC03), EC in the alluvium has been consistently saline at around 25,000 $\mu\text{S}/\text{cm}$. This is well above the regionally measured EC and indicates that recharge from Nogoa River into the groundwater is highly unlikely.

A site inspection along Nogoa River on 24 July 2019 identified several groundwater expressions into Nogoa River, one of which has been formally documented. Table 9 lists the coordinates, a photograph, water quality parameters and water type assessment for this field observation. The water type is a Sodium-Chloride (Na-Cl) water type, similar to the Nogoa River alluvium groundwater. The sulphate/chloride ratio is 0.16 milli-equivalents (meq), which indicates that the groundwater expression is unlikely to be related to mine affected water.

These groundwater expressions are not considered natural springs, but considered to be caused by upstream irrigation that be potentially causes elevated groundwater levels in the area upstream of EC01 that result in discharge into Nogoa River. The groundwater levels at EC01 and EC03 have been identified as being impacted by irrigation (refer to Section 5.2.1), with groundwater levels staying high whilst climatic conditions were dry and other alluvial bores showed a decline (Figure 15). No processes related to mining could be identified that would cause the high alluvial groundwater levels and the associated observed groundwater expression in this area upstream of mining activities.

The groundwater quality observed at this local groundwater expression is more saline than the Nogoa River, hence this discharge could lead to decreasing water quality in Nogoa River.

Table 9 Groundwater expression field observation

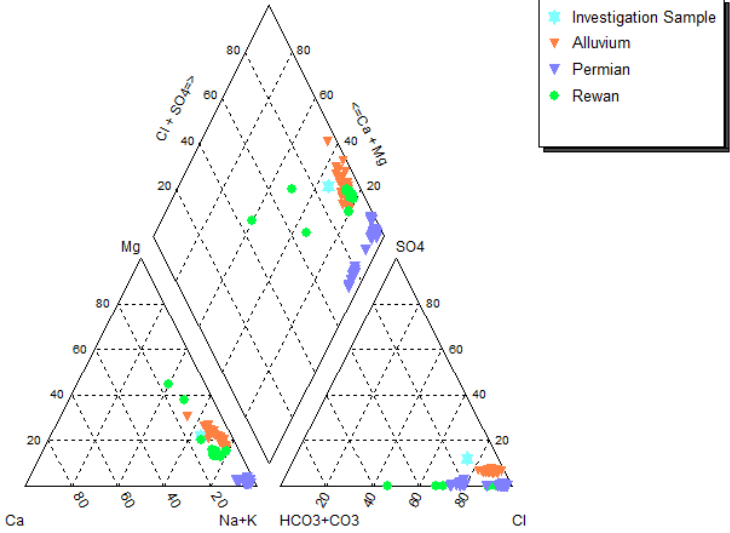
Parameter	Value
Easting (GDA94, Z55)	649216.196
Northing (GDA94, Z55)	7405074.399
Photograph	
EC (field)	7,762 $\mu\text{S}/\text{cm}$
Sodium	1,110 mg/L
Chloride	1,980 mg/L
Sulphate	436 mg/L
Water type	Na-Mg-Cl type water - similar water type to alluvium 

Figure 21 Water level elevations at groundwater bores EC03 and EC04 and at river gauge station 130219A

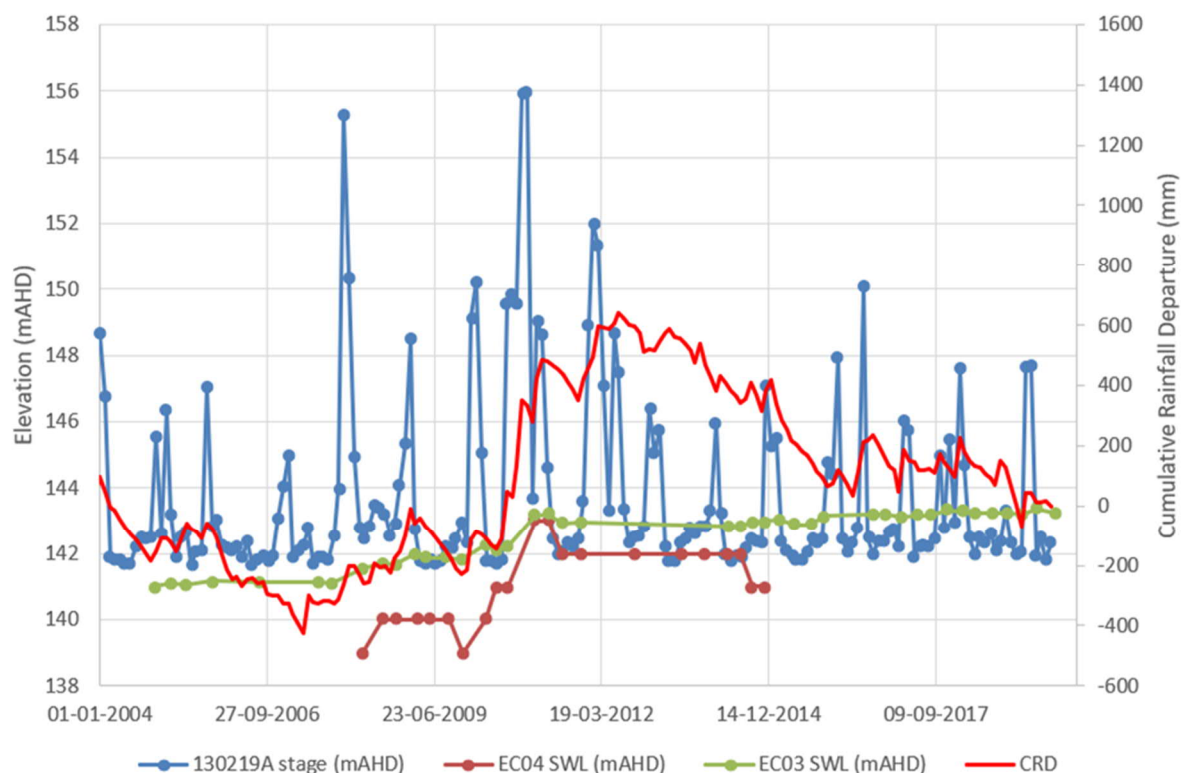
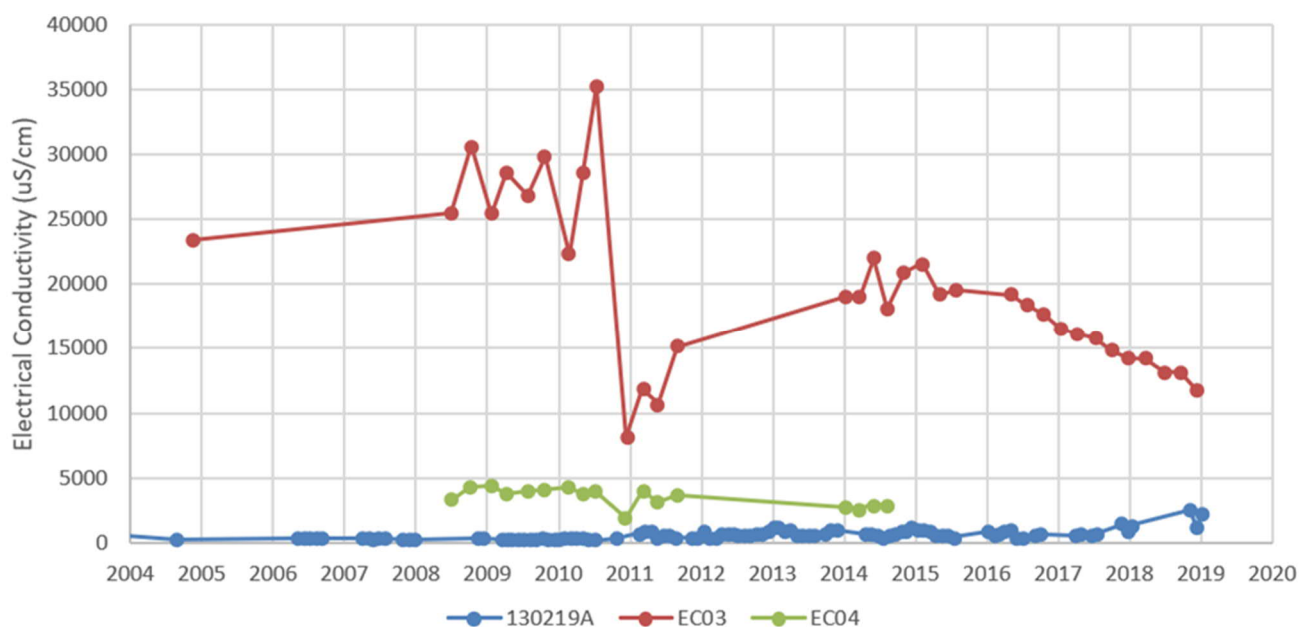


Figure 22 Electrical conductivity measured at EC03, EC04 and station 130219A



5.3 Hydraulic properties

5.3.1 Hydrogeological units

Reported hydraulic and storage properties of key formations in the broader Bowen Basin have been gathered from various sources and summarised in Table 10. Not unexpectedly, there is a very wide range of values in each formation. Table 10 lists the horizontal hydraulic conductivity (Kh), the vertical hydraulic conductivity (Kv), the specific yield (Sy) and the specific storage (Ss).

Coffey (2014) compiled packer testing data from mines in the northern Bowen Basin and found that although there was a degree of variability in the dataset due to irregular fracturing, there is a general trend of reducing hydraulic conductivity with depth. This is likely due to increasing overburden pressure resulting in a reduction in fracture aperture with depth. Hydraulic conductivity of the coal seams is typically three times higher than that of the interburden.

A historic study by AQC-Pacific Pty Ltd (1986) found that the horizontal hydraulic conductivity of the Castor Seam ranged between 0.3 m/day and 5.9 m/day. A study has also been conducted by Sigra in 2013 at Ensham Mine, involving packer testing of two exploration holes that intersect the Rangal Coal Measures at Ensham Mine, C4878 and C4879. The results indicate that hydraulic conductivity within the A22 and A2C seam can range between 0.07 m/day and 0.2 m/day at depths greater than 88.5 m below surface.

Table 10 Summary of adopted hydraulic properties from other Bowen Basin studies

Age	Formation	Kh [m/d]	Kv [m/d]	Sy	Ss [m ⁻¹]	Source
Quaternary	Alluvium	1.00E+00 to 4.00E+01	1.00E-01 to 2.50E+01	5.00E-02 to 1.80E-01	5.00E-04	2
		1.00E+02	1.00E+01	2.50E-01	1.00E-03	1
		7.00E-01 to 1.50E+00				3
		1.00E+01	1.00E+00	2.00E-01	1.00E-04	7
		8.80E-02 to 3.80E-01				5
		1.00E+01	1.00E+00	1.00E-01	1.00E-05	10
			3.80E-01 to 8.40E+00			12
		1.50E+00	3.80E-01	1.20E-01	8.60E-06	14
		1.00E+00				15
		7.00E-03 to 4.20E+00				16
		2.00E-02	4.00E-03			15

Age	Formation	Kh [m/d]	Kv [m/d]	Sy	Ss [m ⁻¹]	Source
Tertiary	Basalt	1.00E-01 to 1.00E+01	5.00E-03 to 1.00E+00	5.00E-02 to 2.00E-01	5.00E-07 to 5.00E-05	2
		6.10E-03 to 6.20E-01				13
		1.10E-01				16
		5.00E-01	1.00E-01			15
	Undifferentiated Tertiary Sediments	4.30E-01				13
		5.00E-01	1.30E-01	5.00E-02	8.60E-06	14
		1.00E-02	2.00E-03			15
Triassic	Rewan Group	1.00E-05 to 1.00E-04	1.00E-06 to 1.00E-04	5.00E-03	1.00E-06	1
		1.00E-01		5.00E-02	5.00E-06	6
		1.00E-04	1.00E-05	1.00E-02	1.00E-05	10
		3.60E-04	7.40E-06			11
		1.30E-05 to 2.70E-03	5.80E-09	3.00E-05		12
			2.20E-08			13
		5.00E-04 to 5.00E-02	1.00E-07 to 1.00E-04	1.00E-01 to 2.50E-01	5.00E-06 to 5.00E-04	2
		2.00E-03	5.00E-04			14
		1.00E-03	2.00E-04	3.00E-02	8.60E-06	15
		9.00E-04	5.40E-05			9
Permian	Rangal Coal Measures – coal seams	2.80E-03 to 4.70E-02				4
		1.00E-05 to 5.00E-02	5.00E-04 to 5.00E-03	0.01 to 0.12	5.0E-6 to 5.0E-4	2
		1.00E-02	2.50E-03	5.00E-02	8.60E-06	14
		2.00E-05 to 2.30E+00	2.00E-06 to 1.00E-01			15
						3
		1.00E-06 to 1.00E+00	1.00E-06 to 1.00E+00	1.00E-02	1.00E-06	1
		1.10E-01 to 9.00E-01		8.00E-02	4.00E-04	7
		5.00E+00		5.00E-02	5.00E-06	6
		5.00E-02	5.00E-03	1.00E-02	1.00E-05	10
		9.00E-04	1.80E-05			9
		1.00E-04	7.00E-08	5.00E-02	1.00E-05	2

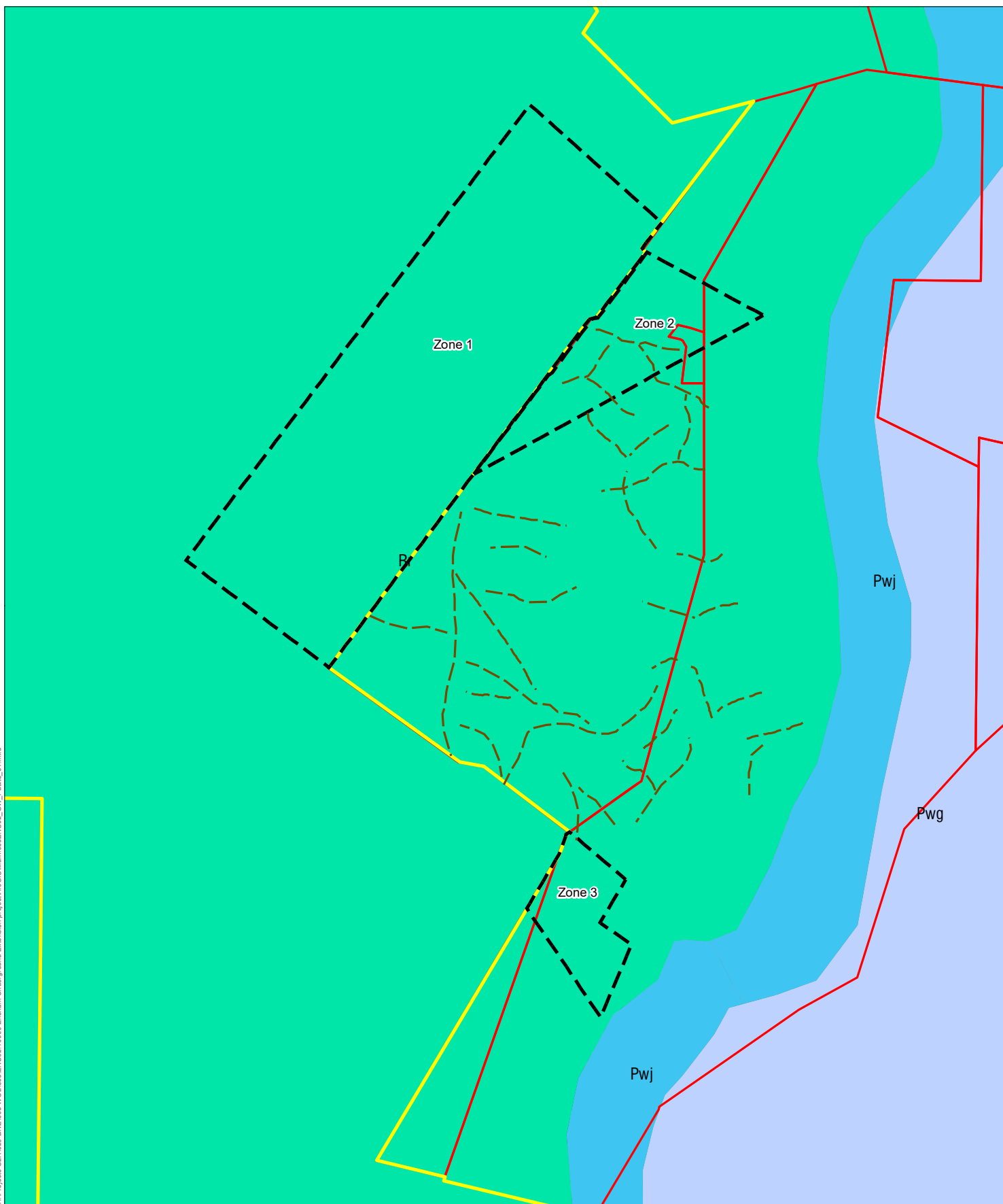
Age	Formation	Kh [m/d]	Kv [m/d]	Sy	Ss [m ⁻¹]	Source
	Rangal Coal Measures - Interburden	1.20E-01	3.00E-02	3.00E-02	8.60E-06	14
		2.00E-05 to 2.00E-02	2.00E-05 to 2.00E-03			15
		1.00E-01		5.00E-02	5.00E-06	6
		1.00E-03	1.00E-05	1.00E-02	1.00E-05	10
1: AGE (2006); 2: Ausenco-Norwest (2012); 3: JBT (2012); 4: Parsons Brinckerhoff (2011); 5: URS (2009); 6: BHP Billiton Mitsubishi Alliance (2009); 7: Matrix Plus (2010); 9: AGE (2013); 10: CDM Smith (2013); 11: GHD (2013); 12: OGIA (2016); 13: Coffey (2014); 14: JBT(2016); 15: KCB (2016); 16: AGE (2016)						

5.3.2 Faults

Faults can increase permeability within strata parallel with the fault plane, and lower permeabilities within strata perpendicular to the fault plane (Jourde et al. 2002). Coffey (2014) developed a conceptual model for fault zone hydraulic characterisation in the Bowen Basin. The study found that strata perpendicular to the fault plane recorded a hydraulic conductivity one to three orders of magnitude lower than the regional host rock, and the damage zone (parallel to the fault plain) approximately one order of magnitude higher. However hydraulic conductivity within the damage zone is also dependent on timing, with hydrothermal alternation and mineralisation filling the fractured pore space over time (Paul et al. 2009; Uysal et al. 2000).

The Project targets Permian aged coal seams within the Bowen Basin, where faulting has been inactive for over 140 million years (Clark et al. 2011). No regional-scale faulting has been mapped within the Project Area according to basement geology mapping (refer to Section 4.5). However, site observations indicate that there is local faulting in the currently approved MLs, they are shown on Figure 23. These faults have been included in the groundwater model (refer to Section 6.3.2). Note that these faults are only mapped and included in the model as shown in Figure 23. It is likely that some faulting and or fractures are present in the Project Area.

H:\Projects\SLR\626-BNE-665-VOL-066-ENS02-10000-Ensham Underground Extension project\ArcGIS\Main\665ENS02_GW_Faults_01.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:75,000

Project No.: 665.ENS02.10000
Date: 26/02/2020
Drawn by: SLR Consulting
Sheet Size: A4

Legend

- Faults
- Project Area
- Mineral Development Licence (MDL) 217
- Mining Lease (Granted)

Solid Geology

- Rewan Group (Rr)
- Rangal Coal Measures (Pwj)
- Burngrove Formation (Pwg)

GROUNDWATER IMPACT ASSESSMENT

Local faults

Figure 23

5.4 Groundwater quality

Recent groundwater quality data are available for 21 bores for parameters outlined within the current EA for the Ensham Mine (refer to Section 5.1). In addition, historical data are available for 49 bores across the mine site and its surroundings. In this section, only the bores for which the bearing strata is known are discussed. Summary statistics (triggers) for all EA parameters and all 49 bores are presented in Appendix C.

Physiochemical parameters and metals are discussed for each groundwater unit in Section 5.4.1 and Section 5.4.2. The water quality results are compared against water quality triggers for relevant environmental values, as discussed in Section 5.5. These comparisons are shown in Appendix D.

5.4.1 Physiochemical parameters

Physiochemical parameters include:

- major ions, i.e. calcium (Ca), sodium (Na), magnesium (Mg), potassium (K), sulphate (SO₄), chloride (Cl), bicarbonate (HCO₃)
- Electrical Conductivity (EC)
- Total Dissolved Solids (TDS)
- pH.

Major ions allow comparison of water types (ionic dominance) between bores. According to DSITI (2017), major anions and cations analysis enables characterisation of the groundwater regardless of the activity. The water type can also be used in correlation with other physiochemical parameters, precipitation records and groundwater level measurements to inform groundwater flow and hydrological processes.

Table 11 lists the 20th percentile, median and 80th percentile of the pH (field and laboratory) for the alluvium, the Rewan Group and the Rangal Coal Measures. The field pH is considered the more accurate measurement, as pH has a short holding time for laboratory analysis. However, the laboratory pH is listed here, because the field pH has not been measured until 2013. The waters are all neutral to slightly alkaline, with median field pH values of 7.1 for the alluvium and 7.7 and both the Rewan Group and Rangal Coal measures.

Table 11 Summary statistics of pH observations

		Number of observations	20 th percentile	Median	80 th percentile
Alluvium	Field pH	204	6.7	7.1	7.4
	pH Lab	308	7.0	7.5	7.9
Rewan	Field pH	46	7.4	7.7	7.9
	pH Lab	61	7.7	7.9	8.1
Coal Measures	Field pH	181	7.0	7.7	8.0
	pH Lab	180	7.5	7.9	8.2

EC and TDS both are both a measure of salinity levels in water. EC is generally recommended to measure salinity as it can be easily measured on site without requiring laboratory analysis. EC measured in the field is generally recommended over laboratory analysis due the potential for change in salt composition that can occur with temperature change during the sample transport and storage prior to analysis.

EC measured in the field is available for EA bores only, from 2014 onward. Where no EC field data are available, EC lab is discussed instead. TDS data, which is strongly correlated to EC field and EC lab is not discussed here but is presented on a Boxplot in Appendix D - Figure 2.

Table 12 lists the 20th percentile, median and 80th percentile of the EC (field and laboratory) for the alluvium, the Rewan Group and the Rangal Coal Measures. The median EC in the alluvium is around double the median EC in the Rewan Group and the Rangal Coal Measures. This indicates generally poor water quality, that may not be suitable for all users (this will be further discussed in Section 5.5).

Historical water quality records from DRNME bores (Appendix N) showed high EC values in the alluvium before underground mining started, which indicates that these EC values are occurring naturally. The EC observations in the late 1990ies and early 2000s ranged from 710 $\mu\text{S/cm}$ in Bore RN13020175 to 38,900 $\mu\text{S/cm}$ in Bore RN13020173.

Table 12 Summary statistics of EC observations

		Number of observations	20 th percentile ($\mu\text{S/cm}$)	Median ($\mu\text{S/cm}$)	80 th percentile ($\mu\text{S/cm}$)
Alluvium	Field EC	204	4,072	13,150	20,826
	EC Lab	308	4,340	12,250	22,360
Rewan Group	Field EC	46	4,050	5,825	7,430
	EC Lab	61	3,960	6,290	7,520
Rangal Coal Measures	Field EC	181	3,780	7,620	10,800
	EC Lab	180	3,496	7,345	10,520

Discussion on the physiochemical properties for each groundwater bearing unit is presented in Section 5.4.1.1 to Section 5.4.1.3.

5.4.1.1 Alluvium

Major ions analysis reveals that the majority of alluvium bores are of sodium-chloride (Na-Cl) water type dominance (Figure 24). As described in Section 5.2.1, most of the alluvium is hydraulically isolated from the Nogoia River, resulting in brackish to highly saline conditions. Slow infiltration recharge and evapotranspiration are likely to be the dominant processes resulting in salinisation of the alluvium.

Alluvium bores show a wide range in salinity with recorded values from about 1,000 $\mu\text{S/cm}$ to 30,000 $\mu\text{S/cm}$.

The data suggest that most alluvium bores are responsive to rainfall events indicating that rainfall infiltration is likely the main recharge process. The EC in bores EC07, EC09A, EC11 and EC13 is responsive to rainfall changes, with various delay of response (Figure 25 and Figure 26). A large recharge event reduces the EC and prolonged drought will increase the EC over time.

Those bores had a higher EC before the main recharge event in late 2010 (shown with an increasing CRD), and then decreased during the inflow of fresher water (blending). The bores have since increased in EC with different timing in onset, with EC07 (most upstream) starting in 2013 and EC13 (downstream) starting around 2016.

The reason for this increase is unclear. The corresponding increase from upstream to downstream along Nogoa River would indicate that the increase is not mining related. If it was a mining related effect, the EC increase would be expected to start in the bores closest to the mine (EC11 and EC13). At this stage, it is plausible that the continued drier conditions since the last major recharge event could lead to the increase in EC. This, however, would not explain the different times of the onset of the increase. Although EC1 and EC3 do not show an increase in EC, they show a decreasing trend over the last five years.

Figure 24 Durov diagram - alluvium

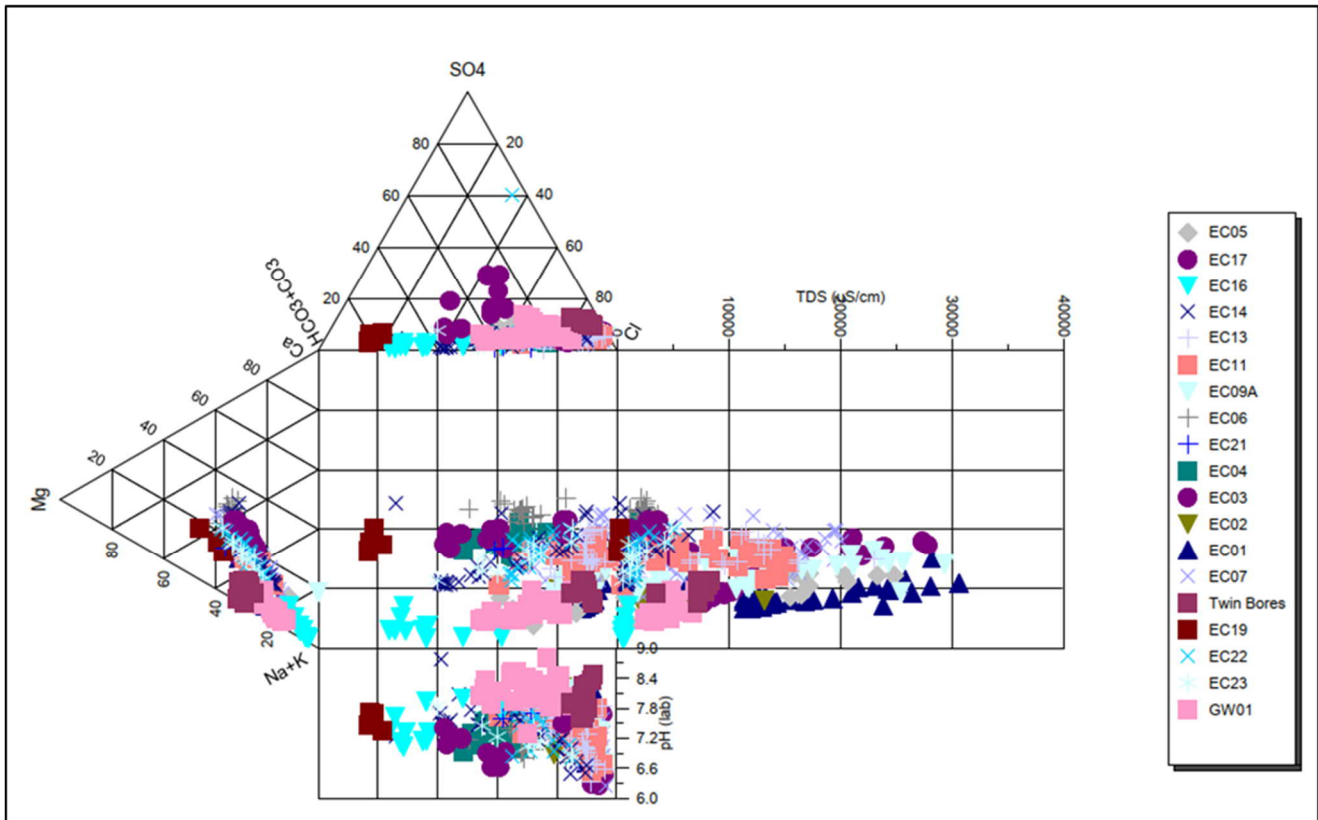


Figure 25 Lab EC - alluvium

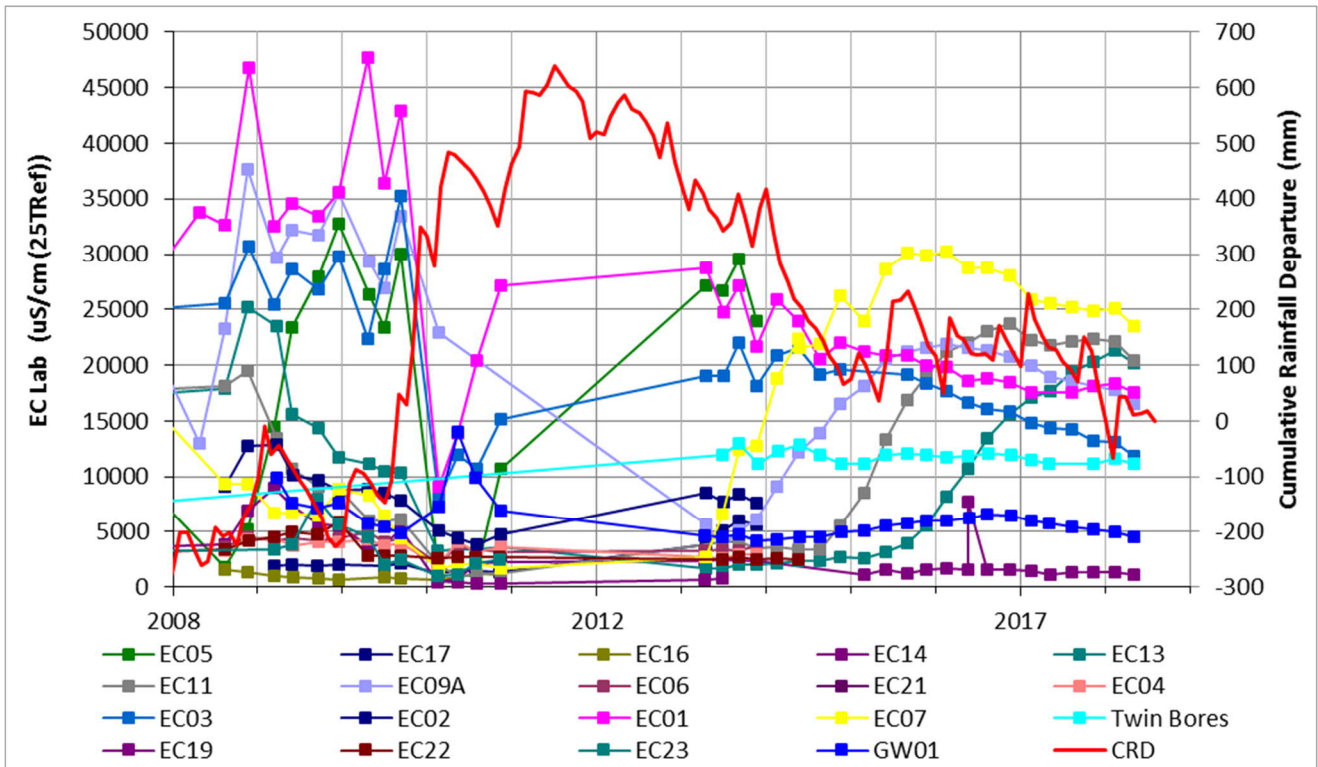
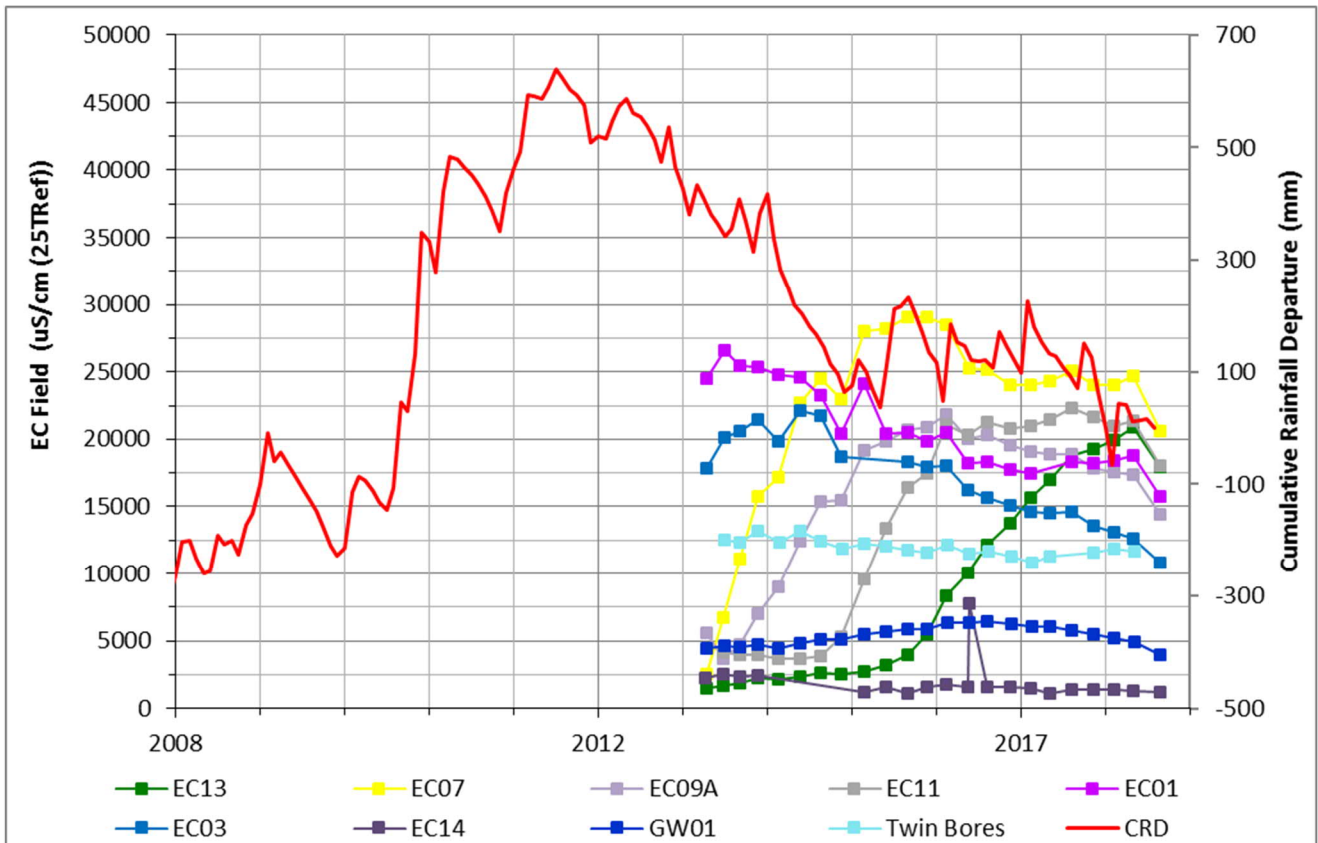


Figure 26 Field EC - alluvium



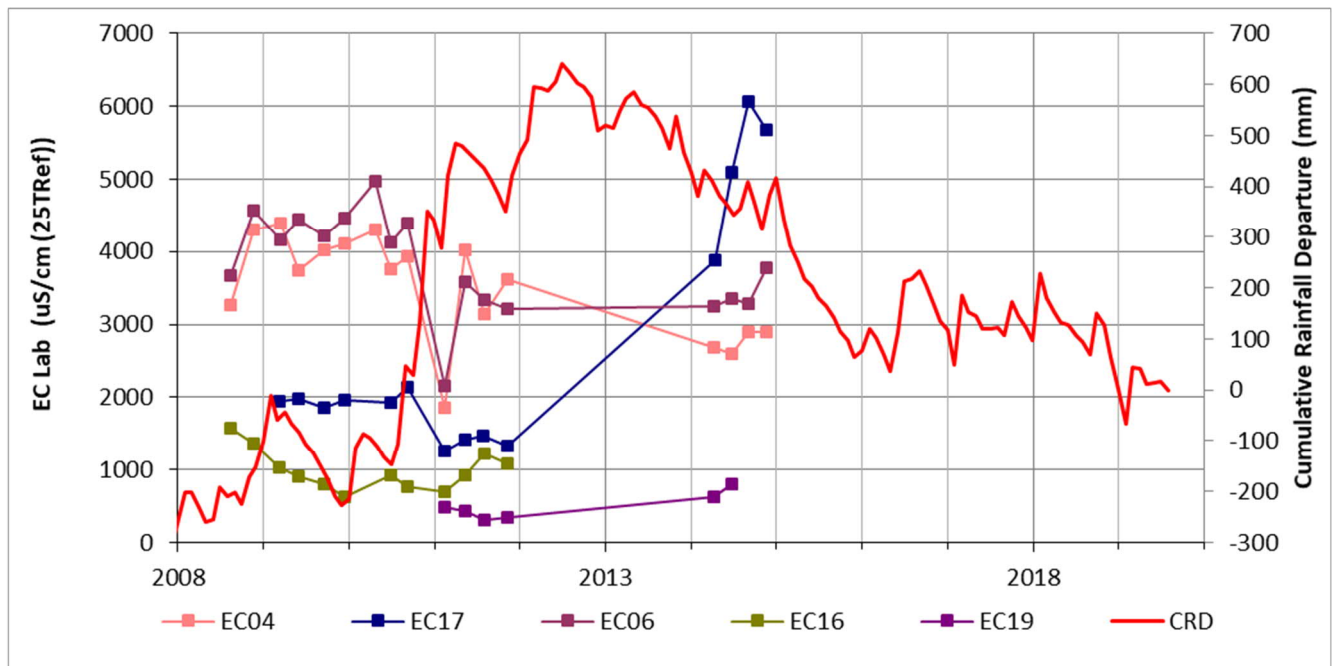
Bores that are not of NaCl dominance or bores that show high variation in water chemistry include EC04, EC06, EC14, EC16, EC17 and EC19.

Bore EC04 and EC17 are of Mg-Na-Cl water type. The presence of Mg ions, which are strongly adsorbed in clay environments may indicate that these bores are located along a preferential flow path that receive recharge from rainfall or through baseflow from the Nogoa River. EC measurements at bores EC04 and EC17 (Figure 27) indicate less variability compared to other alluvium bores with mildly brackish water.

Bore EC06 is Mg-Cl dominant. Like EC04 and EC17, this bore may be located along a preferential flow path that receives more regular recharge than other alluvium bores.

Bores EC16 and EC19 are of Na-HCO₃ and Mg-HCO₃ dominance respectively. These bores monitor fresh to slightly brackish water and are likely located along a preferential recharge flow path. EC19 likely monitors younger groundwater (presence of Mg ions) with measured EC below 800 $\mu\text{S}/\text{cm}$ (Figure 27).

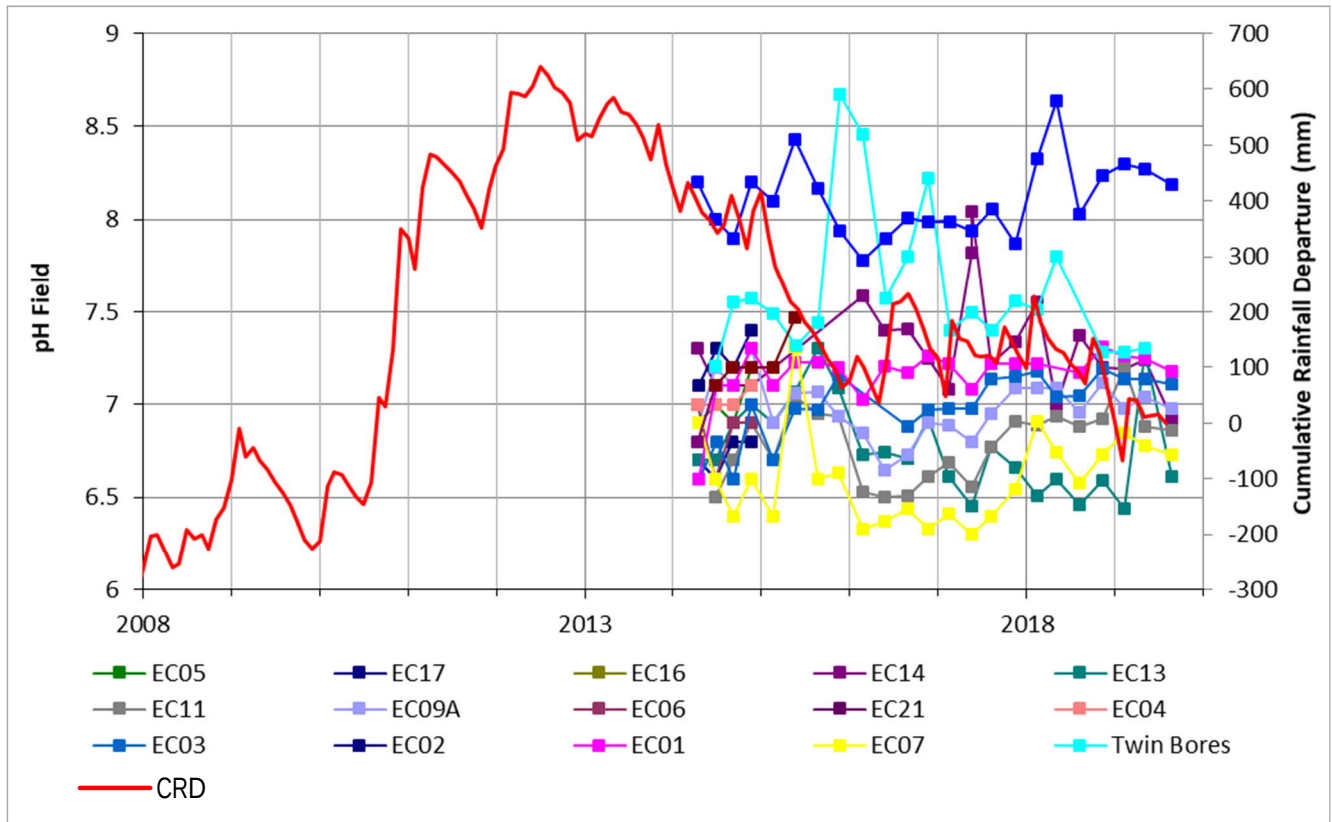
Figure 27 Electrical conductivity (Lab) - EC04, EC06, EC16, EC17 and EC19



Regional water quality objectives (WQO) for aquatic ecosystem protection are available for EC (DEHP, 2011). Several alluvium bores (EC01, EC03, EC05, EC07, EC09A, EC11 and EC13) have 80th percentile above the regional WQO (Appendix D - Figure 1).

Variations in pH are generally small with the regional bore (Twin Bore) showing a higher degree of variability (Figure 28). Most measurements are between 6.5 and 8.5, which is within the lower Nogoa River EVs for aquatic ecosystem protection (DEHP, 2011b). Bore GW01 is slightly basic and has exceeded the upper WQO three times in the past ten years (Appendix D - Figure 3).

Figure 28 Field pH - alluvium



5.4.1.2 Rewan Group

Bores screened in the Rewan Group (Winton Creek Bore and Jamar Bore) are all Na-Cl dominant (Figure 29).

Laboratory EC available from 2004 at Winton Creek Bore and Jamar Bore show that these bores are likely to respond to very high intensity rainfall events and associated major flooding (refer to Figure 7), with EC level decreasing for a short period of time following such events (Figure 30).

Figure 29 Durov diagram - Rewan Group

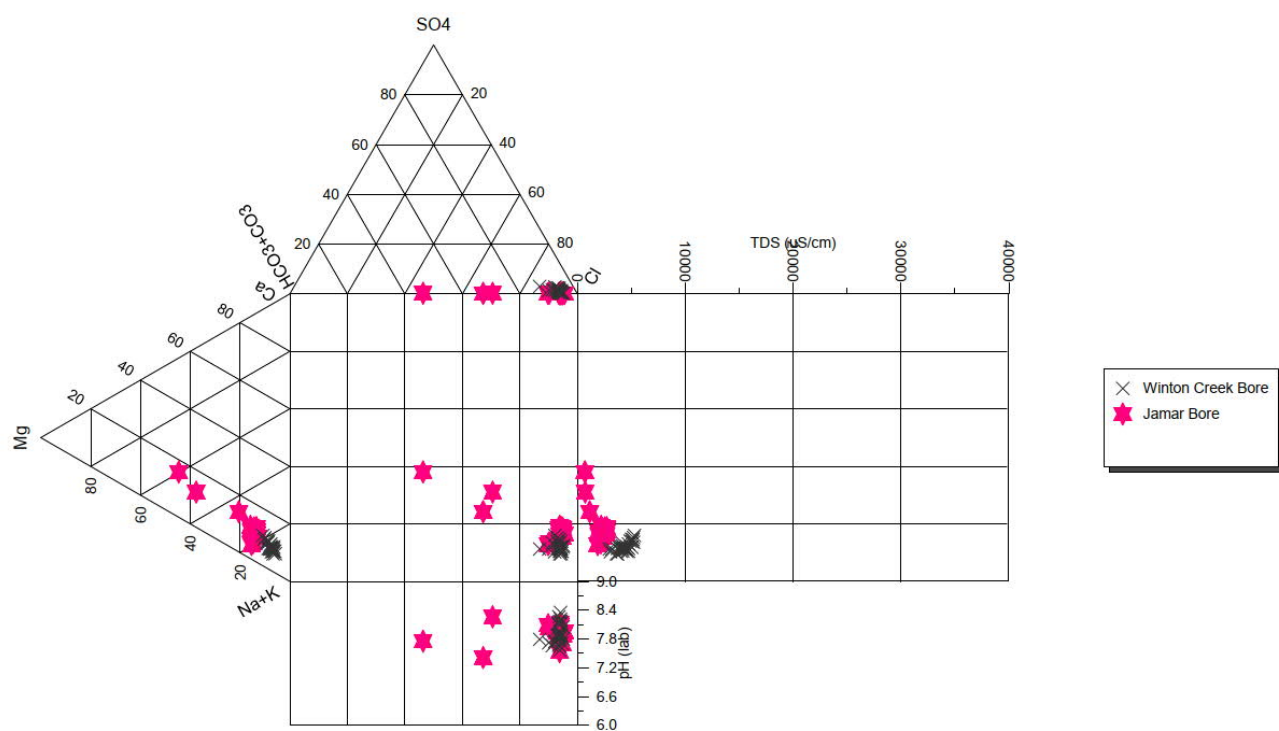


Figure 30 Field EC - Rewan Group

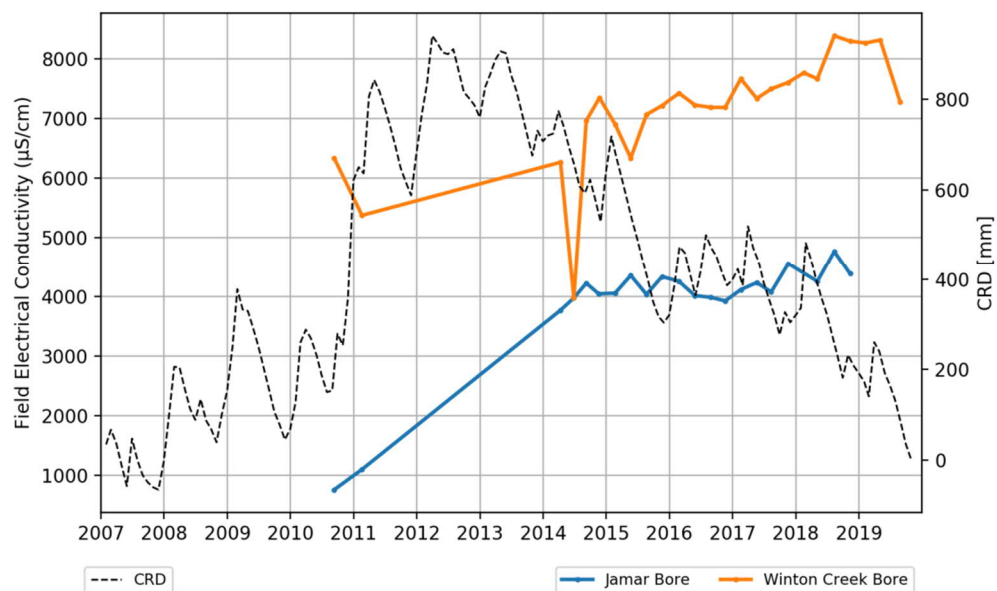
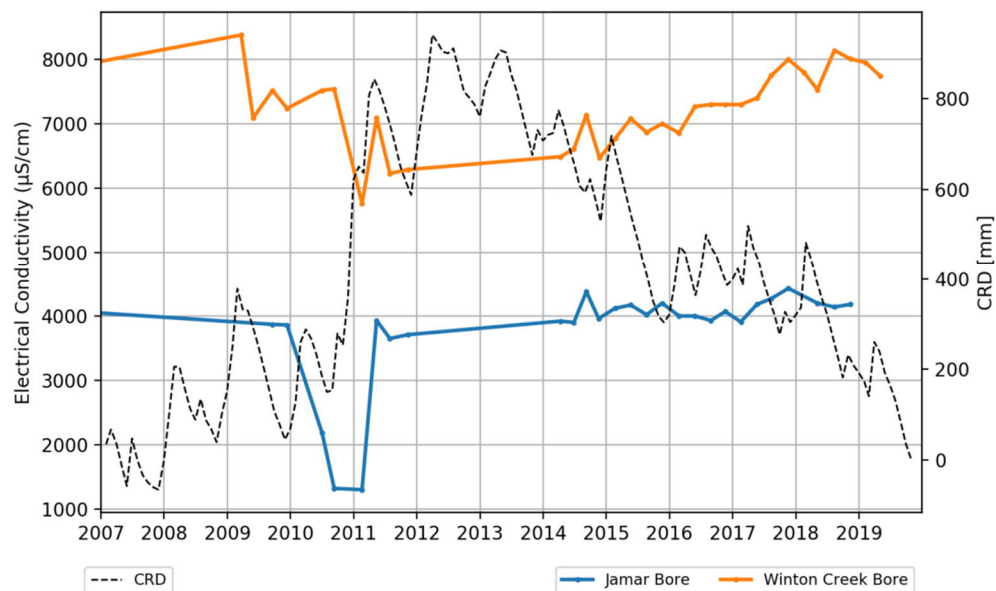
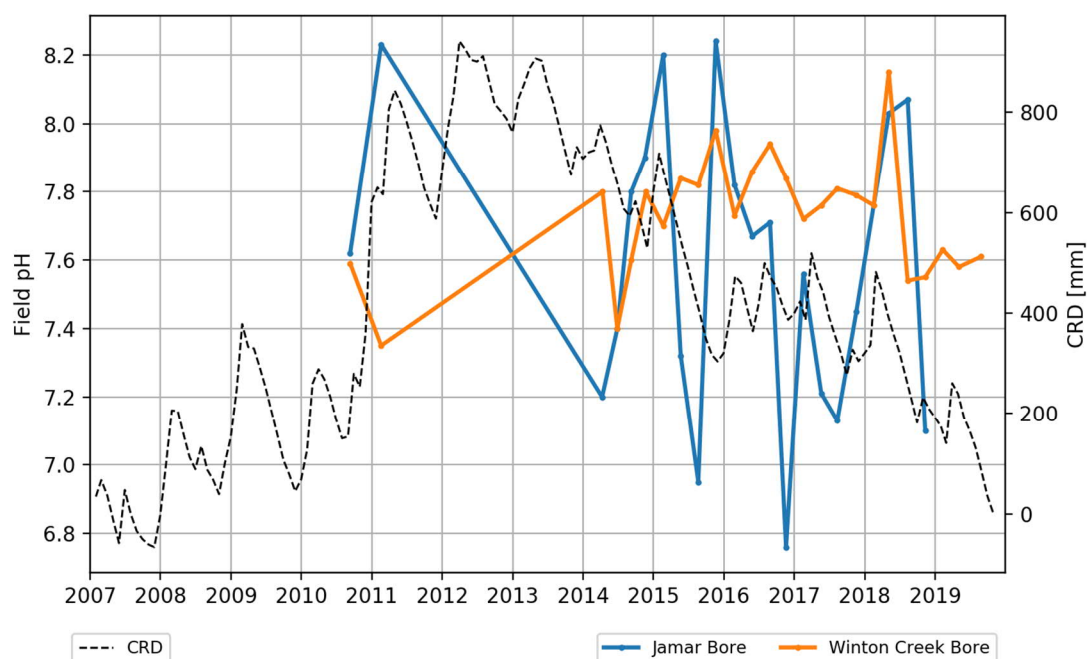


Figure 31 Electrical conductivity (Lab) - Rewan Group



Variations in pH are between 6.5 and 8.5 (Figure 32), which is within the lower Nogoa River WQOs for aquatic ecosystem protection (Appendix D - Figure 3).

Figure 32 Field pH - Rewan Group



5.4.1.3 Rangal Coal Measures

All bores monitoring the Rangal Coal Measures are Na-Cl dominant with the exception of Karanga Bore (private bore to the south of the open-cut pits), which is Mg-Cl dominant (Figure 33). The presence of Mg ions, which are strongly adsorbed compared to K or Na ions may indicate that this bore monitors an area that receives higher recharge and where groundwater is younger. This corresponds with the location of the bore where the coal measures occur at outcrop and is consistent with persistent low EC value measured at Karanga Bore from 2014 onwards (Figure 34) and groundwater level variations.

Bores screened within the deeper Rangal Coal Measures generally record relatively stable trends in EC, similar to relatively stable to slightly declining trends in groundwater levels. This highlights the relatively low response to rainfall recharge. An outlier can be seen in Figure 34 for RB01 (field EC), which is likely attributed to a measurement or transcription error.

Monitoring bores WSMB2D, RB02, RB03 and RB04 have 80th percentile above the regional WQO for EC (Appendix D - Figure 1).

The pH variations are between 6.3 and 9.8 (Figure 35), however, all bore have 80th percentiles within the lower Nogoa River EVs for aquatic ecosystem protection (Appendix D - Figure 3). Alkaline pH values at RB04 and RB05 for two sampling events following bore construction are likely due to poor development of the bore initially.

Figure 33 Durov diagram - Rangal Coal Measures

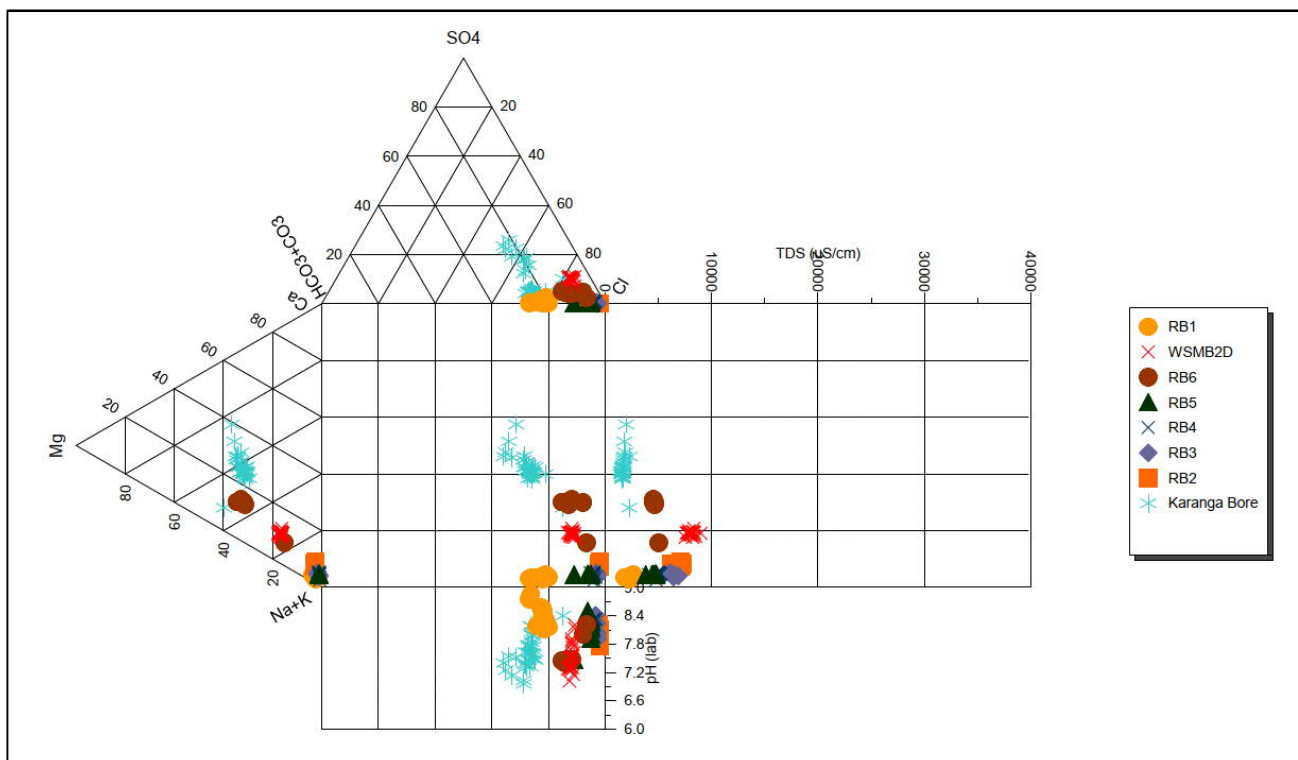


Figure 34 Field EC - Rangal Coal Measures

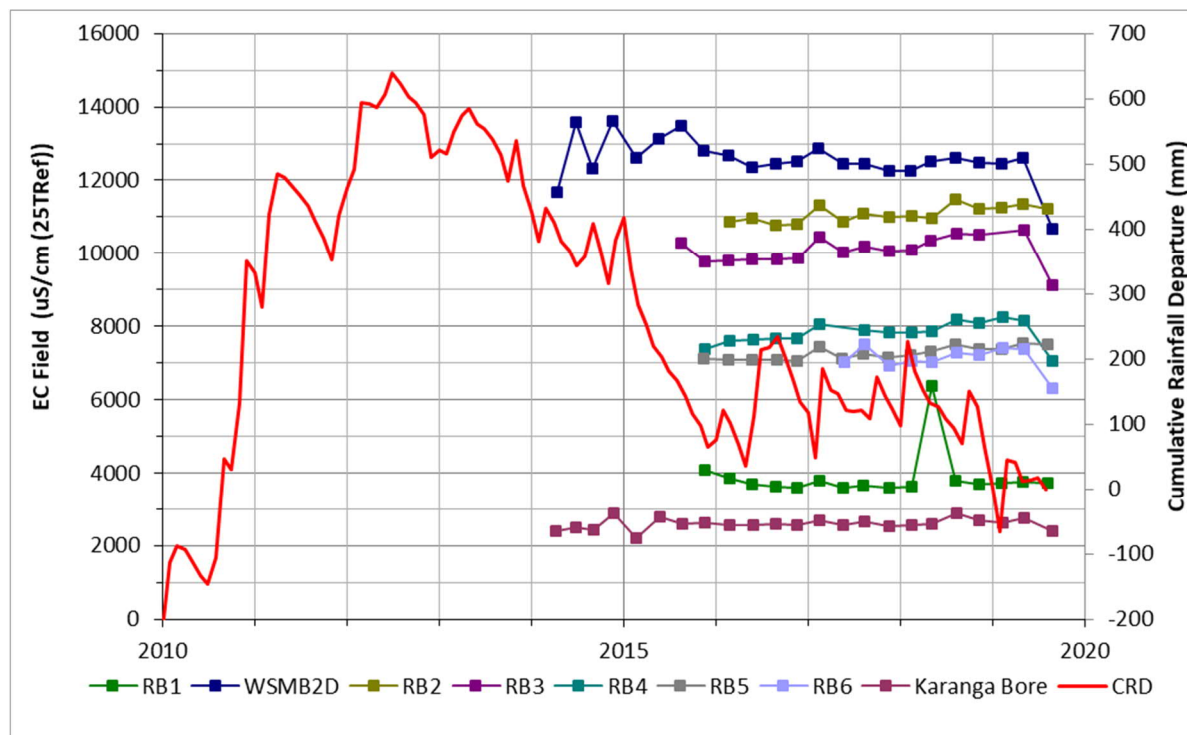
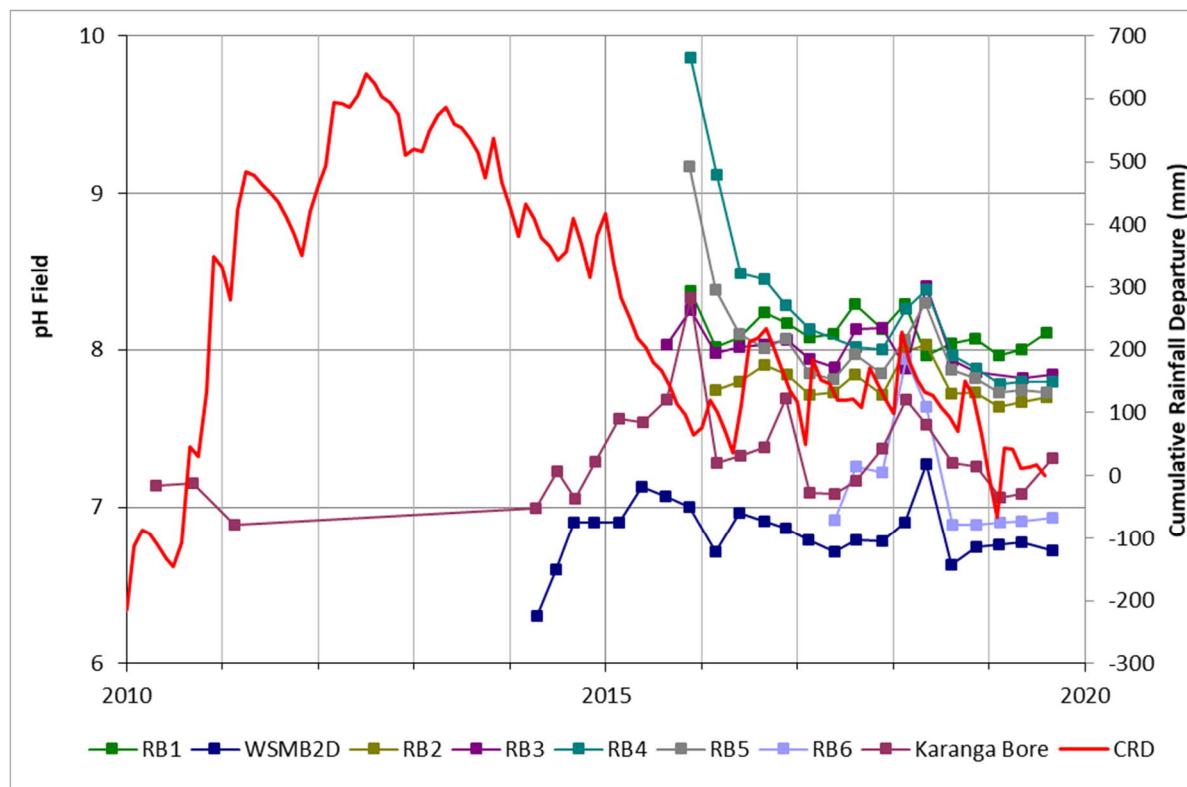


Figure 35 Field pH - Rangal Coal Measures



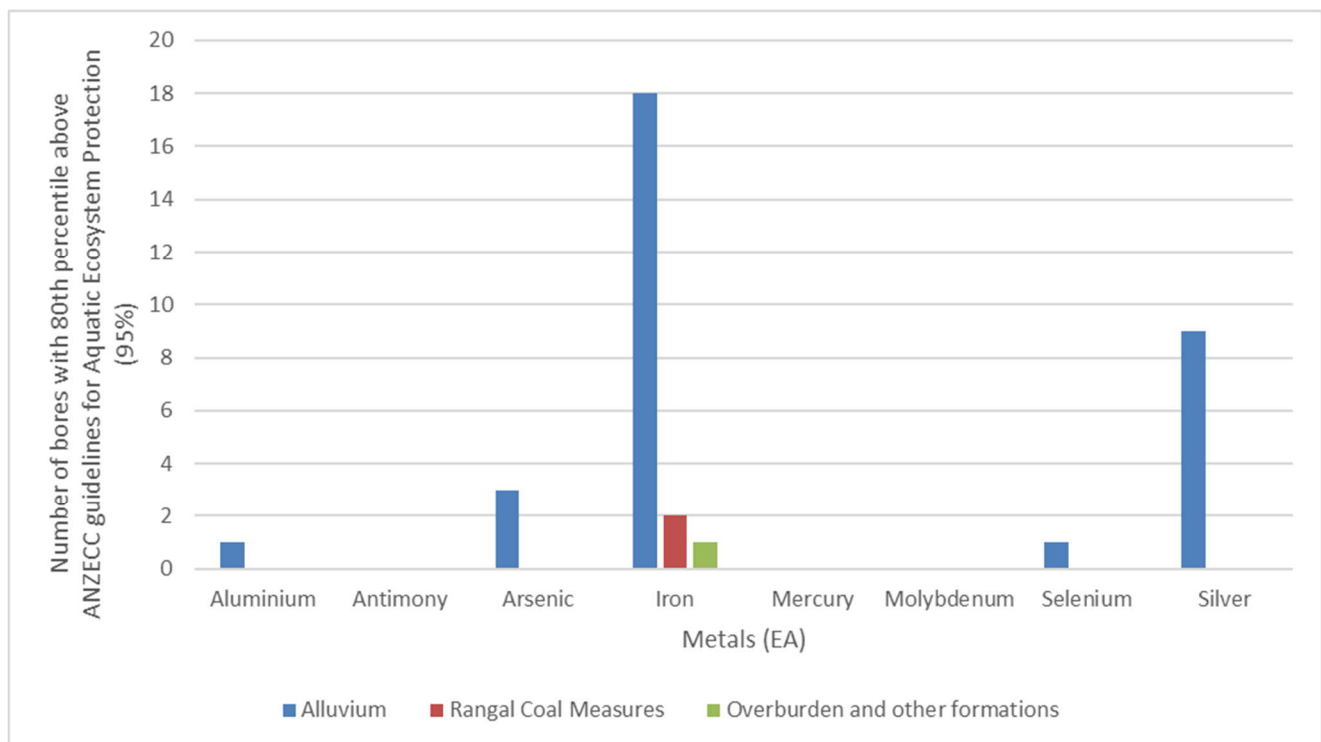
5.4.2 Metals and metalloids

Metal and metalloids identified as potential stressors in the current EA include iron, aluminium, arsenic, silver, mercury, selenium, antimony and molybdenum. Metal and metalloids stressors are identified based on their abundance in the geological formations that are disturbed during mining and their potential for leaching. The selected metal and metalloids in the current EA are based on previous investigations and discussions between Ensham and the regulator and are appropriate to the Project Area, which share the same geological and hydrogeological setting as the rest of the Ensham Mine.

Iron is the most abundant dissolved metal in groundwater across the study area (Figure 36). Most bores in the alluvium have an 80th percentile above the ANZECC guidelines for aquatic ecosystem protection (95 per cent). Several bores in the Rewan Group and Rangal Coal Measures also show elevated values compared to the aforementioned guidelines.

In the alluvium, some bores have an 80th percentile slightly above the ANZECC guidelines for silver, arsenic, selenium and aluminium. Individual time series and trend for these bores, in addition with pH, EC and sulphate variations do not indicate that the water quality in these bores is likely impacted by mining activities. Time series for each bore and parameters are provided in Appendix E.

Figure 36 Number of bores with 80th percentile above ANZECC guidelines for aquatic ecosystem protection (95%) in the main hydrogeological units



5.5 Groundwater use and management

The study area is covered by the Highlands Groundwater Management Area under the Fitzroy Water plan.

The study area is located in the lower Nogoia Groundwaters of the Fitzroy Groundwater plan (DEHP, 2011). EVs pertinent to the Project are listed in DEHP (2011b) as:

- aquatic ecosystems
- irrigation
- farm supply/use
- stock water
- primary recreation
- drinking water
- cultural and spiritual values.

Primary recreation EVs apply to water reservoirs and connected waterbodies. The lack of connectivity between groundwater and surface water within the study area means that the primary recreation EV is not relevant to groundwater for the Project.

As presented in Section 5.4, the groundwater quality in the vicinity of the Project Area is not suitable for drinking. Most bores are brackish to highly saline. A bore census undertaken by AGE (2017) revealed no bores were used for drinking water within a 10 km radius from the Project Area. Of the nine private bores identified as being in use, seven were reported to be used for stock water and two bores are in use for irrigation / stock and domestic.

Although groundwater in the vicinity of the Project Area may have some cultural and spiritual values, none were identified in the literature reviewed. Considering the brackish nature of the groundwater and the availability of freshwater in the nearby Nogoa River, it is unlikely that groundwater in the area will hold significant cultural or spiritual values.

As detailed in Ensham Resources (2018), the EVs pertinent to groundwater in the vicinity of the Ensham Mine are:

- ecosystems
- irrigation
- farm supply / use and stock water supply.

5.5.1 Ecosystems

As discussed in Section 5.2.1, the alluvium is mainly unsaturated and the connectivity between the Nogoa River and the alluvium is likely to be limited. The potential for hydraulic connectivity between groundwater and surface water is assessed in Section 5.2.4. Note that there will be no change to the surface of the Project Area and hence, the impact on surface water and shallow groundwater due to the Project will be limited.

Ecosystems (aquatic and terrestrial) that are dependent on groundwater or that may be affected by change in groundwater quality and levels are referred to as groundwater dependant ecosystems (GDEs). GDE mapping is available from the Department of Science (DES) (Figure 37). They are summarised as follows:

- potential GDE aquifer: unconsolidated sedimentary (alluvium) aquifer along the reaches of the Nogoa River and a small consolidated sedimentary aquifer on the southern end of the Project Area.
- surface expression GDE: derived GDE with low confidence along the Nogoa River and Winton Creek.
- terrestrial GDE areas: derived GDE with low confidence along the Nogoa River and parts of Winton Creek.

Terrestrial GDEs are ecosystems that are dependent on the sub-surface presence of groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. Terrestrial GDE area features include riverine wetlands and treed (deep rooted) regional ecosystems that have some sub-surface groundwater dependency. Most species would not thrive in a setting with an average salinity of greater than 5,000 $\mu\text{S}/\text{cm}$ and groundwater levels deeper than 10 mBGL. *Eucalyptus Camaldulensis*, a tree species identified in the Project Area (Ensham, 2018) can develop deep roots (>10 m vertically) and has been found to be resilient to saline groundwater conditions (Hulme, 2010). Mature trees with root systems able to reach within 2 m of the water table may rely on groundwater during periods of rainfall deficit and could hence be considered a temporal GDE component on the Project Area.

GDE aquifers have the potential to support subterranean fauna (stygo fauna). However, as detailed in Ensham (2018), the potential for aquifers in the Project Area to support high stygo fauna diversity are low. This is because the salinity levels in the vicinity of the Project are above 5,000 $\mu\text{S}/\text{cm}$. According to Hancock and Boulton (2008), most stygo fauna collected from alluvial aquifers in New South Wales and Queensland prefer salinities less than 5,000 $\mu\text{S}/\text{cm}$. Hose et al. (2015) reported that the salinity range for aquifers in the Bowen Basin that yielded stygo fauna was 342 $\mu\text{S}/\text{cm}$ to 9,975 $\mu\text{S}/\text{cm}$ (Hose et al., 2015).

Surface expression GDE refers to ecosystems reliant on surface water hydraulically connected with groundwater. As discussed in Section 5.2.1, there is little potential for surface expression GDE around the Project Area.

5.5.2 Springs

A search with Queensland's WetlandInfo Portal (WetlandInfo, 2019) showed that there are no registered springs in a 50 km radius of the Project Area (Appendix M).

5.5.3 Wetlands

A search within Queensland Globe showed a wetland of high significance located 2.6 km south of the existing open-cut mine. Refer to Figure 37 for the location of this wetland. The wetland is surrounded by agriculturally used land, as indicated by farm dams and irrigation pivots in the area. The wetland has not been confirmed by a site visit.

Appendix M also shows the same wetland; however, it is hard to identify on the scale used in the WetlandInfo report output. According to the report, it is classified as a Palustrine wetland. Palustrine wetlands are primarily vegetated non-channel environments of less than 8 hectares.

5.5.4 Irrigation, farm supply / use and stock water (private bores)

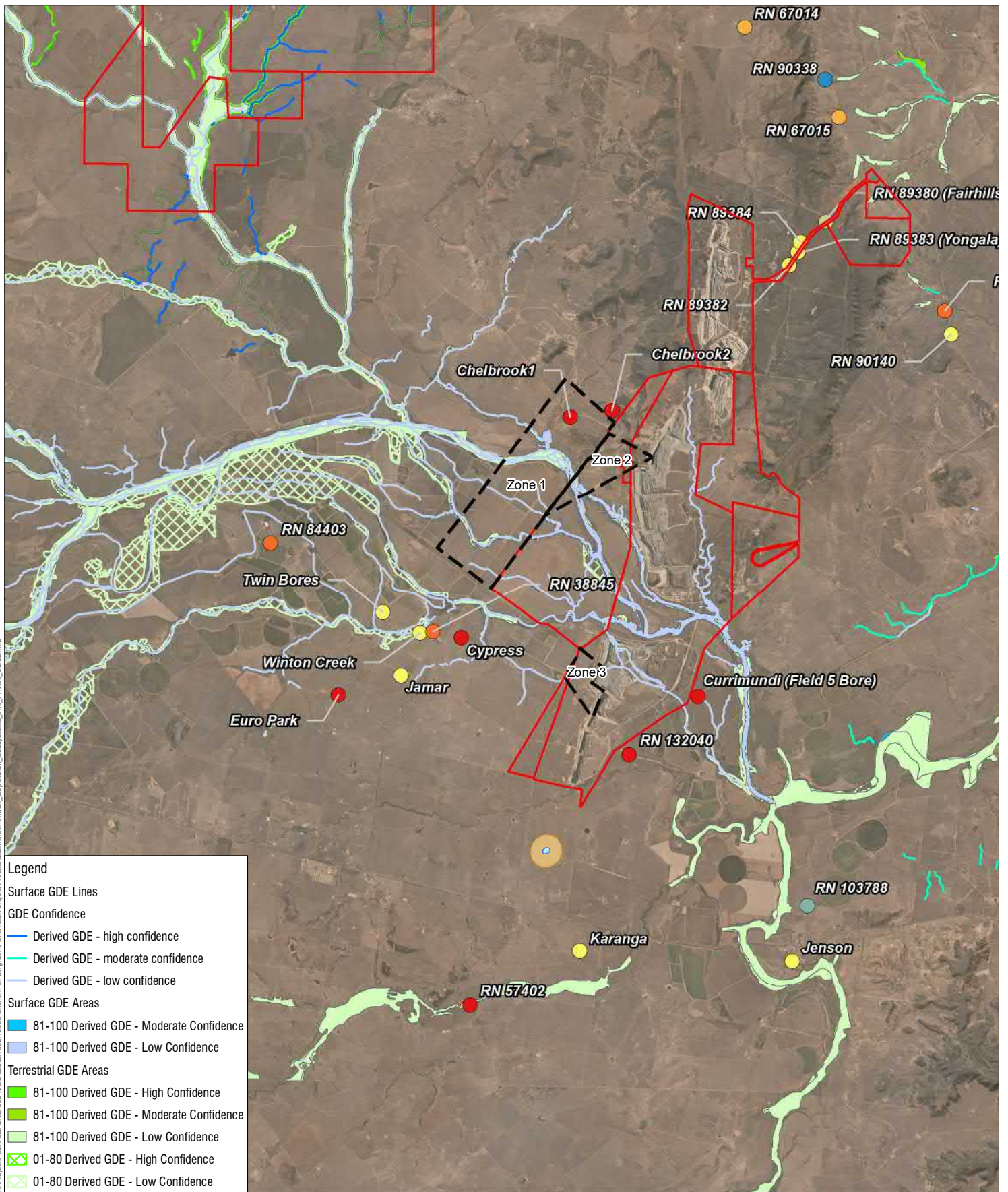
Several private bores extract groundwater adjacent to the mine lease boundary for irrigation, farm supply or stock water. AGE (2017) reported on a bore census conducted in September 2014 coupled with a database search for registered bores on the Department of Natural Resources, Mines and Energy (DNRME) groundwater database (GWDB).

For this report, an additional database search was conducted and a summary of identified existing bores within a 15 km radius from the proposed lease is provided in Table 13. Overall, groundwater usage is limited in the district, given access to better quality water from the perennial Nogoa River.

The distribution of private bores, categorised according to use, is shown on Figure 37.

Table 13 Existent private groundwater bores

Registered RN (ID)	Bore name	Easting (mMGA)	Northing (mMGA)	Geology	Bore depth (m)	Use
103788	Conmurra	657954	7390072	Fair Hill Formation	66	Irrigation (stock and domestic)
132040	Currimundi	650966	7395998	Burngrove Formation	-	Not in use
57402	Kensington	644749	7386154	Tertiary undifferentiated	-	Not in use
84403	-	636913	7404293	Alluvium	-	Unknown
89380	Fair Hills	658696	7416877	Burngrove Formation	77	Stock and domestic
89383	Yongala	657586	7415693	Burngrove Formation	74	Stock
89382	-	657253	7415184	Burngrove Formation	74	Stock
89384	-	657691	7416083	Burngrove Formation	78	Stock
90140	Railway	663591	7412470	Fair Hill Formation	61	Stock
-	Chelbrook1	648661	7409238	Tertiary undifferentiated	24	Not in use
-	Chelbrook2	650303	7409481	Rangal Coal Measures	>100	Not in use
-	Currimundi (Field 5 bore)	653687	7398270	Alluvium	29	Not in use
-	Cypress	644408	7400570	Rangal Coal Measures	>160	Not in use
-	Euro Park	639581	7398327	Rewan Group	74	Not in use
-	Jamar	642025	7399084	Rewan Group	90	Stock
-	Jenson	657364	7387906	MacMillan Formation	41	Stock
-	Karanga	649043	7388304	Rangal Coal Measures	~50	Stock
-	Twin Bores	641319	7401567	Basal alluvium	18	Stock
-	Winton Creek	642771	7400758	Rewan Group	60	Stock



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 26/02/2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

Wetland

Wetland Protection Area

Mining Lease

Registered and Private Bores

Farm Supply (Potable)

Irrigation, Stock, and Domestic

Stock and Domestic

Stock

Unlikely used (very saline)

Unknown

Not in use

GROUNDWATER IMPACT ASSESSMENT

Groundwater Dependant Ecosystems and Private bores

Figure 37

5.6 Conceptual Groundwater Model

After reviewing new data, the conceptual model by AGE (2017) and checked by HydroSimulations (2020) is considered relevant to the proposed Project (refer to Section 1.4), as there were no conceptual changes identified. A conceptual cross section for the study area centred on the Ensham Mine is presented on Figure 38. Note that the cross section is oblique to strike and dip (refer to Figure 13 for the location of the cross section B-B'). However, it captures the relevant formations, their apparent thickness and the recharge/discharge processes.

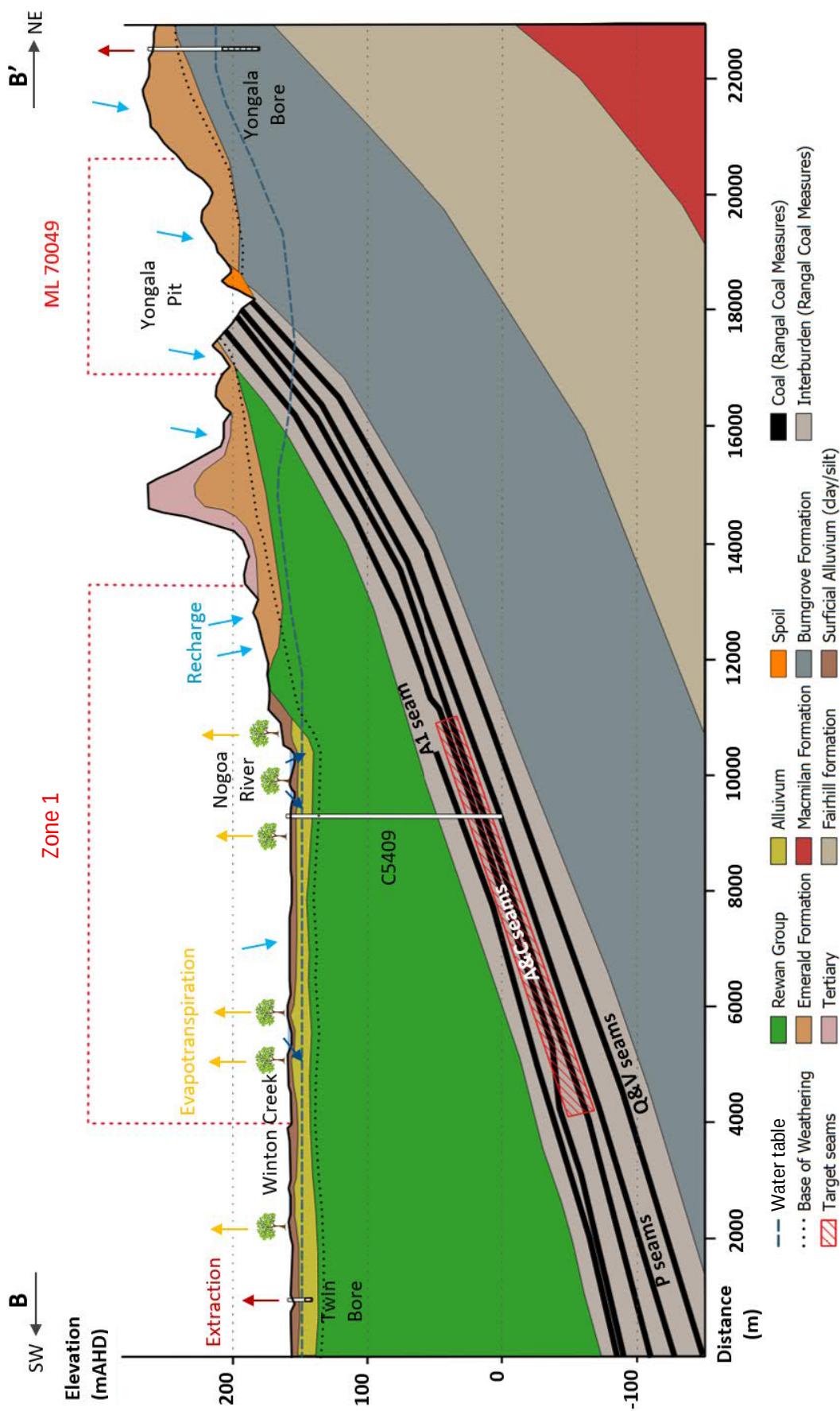
The cross-section was selected from south-west to north-east to show two landholder bores (Twin Bore and Yongala Bore) and the exploration hole C5409. C5409 reaches the Pollux Seam at an elevation of ~ 0 m AHD and will be developed as a set of nested bores to monitor groundwater level in the alluvium, Rewan Group and coals seams of the Rangal Coal Measures (Section 8.4.1). The conceptual cross section includes the Nogoa River, the agricultural area within the flood plain and the Yongala pit.

The surface elevation was sourced from the three second Digital Elevation Model developed by Geoscience Australia (2011). The approximate location of the coal seams (not to scale) are based on previous conceptualisation by AGE (2017) and Gordon Geotechniques (2016). The Project targets the Aries and Castor seams at depth of 120 m to 210 m below surface. The Rewan Group separates the Nogoa River flood plain and alluvium from the proposed underground working.

The water table shown on Figure 38 in the alluvium is relatively flat at 140 mAHD and is thought to be discontinuous.

The (existing) underground access to the target seams is from the east and is not represented on the cross section. This is shown on the mining schedule on Figure 3.

Figure 38 Conceptual hydrogeological section of the Project Area and surroundings



6 Groundwater model

6.1 Model objectives

Numerical modelling was undertaken to assess the impact of the Project on the groundwater regime. The objectives of the predictive modelling were to:

- estimate the groundwater inflow to the mine workings as a function of mine position and timing
- simulate and predict the extent and area of influence of dewatering and the level and rate of drawdown at specific locations (bores identified in Section 5.5.4 and the EA monitoring bores for ongoing model validation)
- identify areas, where groundwater impact mitigation / control measures may be necessary.

6.2 Software

The groundwater model was originally constructed and calibrated in 2016 by AGE (2017) using MODFLOW-USG, version 1.2.4 (Panday et al., 2013) software coupled with mesh generation software AlgoMesh developed by HydroAlgorithmics Pty Ltd (Merrick and Merrick, 2015). Functionality of the MODFLOW-USG package has been employed to represent discontinuous lithology, time-variant hydraulic properties and improved model stability under desaturated conditions.

The 2016 AGE model was further refined for a final void study to assess several scenarios for final voids, the resulting peer reviewed groundwater model from this study is documented in HydroSimulations, 2020. The study assessed three final landform options. Since then, Scenario 2 (excluding the infrastructure to support a water storage facility) referred to as the Submitted option has been chosen as the final landform based on a triple bottom line assessment, and thus the modelling files for this scenario have been used in this study. This means that in addition to the existing underground mining operations and the Project, the final landforms for the Submitted option are considered in the groundwater model for this report. The open-cut portion of the model remained unchanged from (HydroSimulations 2020, Scenario 2, refer to Table 18 for details) and the underground mining was modelled as to assess the existing underground mining and the Project.

6.3 Model setup

A groundwater flow model is a computer-based three-dimensional mathematical representation of a groundwater system using the laws of physics. A model is generally developed for all or part of a groundwater system. The modelled area is referred to as the model domain, which exists in three dimensions. It is divided into a number of building blocks to represent key features of the groundwater flow system including the elevation of the ground surface and each geological formation present within the area.

The groundwater model presented here was established with a number of layers that represent the hydrogeological units (Section 6.3.1), based on the data collected and described in Section 5. The model layers get assigned aquifer parameters (Section 6.3.2), initial conditions (i.e. the water level at the start of the modelling period) and boundary conditions (Section 6.3.3). These conditions were adopted from previous model iterations (HydroSimulations, 2020).

The model will calculate the response of this conceptualised groundwater system to the following boundary conditions:

- No flow and general head boundary (Section 6.3.3.1 and 6.3.3.2)
- The climatic inputs and outputs, specifically the rainfall recharge and evapotranspiration (Section 6.3.3.3)
- Interactions of the groundwater system with open-cut mining operations (Section 6.3.3.4)
- Interactions of the groundwater system with the underground operations (Section 6.3.3.5)
- Interaction with natural surface water bodies (Section 6.3.3.6)

The model is not only discretised in space, but also in time. The time steps used in this model are adopted from HydroSimulations, 2020 and described in Section 6.3.4.

6.3.1 Model grid and layers

Figure 39 shows the model domain and the model grid (a voronoi polygon mesh). Consistent with the previous model iterations, there are 12 layers in the model. As a fully unstructured model, the layers are not required to be present in all areas as was the case in former versions of MODFLOW.

All model iterations, including the model presented in this report (SLR 2019 model), utilise the pinching capability of MODFLOW-USG. This capability allows to reduce overall cell count, when a layer is not present at a location (for example coal outcrops). In this model, the maximum number of cells is 770,190 compared to 952,236 cells in an equivalent layered model. This represents a saving of about 20 percent.

The stratigraphic units which are represented by each model layer are summarised in Table 14. The alluvium and the Rewan Group are both discretised with two model layers. The alluvium is subdivided, because two distinct layers are observed (Section 5.2.1). The Rewan Group was subdivided to provide better vertical resolution. Further, the division into two layers allows to assign different parameters. The Rangal Coal Measures are split into seven layers, accounting for three coal seams and the overburden, interburden and underburden.

Table 14 Stratigraphy - model layer summary

Model layer	Geological age	Stratigraphic unit	
1	Quaternary	Low permeability alluvium and regolith	
2		Alluvium (basal gravel) and regolith	
3	Triassic	Rewan Group - fine grained sandstone and siltstone	
4			
5	Permian	Rangal Coal Measures	Sandstone, siltstone and shale
6			Aries 1 seam
7			Sandstone, siltstone and shale
8			Aries 2 seam and Castor seam
9			Sandstone, siltstone and shale
10			Pollux seam
11			Sandstone, siltstone and shale
12		Burngrove Formation	Sandstone, siltstone, shale and coal

6.3.2 Model properties

Summaries of the model layer calibrated properties from Hydrosimulation, 2018 and adopted in this model are presented in Table 15. A comparison between adopted hydraulic conductivities and field data is presented in Table 16. Appendix H, Figure H1-1 to Figure H1-12 show the hydrostratigraphic zones for each layer.

Table 15 Simulated aquifer properties (adopted from HydroSimulations, 2020)

Model layer	Lithology	Horizontal hydraulic conductivity Kh (m/day)		Vertical hydraulic conductivity Kv (m/day)		Specific yield Sy (-)	Specific storage Ss (m)
		From (lower value)	To (upper value)	From (lower value)	To (upper value)		
1	Surficial alluvium (clay / silt)	1.00E-03	1.00E-03	5.00E-05	5.00E-05	7.50E-03	1.00E-06
1,2	Regolith	2.80E-01	2.80E-01	7.00E-03	7.00E-03	7.50E-03	1.00E-06
1,2	Permian subcrop	3.00E-02	3.00E-02	1.20E-04	1.20E-04	1.50E-02	1.00E-06
2	Basal alluvium (sand / gravel)	1.00E+01	1.00E+01	5.00E-01	5.00E-01	1.50E-01	5.00E-06
3	Rewan Group	4.20E-02	4.20E-02	2.10E-04	2.10E-04	7.50E-03	1.70E-06
4	Rewan Group	1.20E-04	1.20E-04	6.00E-07	6.00E-07	7.50E-03	1.50E-06
5	Sandstone / siltstone / shale	2.00E-04	2.00E-01	4.55E-06	4.55E-03	3.75E-02	1.00E-07
6	Aries 1 Seam	1.00E-02	1.00E+01	2.78E-04	2.78E-01	7.50E-03	1.00E-07
7	Sandstone / siltstone / shale	4.00E-04	2.00E-01	3.57E-06	3.57E-03	1.38E-03	5.00E-07
8	Aries 2 and Castor Seam	5.00E-03	5.00E-01	2.50E-04	2.50E-01	7.50E-03	5.00E-07
9	Sandstone / siltstone / shale	1.00E-04	1.00E-01	5.00E-06	5.00E-03	7.80E-04	5.00E-07
10	Pollux Seam	5.00E-03	5.00E+00	2.78E-04	2.78E-01	7.50E-03	5.00E-07
11	Sandstone / siltstone / shale	1.00E-04	1.00E-01	4.17E-06	4.17E-03	7.73E-04	5.00E-07
12	Burngrove Formation	1.00E-05	1.00E-04	8.60E-06	8.60E-06	1.00E-03	5.00E-06
-	Spoil	1.00E+00	1.00E+00	1.00E-01	1.00E-01	4.00E-02	1.00E-03
-	Void	1.00E+03	1.00E+03	1.00E+03	1.00E+03	1.00E+00	1.00E-04
-	Bord and Pillar zone	1.00E+02	1.00E+02	1.00E+02	1.00E+02	5.00E-01	1.00E-04
-	Faults	1.00E-05	1.00E-04	1.00E-06	1.00E-05	1.00E-02	1.00E-05

Table 16 Adopted properties relative to field data ranges

Model layer	Lithology	Validated horizontal hydraulic conductivity kh (m/day)		Field data horizontal hydraulic conductivity kh (m/day)	
		From (lower value)	To (upper value)	From (lower value)	To (upper value)
1	Surficial alluvium (clay / silt)	1.00E-03	1.00E-03	9.00E-04	1.00E-03
1,2	Regolith	2.80E-01	2.80E-01	4.30E-01	4.30E-01
1,2	Permian subcrop	3.00E-02	3.00E-02	-	-
2	Basal alluvium (sand / gravel)	1.00E+01	1.00E+01	9.00E-02	1.00E+02
3	Rewan Group	4.20E-02	4.20E-02	-	-
4	Rewan Group	1.20E-04	1.20E-04	-	-
5	Sandstone / siltstone / shale	2.00E-04	2.00E-01	4.00E-03	4.00E-03
6	Aries 1 Seam	1.00E-02	1.00E+01	9.00E-03	5.90E+00
7	Sandstone / siltstone / shale	4.00E-04	2.00E-01	1.80E-02	1.19E+00
8	Aries 2 and Castor Seam	5.00E-03	5.00E-01	9.00E-03	5.90E+00
9	Sandstone / siltstone / shale	1.00E-04	1.00E-01	1.80E-02	1.19E+00
10	Pollux Seam	5.00E-03	5.00E+00	9.00E-03	5.90E+00
11	Sandstone / siltstone / shale	1.00E-04	1.00E-01	1.80E-02	1.19E+00
12	Burngrove Formation	1.00E-04	1.00E-04	-	-
-	Spoil	1.00E+00	1.00E+00	-	-

6.3.3 Boundary conditions

The model boundary conditions that were applied consistent with the previous model iterations (HydroSimulations, 2020). Figure 39 shows the General head boundary (GHB) to the southwest and south of the model, the mining related drain boundaries and the surface water related River and Streamflow boundaries. They are described in more detail below.

6.3.3.1 No flow boundary

No-flow boundary conditions were applied for the north-west to eastern boundary, which means that no groundwater flow occurs across these boundaries. These boundaries were chosen by earlier model iterations (AGE, 2017, HydroSimulations, 2020) and were kept consistent in this model.

6.3.3.2 General head boundary

General head boundaries represent regional inflow or outflow. The GHBs were chosen by earlier model iterations (AGE, 2017, HydroSimulations, 2020) and were kept consistent in this model. The GHB is applied to the south and southwest of the model domain for all model layers. The GHB heads range is from 140 to 150 mAHD (no change over time).

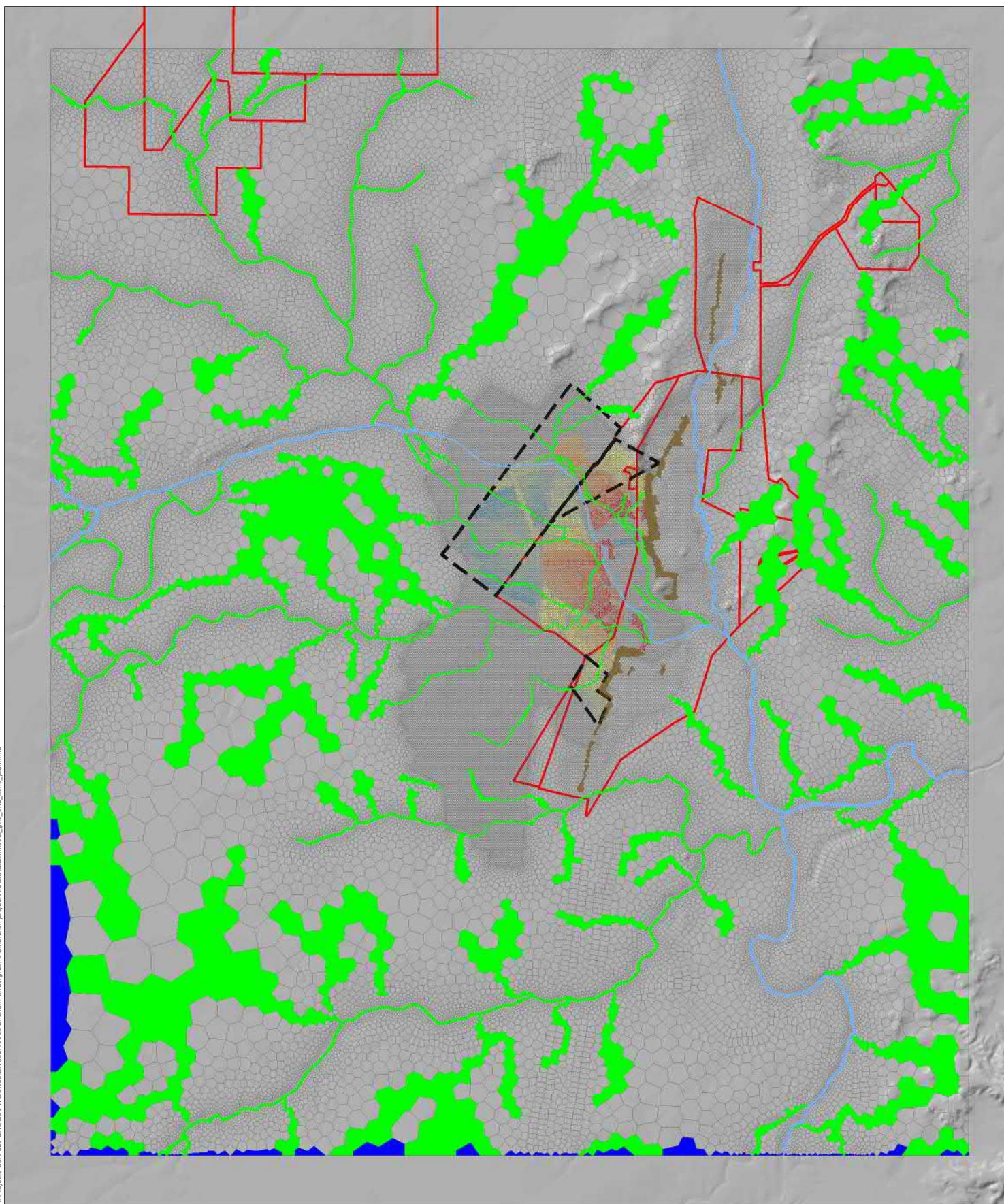
6.3.3.3 Recharge and evaporation

Recharge from rainfall assigned to the top model layer as a percentage of the rainfall. The calibrated values from HydroSimulations, 2020 are presented in Table 17 below and were adopted in this model. Appendix H, Figure H2-1 presents the zones for the groundwater recharge.

Table 17 Recharge values

Zone	Diffuse recharge rate	
	mm / yr	Per cent of annual rainfall (%)
Surficial alluvium	5.18	0.8
Regolith	0.64	0.01
Permian subcrop	0.64	0.01
Spoil	53.1	8.2
Open-cut void	647.5	100

The evapotranspiration rates are 1,030 mm/year for the general areas and 1,650 mm/year for the open water bodies of the voids, which equates to 50% and 80% of the long-term pan evaporation observations of 2,062 mm/year. The rates are applied at the surface at the reported values and decrease linearly over depth to zero at the so-called extinction depth of 2 m BGL. This means that the evapotranspiration processes are most prevalent at the surface and expected to reach down to 2 m below ground surface, representing the root zone.



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 26/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Open Cut DRN Cells
- STR Stream cells
- RIV River cells
- GHB General Head Boundary
- Model Grid
- Project Area
- Mining Lease

GROUNDWATER IMPACT ASSESSMENT Model grid, boundary conditions and mine plan

Legend

- | Mine Schedule | |
|---|--|
| 2019 | 2025 |
| 2020 | 2026 |
| 2021 | 2027 |
| 2022 | 2028 |
| 2023 | 2029 |
| 2024 | 2030 |
| 2032 | 2031 |
| 2033 | 2034 |
| 2035 | 2036 |
| 2037 | |

Figure 39

6.3.3.4 Open-cut mining

The open-cut mine and associated spoils are implemented through the use of MODFLOW drain cells and the time variant materials (TVM) process. Figure 39 shows the modelled mine progression. The drain cell conductance was selected as 100 m² / day.

The drain cells approach was used based on the HydroSimulations model (2020). The implemented water management strategies for each pit from HydroSimulations (2020) have been adopted and are reproduced in Table 18.

As open-cut operations progress, pits are backfilled with waste rock. This creates a porous medium through which water can flow. This water is treated as groundwater and is included in the model through implementation of the TVM package. Similar to an aquifer, the waste material is assigned hydraulic properties (a conductivity of 1 m/day and storage properties, a specific yield of 0.04). Water stored in waste material impacts on rate of void water rebound and pit water level predictions. Having the material in place also reduces the evaporation volume compared to an open water surface setting. It is thus critical to include these flows in the groundwater model.

Table 18 Open-cut modelled water management

Pit	Water management
A south	Water storage, no active level control or top-up
A north	Water storage, no active level control or top-up
B	Water storage, no active level control or top-up
C	Actively dewatered to end 2028. Following this time natural rebound permitted*
D	Actively dewatered to end 2028. Following this time natural rebound permitted*
E	Actively dewatered to end 2028. Following this time natural rebound permitted
F	Actively dewatered to end 2022. Following this time natural rebound permitted
Y	Actively dewatered to end 2017. Following this time natural rebound permitted

Note * The open-cut model drains switch off at the end of 2028, consistent with HS, 2018. However, should there be water in pits C and D after 2028, it will be dewatered until the end of the Project for underground access/mining/rehabilitation.

6.3.3.5 Underground workings

The underground bord and pillar mine simulates the gradually developing underground workings. The mine plan for the calibration model was updated in HydroSimulations, 2020. The underground mine plan for the predictive model has been updated to include the Project mine plan. At the changeover from the calibration model and the predictive model, there were challenges in reconciling actual versus predicted mining plans in the early time periods of the SLR predictive model (6 months). However, this does not markedly impact on long term prediction of inflows (~20 years). In this report, all values will be reported commencing in January 2020, by which date the model predictions are no longer impacted by the minor discrepancies between actual and predicted mine plans.

The mining is modelled using drain cells. A drain cell in a groundwater model has two properties assigned to it, a water level (to which the model attempts to drain this cell to) and a conductance (a parameter that defines how much resistance the surrounding groundwater shows against the drain).

The model then calculates the inflow into the drain cell based on these two parameters. First, it compares the groundwater level to the drain level. If the groundwater is above this level, the drain cell will remove water until the groundwater and the drain cell head are at the same level, using the drain cell conductance as a factor. If the groundwater level is below the drain cell head, no water is removed from or added to the groundwater. The heads in the drain cells in the model range from -74.85 mAHD in the west to 94 mAHD in the east for the underground workings, accounting for the dip in the westerly direction. The drain cell conductance was selected as 100 m² / day in accordance with previous models (HydroSimulations, 2020).

The underground mining is represented by two model packages.

- Firstly, as described above, when mining moves into an area, the model uses drain cells to actively dewater the area. The drains are active for two years, which likely leads to an overprediction of the inflows to the underground mine. However, the approach is consistent with the previous model (HydroSimulations, 2020). Therefore, the model provides ingress predictions up to 2039, which is two (2) years after the final mine bord and pillar sections commence in February 2037.
- Secondly, once the active mining moves out of the area, a void is left behind. This void is represented by changing the material properties of the area, using the TVM. The specific yield for the underground workings after coal removal was set to 0.5 (i.e. 50% of coal left in place and 50% of void space created).

6.3.3.6 Rivers

Groundwater interaction with surface drainage was modelled using the stream routing (STR) package for major rivers and creeks and using the river (RIV) package for minor drainage lines. Both boundary conditions have a surface water head assigned to them (steady state or transient). The surface water level in each cell that has a STR or RIV component is compared to the groundwater level in the respective cell:

- if the groundwater level is higher than the surface water level, the model will calculate the discharge of groundwater into the surface water based on the stream or river bed conductance (a variable describing the permeability of a stream or river bed).
- if the surface water level is higher than the groundwater level, the model will calculate the infiltration of surface water into the groundwater based on the river bed conductance (STR package only).
- If the surface water and groundwater are in equilibrium, no flow is calculated.

Stream cells are set up to use the dynamic stage functionality of the STR package. This represents a basic flow volume - stage relationship. During the flood periods in particular, stream stages are elevated and there is an increase of water recharged into the groundwater system. Conductances are consistent with the previous model in the 200-300 m²/day range. The low hydraulic conductivity in the upper alluvial layer is limiting the water flux between river and alluvium in line with the conceptual model.

River cells have moderate conductances ranging from 5 to 20 m² / day and are set up so that they act as drain cells (gaining water, but never losing water) (AGE, 2017). This boundary condition is used for smaller drainage lines.

6.3.3.7 Other stresses

In the model, irrigation by groundwater pumping is not explicitly represented because it is considered minor. Non-consumptive return of irrigation water is not represented either, although the evapotranspiration package (Section 6.3.3.3) has been used as a surrogate mechanism.

6.3.4 Temporal discretisation

Two models are used to assess the impact of the Project on groundwater resources.

- Model 1 is the validation model it runs from 1995 to 2018. It includes historical open-cut and underground mining.
- Model 2 is the predictive model and was used to model three run options:
 - the existing operations (Model 2a): with active mining from September 2018 to 2028, as approved under current EA. The model covers the time period 2018 to 2261 to capture active mining, short term recovery (quarterly stress periods to model the initial recovery response) and long-term recovery (annual stress periods to model the long-term recovery response).
 - the Project (Model 2b): with active mining from September 2018 to 2037, as proposed for the Project. The model covers the time period 2018 to 2261 to capture active mining, short term recovery (quarterly stress periods to model the initial recovery response) and long-term recovery (annual stress periods to model the long-term recovery response).
 - the Null run (Model 2c): no underground mining from September 2018 onwards, as a hypothetical “no future mining” scenario. The model covers the time period 2018 to 2261 to capture open-cut mining, short term recovery (quarterly stress periods to model the initial recovery response) and long-term recovery (annual stress periods to model the long-term recovery response).

The set-up of the temporal discretisation is presented in Table 19.

Table 19 Models and stress periods

Model	Stress period number	Stress period Length	Time frame covered	Comments
1 Validation model	1 - 2	10 years	1/9/1995-31/8/2005	
	3 - 55	3 months	1/9/2005-31/8/2018	
2a Existing operations	1 - 45	3 months	1/9/2018-31/12/2029	Active mining ^{1,2}
	45 - 172	3 months	1/1/2030-30/9/2061	Short term recovery
	173 - 372	1 year	1/10/2061-30/09/2261	Long term recovery
2b Project	1 - 77	3 months	1/9/2018-31/12/2037	Active mining ^{1,2}
	77 - 172	3 months	1/1/2038-30/9/2061	Short term recovery
	173 - 372	1 year	1/10/2061-30/09/2261	Long term recovery
2c Null run	1 - 45	3 months	1/9/2018-31/12/2029	Active mining ³
	45 - 172	3 months	1/1/2030-30/9/2061	Short term recovery
	173 - 372	1 year	1/10/2061-30/09/2261	Long term recovery

Notes: 1 the first Stress period is 4 months long, 2 Active mining plus two years of active drains as per model conceptualisation, 3 open cuts only.

6.3.5 Validation

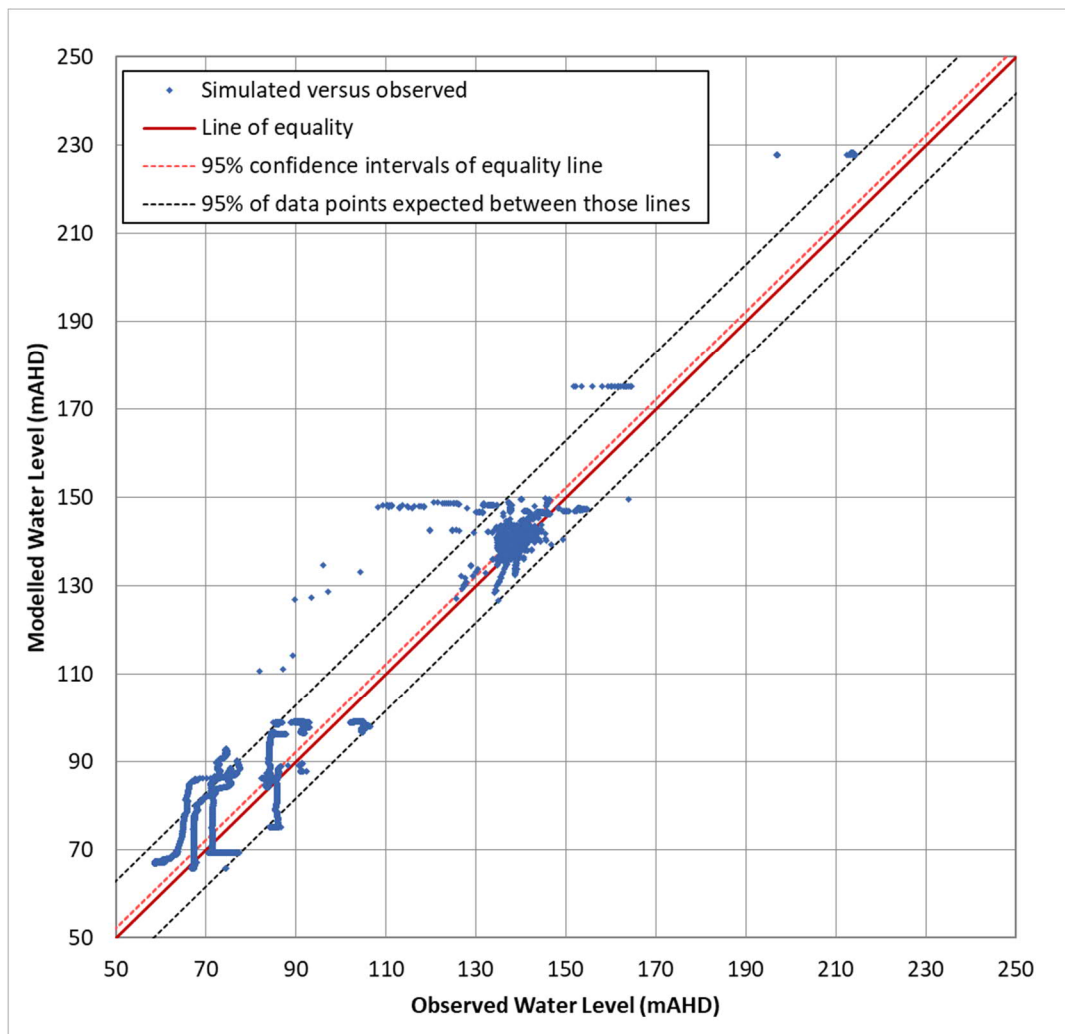
As the groundwater model was last calibrated in 2018 (HydroSimulations, 2020), the calibrated parameters of that peer-reviewed calibrated model were applied, and the model was then evaluated against the updated water level observations collected since the last calibration. The Australian groundwater modelling guidelines recommend a scaled root mean square (SRMS) error less than 10 per cent (Barnett et al. 2012).

The root mean square (RMS) error for the transient model is 7.9 m and the Scaled SRMS error is 4 per cent. This is within acceptable limits recommended by Barnett et al. (2012).

The comparison between the observed water levels and the water levels simulated for the validation period (01/09/2015 to 31/08/2018) is presented on Figure 40. In addition to those observed versus modelled water levels, the figure shows three types of lines:

- Line of equality: This line represents the ideal modelling outcome, i.e. the line that represents the case where observed water levels are matched exactly by the model.
- The 95% confidence interval of equality line: The goal for model calibration is to have the 95% confidence interval lines fall either side of the equality line. In this instance, both lines are above the line of equality, which means that there is a slight bias in the modelled water levels.
- The 95% interval lines: the interval between those two lines represents the area where 95% of the total number of data points are expected to occur. In this instance, only 83% of the points (10,000 of 12,000 observations) fall within the line, showing some room for improvement for the calibrations.

Figure 40 Observed vs computed target water levels



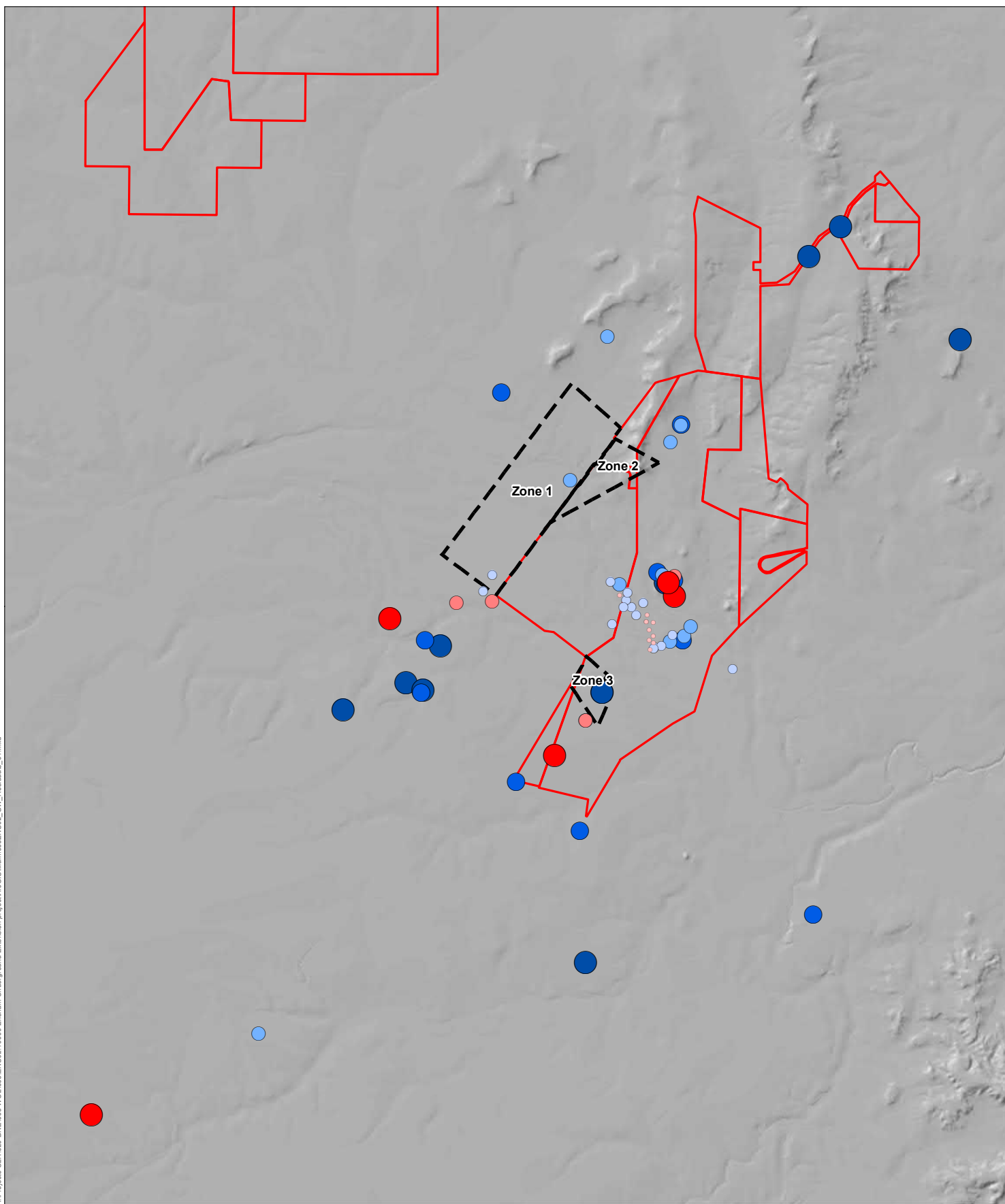
A full set of calibration hydrographs are presented in Appendix G. The hydrographs are consistent with the hydrographs presented in the Hydrosimulations, 2018 model. Some hydrographs are discussed below.

Generally, the model reproduces water levels well within the alluvium, especially during the 2008 - 2014 period. Before that (1995-2008), the model is not reproducing the observations as well, this may be due to the initial conditions (sparse data available) and stress period length (5 yearly). EC01 is the only alluvium bore that is not well calibrated. As discussed in Section 5.2.1, EC01 is likely showing a response to irrigation which is not explicitly reproduced in the model. Prior to 2008, the model generally overestimates water levels in the alluvium and after 2014, the model generally underestimates water levels in the alluvium. However, the decreasing trend that is simulated from 2014 stabilises in 2018 and water levels show a slow increase in 2019, in accordance with observed values. In general, the model reproduces observed streamflow response and flood events quite well.

The RB series of bores (Regional Bores, refer to Table 8) is installed in coal seams at depths of about 100 to 240 mBGL. There is some mining effect observed at RB03, with the modelled rate of drawdown being larger than observed. The model generally overestimates the heads at these bores by 0.5 to 7.0 m.

The model simulated average inflows of 3.3 ML/day into underground mining during the calibration period. This is consistent with the results from the previous calibrated model (Hydrosimulations, 2018), which reported inflows of 3 to 5 ML/day during the calibration period. Observed site inflows ranged from 0.2 to 3.9 ML / day between December 2016 and September 2018 (note that the underground inflow is not metered by one device but calculated from two other metered water flows).

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 630.11929
Date: 26/02/2020
Drawn by: PM
Sheet Size: A4

Legend

Mining Lease
 Project Area

Residuals (m)

● -10 - -5	● 0 - 2
● -5 - -2	● 2 - 5
● -2 - 0	● 5 - 10
	● > 10

GROUNDWATER IMPACT ASSESSMENT

Map of Average Residuals

Figure 41

6.4 Model predictions

The predictive model was run for three cases, as listed in Table 20. As stated in Section 6.3.4, there are three model runs, a Null run, the existing operations, and the Project. These three runs were used to assess

- cumulative impacts: represented by the difference in results predicted for the Null run and results predicted for the existing operation and the Project. For the purpose of this report, “cumulative impacts” refers to the impacts from underground operations compared to a hypothetical case where all underground mining stopped in September 2018. It does not refer to potential impacts from mining operations at other locations.
- incremental impacts: represented by the difference in results predicted for the existing operations and results predicted for the Project.

The model predictions are mainly presented as incremental impacts, i.e. as a comparison between results obtained when modelling the existing operations (with end of mining in December 2027) and results obtained when modelling the Project (with end of mining in February 2037). This captures the impacts that are in addition to the those from existing operations.

An assessment of cumulative impact was conducted to ensure completeness from a regulatory perspective (refer to Table 1 and Table 2).

Table 20 Model run selections

Run name	Properties	Rationale
Null run	• Open cut (past and planned until 2030*) • no underground mining after September 2018)	The Null run was used to assess the cumulative impact from the underground mining (Null run – Project) . Because the underground mining at Ensham is a historical fact, the “No future mining” scenario start was set to September 2018 to coincide with the start of the predictive model. The Project run includes approved mining until 2028 and the proposed extension.
Existing operations	• Open cut (past and planned until 2030*) • future underground mining as approved (2028)	The existing operations was used to assess the incremental impacts between existing operations and Project, i.e. the impact of the extension only.
Project	• Open cut (past and planned until 2030*) • Future underground mining as approved (2028) • Further future underground mining as proposed (2036)	This run was used in both the cumulative impact assessment and incremental impact assessment.

Note: open-cut mining active until 2024. However, some drains remain active in the model to 2030. As the open-cuts have not been altered, these are the same as in HydroSimulations, 2020.

6.4.1 Groundwater model water balance

The groundwater model water balance for the Null Run, existing operations and the Project are presented in Table 21, as an average over the time period between 2020 and 2039.

The climatic components are comparable, with the evapotranspiration (ET) showing a negligible variation for the Null run (-1.0 per cent). The flows from and to rivers (RIV package) and streams (STR package) are identical for both the existing operations and Project and slightly smaller for the Null run. This indicates stream flows are not changing as a result of the proposed mining extension.

The constant head boundary shows slightly different results for the Null Run, existing operations and the Project. However, these differences are not significant when the constant head fluxes are set into context with the climatic components, which are by an order of magnitude larger.

The difference in the drains (i.e. mining) outflow rates is due to the longer timeframe of the Project. Averaged over the assessment period, the Project is predicted to increase mining inflow on average by 4.3 ML / day (this includes open cut drains). The temporal mining inflows are discussed in Section 6.4.2. The drain component for the Null run constitutes only of the open cut operations. These open cut inflows for the Null run are slightly higher than for the existing operations and Project, because in the latter two runs, more water is captured by the underground drains.

Table 21 Average simulated water balance during the prediction period (2020 to 2039)

Component	Null run		Existing operations		Project	
	Inflow (ML / d)	Outflow (ML / d)	Inflow (ML / d)	Outflow (ML / d)	Inflow (ML / d)	Outflow (ML / d)
Recharge (RCH)	15.92	0.00	15.92	0.00	15.92	0.00
ET (from GW) (EVT)	0.00	17.52	0.00	16.83	0.00	16.65
RIV	0.00	0.10	0.00	0.10	0.00	0.10
STR	13.93	0.51	13.96	0.51	13.97	0.51
Regional GW Flow (GHB)	0.12	0.46	0.12	0.46	0.12	0.46
Constant Head (CHD)	1.10	0.67	1.19	0.66	2.20	0.65
Mine inflows (DRN)	0.00	OC 3.89 UG 0.00	0.00	OC 2.12 UG 4.52	0.00	OC 2.12 UG 8.90
Storage	3.45	11.37	8.20	14.19	12.53	15.38
Total (ML / day)	34.52	34.52	39.39	39.39	44.74	44.74
Mass Balance	0.00		0.00		0.00	

Notes: OC = Open Cut, UG = underground

6.4.2 Predicted groundwater interception

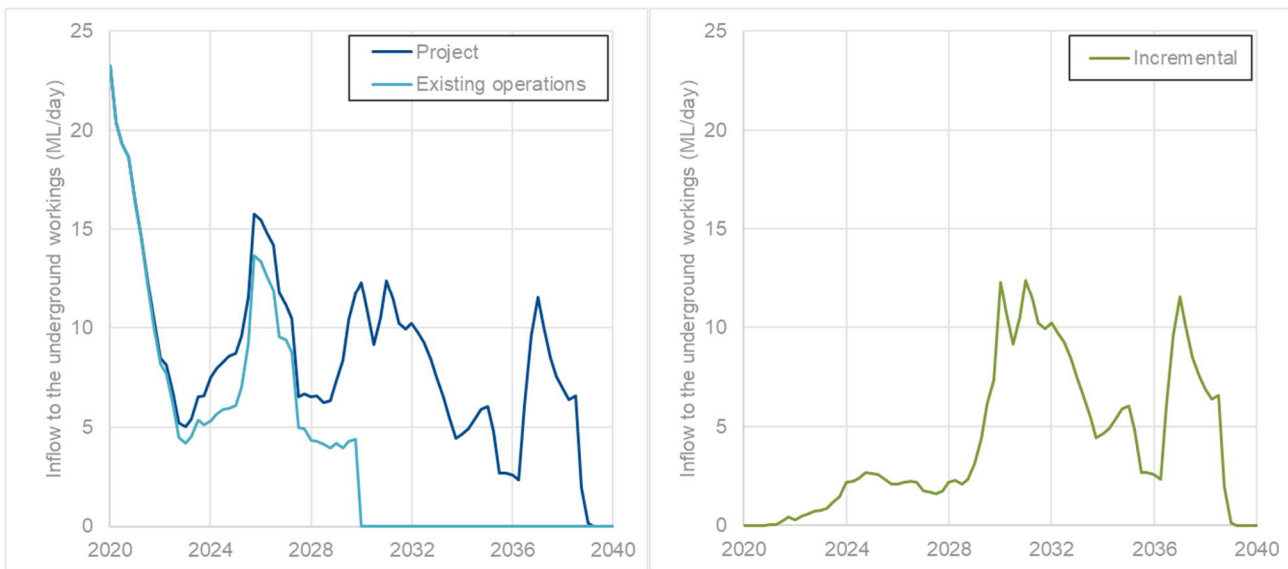
The daily predicted inflow rates into the underground operations are shown on Figure 42 (left) for both the existing operations and the Project. Figure 42 (right) shows the incremental inflows (difference between existing operations and Project) into the underground.

The Project inflows are the cumulative inflows (Project compared to Null run, which has no underground mining in the predictive period). As shown on Figure 42, after an initial higher inflow in 2020 of 20 ML/day, both the existing operations and the Project show inflows of 5-15 ML/day for the period between 2021 and 2029. Lower inflows can be expected when mining remains in an area for a longer time. When going into new areas, the inflows can increase, as no previous dewatering was active there. The inflows for the existing operations then cease (end of mining December 2027, drains active until December 2029). The Project (mining up to February 2037) shows further inflow until the model drains are inactive (February 2039). Between 2020 and 2028 the Project shows slightly higher inflows than the existing operations is due to the Project moving into new areas by 2021 (refer to Section 1.3)

Due to the conceptualisation (drains active for two years after mining in each cell), these inflow estimates are likely an overestimation. For the context of the impact assessment, an overestimation of inflow will result in a larger drawdown and hence a conservative impact assessment.

The inflows are a combination of the losses from coal removal (water in pore space) and active pumping within the underground workings. The model does not quantify the losses from the coal removal. This means that the actual requirement for pumping will be lower than this total estimate.

Figure 42 Predicted underground mine inflow



6.4.3 Predicted drawdown

The process of mine dewatering directly and indirectly (induced flow) reduces water levels in surrounding groundwater units. The extent of the zone affected by the mine dewatering (resulting in decreased water levels) is dependent on the hydraulic properties of the aquifers / aquitards and is referred to as the zone of depressurisation in a confined aquifer and zone of drawdown within the (unconfined aquifer) water table. Depressurisation and drawdown of groundwater levels are greatest at the mine working coal-face, and reduces with distance from the mine.

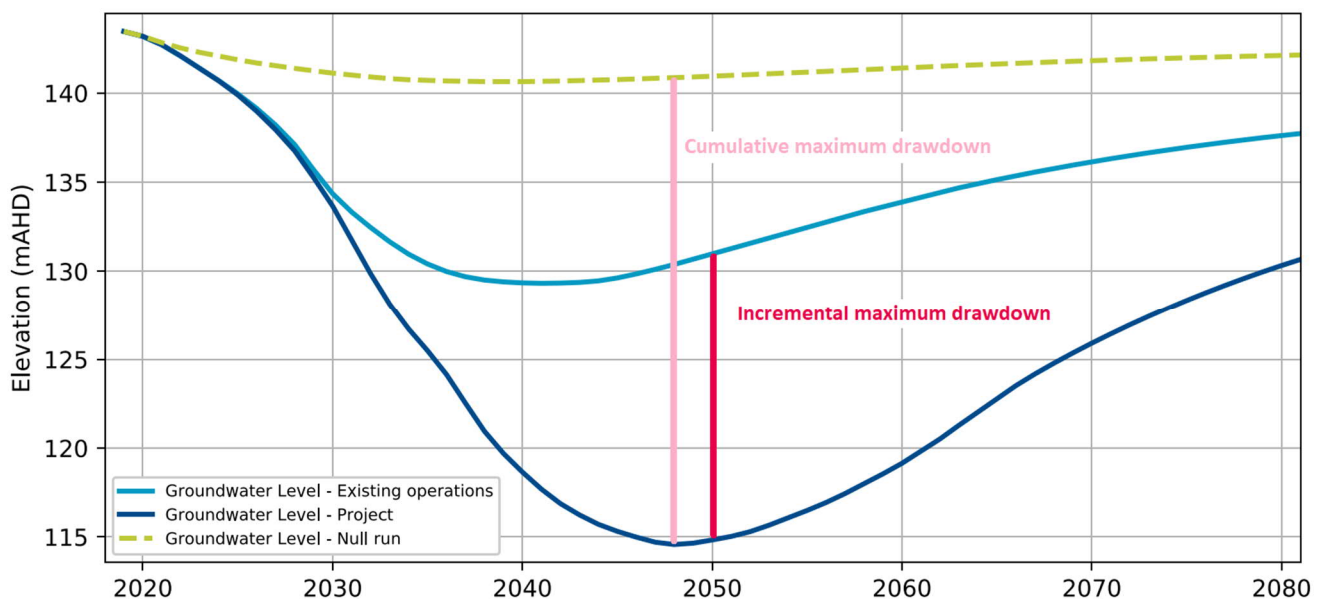
A full set of water level maps at selected time steps is shown in Appendix I, a full set of drawdown maps (incremental and cumulative) at selected time steps is shown in Appendix J.

In addition to the results at the selected time steps, the maximum incremental drawdown was calculated as follows:

- At each model cell and at each timestep, the water level (or pressure) for the existing operations and the Project are exported.
- These two levels are then compared.
- Starting at the first timestep, this difference is stored as the maximum drawdown and the next timestep will be evaluated.
- If the difference is larger than in the previous time step, the new difference will become the maximum drawdown at that model cell.

It is worth noting that the resulting map of maximum drawdowns is not a snapshot of one particular point in time, because the maximum difference in water level will not occur at the same point in time for all locations. This is illustrated in Figure 43, where the incremental and cumulative maximum drawdowns are occurring at different times due to the water level recovery in the existing operations.

Figure 43 Illustration of drawdown calculations



6.4.3.1 Incremental drawdown

The incremental drawdown for the unconsolidated (L2), target coal seam (L8) and the water table are shown in Appendix J, Figures J-1 to J-21 for selected time steps. The maximum drawdown maps are shown in Appendix J and discussed here in more detail.

Figure 44 shows the maximum incremental drawdown due to the Project within layer 2 (L2), where the unit is predicted to be saturated. As shown on Figure 44, the drawdown in the alluvium in the study area is localised east of the open-cut pits and is not affecting the area around the actual underground mining activities. There are two more predicted areas of additional drawdown, of approximately 1m. These drawdown areas occur in the regolith in Zone 2 and to the north of the Project Area, where the coal seams subcrop.

Figure 45 shows the maximum incremental drawdown due to the Project within the mined Aries 2 and Castor Seams (A2C, layer 8 (L8)). As shown on Figure 45 the maximum groundwater level drawdown within the A2C seams is predicted to extend up to 10 km to the west (0.5 m drawdown contour) of the underground mining operations. Groundwater level drawdown within the A2C seams is limited to where the coal seam is present (outcrop to the east).

Figure 46 shows the incremental drawdown in the water table due to the Project only at the end of mining. The water table is the water level in the first saturated model layer. The figure indicates the water table drawdown is limited to the same extent as the alluvial layer, which indicates that the depressurisation of the coal seams is not resulting in induced flow through the Rewan Group into the alluvium for this simulated period ending 2040.

6.4.3.2 Cumulative drawdown

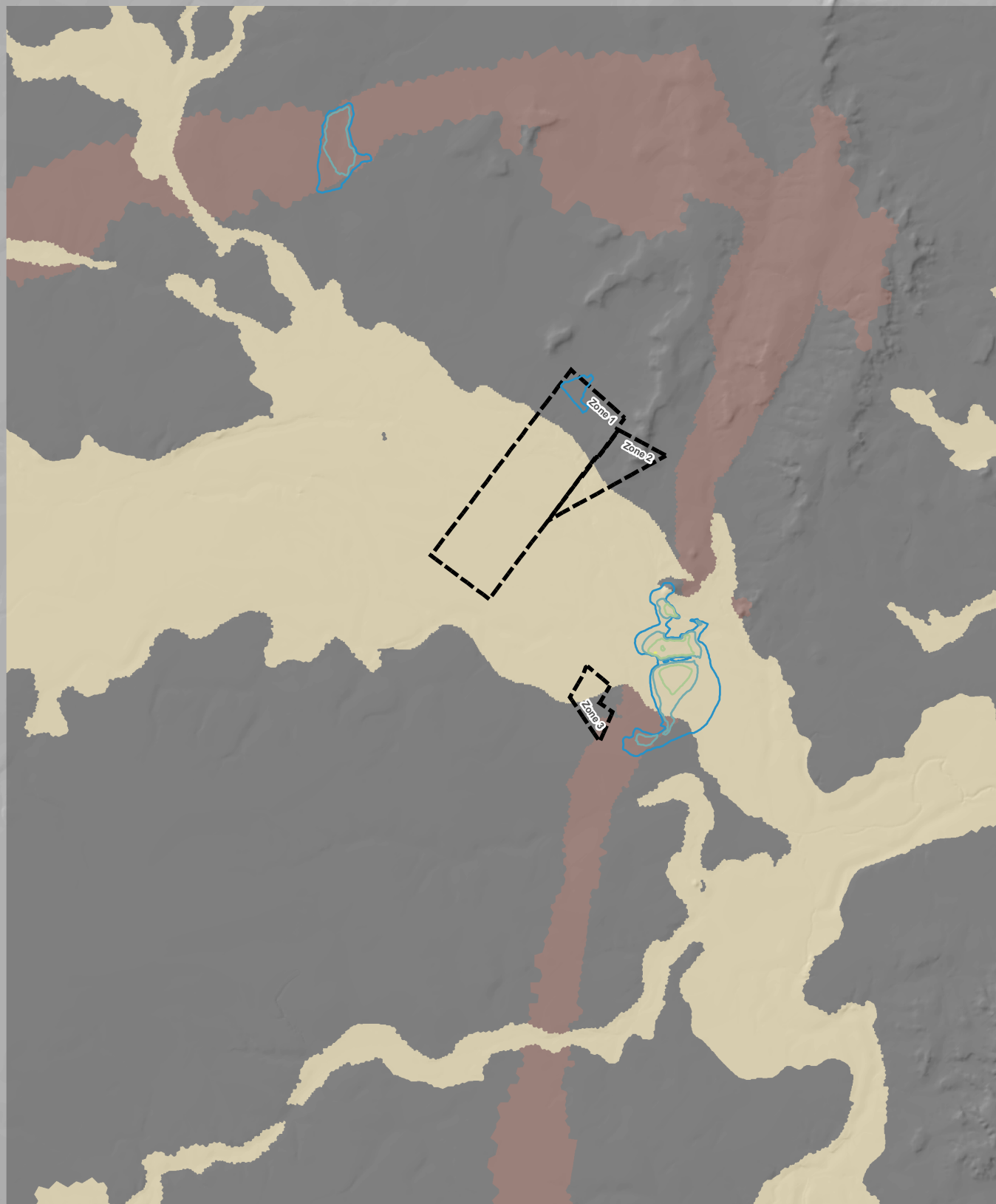
The cumulative drawdown was assessed based on the difference between the existing operation plus the Project and the hypothetical scenario where all underground mining stops at 2018. That hypothetical scenario will lead to earlier recovery, which makes the resulting drawdown curves extent deeper and further.

The results for the unconsolidated (L2) and target coal seams (L8) are shown in Appendix J, Figures J-22 to J-33 for five selected points in time between 2020 and 2261. The maximum cumulative drawdown was not plotted spatially as the incremental and cumulative extents were comparable, with the cumulative drawdowns extending slightly further than the incremental.

The cumulative drawdown for a time step after end of mining (year 2040) in the target Aries 2 and Castor seams is shown in Figure 47 in comparison with the incremental drawdown at the same time step. It is evident the cumulative drawdown is extending further away from the underground mining activities. For example, the cumulative 5 m drawdown curve is extending approximately 1 km further than the incremental 5 m drawdown curve, which extends to approximately 6 km from the Project Area to the west.

Further, the maximum drawdown is visualised in Appendix K for selected bores, similar to Figure 43.

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Modelling\Maximum_additional_drawdown_due_to_Project_in_the_Alluvium_(L2).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

Drawdown (m) 2 L2 K Zones

— 0.5

— 1

— 5

— Alluvium

— Regolith

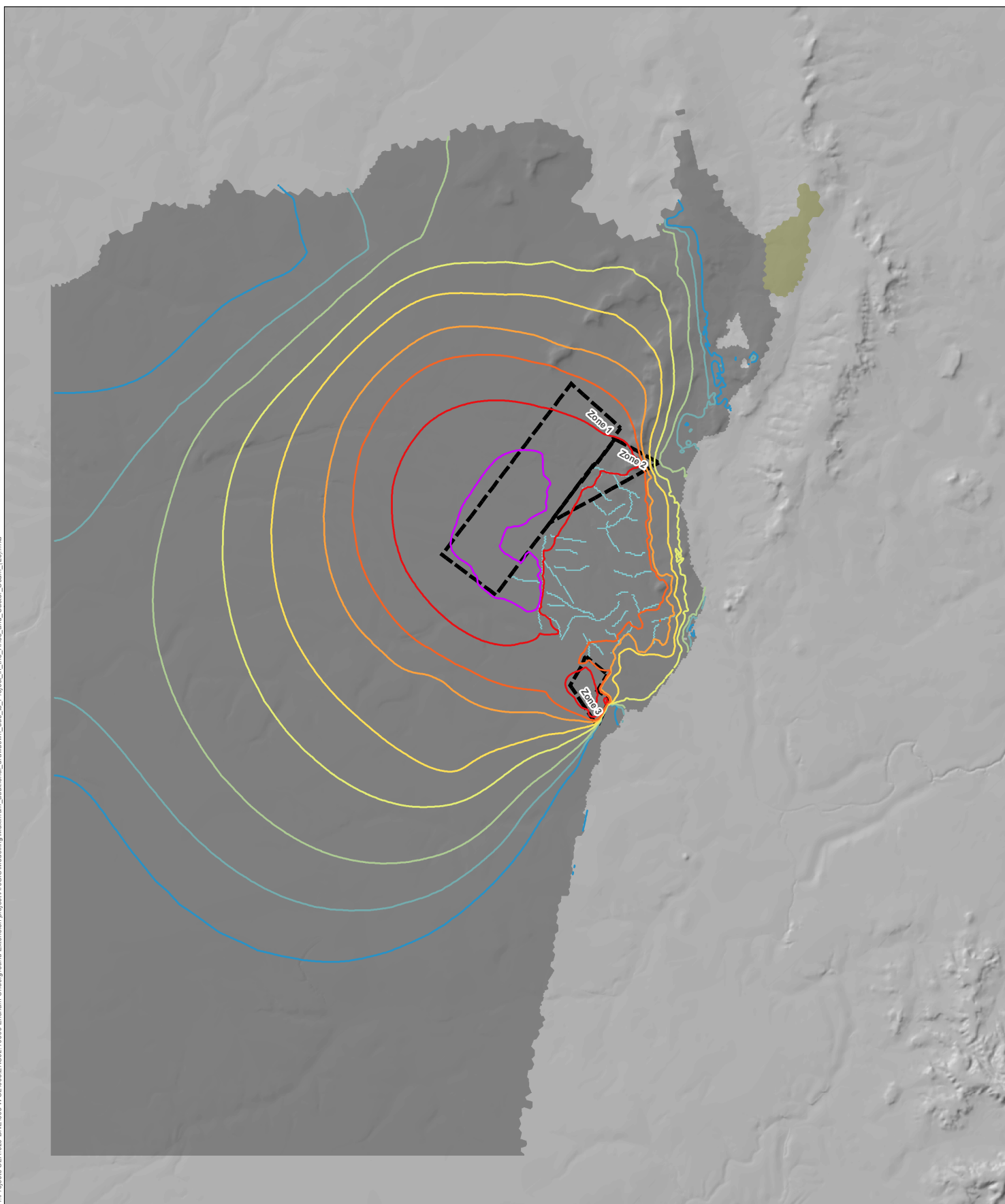
— Shallow CM

GROUNDWATER IMPACT ASSESSMENT

Maximum incremental drawdown due to the Project in the unconsolidated (L2)

Figure 44

H:\Projects\SLR620-BNE665-VOL665-ENS02-10000 Ensham Underground Extension project\ArcGISModeling\Maximum_additional_drawdown_due_to_Project_in_the_Aries_and_Castor_Seam_(L8).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

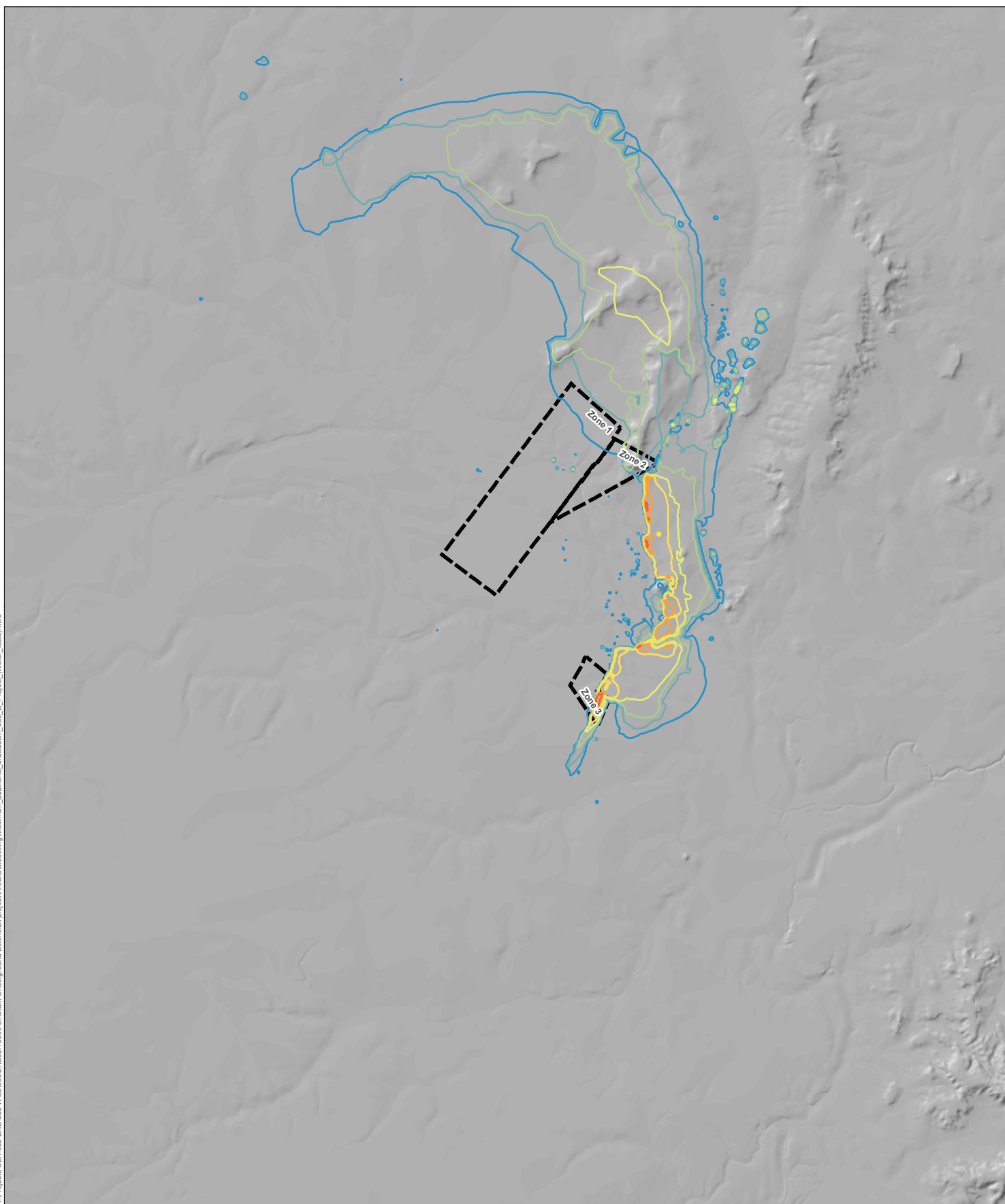
Drawdown (m)	Color	L8 K Zones
0.5	Blue	
1	Light Blue	
2	Green	
5	Yellow	
10	Orange	
20	Red	
30	Purple	
50	Dark Purple	
100	Black	
		Aries 2 and Castor
		Basement
		Fault

GROUNDWATER IMPACT ASSESSMENT

Maximum incremental drawdown due to Project in the Aries and Castor seam (L8)

Figure 45

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Modelling\Maximum_additional_drawdown_due_to_Project_(Water_table).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

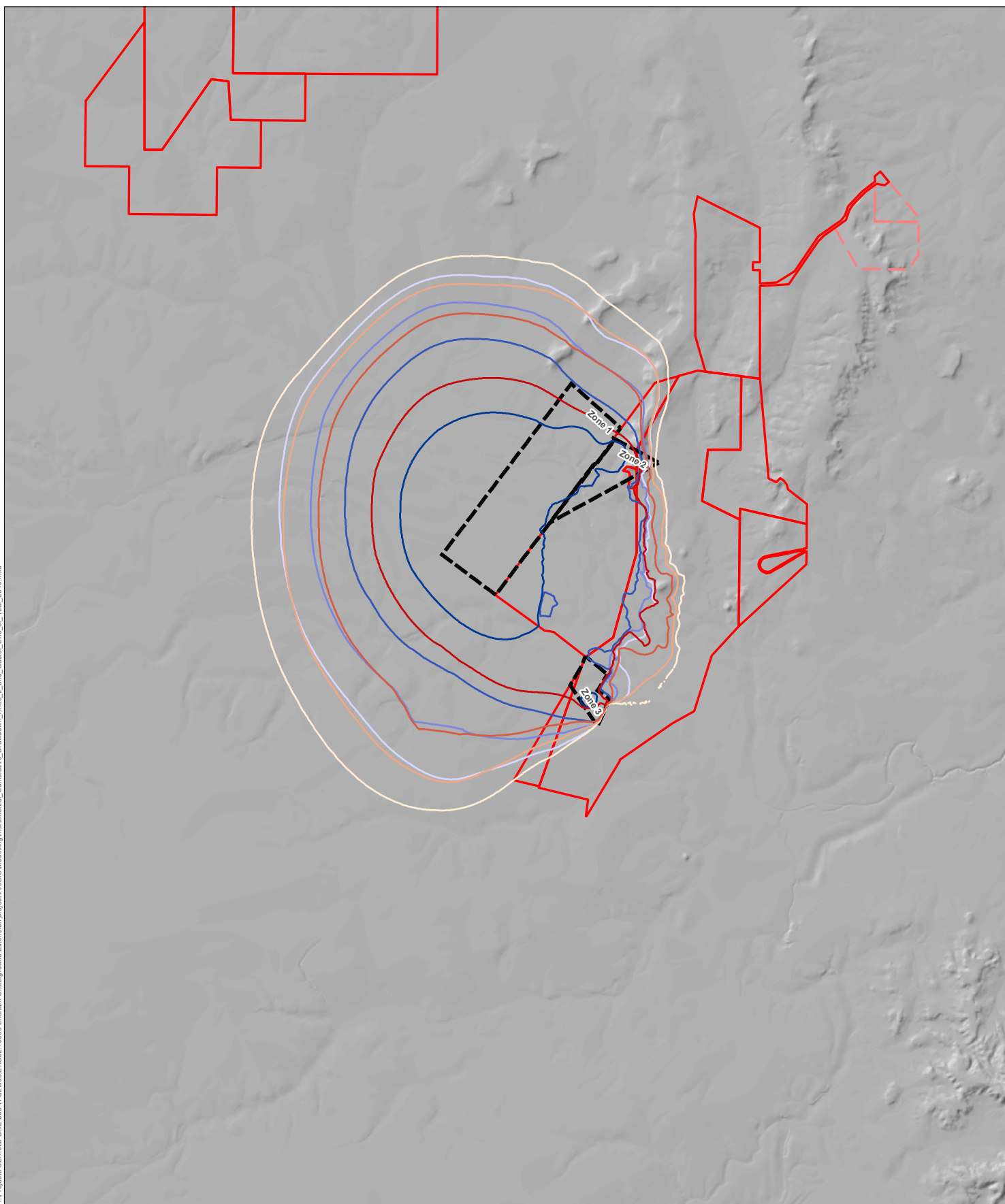
Drawdown (m)

	0.5		5
	1		10
	2		20
			30

GROUNDWATER IMPACT ASSESSMENT

Maximum incremental drawdown due to Project (Water table)

Figure 46



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

Incremental Drawdown (m) Cumulative Drawdown (m)

- | | |
|--|--|
| — 5 | — 5 |
| — 10 | — 10 |
| — 20 | — 20 |
| — 50 | — 50 |

GROUNDWATER IMPACT ASSESSMENT

Incremental and cumulative drawdown in the Aries and Castor seam (L8) in 2040

FIGURE 47

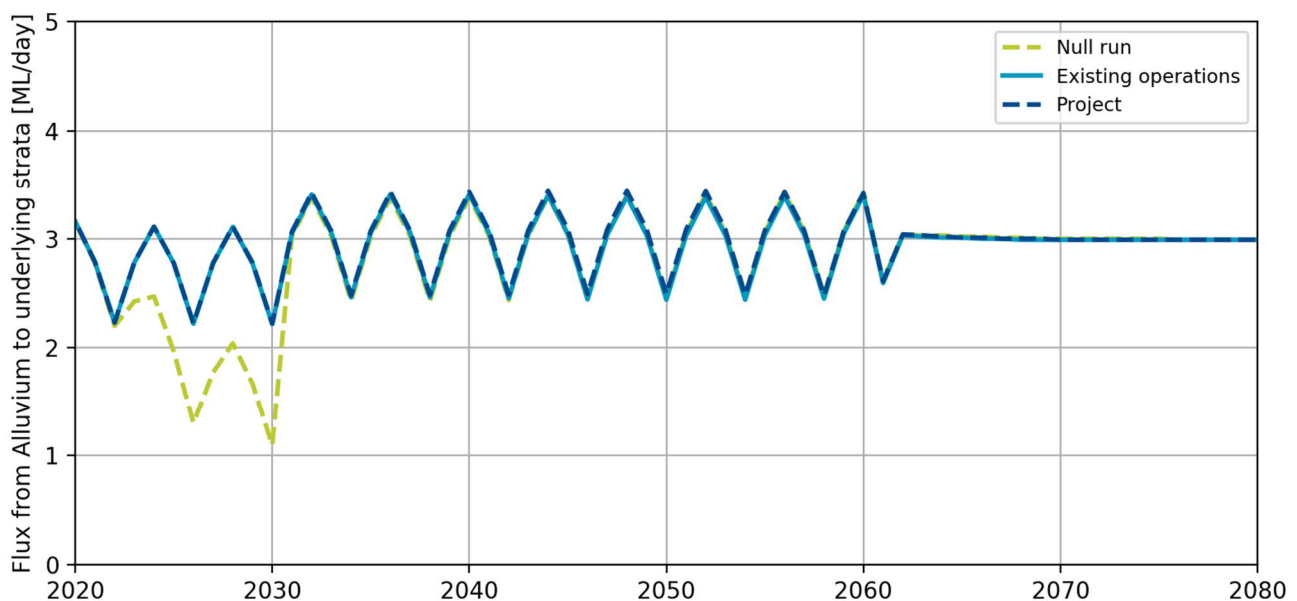
6.4.4 Incidental water impact

6.4.4.1 Influence on alluvium

Figure 48 shows the flux from the alluvium into the underlying formations for the Null run, the existing operations and the Project. The three cases are near identical before 2022 and after 2032. In the period between 2022 and 2032, the Null run shows a reduction of flux by approximately 1 ML/day compared to the existing operation and Project. This reduction in flux (i.e. Nogoa River loses less water) is likely associated with a process around the open-cut mining, which is active in the Null run up to 2030. However, as will be discussed in Section 6.7, this result is one that could not be confidently attributed to one specific process. After 2030 the Null run alluvial flux is again near identical to the existing operations and the Project. The long-term average alluvial take based on annual climatic inputs is around 3 ML / day for all three model runs.

Interference of the alluvial groundwater only relates to increased leakage to the underlying stratigraphy, induced by depressurisation of the Permian coal measures. This is distinct from direct interception of alluvial groundwater.

Figure 48 Flux from the Alluvium into underlying strata

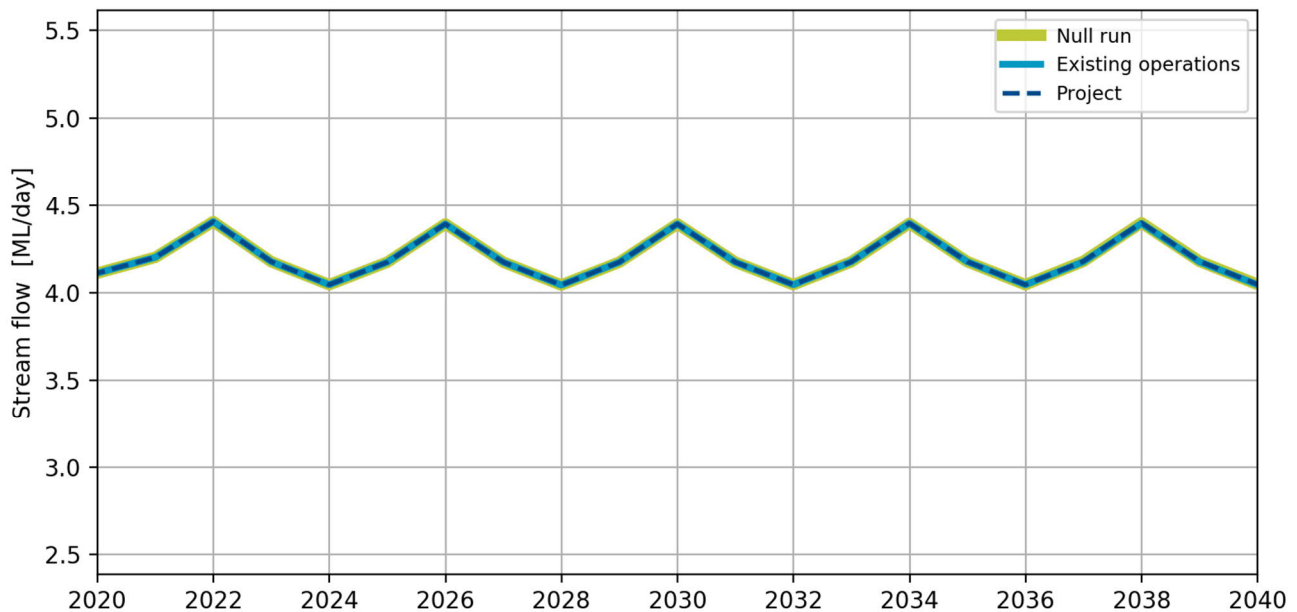


6.4.4.2 Influence on baseflow

The model predicts no measurable reduction in baseflow in Nogoa River between the Null run, existing operations and the Project over the life of the mine. Figure 49 shows the net flow of Nogoa River for the Null run, the existing operations and the Project. The net flow is a loss from the River into the shallow unconsolidated formations. There are no changes due to the Project, which indicates that the underground mining has no measurable impact on baseflow.

The long-term net baseflow based on annual climatic inputs is around 2.7 ML / day (recovery model 2060-2140) for the Null run, the existing operations and Project.

Figure 49 Stream loss in Nogoia River



6.4.5 Post mining equilibrium

The model was run from 2040 to 2060 in quarterly stress periods and then from 2060 to 2260 in annual stress periods to simulate long-term recovery with annual averaged climatic inputs. Figure 50 shows the water levels for the Null run, the existing operations and the Project for alluvium near Ensham Mine at EC03, and for the Permian coal measures to the south-west of the Project extent at RB04. Appendix K shows the prediction hydrographs for all relevant bores.

The alluvial bore EC03 (Figure 50, top) is not predicted to have any changes in water level from the existing operations to the Project, however, it shows some minor drawdown between the Null run and the mining scenarios. The slight decrease observed in all three cases around 2060 can be attributed to the change of model stress periods from quarterly to annually (i.e. model mathematical error rather than hydraulic response during recovery). The Null run, the existing operations and the Project predict the same groundwater levels over the recovery period from 2060 to 2260 (assuming no significant impact from climate change).

The bore RB04 (refer to Figure 50, bottom) is located within the target coal seams (Aries 2 and Castor) and experiences incremental drawdown due to the proposed expansion of the underground mine as well as cumulative drawdown compared to the Null run. The minimum water level was calculated at 141 mAHD for the Null run, at 129 mAHD for the existing operations in 2040 and at 114 mAHD in 2045. Hence the predicted cumulative maximum drawdown is 27 m and the incremental drawdown is around 15 m. Note that the final water level for the Project at RB04 recovers to about a meter less than the recovery groundwater level for the existing operations and about 2 meters less than the recovery groundwater level for the Null run.

Figure 50 Recovery times series for two selected bores

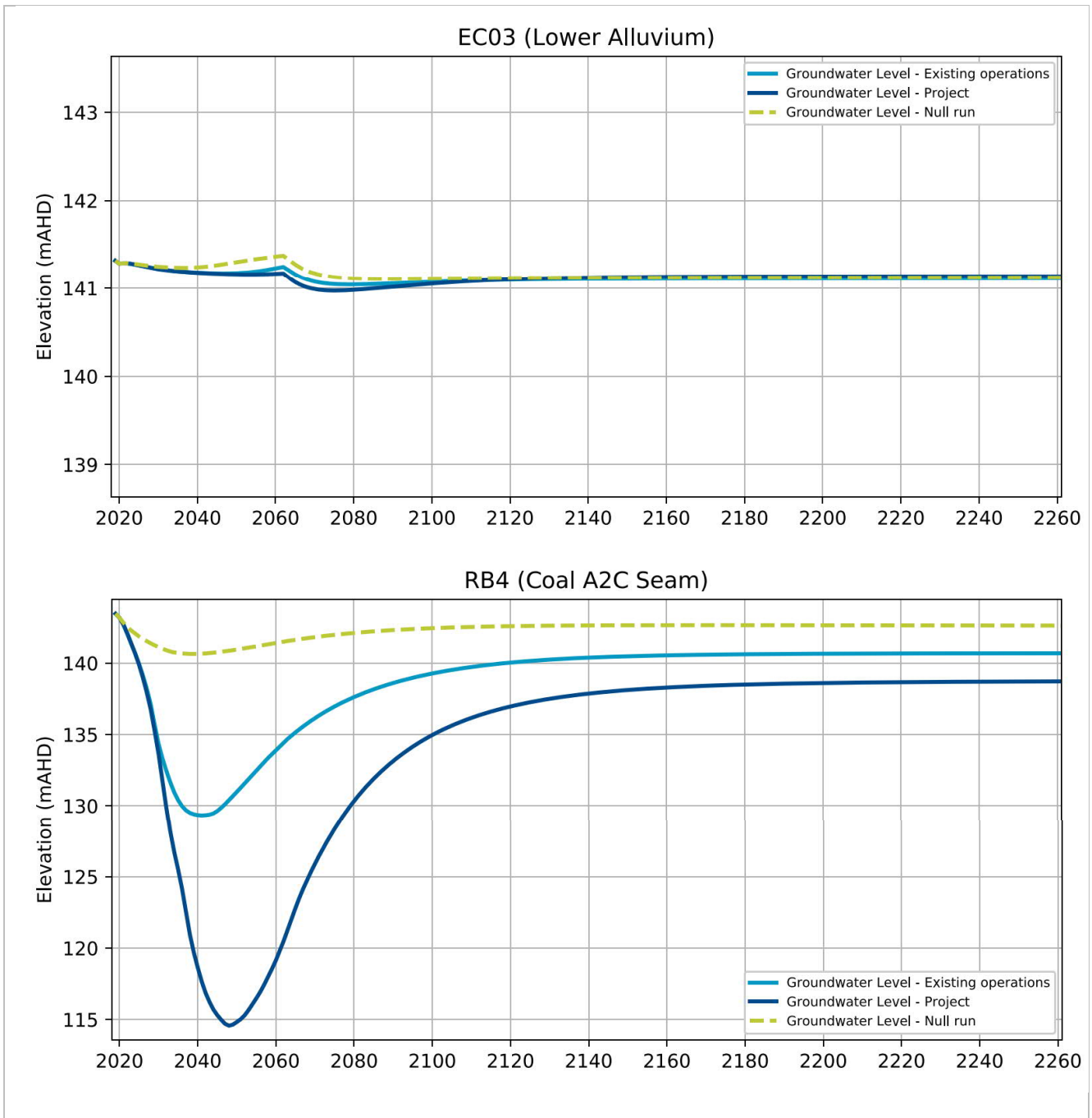
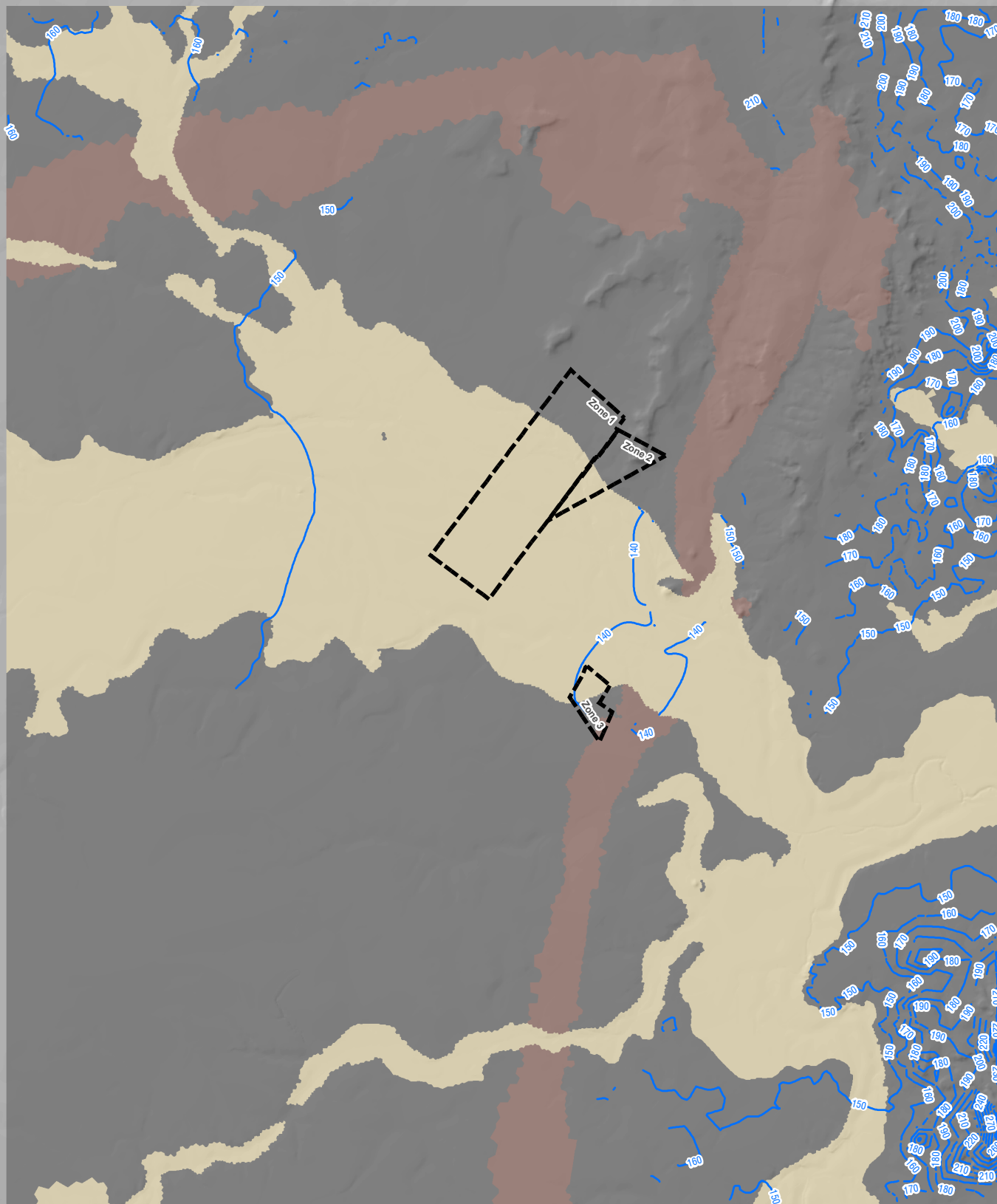


Figure 51 and Figure 52 show the post mining equilibrium water levels in the alluvium (and regolith, model layer 2) and the Aries 2 and Castor coal seams (model layer 8) respectively. The alluvial water levels show the same general flow direction as Nogoa River (west to east).

As expected, the water level contours in the coal seams (in 2260) show a lower water level in the area where the underground mining was occurring. The water levels are around 10 m lower than in the surrounds.

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

Potentiometric Surface L2 K Zones

Alluvium

Regolith

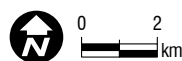
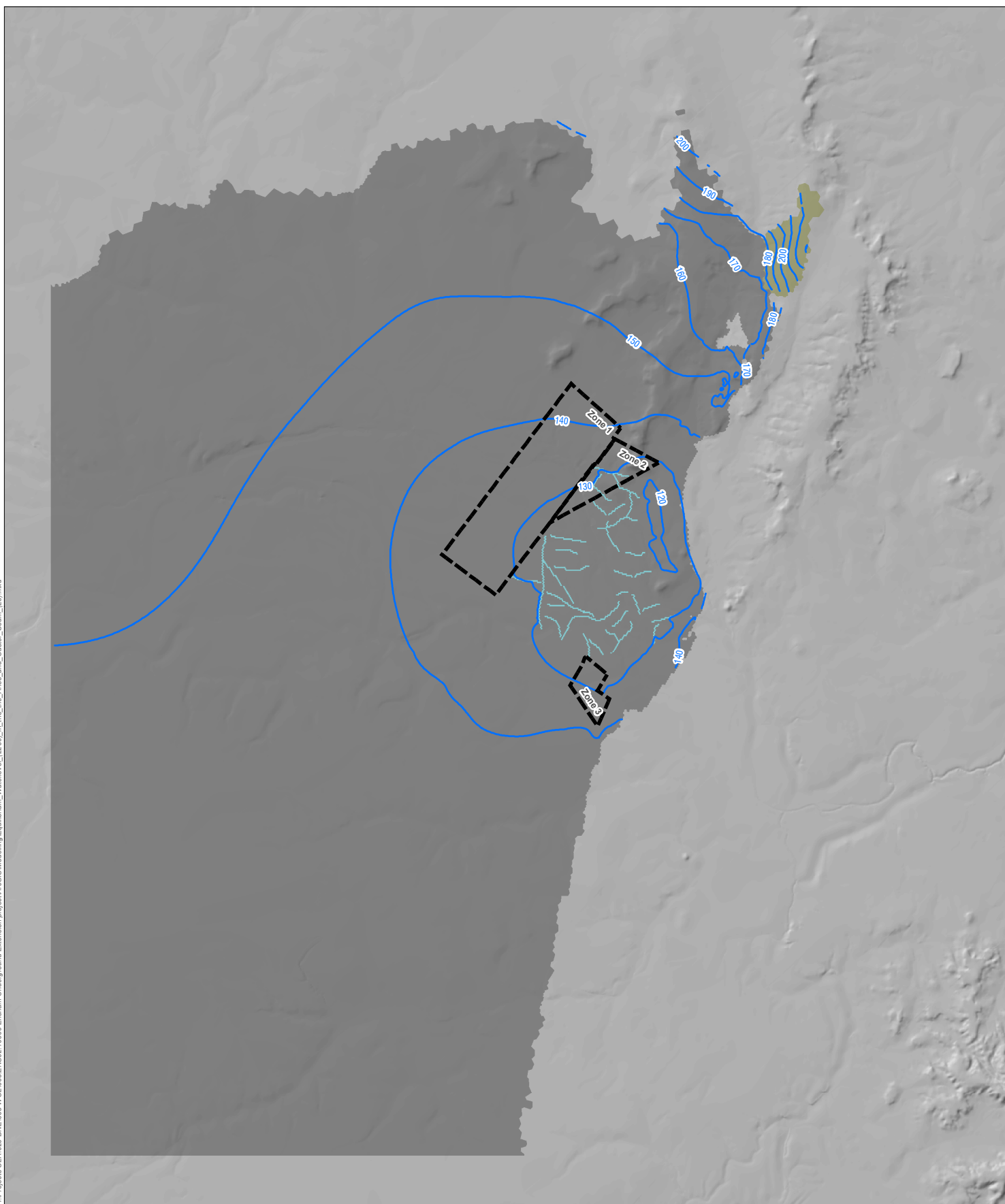
Shallow CM

GROUNDWATER IMPACT ASSESSMENT

Equilibrium groundwater level (2260) in the unconsolidated (L2)

Figure 51

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

Project Area

Potentiometric Surface L8 K Zones

Aries 2 and Castor

Basement

Fault

GROUNDWATER IMPACT ASSESSMENT

Equilibrium groundwater level (2260) in the Aries and Castor seam (L8)

Figure 52

6.5 Sensitivity analysis

The uncertainty of model predictions was assessed with a deterministic approach to sensitivity analysis. Sensitivity analysis evaluates the effects of model parameters on model results and provides information on the degree to which the adopted values for the various parameters in the model influence predictions. It can provide an indication of the uncertainty in the results and guide future data collection to reduce this uncertainty.

6.5.1 Scenario selection

Parameter sensitivity on the predictive period (Project model run) was explored through additional model simulations where model parameters were varied. These parameters and model inputs were considered because they could potentially impact the model predictions. The nine analysed parameters are listed in Table 22 together with the magnitude of change imposed on each parameter. A total of 17 runs were performed in addition to the base case (described in Section 6.3). The upper and lower bounds have been chosen as a wide range (refer to Table 10). The results should not be viewed as absolute; this analysis is performed to assess relative changes and identify parameters that might need further investigation.

Table 22 Sensitivity analysis – overview of scenarios

Parameter	Lower bound	Base case (S1)	Upper bound
Stream conductance (S2 and S3)	Factor 10 lower	1-1000 m ² /day (depending on cell size)	Factor 10 higher
Alluvium horizontal hydraulic conductivity (S4 and S5)	Factor 10 lower	L1: 0.001 m/day L2: 10 m/day	Factor 10 higher
Alluvium vertical hydraulic conductivity (S6 and S7)	Factor 10 lower	L1: 5.60E-05 m/day L2: 0.5m/day	Factor 10 higher
Coal (L8) horizontal hydraulic conductivity (S8 and S9)	Factor 10 lower	0.004 - 1.250 m/day	Factor 10 higher
Coal (L8) vertical hydraulic conductivity (S10 and S11)	Factor 10 lower	2.53E-04 - 0.186 m/day	Factor 10 higher
Coal (L8) specific yield (S12 and S13)	0.01	0.04	0.07
UG workings specific yield (S14 and S15)	0.4	0.5	0.6
Recharge (S16 and S17)	20% decrease	Surficial alluvium: 5.18 mm/yr Regolith: 0.64 mm/yr Permian subcrop: 0.64 mm/yr Spoil: 53.1 mm/yr Open-cut void: 647.5 mm/yr	20% increase
Rewan (L3 and L4) vertical hydraulic conductivity (S18)	Not calculated	Layer 3: 2.10E-04 m/day Layer 4: 6.00E-07 m/day	Factor 10 higher

6.5.2 Results

This section discusses the results of the sensitivity analysis. The changes in predicted drawdown in the coal seam (model layer 8), inflow into the mine during mining and the loss from Nogoa River were assessed. In summary, the predictions were most sensitive to the hydraulic conductivity of the coal seams. This means that uncertainties in the hydraulic conductivity of the coal seams leads to uncertainty about the absolute value of the predicted impact (drawdown or mine inflow). However, since the impacts are on the coal seams and therefore do not affect water users and GDEs, certainty about absolute value of impact is not essential to assess impacts from the Project on these types of receptors. The uncertainty of the parameters identified to be sensitive can be addressed by future field work.

6.5.2.1 Drawdowns

The resulting drawdown contours are presented in Appendix L. The base case additional drawdown curve is shown together with the resulting 5 m drawdown contour for each of the parameter permutation scenarios. The sensitivity was assessed for L8 (A2C seam) only, as the alluvium is predicted to have little or no drawdown due to the underground mining.

In general, most scenarios show the same extent of the 5 m drawdown curve to the north, west and south. To the east towards the outcrops, some changes are apparent. These are, however, minor and likely attributed to the difference in recovery.

Scenario 8 and scenario 9 (horizontal hydraulic conductivity in the Coal L8), however, show a change in the extent of the 5 m drawdown curve. A reduced horizontal hydraulic conductivity results in a reduction of the 5 m drawdown curve by approximately 1 km in north-westerly (along strike) direction, whereas an increased horizontal hydraulic conductivity results in an extension of the 5 m drawdown curve by 2 km in westerly (down dip) direction (Refer to Appendix L, Figure L-4).

In Scenario 18, a greater vertical conductivity was assigned to the Rewan Group, which resulted in the model predicting an increased leakage from the Rewan Group and thus predicting a reduction of the drawdown in the coal seams.

In summary, the extent of the drawdown curve to the west (down dip) is not sensitive to any parameter changes except the coal horizontal hydraulic conductivity. Should new bores be drilled in the coal seams in that area, it would be beneficial to undertake hydraulic testing of the aquifer properties (also see Section 10) to assess the hydraulic conductivity in general and the potential decrease of hydraulic conductivity with depth.

6.5.2.2 Water fluxes

Table 23 lists the average percent change for the underground mine inflow predictions for all 17 sensitivity scenarios compared to the base case between 2020 and 2040. Note that for the sensitivity analysis, the numbers reported are for the Project only. The mine inflow rates over time are presented on Figure 53.

It is apparent that the underground mine inflow estimates are most sensitive to the coal horizontal hydraulic conductivity (a 10 per cent increase of which results in 94 per cent higher inflows) and to a lesser degree to the alluvial horizontal hydraulic conductivity (+34 per cent). Other sensitive parameters include the recharge, the specific yield of the coal seams and of the underground workings.

Table 23 lists the average percent change for the Nogoa River stream losses for all 17 sensitivity scenarios compared to the base case between 2020 and 2040. An increase in stream conductance and alluvial horizontal hydraulic conductivity increases the stream losses by 64 per cent and 80 per cent, respectively. A decrease in those parameters is resulting in a decrease of 81 per cent and 39 per cent, respectively. Changing the vertical alluvial hydraulic conductivity results in changes in stream losses (-16 per cent and +14 per cent, respectively). All other parameters are not sensitive for the stream flow predictions. The base flow changes over time are presented on Figure 54.

In summary, the flows (both mine inflow and Nogoa River baseflow) are sensitive to the stream conductance, alluvial horizontal and vertical hydraulic conductivity, and coal hydraulic conductivity. The flows are not sensitive to an increased vertical hydraulic conductivity of the Rewan Group.

The extent of the drawdown curves is not sensitive to the west (except for coal seam hydraulic conductivity). The drawdown curves show higher variability towards the outcrop, where the coal seams interact with other formations and the open-cut pits. This aligns with the sensitivity to the flows, because at those locations, the drawdown will be influenced by availability of water from the pits, and the streams.

Table 23 Sensitivity analysis – changes to mining inflow and stream flow losses

Scenario #	Description	Change of model parameter value	UG mine inflows % change	Nogoa River streamflow losses % change
1	Base case	(none)	NA	NA
2	Stream conductance (lower)	÷ 10	-12%	-81%
3	Stream conductance (higher)	* 10	16%	64%
4	Alluvium Kh (lower)	÷ 10	-9%	-39%
5	Alluvium Kh (higher)	* 10	34%	80%
6	Alluvium Kv (lower)	÷ 10	-4%	-16%
7	Alluvium Kv (higher)	* 10	1%	14%
8	Coal L8 Kh (lower)	÷ 10	-23%	-3%
9	Coal L8 Kh (higher)	* 10	94%	8%
10	Coal L8 Kv (lower)	÷ 10	-2%	0%
11	Coal L8 Kv (higher)	* 10	1%	0%
12	Coal L8 Sy (lower)	- 0.03	-9%	0%
13	Coal L8 Sy (higher)	+ 0.03	9%	0%
14	UG workings Sy (lower)	- 0.1	16%	0%
15	UG workings Sy (higher)	+ 0.1	-7%	0%
16	Recharge (lower)	* 0.8	-4%	0%
17	Recharge (higher)	*1.2	5%	0%
18	Rewan Kv L3/L4 (higher)	* 10	3%	5%

Figure 53 Underground mine inflow (sensitivity analysis)

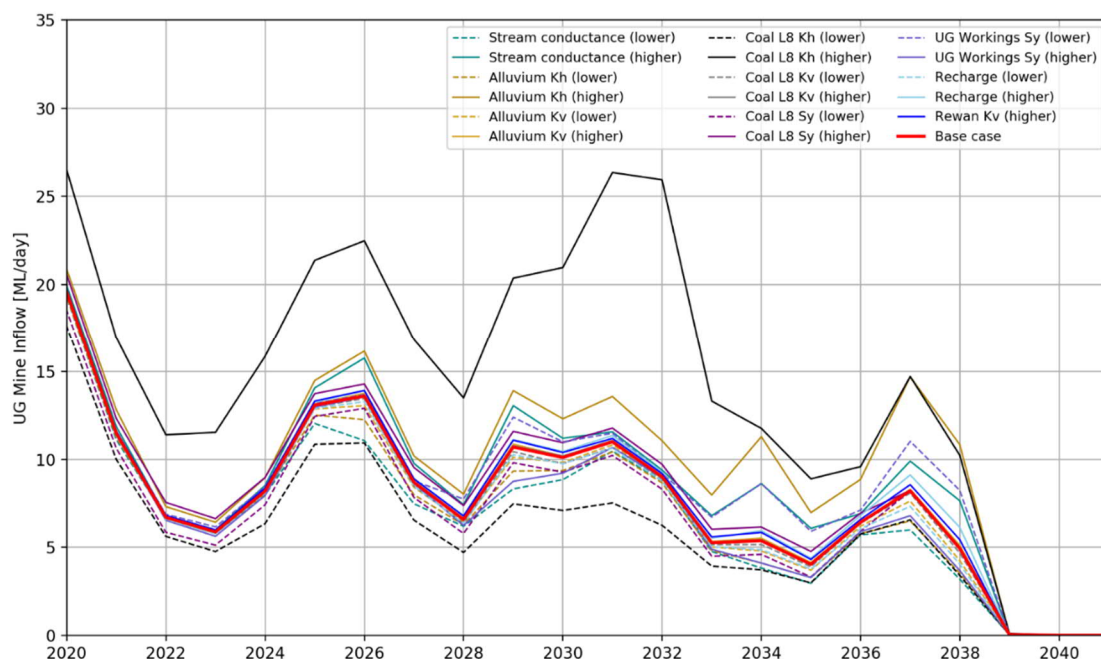
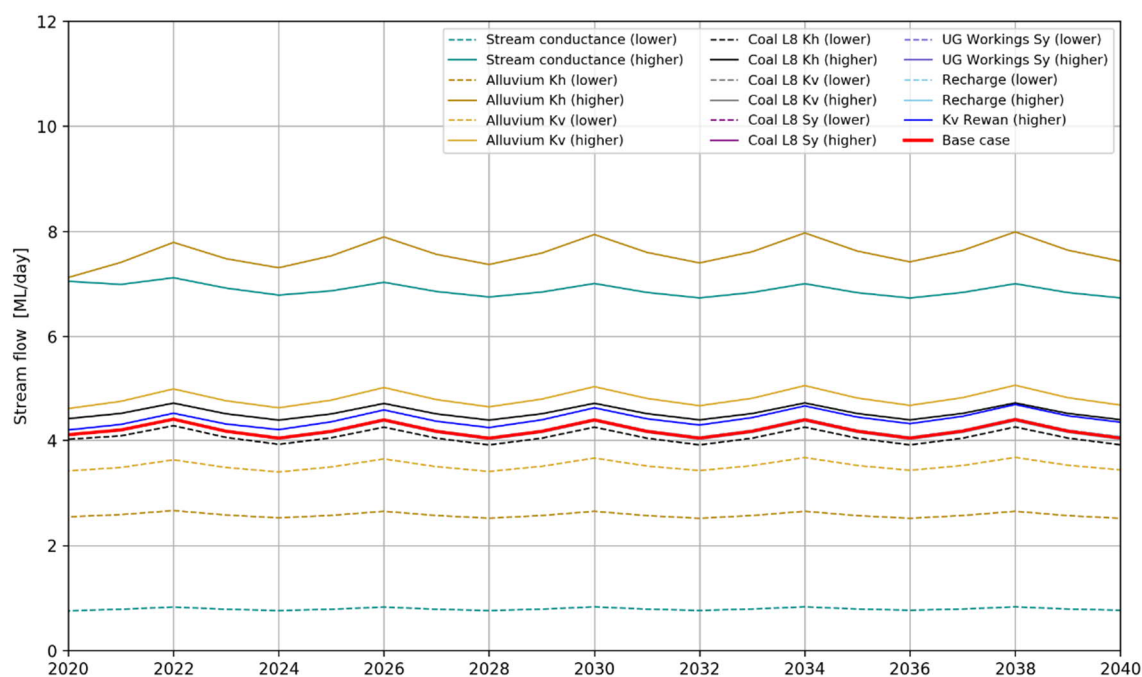


Figure 54 Nogoia River net stream flow(sensitivity analysis)



6.6 Model confidence

Groundwater modelling has been conducted in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and the Murray Darling Basin Commission Groundwater Flow Modelling Guideline (Middlemis et al., 2001). As these are mostly generic guides, there are no specific guidelines on special applications, such as coal mine modelling or mine closure.

Under the earlier MDBC modelling guideline (Middlemis et al., 2001), the model is best categorised as an Impact Assessment Model of medium complexity. That earlier guide (Middlemis et al., 2001) describes this model type as follows:

"Impact Assessment model - a moderate complexity model, requiring more data and a better understanding of the groundwater system dynamics, and suitable for predicting the impacts of proposed developments or management policies."

The 2012 guide has replaced the model complexity classification of the previous guideline by a "model confidence level", (Class 1, Class 2 or Class 3 in order of increasing confidence) typically depending on:

- available data (and the accuracy of that data) for the conceptualisation, design and construction phases of a model
- calibration procedures that are undertaken during model development
- consistency between the calibration and predictive analysis
- level of stresses applied in predictive models.

Table 24 (based on Table 2.1, Barnett et al., 2012) summarises the classification criteria and shows a scoring system allowing model classification. Based on Table 24, the groundwater model developed for this groundwater assessment may be classified as a mixture of Class 2 (about 40 per cent) and Class 3 (about 60 per cent).

Table 24 Groundwater model classification

Class	Data		Calibration		Prediction		Indicators		TOTAL
1	Not much		Not Possible		Timeframe>> calibration		Timeframe>10x		1
	Sparse		Large error statistics		Long stress periods		Stresses>5x		
	No metered usage	✓	Inadequate data spread		Transient prediction but steady state calibration		Mass balance>1% (or single 5%)		
	Remote climate data		Targets incompatible with model purpose		Bad verification		Properties<>Field		
							Bad discretisation		
							No review		
2	Some	✓	Partial performance	✓	Timeframe> calibration	✓	Timeframe=3-10x	✓	10

Class	Data		Calibration		Prediction		Indicators		TOTAL
	Poor coverage		Long-term trends wrong		Long stress periods		Stresses=2-5x	✓	
	Some usage info	✓	Short time record	✓	New stresses not in calibration	✓	Mass balance<1%		
	Baseflow estimates		Weak seasonal replication		Poor verification	✓	Some properties<> Field measurements		
			No use of targets compatible with model purpose				Some key coarse discretisation		
							Reviewed by hydrogeologist	✓	
3	Lots		Good performance stats		Timeframe~calibration		Timeframe<3x		12
	Good aquifer geometry	✓	Long-term trends replicated	✓	Similar stress periods	✓	Stresses<2x		
	Good usage info		Seasonal fluctuations represented well	✓	Similar stresses to those in calibration	✓	Mass balance<0.5%	✓	
	Local climate info		Present day data targets	✓	Steady state prediction consistent with steady state calibration		Properties~ Field measurements	✓	
	K measurement	✓	Head and flux targets		Good verification		Some key coarse discretisation	✓	
	Hi -res Digital Elevation Model (DEM)	✓					Reviewed by modeller	✓	

6.7 Model limitations

The IESC Uncertainty analysis – Guidance for groundwater modelling within a risk management framework (2018) also identifies four key sources of scientific uncertainty affecting groundwater model simulations:

- structural / conceptual
- parameterisation
- measurement error
- scenario uncertainties.

These four sources of scientific uncertainty have been qualitatively assessed and are presented in Table 25. Overall, it is considered that the groundwater model is fit for the purpose for addressing the objectives of the Project as outlined in Section 6.1.

The groundwater model was used to assess the impacts of underground mining in this complex setting. The complexity is based on the history of mining (both open-cut and underground mining), complex geology, interactions between aquifers, interactions between groundwater and surface water, changes in material properties over time and so forth. Due to the aforementioned complexity, some of the modelling results might not be easily attributed to certain inputs, processes or settings. The presented potential impacts need to be accepted based on the model set-up, parametrisation and choice of result display.

Table 25 Groundwater model and data limitations

Type	Part	Status	Comment
Structural / conceptual geology / structure	Grid	Fit for purpose	Model has unstructured Voronoi grid that includes detailed cell refinement around site and along drainage features.
	Layer 1 to layer 2	Fit for purpose	Top of layer 1 based on LiDAR data at site and DEM outside of site. Alluvium thickness based on site drill data where available.
	Layer 3 to layer 4	Fit for purpose	Top of Rewan Group based on bottom of alluvium Bottom of Rewan Group based on top of Rangal Coal Measures from a mine geological model.
	Layer 4 to layer 11	Fit for purpose	The structure to Layers 4 to 11 is based on previous peer reviewed model iterations. Rangal Coal Measures at site were based on detailed geological model, which captures minor fault displacements in coal measures in the approved area. The layer divisions were based on hydrostratigraphic horizons available within geological models and extrapolated beyond the limit of these using available data where applicable.

Type	Part	Status	Comment
	Geological structure	Fit for purpose with future improvements	The structure of the geology is based on previous peer reviewed model iterations. Those models were based on site and regional geological mapping to understand the outcrop extents, strike and dip of the Permian Coal Measures. There is limited fault mapping in the area, which was used in the model (Figure 23 and Appendix H, Figures H-5 to H-12). Understanding of faults can potentially be further improved with analysing data from the ongoing collection of site geological information. Potential connectivity between the coal seam and the shallow formations was tested during sensitivity analysis. The vertical hydraulic conductivity of the Rewan Formation was increased by a factor of 10 to simulate how faulting or fractures could impact the model predictions.
Parameterisation	Hydraulic conductivity	Fit for purpose	Field testing of hydraulic conductivity (horizontal and vertical) has been conducted at the site and surrounds for the coal seams and the alluvium. Values for the other hydrostratigraphic units were taken from the literature (Table 10). Model parameters calibrated in line with field data ranges and in consideration of model parameters used in the region. Scenario analysis was run to test hydraulic properties by varying them by an order of magnitude within the alluvium, the Rewan Group and the Rangal Coal Measures in order to understand the influence this had on the model predictions.
	Storage properties	Fit for purpose	Limited site data available for the storage properties, but values matched to align with parameters used at surrounding mines and consistent with current literature (i.e. Rau et al 2018).
	Recharge	Fit for purpose	Recharge parameters were zoned based on surface geology / land use and calibrated in the steady state calibration. Recharge in the transient calibration was represented based on actual quarterly rainfall to capture seasonal variability.
	Mine inflows	Future improvements	The approach how adopted to simulate mine inflows was kept consistent with previous models (drain cells active for two years when mining commences at a location). This is a conservative approach and may lead to overestimation of the mine inflows.
Measurement Error	Observation Data quality	Fit for purpose with future improvements	As part of the conceptualisation the quality of data was reviewed, including review of groundwater level and quality trends to verify target lithology. The quality of the observation data for water levels is fit for purpose. There is a need for more accurate collection of groundwater dewatering data from underground.

Type	Part	Status	Comment
	Spatial spread	Fit for purpose with future improvements	Observation targets are available for most model layers across the model domain. Additional monitoring bores are suggested for the future mining west of the Project Area (Table 31). Specifically, to verify the lack of connectivity between formations, a VWP was installed in November 2019 to observe the vertical head gradients between the alluvium, the Rewan Group and the coal measures.
	Temporal spread	Fit for purpose with future improvements	Groundwater levels have been recorded on a quarterly basis across the network. Groundwater level readings for bores within the existing mine have historical data from around 2005 to 2019, capturing responses to rainfall events and mining in the region over the calibration period. Ongoing monitoring of the bores will be conducted, which will be incorporated into future iterations of the groundwater model. The model changes from quarterly to annual time steps in 2060. For some bores, this change is visible in the hydrographs. This can be improved for future model iterations.
Scenario uncertainties future stresses/ conditions	Calibration	Fit for purpose With future improvements	Previous transient calibration from December 2005 to March 2019 (13 years) with quarterly stress periods. The calibration data set (water levels) is well suited in the vicinity of the mine. However, the bores of the RB-series (observing the target coal seam), have not yet shown a clear mining impact. The timing and extent of drawdown distal to the mine is hence still uncertain. The sensitivity analysis showed potential extents for varying coal conductivities.
	Predictive	Fit for purpose	Predictive model January 2019 to January 2039 (20years) with quarterly stress periods. Model predictive time frame is less than 3 times the duration of transient calibration. Temporal discretisation varies to calibration, in order to align with mine plan design timing.
	Recovery	Fit for purpose	Recovery model was run in quarterly time steps between 2040 and 2060 and then in annual time steps between 2060 and 2260. The total recovery period is 220 years and the hydrographs are flattening out for all bores, which indicates long-term equilibrium has been captured.
	Sensitivity	Fit for purpose with future improvements	Nine key parameters were selected and changed by permutation to assess the predictive uncertainty for the drawdown, the Project inflows and the stream flow losses.

7 Potential Impacts

7.1 Assessment framework

The potential impacts of the Project on the groundwater resources is assessed both in term of change in groundwater levels and groundwater quality, in accordance with the requirements listed in Table 1 and Table 2. Note that the impacts presented are incremental impacts, i.e. the additional impact of the Project compared to the existing operations.

Each EV (as detailed in Section 5.5) may be impacted differently by changes in groundwater levels and groundwater quality. The basis for assessing impact for each groundwater EV is presented in Table 26.

Table 26 Impact assessment framework for each environmental value

EVs pertinent to Ensham	Potential impact 1 – groundwater drawdown	Impact assessment 1	Potential impact 2 – Groundwater quality degradation	Impact assessment 2
Aquatic ecosystem	A decrease of the groundwater table may reduce the ability for some vegetation to access groundwater. It may also affect baseflow in connected waterways	Drawdown (m) in the alluvium, at a wetland and mapped GDE area	Changes in groundwater quality may affect the health of groundwater dependant ecosystems	Predicted change in quality, area affected and potential impact on GDE.
Irrigation; farm supply / use; stock water	A decrease of the groundwater table may reduce bore yield or degrade groundwater quality (e.g. increase EC).	Drawdown (m) in all affected private bores	Change in groundwater quality may reduce potential use of groundwater depending on groundwater usage	Predicted change in quality, private bores affected and potential impact for each bore based on usage.

7.2 Water licensing

As outlined in Section 2.1.1, the Project Area is within the water plan (Fitzroy Basin), which covers surface water resources only. Groundwater at the Project Area is part of the Highlands Groundwater Management Area, which has no information about groundwater use and therefore licensing for groundwater interception is not required.

The model predicts no reduction in baseflow in Nogoa River over the life of the existing mine from the existing operations or for the Project.

7.3 Potential impact on aquatic and terrestrial ecosystems

The potential impact on aquatic ecosystem was assessed by reviewing the potential alluvial drawdown in the context of the aquatic and terrestrial ecosystems. Figure 55 shows that the 0.5 m contour of the maximum additional drawdown in the unconsolidated material (model layer 2) does not extend to any of the GDEs in the Project Area.

However, there are two locations with an additional drawdown of more than 0.5 m around GDEs. Most part of the additional drawdown is observed around the open-cut areas and rehabilitated landforms, which can be explained with the different timing of the recovery after mining ceases. Another location is northwest of the Project Area. The drawdown is intersecting a low confidence GDE there. This drawdown is related to the coal sub-cropping at this location.

7.4 Potential impact on private bores

The potential incremental and cumulative impact on each private bore (irrigation, farm supply/use and stock water) identified within 15 km radius of the Project is presented in Table 27 and Table 28 respectively. Some bores are not in use or screened within units that have not been identified / logged. For these bores, the impacts cannot readily be assessed.

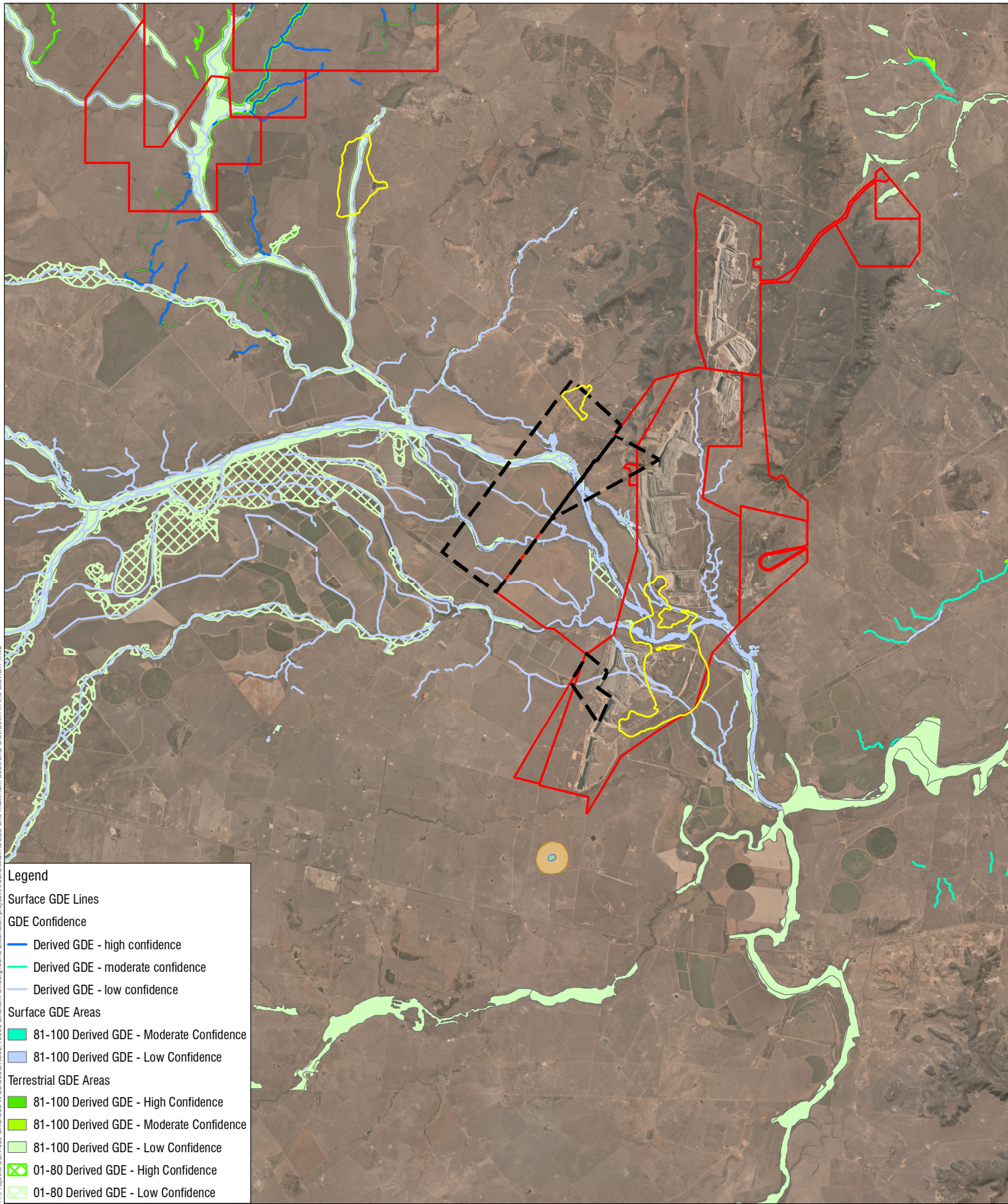
The bores with the largest incremental drawdown impact are Jamar Bore (0.10 m) and Winton Creek Bore (0.08 m), both screened in the Rewan Group. The cumulative drawdowns for those bores are 0.17 m and 0.15 m respectively. These bores were previously (HydroSimulations, 2020) attributed to model layer 4 (lower Rewan). The re-assessment of the bore log for RB04 and the reported depths of Jamar and Winton Creek bores in comparison with the model geometry concluded that these bores are screened in model layer 3 (Upper Rewan). The impacts were assessed for model Layer 3 (Table 27 and Table 28).

7.5 Impact on groundwater quality

The Project does not include any additional open voids or spoil emplacements, which could potentially impact the groundwater quality. The Project is exclusively underground bord and pillar mining, leaving the excavated underground voids in the coal body to recharge naturally over time. The inflowing water will have the same quality than the water previously stored in the coal.

As discussed in Section 5.4.1.1, the alluvial groundwater shows a great disparity in salinity with recorded values ranging from about 1,000 $\mu\text{S} / \text{cm}$ to 50,000 $\mu\text{S} / \text{cm}$. As there is no additional absolute drawdown expected due to the Project (the difference is caused by the delay in recovery, not in more absolute drawdown), the groundwater quality is not predicted to change due to the Project.

Current recharge and discharge mechanisms (recharge through large rain or flood events and discharge through droughts) will have a greater impact on the groundwater quality in the alluvium (reduction of EC in wet periods by dilution and increase of EC during droughts) than mining.



Projection: GDA 1994 MGA Zone 55

 Scale: 1:200,000

 Project No.: 665.ENS02.10000

 Date: 23-Apr-2020

 Drawn by: PM

 Sheet Size: A4

Legend

- Project Area
- Wetland
- Wetland Protection Area
- Mining Lease

Drawdown (m)

- 0.5

GROUNDWATER IMPACT ASSESSMENT
Maximum incremental drawdown in the unconsolidated and GDE's

Figure 55

Table 27 Predicted maximum incremental drawdown at private bores due to the Project

Registered RN (ID)	Bore name	Bore depth (m)	Use	Geology (in GW model)	SWL (mAHD)	Maximum additional DD (m)	Time of max. DD occurring (year)	Long-term additional impact (m) (year 2260)
103788	Conmurra	66	Irrigation (stock & domestic)	Regolith	140	1.5e-05	2051	0
132040	Currimundi	-	Not in use	Unknown	Unknown	NC	NC	NC
57402	Kensington	-	Not in use	Unknown	Unknown	NC	NC	NC
84403	-	-	Unknown	Unknown	Unknown	NC	NC	NC
89380	Fair Hills	77	Stock & domestic	Burngrove	196-214	0.009	2245	0.008
89383	Yongala	74	Stock	Burngrove	213	0.004	2173	0.0009
89382		74	Stock	Unknown	213	NC	NC	NC
89384		78	Stock	Unknown	213	NC	NC	NC
90140	Railway	61	Stock	Regolith	130 - 160	1.00E-05	2051	0
-	Chelbrook1	24	Not in use	Unknown	Unknown	NC	NC	NC
-	Chelbrook2	>100	Not in use	Unknown	Unknown	NC	NC	NC
-	Currimundi (Field 5 Bore)	29	Not in use	Unknown	Unknown	NC	NC	NC
-	Cypress	>160	Not in use	Unknown	Unknown	NC	NC	NC
-	Euro Park	74	Not in use	Rewan (upper)	Unknown	0.07	2098	0.05
-	Jamar	90	Stock	Rewan (upper)	108 - 126	0.10	2079	0.04
-	Jenson	41	Stock	Unknown	Unknown	NC	NC	NC
-	Karanga	~50	Stock	Burngrove	133	0.022	2150	0.017
-	Twin Bore	18	Stock	Alluvium	153	0.03	2068	0.006
-	Winton Creek	60	Stock	Rewan (upper)	138	0.09	2063	0.02
67014		80	Unlikely used (very saline)	Unknown	164.3 (1983)	NC	NC	NC
90338		30	Farm supply (potable)	Unknown	Unknown	NC	NC	NC
67015		44	Unlikely used (very saline)	Unknown	Unknown	NC	NC	NC
38845		70	Unknown	Unknown	Unknown	NC	NC	NC
90337		31	Unknown	Unknown	Unknown	NC	NC	NC

NC: not calculated: bore not in use or geology not known (hence no attribution to model layer possible) , DD: drawdown (base case).

Table 28 Predicted maximum cumulative drawdown at private bores due to the Project

Registered RN (ID)	Bore name	Bore depth (m)	Use	Geology (in GW model)	SWL (mAHD)	Maximum additional DD (m)	Time of max. DD occurring (year)	Long-term additional impact (m) (year 2260)
103788	Conmurra	66	Irrigation (stock & domestic)	Regolith	140	3.64E-05	2063	0.000
132040	Currimundi	-	Not in use	Unknown	Unknown	NC	NC	NC
57402	Kensington	-	Not in use	Unknown	Unknown	NC	NC	NC
84403	-	-	Unknown	Unknown	Unknown	NC	NC	NC
89380	Fair Hills	77	Stock & domestic	Burngrove	196-214	0.02	2221	0.02
89383	Yongala	74	Stock	Burngrove	213	0.01	2169	0.002
89382		74	Stock	Unknown	213	NC	NC	NC
89384		78	Stock	Unknown	213	NC	NC	NC
90140	Railway	61	Stock	Regolith	130 - 160			
-	Chelbrook1	24	Not in use	Unknown	Unknown	NC	NC	NC
-	Chelbrook2	>100	Not in use	Unknown	Unknown	NC	NC	NC
-	Currimundi (Field 5 Bore)	29	Not in use	Unknown	Unknown	NC	NC	NC
-	Cypress	>160	Not in use	Unknown	Unknown	NC	NC	NC
-	Euro Park	74	Not in use	Rewan (upper)	Unknown	0.12	2148	0.09
-	Jamar	90	Stock	Rewan (upper)	108 - 126	0.17	2077	0.09
-	Jenson	41	Stock	Unknown	Unknown	NC	NC	NC
-	Karanga	~50	Stock	Burngrove	133	0.06	2165	0.05
-	Twin Bore	18	Stock	Alluvium	153	0.05	2065	0.01
-	Winton Creek	60	Stock	Rewan (upper)	138	0.15	2061	0.04
67014		80	Unlikely used (very saline)	Unknown	164.3 (1983)	NC	NC	NC
90338		30	Farm supply (potable)	Unknown	Unknown	NC	NC	NC
67015		44	Unlikely used (very saline)	Unknown	Unknown	NC	NC	NC
38845		70	Unknown	Unknown	Unknown	NC	NC	NC
90337		31	Unknown	Unknown	Unknown	NC	NC	NC

NC: not calculated: bore not in use or geology not known (hence no attribution to model layer possible) , DD: drawdown (base case).

7.6 Other potential impacts

This section covers other potential impacts on the groundwater resources from the extension of the underground mine. These potential impacts have been qualitatively assessed and are presented in Table 29.

Table 29 Qualitative assessment of other potential impacts

Potential Impact	Qualitative assessment
Contamination from underground machinery, fuel storage, workshops, waste storage	The extension of the underground coal mine will not have any additional impacts compared to the existing operations. The same methods of underground mining will be used. The only difference to the existing operations in this context is the duration of mining (8 years for the existing operations versus 17 years for the Project).
Incidental mine gas	The measured seam gas content in the current ML 7459 and ML 70365 areas is generally low. The current operational procedures will be utilised for incidental mine gas hazard management. The current ventilation system will be utilised to manage incidental gas for the underground mining in the Project Area. There is no likely impact on landholder bores. Should any of the bores become gassy, the Groundwater Management Plan (GWMP) should be amended to include gas sampling at these bores.
Flood mitigation measures	There are no additional surface water infrastructure features planned, hence there are no additional impacts on the groundwater.
Any ventilation shafts	No additional ventilation shafts are required, hence no additional impact on the groundwater is expected.

8 Management and mitigation

8.1 Mine affected water

Mine-affected water will be managed using the existing mine water management system. No new infrastructure will be required. The existing water management system was approved and is regulated through the Environmental Authority EPML00732813.

The current EA defined conditions for the release of mine affected water including release points, sources, release limits and receiving water. The source water associated with the Project will be Ramp 24 Fill Point Dam and Ramp 3 / 4 Drain (Table 30).

Table 30 Release points and source water conditions (Table C1 of EPML00732813)

Release point	Easting (GDA94)	Northing (GDA 94)	Mine affected water source and location	Monitoring point	Receiving waters description
RP1	653731	7401335	Ramp 24 Fill Point Dam, Ramp 3 / 4 Drain, A, B, C, D, E, F and Y pits	End of pipe	Nogoa River
RP3	651680	740068	Ramp 24 Fill Point Dam, Ramp 3 / 4 Drain, A, B, C, D, E, F and Y pits	End of pipe	Nogoa River

8.2 Subsidence

Ensham is currently operating a bord and pillar mine downdip of the open-cut and is planning to extend mining operations into the Project Area using the same mining methodology. This mining system forms a regular array of stable coal pillars and roadways in each panel and does not cause large scale overburden fracturing and subsidence. In the thicker seam areas, additional coal may also be recovered from the floor of the roadways.

Gordon Geotechniques (2020) assessed the subsidence risk for the Project. The assessment of the stability of the coal pillars in the Project Area has been carried out using the industry accepted University of New South Wales Pillar Design Procedure. There is a high degree of confidence in these subsidence predictions due to the amount of information from the existing bord and pillar mining at Ensham with similar mining heights, depth of cover and mining methodology. This assessment, using a minimum pillar Factor of Safety of 1.6, has confirmed the long-term stability of the proposed mine layout.

Due to the nature of the bord and pillar mining method, subsidence is predicted to be typically less than 40 mm in the Project Area; this is as a result of elastic compression of the strata (i.e. compression due to the additional load on the pillars after the coal is extracted). To provide context, DAWE states that seasonal variation in surface levels can be as high as 50 mm as a result of changes in moisture content. Due to the low levels of subsidence and associated strains and tilts, no surface cracking is anticipated within the Project Area. The expected low levels of subsidence are also unlikely to result in the formation of significant depressions in the surface topography where ponding of the surface drainage may occur. This is consistent with experience at the existing Ensham Mine operations where no surface cracking or ponding has been observed above the operating bord and pillar mine areas.

Subsidence or ground instability due to the removal of groundwater is, based on the geology overlying the target coal seams, deemed to be limited.

8.3 Groundwater users

As reported in Section 7.4, there are two private bores (Jamar Bore and Winton Creek Bore, in the Rewan Group) that may experience an incremental drawdown of less than 10 cm and a cumulative drawdown of less than 20 cm due to the Project.

Make good measures would be put in place with landholders with bores predicted to be affected by the Project mine dewatering (where groundwater levels are predicted to decrease by > 2 m in the alluvium and > 5 m in the consolidated hydrostratigraphic units) to ensure the bore owner has access to a similar quantity and quality of water for the water bore's authorised purpose. As the modelled drawdowns are below the thresholds above, no make good measures need to be put in place. The two private bores (Jamar Bore and Winton Creek Bore) are currently monitored (water level and water quality) on a quarterly basis, which is recommended to be continued.

8.4 Groundwater monitoring program

8.4.1 Monitoring location

The groundwater monitoring bore network as per the current EA (refer to Section 5.1) is extensive and allows for the compilation of groundwater data from the Quaternary (alluvium), Triassic age sediments, Rewan Group and Rangal Coal Measures around the Project.

It is recommended to maintain the current monitoring network and schedule, as detailed in the current EA and add five new monitoring bores. The location of existing monitoring bores in the current EA and proposed additional bores for the Project Area is presented in Table 31 and Figure 56. The suggested new bores are highlighted in the table and the rationale for the installation is explained in the paragraphs below.

The monitoring of the Nogoa River alluvium is currently focused on the area around the open-cut pits (EC-series). The purpose of the suggested three new alluvial bores is to augment the monitoring of the alluvium through adding additional monitoring points across the Project Area. One of those bores, proposed bore 1A, was installed in October 2019.

Further, two bores in the coal measures are proposed, one of which will be a VWP in the northern part of the Project Area, suitable for assessing vertical gradients in the water levels and to validate the model predictions. This is proposed bore 1B, which was installed in November 2019. The VWP will monitor the water pressure in the lower alluvium, the Rewan Group, overburden, target coal seam and the underburden.

The second proposed monitoring bore for the coal measures is to be placed at the western boundary of the Project Area into the target coal seam such that the predicted modelled impacts to the west can be monitored and be validated. The RB-bore series is in a suitable location to monitor the predicted water level impacts to the north and south of the Project and therefore no further bores are proposed.

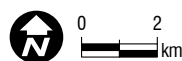
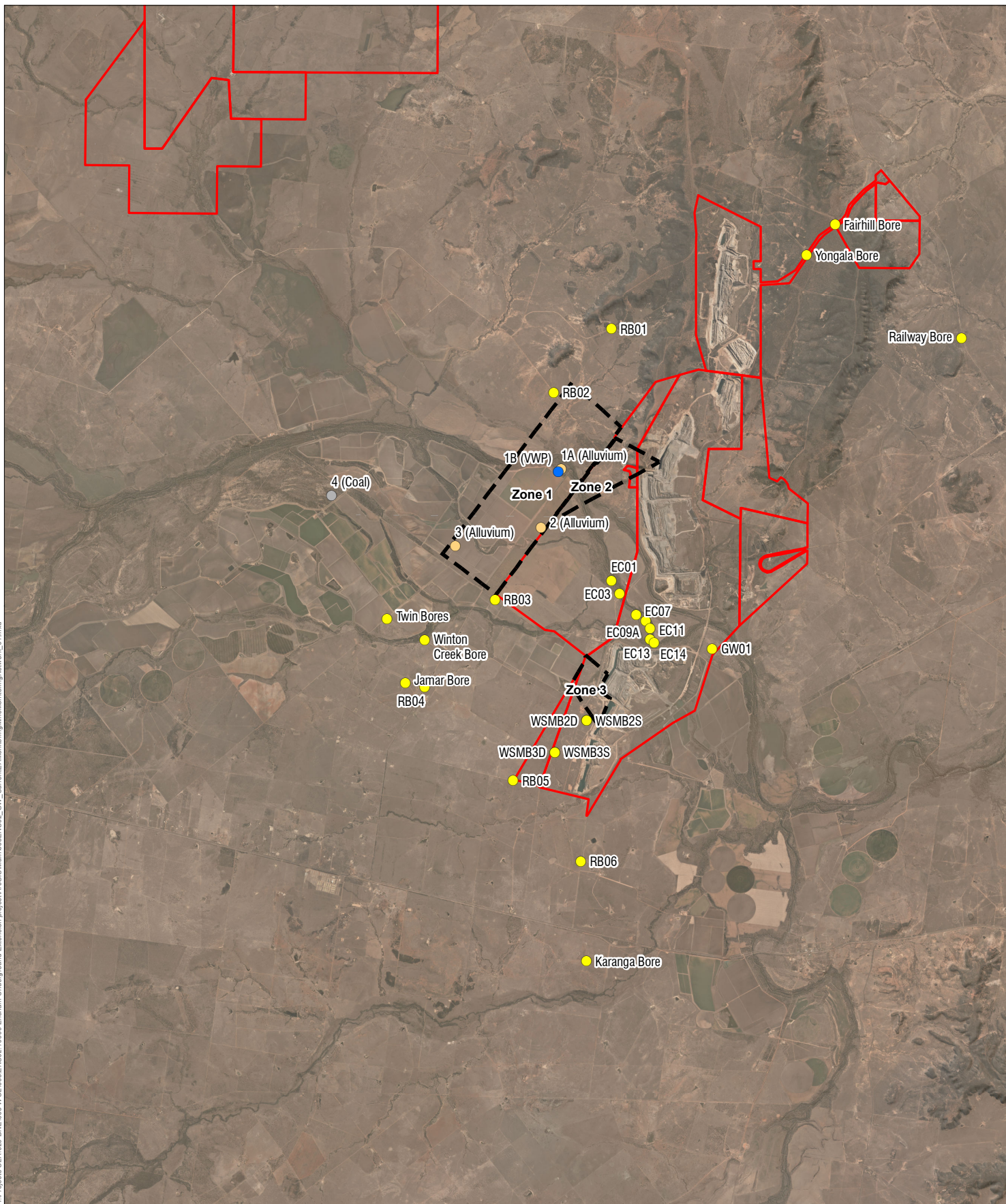
Table 31 Current and proposed groundwater monitoring network

Location	Monitoring point	Easting (GDA94)	Northing (GDA94)	Aquifer	Frequency
Nogoa River Alluvium	EC01	650018	7403059	Alluvium	Quarterly
Nogoa River Alluvium	EC03	650338	7402547	Alluvium	Quarterly
Nogoa River Alluvium	EC07	650973	7401746	Alluvium	Quarterly
Nogoa River Alluvium	EC09A	651354	7401504	Alluvium	Quarterly
Nogoa River Alluvium	EC11	651517	7401192	Alluvium	Quarterly
Nogoa River Alluvium	EC13	651517	7400776	Alluvium	Quarterly
Nogoa River Alluvium	EC14	651676	7400653	Alluvium	Quarterly
Nogoa River Alluvium	GW01	653934	7400423	Alluvium	Quarterly
Nogoa River Alluvium	Proposed 1A* (RN165935, RB07A)	647738	7407169	Alluvium	Quarterly
Nogoa River Alluvium	Proposed 2 [#]	TBC	TBC	Alluvium	Quarterly
Nogoa River Alluvium	Proposed 3	TBC	TBC	Alluvium	Quarterly
Regional Bores (Private Property)	Karanga (Bore A)	649043	7388304	Rangal Coal Measures	Quarterly
Regional Bores (Private Property)	Winton Creek (Bore 4)	642771	7400758	Rewan Group	Quarterly
Regional Bores (Private Property)	Twin Bore (Bore 5)	641319	7401567	Basal Alluvium	Quarterly
Regional Bores (Private Property)	Jamar Bore (Bore 7)	642025	7399084	Rewan Group	Quarterly
Regional Bores (Private Property)	Yongala (RN89383)	657586	7415693	Burngrove Formation	Quarterly
Regional Bores (Private Property)	Fairhills (RN89380)	658696	7416877	Burngrove Formation	Quarterly
Regional Bores (Private Property)	Railway (RN90140)	663591	7412470	Undiff Coal Measures	Quarterly
Regional Bores (existing mine)	RB01	650018	7412835	Rangal Coal Measures – Coal (A2C)	Quarterly
Regional Bores (existing mine)	RB02	647787	7410365	Rangal Coal Measures – Coal	Quarterly
Regional Bores (existing mine)	RB03	645503	7402324	Rangal Coal Measures – Coal (A2C)	Quarterly
Regional Bores (existing mine)	RB04	642784	7398932	Rangal Coal Measures – Coal (A21)	Quarterly
Regional Bores (existing mine)	RB05	646209	7395311	Rangal Coal Measures – Coal (A21)	Quarterly
Regional Bores (existing mine)	RB06	648836	7392168	Rangal Coal Measures – Coal (A2C)	Quarterly

Location	Monitoring point	Easting (GDA94)	Northing (GDA94)	Aquifer	Frequency
Project Area (existing mine)	Proposed 1B* (VWP) Installed as RB07B	TBC	TBC	Alluvium, Rewan Group, overburden, AC seam and underburden	WL only , at a minimum frequency of 6 hours
Project Area (existing mine)	Proposed 4	TBC	TBC	Coal	Quarterly

Notes: * Proposed bore was constructed in October/November 2019. # an existing bore could be considered for re-activation (Appendix N)

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 23-Apr-2020
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Sheet Size: A4

Legend

- Proposed Groundwater Monitoring Project Area
 Alluvium
 VWP
 Coal
 Existing Monitoring Network
 Mining Lease

GROUNDWATER IMPACT ASSESSMENT

Existing monitoring network and proposed new monitoring bores for Project Area

Figure 56

8.4.2 Contaminants of concern

The principal contaminants of concern associated with coal mining are linked to mine-affected water. It includes potential change to salinity and pH, modification of the ionic composition of water and introduction of potential toxic levels of metal and metalloids.

The existing EA for mining leases adjacent to the Project Area include stressors that are directly toxic to biota (pH, salinity, heavy metals and petroleum hydrocarbon). For each of the existing EA bores, a trigger level and contaminant limit has been assigned based on their respective data record (mean plus (plus/minus for pH) three standard deviations). It is recommended to assign a trigger level and contaminant level for each of the new bores once they are included in the sampling program.

Groundwater quality monitoring will continue to be undertaken on a quarterly basis as outlined within the EA, as per condition C39. As part of the full water quality monitoring, in addition to collecting field parameters (EC and pH), water samples will be submitted to a NATA accredited laboratory for analysis of:

- physiochemical indicators (total dissolved solids (TDS))
- major ions (calcium, fluoride, magnesium, potassium, sodium, chloride, sulphate), hardness and ionic balance (total anions / cations)
- total alkalinity as CaCO_3 , HCO_3^- , CO_3^{2-}
- total and dissolved metals: iron, silver, arsenic, mercury, antimony, molybdenum and selenium
- total petroleum hydrocarbons (C6-C9, C10-C14, C15-C28 and C29-C36) with silica gel clean-up.

8.4.3 Impact assessment criteria

Groundwater monitoring criteria will be established to monitor predicted impacts on both environmental values and predicted changes in groundwater quality. Impact assessment criteria for the site will be in line with current site approvals and will be documented within the GWMP).

Groundwater quality trigger levels for newly installed bores will be developed in line with the Department of Science, Information Technology and Innovation guideline on “Using monitoring data to assess groundwater quality and potential environmental impacts” (DSITI, 2017). The trigger levels will be established once 12 to 24 months of data (to be collected quarterly) have been collected from the site monitoring network. As per the DSITI (2017) guidelines, the triggers will be established in consideration of the Water Plan (Fitzroy Basin) 2011 WQOs, ANZECC (2000) criteria, and site-specific conditions. Trigger criteria will be established for each groundwater unit potentially impacted by the Project, being alluvium, regolith and the Rangal Coal Measures. In line with the current EA, the site-specific triggers will be established on a bore by bore basis.

All current and proposed site monitoring bores are located within the zone of predicted groundwater level change due to the Project. Therefore, changes in groundwater levels at the site bores will be compared to predicted groundwater trends (extent of drawdown and rate of drawdown) to evaluate any deviations from the predicted trends.

8.4.4 Data management and reporting

Routine groundwater monitoring continues to be conducted on a quarterly basis. The new bores will be included in the routine monitoring program. Data will be stored within the existing consolidated groundwater database. Quality assurance and quality control procedures, such as field sampling procedures and the use of NATA accredited laboratories, will continue to be in place to help ensure the accuracy of data entered into the database. Prior to commencement of coal extraction associated with the Project, groundwater quality triggers for the new bores will be established as outlined in Section 8.4.3 on a per-bore basis.

In accordance with the current EA, findings from the quarterly monitoring events will continue to be documented. The quarterly review will include identification of any groundwater quality trigger exceedances. Where a trigger exceedance is identified, the regulator will be notified within 28 days and an investigation into the potential for environmental harm will be completed. The groundwater database and factual quarterly documentation will be available for provision to the regulator upon request.

Each year an annual review of groundwater level and quality trends will be conducted by a suitably qualified person and provided to the regulator. The review will assess the change in groundwater level and quality over the year, compared to historical trends and impact assessment predictions. The annual review will discuss any groundwater trigger exceedances or where trends show potential for environmental harm.

8.4.5 Future modelling

The model limitation assessment (Table 25) showed that at the time of modelling, there was insufficient water level data available from the groundwater monitoring bore network to calibrate (transient) the drawdown in the target coal seams.

As underground mining progresses, more observation data will become available. If the measurements diverge significantly from the predictions, the groundwater model should be updated with the most recent data, such as mine plans and water level observations and re-calibrated if required.

9 Conclusions

The key conclusions of this groundwater assessment are:

- The impact assessment was carried out as incremental (difference between existing operations and the Project) and cumulative (difference between existing operations plus Project and a hypothetical “no underground mining after 2018” scenario). The focus in this section is on the incremental impacts, as they describe the impacts beyond already approved impacts.
- The Project has a predicted underground mine inflow between 3 and 20 ML / day, with an average of 8.9 ML / day. Due to the methodology used, these inflows are considered a conservative over-estimate. An increase of total inflow is predicted due to the extension of the mine life. The daily inflow rates of the Project are similar compared to the existing operations.
- There is no predicted incremental groundwater level drawdown within the alluvium in the Project Area as a result of the Project. However, some incremental drawdown is observed in the wider study area, specifically east of the open-cut voids.
- Impacts on any identified GDEs are negligible. No maximum incremental drawdown larger than 0.5 m was predicted in the alluvium in the Project Area.
- The incremental groundwater level drawdown within the Rangal Coal Measures could extend up to 7 km to the west to south-west (down dip) of the Project Area, the cumulative drawdown extends another kilometre.
- No private landholder bores are predicted to have an additional decline in groundwater levels greater than 2 m at any point in time in the long term (after the life of the Project). The largest predicted incremental drawdowns in landholder bores were 10 cm. The largest predicted cumulative drawdowns in landholder bores were 17 cm.
- The incremental net indirect loss of groundwater from the Nogoa River alluvium (within the model domain) to underlying strata due to the Project is predicted to be about 0.01 ML / day on average, with an additional peak loss of 0.05 ML / day. This is considered negligible, as the total loss from the alluvium to the underlying strata from natural processes is around 3 ML / day.
- The predicted change in baseflow of the Nogoa River due to the Project is negligible, both for the incremental and cumulative change.
- There is no leakage from the coal measures predicted to flow into the alluvium, for both the existing operations and the Project.
- There are no additional impacts on groundwater quality predicted for the Project Area.
- Post mining, the groundwater levels will recover slowly based on 200-year recovery simulations. Some permanent reduction in water levels is predicted in the target coal seams.

10 Recommendations

It is recommended to amend the existing groundwater monitoring plan (GWMP) for the Project based on the results of this assessment, which would include details on the groundwater monitoring and management regime to be implemented for the Project.

It is recommended that the existing Ensham Mine monitoring bore network be further expanded to include an additional five groundwater monitoring bores. One alluvial standpipe and the proposed VWP have recently been installed in October and November 2019 respectively, leaving three more bores to be installed in the future.

Once sufficient data have been collected from the new monitoring bores, it is recommended that site specific trigger levels will be established and specified within the GWMP.

The sensitivity analysis showed that the model predictions are most sensitive the coal horizontal hydraulic conductivity, which means that the certainty of the model predictions can be improved by reducing the uncertainty around this parameter. For the recommended remaining new bore to be drilled in the coal seams, it is recommended to undertake hydraulic testing to determine aquifer properties. It is recommended to conduct down hole packer tests in the Rewan Group and coal seams for hydraulic conductivity data with depth, this will assist in validating model assumptions and the aquitard low permeabilities.

11 References

- AQC-Pacific Pty Ltd 1986, Geology and Coal Resources of the Ensham Open Cut Area, A to P 426C, reported in AGE 2006, Ensham Alluvial Project Phase 1 Hydrogeological Assessment, Project G1229, prepared for Hansen Consulting, August 2004.
- Ausenco-Norwest 2012, Groundwater Model, Northern Bowen Basin Regional Model Impact Predictions, Queensland, Australia, Prepared for Arrow Energy Pty Ltd.
- Australasian Groundwater and Environmental (AGE) Consultants 2006, Report on Ensham Central Project – EIA, Groundwater Impact Assessment, Project No. G1258, Appendix C of EIS, February 2006.
- Australasian Groundwater and Environmental Consultants 2013, Minyango Project Groundwater, Proj G1562, Report for Hansen Bailey, April 2013.
- Australasian Groundwater and Environmental Consultants 2015, Gregory Crinum Kestrel Groundwater Model Update, Prepared for BHP Billiton Mitsubishi Alliance. March 2015.
- Australasian Groundwater and Environmental Consultants 2017, Ensham Underground Groundwater Model, Report prepared for Ensham Resources Pty Ltd. February 2017.
- Barnett, B, Townley, LR, Post, V, Evans, RE, Hunt, RJ, Peeters, L, Richardson, S, Werner, AD, Knapton, A & Boronkay, A, 2012. Australian Groundwater Modelling Guidelines. Waterlines Report 82, National Water Commission, Canberra.
- BHP Billiton Mitsubishi Alliance, 2009. Daunia Coal Mine Project - Environmental Impact Statement', Appendix H Technical Report: Groundwater Modelling Assessment of Impact of Daunia Coal Mine on Regional Groundwater Aquifers.
- Bureau of Meteorology (BOM), 2018. Latest River Heights for Nogoa R at Duckponds, <<http://www.bom.gov.au/fwo/IDQ65392/IDQ65392.535097.plt.shtml#notes> >
- CDM Smith, 2013, Springsure Creek Coal Mine Project: EIS Chapter 9 – Groundwater, Report for Springsure Creek Coal Pty Ltd.
- Clark, D, McPherson, A & Collins, C 2011, Australia's seismogenic neotectonic record, Geoscience Australia record 2011/11.
- Coffey, 2014, Appendix E - Supplementary Groundwater Assessment, Arrow Energy Bowen Gas Project. Supplementary Report to the EIS, 17 April 2014.
- Department of Environment and Heritage Protection, 2011. Nogoa River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Nogoa River Sub-basin. Environmental Protection (Water) Policy 2009. September 2011.
- Department of the Environment, Australian Government, 2013, Matters of National Environmental Significance Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999
- Department of Infrastructure, Local Government and Planning (DILGP), 2014, State Planning Policy (SPP).

Department of Science, Information Technology and Innovation (DSITI), 2017, Using monitoring data to assess groundwater quality and potential environmental impacts, Version 1, Brisbane, Australia: Queensland Government.

Ensham Resources, 2018, Residual Void Project, Final Report – Stage 3, Environmental Assessment Report.

GeoResGlobe, 2020, GeoResGlobe - A new and improved mapping application, visited 07 April 2020, < <https://georesglobe.information.qld.gov.au/>>.

Geoscience Australia, 2011, Geoscience Australia, 1 second SRTM Digital Elevation Model (DEM), Bioregional Assessment Source Dataset, Viewed 10 December 2018, <<http://data.bioregionalassessments.gov.au/dataset/9a9284b6-eb45-4a13-97d0-91bf25f1187b>>

GHD, 2013, Carmichael Coal Mine and Rail Project SEIS - Mine Hydrogeology Report Addendum. Report 41/26422/452475, October 2013.

Golder Associates, 2017, Human Health and Ecological Chemical Assessment – Hydraulic stimulation chemical assessment QGC Surat and Bowen Basin operation. Report 127635006-004-R-Rev4-05300, 29 June 2017

Gordon Geotechniques, 2016, Geotechnical review of the mine plan extension into MDL217, Report prepared for Ensham Resources Pty Ltd, September 2016.

Gordon Geotechniques, 2020, Subsidence Report for the Ensham Life of Mine Extension Project, Prepared for Aecom Australia Pty Ltd on behalf of Ensham Resources Pty Ltd, November 2019

Habermehl MA, 1980, The Great Artesian Basin, Australia. BMR Journal of Geology & Geophys. 5, 9-38.

Habermehl MA, 1998, Hydrogeology and hydrochemistry of the Great Artesian Basin, Australia. AGSO (Geoscience Australia) Canberra, ACT

HydroSimulations, 2020, Ensham Resources Residual Void Project - Groundwater Assessment Stage 3, Prepared for Ensham Resources Pty Ltd, Rev R, April 2020.

Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), 2015, Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals.

JBT Consulting, 2012, Report on Groundwater Seepage Studies and Operational Monitoring Review: Baralaba North Project, Report for CCL, December 2012.

JBT Consulting, 2016, Lake Vermont Northern Extension Groundwater Impact Assessment, Prepared for AARC on Behalf of Bowen Basin Coal Pty Ltd.

Jeffrey, SJ, Carter, JO, Moodie, KB and Beswick, AR (2001), Using spatial interpolation to construct a comprehensive archive of Australian climate data, Environmental Modelling and Software, Vol 16/4, pp 309-330. DOI: 10.1016/S1364-8152(01)00008-1.

Jourde, H, Flodin, EA, Aydin, A, Durlofsky, LJ, & Wen, XH, 2002, Computing permeability of fault zones in eolian sandstone from outcrop measurements, AAPG Bulletin, v. 86, no. 7, p. 1187–1200

KCB, 2016. Isaac Plains East Project Groundwater Modelling Report. Prepared for Hansen Bailey, EAR Groundwater Report Appendix IV.

Matrix Plus, 2010. Groundwater Impact Assessment for Millennium Expansion Project EIS.

Merrick, DP & Merrick, NP, 2015, AlgoMesh: A New Software Tool for Building Unstructured Grid Models, MODFLOW and More 2015 Proceedings, Colorado School of Mines, Integrated Groundwater Modeling Center, May 31 – June 3, 2015, 321-325.

Merrick, NP & Merrick, DP, 2017, Does MODFLOW-USG / AlgoMesh Give the Same Results as MODFLOW-SURFACT? MODFLOW and More 2017 Proceedings, Colorado School of Mines, Integrated Groundwater Modeling Center, May 21 – 24, 2017.

Northern Resource Consultants (NRC), 2018. Wilton Coal Project, Response to information Request – Groundwater. Prepared for Wilton Coking Coal Pty Ltd. February 2019.

Office of Groundwater Impact Assessment 2016, Groundwater modelling report for the Surat Cumulative Management Area. State of Queensland, September 2019.

Queensland Resources Council (QRC) 2019, Kestrel Coal Resources. Viewed online on the 11th of September 2019.

<<https://www.qrc.org.au/our-members/kestrel-coal-resources/>>

Panday, S, Langevin, CD, Niswonger, RG, Ibaraki, Motomu, & Hughes, JD, 2013, MODFLOW– USG version 1: An unstructured grid version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation: U.S. Geological Survey Techniques and Methods, book 6, chap. A45, 66 p. < <https://pubs.usgs.gov/tm/06/a45>>

Parsons Brinckerhoff, 2011, Middlemount Coal Project Stage 2 Environmental Impact Statement - Chapter 10 Groundwater, Prepared for Middlemount Coal.

Paul PK, Zoback MD & Hennings PH, 2009, Fluid Flow in a Fractured Reservoir Using a Geomechanically Constrained Fault-Zone-Damage Model for Reservoir Simulation, SPE Reservoir Evaluation & Engineering, Volume 12, Number 4, p. 562-575.

SLR Consulting (SLR), 2019a, Fairhill Coal Project, Underground Water Impact Report, Prepared for Fairhill Coking Coal Pty Ltd, May 2019.

SLR Consulting (SLR), 2019b, Ensham Mine Groundwater 3rd Quarter Report 2019 Prepared for: Ensham Resources Pty Ltd Ensham Mine, SLR Ref: 620.12225.10000-R23, Version No: -v3.0 , October 2019.

URS, 2009. Caval Ridge Groundwater Impact Assessment. Prepared for BM Alliance Coal Operations Pty Ltd.

Uysal, T, Golding, S & Glikson, M, 2000, Thermal and Fluid Flow History in the Bowen Basin, Bowen Basin Symposium 2000.

WetlandInfo, 2019: WetlandInfo—your first-stop-shop for wetland management resources in Queensland, visited 24 October 2019, <<https://wetlandinfo.des.qld.gov.au/wetlands/>>

APPENDIX A

Current water quality trigger thresholds for annually reviewed trigger

Appendix A-Table 1 Current water quality trigger thresholds for annually reviewed trigger (current EA)

Bore	pH*		EC (µS/cm)		TDS (mg/L)		CO ₃ (mg/L)	HCO ₃ (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)	K (mg/L)	Cl (mg/L)	SO ₄ (mg/L)	Fe (mg/L)
	m+3s	m-3s	m+3s	m-3s	m+3s	m-3s	m+3s	m+3s	m+3s	m+3s	m+3s	m+3s	m+3s	m+3s	m+3s
EC01	8.8	6.2	53507	-1054	36910	-2246	18	2198	1114	1875	9033	12	18344	1759	25.4
EC03	8.7	5.9	38860	835	32574	-3910	9	1993	1575	1811	4696	24	13651	1406	41.9
EC07	8.2	6.1	48690	-15018	31669	-10638	9	1677	2359	1835	6399	19	17856	1430	96.4
EC09A	8.7	6.1	46911	-6377	35723	-7563	9	2661	1477	1729	6680	18	16310	1364	8.3
EC11	8.3	6.2	36411	-12557	23528	-8411	9	2204	1200	1267	5176	16	11803	981	77.2
EC13	8.6	5.9	31924	-12597	23978	-10562	9	1238	1332	1072	4027	26	10543	835	27.2
EC14	9.0	6.0	10177	-4021	7640	-3700	80	749	445	386	1457	19	3187	172	102.3
EC17_2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW01	9.0	7.4	12229	163	7447	359	151	1916	125	332	1880	8	3071	352	3.0
RB01†	9.0	7.7	4128	3080	2870	1735	116	494	19	14	797	5	1097	48	13.6
RB02†	8.4	7.3	11752	10165	7998	6091	-	142	177	35	2317	10	4422	<1	1.0
RB03†	8.5	7.6	10751	9097	7434	5294	-	196	85	17	2363	7	3919	23	0.6
RB04†	9.2	7.3	8307	6949	5753	4024	70	285	90	11	1669	22	2990	43	0.4
RB05†	8.7	7.3	7498	6748	5294	3852	6	430	64	10	1686	11	2816	18	1.0
RB06†	8.7	6.5	7939	6370	5207	4109	-	740	267	408	1351	10	2723	207	80.3
Karanga	8.7	6.6	3347	1923	2242	1152	19	507	220	151	358	25	882	382	1.1
Winton Ck.	8.5	7.3	9044	5422	6216	2463	9	355	174	104	1624	12	3107	104	1.6
Twin Bore	8.7	7.2	15494	7623	10398	4411	52	657	314	600	2380	14	5367	938	5.6
Jamar Bore	8.6	7.2	6189	1376	4061	524	4	366	117	77	1049	13	2014	3	4.4
Yongala	9.0	6.0	3138	2640	2184	1511	36	273	87	74	476	18	908	64	12.5
Fairhills	9.0	5.8	2301	1524	1561	890	48	303	41	34	399	14	558	102	8.1
Railway	8.9	6.5	7265	5335	4833	3287	263	1345	124	216	1339	32	1496	720	0.8

Notes: m+3s : mean + 3x standard deviation

m-3s : mean - 3x standard deviation

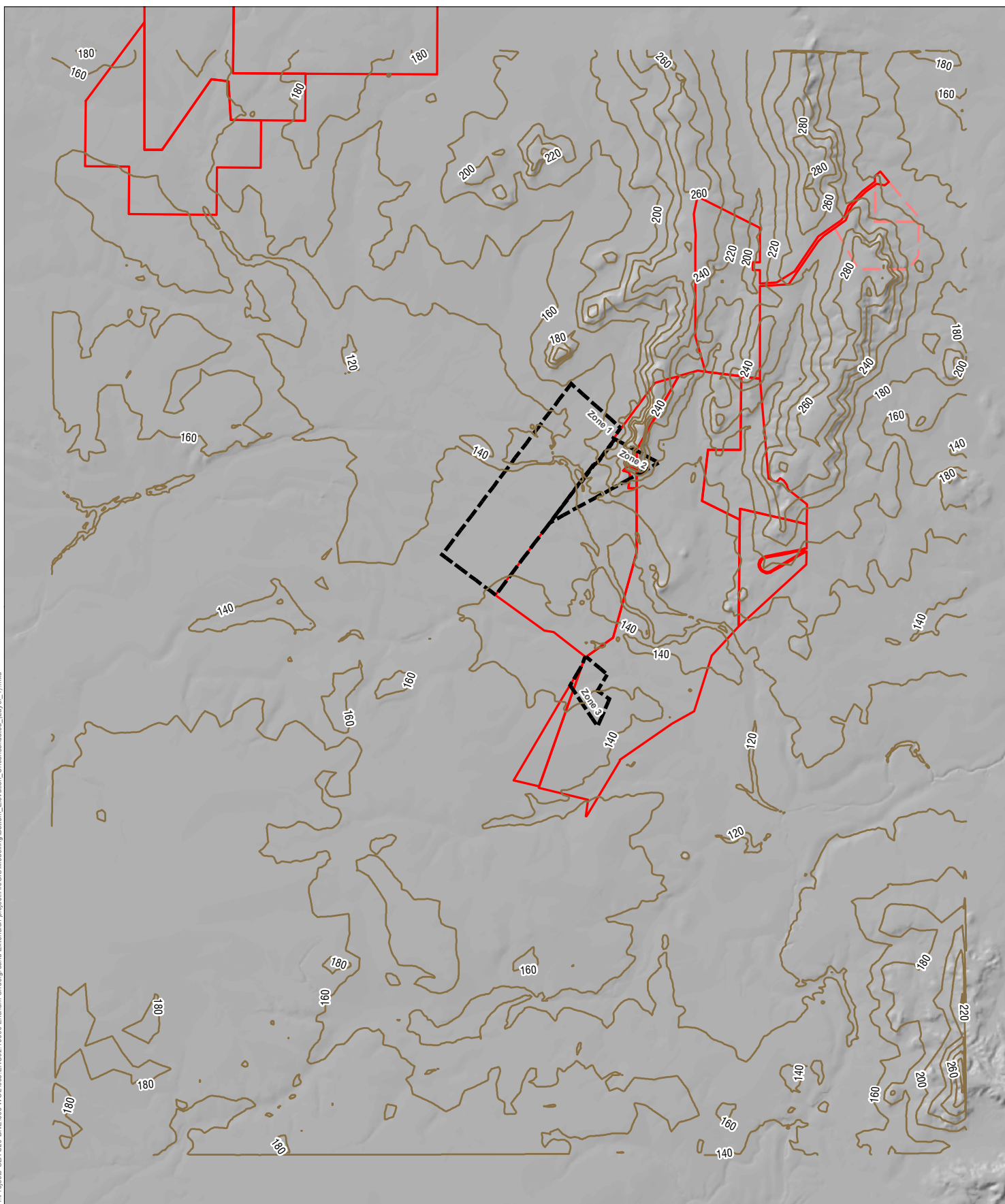
†trigger established to Feb 2019

*no data available aa bore is dry

APPENDIX B

Aquifer depths and thicknesses

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Date: 07-Feb-2020
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Legend

- ▬ Mining Lease (Granted)
- ▬ Mining Lease (Application)
- Project Area

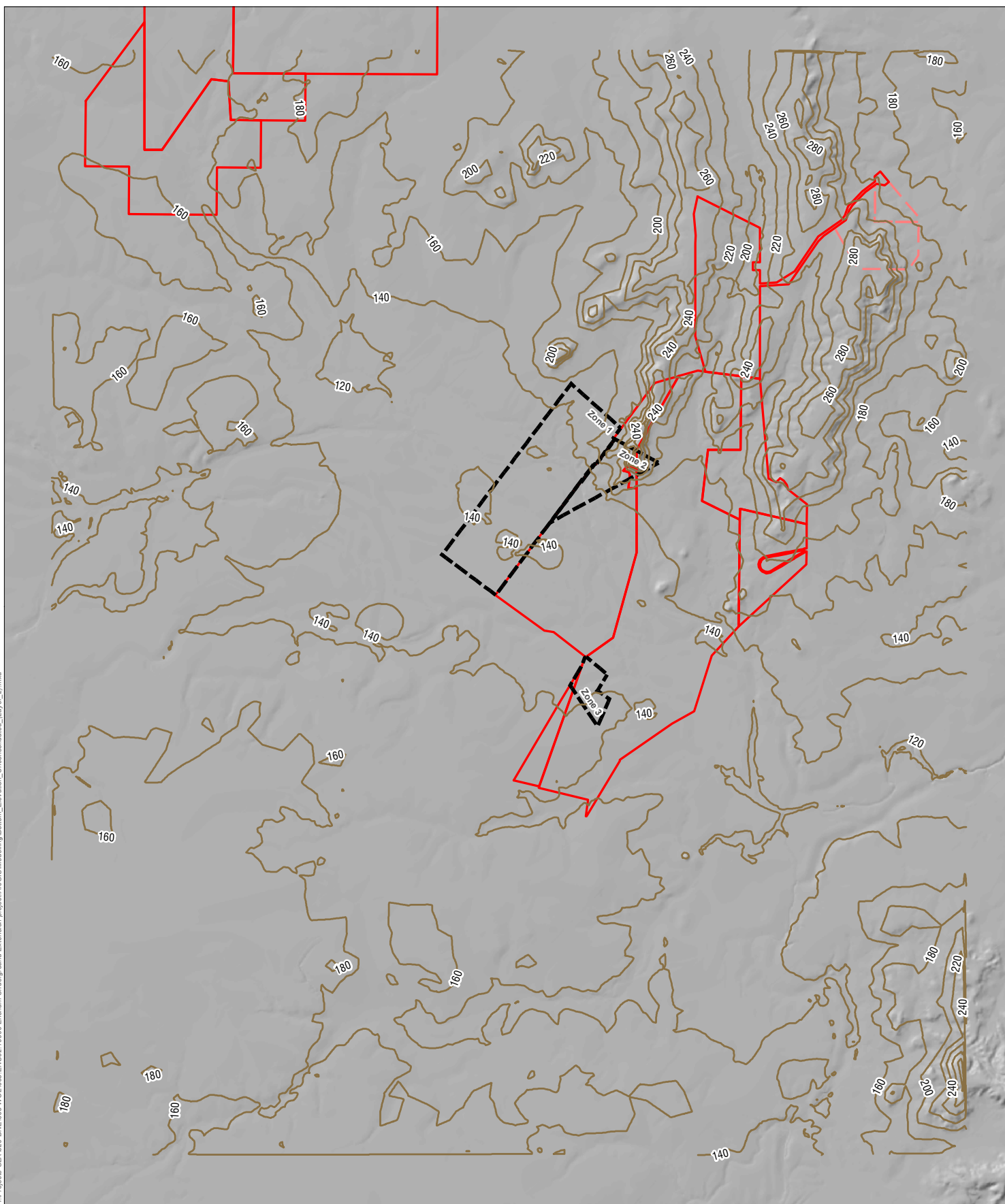
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GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Unconsolidated (Layer 1)

B1-1

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- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

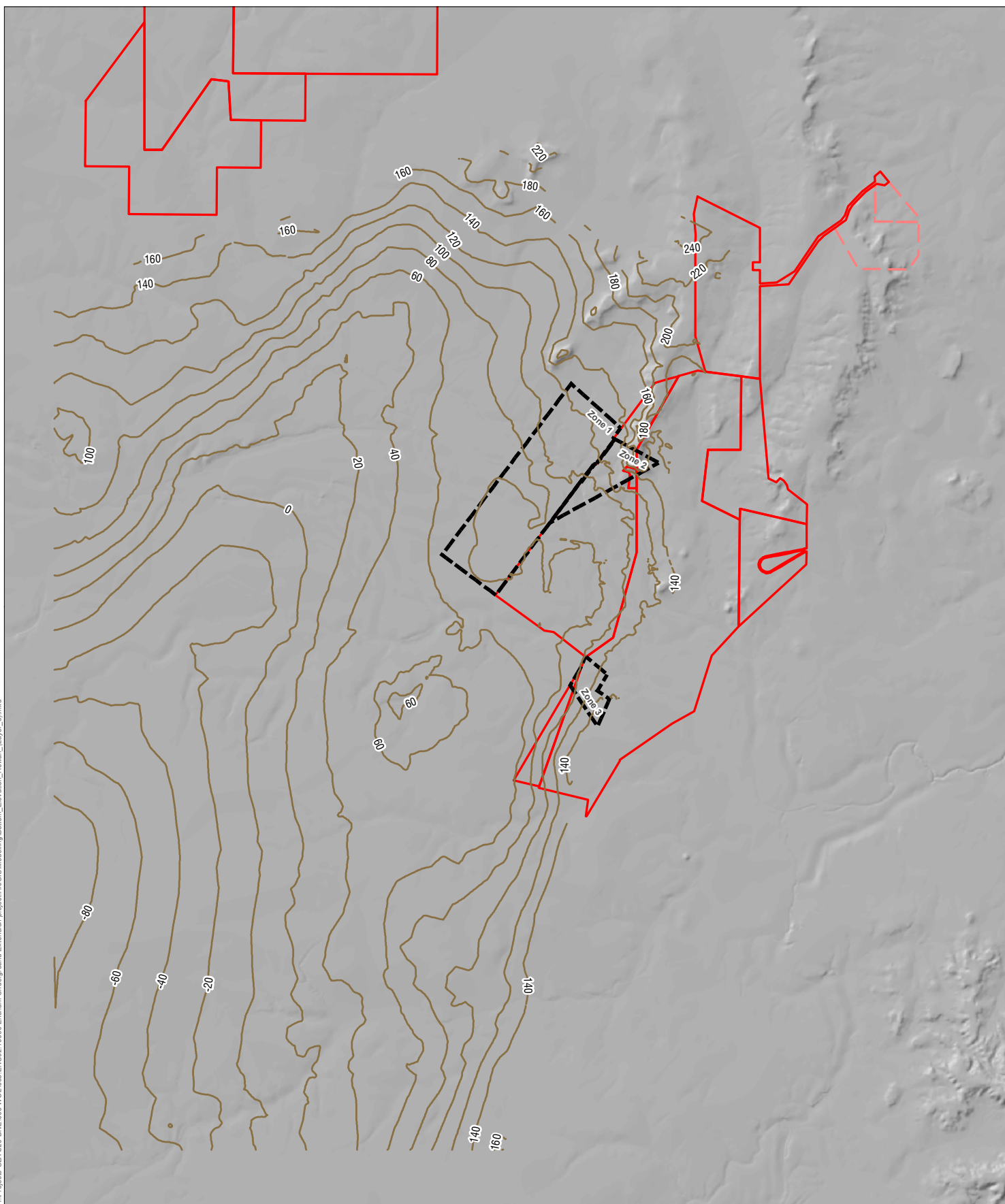
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GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Unconsolidated (Layer 2)

B1-2

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Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
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Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

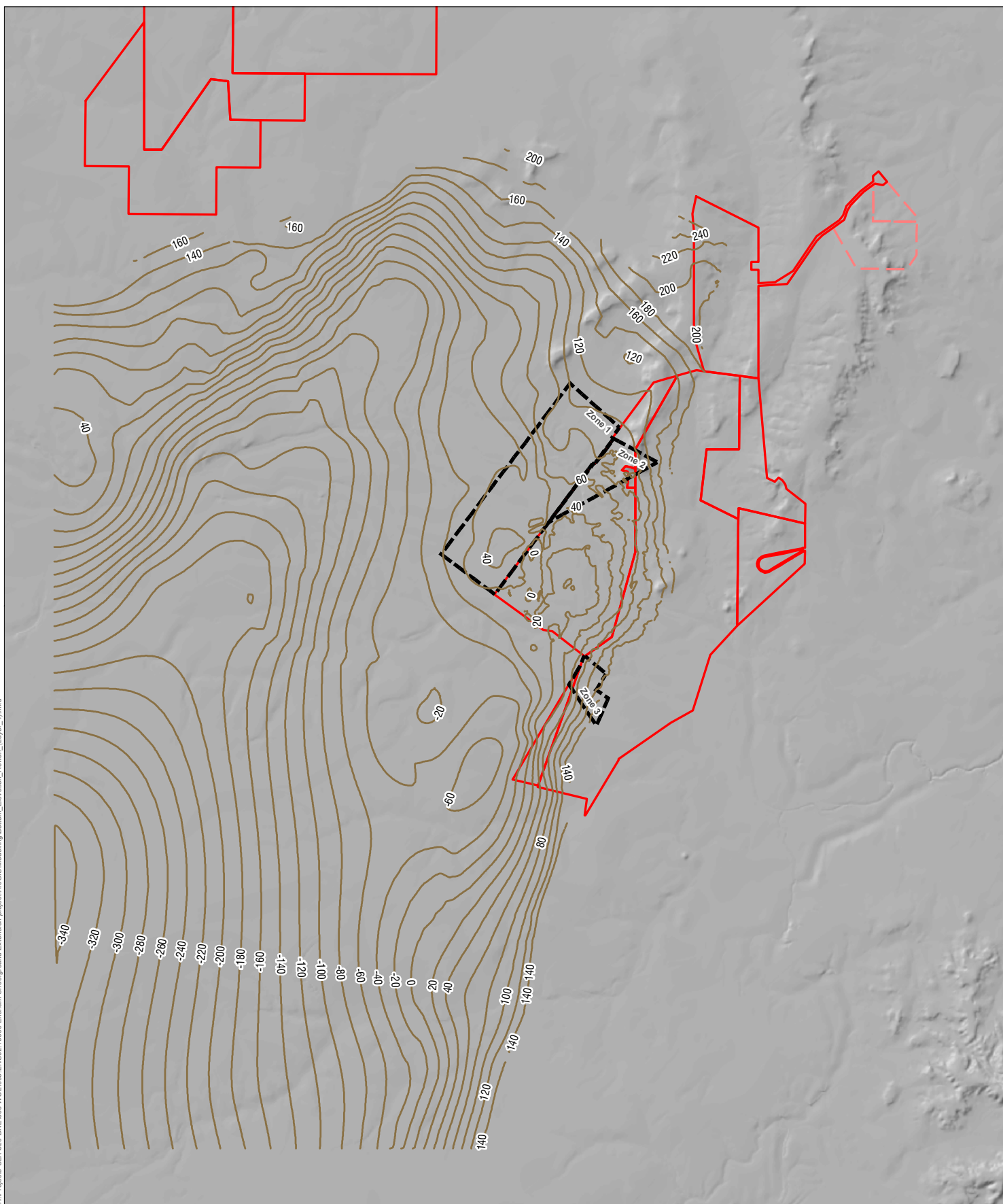
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GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Rewan (Layer 3)

B1-3

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
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Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

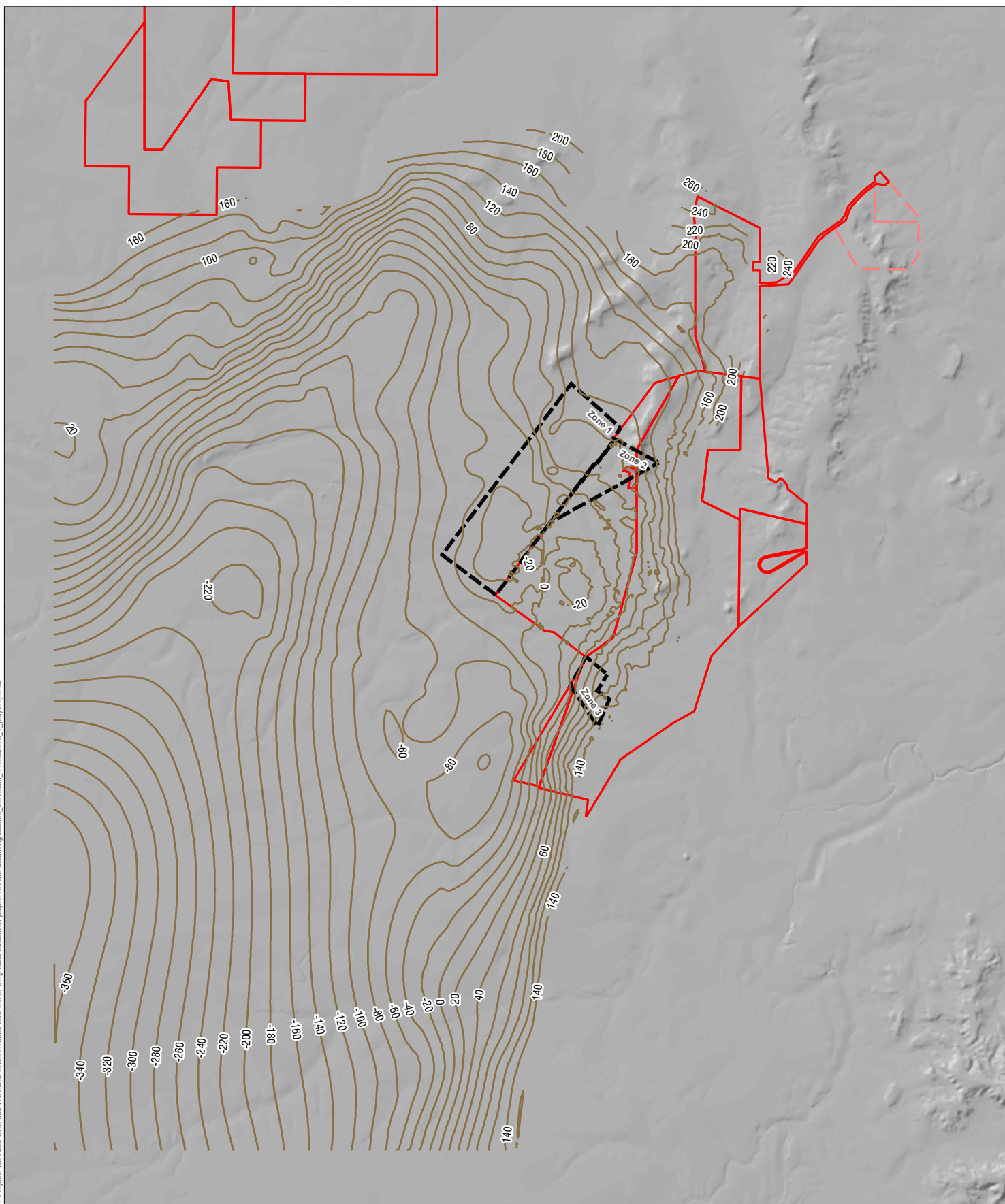
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GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Rewan (Layer 4)

B1-4

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
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Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

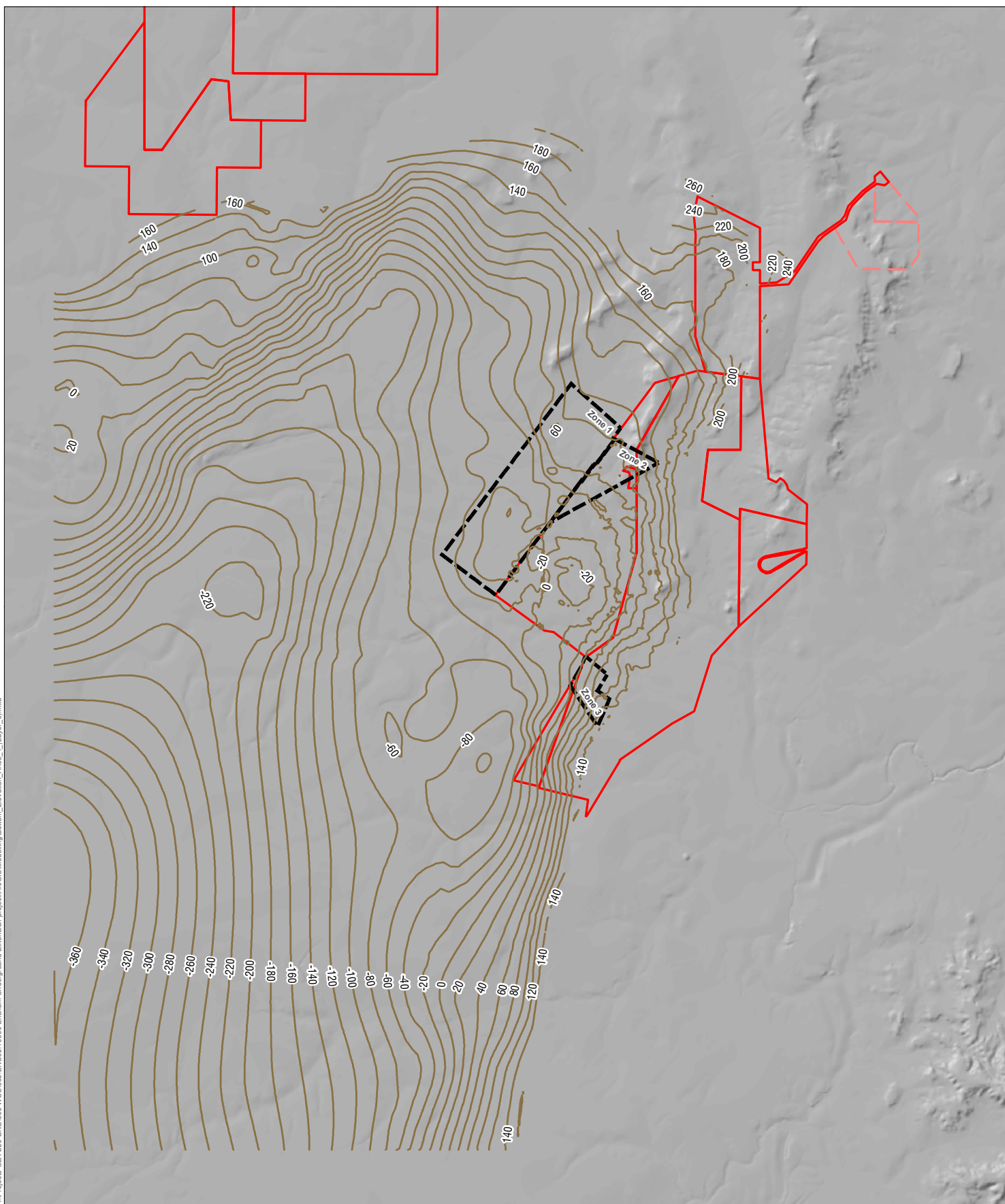
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GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Interburden 1 (Layer5)

B1-5

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Project No.: 665.ENS02.10000
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Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

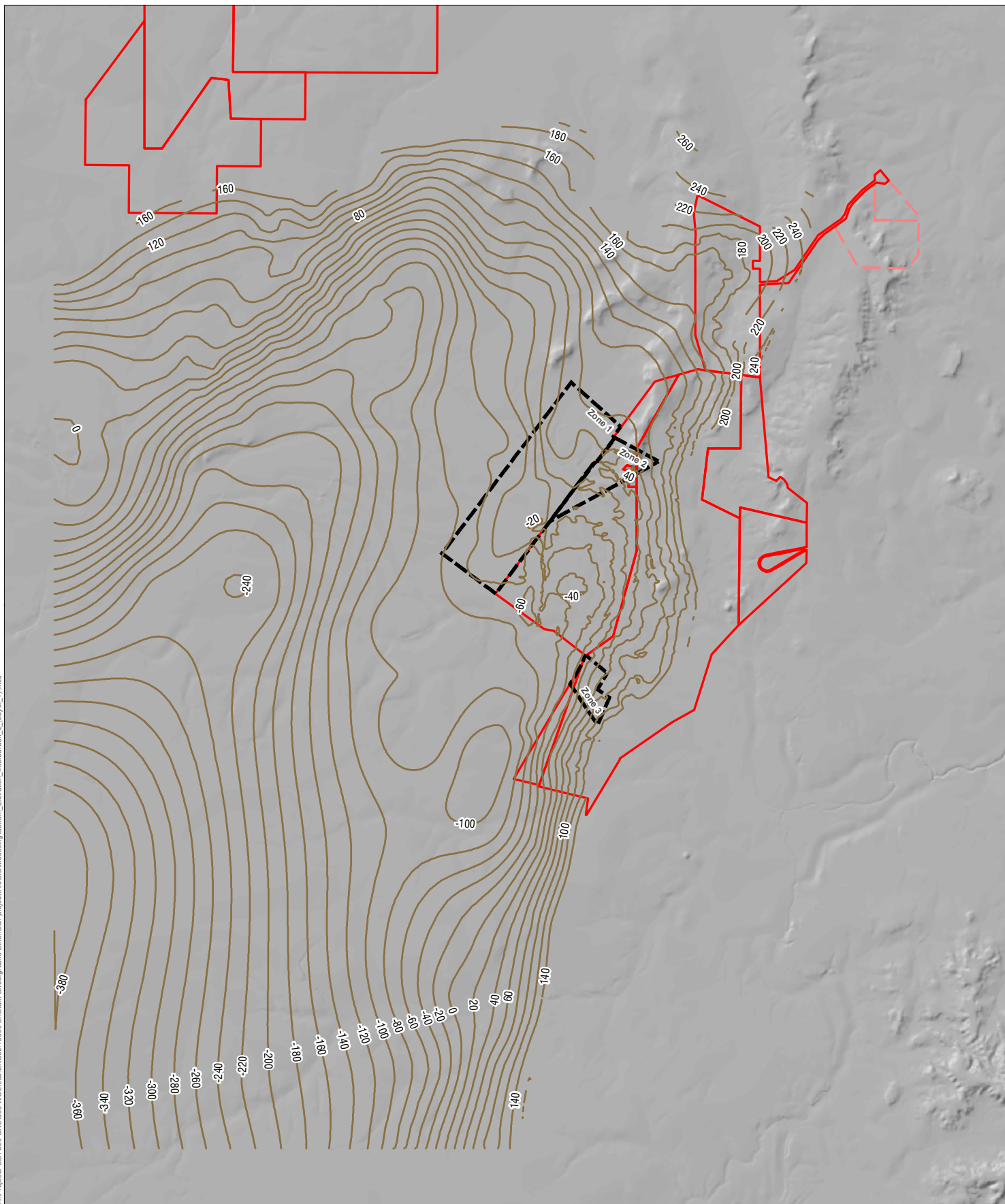
Elevation Contours (mAHd)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Aries 1 (Layer 6)

B1-6

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Enham-Underground-Extension-project-ArcGIS\Modelling\Bottom_Elevation_Interburden_2_Layer_7.mxd



0 2
km

Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

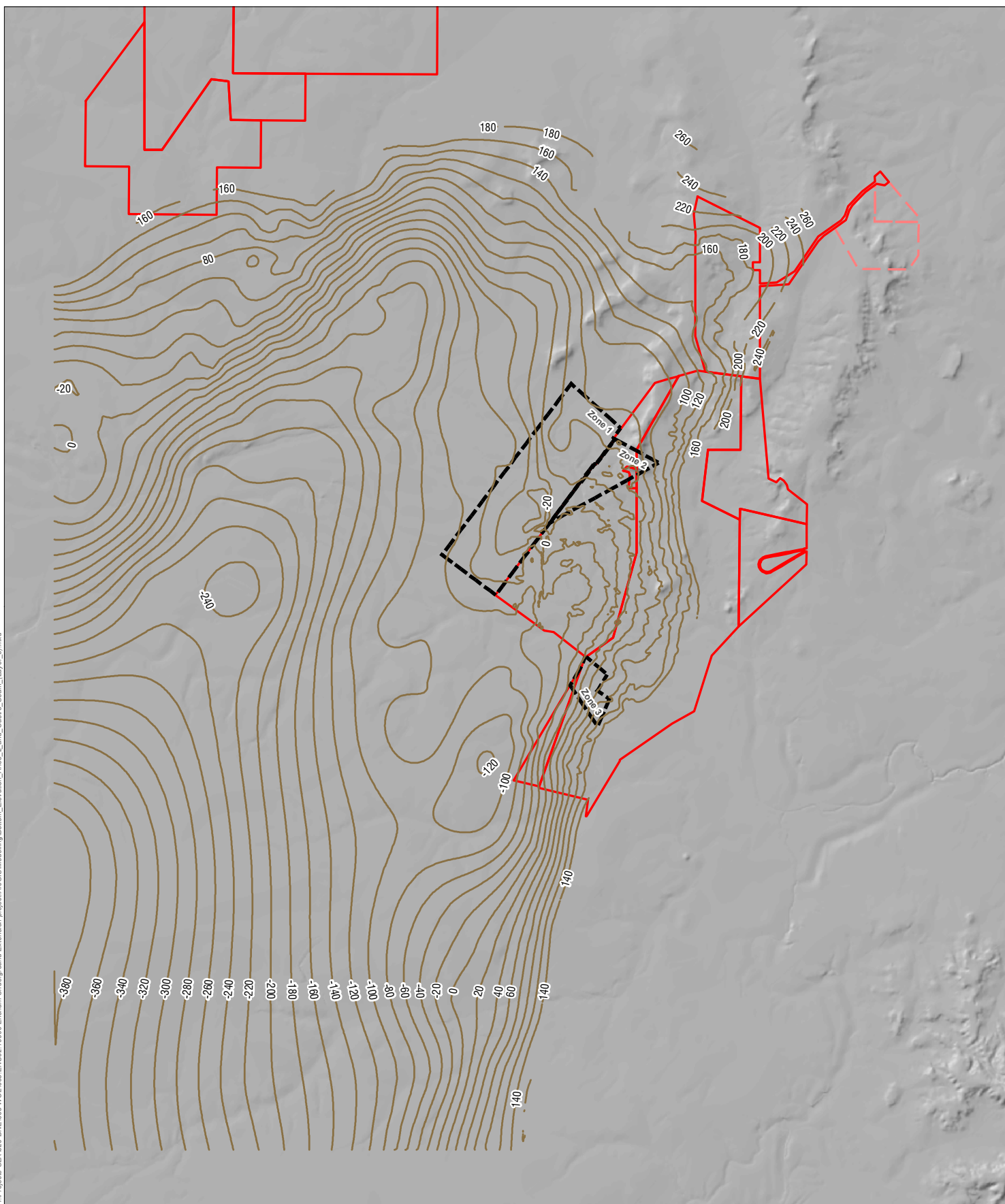
— Elevation Contours (mAHd)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Interburden 2 (Layer 7)

B1-7

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Ensham-Underground-Extension-project-ArcGIS\Modelling\Bottom_Elevation_Aries_2_and_Castro_Seam_Layer_8.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

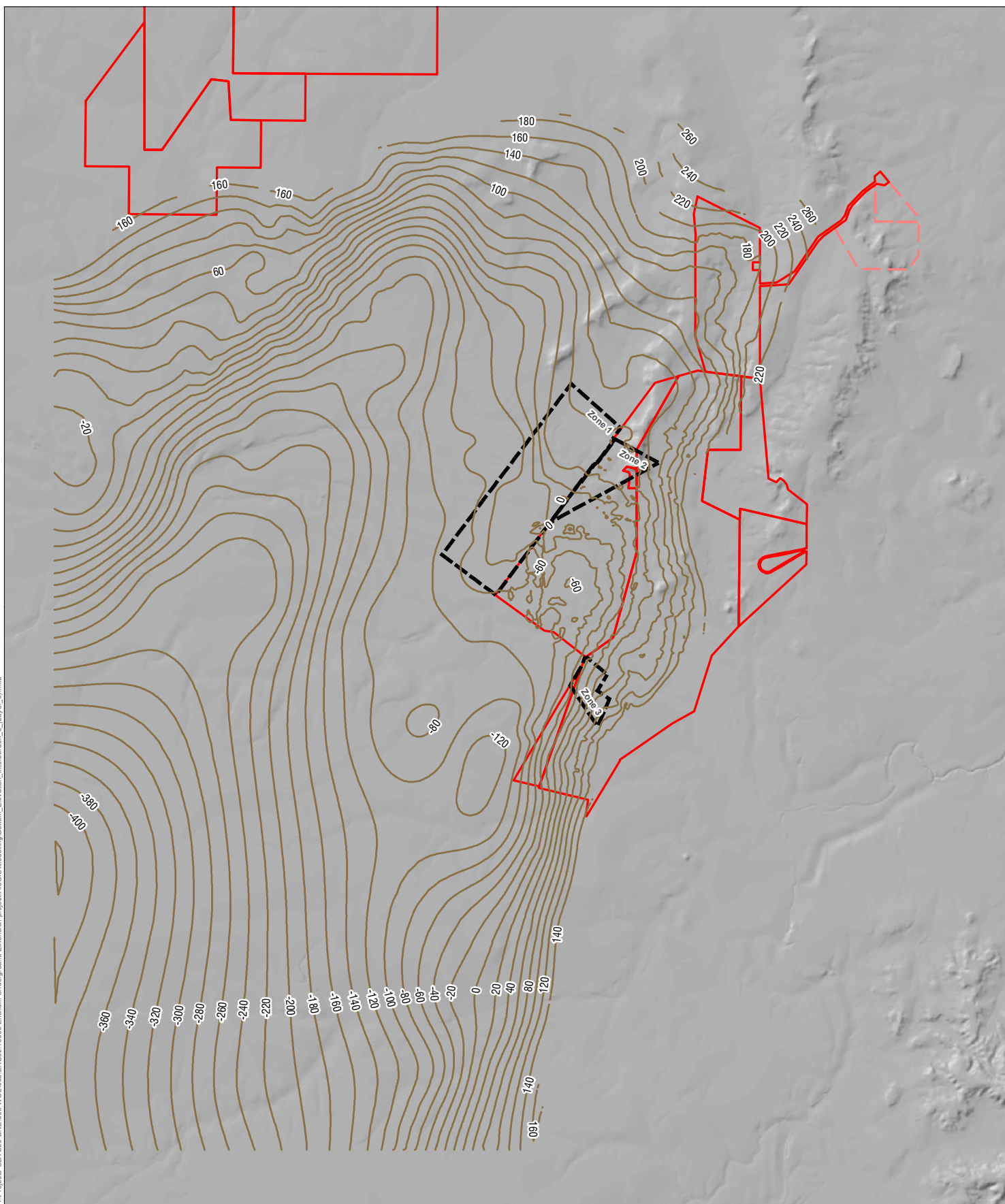
- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

— Elevation Contours (mAHAD)

GROUNDWATER IMPACT ASSESSMENT Bottom Elevation Aries 2 and Castro Seam (Layer 8)

B1-8

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Ensham-Underground-Extension-project-ArcGIS\Modelling\Bottom_Elevation_Interburden_3_(Layer_9).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▬ Mining Lease (Granted)
- - - Mining Lease (Application)
- Project Area

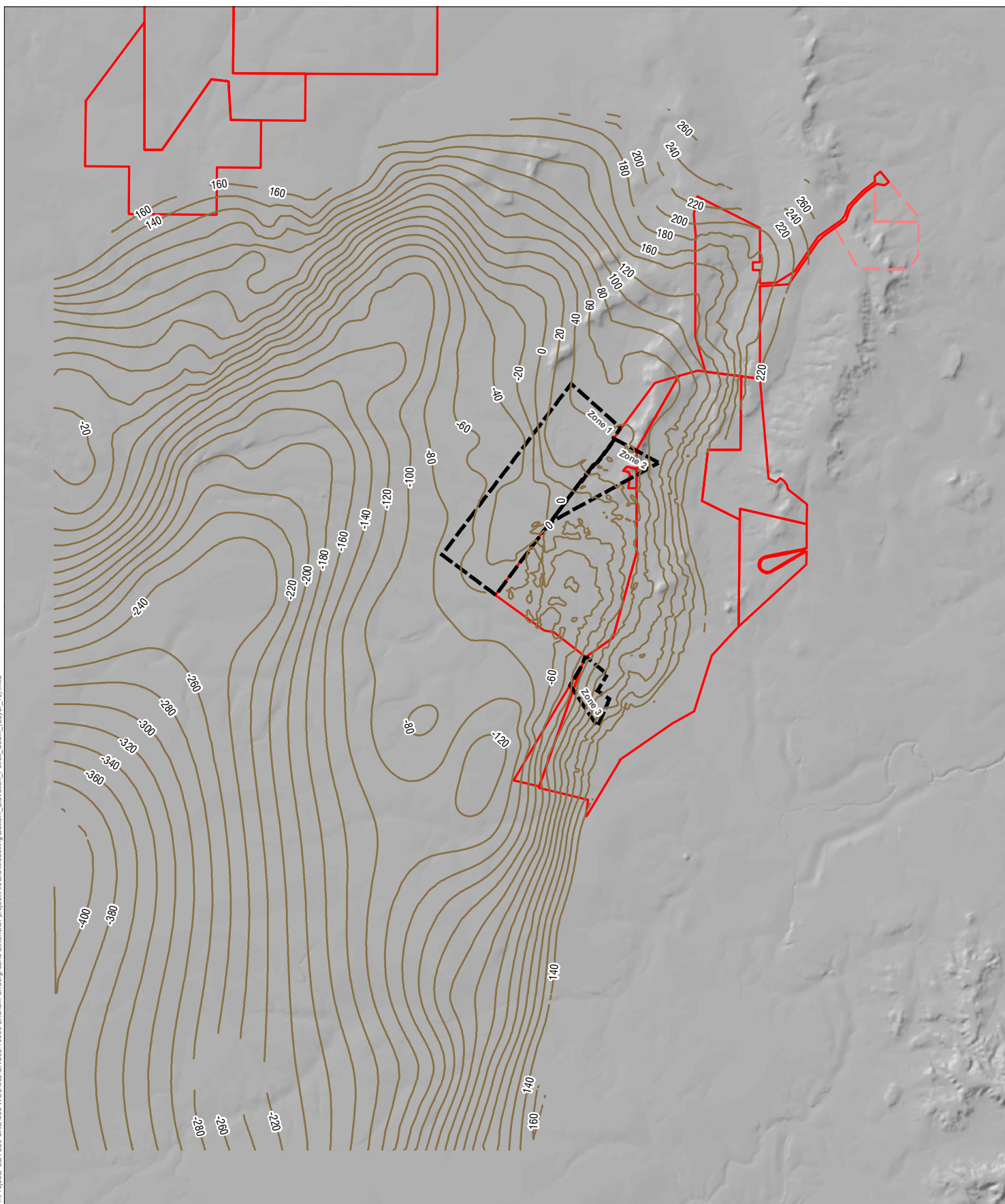
— Elevation Contours (mAHd)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Interburden 3 (Layer 9)

B1-9

H:\Projects-SLR\620-6NE\665-WOL\665-ENS02-10000-Enham-Underground-Extension-project-ArcGIS\Modelling\Bottom_Elevation_Pollux_Seam_(Layer_10).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

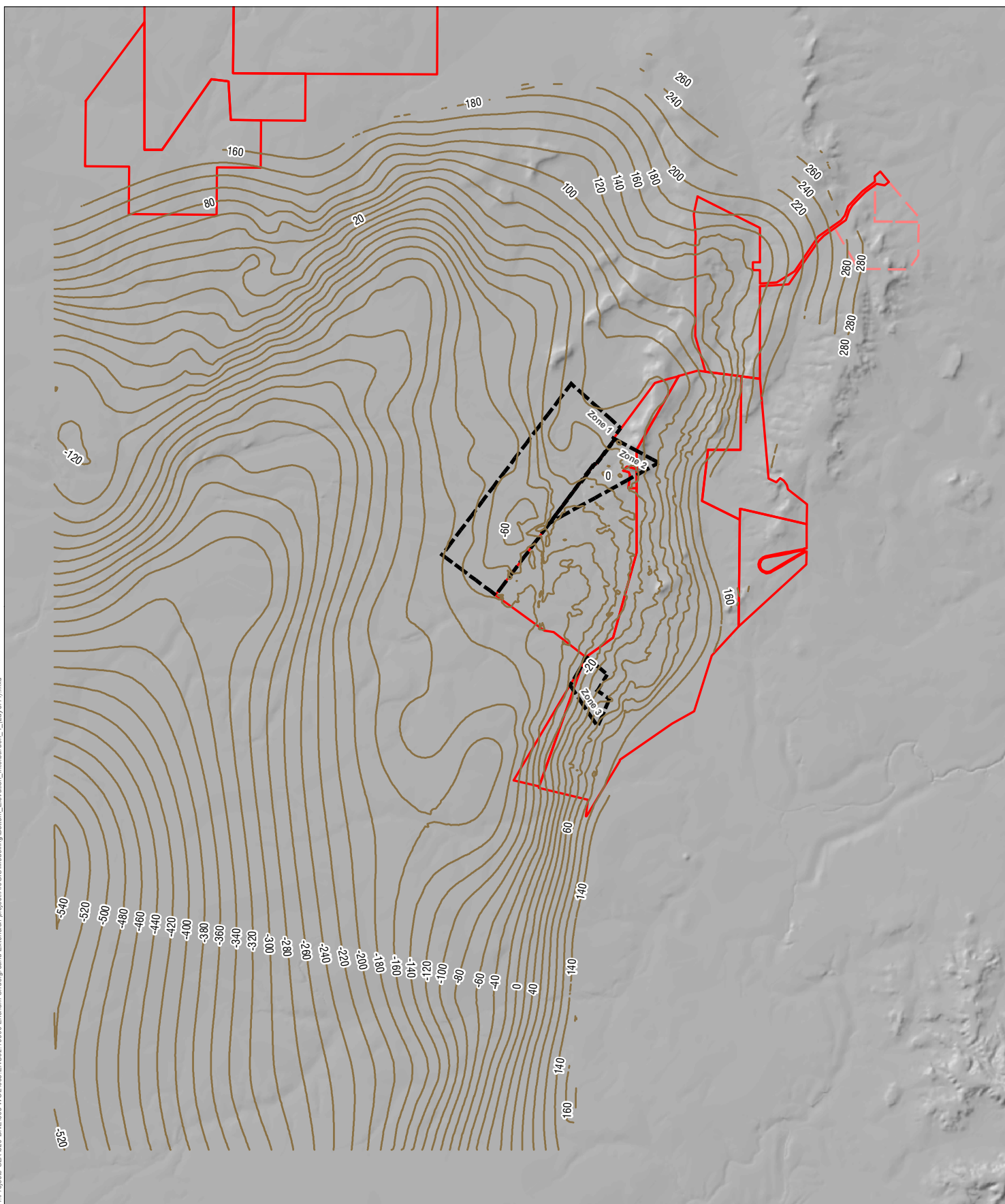
— Elevation Contours (mAHd)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Pollux Seam (Layer 10)

B1-10

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Ensham-Underground-Extension-Project-ArcGIS\Modelling\Bottom-Elevation-Interburden_4_(Layer11).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

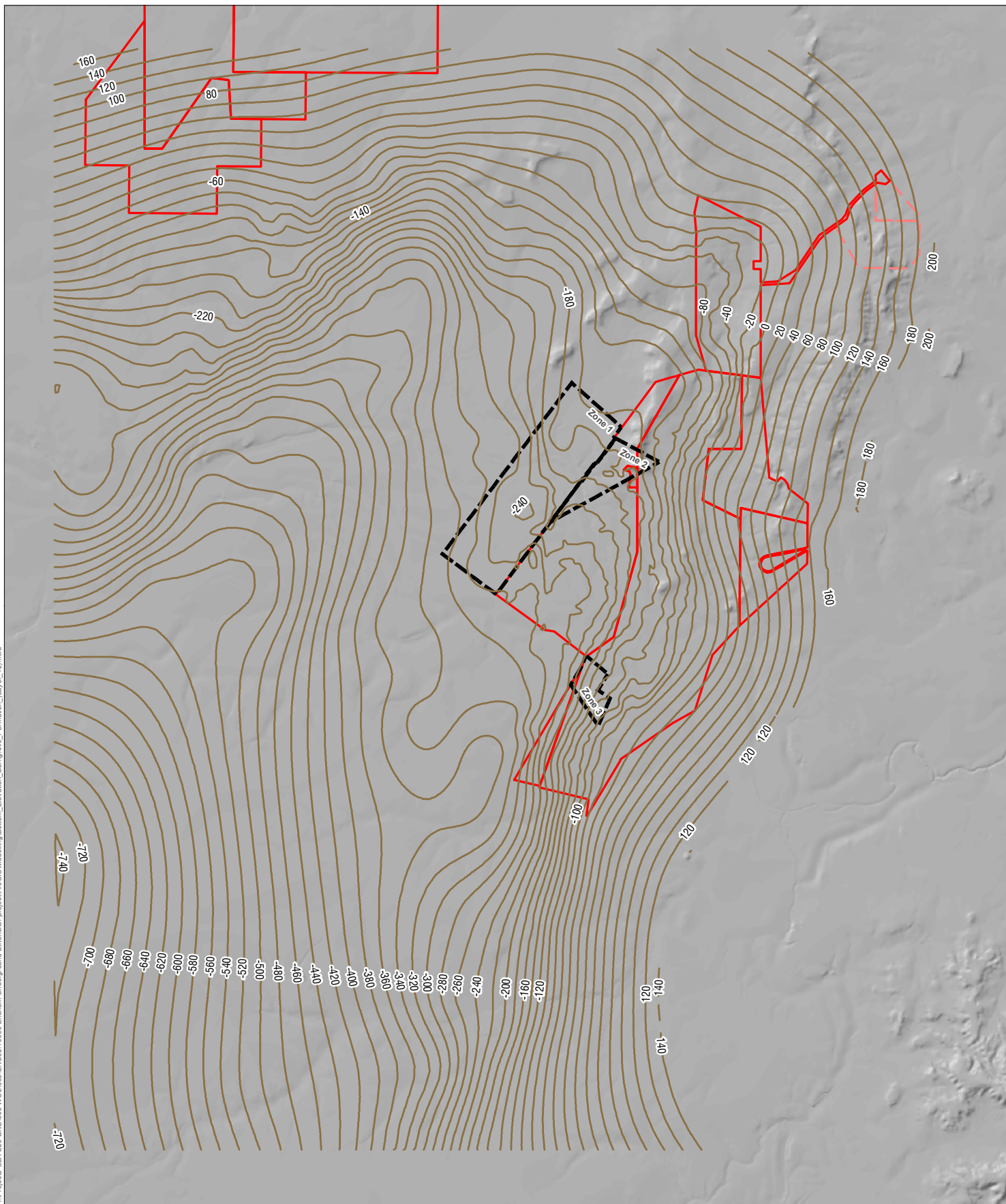
Elevation Contours (mAHd)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Interburden 4 (Layer11)

B1-11

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Ensham-Underground-Extension-project-ArcGIS\Modelling\Bottom_Elevation_Burngrove_Formation_(Layer_12).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

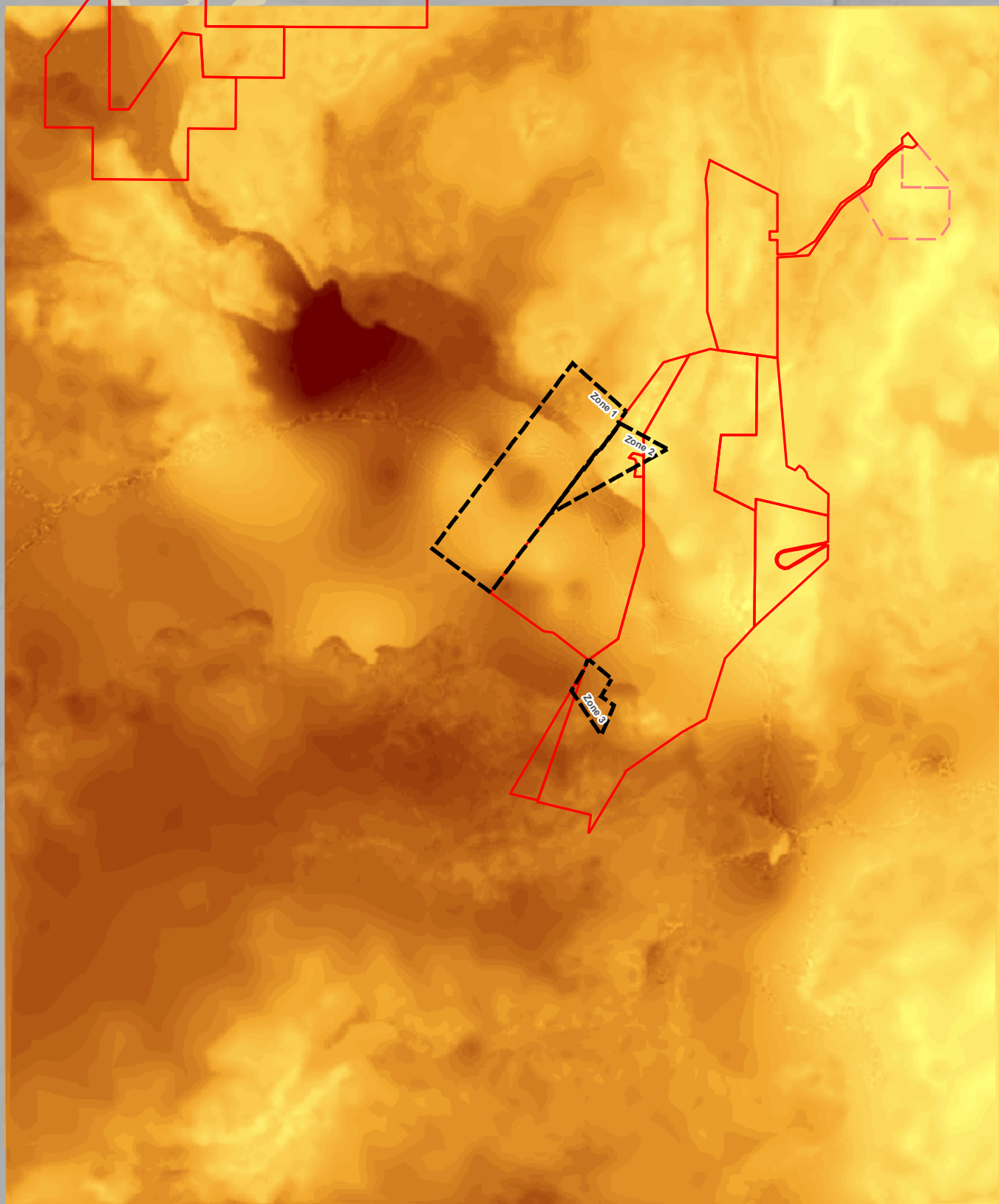
— Elevation Contours (mAHD)

GROUNDWATER IMPACT ASSESSMENT

Bottom Elevation Burngrove Formation (Layer 12)

B1-12

H:\Projects-SLR\620-ENE665-VOL066-ENS02-10000-Ennham-Underground-Extension-project-ArcGIS\Modelling\Isopach_Unconsolidated_Layer_1_and_Layer_20.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 07-Feb-2020

Drawn by: PM

Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

Value

High : 46
Low : 1

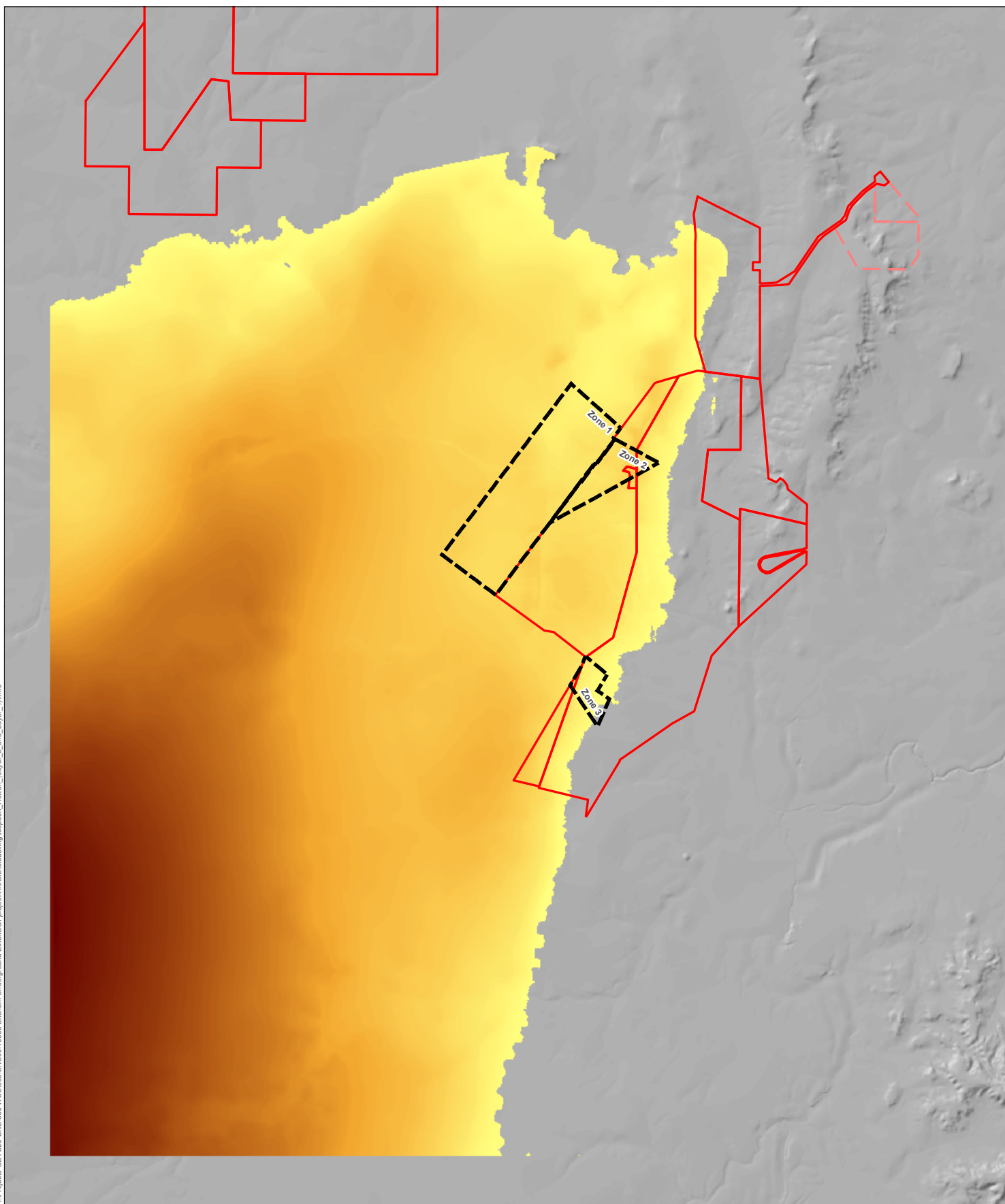
 Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Isopach - Unconsolidated (Layer 1 and Layer 2)

B2-1

H:\Projects-SLR\620-ENE\665-VOL\665_ENS02_10000_Ernam Underground Extension project\ArcGIS\Modelling\Isopach_Rewan_(Layer_3_and_Layer_4).msd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 07-Feb-2020

Drawn by: PM

Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

Value

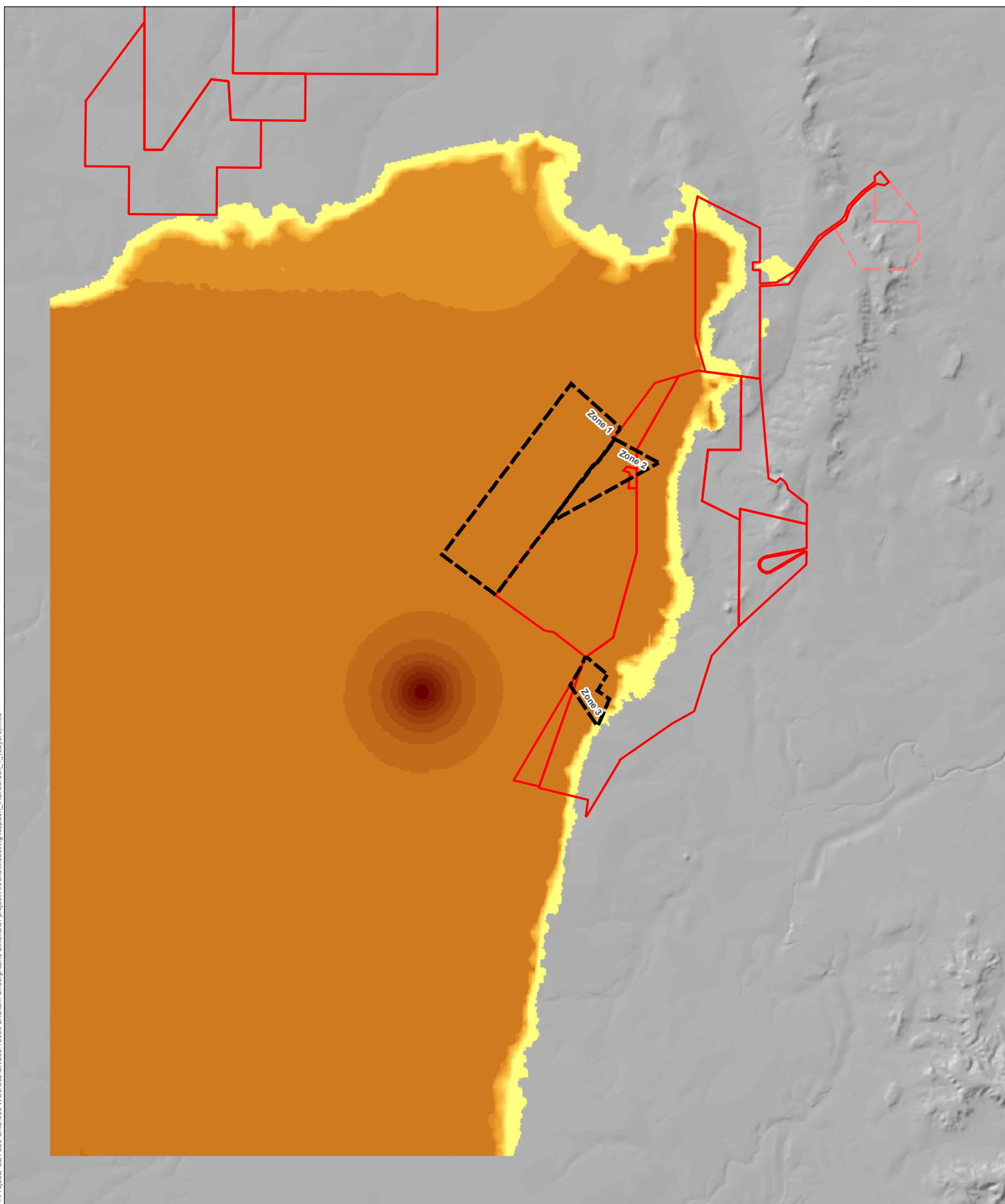
High : 518
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Rewan (Layer 3 and Layer 4)

B2-2

H:\Projects-SLR\620-ENE\665-VOL\665-ENS02-10000-Ensham-Underground-Extension-Isopach-ArcGIS\Modelling\Isopach_Interburden_1_(Layer5).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

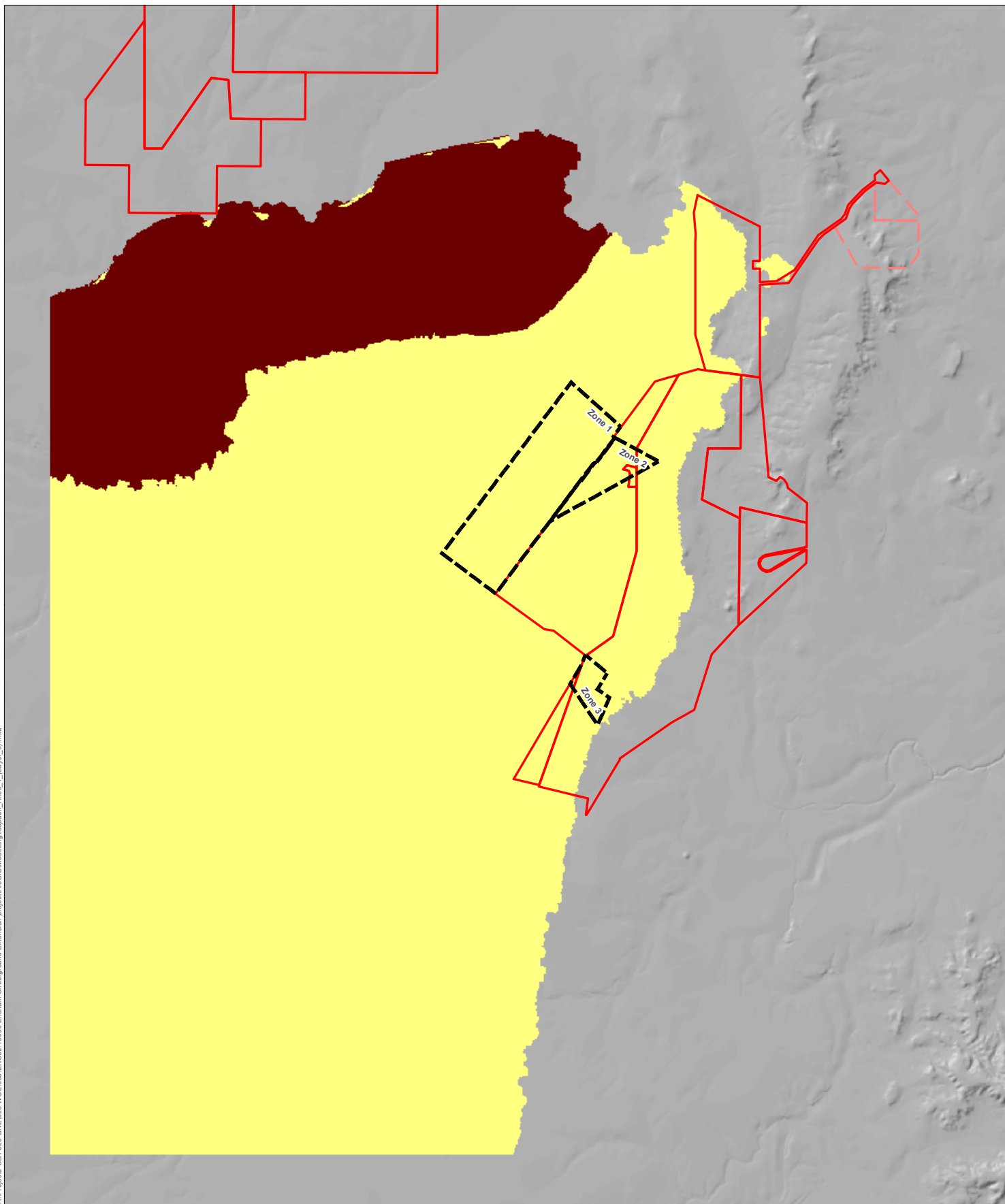
Value
High : 37
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Interburden 1 (Layer5)

B2-3

H:\Projects-SLR\620-ENE\665-VOL\665-ENS02-10000-Enham-Underground-Extension-project\ArcGIS\Modelling\Isopach_Aries_T_(Layer_6).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

Value

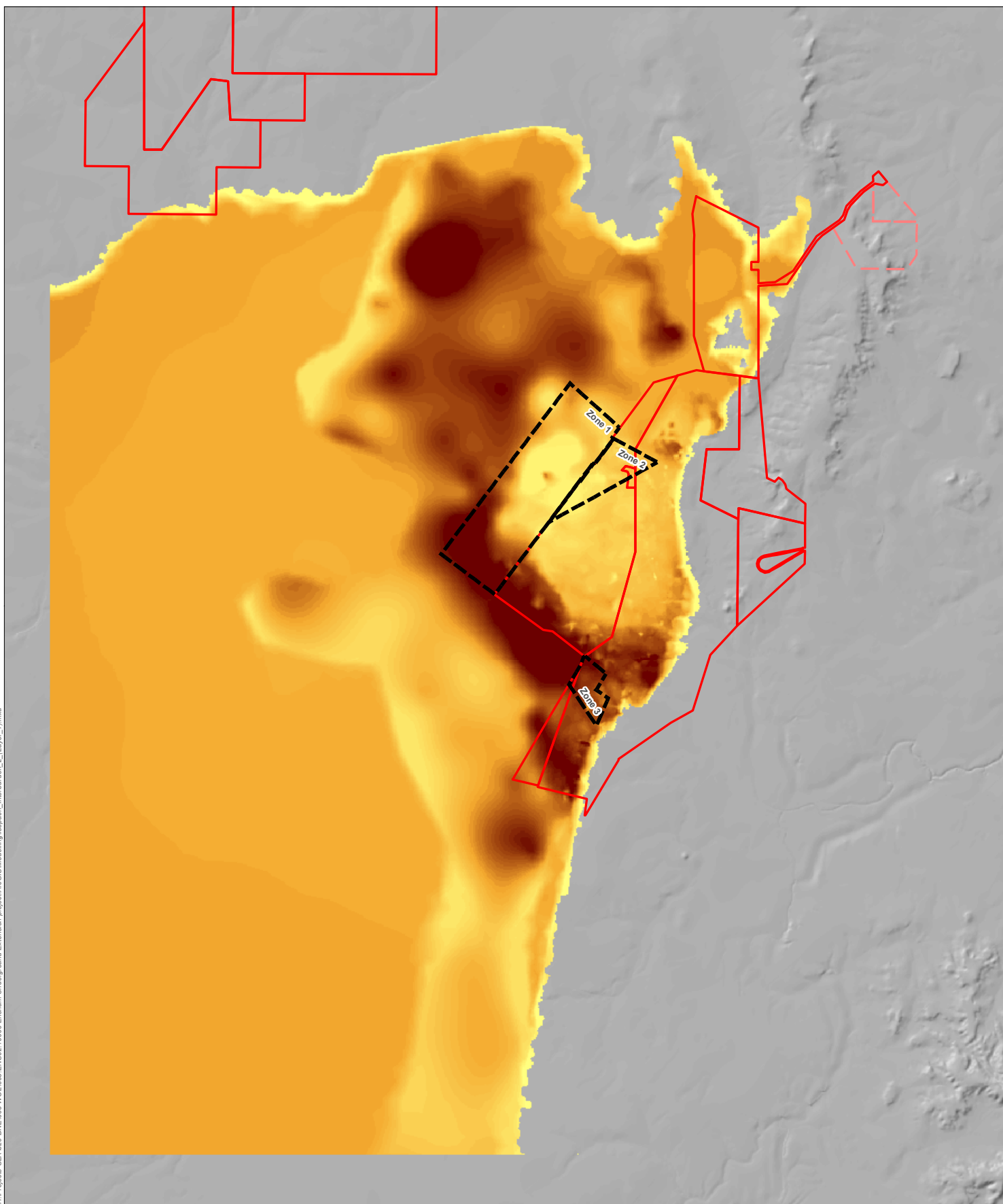
High : 1
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Aries 1 (Layer 6)

B2-4

H:\Projects-SLR\620-ENE\665-VOL\665_ENS02_10000_Eneham_Underground_Extension_project\ArcGIS\Modelling\Isopach_Interburden_2_Layer_7.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

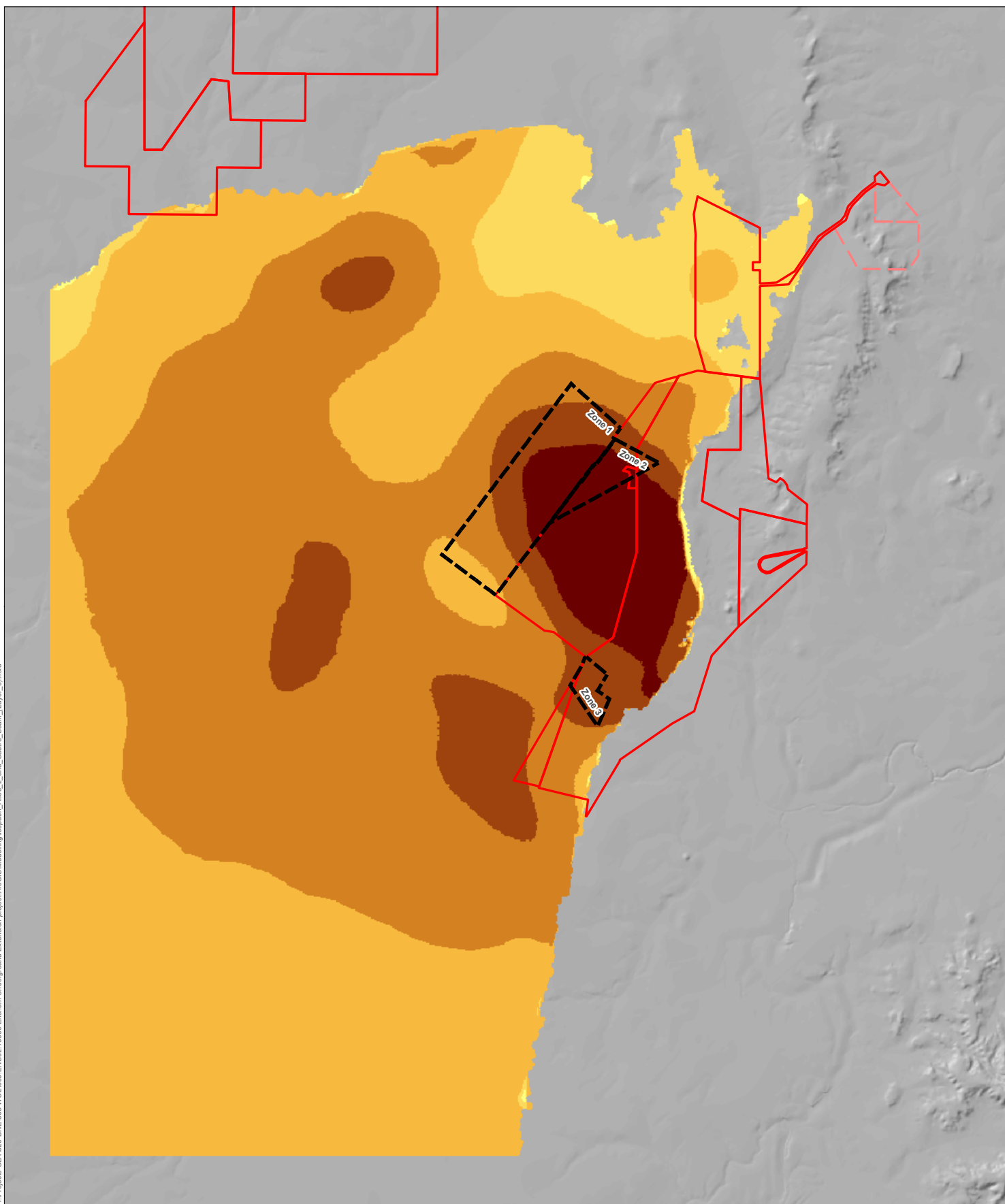
Value
High : 48
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Interburden 2 (Layer 7)

B2-5

H:\Projects-SLR\620-6NE\665-VOL\665 ENS02.10000 Ensham Underground Extension project\ArcGIS\Modelling\Isopach_Aries_2_and_Castro_Seam_(Layer_8).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Value

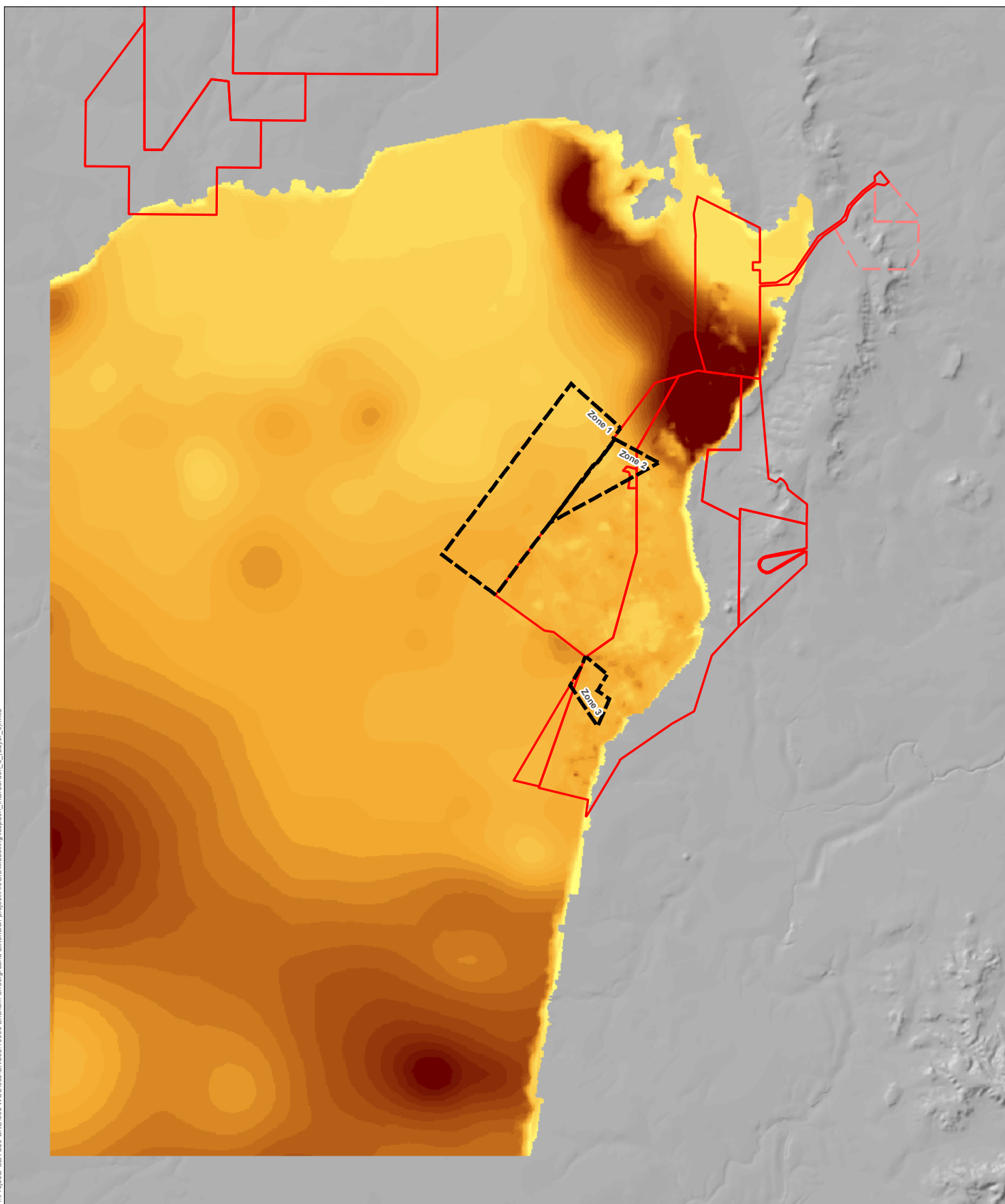
High : 5
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Aries 2 and Castro Seam (Layer 8)

B2-6

H:\Projects-SLR\620-ENE\665-VOL\665-ENS02-10000-Ennham-Underground-Extension-project\ArcGIS\Modelling\Isopach-Interburden_3_Layer_9.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

Value

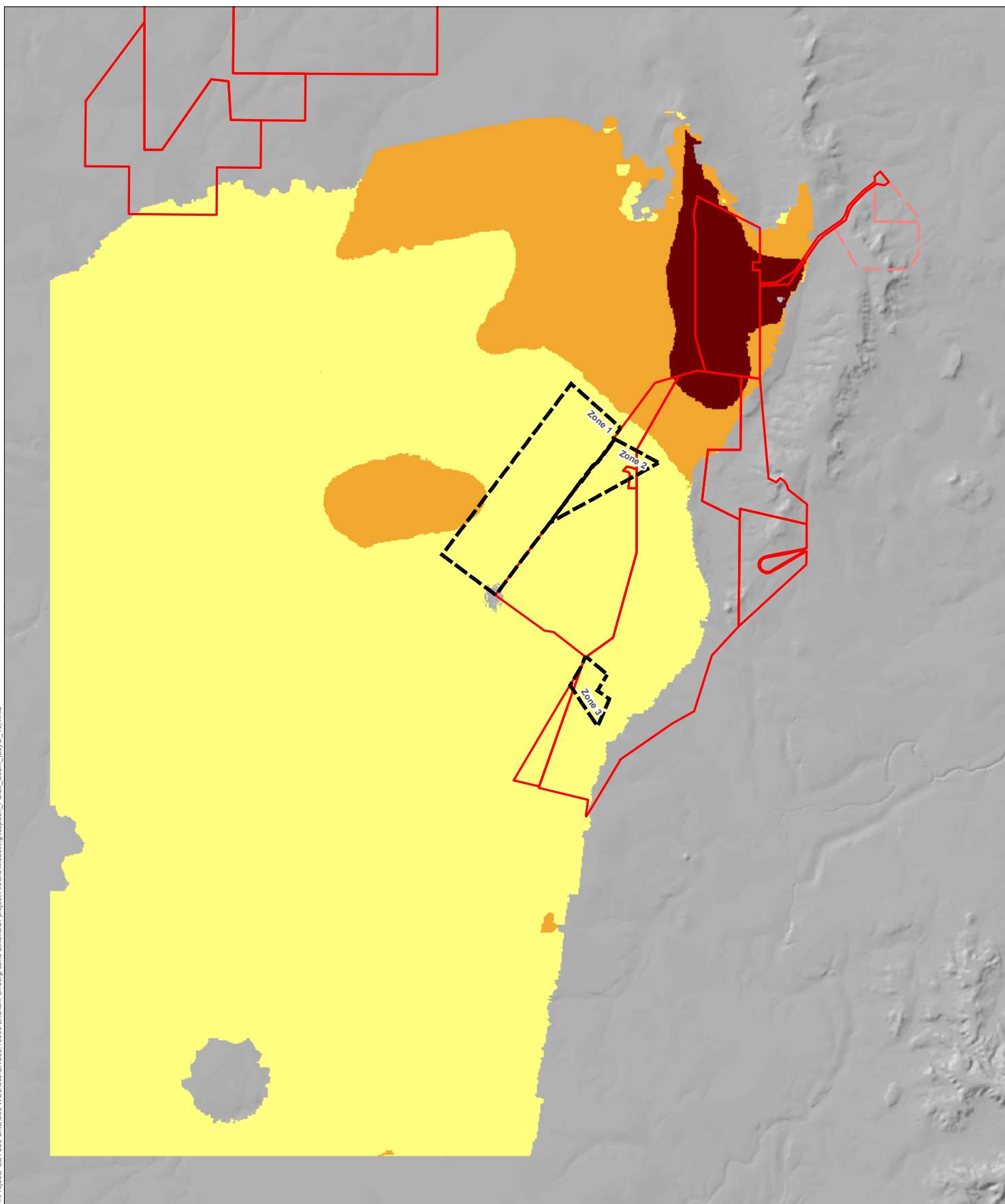
High : 32
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Interburden 3 (Layer 9)

B2-7

H:\Projects-SLR\620-6NE665-VOL1\665-ENS02-10000-Ensham-Underground-Extension-project\ArcGIS\Modelling\Isopach_Pollux_Seam_Layer_10.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Value

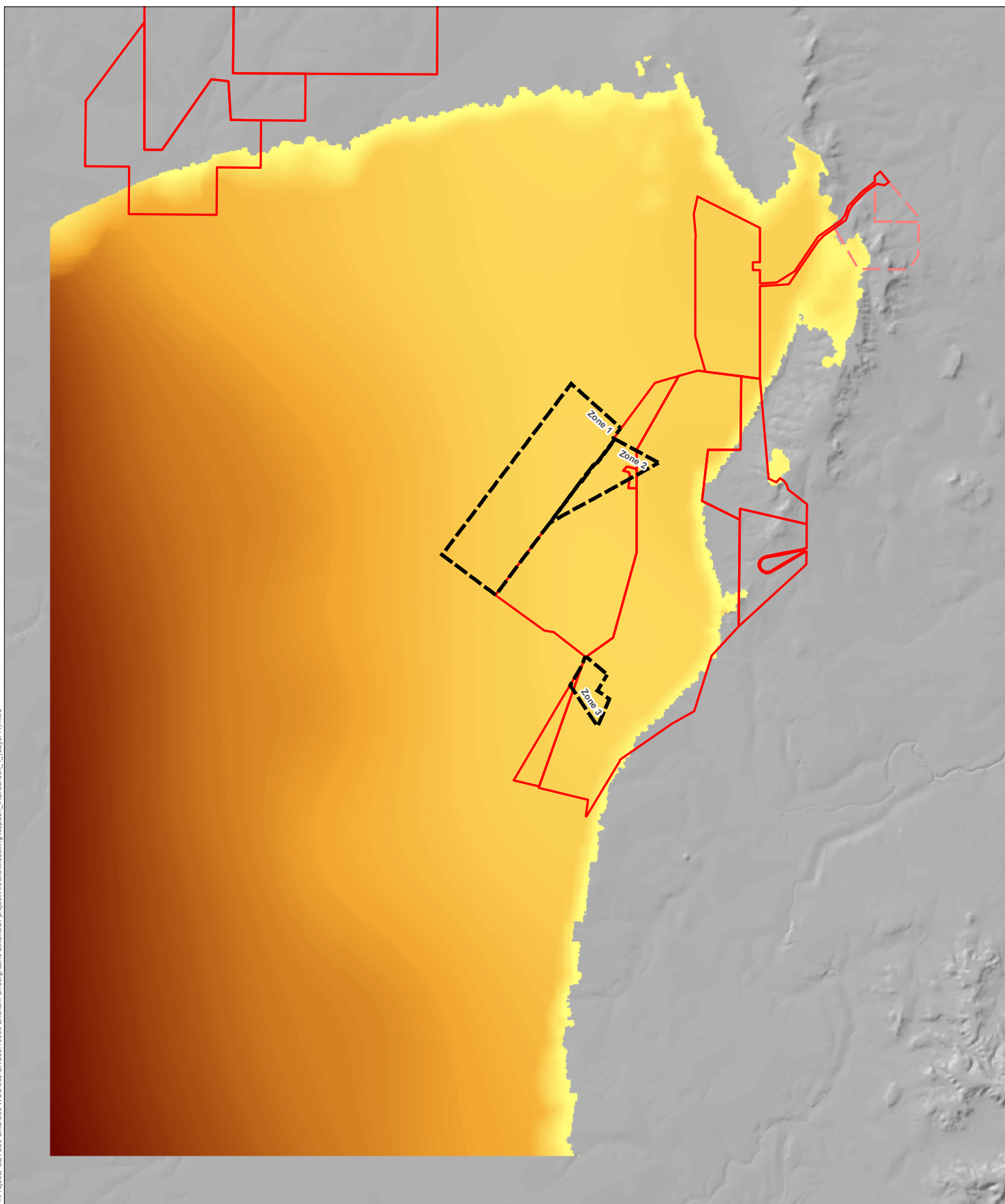
High : 2
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Pollux Seam (Layer 10)

B2-8

H:\Projects-SLR\620-6NE665-VOL665-ENS02-10000-Ensham-Underground-Extension-Isopach-Interburden_4_(Layer11).mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 07-Feb-2020

Drawn by: PM

Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Value

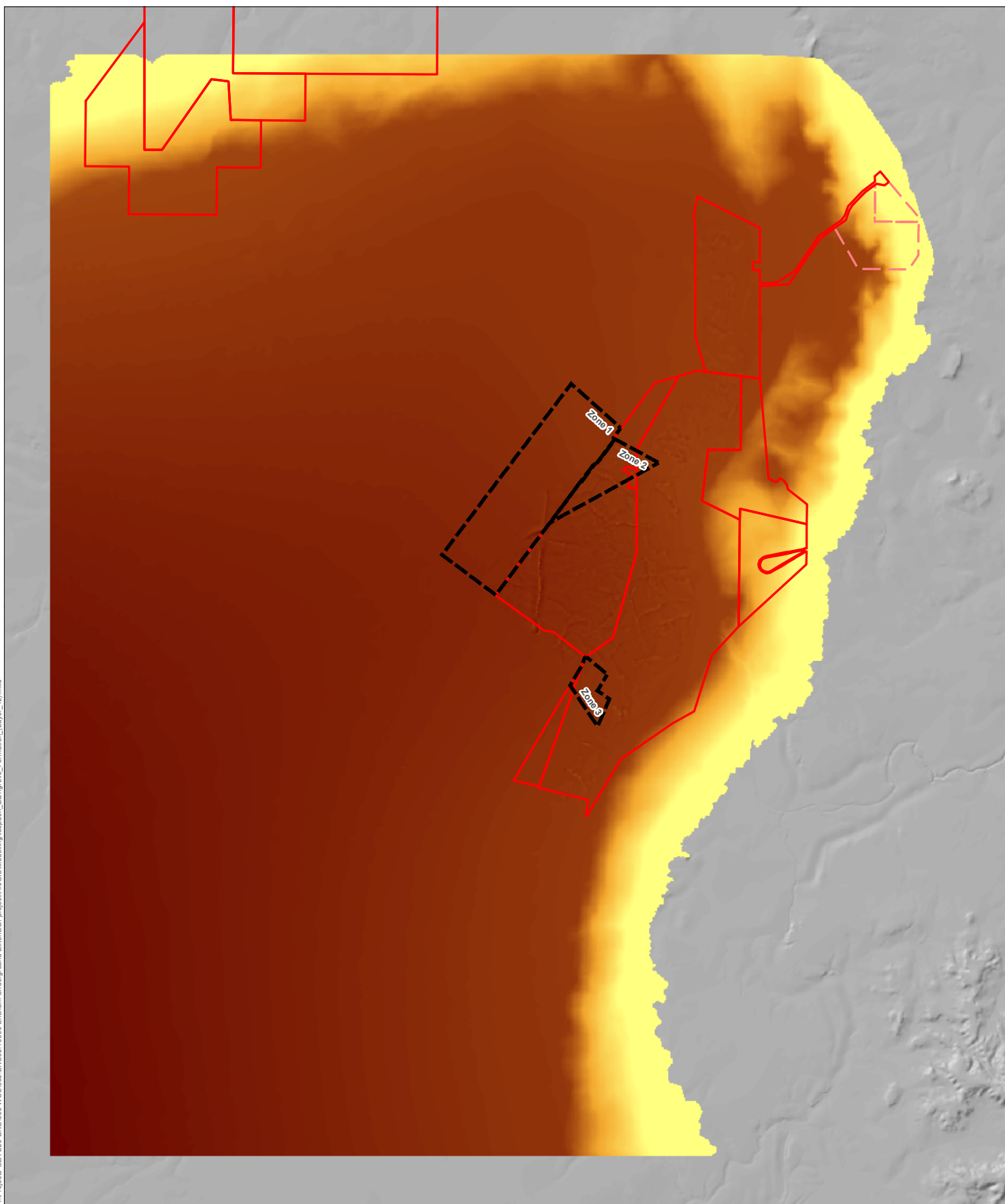
High : 132
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Interburden 4 (Layer11)

B2-9

H:\Projects-SLR\620-6NE\665-WOL\665-ENS02-10000-Ensham-Underground-Extension-project-ArcGIS\Modelling\Isopach_Burngrove_Formation_Layer_12.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 07-Feb-2020

Drawn by: PM

Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Value

High : 197
Low : 0

GROUNDWATER IMPACT ASSESSMENT

Isopach - Burngrove Formation (Layer 12)

B2-10

APPENDIX C

Summary statistic of EA water quality parameters

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
13020177	Max	0.02	0.001	0.027	645	61	10	1240	5540	5.66	123	1.00E-04	0.002	8.31	2	0.01	0.001	897	477	3150
	Mean - 3stddev	-0.004017	6.14E-05	-0.007006	230.371527	13.33419	-6.494085	235.0777	1291.637625	-3.862653	23.04022114	-5.18E-06	-0.000326315	6.370593	-0.042118	0.000614	-5.18E-05	276.0371	-137.5028	734.8894
	Mean + 3stddev	0.02219885	0.001575	0.036006	816.128473	74.54081	10.306585	1674.047	6995.862375	4.971403	155.3347789	0.000155	0.002780861	9.200657	2.442118	0.01575	0.001552	1156.463	421.1278	3932.111
	Median	0.01	0.001	0.0155	529.5	43	1	1050	4280	0.05	88.5	7.50E-05	0.001	7.915	1	0.01	0.00075	763	127.5	2465
	Min	0.005	5.00E-04	0.001	327	27	0.5	514	2400	0.025	52	5.00E-05	5.00E-04	6.31	1	0.005	5.00E-04	429	63	1320
	N	11	11	10	16	16	16	16	16	16	16	16	8	11	15	11	8	16	16	16
	Outlier_count	1	0	0	0	0	5	0	0	0	3	0	0	0	1	3	0	0	1	0
	Percentile_05	0.005	5.00E-04	0.00505	366	30	0.5	541	2685	0.025	57.25	5.00E-05	0.00075	7.045	1	0.005	5.00E-04	482.25	75.75	1537.5
	Percentile_20	0.005	5.00E-04	0.01	449	37	1	723	3400	0.025	72	5.00E-05	0.001	7.67	1	0.005	5.00E-04	567	97	1780
	Percentile_80	0.01	0.001	0.0186	607	53	1	1150	4880	0.15	112	1.00E-04	0.002	8.14	1.2	0.01	0.001	831	147	2800
	Percentile_95	0.015	0.001	0.0243	642.75	59.5	8.5	1217.5	5420	3.14	121.5	1.00E-04	0.002	8.205	2	0.01	0.001	886.5	231.75	3037.5
	Max	0.005	5.00E-04	0.003	734	112	0.5	1260	5620	0.025	219	5.00E-05	0.003	7.88	13	0.005	5.00E-04	745	167	3180
Conmurra Bore	Mean - 3stddev	0.005	5.00E-04	-0.001224	567.805941	52.59458	0.5	887.8572	3481.88754	0.025	84.34839104	5.00E-05	-0.001224038	7.360678	6.7502809	0.005	5.00E-04	476.1647	36.975	2632.321
	Mean + 3stddev	0.005	5.00E-04	0.004624	810.194059	133.8054	0.5	1448.143	6274.11246	0.025	269.251609	5.00E-05	0.004624038	8.103322	15.649719	0.005	5.00E-04	891.8353	217.025	3523.679
	Median	0.005	5.00E-04	0.002	666	90	0.5	1200	4840	0.025	161	5.00E-05	0.002	7.67	11	0.005	5.00E-04	728	118	3150
	Min	0.005	5.00E-04	5.00E-04	648	76	0.5	1020	4350	0.025	152	5.00E-05	5.00E-04	7.61	9	0.005	5.00E-04	605	91	2830
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Outlier_count	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1
	Percentile_05	0.005	5.00E-04	6.00E-04	651.6	78.4	0.5	1044	4418	0.025	152	5.00E-05	6.00E-04	7.618	9.4	0.005	5.00E-04	606.4	95.2	2874
	Percentile_20	0.005	5.00E-04	9.00E-04	662.4	85.6	0.5	1116	4622	0.025	152	5.00E-05	9.00E-04	7.642	10.6	0.005	5.00E-04	610.6	107.8	3006
	Percentile_80	0.005	5.00E-04	0.0022	731.6	102.4	0.5	1228	5036	0.025	203.8	5.00E-05	0.0022	7.856	12.2	0.005	5.00E-04	733	151	3180
	Percentile_95	0.005	5.00E-04	0.0028	733.4	109.6	0.5	1252	5474	0.025	215.2	5.00E-05	0.0028	7.874	12.8	0.005	5.00E-04	742	163	3180
	Max	0.5	0.005	0.05	1750	1270	21	15300	47700	3.5	1610	1.00E-04	0.01	8.33	13	0.1	0.0025	7700	1320	30600
	Mean - 3stddev	-0.2555533	-0.002033	-0.021841	-22.108049	-325.9595	-9.512081	-764.1344	-1245.739334	-1.777972	-351.156394	-1.95E-05	0.000500271	6.228426	-4.5142132	-0.046424	-0.000863	94.51033	-16.18382	-2358.34
Mean + 3stddev	0.30448182	0.0036047	0.033721	2181.73963	1106.275	12.414784	18237.92	53238.89723	2.656305	1865.156394	0.000124	0.011192037	8.757364	12.189889	0.067535	0.002342	8978.332	1747.763	36683.94	
EC01	Median	0.005	5.00E-04	0.004	1030	276.5	0.5	8155	22950	0.13	631.5	5.00E-05	0.006	7.53	2	0.005	5.00E-04	4225	793	14100
	Min	0.0025	0.00025	0.002	303	178	0.15	2850	9130	0.01	231	2.50E-05	0.003	6.39	1	0.0025	0.00025	1450	292	6270
	N	28	28	27	38	38	37	38	38	38	38	25	28	38	37	27	24	38	38	35
	Outlier_count	3	2	7	0	1	2	0	0	3	0	10	5	0	2	3	2	0	0	0
	Percentile_05	0.0025	0.00025	0.0021	499.6	193.85	0.25	4845	16960	0.025	368.45	2.50E-05	0.00325	6.7285	2	0.0025	0.00025	2905	532	10170
	Percentile_20	0.0035	0.00035	0.004	825	222.4	0.5	5872	18540	0.06	466.8	2.50E-05	0.004	7.2	2	0.003	5.00E-04	3380	613.6	12000
	Percentile_80	0.01	0.001	0.004	1487.4	539	1	12500	34280	0.65	1132	5.00E-05	0.006	7.892	5.8	0.01	0.001	5956	1203.6	24260
	Percentile_95	0.02325	0.001975	0.0078	1721.5	778.55	2.8	13035	43485	1.97	1374.5	1.00E-04	0.00975	8.042	9.6	0.0285	0.00185	6835	1246.2	28090.8
	Max	0.23	0.001	0.012	1310	113	10	3150	12900	4.13	256	1.00E-04	0.002	8.22	9	0.01	0.001	2063	291	13200
	Mean - 3stddev	-0.1727592	6.14E-05	-0.001502	144.252866	26.60202	-5.217335	63.14535	461.845175	-2.60381	20.58083663	-5.18E-06	0.000166667	6.432113	-2.3980322	0.000614	-5.18E-05	216.4716	30.9515	-2390.369
	Mean + 3stddev	0.22912279	0.001575	0.018252	1491.98243	141.2803	8.2479227	4166.384	15894.62541	3.32381	331.5368104	0.000155	0.003166667	8.580828	8.045091	0.01575	0.001552	2602.47	367.4014	12740.96
	EC02	Median	0.01	0.001	0.009	870	87	1	2210	8530	0.05	187	7.50E-05	0.002	7.39	2	0.01	0.00075	1510	200
Min		0.005	5.00E-04	0.004	476	49	0.5	935	3850	0.025	82	5.00E-05	0.001	6.88	1	0.005	5.00E-04	682	114	2110
N		11	11	10	17	17	17	17	17	17	17	8	11	17	17	11	8	17	17	17
Outlier_count		1	0	0	1	0	6	0	6	4	0	0	0	1	1	0	0	5	0	4
Percentile_05		0.005	5.00E-04	0.00435	501.6	53	0													

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EA Trigger Level	5	0.005	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
EC03	Max	0.35	0.001	0.014	1440	1180	10	11000	35300	13.8	1400	1.00E-04	0.016	8.27	21	0.08	0.003	3640	1150	27800
	Mean - 3stddev	-0.1801182	-0.000283	-0.003156	-212.060028	-345.5734	-4.028045	-481.3061	436.6562323	-8.378224	-381.550989	-2.39E-05	-0.007431289	5.880265	-7.130728	-0.036362	-0.001115	813.6508	-87.13724	-4158.852
	Mean + 3stddev	0.21771082	0.0014121	0.011822	1988.2365	1576.456	5.8095158	13616.72	38785.10847	15.3697	1808.198048	0.000126	0.021671289	8.708558	24.071905	0.053862	0.002355	4670.29	1401.02	32418.49
	Median	0.005	5.00E-04	0.004	835	562	0.5	6680	19000	1.435	681.5	5.00E-05	0.008	7.38	7.5	0.005	5.00E-04	2860	647.5	12700
	Min	0.0025	0.00025	0.003	129	173	0.035	2550	8090	0.025	239	2.50E-05	0.001	6.27	2	0.0025	0.00025	1040	218	5160
	N	29	29	28	36	36	36	36	34	36	36	26	29	36	36	28	25	36	36	33
	Outlier_count	2	0	2	0	0	1	0	0	4	0	4	0	0	0	1	5	3	0	0
	Percentile_05	0.0025	0.00025	0.003	330.9	233.95	0.25	3393	11415	0.1865	269.15	2.50E-05	0.001	6.397	3	0.0025	0.00025	1328.5	275.9	6184
	Percentile_20	0.0025	0.00025	0.003	531.8	311.2	0.25	4272	14260	0.796	340.8	2.50E-05	0.002	6.87	3	0.0025	0.00025	2366	429.2	9258
	Percentile_80	0.01	0.001	0.004	1248	971.8	1	8946	25452	5.446	1104	5.00E-05	0.0112	7.654	13.4	0.01	0.0008	3172	895.6	20960
	Percentile_95	0.017	0.001	0.00925	1371	1147	1	10370	30097.5	12.315	1340.5	1.00E-04	0.0146	7.8205	16.35	0.0175	0.001	3623.5	1077	25260
	Max	0.01	0.001	0.004	1130	210	10	1030	4390	2.58	187	1.00E-04	0.002	7.78	9	0.01	0.001	594	118	2810
EC04	Mean - 3stddev	0.00061394	6.14E-05	-0.001008	-9.39382462	36.24697	-5.32742	222.5499	1330.539004	-1.566679	28.98932192	-5.18E-06	-0.000643168	6.632452	-3.1536764	0.000614	-5.18E-05	157.577	3.875683	588.2306
	Mean + 3stddev	0.01574969	0.001575	0.006341	1447.04088	282.5766	8.0822432	1225.568	5677.69629	3.245429	228.775384	0.000155	0.002643168	8.17696	8.0948529	0.01575	0.001552	720.5407	167.3008	3457.064
	Median	0.01	0.001	0.003	600	177	1	684	3740	0.47	142	7.50E-05	0.001	7.48	2	0.01	0.00075	408	92	2010
	Min	0.005	5.00E-04	0.001	419	87	0.416	311	1860	0.06	70	5.00E-05	5.00E-04	6.92	1	0.005	5.00E-04	216	39	989
	N	11	11	10	17	17	17	17	17	17	17	8	11	17	17	11	8	17	17	17
	Outlier_count	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0
	Percentile_05	0.005	5.00E-04	0.001	444.6	96.6	0.4832	539.8	2452	0.0975	77.2	5.00E-05	5.00E-04	6.968	1	0.005	5.00E-04	328	41.4	1285.8
	Percentile_20	0.005	5.00E-04	0.0016	512.8	112.8	0.5	616	2892	0.21	90.6	5.00E-05	5.00E-04	7.192	1	0.005	5.00E-04	380.4	60.2	1686
	Percentile_80	0.01	0.001	0.004	931.2	194.2	1	861.4	4094	1.4	152	1.00E-04	0.001	7.586	3	0.01	0.001	529.6	110	2358
	Percentile_95	0.01	0.001	0.004	1089.2	206.8	2.8	957.2	4326	2.43	167	1.00E-04	0.002	7.74	4.2	0.01	0.001	558.8	118	2778
	Max	0.25	0.005	0.025	2090	781	10	11400	32800	2.05	1270	1.00E-04	0.008	7.89	17	0.05	0.005	5560	1140	24800
	Mean - 3stddev	-0.183263	-0.002492	-0.015336	-1107.91688	-447.4278	-5.091256	-6513.424	-16596.75228	-1.191012	-654.942838	-5.18E-06	-0.002096999	6.925016	-6.8815227	-0.024115	-0.003004	-2863.516	-562.095	-12233.75
	Mean + 3stddev	0.26780845	0.0053101	0.026836	2678.25022	1293.65	7.8669222	19308.53	54040.86339	1.842777	1834.498394	0.000155	0.010396999	8.189429	24.6593	0.054115	0.006129	9013.96	1770.873	37766.86
EC05	Median	0.01	0.001	0.004	647	501.5	1	8175	23650	0.15	771	7.50E-05	0.0035	7.535	8.5	0.01	0.001	3685	799	16200
	Min	0.005	5.00E-04	0.001	178	12	0.5	212	1240	0.01	12	5.00E-05	0.002	7.21	1	0.005	5.00E-04	220	40	739
	N	11	11	11	18	18	18	18	18	18	18	8	11	18	18	11	8	18	18	18
	Outlier_count	2	4	1	3	0	5	0	0	2	0	0	0	0	0	2	1	0	0	0
	Percentile_05	0.005	5.00E-04	0.001	188.2	14.55	0.5	277.45	1401.5	0.034	16.25	5.00E-05	0.002	7.2355	1.85	0.005	5.00E-04	260.8	60.4	801.05
	Percentile_20	0.01	0.001	0.0022	241.4	38	0.6924	665.4	3128.2	0.05	39.2	5.00E-05	0.0024	7.38	3.4	0.01	7.00E-04	526.8	88.2	1520
	Percentile_80	0.025	0.001	0.0062	1238.4	688	1	10100	28780	0.43	906.8	1.00E-04	0.0054	7.758	14.4	0.02	0.0019	4800	898.4	19120
	Percentile_95	0.18	0.00375	0.0169	1928.5	753.8	2.35	11400	30420	1.178	1057.5	1.00E-04	0.00755	7.8815	17	0.0375	0.004125	5381.5	1080.5	23525
	Max	0.01	0.001	0.015	1286	329	10	1400	4980	6.83	274	1.00E-04	0.002	7.53	22	0.01	0.001	530	111	3720
	Mean - 3stddev	0.00061394	6.14E-05	-0.002379	92.2910493	80.48321	-5.371623	144.073	1742.385179	-3.525078	43.58918626	-5.18E-06	-6.49E-05	6.28969	-4.3043031	0.000614	3.62E-05	107.7995	4.369333	475.2496
	Mean + 3stddev	0.01574969	0.001575	0.019045	1310.76777	403.0462	8.0919756	1669.339	5898.791291	8.896843	298.2931667	0.000155	0.002464911	7.958545	24.539597	0.01575	0.001589	588.0829	137.1601	4328.633
	Median	0.01	0.001	0.008	692	235	1	856	3770	2.53	166	7.50E-05	0.001	7.16	9	0.01	0.001	320	72	2350
	Min	0.005	5.00E-04	0.004	243	140	0.123	332	2160	0.05	90	5.00E-05	0.001	6.6	5	0.005	5.00E-04	191	39	1230
EC06	N	11	11	10	17	17	17	17	17	17	17	8	11	17	17	11	8	17	17	17
	Outlier_count	0	0	1	2	0	1	0	0	0	1	0	2	0	0	0	0	3	0	0
	Percentile_05	0.005	5.00E-04	0.004	495	183.2	0.4246	637.6	3000	0.066	124.4	5.00E-05	0.001	6.704	5.8	0.005	5.00E-04	270.2	41.4	1710
	Percentile_20	0.005	5.00E-04	0.0052	619.6	199.2	0.5	752.8	3298	0.844	142	5.00E-05	0.001	6.896	7	0.005	5.00E-04	304	51	1892
	Percentile_80	0.01	0.001	0.0102	758.4	292.8	1	1078	4432	4.56	203.4	1.00E-04	0.0012	7.336	12.8	0.01	0.001	401.8	87.2	2655.6
	Percentile_95	0.01	0.001	0.0138	956.4	322.6	2.8	1328	4644	5.75	235.6	1.00E-04	0.002	7.522	20.4	0.01	0.001	499.6	110.2	3496

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EA Trigger Level	5	0.005	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
EC07	Max	0.13	0.001	0.024	1570	1620	10	13000	31800	47.8	1400	1.00E-04	0.004	7.97	24	0.01	0.001	5270	1170	20100
	Mean - 3stddev	-0.0585267	-0.000246	-0.001317	-622.822172	-863.4819	-3.858898	-5955.986	-14564.0073	-29.45154	-660.969088	-1.96E-05	-0.001195088	6.145628	-3.9348414	-0.002577	-0.000209	-2019.957	-504.9718	-10337.56
	Mean + 3stddev	0.07902672	0.0013628	0.035032	1796.38974	2335.914	5.5790064	17819.93	48596.43974	59.50398	1817.455575	0.000121	0.003995088	8.174372	19.340247	0.013784	0.001228	6496.227	1433.783	31634.11
	Median	0.005	5.00E-04	0.0185	468	874	0.5	7520	21500	8.76	599	5.00E-05	0.001	7.14	8	0.005	5.00E-04	2280	502	13100
	Min	0.0025	0.00025	5.00E-04	162	37	0.072	351	1620	0.05	28	2.50E-05	5.00E-04	6.25	2	0.0025	0.00025	224	22	940
	N	30	30	29	37	37	37	37	37	37	37	27	30	37	37	29	26	37	37	36
	Outlier_count	2	14	2	1	0	1	0	0	0	0	4	1	2	1	14	4	0	0	0
	Percentile_05	0.0025	0.00025	0.003475	171	51	0.25	459.6	1966	0.14	35.8	2.50E-05	5.00E-04	6.636	3	0.0025	0.00025	286.4	28	969.75
	Percentile_20	0.0025	0.00025	0.013	239.2	148.6	0.3	1984	6502	1.952	132.4	2.50E-05	9.00E-04	6.95	4	0.0025	0.00025	895.8	159.6	3880
	Percentile_80	0.01	0.001	0.021	876.8	1244	1	9440	27720	29.6	902.8	5.00E-05	0.002	7.432	10	0.01	5.00E-04	3676	754.8	17000
	Percentile_95	0.0155	0.001	0.024	1440	1464	1	10940	30120	42.12	1142	1.00E-04	0.003	7.632	11.2	0.01	0.001	4026	820.8	19600
	Max	0.14	0.001	0.006	587	124	10	440	1990	11.4	62	1.00E-04	0.001	7.36	11	0.01	0.001	277	8	1300
EC08	Mean - 3stddev	-0.1274787	0.001	0.002575	-33.1280891	-33.19551	-6.835116	-265.637	-341.3460595	-6.968794	-17.2628634	1.00E-04	0.001	6.521102	-1.7756356	0.01	0.001	-84.31405	-4.180355	-274.0325
	Mean + 3stddev	0.21319295	0.001	0.007092	806.728089	135.9955	10.475316	502.437	2501.546059	14.07879	82.06286339	1.00E-04	0.001	7.702898	12.975636	0.01	0.001	341.9141	11.58036	1552.433
	Median	0.01	0.001	0.005	393.5	44.5	1	67	1020	2.8	30	1.00E-04	0.001	7.15	5.5	0.01	0.001	130	2	634
	Min	0.01	0.001	0.004	152	28	0.201	9	311	0.06	12	1.00E-04	0.001	6.77	3	0.01	0.001	20	1	218
	N	7	7	6	10	10	10	10	10	10	10	4	7	10	10	7	4	10	10	10
	Outlier_count	1	0	0	0	1	2	1	2	1	0	0	0	0	0	0	0	3	0	3
	Percentile_05	0.01	0.001	0.004	179.45	29.8	0.56055	18	423.95	0.1275	13.35	1.00E-04	0.001	6.7835	3	0.01	0.001	27.65	1.45	242.3
	Percentile_20	0.01	0.001	0.004	276.2	32.8	1	39.4	830.8	1.002	19.8	1.00E-04	0.001	6.968	3.8	0.01	0.001	97	2	480
	Percentile_80	0.09	0.001	0.005	513.2	56	1	175.4	1298	4.726	44.4	1.00E-04	0.001	7.256	6.4	0.01	0.001	161.6	7	733.2
	Percentile_95	0.131	0.001	0.00575	554.15	98.8	5.95	330.65	1801	9.6855	58.4	1.00E-04	0.001	7.324	9.65	0.01	0.001	227.95	7.55	1115.5
	Max	0.01	0.001	0.005	672	1160	10	12100	30900	12.5	1200	1.00E-04	0.004	8.17	11	0.01	0.001	4390	1050	31200
	Mean - 3stddev	0.00125431	0.0001254	-5.65E-05	88.4521547	-791.9925	-5.675425	-8104.609	-21212.809	-8.666741	-845.824778	-1.61E-06	-0.001696775	6.110255	-3.5655632	0.001254	-1.61E-05	-2812.13	-736.4545	-19696.42
	Mean + 3stddev	0.01574569	0.0015746	0.006501	845.281179	1675.859	8.5858246	17333.54	49204.809	12.49103	1760.358112	0.000159	0.005918998	8.655078	15.565563	0.015746	0.001587	6575.064	1534.988	40560.42
	Median	0.01	0.001	0.003	395	252	1	3040	11200	0.485	311	1.00E-04	0.002	7.45	6	0.01	0.001	1220	204	6490
EC09	Min	0.005	5.00E-04	0.002	326	27	0.328	316	1550	0.025	25	5.00E-05	0.001	6.68	1	0.005	5.00E-04	295	37	864
	N	10	10	10	15	15	15	15	15	15	15	7	10	15	13	10	7	15	15	15
	Outlier_count	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0
	Percentile_05	0.005	5.00E-04	0.002	335.8	28.4	0.4484	320.2	1557	0.025	25.7	5.00E-05	0.001	6.75	1.6	0.005	5.00E-04	304.1	41.2	994.2
	Percentile_20	0.005	5.00E-04	0.002	351.8	103.6	0.5	726	3208	0.05	71.6	5.00E-05	0.001	7.028	3.4	0.005	5.00E-04	436.2	50.4	1715.6
	Percentile_80	0.01	0.001	0.004	612	802.8	1	8980	28580	2.164	860.8	1.00E-04	0.0034	7.694	9.2	0.01	0.001	3706	790.6	18280
	Percentile_95	0.01	0.001	0.0046	654.5	1118	3.7	11120	30760	8.574	1151	1.00E-04	0.004	8.009	10.4	0.01	0.001	4089	1005.9	26650
	Max	0.03	0.001	0.008	1990	1100	10	12200	37650	21	1240	1.00E-04	0.003	8.18	17	0.02	0.002	5040	1080	29300
	Mean - 3stddev	-0.0117037	-0.000209	-0.000152	-698.753595	-259.3738	-4.013612	-2133.082	-5087.403377	-10.04795	-347.437377	-5.78E-06	-0.000731845	6.130675	-7.0374532	-0.00575	-0.00061	-516.1791	-207.8699	-6721.718
	Mean + 3stddev	0.02458835	0.0012284	0.008318	2702.53137	1461.54	5.7059547	16068.97	46221.29227	14.52595	1710.604043	9.49E-05	0.003931845	8.617658	18.408882	0.01675	0.001633	6581.512	1348.259	35299.78
	Median	0.005	5.00E-04	0.004	813.5	600.5	0.5	6880	21000	0.81	724	5.00E-05	0.002	7.39	3	0.005	5.00E-04	3145	556	13000
	Min	0.0025	0.00025	0.001	140	75	0.066	922	3590	0.025	3	2.50E-05	5.00E-04	6.41	1	0.0025	0.00025	645	113	1870
EC09A	N	26	29	25	36	36	35	36	36	36	36	23	26	36	35	25	22	36	36	33
	Outlier_count	5	4	4	0	0	1	0	0	4	0	1	0	0	2	4	2	0	0	0
	Percentile_05	0.0025	0.00025	0.003	370.25	130.25	0.25	1610	5550	0.05	108.5	2.50E-05	5.00E-04	6.66	2	0.0025	0.00025	884.75	155.75	3494
	Percentile_20	0.0025	0.00025	0.003	494	380	0.25	5210	13900	0.348	415	2.50E-05	5.00E-04	7.1	3	0.0025	0.00025	1930	366	9704
	Percentile_80	0.005	5.00E-04	0.0044	1730	891	1	10000	28600	2.996	987	5.00E-05	0.002	7.7	9.4	0.005	5.00E-04	4080	857	21020
	Percentile_95	0.0175	0.001	0.00685	1885	1012.5	1	11675	33925	9.298	1202.5	5.00E-05	0.0028	7.98	14.3	0.01	0.000975	4654	1020	25470.4

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EA Trigger Level	5	0.005	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
EC10	Max	0.09	0.001	0.005	471	150	10	1235	6635	0.86	170	1.00E-04	0.001	8.02	7	0.01	0.001	740	111	2538
	Mean - 3stddev	-0.0623083	6.14E-05	0.001069	113.513627	-45.96438	-5.368716	-304.5334	-1659.959439	-0.627893	-39.1191367	-5.18E-06	6.14E-05	6.500065	-2.9236278	0.000614	-5.18E-05	-89.07118	-30.15732	-450.4526
	Mean + 3stddev	0.10594471	0.001575	0.006265	595.42755	183.6114	8.0911861	1437.827	6927.018262	1.027893	206.5309014	0.000155	0.001574969	8.605817	6.2986278	0.01575	0.001552	763.1888	149.6867	3332.57
	Median	0.01	0.001	0.004	360	58	1	478	2170	0.05	78	7.50E-05	0.001	7.64	1	0.01	0.00075	298	47	1200
	Min	0.005	5.00E-04	0.002	197	12	0.141	88	725	0.025	16	5.00E-05	5.00E-04	6.81	1	0.005	5.00E-04	115	12	540
	N	11	11	10	17	17	17	17	17	17	17	8	11	17	16	11	8	17	17	17
	Outlier_count	2	0	0	0	1	1	4	3	3	1	0	0	0	1	0	0	3	0	0
	Percentile_05	0.005	5.00E-04	0.0024	225.8	20	0.4282	181.6	1137	0.025	26.4	5.00E-05	5.00E-04	6.898	1	0.005	5.00E-04	166.2	20	621.6
	Percentile_20	0.005	5.00E-04	0.003	305.2	43.6	0.5	422.8	1858	0.03	54.4	5.00E-05	5.00E-04	7.304	1	0.005	5.00E-04	261.6	40.2	1082
	Percentile_80	0.03	0.001	0.004	422.4	90.8	1	689.6	3428	0.276	111.4	1.00E-04	0.001	7.852	2	0.01	0.001	397.4	94.6	2030
EC11	Percentile_95	0.075	0.001	0.0046	456.6	138.8	2.8	1063	5247	0.804	155.6	1.00E-04	0.001	7.996	4	0.01	0.001	572	104.6	2534.8
	Max	0.04	0.001	0.009	1710	823	10	7940	23700	58	852	1.00E-04	0.007	7.81	16	0.01	0.001	3600	664	15400
	Mean - 3stddev	-0.0205537	-0.00027	-0.002432	-926.536073	-384.588	-3.968313	-4354.148	-12331.41621	-30.13972	-454.054908	-2.24E-05	-0.003502811	6.194921	-1.9884951	-0.002825	-0.000276	-2010.678	-381.0677	-8273.058
	Mean + 3stddev	0.03751799	0.0013948	0.013778	2290.82179	1193.902	5.7290561	11967.52	36669.87335	62.70286	1269.59765	0.000124	0.008539848	8.273651	16.331352	0.014121	0.001338	5290.907	998.5534	23727.65
	Median	0.005	5.00E-04	0.006	439	375	0.5	3350	10700	12.3	340	5.00E-05	0.001	7.3	7	0.005	5.00E-04	1390	284	7290
	Min	0.0025	0.00025	5.00E-04	144	20	0.063	156	903	0.01	17	2.50E-05	0.001	6.52	2	0.0025	0.00025	128	13	440
	N	28	28	27	35	35	35	35	35	35	35	25	28	35	35	27	24	35	35	34
	Outlier_count	3	0	0	0	0	1	0	0	4	0	4	0	0	3	0	5	0	0	0
	Percentile_05	0.0025	0.00025	0.001	188.2	41.2	0.25	269.8	1235	0.0425	32.4	2.50E-05	0.001	6.658	3	0.0025	0.00025	158.7	19.2	718.35
	Percentile_20	0.0025	0.00025	0.003	318.4	139.2	0.25	1004.8	3544	2.88	111.4	2.50E-05	0.001	6.916	4.8	0.0025	0.00025	461.4	77.8	2290
EC12	Percentile_80	0.01	0.001	0.008	1310	667.6	1	7070	21840	24.14	724.8	5.00E-05	0.0048	7.57	9	0.01	0.0007	3156	589.4	13960
	Percentile_95	0.033	0.001	0.009	1666	784.1	1	7331	22510	50.3	833.2	1.00E-04	0.006	7.72	12.6	0.01	0.001	3447	632.2	14675
	Max	0.01	0.001	0.017	526	800	10	5630	12300	28	1000	1.00E-04	0.001	7.95	12	0.02	0.001	1400	300	8880
	Mean - 3stddev	0.00061394	6.14E-05	-0.00014	73.4252769	-461.7012	-4.991356	-3062.531	-5598.037248	-19.11617	-514.624329	-5.18E-06	6.14E-05	5.201945	-5.816817	-0.004017	-5.18E-05	-436.2491	-125.7453	-4310.434
	Mean + 3stddev	0.01574969	0.001575	0.025918	611.029269	960.2466	7.5050555	6356.531	16009.85543	29.01046	1014.442511	0.000155	0.001574969	9.014419	18.016817	0.022199	0.001552	1505.34	339.8362	10650.64
	Median	0.01	0.001	0.015	347.5	187.5	1	1245	4900	0.65	162	7.50E-05	0.001	7.165	6.5	0.01	0.00075	505.5	102	2860
	Min	0.005	5.00E-04	0.003	132	28	0.037	159	1110	0.05	28	5.00E-05	5.00E-04	5.75	1	0.005	5.00E-04	164	24	568
	N	11	11	10	22	22	20	22	22	22	22	8	11	22	20	11	8	22	22	19
	Outlier_count	0	0	1	0	0	1	2	0	3	2	0	0	0	0	0	0	2	1	0
	Percentile_05	0.005	5.00E-04	0.0062	240.45	28.4	0.09685	191.85	1219.5	0.13	32.4	5.00E-05	5.00E-04	5.9075	1.95	0.005	5.00E-04	167.75	30.2	634.6
EC13	Percentile_20	0.005	5.00E-04	0.011	266.2	46	0.5	369.8	1764	0.25	56	5.00E-05	5.00E-04	6.622	2	0.005	5.00E-04	267.6	42.2	933.6
	Percentile_80	0.01	0.001	0.016	411.8	376.8	1	2162	7428	8.95	335.6	1.00E-04	0.001	7.692	10	0.01	0.001	620.2	146.4	5490
	Percentile_95	0.01	0.001	0.0166	474.1	757.5	1.45	5197	11738	24	709.2	1.00E-04	0.001	7.896	12	0.015	0.001	1147.75	271.5	6750.6
	Max	0.02	0.001	0.002	1220	914	10	7270	25200	8.79	741	1.00E-04	0.002	8.09	21	0.01	0.001	2932	588	23000
	Mean - 3stddev	-0.0053216	-0.000258	-6.36E-05	-295.72002	-518.5428	-3.914399	-4351.298	-12405.63055	-5.079894	-429.248319	-2.09E-05	-4.85E-05	5.90289	-6.6232954	-0.002698	-0.000224	-1577.953	-378.8966	-10325.09
	Mean + 3stddev	0.01756301	0.0013784	0.002987	1326.9978	1346.043	5.6528433	10900.8	32712.29722	9.830465	1100.303875	0.000123	0.002173524	8.56711	26.234406	0.013948	0.001244	4122.12	867.2855	24394.18
	Median	0.005	5.00E-04	0.001	380.5	392.5	0.5	3435	10400	1.15	328	5.00E-05	0.001	7.29	10.5	0.005	5.00E-04	1200	233	6600
	Min	0.0025	0.00025	0.001	119	63	0.042	406	1670	0.025	47	2.50E-05	0.00025	6.32	4	0.0025	0.00025	241	5	949
	N	29	29	27	36	36	36	36	36	36	36	26	29	36	36	28	25	36	36	35
	Outlier_count	1	14	0	0	0	1	0	0	0	0	4	5	0	0	0	4	0	0	0

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
EC14	Max	0.47	0.001	0.017	608	558	94	2950	9000	9.87	400	1.00E-04	0.004	8.78	24	0.01	0.001	1560	172	8640
	Mean - 3stdev	-0.2471501	-0.000325	-0.001359	50.0249592	-234.3921	-45.13031	-1543.016	-3878.343987	-5.651542	-200.978499	-2.83E-05	-0.000798076	5.964235	-6.1166328	-0.003248	-0.000283	-505.9699	-90.86073	-3729.014
	Mean + 3stdev	0.2984963	0.0014402	0.02213	742.399283	450.7557	52.60304	3011.683	9724.950048	8.825784	390.4330444	0.000128	0.004398076	8.929704	19.571178	0.014402	0.001283	1249.424	174.4971	7647.466
	Median	0.005	5.00E-04	0.01	416	53	0.5	497	2120	0.73	40	5.00E-05	0.002	7.48	5	0.005	5.00E-04	257	22	1180
	Min	0.0025	0.00025	0.00025	128	25	0.05	27	419	0.015	9	2.50E-05	0.001	6.49	3	0.0025	0.00025	28	4	272
	N	26	26	25	33	33	33	33	33	33	33	23	26	33	33	26	23	33	33	31
	Outlier_count	3	0	1	3	2	2	3	2	4	2	4	2	1	3	0	4	4	2	4
	Percentile_05	0.0025	0.00025	0.0053	154.6	28.6	0.25	142	930	0.015	19.4	2.50E-05	0.001	6.6	4	0.0025	0.00025	115.2	5	553
	Percentile_20	0.0025	0.00025	0.008	319	36.4	0.25	199.2	1306	0.066	29.2	2.50E-05	0.001	7.064	4	0.0025	0.00025	209.2	8.8	788
	Percentile_80	0.01	0.001	0.0134	472.2	177	1	1309.2	4684	2.73	151.2	5.00E-05	0.002	7.788	7.6	0.01	5.00E-04	498.6	72.4	2570
Percentile_95	0.03	0.001	0.01685	532.4	303.2	4.6	2464	7524	6.592	277.2	1.00E-04	0.0038	8.08	14.6	0.01	0.001	840.2	134.4	5620	
EC15	Max	0.14	0.001	0.001	435	242	1	1110	3870	2.32	207	1.00E-04	0.001	7.84	4	0.01	0.001	222	67	2360
	Mean - 3stdev	-0.1188347	0.001	0.001	1.46813468	-120.297	1	-743.5429	-1776.048547	-1.734083	-112.860739	1.00E-04	0.001	6.577257	-1.802241	0.01	0.001	-80.55601	-39.14389	-1129.241
	Mean + 3stdev	0.17597757	0.001	0.001	558.531865	257.7515	1	1176.27	4280.048547	2.40681	218.1334661	1.00E-04	0.001	8.134743	6.1658773	0.01	0.001	249.2833	79.14389	2577.041
	Median	0.01	0.001	0.001	290.5	41	1	102	886	0.05	32	1.00E-04	0.001	7.32	2	0.01	0.001	68	14	510.5
	Min	0.01	0.001	0.001	153	22	1	10	426	0.05	10	1.00E-04	0.001	7.01	1	0.01	0.001	29	4	250
	N	7	7	6	10	11	11	11	10	11	11	4	7	10	11	7	4	11	10	10
	Outlier_count	1	0	0	0	1	0	1	1	2	1	0	0	0	0	0	0	1	1	1
	Percentile_05	0.01	0.001	0.001	157.95	25	1	14	527.25	0.05	13	1.00E-04	0.001	7.0595	1	0.01	0.001	35	4.45	294.55
	Percentile_20	0.01	0.001	0.001	186.4	37	1	26	666.2	0.05	26	1.00E-04	0.001	7.128	1	0.01	0.001	41	5	369.8
	Percentile_80	0.01	0.001	0.001	349.6	91	1	286	1600	0.24	73	1.00E-04	0.001	7.524	4	0.01	0.001	105	28.2	910.4
Percentile_95	0.101	0.001	0.001	403.05	174.5	1	755.5	2938.5	1.53	141	1.00E-04	0.001	7.759	4	0.01	0.001	175	51.7	1722.8	
EC16	Max	0.53	0.001	0.029	666	32	10	239	1578	10.3	26	1.00E-04	0.005	8	7	0.01	0.001	350	22	1030
	Mean - 3stdev	-0.4987834	0.001	-0.005361	-91.1454986	-16.75308	-5.849217	-56.84815	146.3551806	-7.379937	-9.05447318	1.00E-04	-0.00258332	6.431759	-3.4538402	0.01	0.001	23.92866	-8.348717	213.318
	Mean + 3stdev	0.83021195	0.001	0.038361	750.312165	32.13769	9.1832167	280.5405	1843.811486	9.46763	26.90062703	1.00E-04	0.007726177	8.481575	6.5307633	0.01	0.001	386.2252	23.34872	1106.349
	Median	0.01	0.001	0.0145	279	5	1	90	920	0.05	7	1.00E-04	0.002	7.33	1	0.01	0.001	186	6	643.5
	Min	0.01	0.001	0.008	214	2	0.671	60	621	0.04	3	1.00E-04	0.001	7.03	1	0.01	0.001	140	2	453
	N	7	7	6	12	13	13	13	12	13	13	4	7	12	13	7	4	13	12	12
	Outlier_count	0	0	0	1	2	2	2	0	1	2	0	0	0	2	0	0	1	1	1
	Percentile_05	0.01	0.001	0.00925	215.1	2	0.8684	61.2	662.8	0.046	4.2	1.00E-04	0.001	7.074	1	0.01	0.001	141.8	3.1	482.15
	Percentile_20	0.01	0.001	0.013	223.6	3	1	67	778.2	0.05	6	1.00E-04	0.001	7.142	1	0.01	0.001	155.6	4	560.6
	Percentile_80	0.37	0.001	0.02	388.8	7.6	1	138	1202	0.832	9.6	1.00E-04	0.004	7.766	1	0.01	0.001	247	9	720.6
Percentile_95	0.497	0.001	0.02675	592.3	22.4	4.6	218	1463.6	4.81	20	1.00E-04	0.0047	7.9615	4	0.01	0.001	304.4	15.95	890.3	
EC17	Max	0.01	0.001	0.042	605	328	1	1800	6070	6.81	250	1.00E-04	0.004	7.87	6	0.01	0.001	735	297	3680
	Mean - 3stdev	0.00061394	6.14E-05	-0.016199	136.075325	-150.8866	0.1800601	-1118.165	-2396.201206	-3.504181	-127.067496	3.62E-06	0.001850862	5.961503	2.2143252	0.000614	-5.18E-05	-243.5706	-121.7644	-1598.062
	Mean + 3stdev	0.01574969	0.001575	0.058199	657.067532	431.2866	1.5532732	2303.098	7823.344063	9.299514	326.8008296	0.000159	0.004749138	8.314211	7.3856748	0.01575	0.001552	835.4372	378.1929	5049.491
	Median	0.01	0.001	0.017	370	102	1	320	1950	3	64	1.00E-04	0.003	7.14	5	0.01	0.00075	224	106.5	1225
	Min	0.005	5.00E-04	0.007	300	54	0.5	131	1260	0.025	36	5.00E-05	0.003	6.62	3	0.005	5.00E-04	148	36	676
	N	11	11	10	14	15	15	15	14	15	15	8	11	14	15	11	8	15	14	14
	Outlier_count	0	0	2	2	2	0	1	0	0	3	0	0	0	0	0	0	2	0	0
	Percentile_05	0.005	5.00E-04	0.0098	311.7	57.5	0.5	150.6	1299	0.3855	38.8	5.00E-05	0.003	6.62	3.7	0.005	5.00E-04	153.6	43.8	692.9
	Percentile_20	0.005	5.00E-04	0.014	341.6	71.8	0.5	185.2	1446	0.622	48.6	5.00E-05	0.003	6.774	4	0.005	5.00E-04	157	52.2	791.2
	Percentile_80	0.01	0.001	0.0282	428.6	234.8	1	1214	4370	4.568	169	1.00E-04	0.004	7.494	5.2	0.01	0.001	415.6	187.6	2918
Percentile_95	0.01	0.001	0.042	573.15	324.5	1	1639	5810	5.851	244.4	1.00E-04	0.004	7.662	6	0.01	0.001	625.1	281.4	3680	

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EC18	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
	Max	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	Mean - 3stdev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mean + 3stdev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Median	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	Min	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	N	1	1	1	NA	1	1	1	NA	1	1	NA	1	NA	1	1	NA	1	NA	NA
	Outlier_count	0	0	0	NA	0	0	0	NA	0	0	NA	0	NA	0	0	NA	0	NA	NA
	Percentile_05	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	Percentile_20	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
EC19	Percentile_80	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	Percentile_95	0.46	0.001	0.004	NA	36	1	65	NA	8.4	29	NA	0.001	NA	1	0.01	NA	148	NA	NA
	Max	0.1	0.004	0.042	246	21	1	88	802	0.05	30	1.00E-04	0.003	7.72	1	0.01	0.001	98	12	401
	Mean - 3stdev	-0.0846437	-0.002427	-0.040786	30.6814662	1.161112	0.0587367	-53.45949	-59.23970579	0.002937	2.014948308	5.87E-06	-0.001391023	7.127461	1	0.000587	5.87E-05	-32.61384	-1.498428	71.27264
	Mean + 3stdev	0.13797704	0.0052605	0.057786	339.9852	28.17222	1.60793	127.7928	1054.239706	0.080397	40.65171836	0.000161	0.003891023	7.982539	1	0.016079	0.001608	145.2805	16.16509	529.394
	Median	0.01	0.001	0.002	176.5	14.5	1	20	454	0.05	22	1.00E-04	0.001	7.56	1	0.01	0.001	42.5	7	298.5
	Min	0.005	5.00E-04	0.001	132	9	0.5	15	307	0.025	14	5.00E-05	5.00E-04	7.34	1	0.005	5.00E-04	31	4	200
	N	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	6	6	6	6
	Outlier_count	1	2	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
	Percentile_05	0.005	0.000625	0.001	133	9.5	0.5	16	317.25	0.025	14	5.00E-05	0.000625	7.37	1	0.005	5.00E-04	32	4.25	211.5
EC20	Percentile_20	0.005	0.001	0.001	136	11	0.5	19	348	0.025	14	5.00E-05	0.001	7.46	1	0.005	5.00E-04	35	5	246
	Percentile_80	0.03	0.001	0.003	245	18	1	61	620	0.05	26	1.00E-04	0.001	7.69	1	0.01	0.001	89	9	358
	Percentile_95	0.0825	0.00325	0.03225	245.75	20.25	1	81.25	756.5	0.05	29	1.00E-04	0.0025	7.7125	1	0.01	0.001	95.75	11.25	390.25
	Max	0.01	0.001	0.001	340	73	1	143	1100	0.67	43	NA	0.001	7.29	5	0.01	NA	98	42	616
	Mean - 3stdev	0.01	0.001	0.001	94.4407146	18.2207	1	7.073838	372.1016478	-0.522994	10.31251016	NA	0.001	6.186975	2.1026334	0.01	NA	24.86093	13.97822	258.1605
	Mean + 3stdev	0.01	0.001	0.001	408.892619	87.7793	1	195.9262	1325.565019	0.922994	53.02082317	NA	0.001	7.596358	5.8973666	0.01	NA	122.4724	48.68845	752.5061
	Median	0.01	0.001	0.001	247.5	51	1	100.5	823.5	0.105	30.5	NA	0.001	6.875	4	0.01	NA	73	30.5	484
	Min	0.01	0.001	0.001	200	42	1	51	635	0.05	24	NA	0.001	6.6	3	0.01	NA	50	25	426
	N	3	3	2	6	6	6	6	6	6	6	6	6	3	6	6	3	6	6	6
	Outlier_count	0	0	0	0	0	0	0	0	0	1	0	NA	0	0	2	0	NA	0	1
EC21	Percentile_05	0.01	0.001	0.001	200	42.25	1	60.75	670	0.05	24.5	NA	0.001	6.635	3.25	0.01	NA	53.75	25.75	426.5
	Percentile_20	0.01	0.001	0.001	200	43	1	90	775	0.05	26	NA	0.001	6.74	4	0.01	NA	65	28	428
	Percentile_80	0.01	0.001	0.001	275	58	1	124	936	0.22	36	NA	0.001	6.97	4	0.01	NA	83	32	594
	Percentile_95	0.01	0.001	0.001	323.75	69.25	1	138.25	1059	0.5575	41.25	NA	0.001	7.21	4.75	0.01	NA	94.25	39.5	610.5
	Max	NA	NA	NA	636	480	1	4040	9900	16	740	NA	NA	8	5	NA	NA	760	150	2200
	Mean - 3stdev	NA	NA	NA	48.7727095	-378.2622	1	-3637.047	-6208.559383	-19.91757	-669.873996	NA	NA	4.350362	0.2025651	NA	NA	-218.3264	-156.1911	332.9379
	Mean + 3stdev	NA	NA	NA	976.227291	766.7622	1	6620.047	15308.55938	27.97257	1212.873996	NA	NA	10.21964	7.1307683	NA	NA	1096.326	252.1911	3087.062
	Median	NA	NA	NA	559.5	107	1	746	2980	0.05	134	NA	NA	7.65	3	NA	NA	363.5	16	1640
	Min	NA	NA	NA	295	83	1	434	2340	0.01	78	NA	NA	5.84	3	NA	NA	269	10	1290
	N	NA	NA	NA	4	4	4	4	4	4	4	NA	NA	4	3	NA	NA	4	4	3

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EA Trigger Level	5	0.005	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
EC22	Max	0.88	0.001	0.01	566	271	10	2070	5910	2.11	287	1.00E-04	0.002	8	11	0.01	0.001	776	1962	5170
	Mean - 3stddev	-0.661367	1.93E-05	0.003334	169.857103	-51.96229	-5.080215	-414.1663	117.6388152	-1.355297	-78.2383197	-6.83E-06	-0.000128571	6.26707	-1.484471	0.000614	-6.83E-05	59.14347	-1123.349	-1228.676
	Mean + 3stddev	0.84386703	0.0015641	0.012222	718.037634	298.8044	7.6733729	2050.587	6386.045395	2.201964	314.9751618	0.000151	0.002674025	8.701351	10.852892	0.01575	0.001513	740.0144	1476.717	5429.097
	Median	0.01	0.001	0.008	462	99	1	647	2730	0.11	87	5.00E-05	0.001	7.55	5	0.01	5.00E-04	375	75	1610
	Min	0.005	5.00E-04	0.006	207	67	0.135	490	2380	0.01	60	5.00E-05	0.001	6.81	2	0.005	5.00E-04	262	22	1320
	N	12	12	10	19	19	19	19	19	19	19	9	12	19	19	11	9	19	19	19
	Outlier_count	2	0	2	0	1	1	3	1	1	2	0	0	0	0	0	0	2	1	3
	Percentile_05	0.005	5.00E-04	0.006	324	67.9	0.4635	540.4	2443	0.02275	68.1	5.00E-05	0.001	6.837	2	0.005	5.00E-04	299.8	41.8	1356
	Percentile_20	0.005	5.00E-04	0.0066	369.6	76.6	0.5	574.6	2554	0.05	75.4	5.00E-05	0.001	7.018	3.6	0.005	5.00E-04	332.2	52	1400
	Percentile_80	0.018	0.001	0.0088	517.4	165.4	1	944.6	4285	0.852	164	1.00E-04	0.002	7.844	5.4	0.01	0.001	439.2	112.6	2515.2
	Percentile_95	0.4675	0.001	0.01	560.6	230.5	1.9	1647	5046	1.5405	246.5	1.00E-04	0.002	8	7.4	0.01	0.001	557.3	313.2	4612
	Max	0.02	0.001	0.003	881	369	1	2230	7910	0.9	384	1.00E-04	0.002	8	6	0.01	0.001	799	155	4880
EC23	Mean - 3stddev	8.96E-05	0.001	0.000784	-67.2077671	-175.8078	1	-1086.918	-2605.909314	-0.693135	-182.20296	1.00E-04	-0.000174996	6.193387	-1.2852553	0.01	0.001	-234.2773	-59.84987	-2249.885
	Mean + 3stddev	0.02276751	0.001	0.003883	1024.0411	421.3462	1	2709.841	9018.832391	1.20852	437.5875754	1.00E-04	0.0030322139	8.46828	8.0544861	0.01	0.001	1036.585	183.0165	6352.039
	Median	0.01	0.001	0.002	479	82	1	585	2500	0.08	92	1.00E-04	0.001	7.24	4	0.01	0.001	322	51	1430
	Min	0.01	0.001	0.002	239	21	1	100	954	0.01	23	1.00E-04	0.001	6.83	1	0.01	0.001	134	24	508
	N	7	7	6	12	13	13	13	13	13	13	4	7	12	13	7	4	13	12	13
	Outlier_count	1	0	0	0	1	0	2	1	0	1	0	0	0	0	0	0	0	1	0
	Percentile_05	0.01	0.001	0.002	253.3	24	1	143.8	1041.6	0.034	27.8	1.00E-04	0.001	6.863	1	0.01	0.001	138.8	25.65	530.8
	Percentile_20	0.01	0.001	0.002	321	62	1	396	2016	0.05	57.4	1.00E-04	0.001	7.058	2	0.01	0.001	241.6	29	1098
	Percentile_80	0.01	0.001	0.003	583.4	172.2	1	1136	4280	0.588	179.2	1.00E-04	0.002	7.73	4.6	0.01	0.001	553.6	75.2	3334
	Percentile_95	0.017	0.001	0.003	755.6	305.4	1	1996	6572	0.804	316.8	1.00E-04	0.002	7.912	5.4	0.01	0.001	767.8	136.3	4526
	Max	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Mean - 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mean + 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EURO PARK BORE	Median	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Min	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Outlier_count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Percentile_05	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Percentile_20	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Percentile_80	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Percentile_95	0.005	5.00E-04	5.00E-04	591	79	139	1040	3950	0.16	91	5.00E-05	5.00E-04	8.66	8	0.005	5.00E-04	725	28	2260
	Max	0.02	5.00E-04	0.003	231	34	29	516	2070	3.7	31	5.00E-05	0.001	8.58	14	0.005	5.00E-04	382	96	1340
	Mean - 3stddev	-0.0061101	5.44E-05	0.000488	58.5718232	16.76548	-18.58621	411.781	1527.176658	-2.474831	20.50864771	5.44E-06	-0.000262484	5.74558	8.6189655	0.000544	5.44E-05	226.5761	58.44184	900.9203
	Mean + 3stddev	0.01587202	0.000779	0.004512	303.904367	40.75833	23.729064	553.8381	2296.632866	3.245783	34.25325705	7.79E-05	0.001548198	9.042992	14.142939	0.00779	0.000779	396.9477	102.7963	1551.88
	Median	0.005	5.00E-04	0.003	200	30	0.5	481	1980	0.025	28	5.00E-05	5.00E-04	7.15	11	0.005	5.00E-04	317	78	1280
	Min	0.0025	0.00025	5.00E-04	99	21	0.25	440	1670	0.015	24	2.50E-05	0.00025	6.66	10	0.0025	0.00025	269	70	978
Fairhill Bore	N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	20
	Outlier_count	1	0	0	0	0	2	0	0	4	0	0	0	0	0	1	0	0	0	0
	Percentile_05	0.0025	0.00025	0.002	108	22	0.25	443	1720	0.015	24	2.50E-05	0.00025	6.83	10	0.0025	0.00025	271	72	1036.9
	Percentile_20	0.0025	0.00025	0.002	139	25	0.25	467	1770	0.015	24	2.50E-05	5.00E-04	6.98	11	0.0025	0.00025	285	75	1138
	Percentile_80	0.005	5.00E-04	0.003	209	32	0.5	506	2020	0.025	29	5.00E-05	0.001	7.79	12	0.005	5.00E-04	334	86	1312
	Percentile_95	0.005	5.00E-04	0.003	223	33	17	515	2040	2.44	31	5.00E-05	0.001	8.45	13	0.005	5.00E-04	339	95	1330.5
	Percentile_95	0.005	5.00E-04	0.003	223	33	17	515	2040	2.44	31	5.00E-05	0.001	8.45	13	0.005	5.00E-04	339	95	1330.5

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FIELD 5 BORE	EA Trigger Level	5	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
	Max	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	Mean - 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mean + 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Median	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	Min	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Outlier_count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Percentile_05	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	Percentile_20	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	Percentile_80	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
	Percentile_95	0.005	5.00E-04	0.006	923	704	0.5	6300	20200	0.025	755	5.00E-05	0.002	7.68	41	0.005	5.00E-04	2120	527	13500
GW01	Max	0.01	0.001	0.004	1670	137	165	3740	14000	0.98	406	1.00E-04	0.006	8.81	7	0.01	0.001	1890	303	7040
	Mean - 3stddev	-0.0025769	-0.000258	2.89E-05	-210.760884	-33.35824	-80.30036	-199.9788	140.9632371	-0.519489	-77.5469689	-2.09E-05	-0.001005949	7.383773	-2.6627856	-0.002698	-0.000209	315.9735	-27.86472	347.2628
	Mean + 3stddev	0.0137838	0.0013784	0.00574	1898.39725	123.7825	129.43673	3047.615	12148.73373	0.840399	328.7590901	0.000123	0.008148806	9.041682	7.4484999	0.013948	0.001228	1871.845	366.592	7397.112
	Median	0.005	5.00E-04	0.003	677	36	1	1390	5740	0.07	107	5.00E-05	0.004	8.24	2	0.005	5.00E-04	1030	144	3540
	Min	0.0025	0.00025	0.001	412	24	0.25	877	4150	0.015	64	2.50E-05	0.001	7.29	1	0.0025	0.00025	761	90	2510
	N	29	29	27	33	33	33	33	33	33	33	26	29	33	28	28	26	33	33	32
	Outlier_count	14	14	0	1	3	1	2	3	5	2	4	0	1	3	0	4	4	0	1
	Percentile_05	0.0025	0.00025	0.00125	502.6	25.6	0.25	961.2	4420	0.015	66.8	2.50E-05	0.001	7.852	1	0.0025	0.00025	798.2	101.6	2716.5
	Percentile_20	0.0025	0.00025	0.002	600.2	30	0.5	1060	4672	0.025	83	2.50E-05	0.002	8.03	1	0.0025	0.00025	905.2	111.8	2904
	Percentile_80	0.01	0.001	0.004	1138	51.6	52	1600	7080	0.192	145.2	5.00E-05	0.005	8.422	3	0.01	5.00E-04	1190	240.6	4730
	Percentile_95	0.01	0.001	0.004	1572	106.2	69.2	2196	9902	0.656	228.4	1.00E-04	0.006	8.528	6.65	0.01	0.001	1628	293.2	6266
	Max	0.06	0.001	0.003	602	49	10	1100	5300	1.4	25	1.00E-04	0.001	7.94	7	0.01	0.001	94	150	2546
GW02	Mean - 3stddev	-0.0343125	6.14E-05	-0.00132	-152.050972	1.487502	-5.566168	-657.4026	-2793.232682	-0.923465	2.217454621	3.62E-06	6.14E-05	6.563763	-0.9577612	0.000614	-5.18E-05	-12.98532	-95.31342	-1218.531
	Mean + 3stddev	0.0615852	0.001575	0.00412	542.175972	65.5125	8.3299183	909.9026	4428.107682	2.31159	34.03254538	0.000159	0.001574969	8.248737	7.0827612	0.01575	0.001552	109.8603	123.1884	2148.656
	Median	0.01	0.001	0.0015	186	34	1	63.5	517.5	0.77	19.5	1.00E-04	0.001	7.365	3	0.01	0.00075	44.5	4	325
	Min	0.005	5.00E-04	5.00E-04	112	19	0.11	19	303	0.025	10	5.00E-05	5.00E-04	6.79	2	0.005	5.00E-04	27	2	186
	N	11	11	10	16	16	16	16	16	16	16	8	11	16	16	11	8	16	16	16
	Outlier_count	2	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	2	1	1
	Percentile_05	0.005	5.00E-04	5.00E-04	124	19.75	0.4025	20.5	319.5	0.03625	10.75	5.00E-05	5.00E-04	7.06	2	0.005	5.00E-04	27	2	204
	Percentile_20	0.005	5.00E-04	5.00E-04	129	23	0.5	38	389	0.05	12	5.00E-05	5.00E-04	7.23	2	0.005	5.00E-04	29	2	262
	Percentile_80	0.01	0.001	0.002	197	43	1	96	687	1.18	23	1.00E-04	0.001	7.68	4	0.01	0.001	54	9	419
	Percentile_95	0.04	0.001	0.00255	341.75	48.25	3.25	362	1893.5	1.34	25	1.00E-04	0.001	7.805	4.75	0.01	0.001	88	46.5	996.5
	Max	0.02	0.001	0.041	397	87	4	1400	4430	6.75	70	1.00E-04	0.002	8.32	15	0.01	0.001	770	3	2880
	Mean - 3stddev	-0.0056592	-0.000258	-0.015725	-70.1409412	23.3414	-1.355375	223.1348	1376.395603	-3.797961	47.42603292	-2.25E-05	-0.00094769	7.154882	-0.4928211	-0.002582	-0.000225	128.8238	-0.873187	523.5514
	Mean + 3stddev	0.01765922	0.0013782	0.029485	366.355227	117.1586	2.8375183	2014.222	6189.318683	5.059747	77.07396708	0.000127	0.00230769	8.590118	12.707107	0.013782	0.001269	1048.605	2.416665	4061.189
	Median	0.005	5.00E-04	0.007	123	76	0.5	1220	4000	0.14	63	5.00E-05	5.00E-04	7.89	6	0.005	5.00E-04	626.5	0.5	2550
	Min	0.0025	0.00025	0.001	105	30	0.25	200	1300	0.015	47	2.50E-05	0.00025	7.18	5	0.0025	0.00025	112	0.25	697
Jamar Bore	N	25	25	25	28	28	28	28	28	28	28	23	25	28	28	25	23	28	23	27
	Outlier_count	12	12	1	5	5	1	3	3	4	1	4	12	1	2	12	4	4	1	3
	Percentile_05	0.0025	0.00025	0.0012	107.35	36.1	0.25	340.85	1621	0.0185	54.7	2.50E-05	0.00025	7.452	5	0.0025	0.00025	188.4	0.5	843.9
	Percentile_20	0.0025	0.00025	0.003	111.4	66.4	0.5	1114	3864	0.05	58.4	2.50E-05	0.00025	7.728	5	0.0025	0.00025	587.6	0.5	2032
	Percentile_80	0.01	0.001	0.008	141	80.6	1	1272	4180	0.338	66	5.00E-05	0.001	8.056	6	0.01	5.00E-04	654.6	1	2706
	Percentile_95	0.01	0.001	0.0088	316.8	85.3	1	1326.5	4341.5	3.4905	68.3	1.00E-04	0.002	8.211	10.25	0.01	0.001	710.9	1	2765

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
JANSONS	Max	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Mean - 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mean + 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Median	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Min	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Outlier_count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Percentile_05	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Percentile_20	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Percentile_80	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Percentile_95	0.005	5.00E-04	5.00E-04	622	143	0.5	2610	9010	0.025	342	5.00E-05	0.001	7.68	2	0.005	5.00E-04	1270	239	5330
	Max	0.01	0.001	0.004	398	210	20	870	3320	1.55	157	1.00E-04	0.009	8.4	34	0.01	0.001	380	302	2280
	Mean - 3stddev	-0.0025769	-0.000258	-0.001292	184.101576	45.9196	-8.828059	348.4218	1917.596643	-0.594104	56.87186495	-2.09E-05	-0.00587503	6.614121	-8.082795	-0.002577	-0.000209	135.9925	-150.4127	1152.674
Karanga Bore	Mean + 3stddev	0.0137838	0.0013784	0.004051	505.310189	218.1947	11.195707	879.2841	3339.46218	1.557818	150.2138493	0.000123	0.00913365	8.637055	24.482795	0.013784	0.001228	355.8932	378.8833	2233.993
	Median	0.005	5.00E-04	0.001	360	126	0.5	632	2510	0.5	98	5.00E-05	5.00E-04	7.59	7	0.005	5.00E-04	248	57	1630
	Min	0.0025	0.00025	0.00025	144	53	0.25	336	2400	0.025	84	2.50E-05	0.00025	6.96	6	0.0025	0.00025	130	42	1460
	N	29	29	29	34	35	34	34	34	35	35	26	29	34	35	29	26	35	34	33
	Outlier_count	14	14	2	5	2	1	6	1	2	1	4	4	1	4	4	4	3	0	2
	Percentile_05	0.0025	0.00025	0.00035	237.4	99.7	0.25	445.35	2416.5	0.05	87.1	2.50E-05	0.00025	7.095	6	0.0025	0.00025	198.6	43.95	1520
	Percentile_20	0.0025	0.00025	0.001	343.2	116.6	0.4	603.8	2450	0.116	92	2.50E-05	0.00025	7.378	6	0.0025	0.00025	231.6	49.2	1590
	Percentile_80	0.01	0.001	0.002	368.2	157	1	653.4	2818	0.6	117	5.00E-05	0.0024	7.892	8	0.01	5.00E-04	259	227.4	1756
	Percentile_95	0.01	0.001	0.0032	395.05	175.3	1	671.5	3048	1.138	127.9	1.00E-04	0.0076	8.1705	17.1	0.01	0.001	281.3	258.5	2066
	Max	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	NA	7.5	8	NA	130	1	2440
	Mean - 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mean + 3stddev	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Median	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	NA	7.5	8	NA	130	1	2440
Mine Bore (6)	Min	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	7.5	8	NA	NA	130	1	2440
	N	NA	NA	NA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Outlier_count	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Percentile_05	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	7.5	8	NA	NA	130	1	2440
	Percentile_20	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	7.5	8	NA	NA	130	1	2440
	Percentile_80	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	7.5	8	NA	NA	130	1	2440
	Percentile_95	NA	NA	NA	189	92	1	468	4690	0.24	66	NA	NA	7.5	8	NA	NA	130	1	2440
	Max	0.01	5.00E-04	0.004	1160	143	172	1710	8150	0.65	259	5.00E-05	0.002	8.69	32	0.005	5.00E-04	1430	904	5300
	Mean - 3stddev	-0.0009976	4.55E-05	-0.001849	828.495152	55.62321	-120.5796	804.9282	4825.656372	0.046109	104.4001279	4.55E-06	-0.000537593	6.473496	17.092642	0.000455	4.55E-05	825.9659	323.7178	2975.649
	Mean + 3stddev	0.00974763	0.0007795	0.003024	1341.50485	143.5768	150.12956	1744.072	8093.343628	0.950891	259.6998721	7.80E-05	0.002037593	8.994504	32.907358	0.007795	0.00078	1438.034	899.4822	5366.456
	Median	0.005	5.00E-04	5.00E-04	1100	98	0.5	1245	6335	0.535	174.5	5.00E-05	0.00075	7.535	24.5	0.005	5.00E-04	1120	575.5	4120
	Min	0.0025	0.00025	0.00025	770	77	0.25	1070	5900	0.11	152	2.50E-05	0.00025	7.23	22	0.0025	0.00025	1000	516	3570
	N	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19
Railway Bore	Outlier_count	1	0	1	3	1	2	2	2	3	2	0	1	0	2	0	0	1	2	1
	Percentile_05	0.0025	0.00025	0.00025	988.5	80.8	0.25	1127	5928.5	0.186	155.8	2.50E-05	0.00025	7.268	22	0.0025	0.00025	1000	532.15	3687
	Percentile_20	0.0025	0.00025	0.00025	1066	90.2	0.25	1166	6022	0.496	164	2.50E-05	0.00045	7.352	23	0.0025	0.00025	1060	554.8	3866
	Percentile_80	0.005	5.00E-04	5.00E-04	1124	106.8	0.5	1312	6678	0.582	191.2	5.00E-05	0.001	8.048	26.2	0.005	5.00E-04	1202	634.6	4356
	Percentile_95	0.00525	5.00E-04	0.000675	1160	120.2	118.8	1605.5	7333	0.6405	234.3	5.00E-05	0.00105	8.4715	31.05	0.005	5.00E-04	1249.5	813.75	4796

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
RB1	Max	0.005	5.00E-04	5.00E-04	454	17	86	1020	4040	0.1	14	5.00E-05	0.001	8.85	5	0.005	5.00E-04	769	44	2630
	Mean - 3stdev	0.00019681	1.97E-05	1.97E-05	340.58664	8.941513	-64.00788	746.3518	3062.833815	-0.023197	6.67364598	1.97E-06	-0.000276156	7.658301	1.4858161	0.000197	1.97E-05	650.9616	-22.96615	1763.629
	Mean + 3stdev	0.00780319	0.0007803	0.00078	487.546693	18.79182	100.47455	1084.715	4109.166185	0.141197	14.12635402	7.80E-05	0.001209489	9.052366	5.0475172	0.007803	0.00078	802.2384	45.49948	2827.799
	Median	0.005	5.00E-04	5.00E-04	415	14	3	918	3530	0.07	10	5.00E-05	5.00E-04	8.3	3	0.005	5.00E-04	725	7	2290
	Min	0.0025	0.00025	0.00025	352	11	0.25	776	3350	0.025	9	2.50E-05	0.00025	8.12	3	0.0025	0.00025	677	3	1830
	N	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	14
	Outlier_count	0	0	0	1	1	1	1	1	0	4	0	0	2	0	0	0	0	2	3
	Percentile_05	0.0025	0.00025	0.00025	380	11.7	0.25	840.4	3406	0.025	9	2.50E-05	0.00025	8.141	3	0.0025	0.00025	692.4	3	2057.5
	Percentile_20	0.0025	0.00025	0.00025	401.8	12.8	0.25	877	3478	0.025	10	2.50E-05	0.00025	8.168	3	0.0025	0.00025	706	4	2248
	Percentile_80	0.005	5.00E-04	5.00E-04	431.8	15.2	36.4	950	3688	0.08	11	5.00E-05	5.00E-04	8.554	3.2	0.005	5.00E-04	745.8	16.4	2366
Percentile_95	0.005	5.00E-04	5.00E-04	446.3	16.3	72.7	985	3900	0.093	12.6	5.00E-05	0.001	8.78	4.3	0.005	5.00E-04	765.5	32.8	2545.5	
RB2	Max	0.02	5.00E-04	0.002	145	155	0.5	4030	11700	0.61	34	5.00E-05	0.001	8.24	10	0.005	5.00E-04	2250	1	7600
	Mean - 3stdev	-0.0084808	7.69E-06	-0.000565	115.392527	102.876	0.0076927	3184.285	10096.66334	-0.009292	28.28007398	7.69E-07	-0.000190494	7.331131	4.8736795	7.69E-05	7.69E-06	1880.905	-0.058524	6130.211
	Mean + 3stdev	0.01848076	0.000778	0.002743	147.178902	175.6955	0.7780216	4375.715	11789.05095	0.980006	36.14849745	7.78E-05	0.001047637	8.474183	9.9834633	0.00778	0.000778	2343.381	1.11408	7960.558
	Median	0.005	5.00E-04	0.001	130.5	142.5	0.5	3805	10900	0.54	32	5.00E-05	5.00E-04	7.825	7	0.005	5.00E-04	2100	0.5	7080
	Min	0.0025	0.00025	0.00025	126	114	0.25	3320	10500	0.015	30	2.50E-05	0.00025	7.67	7	0.0025	0.00025	1970	0.25	6250
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	9	13
	Outlier_count	1	0	6	2	0	0	0	1	3	0	0	0	1	0	0	0	0	2	2
	Percentile_05	0.0025	0.00025	0.000413	126	119.85	0.25	3456.5	10630	0.16125	30.65	2.50E-05	0.00025	7.683	7	0.0025	0.00025	2015.5	0.35	6592
	Percentile_20	0.0025	0.00025	8.00E-04	127.6	130.2	0.25	3656	10760	0.476	31	2.50E-05	0.00025	7.742	7	0.0025	0.00025	2064	0.5	6960
	Percentile_80	0.005	5.00E-04	0.0014	133.2	149.2	0.5	3968	11040	0.578	33.4	5.00E-05	5.00E-04	8.07	8	0.005	5.00E-04	2164	0.5	7192
Percentile_95	0.01025	5.00E-04	0.002	141.1	154.35	0.5	3997.5	11375	0.597	34	5.00E-05	0.000675	8.2205	8.7	0.005	5.00E-04	2250	0.8	7408	
RB3	Max	0.02	5.00E-04	0.001	190	78	12	3650	10600	0.34	16	5.00E-05	0.003	8.41	7	0.005	0.002	2190	19	6890
	Mean - 3stdev	-0.0084808	7.69E-06	-0.000306	162.917465	44.65114	-8.072622	2858.358	9106.713138	-0.042862	9.761072356	7.69E-07	-0.001548861	7.631241	4.8233032	7.69E-05	-0.000848	1592.272	-11.04879	5337.894
	Mean + 3stdev	0.01848076	0.000778	0.001235	195.225392	83.92029	10.536907	3915.927	10717.57258	0.476434	17.0960705	7.78E-05	0.002763146	8.485901	7.1766968	0.00778	0.001848	2352.013	22.79879	7386.721
	Median	0.005	5.00E-04	5.00E-04	180	64	0.5	3420	9920	0.235	13	5.00E-05	5.00E-04	8.025	6	0.005	5.00E-04	2000	4	6450
	Min	0.0025	0.00025	0.00025	169	52	0.25	3050	9310	0.025	12	2.50E-05	0.00025	7.91	5	0.0025	0.00025	1720	0.5	5400
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	12	13
	Outlier_count	1	0	2	0	3	1	0	2	0	1	0	0	2	1	0	1	2	2	3
	Percentile_05	0.0025	0.00025	0.00025	170.3	53.3	0.25	3154	9583	0.06725	12	2.50E-05	0.00025	7.923	5.65	0.0025	0.00025	1726.5	0.775	5790
	Percentile_20	0.0025	0.00025	0.00025	175.2	61.2	0.25	3220	9808	0.162	12.6	2.50E-05	0.00025	7.936	6	0.0025	0.00025	1918	2.2	6328
	Percentile_80	0.005	5.00E-04	5.00E-04	182.4	68.2	0.5	3538	10000	0.284	14.4	5.00E-05	5.00E-04	8.134	6	0.005	5.00E-04	2044	7	6500
Percentile_95	0.01025	5.00E-04	0.001	186.1	73.45	4.525	3591.5	10210	0.3075	15.35	5.00E-05	0.0017	8.2995	6.35	0.005	0.001025	2118.5	16.8	6656	
RB4	Max	0.06	5.00E-04	5.00E-04	194	66	47	2670	8070	0.23	10	5.00E-05	0.018	9.23	20	0.005	5.00E-04	1560	38	5240
	Mean - 3stdev	-0.0402788	2.41E-05	2.41E-05	44.820463	22.06863	-33.31947	1950.994	6929.180604	-0.105873	5.597647278	2.41E-06	-0.008270122	7.241678	-1.9550847	0.000241	2.41E-05	1296.375	-16.66677	4018.61
	Mean + 3stdev	0.0864326	0.0007836	0.000784	288.871845	89.46984	43.357929	2987.467	8309.280935	0.363566	11.78696811	7.84E-05	0.019962429	9.212168	21.647392	0.007836	0.000784	1669.779	42.97446	5746.005
	Median	0.02	5.00E-04	5.00E-04	184	61	0.5	2520	7640	0.13	9	5.00E-05	0.004	8.11	8	0.005	5.00E-04	1490	10	4960
	Min	0.0025	0.00025	0.00025	51	25	0.25	1970	7100	0.025	6	2.50E-05	0.002	7.96	7	0.0025	0.00025	1320	5	4060
	N	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
	Outlier_count	0	0	0	2	1	1	1	3	0	1	0	0	2	1	0	0	1	1	3
	Percentile_05	0.0025	0.00025	0.00025	90.6	35.2	0.25	2210	7244	0.025	7.2	2.50E-05	0.0026	7.972	7	0.0025	0.00025	1386	5	4396
	Percentile_20	0.0025	0.00025	0.00025	160.2	52.4	0.25	2404	7520	0.035	8	2.50E-05	0.003	8.048	7.4	0.0025	0.00025	1448	5.4	4806
	Percentile_80	0.04	5.00E-04	5.00E-04	189.6	62.6	4.6	2572	7734	0.206	9	5.00E-05	0.0072	8.326	11	0.005	5.00E-04	1530	19.4	5028
Percentile_95	0.054	5.00E-04	5.00E-04	194	64.8	22.4	2628	7908	0.218	10	5.00E-05	0.015	8.69	17.6	0.005	5.00E-04	1548	30.2	5138	

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EA Trigger Level		5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
RB5	Max	0.02	5.00E-04	5.00E-04	467	60	20	2400	7430	0.35	10	5.00E-05	0.006	8.5	11	0.005	5.00E-04	1570	12	4830
	Mean - 3stddev	-0.0078454	6.36E-06	6.36E-06	41.8364441	38.03637	-12.95634	1623.567	6661.987074	-0.139654	6.767582438	6.36E-07	-0.003573618	7.3349	1.104023	6.36E-05	-3.97E-06	1158.273	-8.320367	3853.311
	Mean + 3stddev	0.01753294	0.0007749	0.000775	423.038556	64.46363	17.581341	2800.183	7585.512926	0.527779	10.48241756	7.75E-05	0.005479868	8.81885	10.770977	0.007749	0.000771	1657.977	12.86582	5300.022
	Median	0.005	5.00E-04	5.00E-04	218.5	52	0.5	2280	7105	0.205	9	5.00E-05	5.00E-04	8.04	5	0.005	5.00E-04	1395	0.5	4620
	Min	0.0025	0.00025	0.00025	183	43	0.25	1760	6820	0.025	8	2.50E-05	0.00025	7.47	5	0.0025	0.00025	1220	0.5	3790
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	15	16	11	15
	Outlier_count	1	0	0	4	1	3	0	4	0	0	0	2	0	0	0	0	0	2	3
	Percentile_05	0.0025	0.00025	0.00025	198	43.75	0.25	1910	6910	0.025	8	2.50E-05	0.00025	7.755	5	0.0025	0.00025	1302.5	0.5	4238
	Percentile_20	0.0025	0.00025	0.00025	215	48	0.25	1980	7050	0.12	8	2.50E-05	0.00025	7.91	5	0.0025	0.00025	1360	0.5	4558
	Percentile_80	0.005	5.00E-04	5.00E-04	223	53	0.5	2380	7180	0.31	9	5.00E-05	0.001	8.29	6	0.005	5.00E-04	1480	3	4692
RB6	Percentile_95	0.00875	5.00E-04	5.00E-04	292.25	57.75	9.5	2392.5	7377.5	0.3425	9.25	5.00E-05	0.00375	8.38	8.75	0.005	5.00E-04	1540	8.5	4795
	Max	0.005	5.00E-04	5.00E-04	487	199	0.5	2280	7730	1.22	297	5.00E-05	0.002	8.21	9	0.005	5.00E-04	1240	154	5020
	Mean - 3stddev	-0.0003468	-3.47E-05	-3.47E-05	74.7974594	95.01073	-0.034683	1459.403	6342.66268	-0.637506	99.43488884	-3.47E-06	-0.001281096	6.569548	6.8964325	-0.000347	-3.47E-05	498.904	60.12783	4092.381
	Mean + 3stddev	0.00659683	0.0006597	0.00066	731.702541	261.2393	0.6596825	2710.597	7899.83732	2.280006	410.8151112	6.60E-05	0.002343596	8.592952	10.103567	0.006597	0.00066	1316.596	205.1222	5173.333
	Median	0.0025	0.00025	0.00025	455.5	189.5	0.25	2140	7075	1.09	269	2.50E-05	0.00025	7.46	8.5	0.0025	0.00025	866	137.5	4600
	Min	0.0025	0.00025	0.00025	221	115	0.25	1680	6890	0.17	130	2.50E-05	0.00025	7.23	8	0.0025	0.00025	813	75	4480
	N	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7
	Outlier_count	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	1	1	1
	Percentile_05	0.0025	0.00025	0.00025	225.2	132.15	0.25	1746.5	6907.5	0.177	174.45	2.50E-05	0.00025	7.2895	8	0.0025	0.00025	825.6	95.65	4489
	Percentile_20	0.0025	0.00025	0.00025	318.2	170.8	0.25	1958	6972	0.266	260.2	2.50E-05	0.00025	7.404	8	0.0025	0.00025	851.8	134.8	4520
Twin Bores	Percentile_80	0.004	4.00E-04	4.00E-04	464	194	0.4	2246	7120	1.216	277	4.00E-05	5.00E-04	7.792	9	0.004	4.00E-04	886.4	144	4630
	Percentile_95	0.005	5.00E-04	5.00E-04	478.95	197.95	0.5	2276.5	7516.5	1.22	290	5.00E-05	0.001475	8.1365	9	0.005	5.00E-04	1116.8	151.2	4903
	Max	0.005	5.00E-04	0.001	496	206	26	4350	13000	1.77	486	5.00E-05	5.00E-04	8.48	13	0.005	0.001	2100	807	8380
	Mean - 3stddev	0.00072378	7.24E-05	-4.06E-05	169.324746	-6.071606	-16.74519	2205.239	7689.368914	-0.850474	224.3167389	7.24E-06	7.24E-05	7.15772	4.6551609	0.000724	-4.06E-05	1161.947	406.3769	4479.029
	Mean + 3stddev	0.00777622	0.0007776	0.000966	661.056206	311.9764	21.554711	5322.38	15383.96442	1.349045	595.4927849	7.78E-05	0.000777622	8.731804	13.535315	0.000776	0.000966	2363.767	931.8136	10311.97
	Median	0.005	5.00E-04	5.00E-04	446	173	0.5	3870	11800	0.17	417	5.00E-05	5.00E-04	7.9	9	0.005	5.00E-04	1760	686	7510
	Min	0.0025	0.00025	0.00025	188	17	0.25	1750	6470	0.025	197	2.50E-05	0.00025	7.6	8	0.0025	0.00025	1040	373	3520
	N	20	20	20	21	21	21	21	21	21	21	20	20	21	21	20	20	21	21	20
	Outlier_count	0	0	1	2	3	3	1	1	1	1	0	0	0	4	0	1	2	3	1
	Percentile_05	0.0025	0.00025	0.00025	216	20	0.25	3490	11100	0.05	361	2.50E-05	0.00025	7.61	8	0.0025	0.00025	1620	536	7035
Weir Bore (2)	Percentile_20	0.0025	0.00025	0.00025	386	126	0.25	3600	11200	0.06	381	2.50E-05	0.00025	7.69	8	0.0025	0.00025	1710	651	7268
	Percentile_80	0.005	5.00E-04	5.00E-04	469	184	0.5	4040	12100	0.28	464	5.00E-05	5.00E-04	8.18	10	0.005	5.00E-04	1880	712	7860
	Percentile_95	0.005	5.00E-04	0.000525	485	194	16	4220	12900	0.48	478	5.00E-05	5.00E-04	8.36	12	0.005	0.000525	1940	766	8123.5
	Max	0.02	0.001	0.006	641	29	50	753	2550	1.04	43	1.00E-04	0.004	8.46	11	0.01	0.001	466	78	1510
	Mean - 3stddev	-0.0024317	0.001	0.002	-46.5642159	-6.586953	-47.90741	-302.8627	586.3252822	-0.803243	-11.3798447	1.00E-04	0.00069002	6.481404	-7.3286797	0.01	0.001	161.169	-26.87189	288.7712
	Mean + 3stddev	0.03043168	0.001	0.008	1035.16422	39.38695	78.907413	879.0627	3263.674718	1.297243	55.57984468	1.00E-04	0.00570998	9.410596	11.52868	0.01	0.001	568.431	110.0719	1872.229
	Median	0.01	0.001	0.005	548	16.5	1	206.5	1815	0.05	20.5	1.00E-04	0.003	8.055	1	0.01	0.001	368	43.5	1065
	Min	0.01	0.001	0.004	34	7	1	118	1330	0.05	10	1.00E-04	0.002	6.7	1	0.01	0.001	275	1	666
	N	5	5	5	10	10	10	10	10	10	10	2	5	10	10	5	2	10	10	10
	Outlier_count	0	0	0	1	0	0	0	0	1	0	0	0	1	2	0	0	0	0	0

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Winton Creek Bore	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
	Max	0.01	0.001	0.001	381	160	9	2650	8380	0.53	99	1.00E-04	0.001	8.35	12	0.01	0.001	1450	96	5290
	Mean - 3stddev	-0.0024734	-0.000247	-0.000247	144.115821	44.14339	-3.578514	1408.113	5446.156336	-0.183576	21.07776156	-2.46E-05	-0.000247337	7.303969	3.8356263	-0.002473	-0.000209	970.9582	-39.66678	2479.004
	Mean + 3stddev	0.01336623	0.0013366	0.001337	353.823573	175.9172	5.33609	3130.069	9050.813361	0.448122	107.1646627	0.00013	0.001336623	8.487547	12.043162	0.013366	0.001228	1622.981	108.8183	6243.496
	Median	0.005	5.00E-04	5.00E-04	241	106	0.5	2310	7300	0.11	61	5.00E-05	5.00E-04	7.86	8	0.005	5.00E-04	1330	26	4430
	Min	0.0025	0.00025	0.00025	193	72	0.25	1610	5760	0.025	43	2.50E-05	0.00025	7.56	5	0.0025	0.00025	1060	1	2970
	N	28	28	28	33	33	33	33	33	33	33	26	28	33	33	28	26	33	33	32
	Outlier_count	6	6	6	1	2	1	0	0	1	1	5	6	0	0	6	4	0	2	0
	Percentile_05	0.0025	0.00025	0.00025	209	78.8	0.25	1732	6266	0.025	48	2.50E-05	0.00025	7.652	6.6	0.0025	0.00025	1112	9.6	3137
	Percentile_20	0.0025	0.00025	0.00025	224.8	96.4	0.5	2062	6806	0.035	52.8	2.50E-05	0.00025	7.738	7	0.0025	0.00025	1184	14.4	3938
	Percentile_80	0.008	0.0008	0.0008	278	128.8	1	2506	7756	0.192	75.2	5.00E-05	0.0008	8.12	9	0.008	5.00E-04	1396	49.2	5002
	Percentile_95	0.01	0.001	0.001	285	152.4	1	2612	8062	0.284	92.4	1.00E-04	0.001	8.23	10	0.01	0.001	1424	84.8	5204.5
WSMB2D	Max	0.02	5.00E-04	0.002	616	310	0.5	4270	13800	1.81	288	5.00E-05	5.00E-04	8.2	18	0.005	5.00E-04	2370	740	8970
	Mean - 3stddev	-0.0058401	6.29E-05	-0.000585	452.411302	209.9667	0.06229061	3220.635	11112.16078	0.301083	212.7997553	6.29E-06	6.29E-05	6.527046	10.400327	0.000629	5.44E-05	1770.453	474.5744	7066.663
	Mean + 3stddev	0.01561282	0.000778	0.001631	688.315971	324.6696	0.778003	4733.911	13806.02104	2.559372	298.2911538	7.78E-05	0.000778003	8.514772	18.96331	0.00778	0.000779	2448.638	808.0619	9088.575
	Median	0.005	5.00E-04	5.00E-04	574	267.5	0.5	4075	12500	1.545	255.5	5.00E-05	5.00E-04	7.515	14	0.005	5.00E-04	2130	653	8060
	Min	0.0025	0.00025	0.00025	414	230	0.25	3280	11700	0.025	235	2.50E-05	0.00025	7.02	13	0.0025	0.00025	1870	479	7510
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	21	22	22	21
	Outlier_count	1	0	2	1	0	0	0	1	5	0	0	0	0	0	4	0	0	1	0
	Percentile_05	0.0025	0.00025	0.00025	548.3	245.05	0.25	3651.5	11905	0.9715	237	2.50E-05	0.00025	7.046	13	0.0025	0.00025	1960.5	578.05	7600
	Percentile_20	0.0025	0.00025	0.00025	558.4	248	0.25	3760	12100	1.424	243	2.50E-05	0.00025	7.272	14	0.0025	0.00025	2004	609.2	7860
	Percentile_80	0.005	5.00E-04	5.00E-04	590	282.4	0.5	4184	12780	1.588	268.4	5.00E-05	5.00E-04	7.816	15.8	0.005	5.00E-04	2198	672	8320
	Percentile_95	0.005	5.00E-04	0.000975	608.5	294	0.5	4258	12895	1.765	275.9	5.00E-05	5.00E-04	8.119	17	0.005	5.00E-04	2229.5	730.15	8520
	Max	0.02	5.00E-04	0.006	954	183	17	3330	10400	1.21	279	5.00E-05	0.001	8.33	29	0.005	0.002	1880	311	11300
WSMB2S	Mean - 3stddev	-0.0058401	6.29E-05	0.000342	503.896553	139.5487	-9.442172	2706.673	9328.942637	-0.555959	212.8981496	6.29E-06	-0.00013111	6.849454	6.9463634	0.000629	-0.000611	1361.275	181.2044	3497.123
	Mean + 3stddev	0.01561282	0.000778	0.008567	1001.55799	195.815	11.783081	3604.236	10816.51191	1.549596	293.9200322	7.78E-05	0.001085656	8.522364	26.326364	0.00778	0.001587	1943.271	313.5228	9933.353
	Median	0.005	5.00E-04	0.004	762	168.5	0.5	3195	10100	0.54	251.5	5.00E-05	5.00E-04	7.7	16	0.005	5.00E-04	1640	246.5	6490
	Min	0.0025	0.00025	0.002	457	146	0.25	2740	9530	0.015	230	2.50E-05	0.00025	7.2	14	0.0025	0.00025	1470	214	5950
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	21	22	22	21
	Outlier_count	1	0	0	2	0	1	0	0	0	0	0	2	0	0	1	0	0	1	1
	Percentile_05	0.0025	0.00025	0.003	701.6	152.05	0.25	2961	9722	0.02775	232.2	2.50E-05	0.00025	7.4205	14	0.0025	0.00025	1511	221.1	6140
	Percentile_20	0.0025	0.00025	0.003	729.6	163	0.25	3044	9870	0.106	242	2.50E-05	0.00025	7.442	15	0.0025	0.00025	1582	228	6340
	Percentile_80	0.005	5.00E-04	0.006	784.2	175	0.5	3304	10300	0.756	265.2	5.00E-05	5.00E-04	7.874	17.8	0.005	5.00E-04	1736	264.4	6700
	Percentile_95	0.005	5.00E-04	0.006	804.75	180.8	0.5	3319.5	10400	0.985	278.5	5.00E-05	0.000975	8.1965	19.95	0.005	5.00E-04	1769	276.55	6760
	Max	0.02	5.00E-04	5.00E-04	147	139	0.5	2180	6740	0.54	83	5.00E-05	5.00E-04	8.28	8	0.005	5.00E-04	1180	4	4380
	Mean - 3stddev	-0.0056049	0.0001422	0.000142	111.072391	100.2199	0.1422065	1432.686	5595.483568	-0.170189	61.49762813	1.42E-05	0.000142206	7.344309	4.1064858	0.001422	0.000133	799.8123	-1.973626	3205.764
	Mean + 3stddev	0.0161049	0.0007578	0.000758	144.727609	147.5801	0.7577935	2404.314	6889.516432	0.889689	90.40237187	7.58E-05	0.000757794	8.464691	9.2935142	0.007578	0.000762	1229.588	3.598626	4737.236
	Median	0.005	5.00E-04	5.00E-04	126	121	0.5	1905	6260	0.44	76	5.00E-05	5.00E-04	7.885	7	0.005	5.00E-04	1000	0.5	4030
	Min	0.0025	0.00025	0.00025	122	107	0.25	1610	5890	0.025	61	2.50E-05	0.00025	7.67	5	0.0025	0.00025	871	0.5	3340
WSMB3D	N	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	16	20
	Outlier_count	5	4	4	1	0	4	0	0	0	1	4	4	0	0	0	4	1	2	1
	Percentile_05	0.0025	0.00025	0.00025	122	114.6	0.25	1676.5	5985	0.025	69.55	2.50E-05	0.00025	7.6795	5.95	0.0025	0.00025	900.45	0.5	3577.5
	Percentile_20	0.0045	0.00045	0.00045	123.8	119.8	0.45	1788	6036	0.23	74	4.50E-05	0.00045	7.74	6	0.0045	4.00E-04	969.6	0.5	3840
	Percentile_80	0.005	5.00E-04	5.00E-04	130.2	131.6	0.5	2092	6360	0.512	79.2	5.00E-05	5.00E-04	8.028	7.2	0.005	5.00E-04	1056	0.5	4130
	Percentile_95	0.00575	5.00E-04	5.00E-04	134.65	135.2	0.5	2161	6673.5	0.521	83	5.00E-05	5.00E-04	8.28	8	0.005	5.00E-04	1123	2.5	4342

Bore	Parameter	Aluminium (d.)	Antimony (d.)	Arsenic (d.)	Bicarbonate	Calcium	Carbonate	Chloride	Electrical Conductivity	Iron (d.)	Magnesium	Mercury (d.)	Molybdenum (d.)	pH	Potassium	Selenium (d.)	Silver (d.)	Sodium	Sulphate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	EA Trigger Level	5	0.005	0.5	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	mean ±3 SD	0.002	0.15	mean ±3 SD	mean ±3 SD	0.1	0.002	mean ±3 SD	mean ±3 SD	mean ±3 SD
Yongala Bore	Max	0.005	5.00E-04	5.00E-04	272	84	30	849	3160	6.69	72	5.00E-05	5.00E-04	8.53	17	0.005	5.00E-04	460	62	2050
	Mean - 3stddev	0.0004548	4.55E-05	4.55E-05	171.788115	57.57815	-22.29284	688.3067	2607.120657	-1.496886	50.74702765	4.55E-06	4.55E-05	5.989669	12.080014	0.000455	4.55E-05	332.3528	38.64355	1505.599
	Mean + 3stddev	0.0077952	0.0007795	0.00078	279.511885	88.82185	29.692838	914.1933	3201.879343	9.945886	75.05297235	7.80E-05	0.00077952	9.143331	17.919986	0.007795	0.00078	476.9472	63.05645	2214.401
	Median	0.005	5.00E-04	5.00E-04	222.5	73	0.5	801	2910	4.69	63	5.00E-05	5.00E-04	7.305	15	0.005	5.00E-04	405	51.5	1890
	Min	0.0025	0.00025	0.00025	195	65	0.25	716	2700	0.025	54	2.50E-05	0.00025	6.91	13	0.0025	0.00025	357	44	1560
	N	21	21	21	20	20	21	20	20	21	21	20	21	21	20	20	21	20	21	19
	Outlier_count	0	0	0	3	5	3	0	1	4	3	0	0	0	0	0	0	3	1	3
	Percentile_05	0.0025	0.00025	0.00025	203.55	65.95	0.25	741.65	2766.5	0.025	57.8	2.50E-05	0.00025	7.0335	13.95	0.0025	0.00025	357.95	45.9	1587
	Percentile_20	0.0025	0.00025	0.00025	215.6	69.4	0.25	769.6	2838	4.196	60	2.50E-05	0.00025	7.13	14	0.0025	0.00025	388.6	47.6	1828
	Percentile_80	0.005	5.00E-04	5.00E-04	231.2	75.2	0.5	837.8	2952	5.32	64.6	5.00E-05	5.00E-04	8.108	16	0.005	5.00E-04	418.6	53.2	1920
	Percentile_95	0.005	5.00E-04	5.00E-04	260.6	81.15	26.2	848.05	3046	6.1485	70.1	5.00E-05	5.00E-04	8.511	16.05	0.005	5.00E-04	444.8	54.4	1987

APPENDIX D

Water quality compared to regional and national guidelines - boxplots

I. Relevant water quality guidelines

As detailed in DSITI (2017): Where multiple EVs (with associated water quality guidelines) have been identified for an area of interest, surface or groundwater quality should be managed to comply with the most conservative water quality guideline so that the most sensitive EV is protected (commonly this is for aquatic ecosystems).

At Ensham, the most sensitive EV identified by HydroSimulations (2020) in the Ensham Residual Void Project Stage 2 Environmental Values Workshop Report is the protection of aquatic ecosystem (biodiversity and habitat).

DISTI (2017) states: The identification of local groundwater triggers can be complicated by the need to account for underlying geology and influence of historic mining activities on groundwater. This is particularly relevant for Ensham where legacy mining is present, and no pre-mining baseline data are available. DISTI (2017) then concludes: The use of ANZECC guidelines values for metals provides a conservative approach to protect surface and groundwater [...] for toxicants, if the local groundwater quality is less than the ANZECC guidelines, then the guidelines value may still be adopted.

DSITI (2017) also states: Where existing guidelines are unsuitable, the approach typically adopted is to compare measured value / values with a trigger value derived from locally relevant background, reference or baseline groundwater quality monitoring.

Water quality triggers should thus be primarily based on the ANZECC guidelines for aquatic ecosystem protection (95 per cent) or alternatively on the Fitzroy groundwater quality objectives for chemistry zone 43 - 80th percentile for shallow (alluvium) and deep (Triassic and Permian units) bores. ANZECC livestock drinking water guidelines may also be considered. It is however noted that ANZECC livestock drinking water guidelines are generally compared against total metal concentration and not dissolved as per the current EA.

II. Comparison with relevant guidelines

Historical datasets have been summarised in boxplots for each parameter listed in the current EA. The 80th percentile (which correspond to the top of the box) – and 20th for pH (which correspond to the bottom of the box) is compared with relevant guidelines in each plot. For consistency purposes, all of the contaminants currently listed on the EA have been compared to relevant guidelines.

i. Electrical conductivity and TDS

Electrical conductivity and TDS both measure salinity levels.

Regional WQO for aquatic ecosystem protection are available for EC. Several alluvium bores (EC01, EC03, EC05, EC07, EC09A, EC11 and EC13) have 80th percentile above the regional WQO. All other alluvium bores are within the regional WQO. Most of the bores screened below the alluvium are compliant to the regional guideline except for WSMB2D, WSMB2S, RB02, RB03 and RB04 (Figure 1).

ANZECC guideline for stock drinking water is available for TDS. Values from which no adverse effects on animal are expected range from 2000 mg / L for poultry to 4000 mg / L for most other stock (table 9.3.3, ANZECC 2000). It is noted that the 80th percentile for most of the deep bores is above the ANZECC guideline (i.e. using the conversion formula presented in ANZECC, 7,700 us / cm = 5,160 mg / L). Logically, most bores are not best suited for stock according to the ANZECC guidelines (Figure 2).

pH

pH is generally comprised between 6.5 and 8.5, which is within the lower Nogoa River EVs for aquatic ecosystem protection (DEHP, 2011). The only exception is bore RB01, with a 80th percentile of 8.55 (Figure 3).

Major ions

Calcium

Calcium values are below the 80th percentile for deep bores for all Triassic and Permian bores. Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC05, EC07, EC09A, EC11 and EC13. All bores are below the ANZECC guideline for stock drinking water except for EC07 (Figure 4).

Magnesium

Magnesium values are below the 80th percentile for deep bores for all Triassic and Permian bores. Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC07 and EC09A (Figure 5).

Sodium

Sodium values are above the 80th percentile for deep bores for several Triassic and Permian bores (RB02, RB03, RB04, RB05, WSMB2D, WSMB2S and Wilton Creek Bore). Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC05, EC07, EC09A and EC11 (Figure 6).

Potassium

No guidelines values are available for potassium.

Chloride

Chloride values are generally below the 80th percentile for deep bores for Triassic and Permian bores except for RB02 and WSMB2D. Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC05, EC07, EC09A and EC11 (Figure 7).

Sulfate

Sulfate values are generally below the 80th percentile for deep bores for Triassic and Permian bores except for WSMB2D and Railway bore. Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC05, EC07, EC09A, EC11 and EC13. All bores are below the ANZECC guideline for stock drinking water except for EC01 (Figure 8). The elevated sulfate value at Railway bore (i.e. compared to regional guidelines) which is located 8 km from mining activity and the low level detected in several mine bores indicate that sulfate values higher than the regional guidelines are likely due to natural geochemistry.

Carbonate

No guidelines values are available for carbonate.

Bicarbonate

Bicarbonate values are generally below the 80th percentile for deep bores for Triassic and Permian bores except for Railway bore. Several alluvium bores have values above the 80th percentile for shallow bores such as EC01, EC03, EC09A, EC11 and GW01 (Figure 9).

Metals and metalloids

Aluminium

Dissolved aluminium values are generally below the ANZECC guideline for aquatic ecosystem protection except for EC16 (Figure 10).

Total aluminium values are generally below the ANZECC livestock drinking water level except for EC03, EC06, EC07, EC14, EC22, EC23 and WSMB2S (Figure 11).

Antimony

No guidelines are available for antimony for livestock drinking water. Dissolved antimony values are all below the ANZECC guideline for aquatic ecosystem protection (low reliability trigger) (Figure 12).

Arsenic

Dissolved arsenic values are generally below the ANZECC guideline for aquatic ecosystem protection except for EC07, EC16 and EC17 (Figure 13).

Total arsenic values are all below the ANZECC livestock drinking water level (Figure 14).

Iron

No guidelines are available for iron for livestock drinking water as it poses a very low health risk to animals. In the alluvium, dissolved iron values are mostly above the regional WQO for aquatic ecosystem protection, to the exception of EC19 (Figure 15). Iron values in most alluvium bores are highly variable and there is no indication that spikes may be related to mining activities.

In the Triassic and Permian formations, most bores are below the regional WQO for aquatic ecosystem protection except for WSMB2D, RB06 and Yongala Bore.

Mercury

Total mercury values are all below the ANZECC livestock drinking water level (Figure 16). Dissolved mercury values are all below the ANZECC guideline for aquatic ecosystem protection (Figure 17).

Molybdenum

Total molybdenum values are all below the ANZECC livestock drinking water level (Figure 18). Dissolved molybdenum values are all below the ANZECC guideline for aquatic ecosystem protection (low reliability trigger) (Figure 19).

Selenium

Total selenium values are generally below the ANZECC livestock drinking water level except for EC05 (Figure 20). Dissolved selenium values are generally below the ANZECC guideline for aquatic ecosystem protection except for EC05 (Figure 21).

Silver

No guidelines are available for silver for livestock drinking water. Dissolved silver values are below the limit of reporting (LoR) for Triassic and Permian bore but above for most alluvium bores (EC01, EC02, EC04, EC05, EC06, EC17, EC19, EC22 and EC23) (Figure 22). As the LoR is above the ANZECC guideline for aquatic ecosystem protection, exceedance for bores below LoR cannot be assessed.

Figure 1: Electrical Conductivity Boxplot

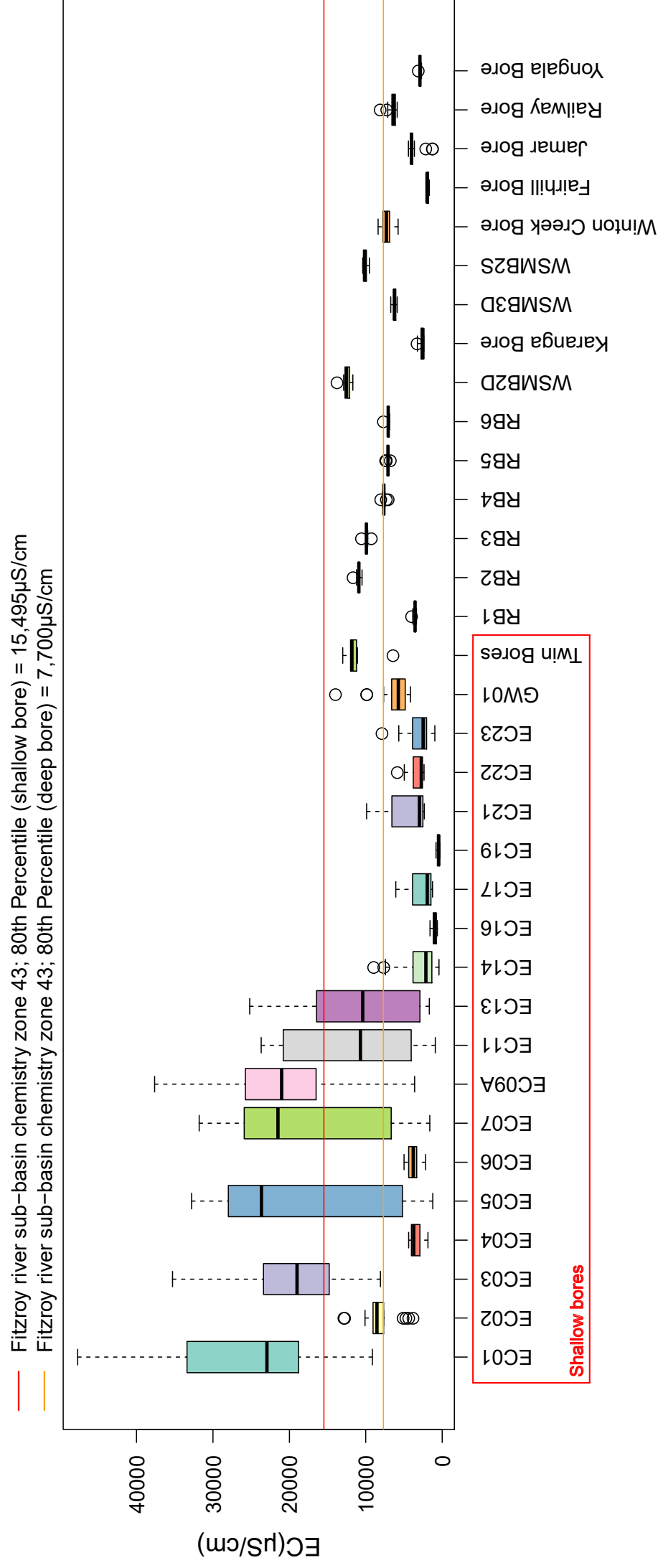


Figure 2: Total Dissolved Solids Boxplot

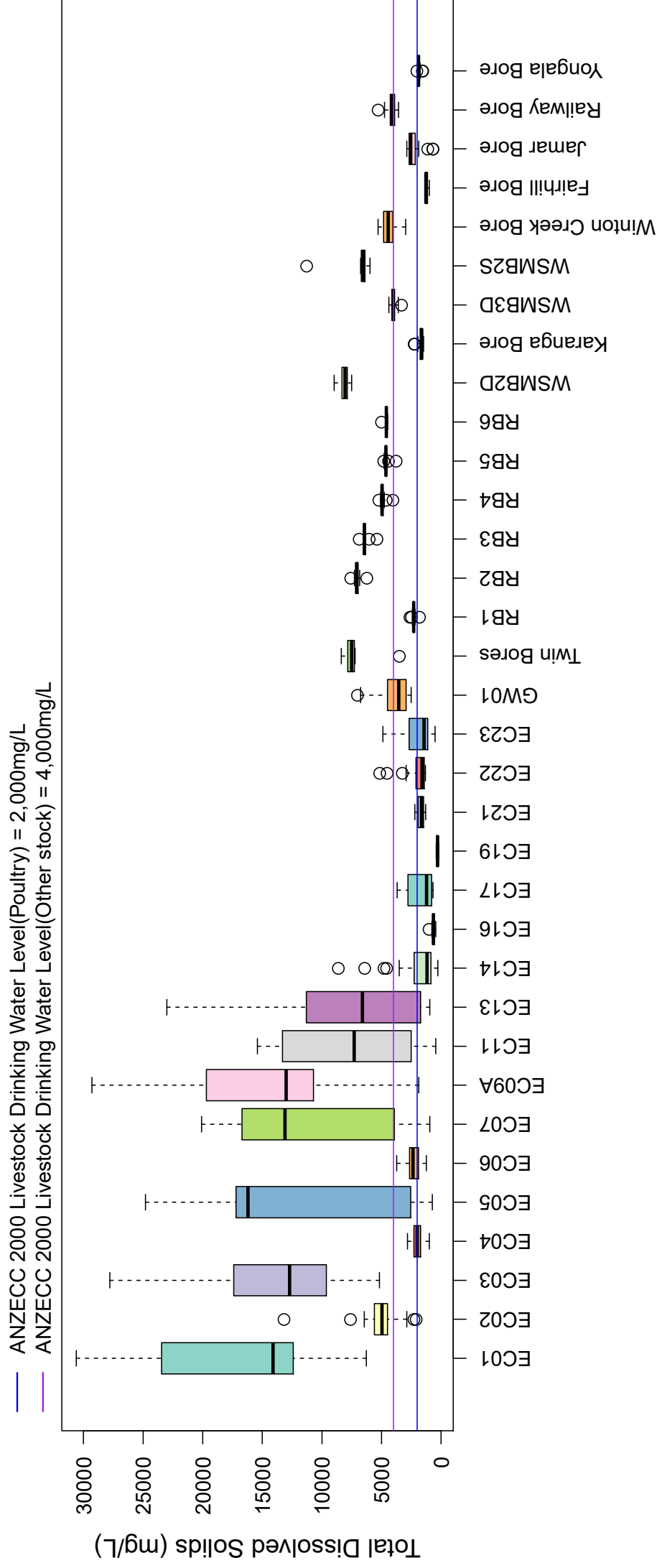


Figure 3: pH Boxplot

- Fitzroy river sub-basin chemistry zone 43; 20th – 80th Percentile (deep bore) = 7.7 – 8.4
- Fitzroy river sub-basin chemistry zone 43; 20th – 80th Percentile (shallow bore) = 7.1 – 8.2
- DEHP (2011) Aquatic Ecosystem Protection (95%) – Lower Nogoa River = 6.5–8.5

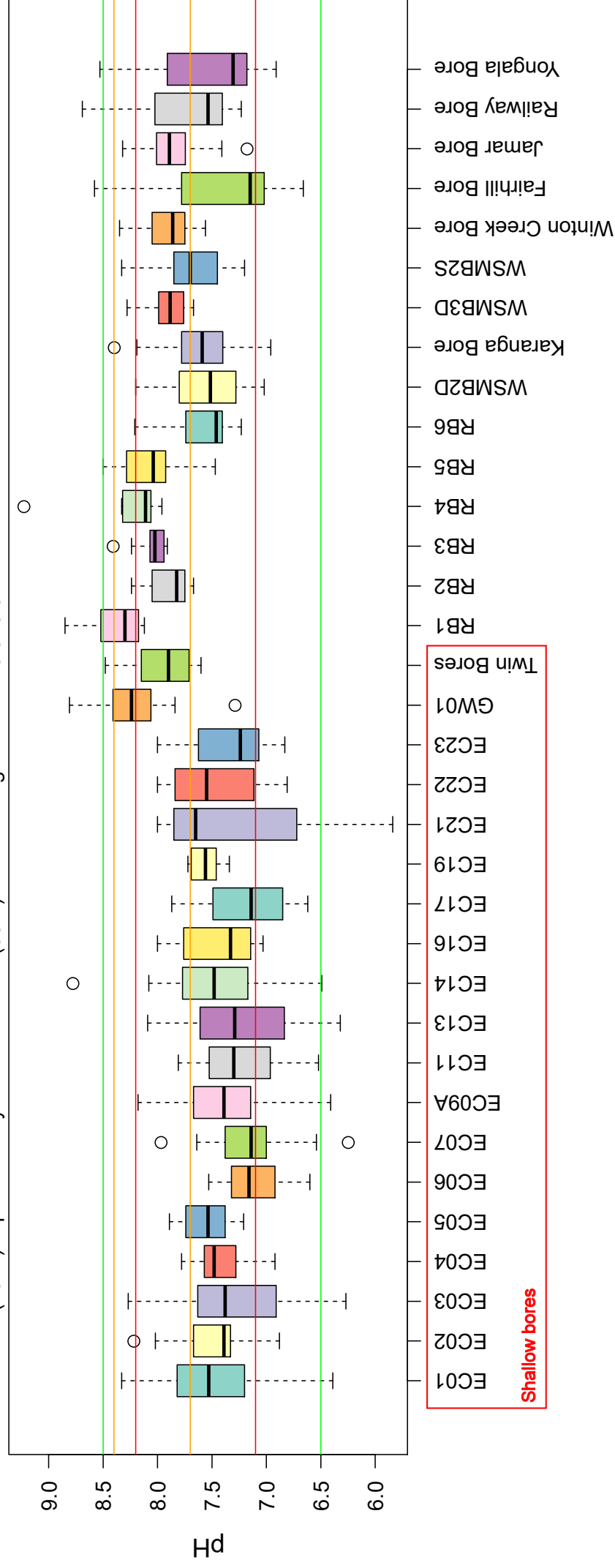


Figure 4: Calcium Boxplot

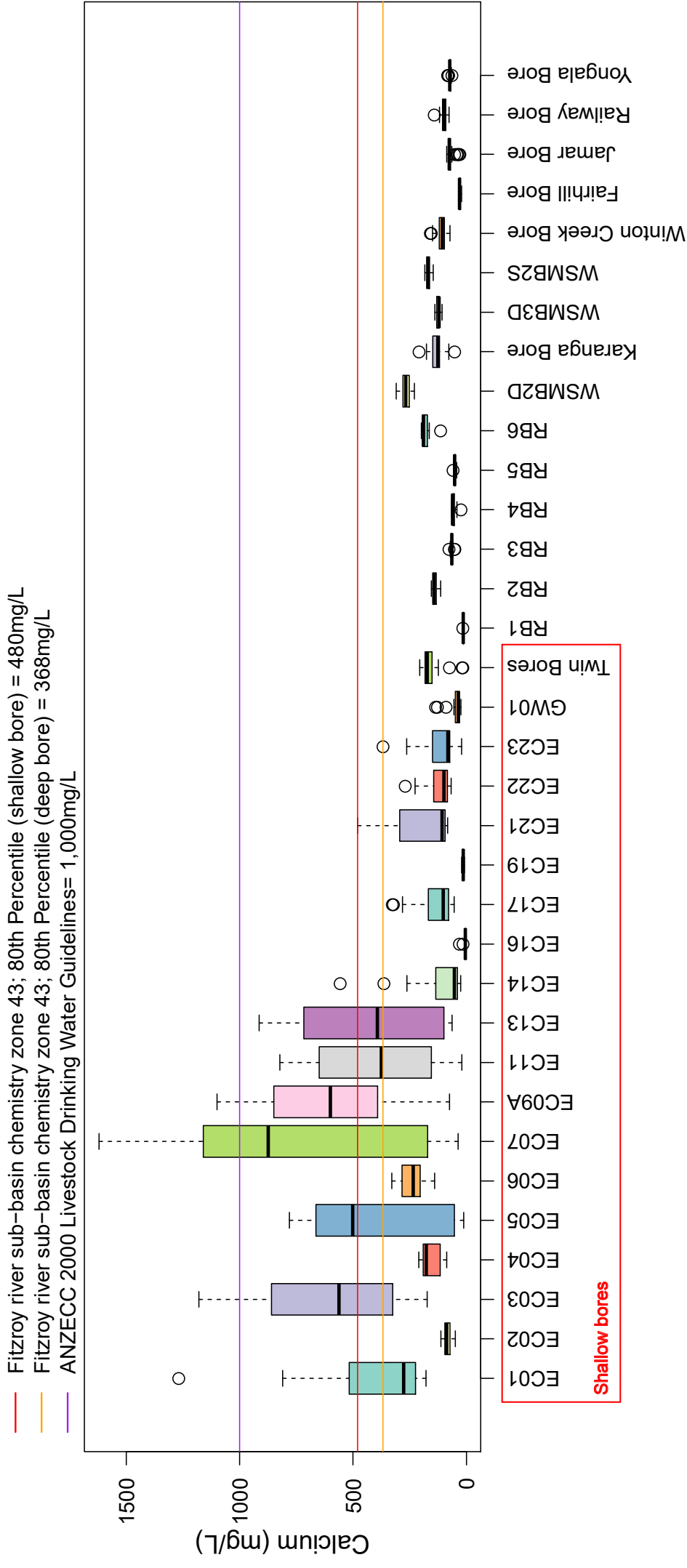


Figure 5: Magnesium Boxplot

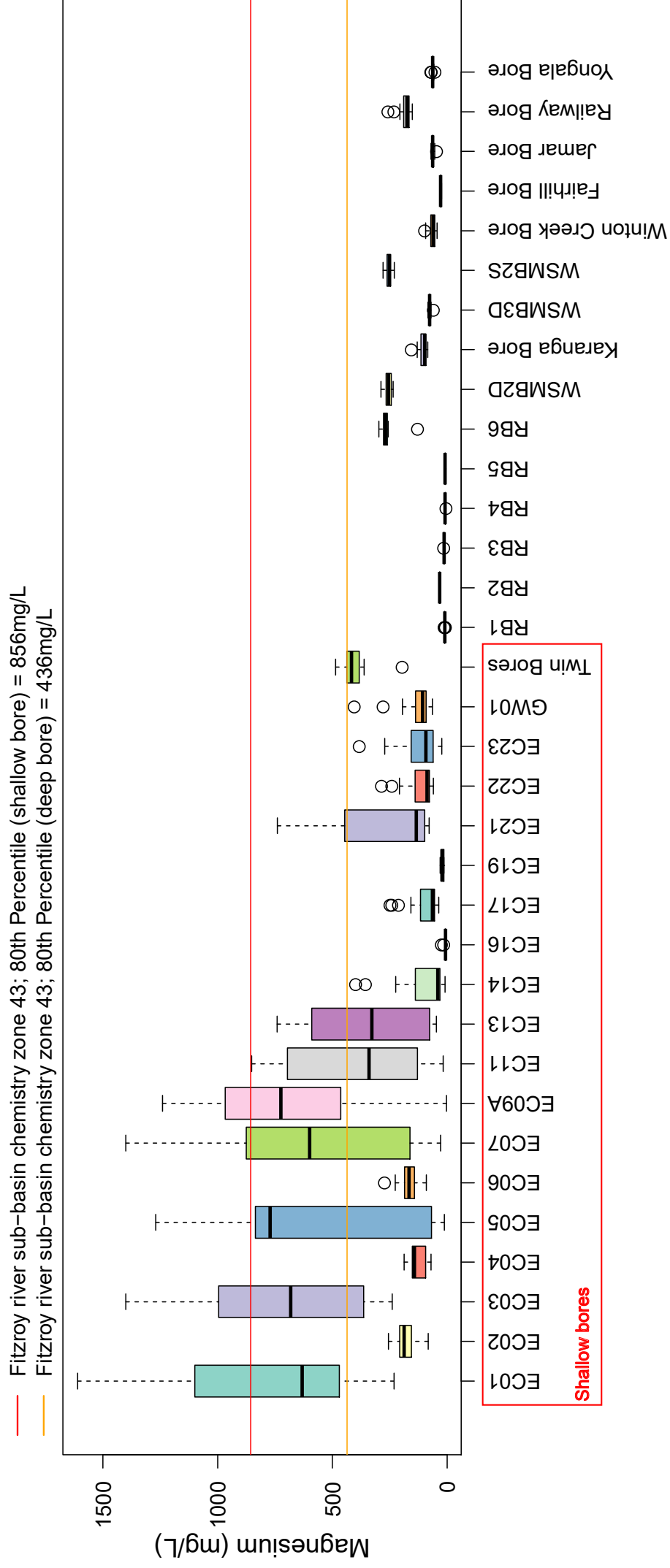


Figure 6: Sodium Boxplot

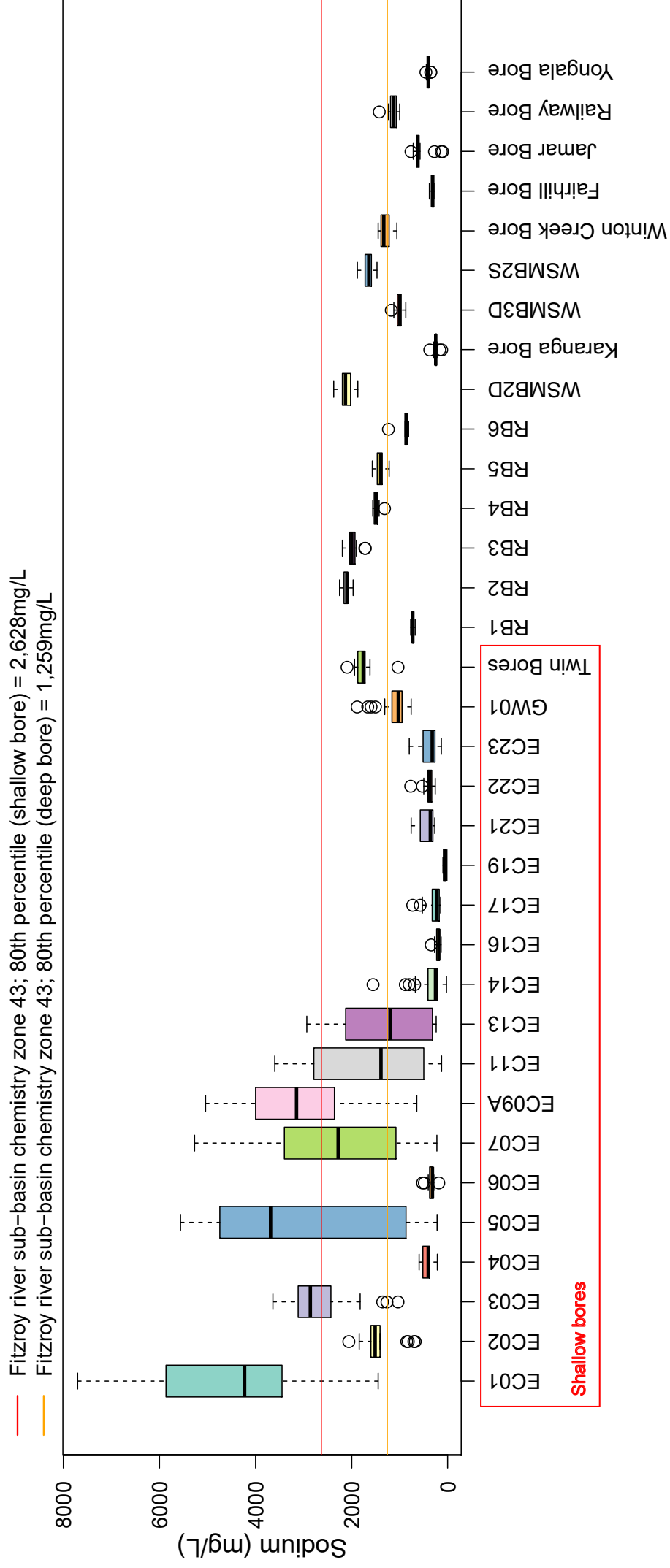


Figure 7: Chloride Boxplot

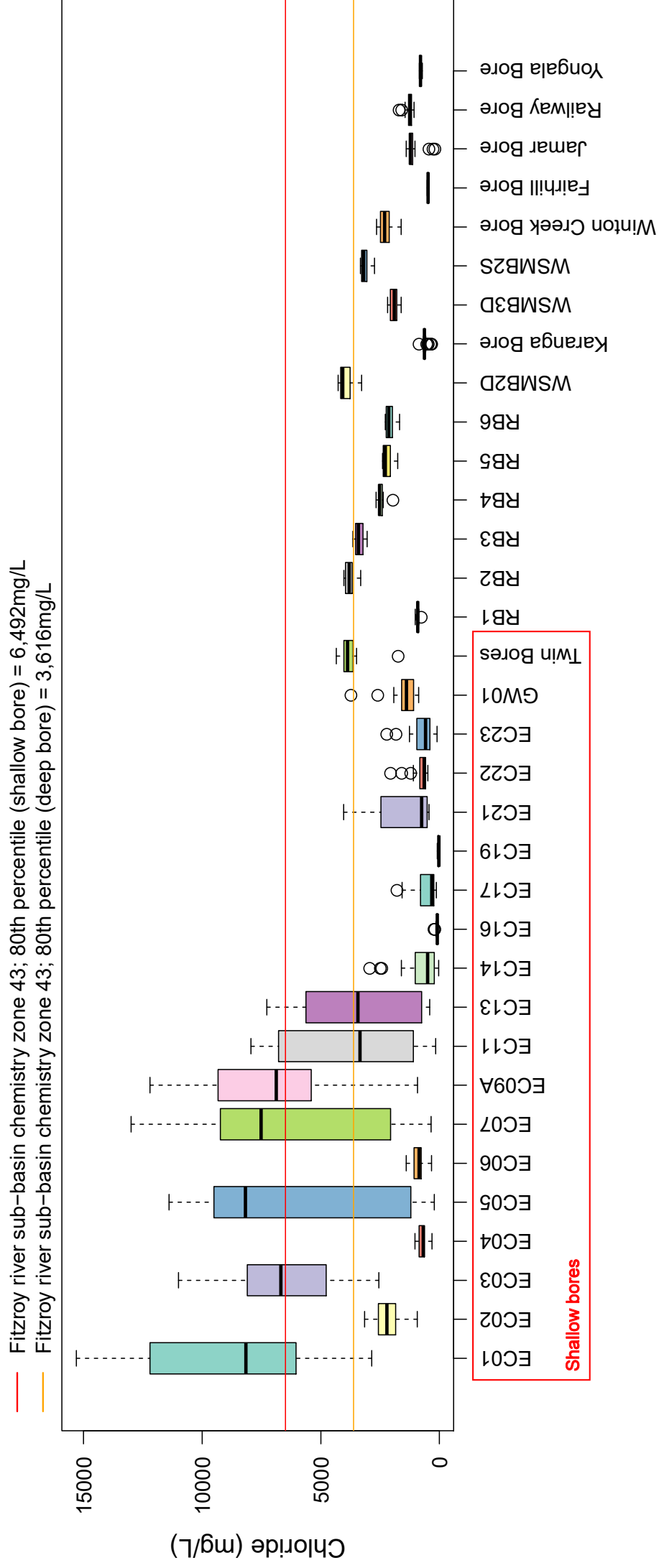


Figure 8: Sulfate Boxplot

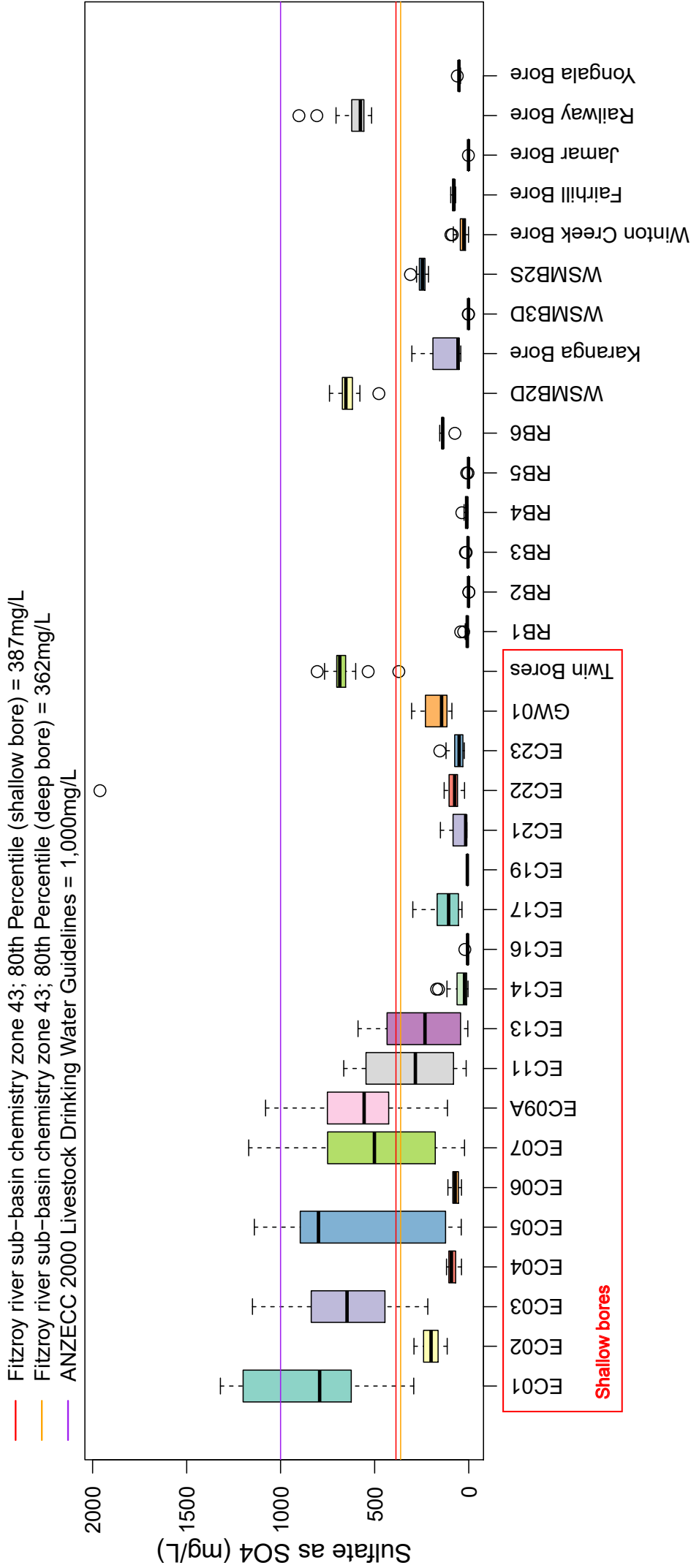


Figure 9: Bicarbonate Boxplot

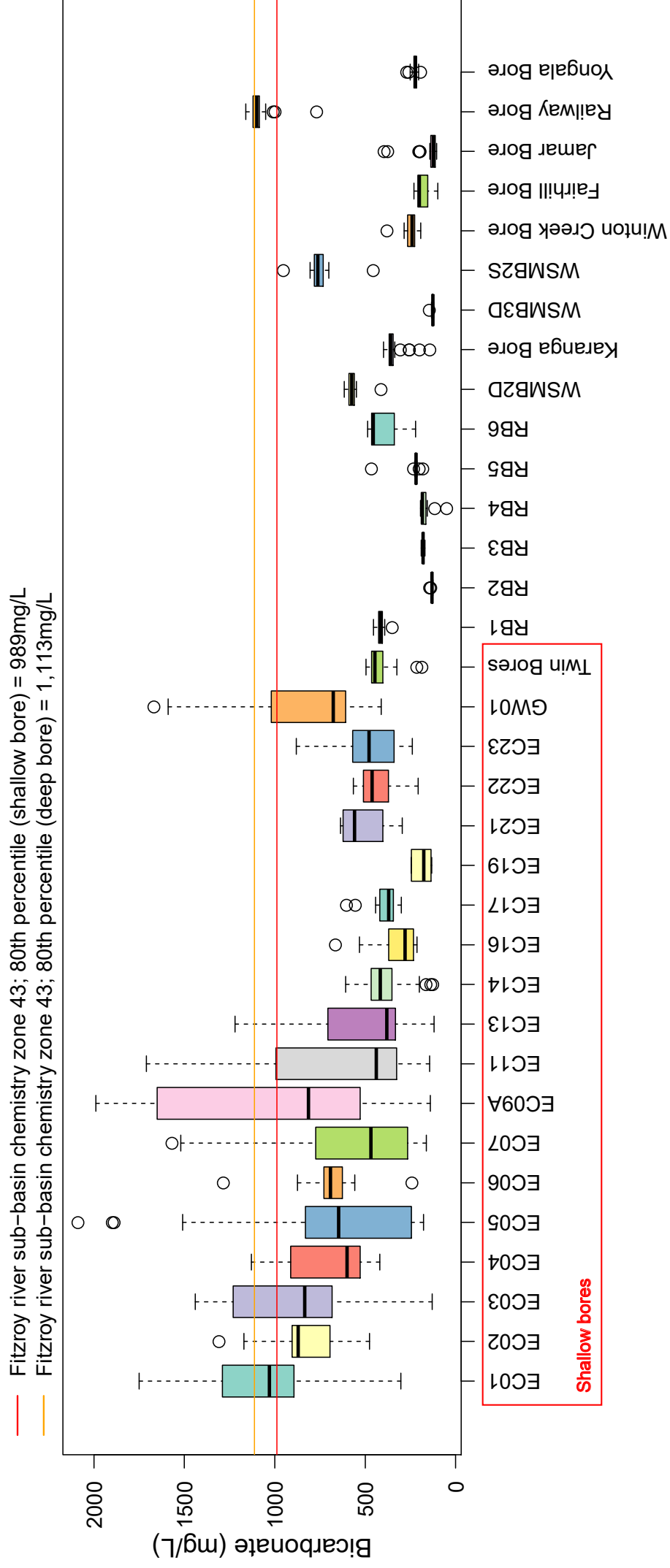


Figure 10: Aluminium (dissolved) Boxplot

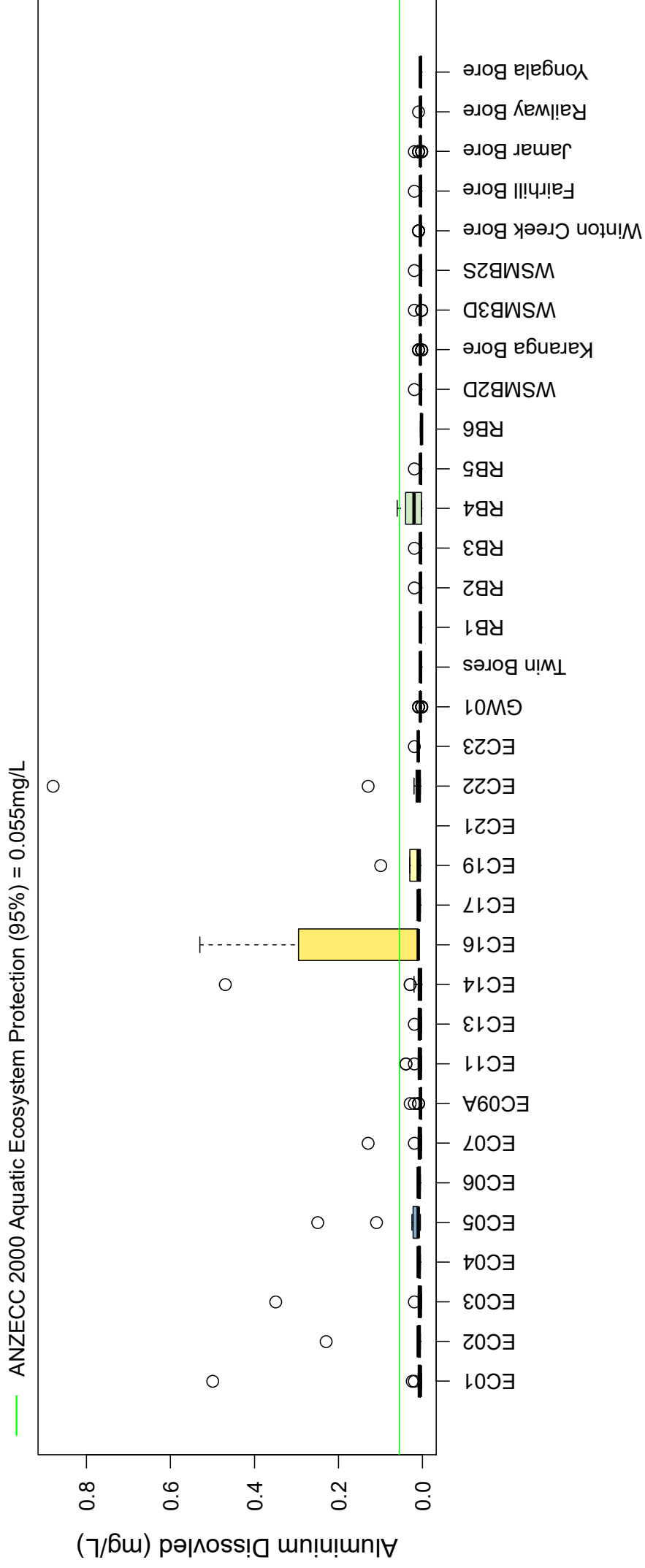


Figure 11: Aluminium (total) Boxplot

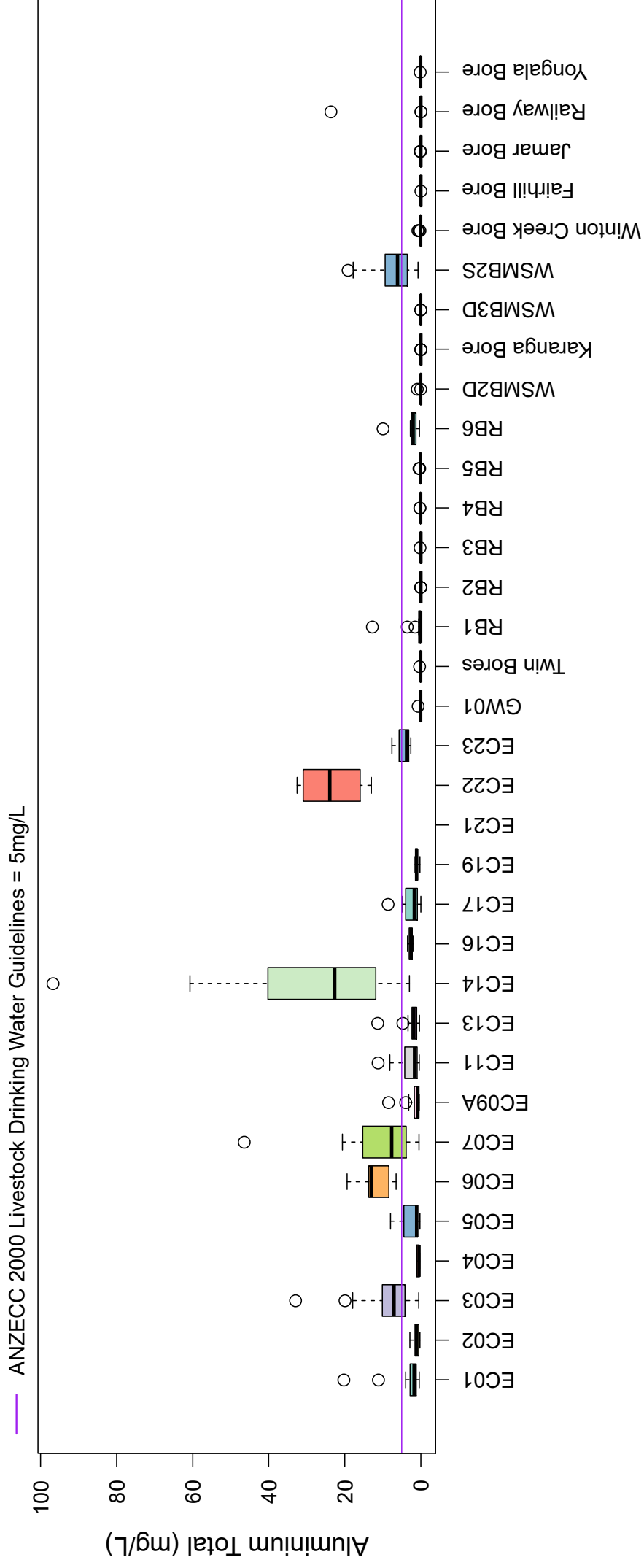


Figure 12: Antimony (dissolved) Boxplot

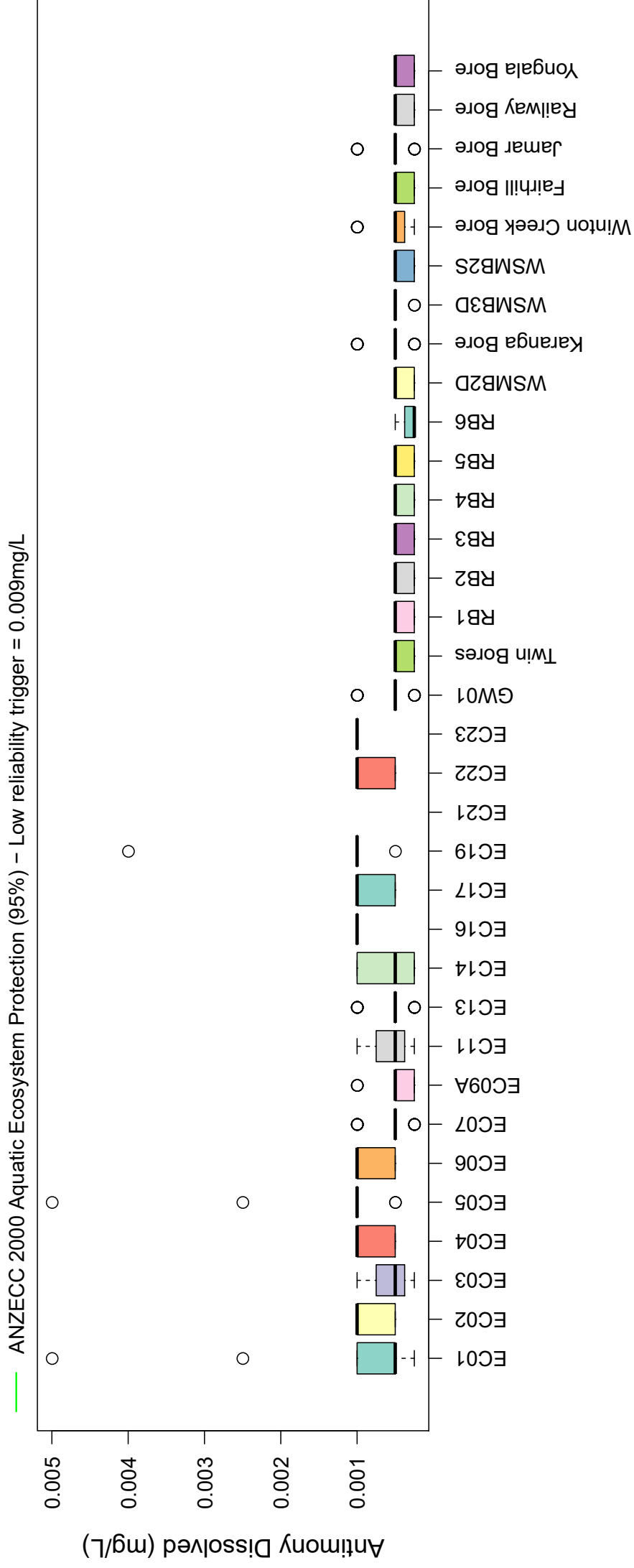


Figure 13: Arsenic (dissolved) Boxplot

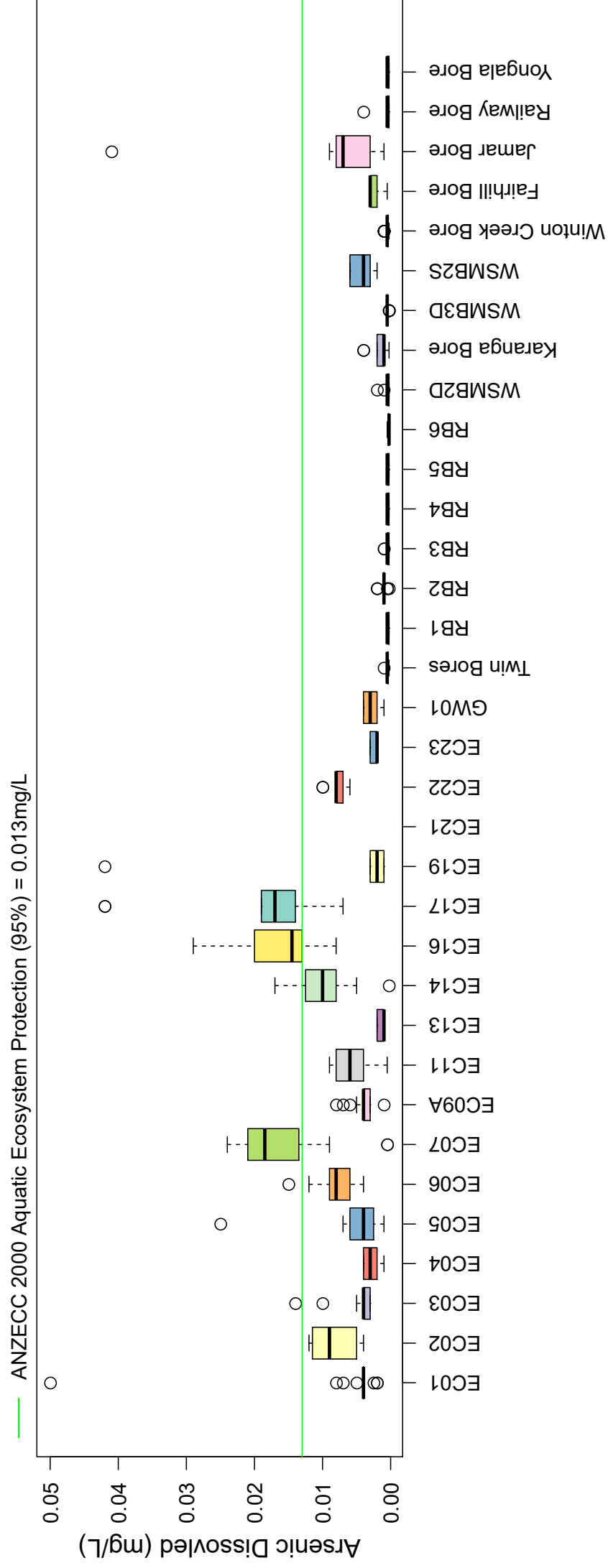


Figure 14: Arsenic (total) Boxplot

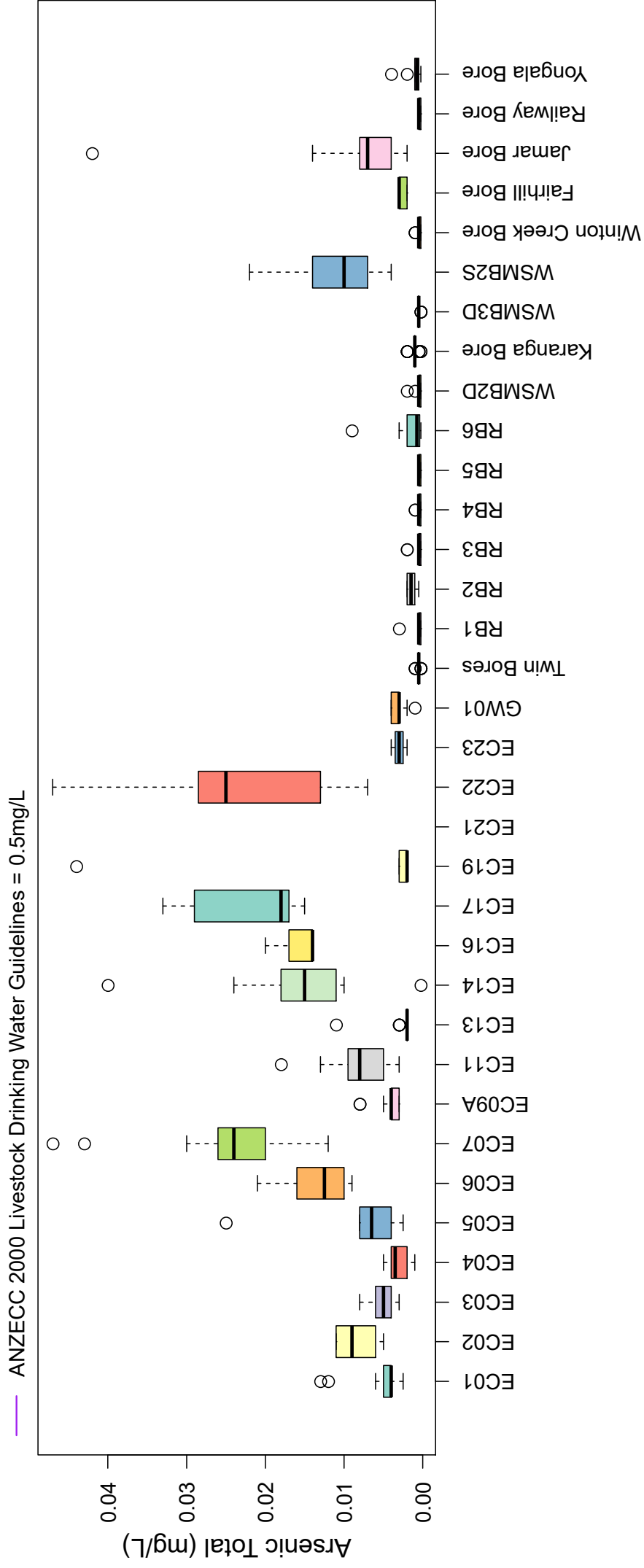


Figure 15: Iron (dissolved) Boxplot

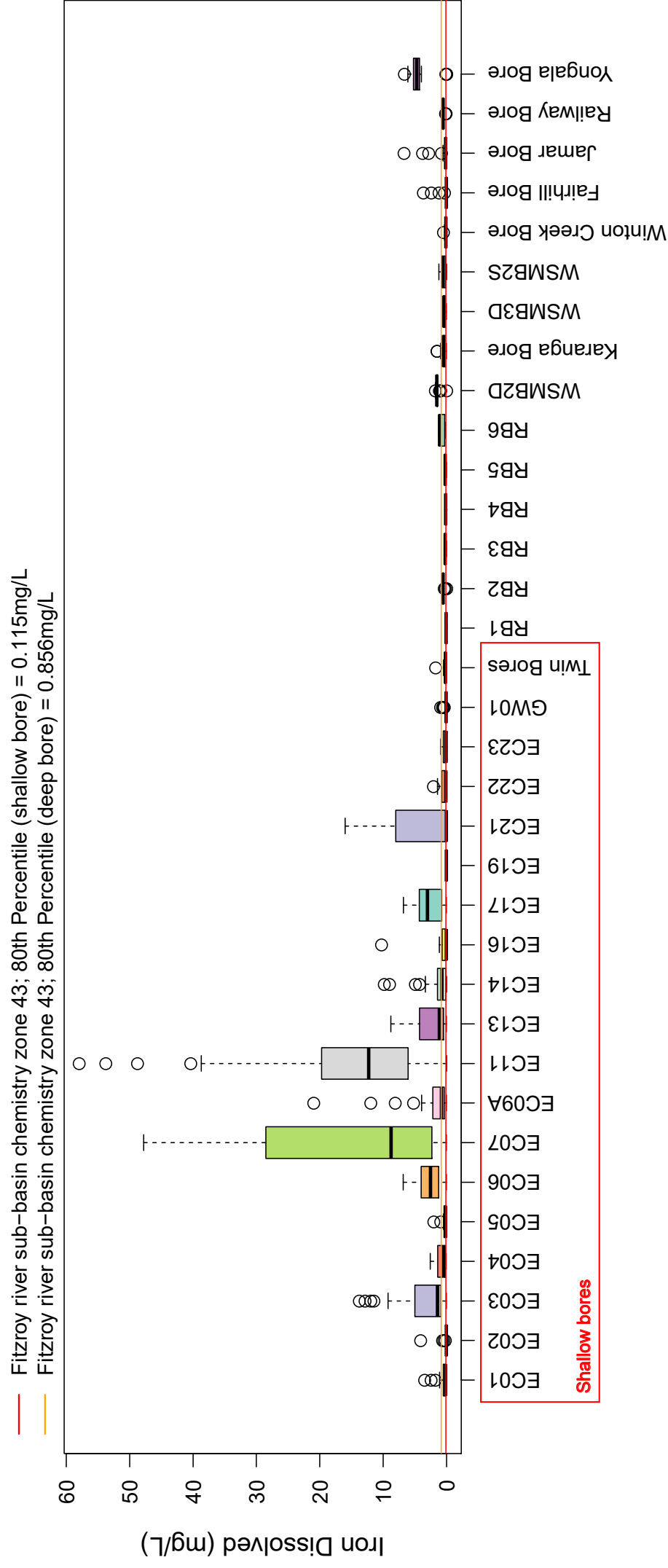


Figure 16: Mercury (total) Boxplot

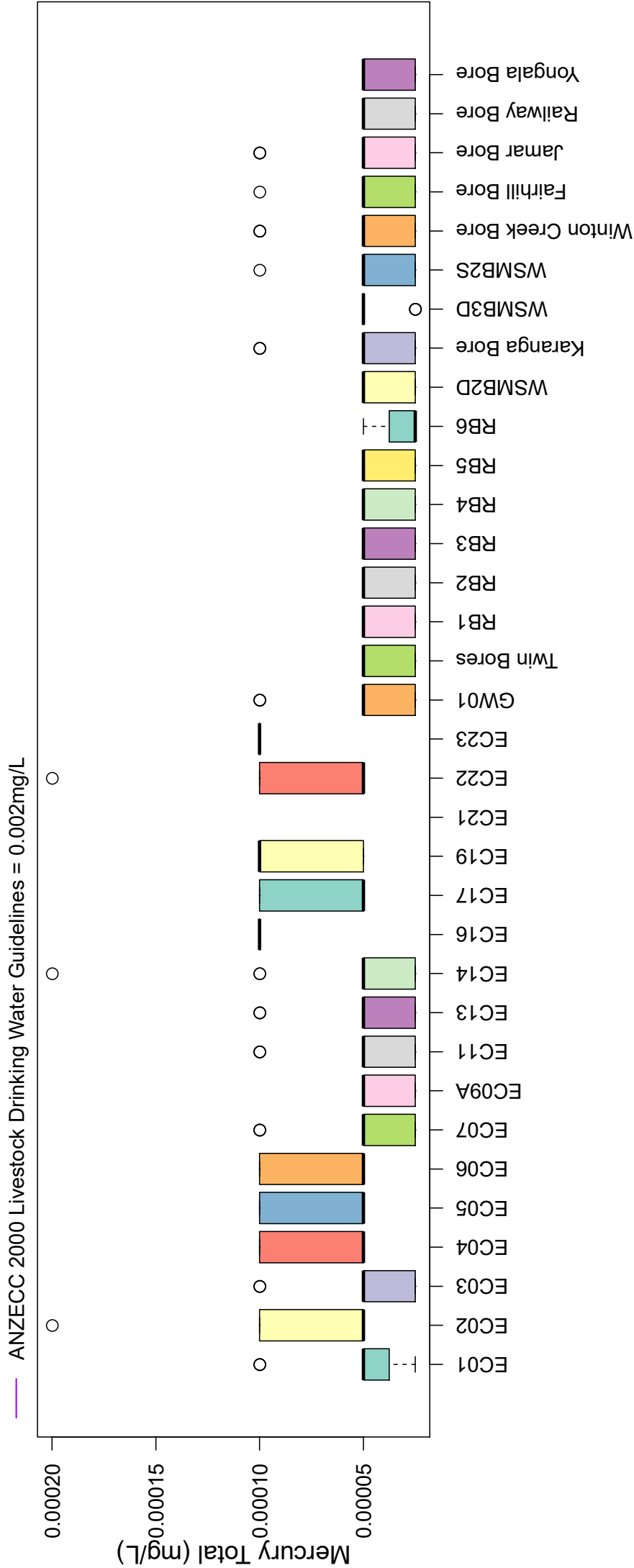


Figure 17: Mercury (dissolved) Boxplot

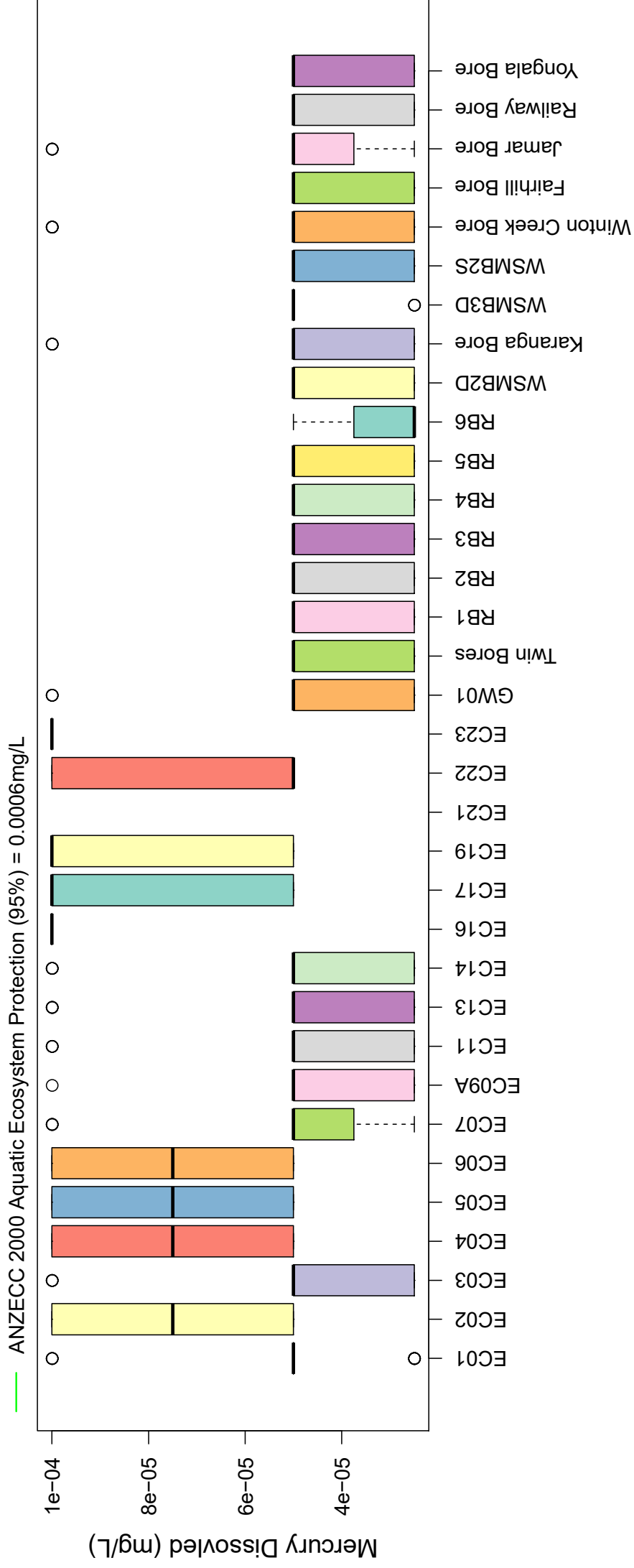


Figure 18: Molybdenum (total) Boxplot

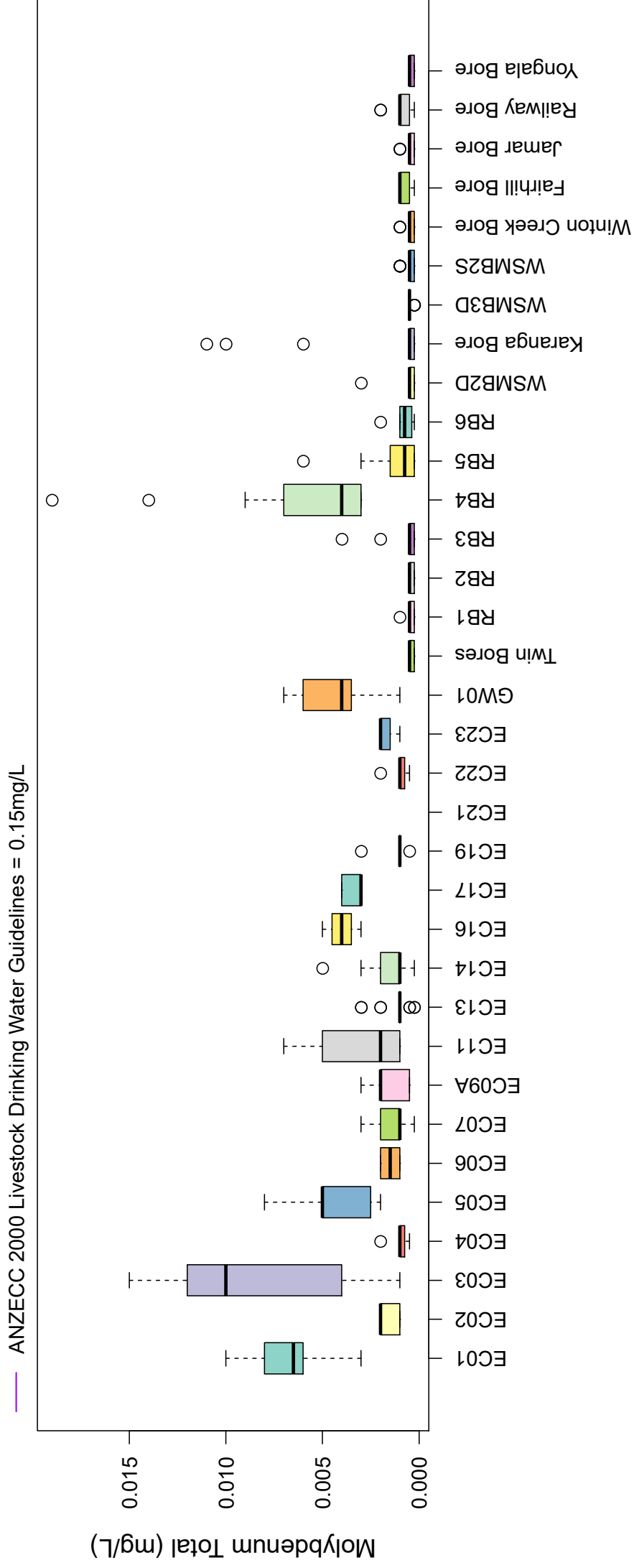


Figure 19: Molybdenum (dissolved) Boxplot

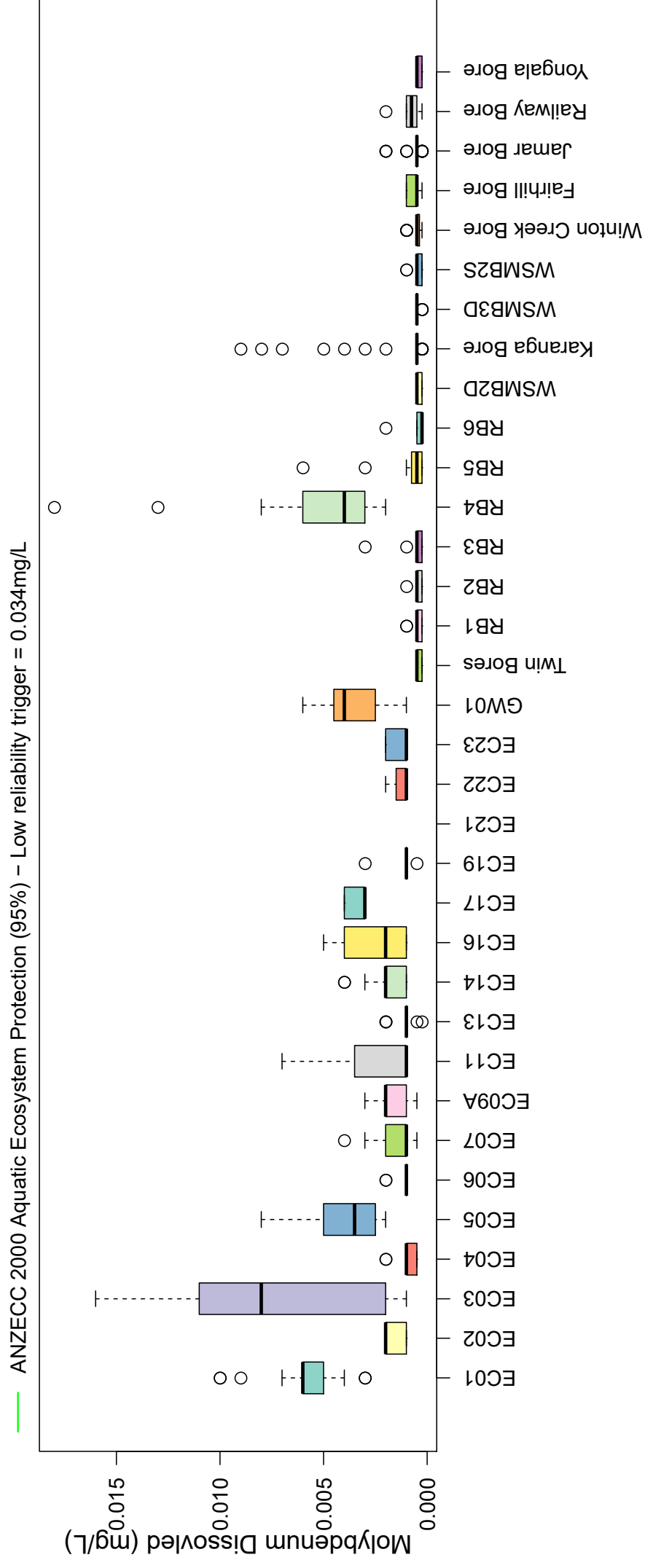


Figure 20: Selenium (total) Boxplot

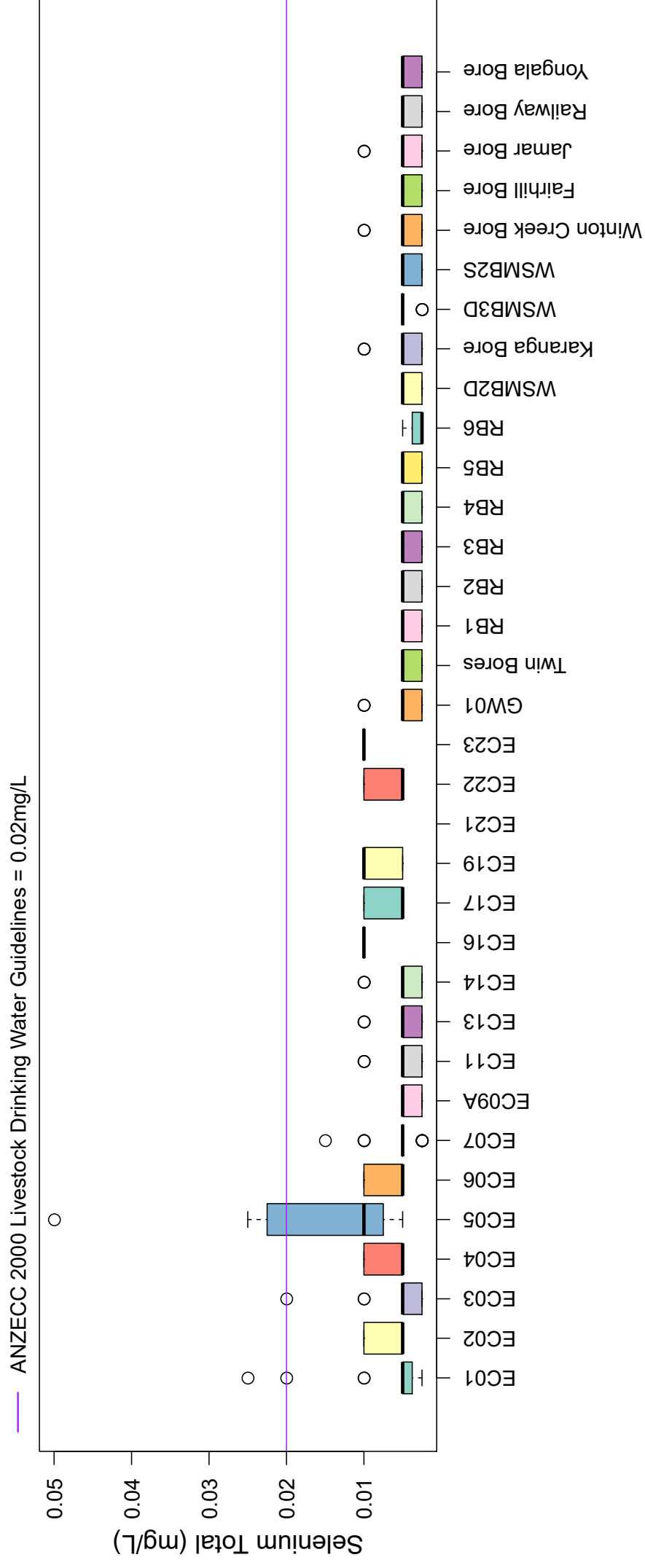


Figure 21: Selenium (dissolved) Boxplot

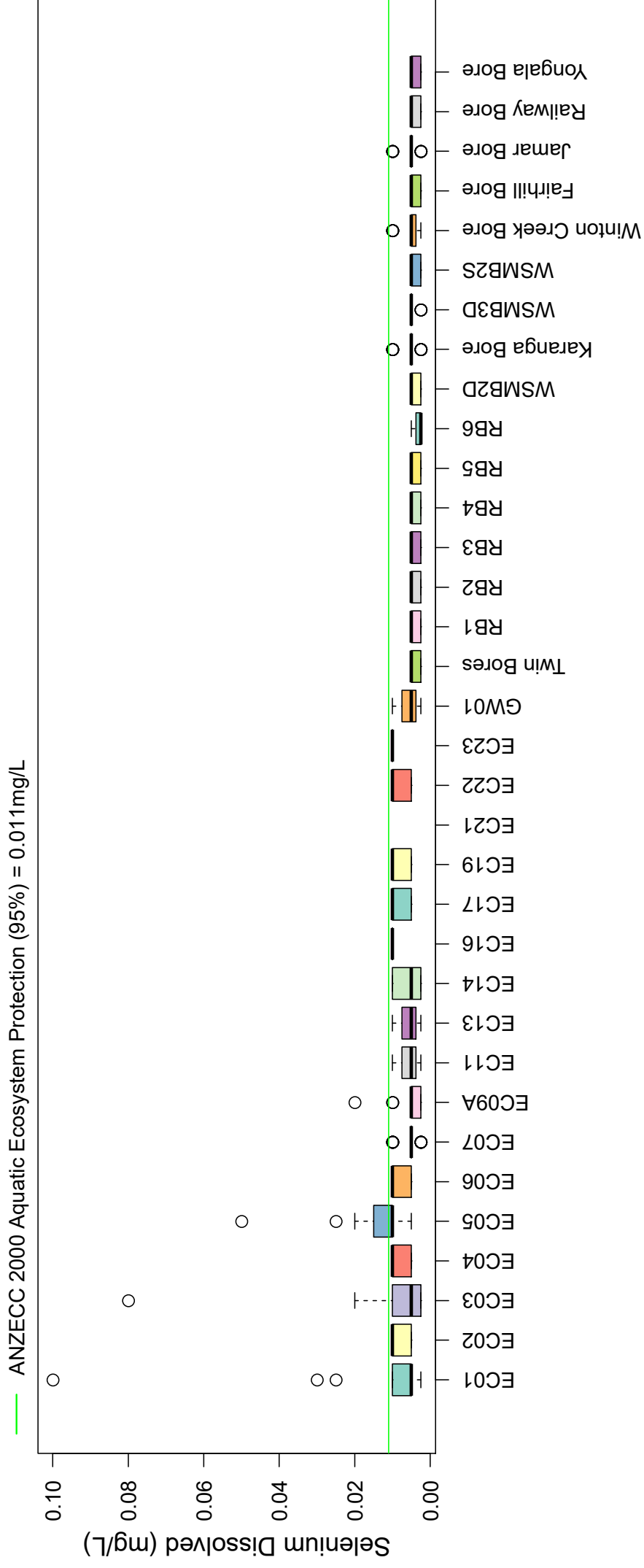
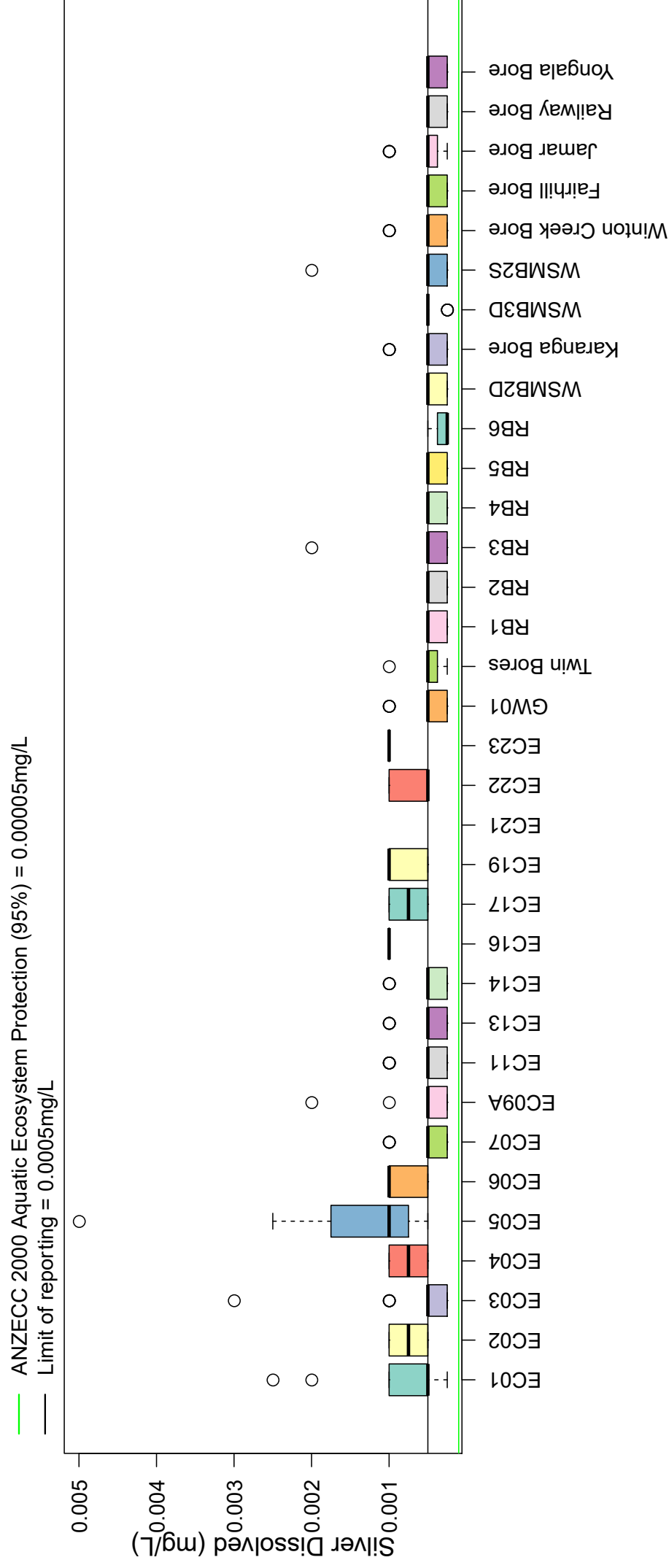


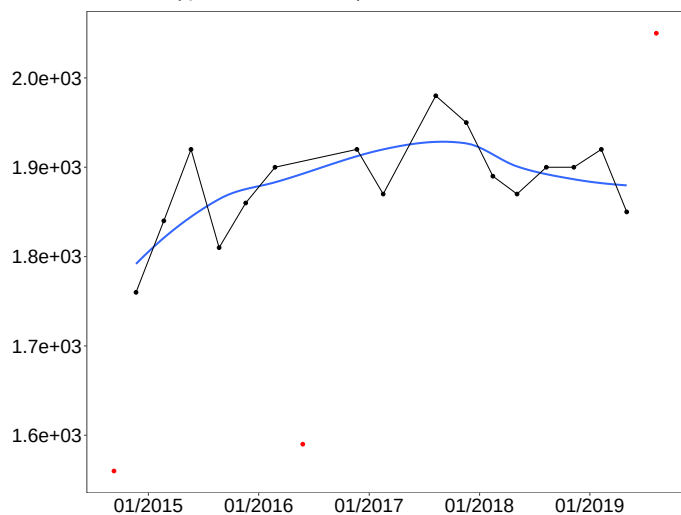
Figure 22: Silver (dissolved) Boxplot



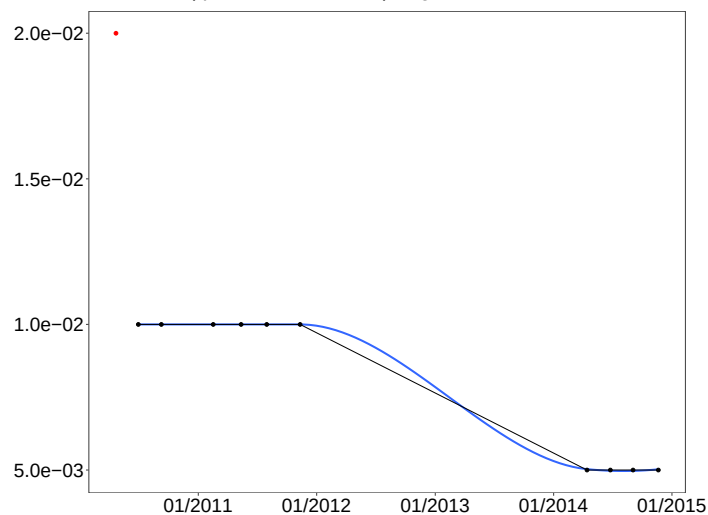
APPENDIX E

Water quality parameters – time series

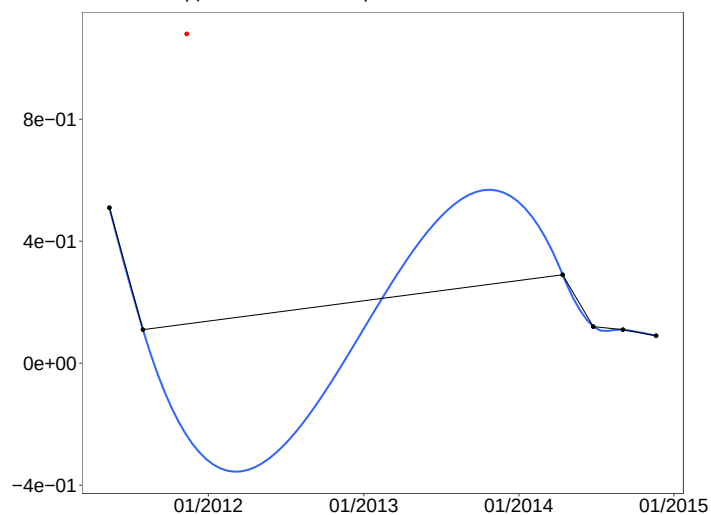
Yongala Bore – TDS
 $\tau = 0.418$ | p-value = 0.0152 | Positive trend



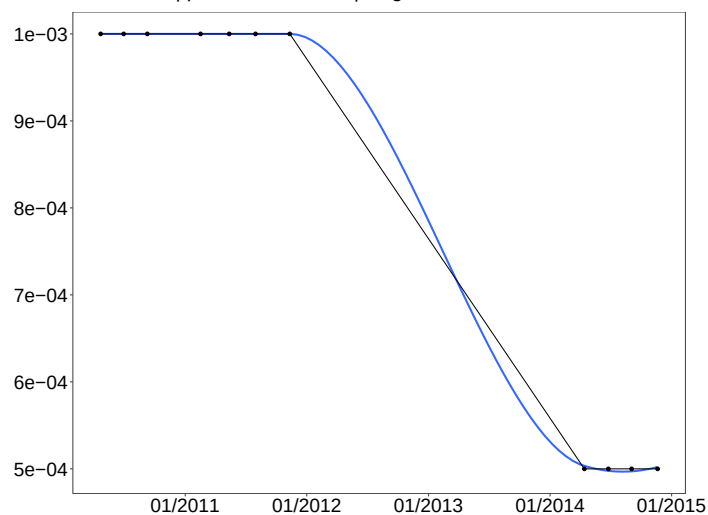
13020177 – Aluminium (d.)
 $\tau = -0.786$ | p-value = 0.00354 | Negative trend



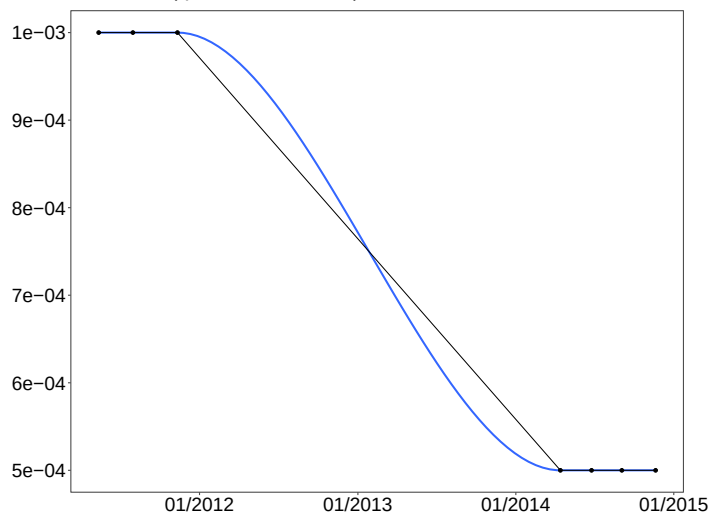
13020177 – Aluminium (t.)
 $\tau = -0.586$ | p-value = 0.0947 | No trend



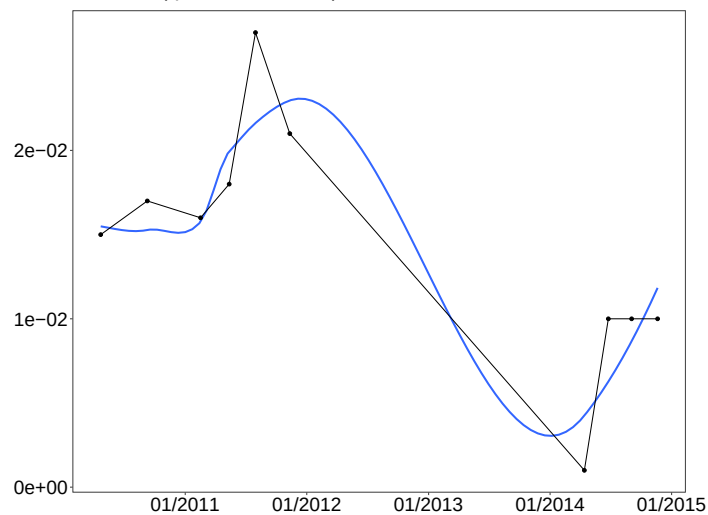
13020177 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



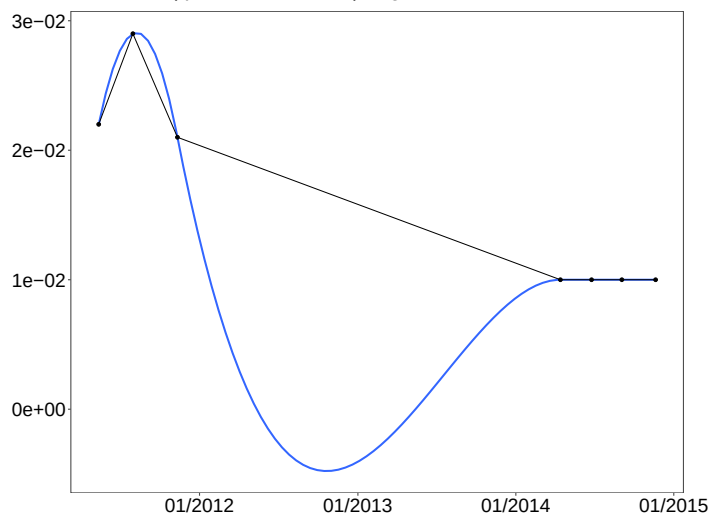
13020177 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



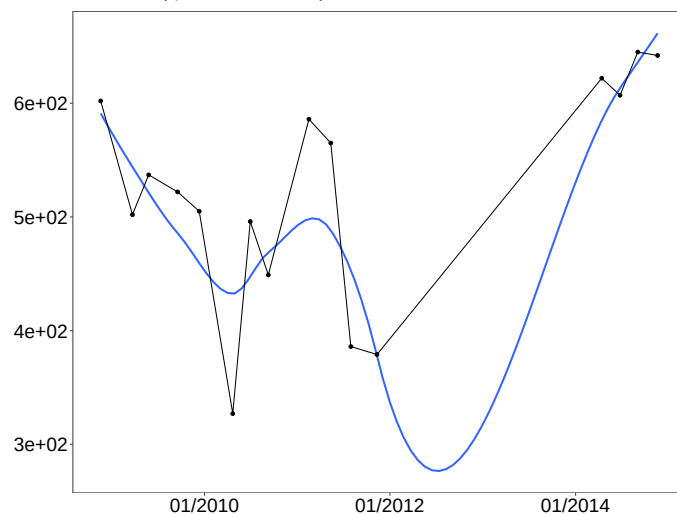
13020177 – Arsenic (d.)
 $\tau = -0.23$ | p-value = 0.414 | No trend



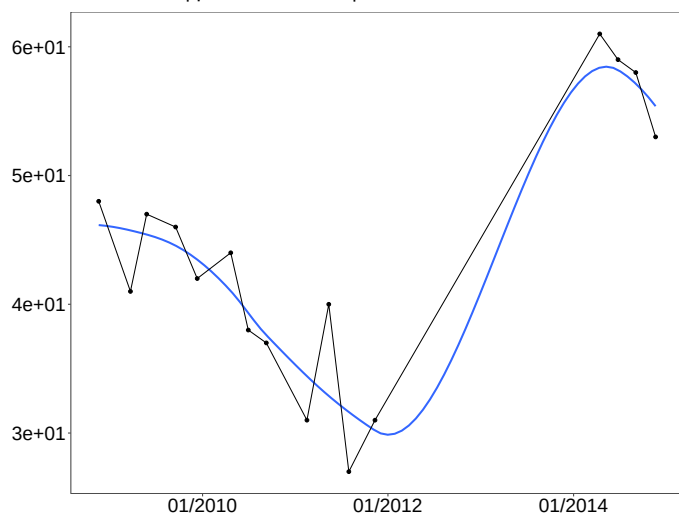
13020177 – Arsenic (t.)
 $\tau = -0.732$ | p-value = 0.0445 | Negative trend



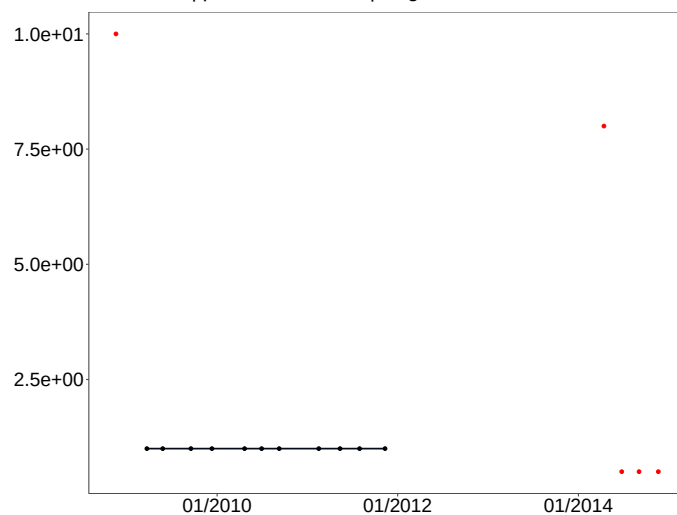
13020177 – Bicarbonate
 $\tau = 0.217$ | p-value = 0.26 | No trend



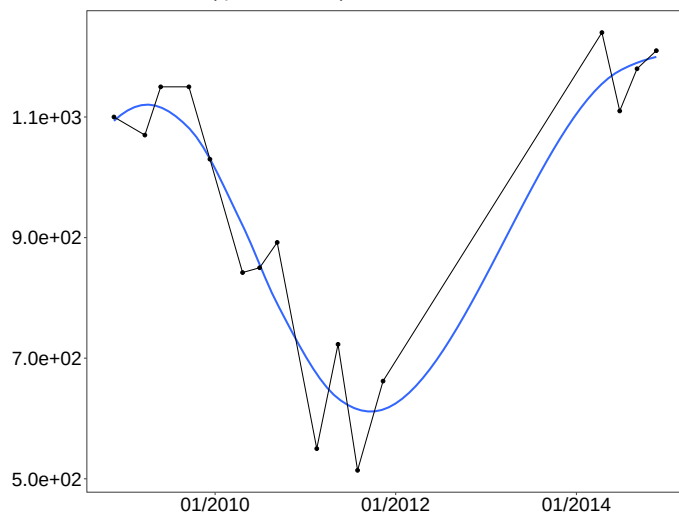
13020177 – Calcium
 $\tau = -0.0418$ | p-value = 0.857 | No trend



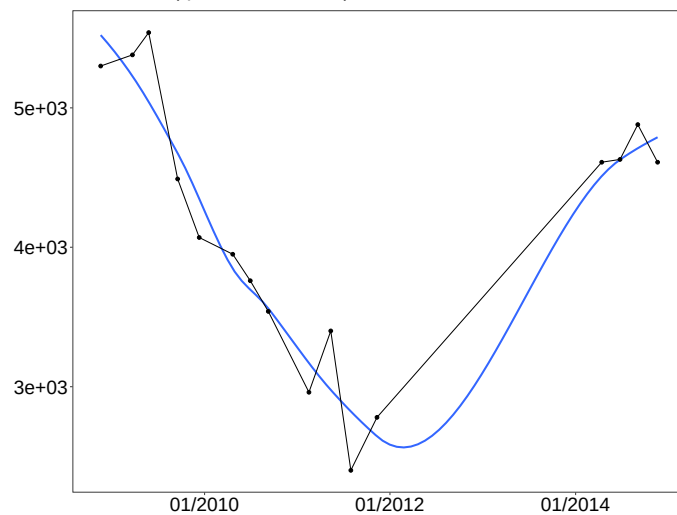
13020177 – Carbonate
 $\tau = -0.464$ | p-value = 0.0304 | Negative trend



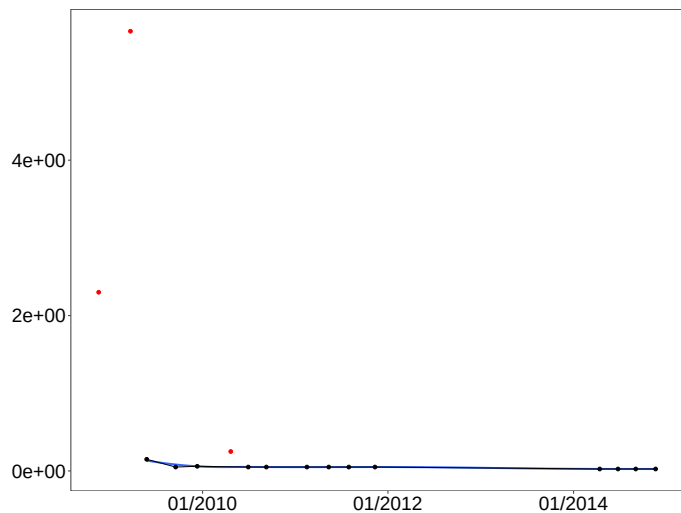
13020177 – Chloride
 $\tau = -0.00837$ | p-value = 1 | No trend



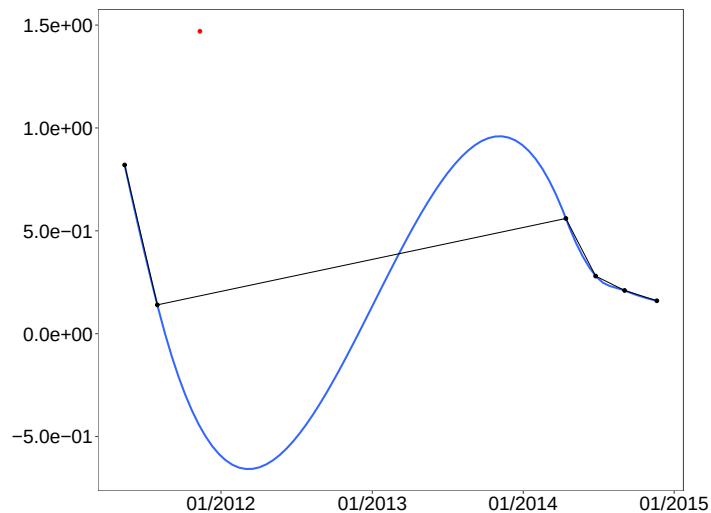
13020177 – Electrical Conductivity
 $\tau = -0.259$ | p-value = 0.176 | No trend



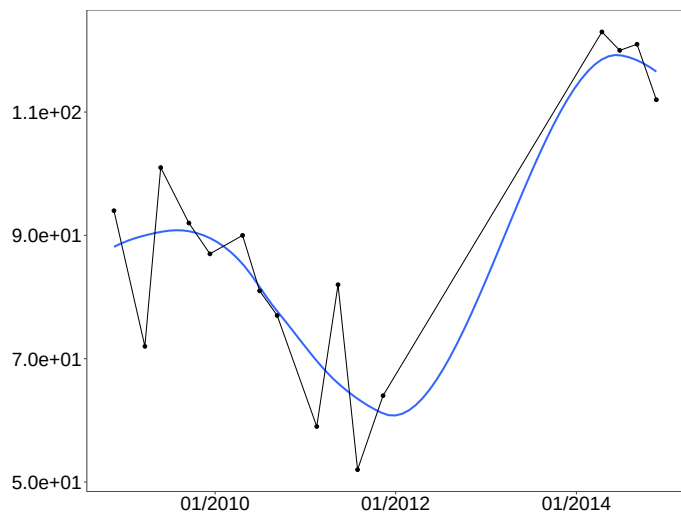
13020177 – Iron (d.)
 $\tau = -0.786$ | p-value = 0.0000932 | Negative trend



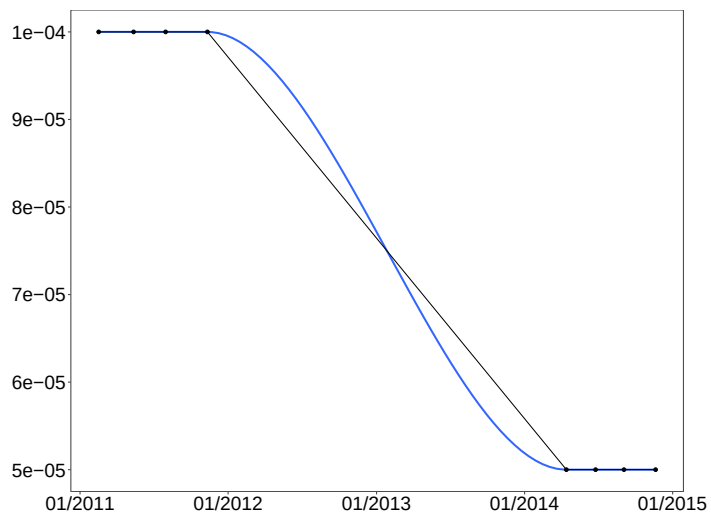
13020177 – Iron (t.)
 $\tau = -0.429$ | p-value = 0.23 | No trend



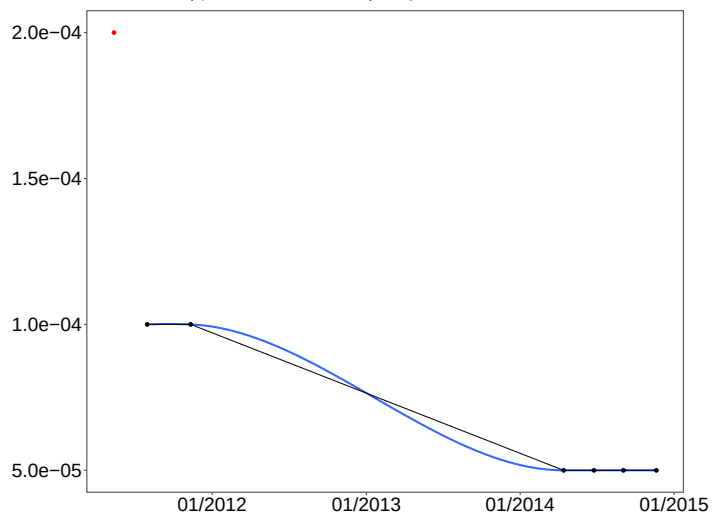
13020177 – Magnesium
 $\tau = 0.05$ | p-value = 0.822 | No trend



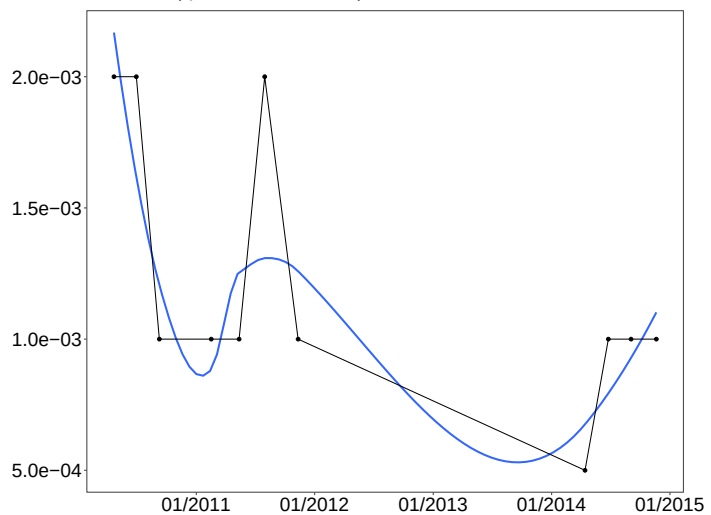
13020177 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



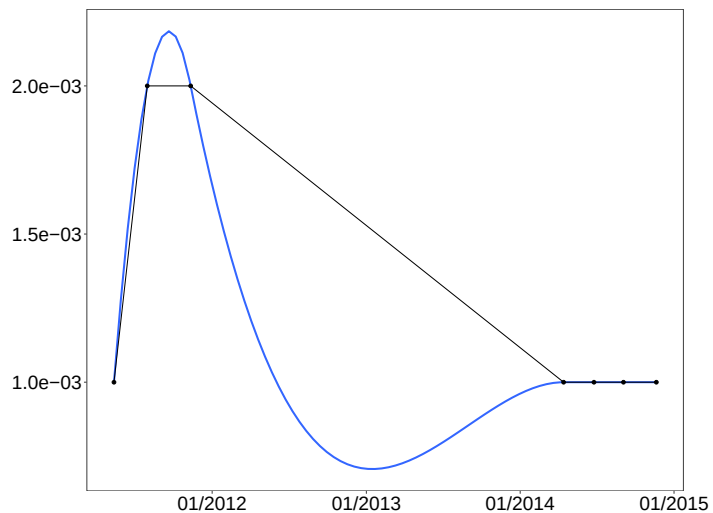
13020177 – Mercury (t.)
 $\tau = -0.816$ | p-value = 0.0272 | Negative trend



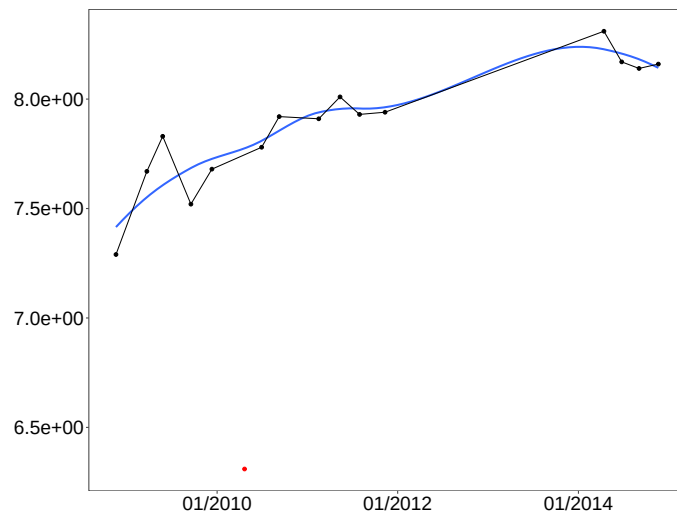
13020177 – Molybdenum (d.)
 $\tau = -0.46$ | p-value = 0.0961 | No trend



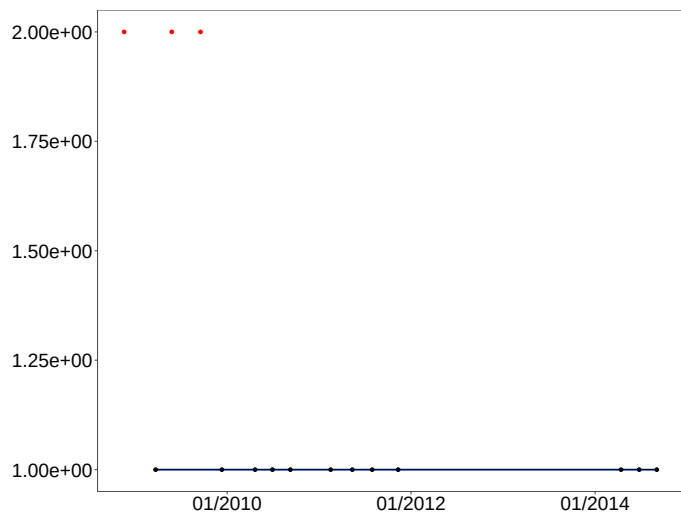
13020177 – Molybdenum (t.)
 $\tau = -0.414$ | p-value = 0.333 | No trend



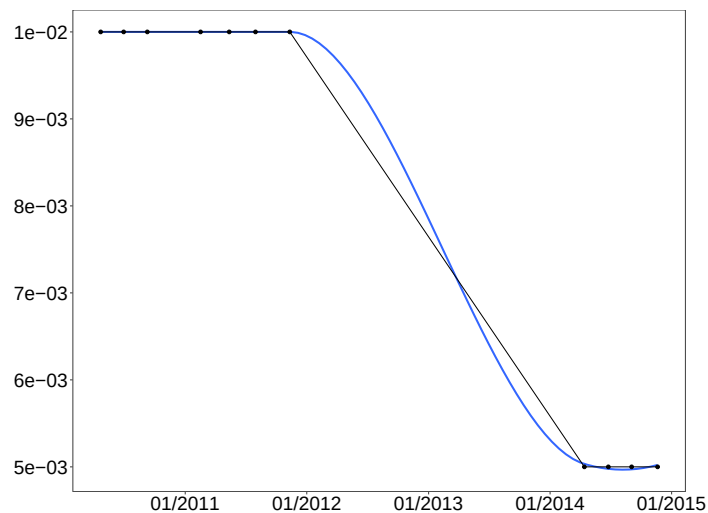
13020177 – pH
 $\tau = 0.717$ | p-value = 0.00013 | Positive trend



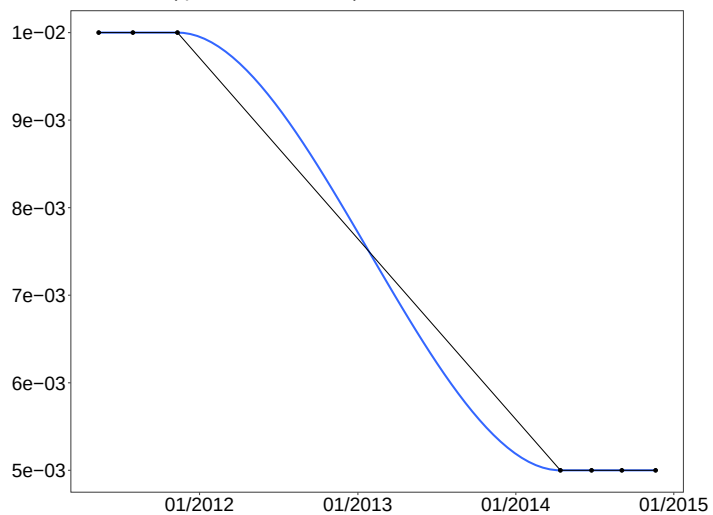
13020177 – Potassium
 $\tau = -0.52$ | p-value = 0.0253 | Negative trend



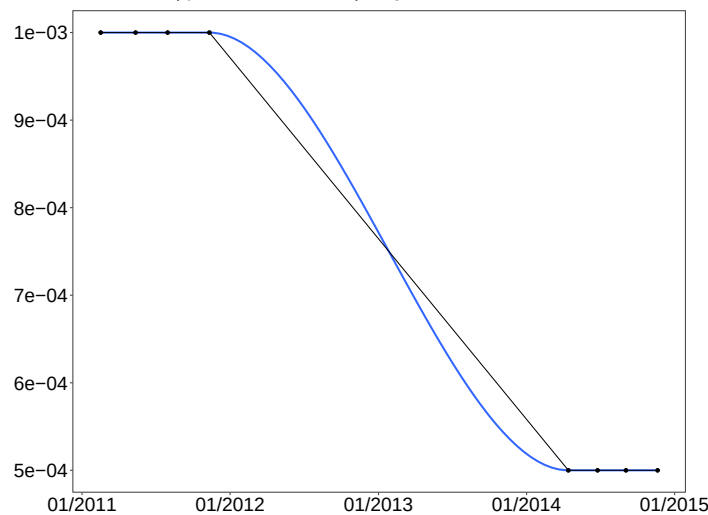
13020177 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



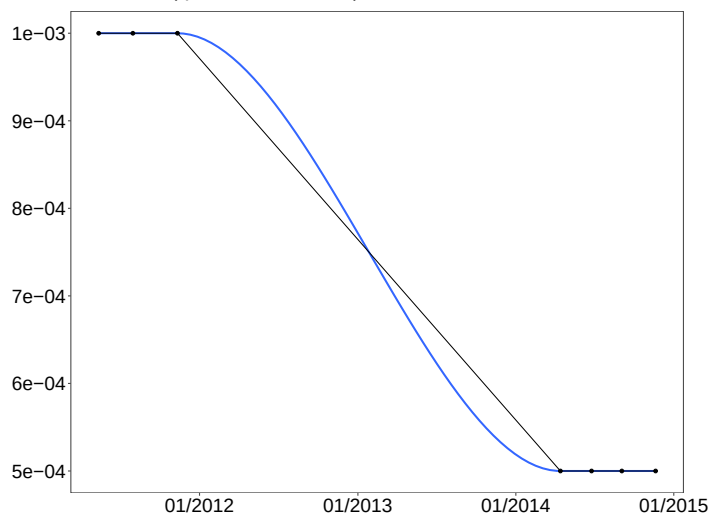
13020177 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



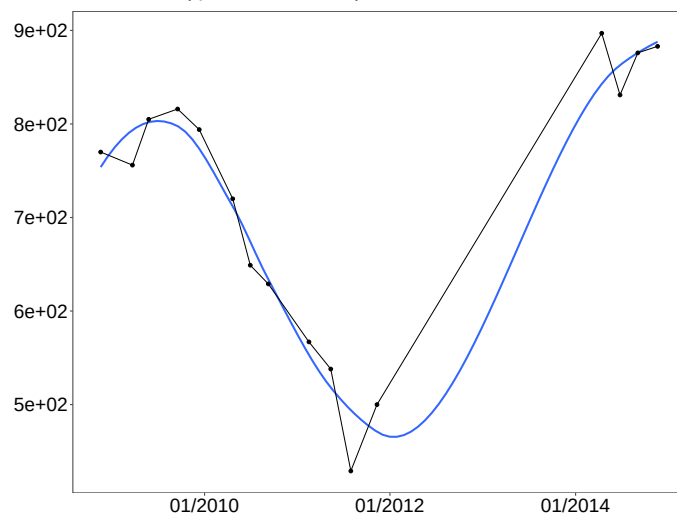
13020177 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



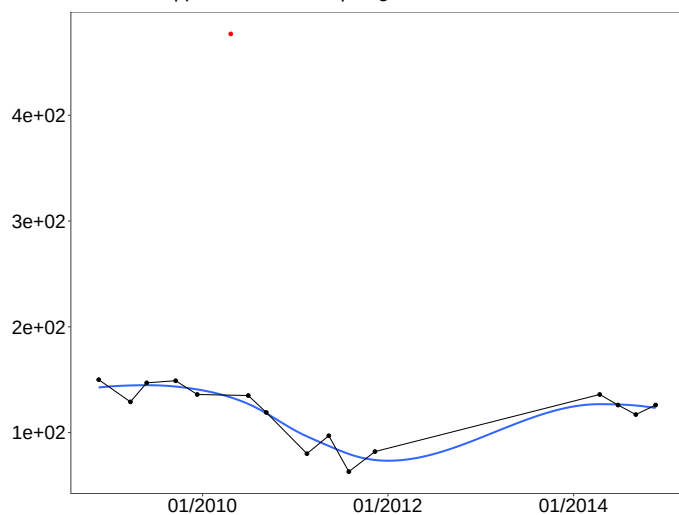
13020177 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



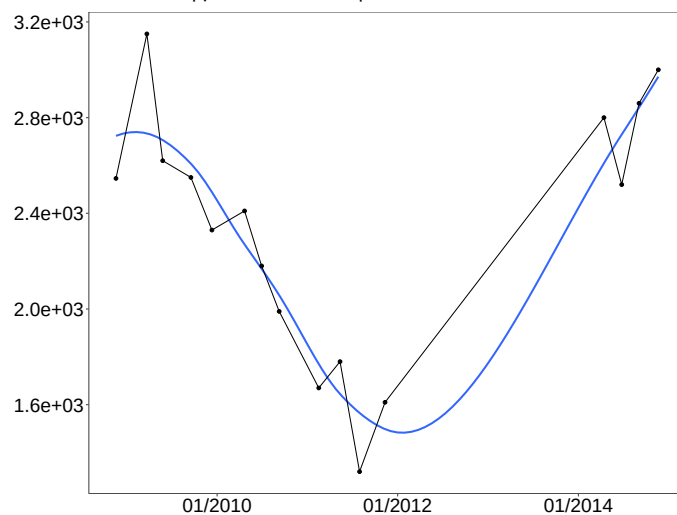
13020177 – Sodium
 $\tau = -0.0167$ | p-value = 0.964 | No trend



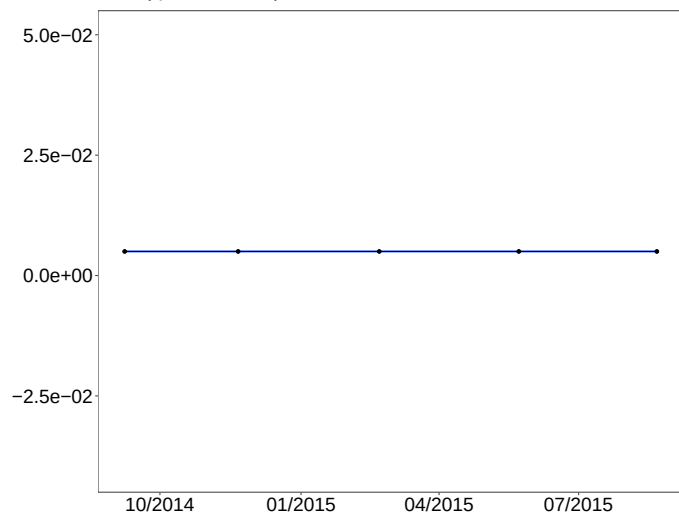
13020177 – Sulphate
 $\tau = -0.403$ | p-value = 0.034 | Negative trend



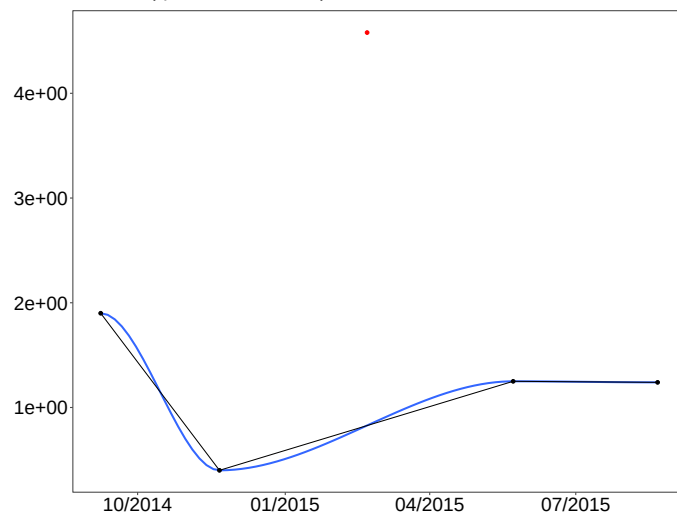
13020177 – TDS
 $\tau = -0.133$ | p-value = 0.499 | No trend



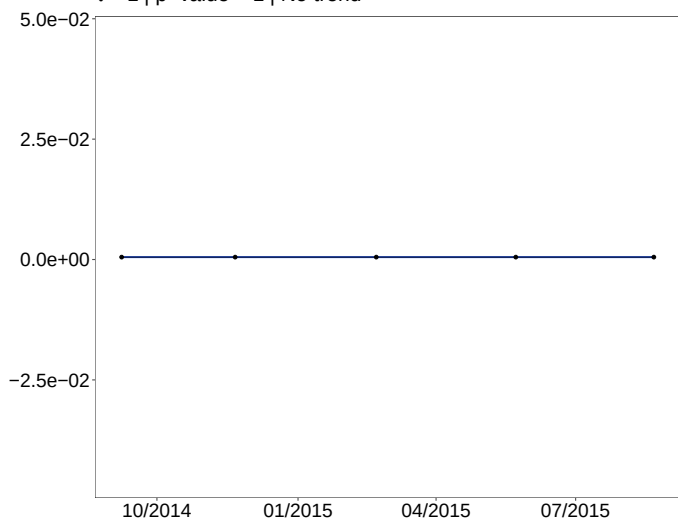
Conmurra Bore – Aluminium (d.)
 $\tau = 1$ | p-value = 1 | No trend



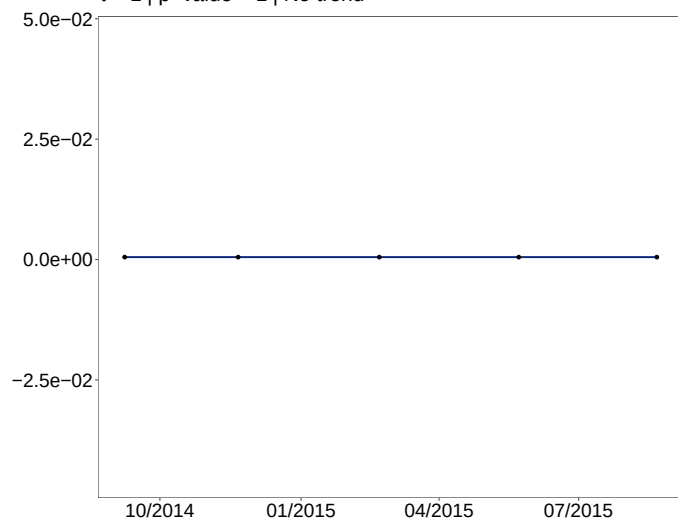
Conmurra Bore – Aluminium (t.)
 $\tau = -0.2$ | p-value = 0.806 | No trend



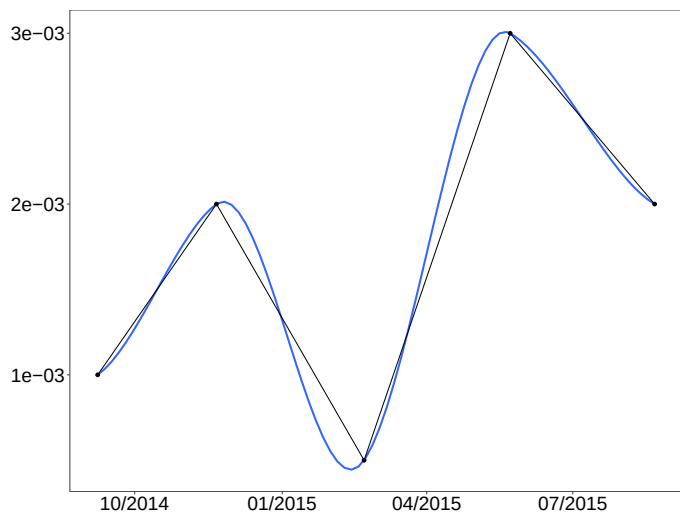
Conmurra Bore – Antimony (d.)
 $\tau = 1$ | p-value = 1 | No trend



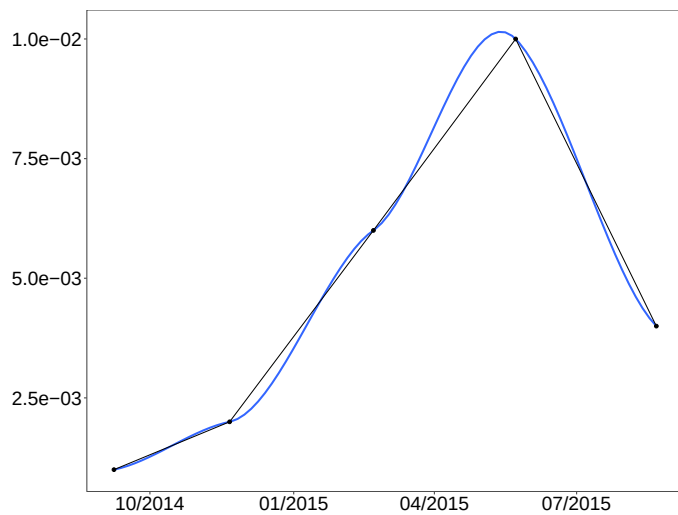
Conmurra Bore – Antimony (t.)
 $\tau = 1$ | p-value = 1 | No trend



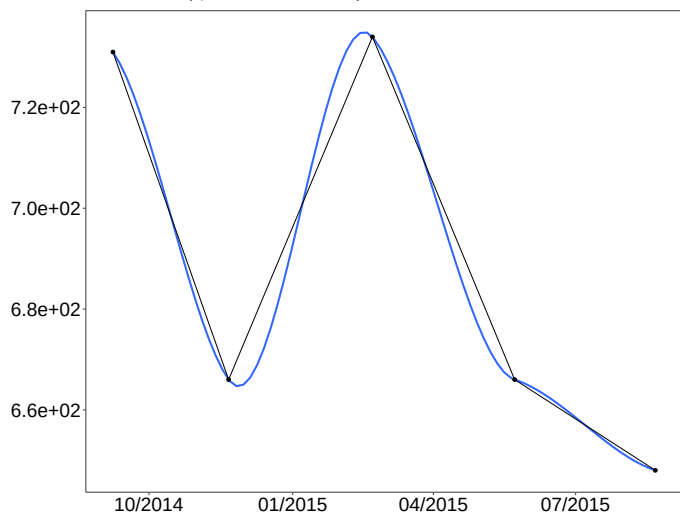
Conmurra Bore – Arsenic (d.)
 $\tau = 0.316$ | p-value = 0.613 | No trend



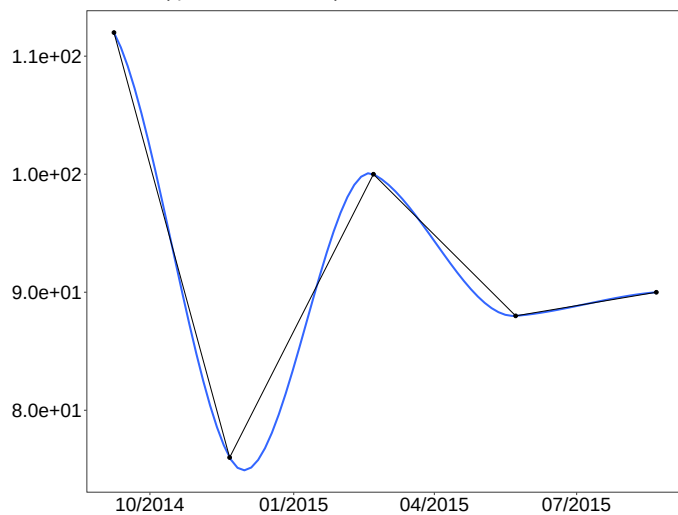
Conmurra Bore – Arsenic (t.)
 $\tau = 0.6$ | p-value = 0.221 | No trend



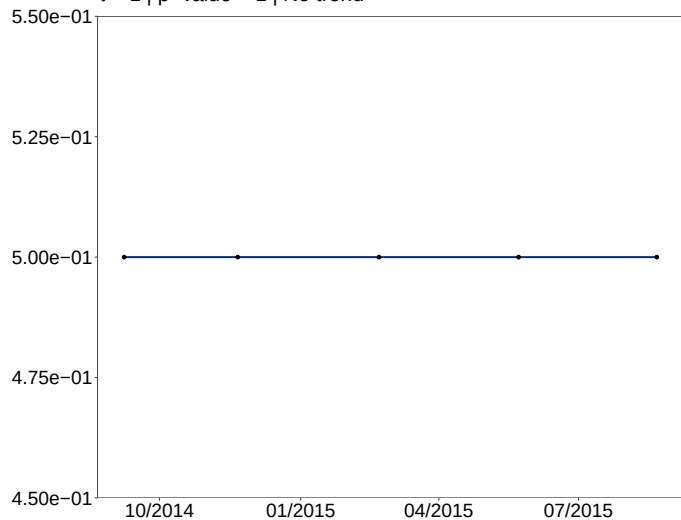
Conmurra Bore – Bicarbonate
 $\tau = -0.527$ | p-value = 0.312 | No trend



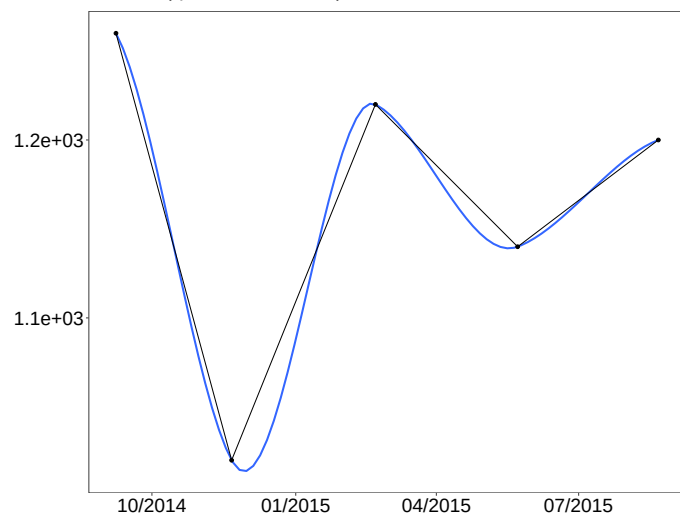
Conmurra Bore – Calcium
 $\tau = -0.2$ | p-value = 0.806 | No trend



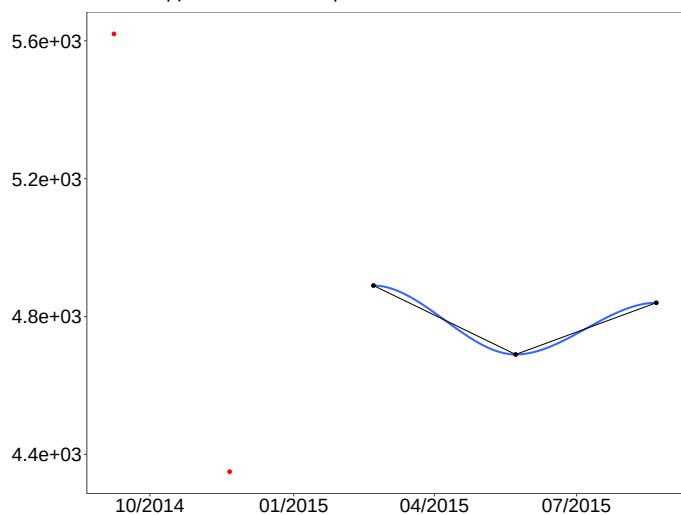
Conmurra Bore – Carbonate
 $\tau = 1$ | p-value = 1 | No trend



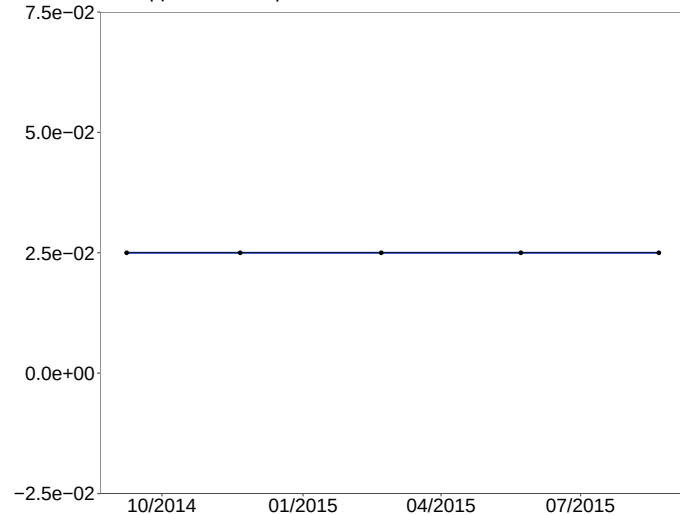
Conmurra Bore – Chloride
 $\tau = -0.2$ | p-value = 0.806 | No trend



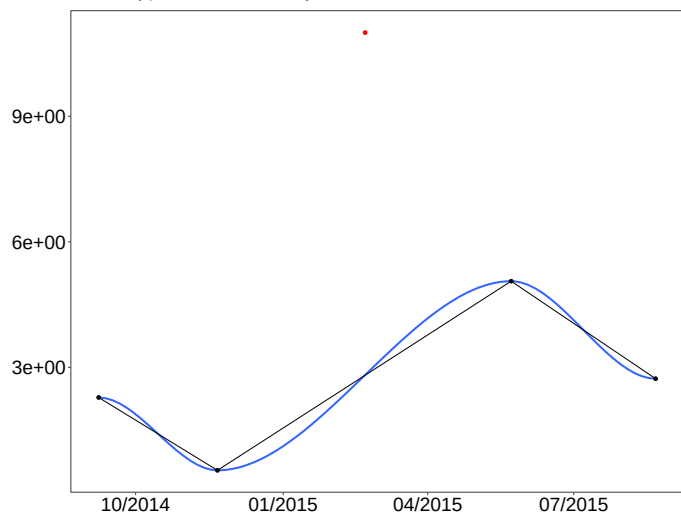
Conmurra Bore – Electrical Conductivity
 $\tau = -0.2$ | p-value = 0.806 | No trend



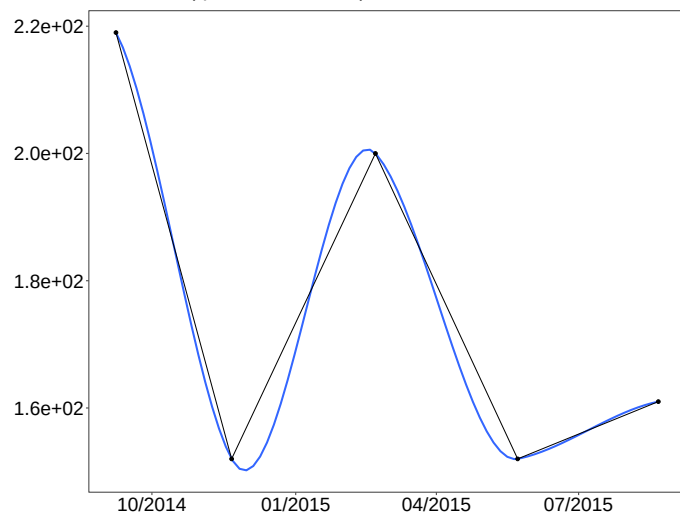
Conmurra Bore – Iron (d.)
 $\tau = 1$ | p-value = 1 | No trend



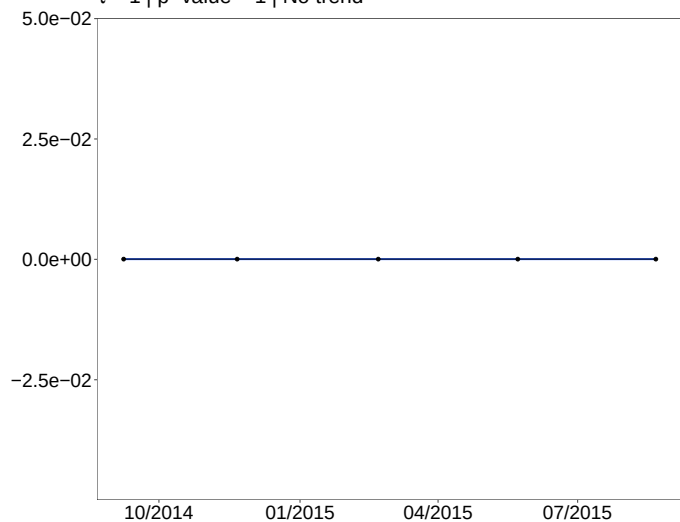
Conmurra Bore – Iron (t.)
 $\tau = 0.2$ | p-value = 0.806 | No trend



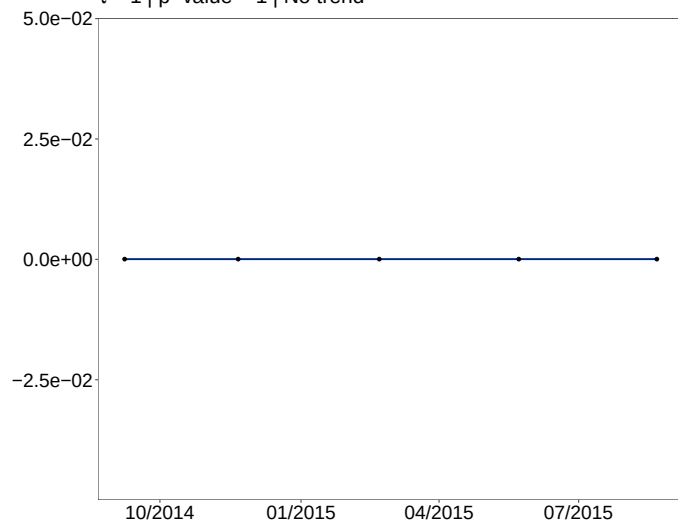
Conmurra Bore – Magnesium
 $\tau = -0.316$ | p-value = 0.613 | No trend



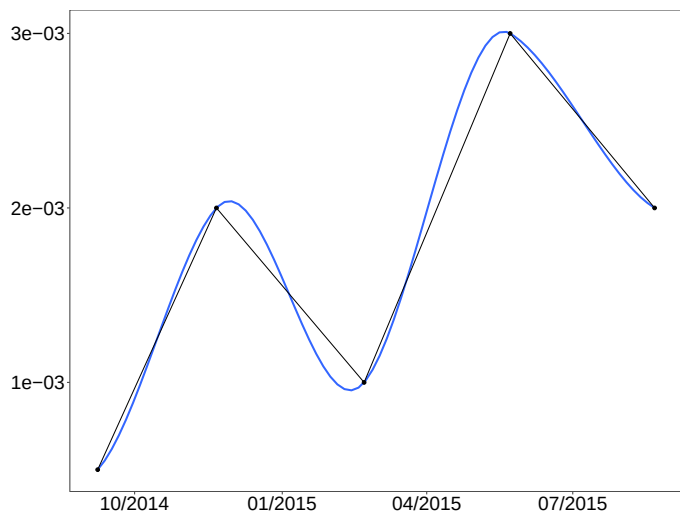
Conmurra Bore – Mercury (d.)
 $\tau = 1$ | p-value = 1 | No trend



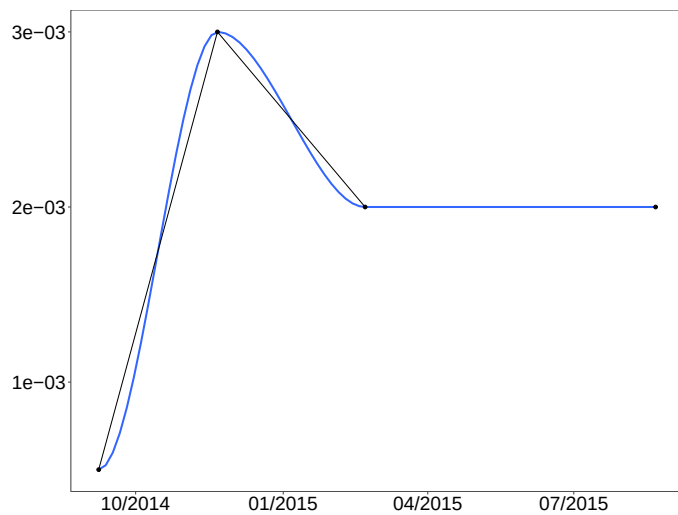
Conmurra Bore – Mercury (t.)
 $\tau = 1$ | p-value = 1 | No trend



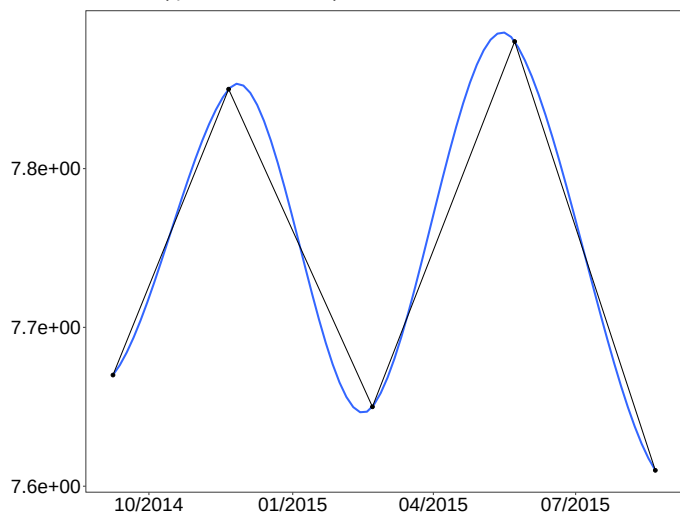
Conmurra Bore – Molybdenum (d.)
 $\tau = 0.527$ | p-value = 0.312 | No trend



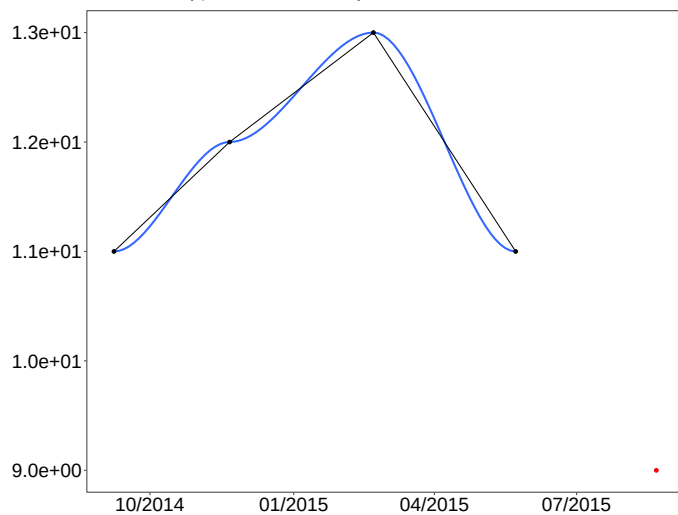
Conmurra Bore – Molybdenum (t.)
 $\tau = 0.183$ | p-value = 1 | No trend



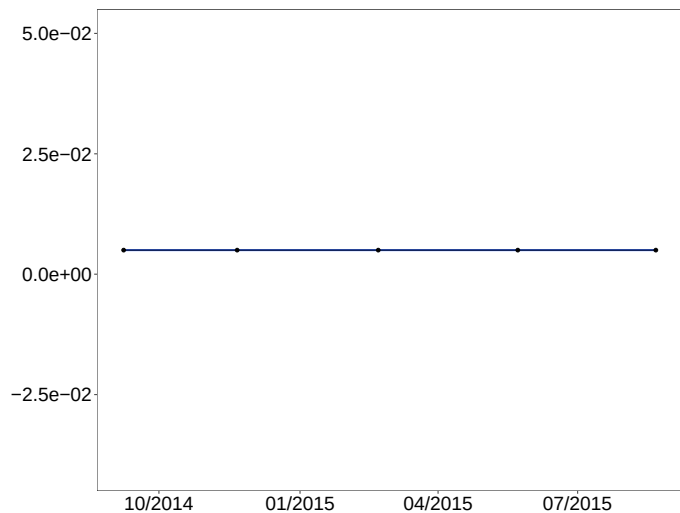
Conmurra Bore – pH
 $\tau = -0.2$ | p-value = 0.806 | No trend



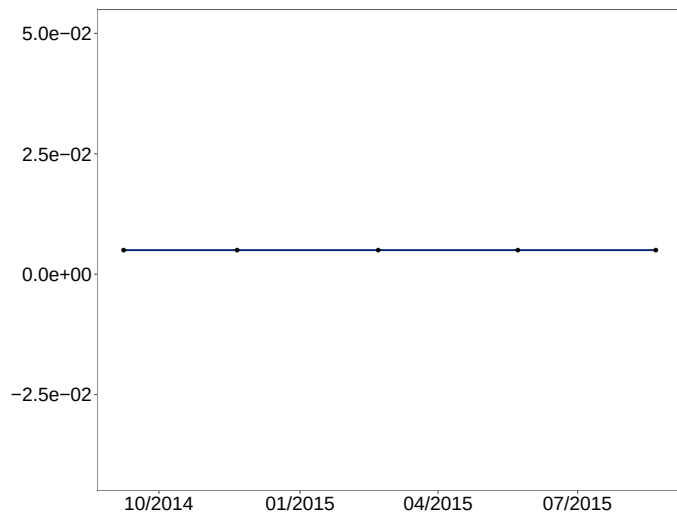
Conmurra Bore – Potassium
 $\tau = -0.316$ | p-value = 0.613 | No trend



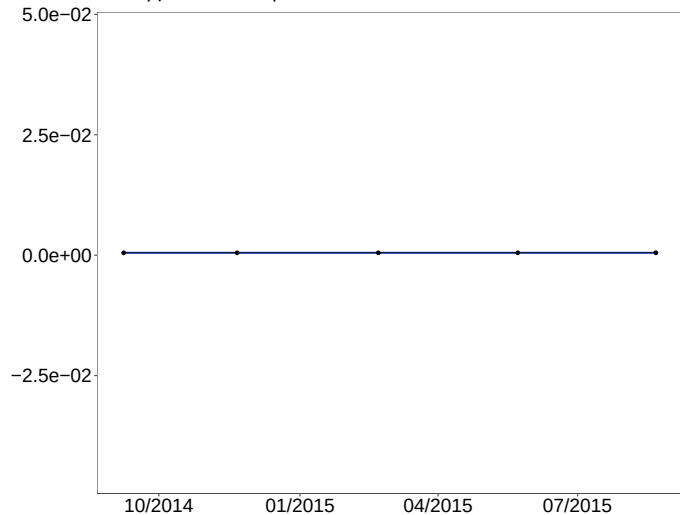
Conmurra Bore – Selenium (d.)
 $\tau = 1$ | p-value = 1 | No trend



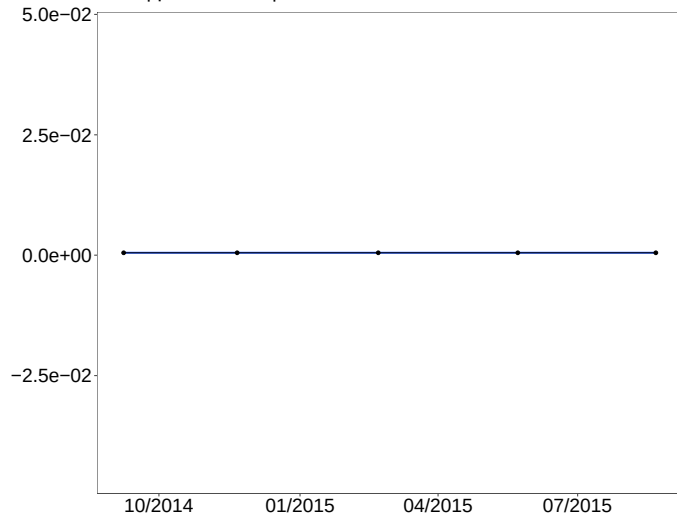
Conmurra Bore – Selenium (t.)
 $\tau = 1$ | p-value = 1 | No trend



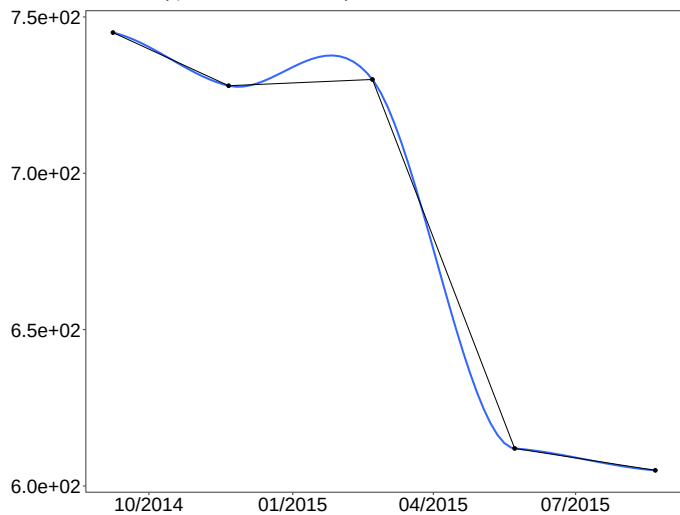
Conmurra Bore – Silver (d.)
 $\tau = 1$ | p-value = 1 | No trend



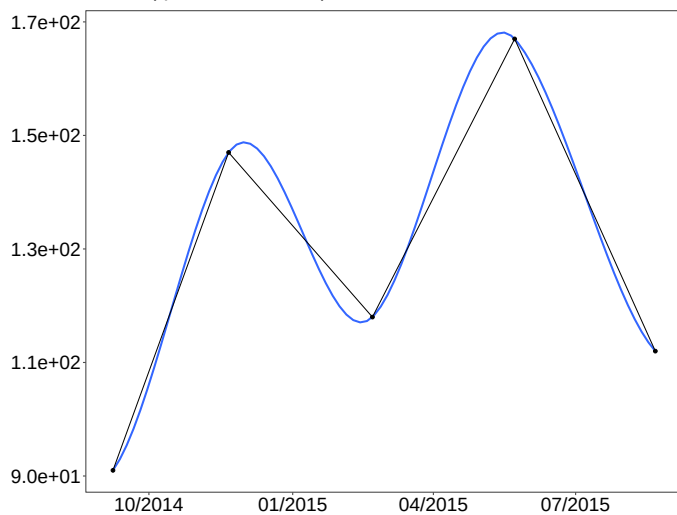
Conmurra Bore – Silver (t.)
 $\tau = 1$ | p-value = 1 | No trend



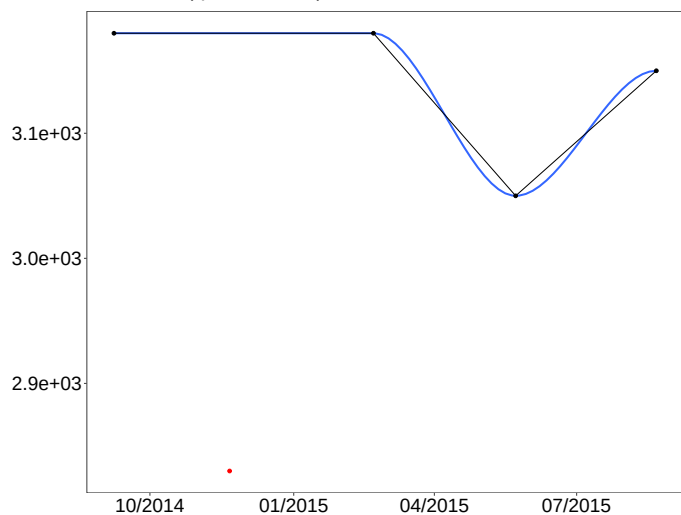
Conmurra Bore – Sodium
 $\tau = -0.8$ | p-value = 0.0864 | No trend



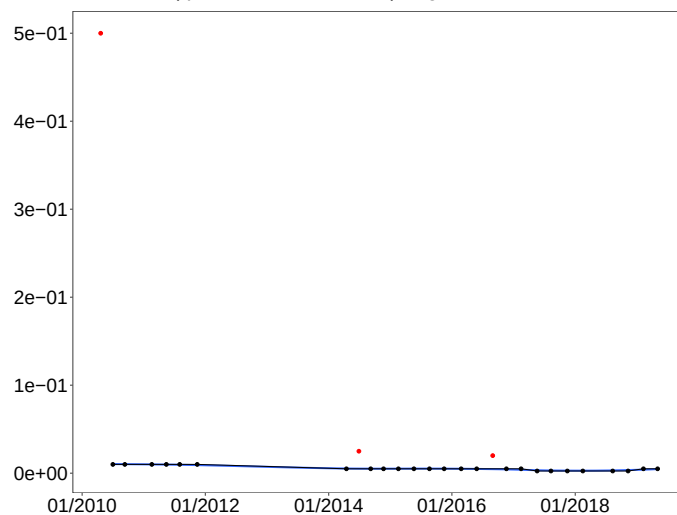
Conmurra Bore – Sulphate
 $\tau = 0.2$ | p-value = 0.806 | No trend



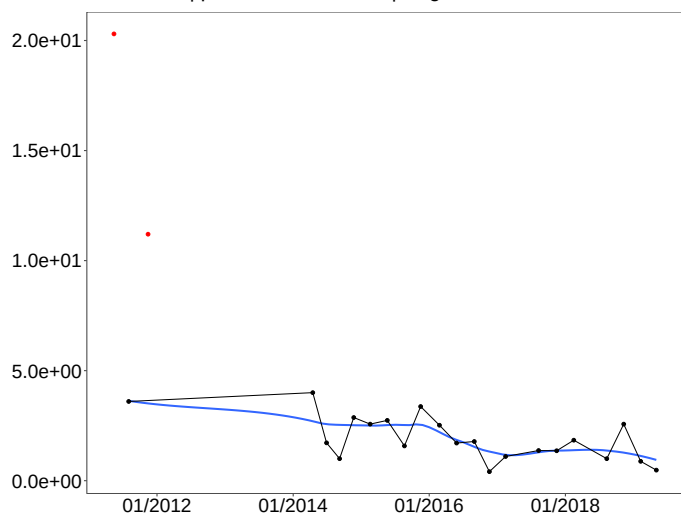
Conmurra Bore – TDS
 $\tau = -0.105$ | p-value = 1 | No trend



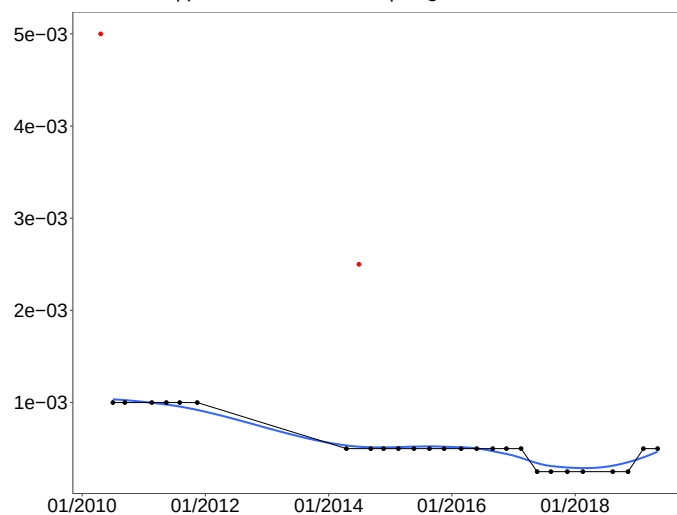
EC01 – Aluminium (d.)
 $\tau = -0.632$ | p-value = 0.0000214 | Negative trend



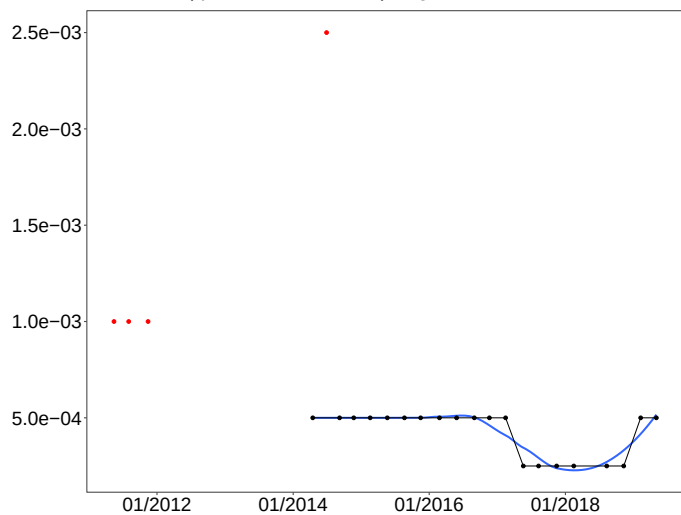
EC01 – Aluminium (t.)
 $\tau = -0.544$ | p-value = 0.000325 | Negative trend



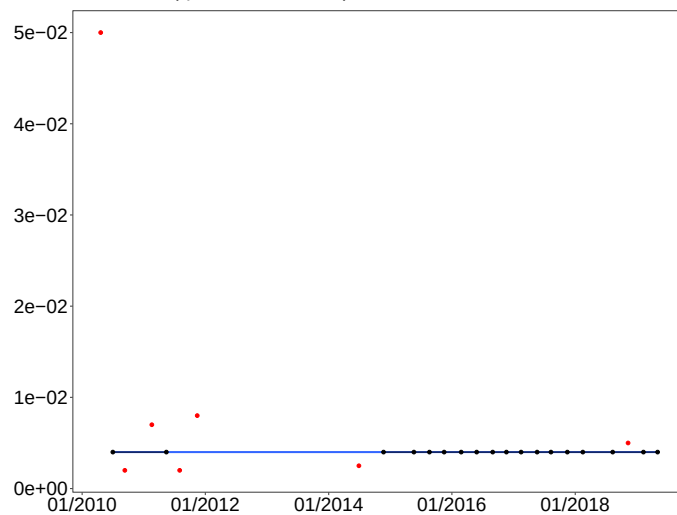
EC01 – Antimony (d.)
 $\tau = -0.703$ | p-value = 0.0000029 | Negative trend



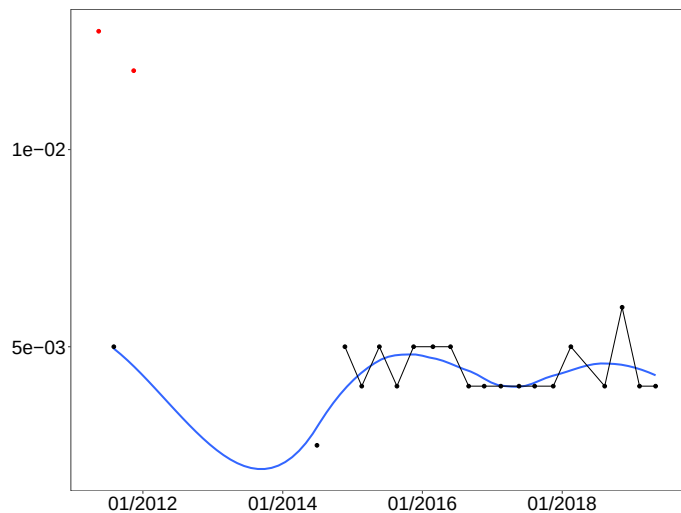
EC01 – Antimony (t.)
 $\tau = -0.629$ | p-value = 0.00016 | Negative trend



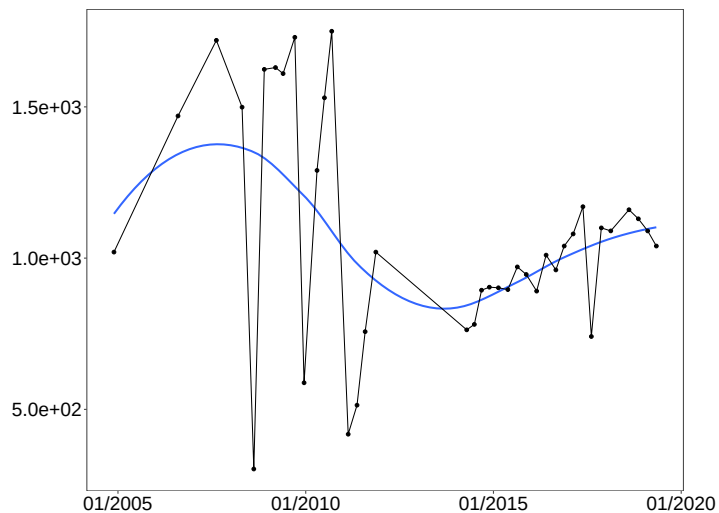
EC01 – Arsenic (d.)
 $\tau = 0.0382$ | p-value = 0.835 | No trend



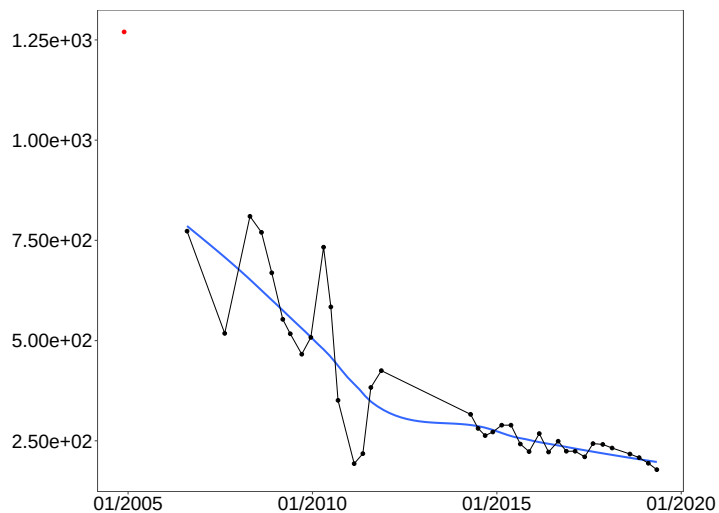
EC01 – Arsenic (t.)

 $\tau = -0.291$ | p-value = 0.0954 | No trend

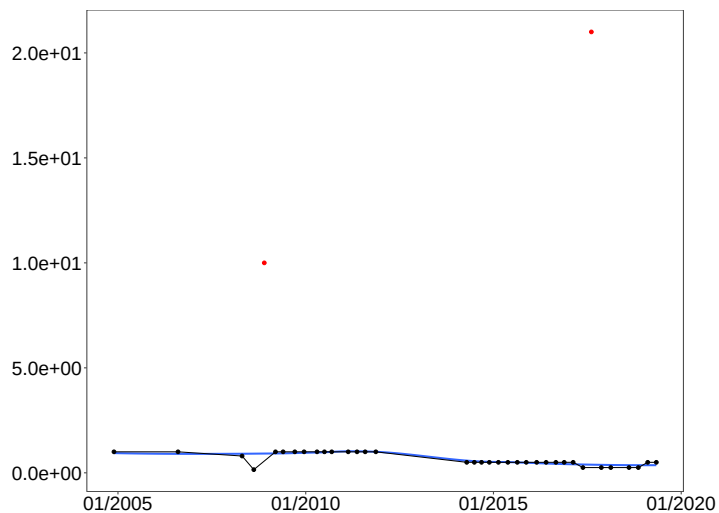
EC01 – Bicarbonate

 $\tau = -0.00855$ | p-value = 0.95 | No trend

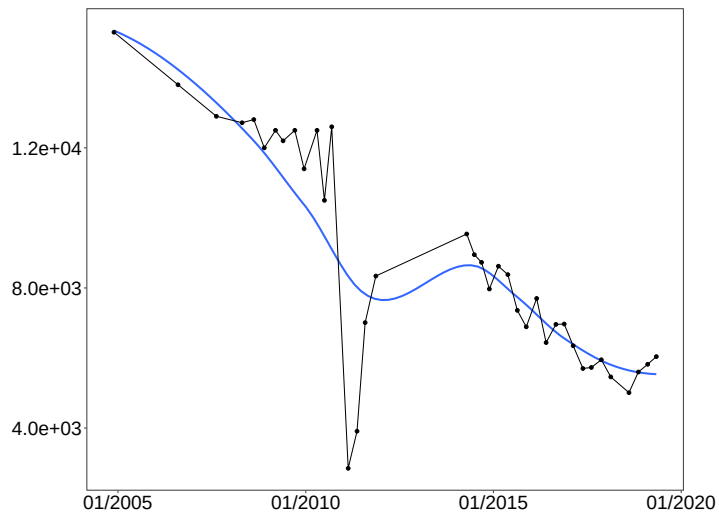
EC01 – Calcium

 $\tau = -0.728$ | p-value = 0.000000000143 | Negative trend

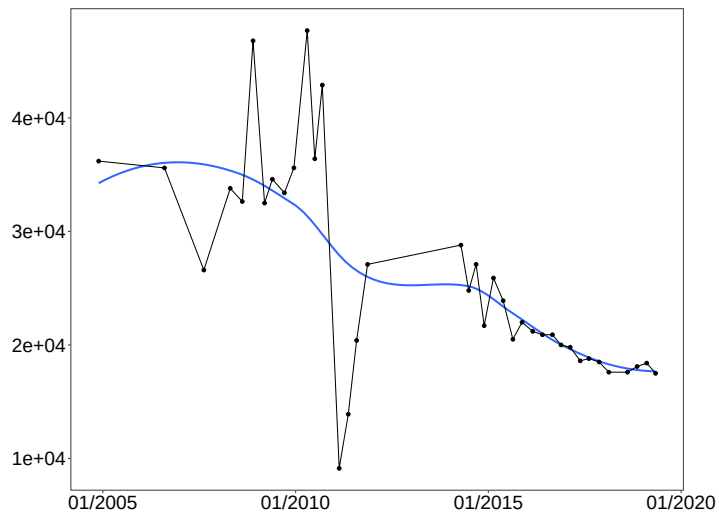
EC01 – Carbonate

 $\tau = -0.536$ | p-value = 0.0000292 | Negative trend

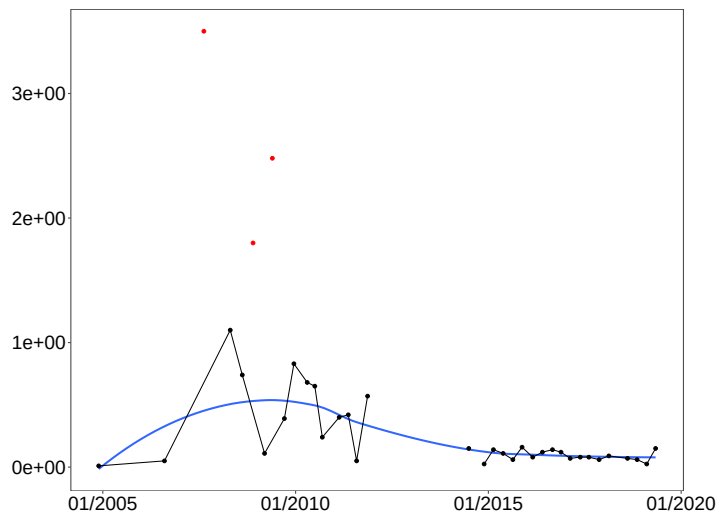
EC01 – Chloride

 $\tau = -0.707$ | p-value = 0.000000000482 | Negative trend

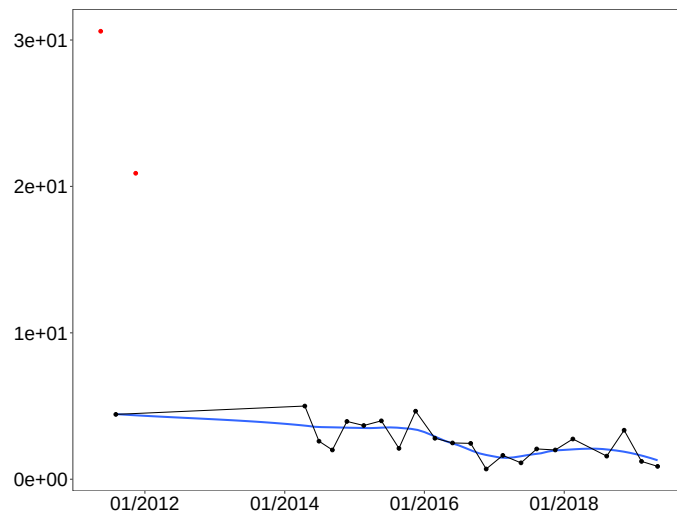
EC01 – Electrical Conductivity

 $\tau = -0.632$ | p-value = 0.0000000272 | Negative trend

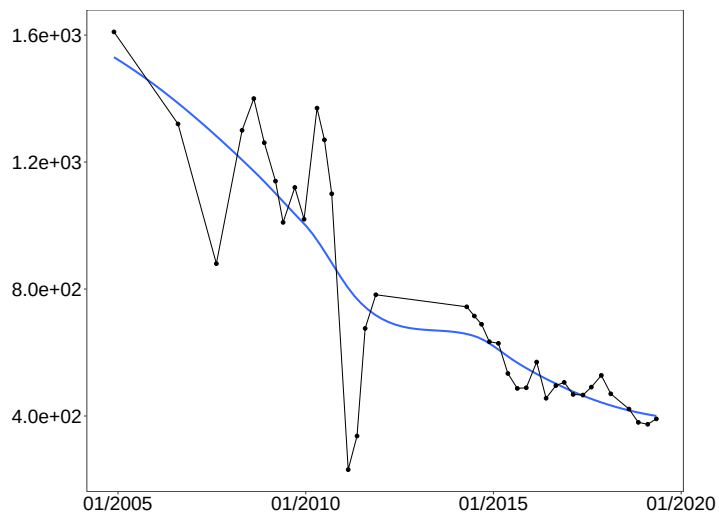
EC01 – Iron (d.)
 $\tau = -0.422$ | p-value = 0.000352 | Negative trend



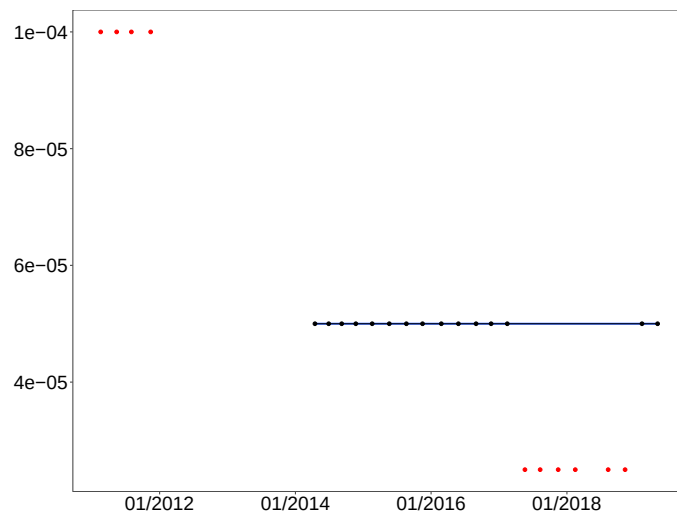
EC01 – Iron (t.)
 $\tau = -0.548$ | p-value = 0.000198 | Negative trend



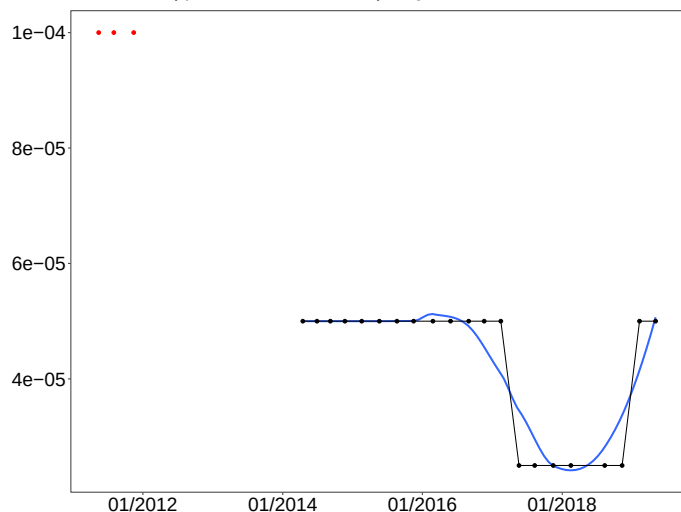
EC01 – Magnesium
 $\tau = -0.687$ | p-value = 0.00000000136 | Negative trend



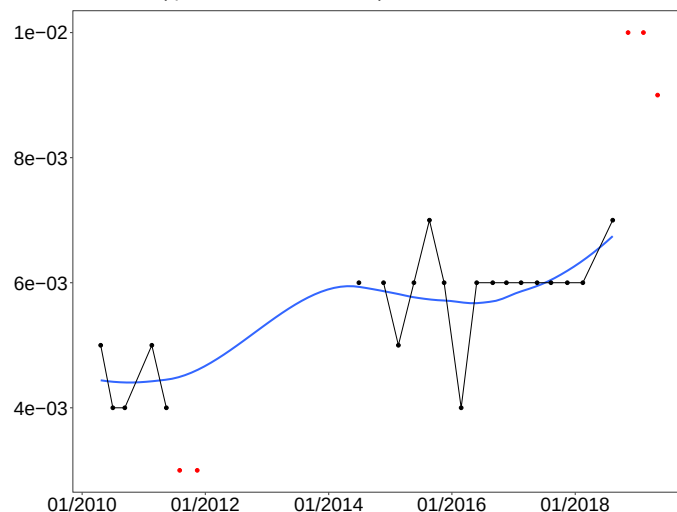
EC01 – Mercury (d.)
 $\tau = -0.657$ | p-value = 0.0000635 | Negative trend



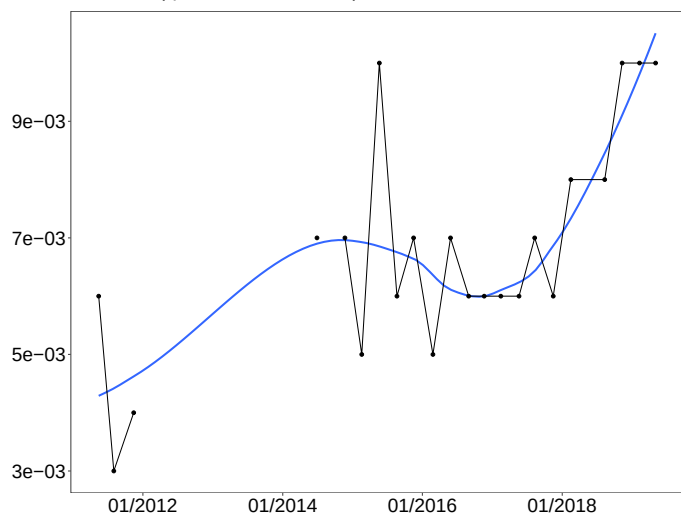
EC01 – Mercury (t.)
 $\tau = -0.628$ | p-value = 0.000201 | Negative trend



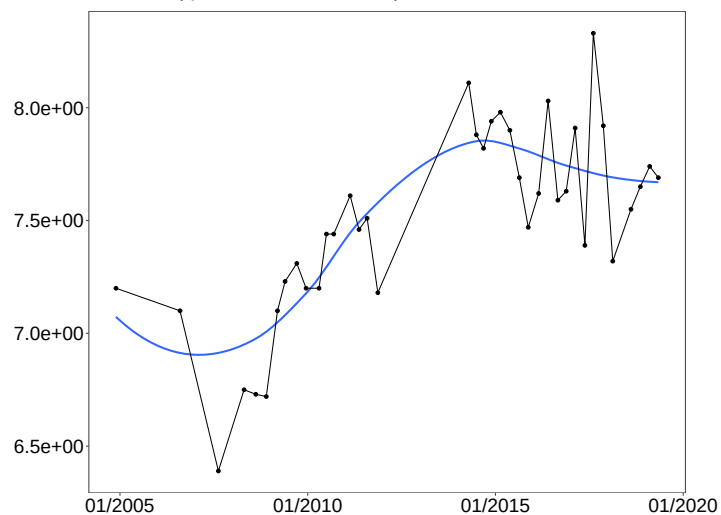
EC01 – Molybdenum (d.)
 $\tau = 0.625$ | p-value = 0.0000389 | Positive trend



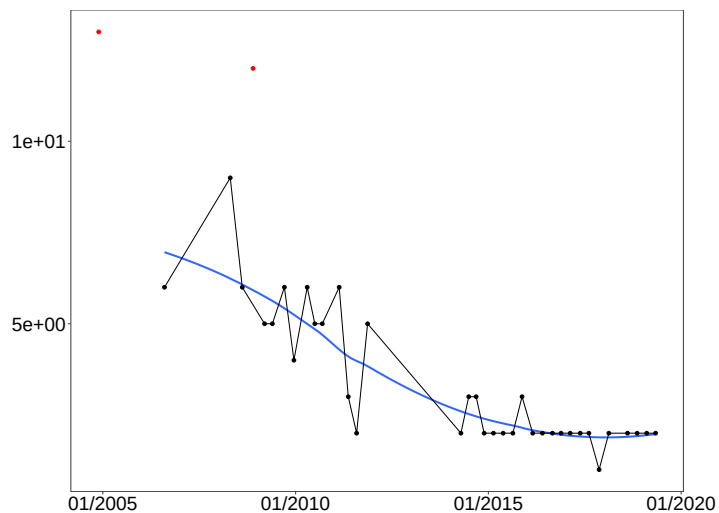
EC01 – Molybdenum (t.)
 $\tau = 0.484$ | p-value = 0.00336 | Positive trend



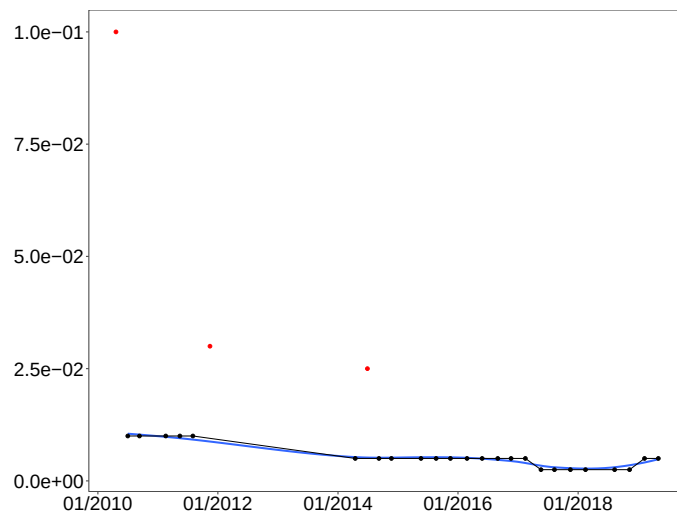
EC01 – pH
 $\tau = 0.501$ | p-value = 0.0000107 | Positive trend



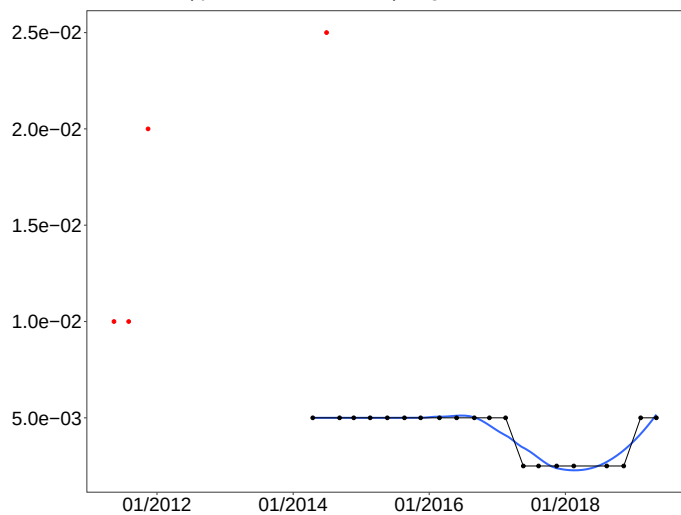
EC01 – Potassium
 $\tau = -0.736$ | p-value = 0.0000000494 | Negative trend



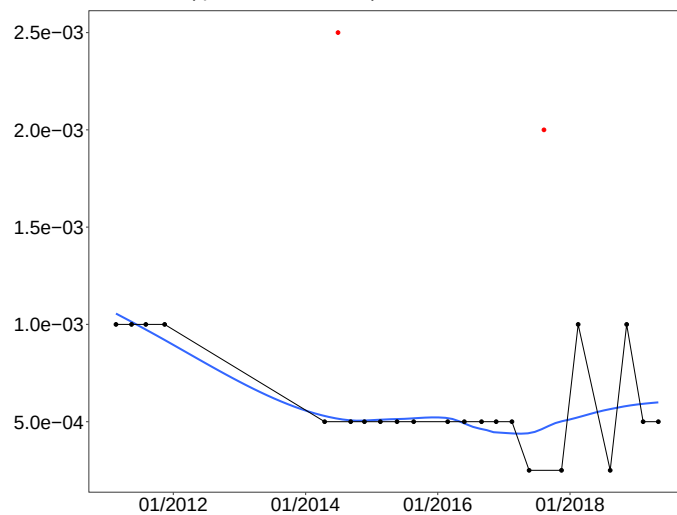
EC01 – Selenium (d.)
 $\tau = -0.685$ | p-value = 0.00000652 | Negative trend



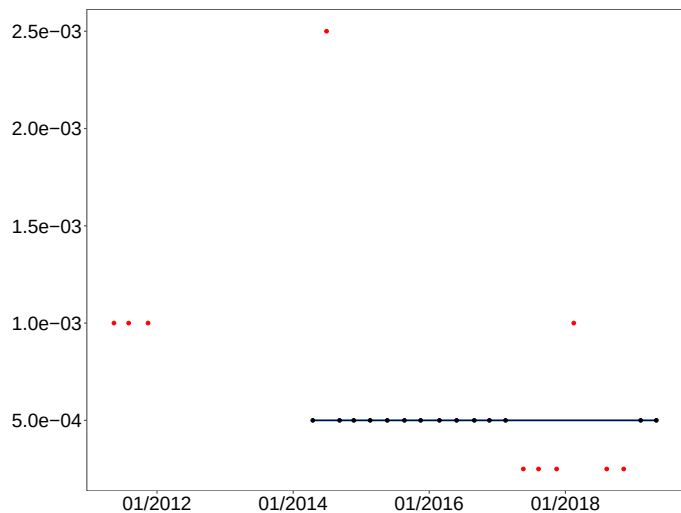
EC01 – Selenium (t.)
 $\tau = -0.616$ | p-value = 0.000203 | Negative trend



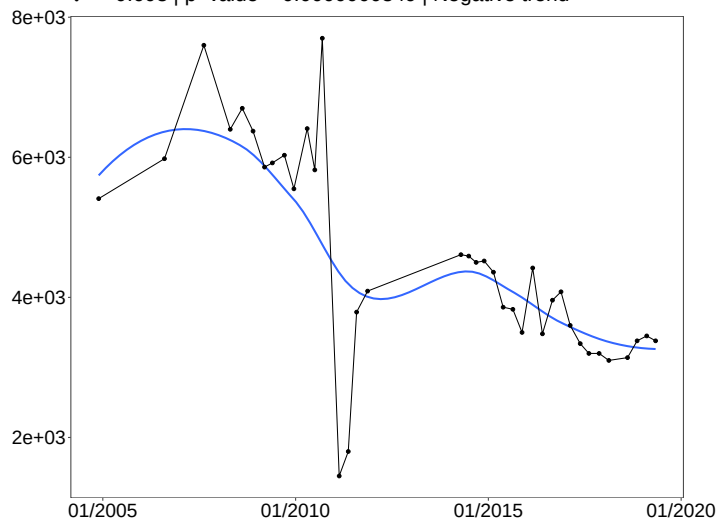
EC01 – Silver (d.)
 $\tau = -0.323$ | p-value = 0.0511 | No trend



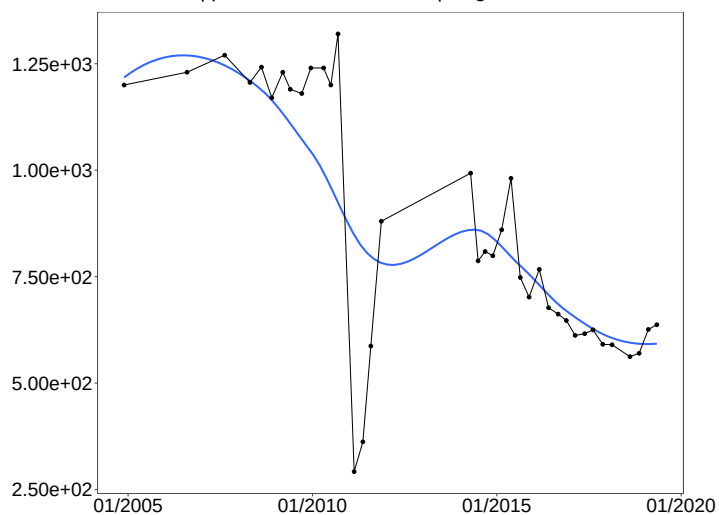
EC01 – Silver (t.)

 $\tau = -0.514$ | p-value = 0.00199 | Negative trend

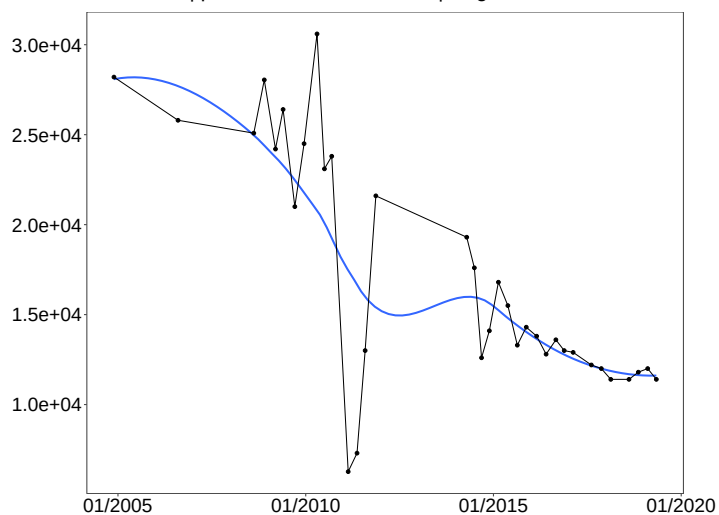
EC01 – Sodium

 $\tau = -0.608$ | p-value = 0.0000000849 | Negative trend

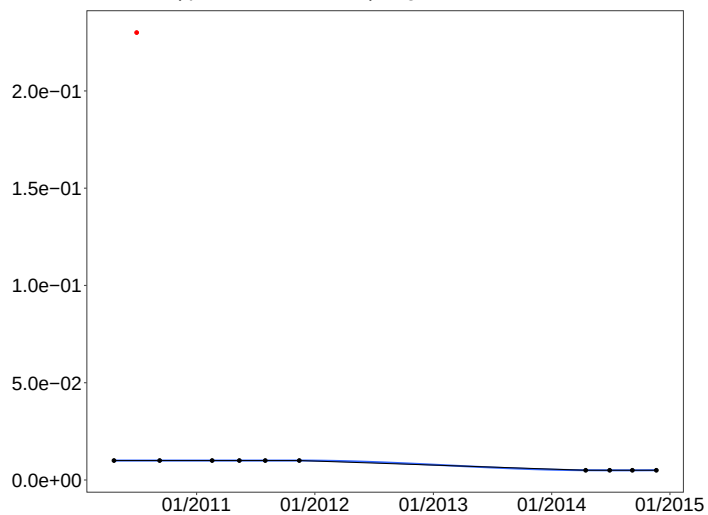
EC01 – Sulphate

 $\tau = -0.599$ | p-value = 0.000000137 | Negative trend

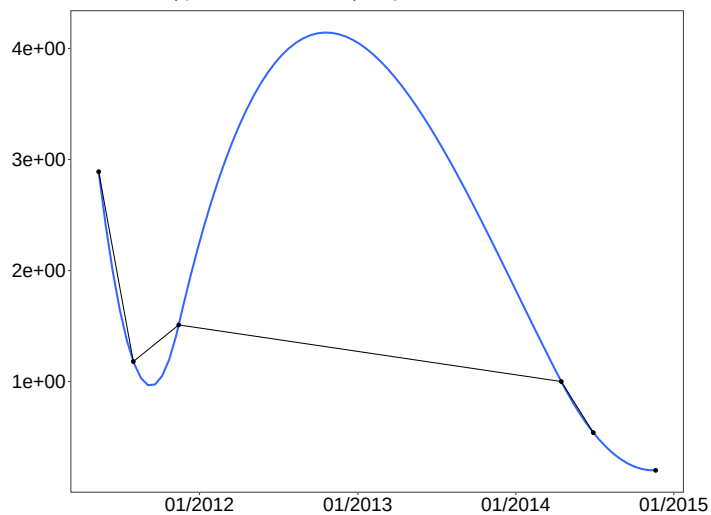
EC01 – TDS

 $\tau = -0.665$ | p-value = 0.0000000235 | Negative trend

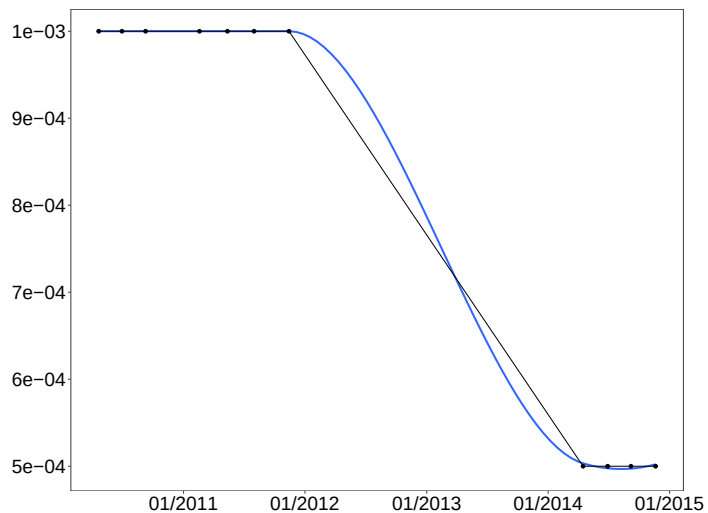
EC02 – Aluminium (d.)

 $\tau = -0.74$ | p-value = 0.00614 | Negative trend

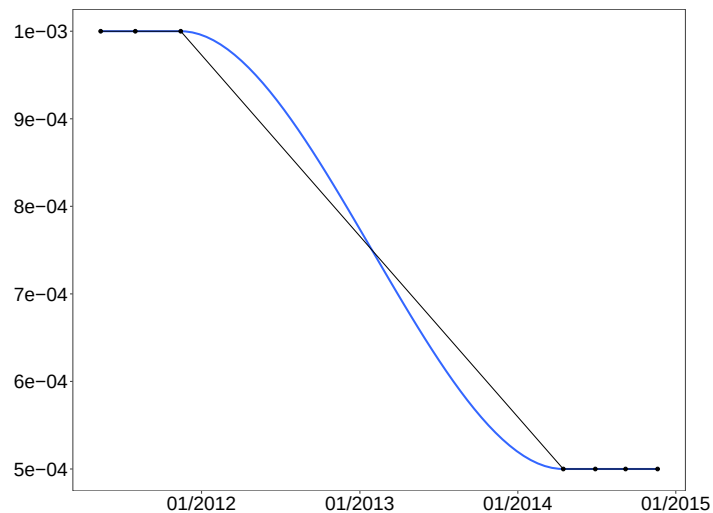
EC02 – Aluminium (t.)

 $\tau = -0.867$ | p-value = 0.0242 | Negative trend

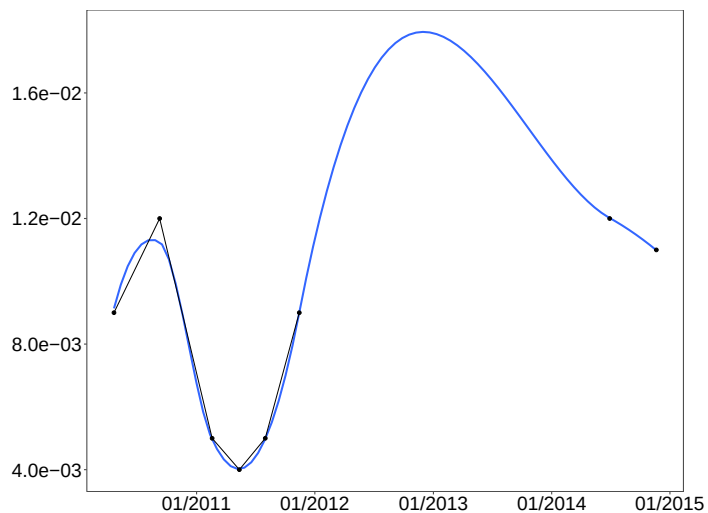
EC02 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



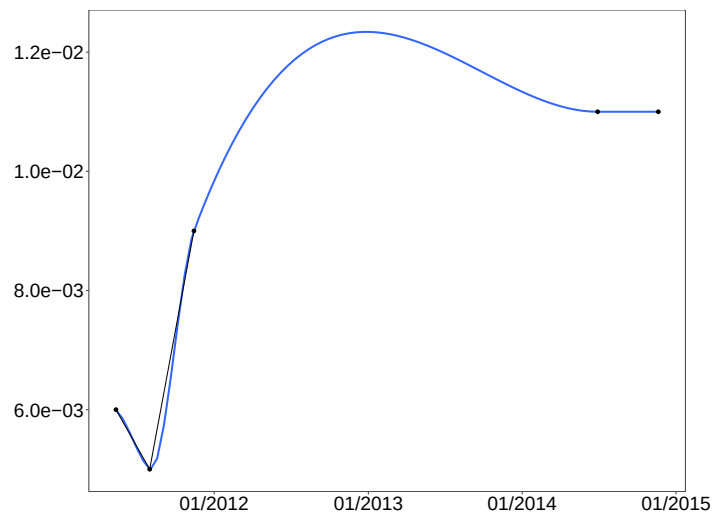
EC02 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



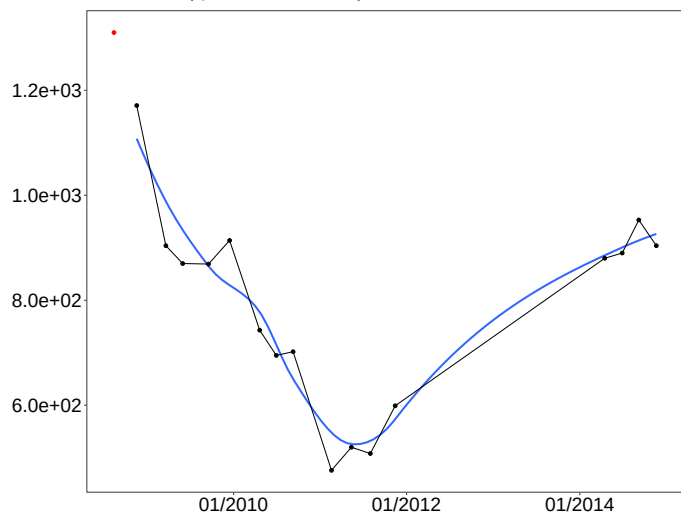
EC02 – Arsenic (d.)
 $\tau = 0.189$ | p-value = 0.612 | No trend



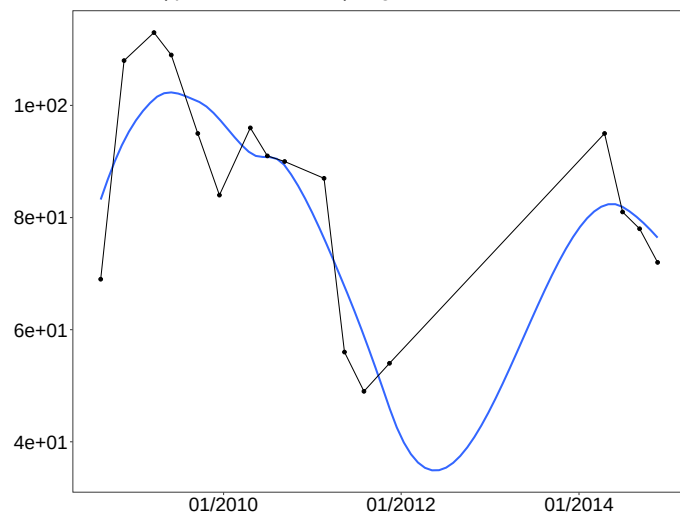
EC02 – Arsenic (t.)
 $\tau = 0.738$ | p-value = 0.13 | No trend



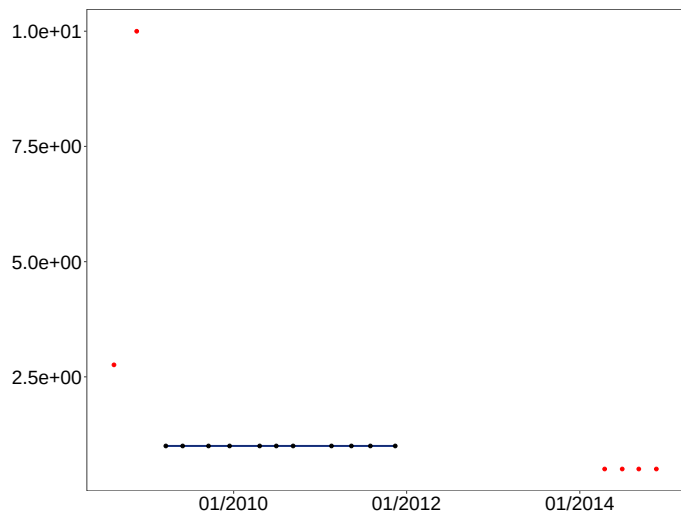
EC02 – Bicarbonate
 $\tau = -0.229$ | p-value = 0.216 | No trend



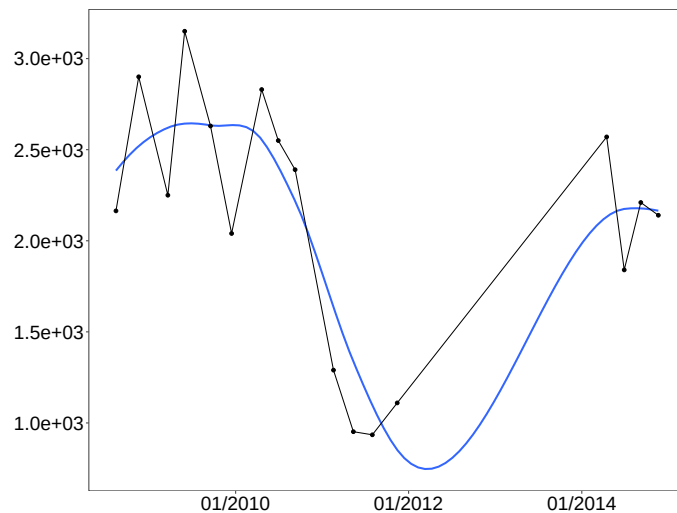
EC02 – Calcium
 $\tau = -0.45$ | p-value = 0.0134 | Negative trend



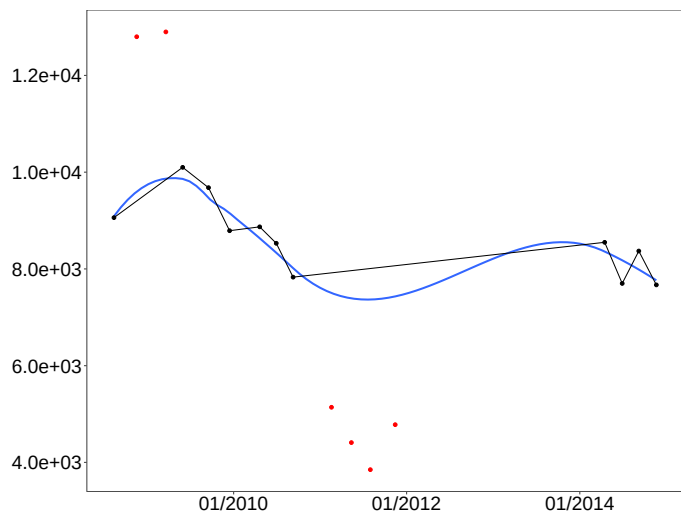
EC02 – Carbonate
 $\tau = -0.723$ | p-value = 0.000413 | Negative trend



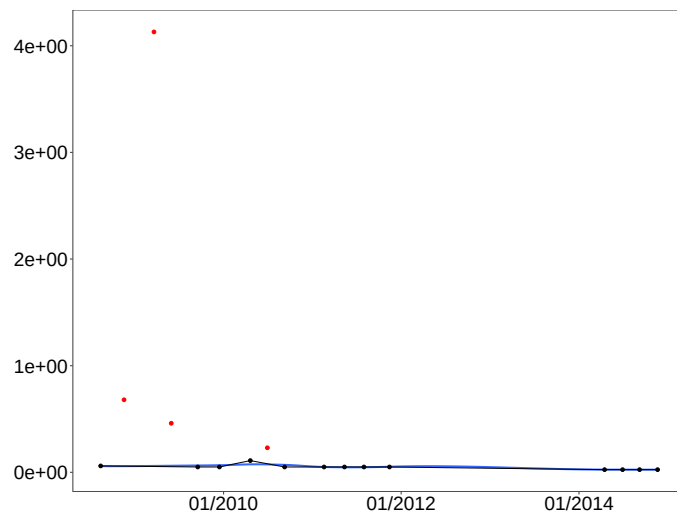
EC02 – Chloride
 $\tau = -0.338$ | p-value = 0.0638 | No trend



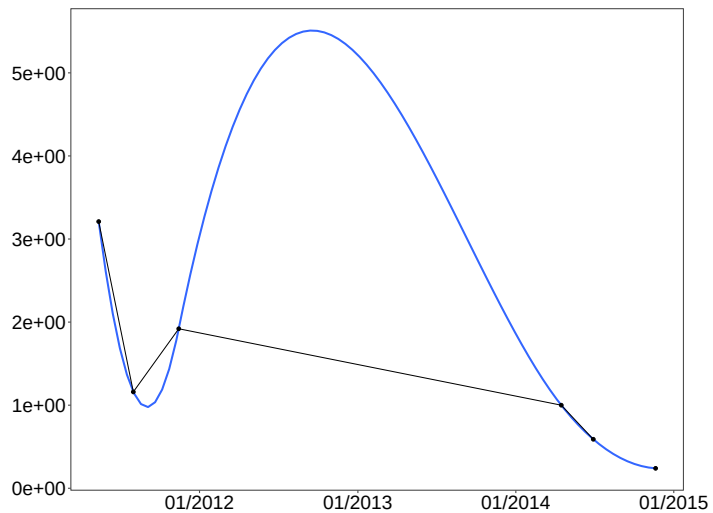
EC02 – Electrical Conductivity
 $\tau = -0.588$ | p-value = 0.00114 | Negative trend



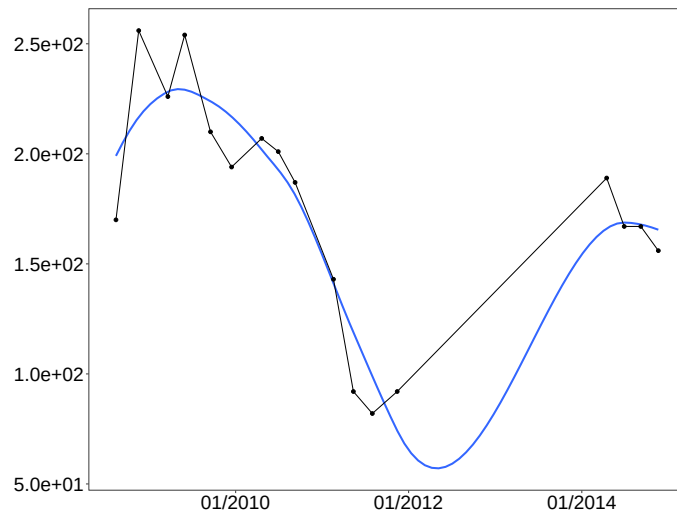
EC02 – Iron (d.)
 $\tau = -0.715$ | p-value = 0.000204 | Negative trend



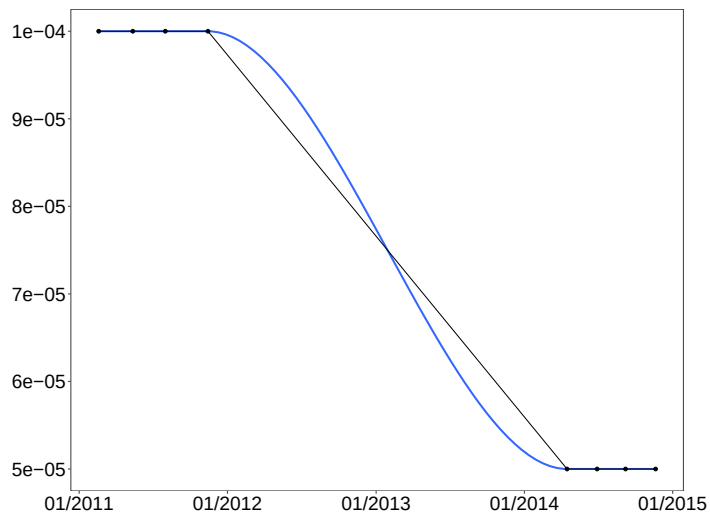
EC02 – Iron (t.)
 $\tau = -0.867$ | p-value = 0.0242 | Negative trend



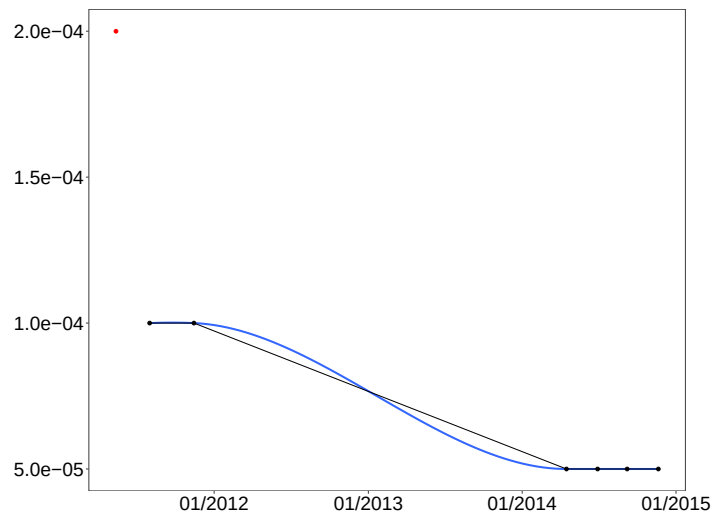
EC02 – Magnesium
 $\tau = -0.548$ | p-value = 0.00259 | Negative trend



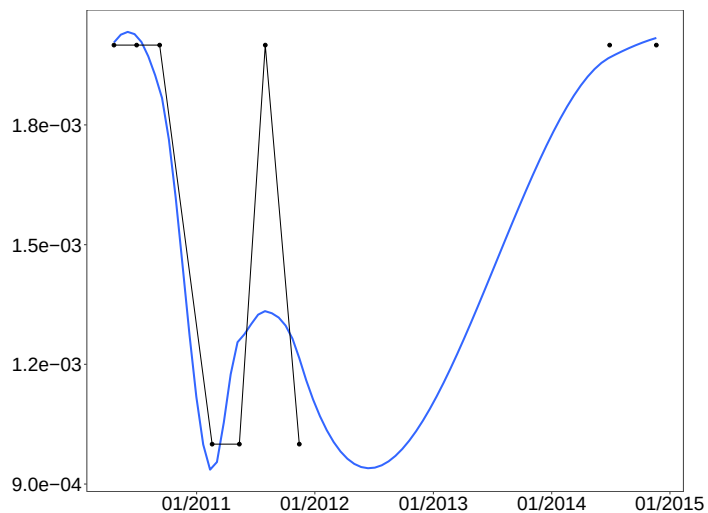
EC02 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



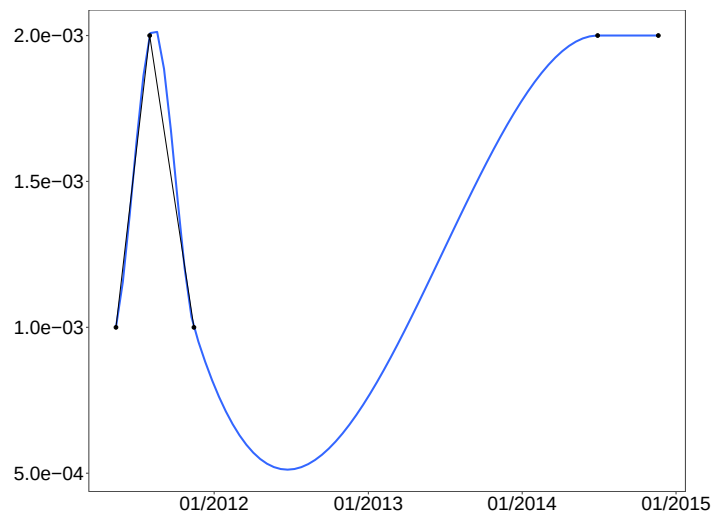
EC02 – Mercury (t.)
 $\tau = -0.816$ | p-value = 0.0272 | Negative trend



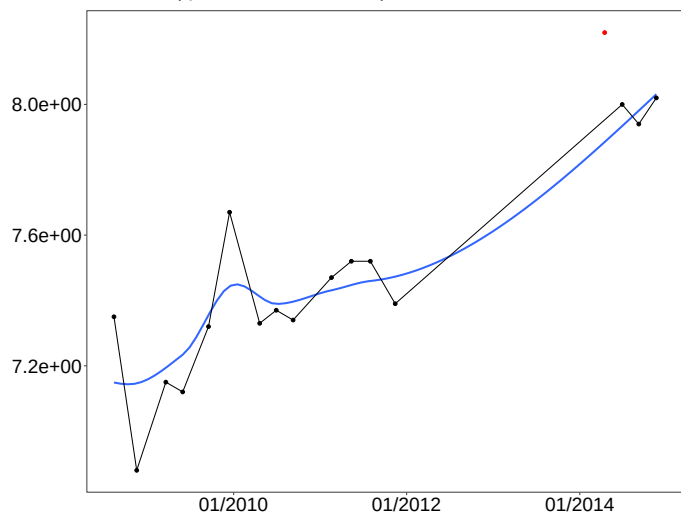
EC02 – Molybdenum (d.)
 $\tau = -0.0786$ | p-value = 0.897 | No trend



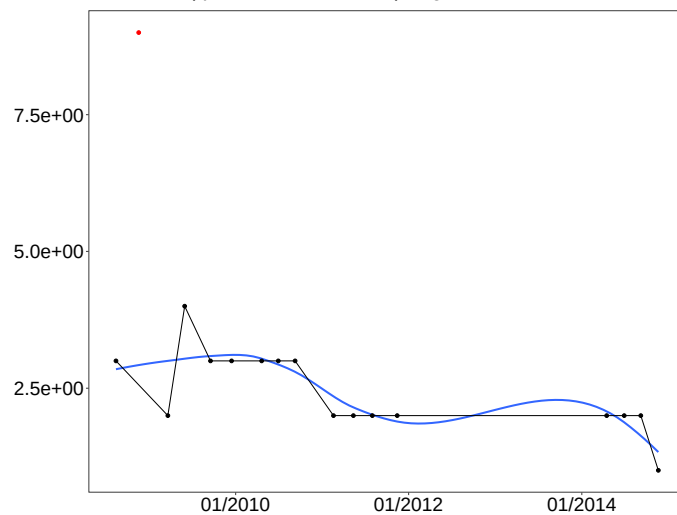
EC02 – Molybdenum (t.)
 $\tau = 0.516$ | p-value = 0.386 | No trend



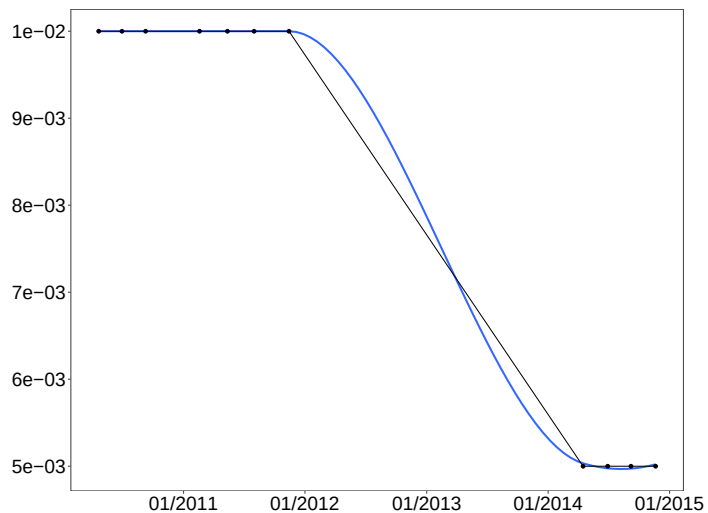
EC02 – pH
 $\tau = 0.672$ | p-value = 0.000207 | Positive trend



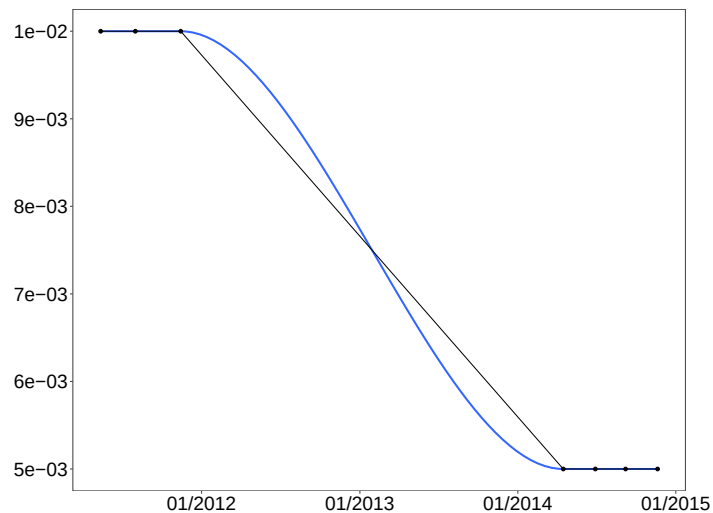
EC02 – Potassium
 $\tau = -0.685$ | p-value = 0.000641 | Negative trend



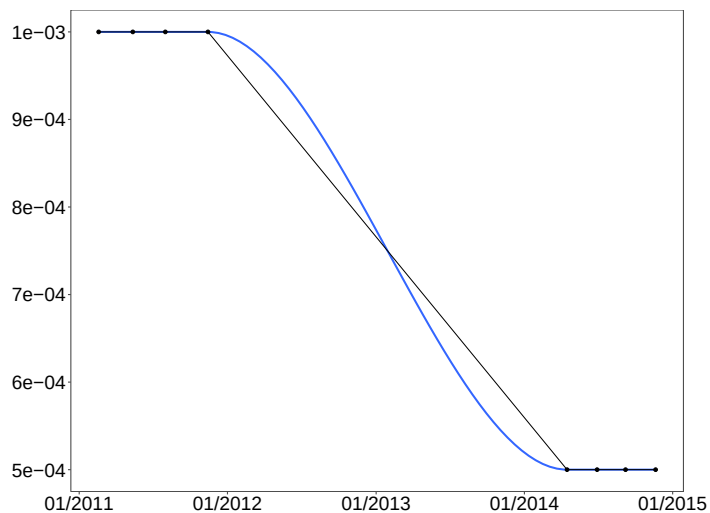
EC02 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



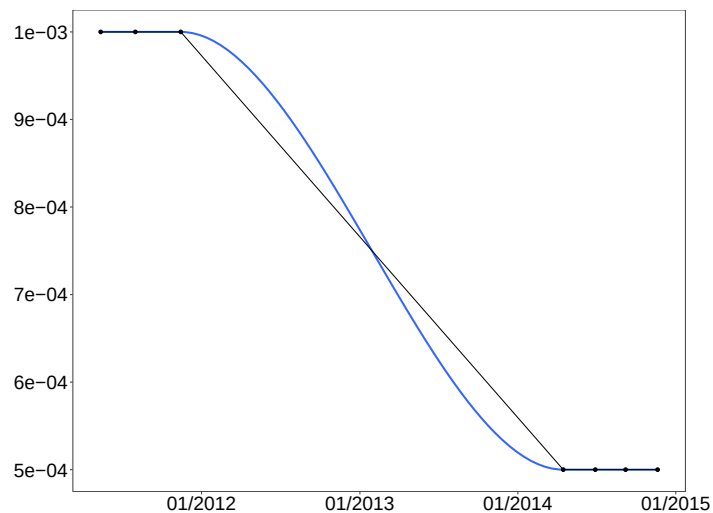
EC02 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



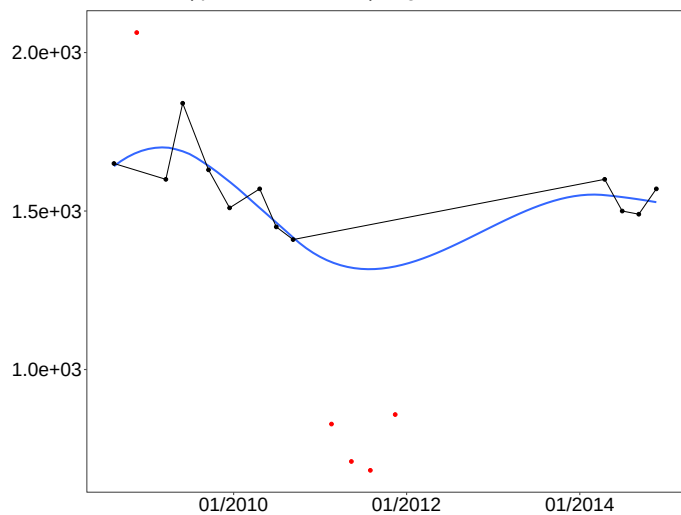
EC02 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



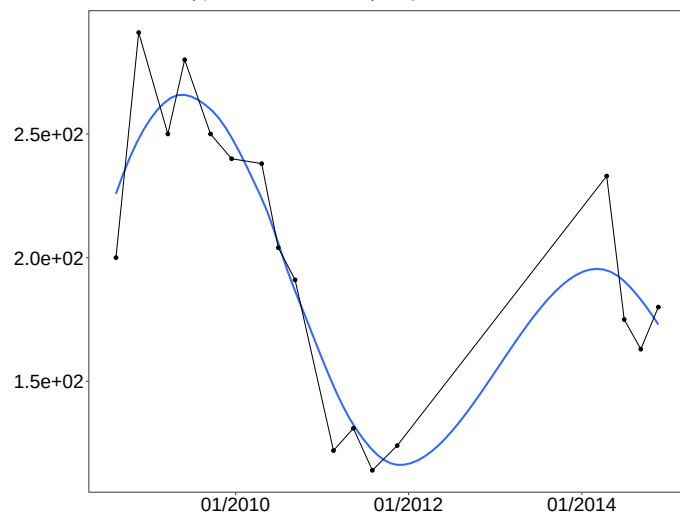
EC02 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



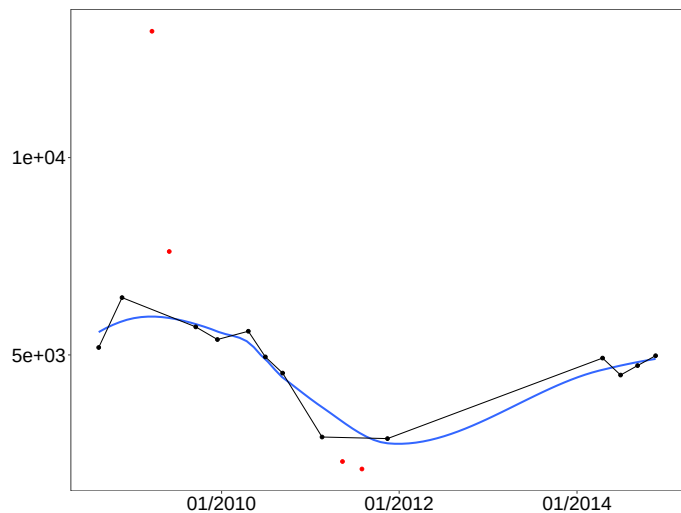
EC02 – Sodium
 $\tau = -0.444$ | p-value = 0.0149 | Negative trend



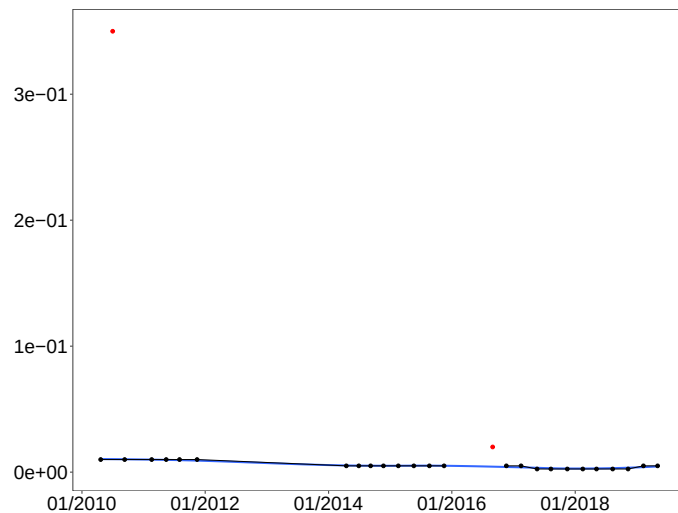
EC02 – Sulphate
 $\tau = -0.524$ | p-value = 0.0039 | Negative trend



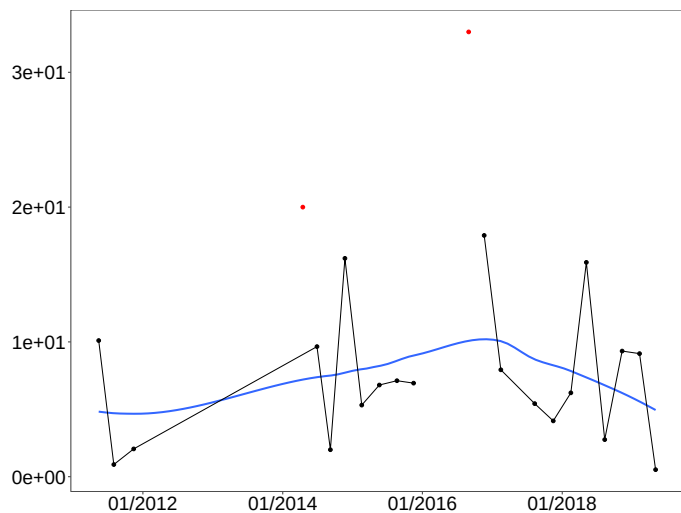
EC02 – TDS

 $\tau = -0.485$ | p-value = 0.00742 | Negative trend

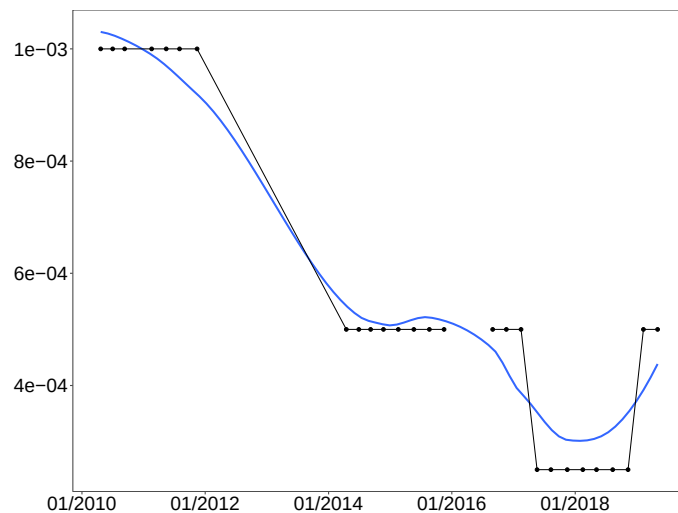
EC03 – Aluminium (d.)

 $\tau = -0.646$ | p-value = 0.0000232 | Negative trend

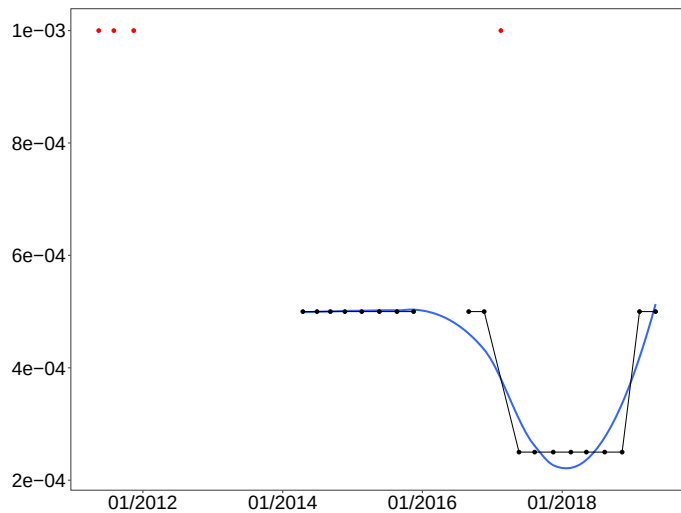
EC03 – Aluminium (t.)

 $\tau = -0.0476$ | p-value = 0.778 | No trend

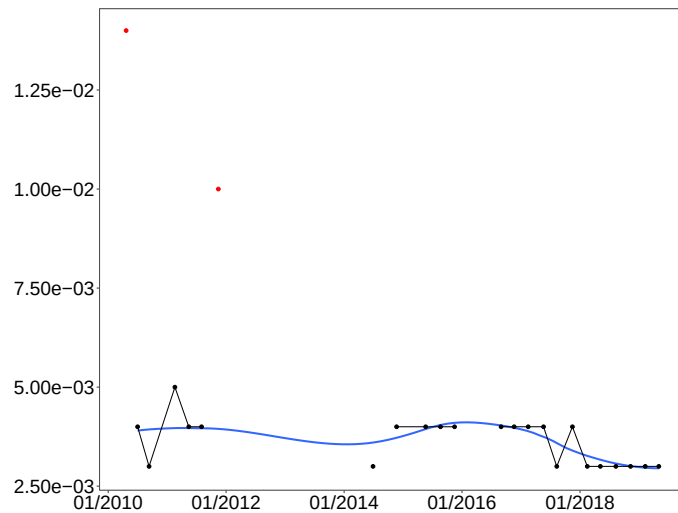
EC03 – Antimony (d.)

 $\tau = -0.713$ | p-value = 0.00000461 | Negative trend

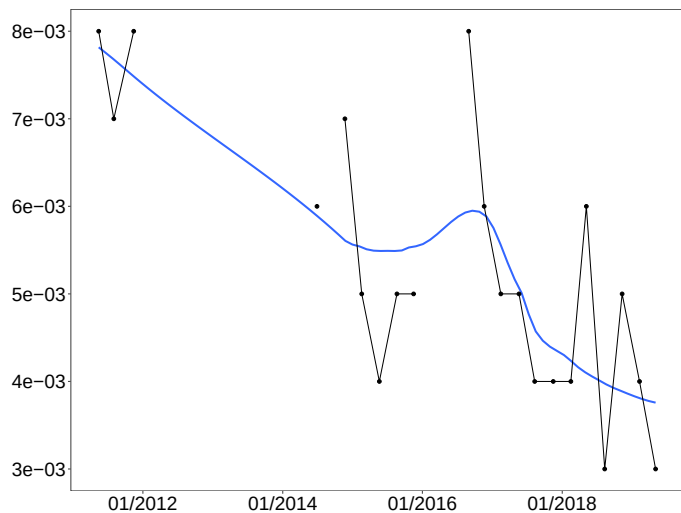
EC03 – Antimony (t.)

 $\tau = -0.557$ | p-value = 0.00116 | Negative trend

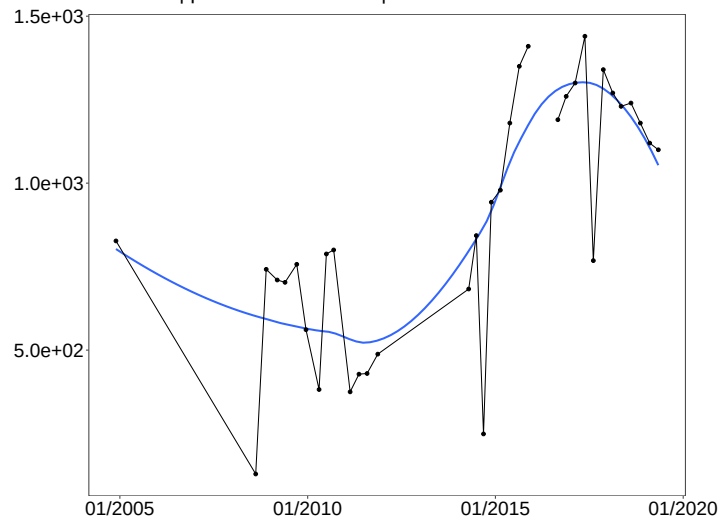
EC03 – Arsenic (d.)

 $\tau = -0.538$ | p-value = 0.00128 | Negative trend

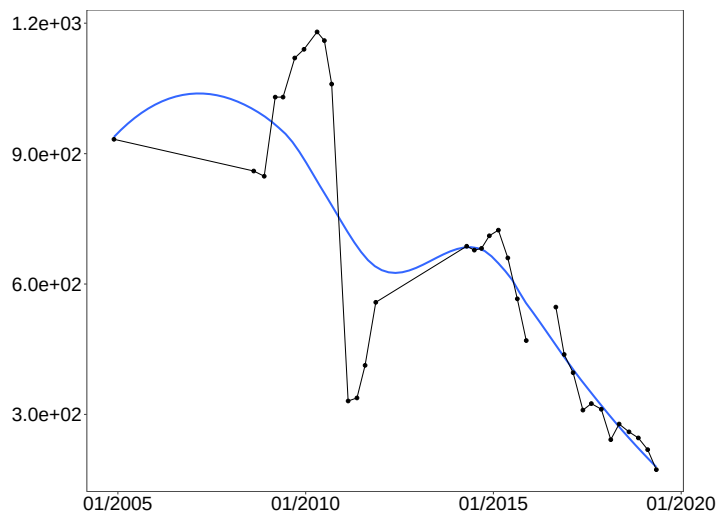
EC03 – Arsenic (t.)
 $\tau = -0.586$ | p-value = 0.000522 | Negative trend



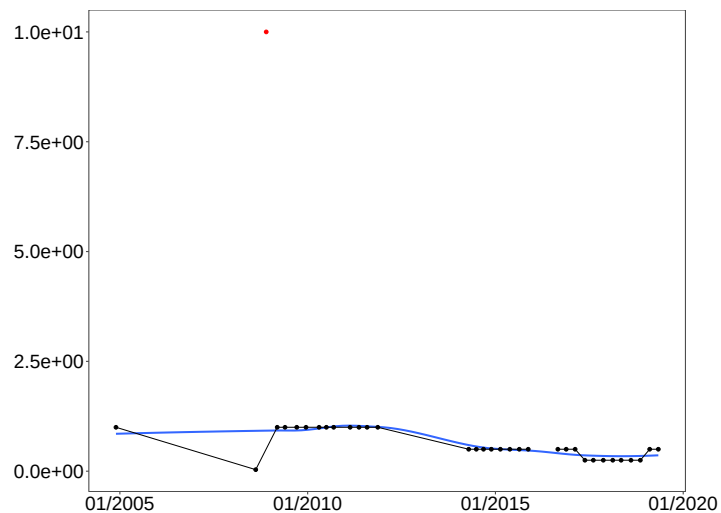
EC03 – Bicarbonate
 $\tau = 0.457$ | p-value = 0.000156 | Positive trend



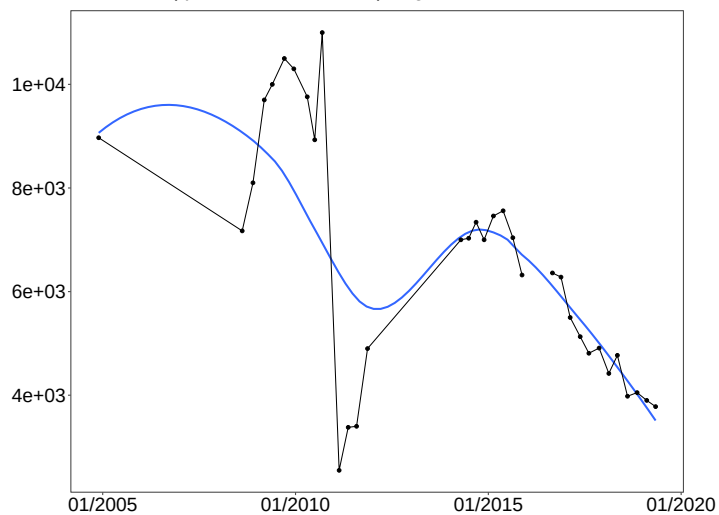
EC03 – Calcium
 $\tau = -0.66$ | p-value = 0.0000000448 | Negative trend



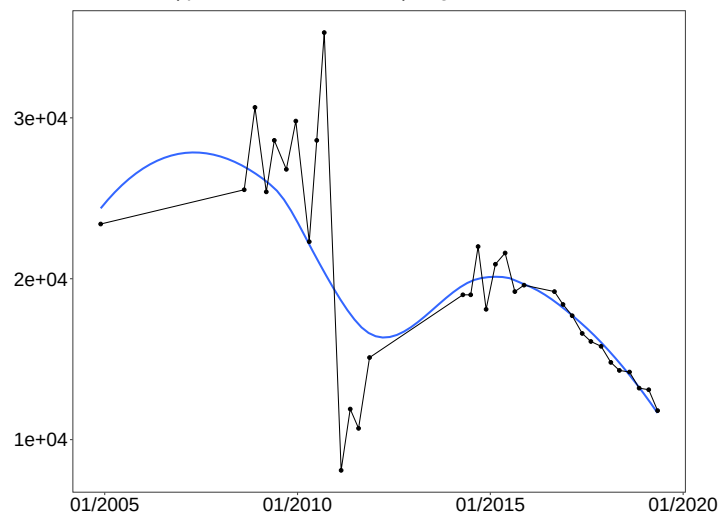
EC03 – Carbonate
 $\tau = -0.641$ | p-value = 0.00000209 | Negative trend



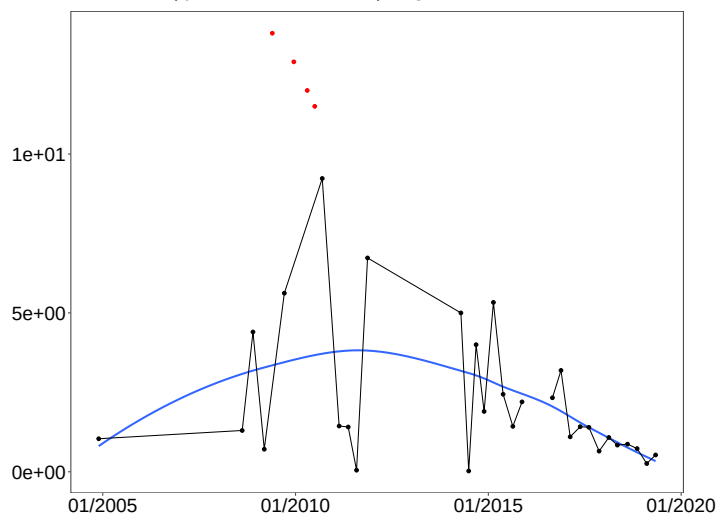
EC03 – Chloride
 $\tau = -0.521$ | p-value = 0.000016 | Negative trend



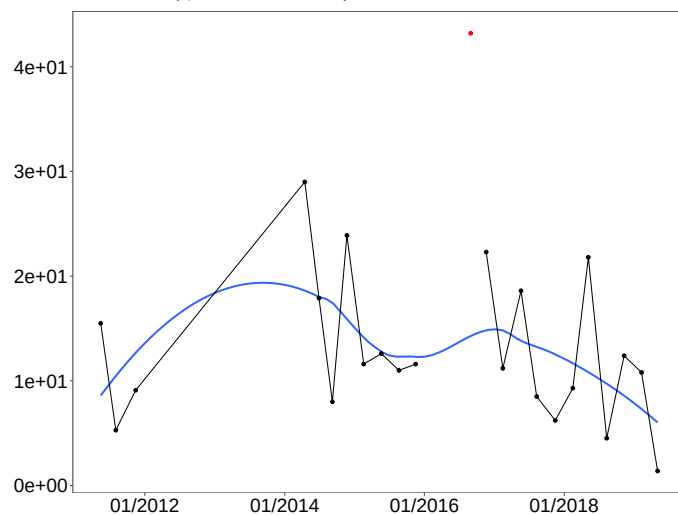
EC03 – Electrical Conductivity
 $\tau = -0.543$ | p-value = 0.00000701 | Negative trend



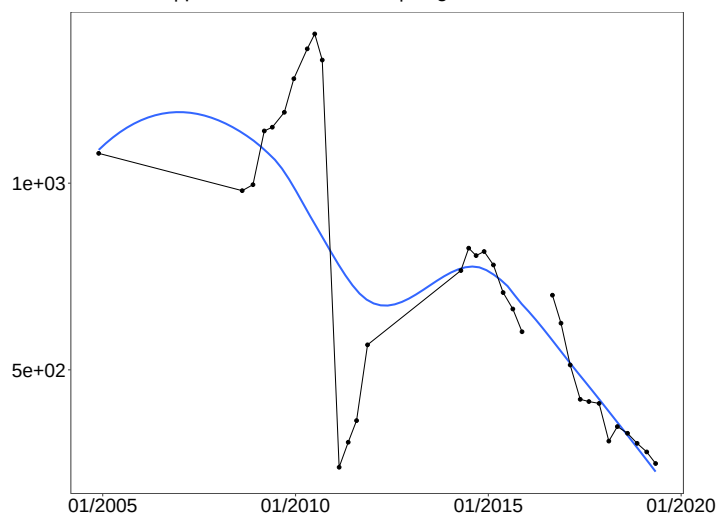
EC03 – Iron (d.)
 $\tau = -0.415$ | p-value = 0.000583 | Negative trend



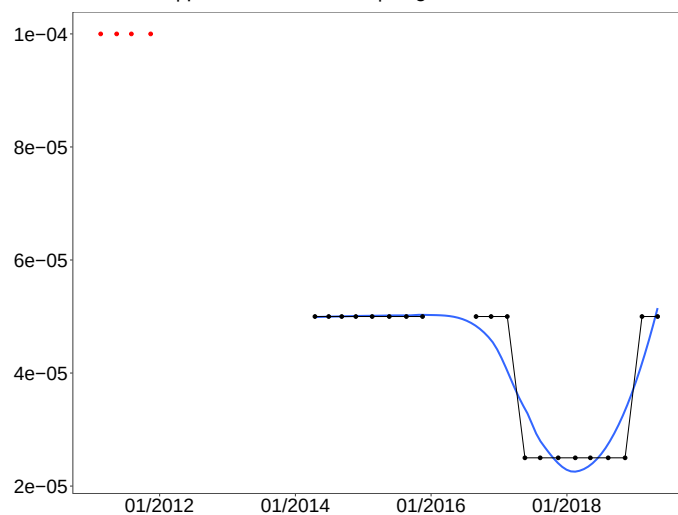
EC03 – Iron (t.)
 $\tau = -0.198$ | p-value = 0.195 | No trend



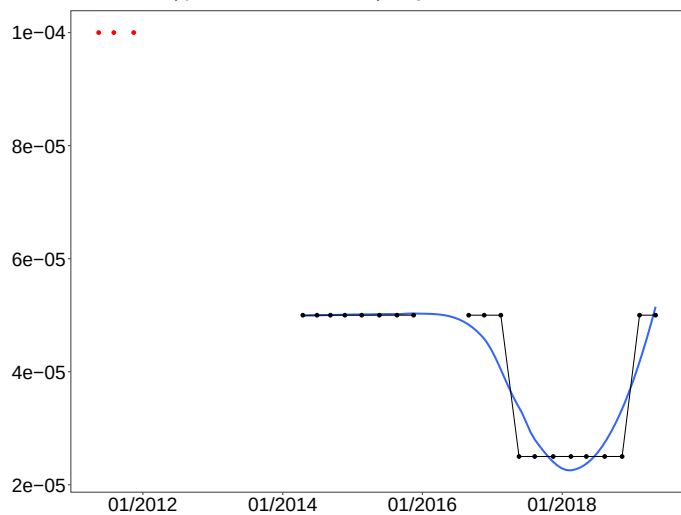
EC03 – Magnesium
 $\tau = -0.579$ | p-value = 0.00000156 | Negative trend



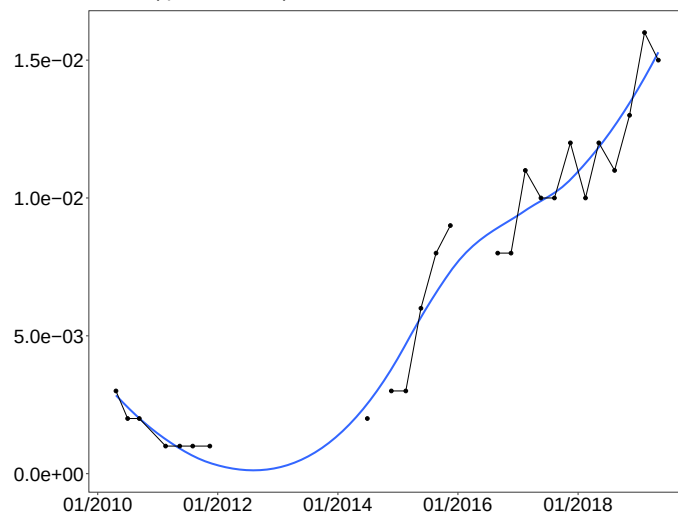
EC03 – Mercury (d.)
 $\tau = -0.658$ | p-value = 0.000084 | Negative trend



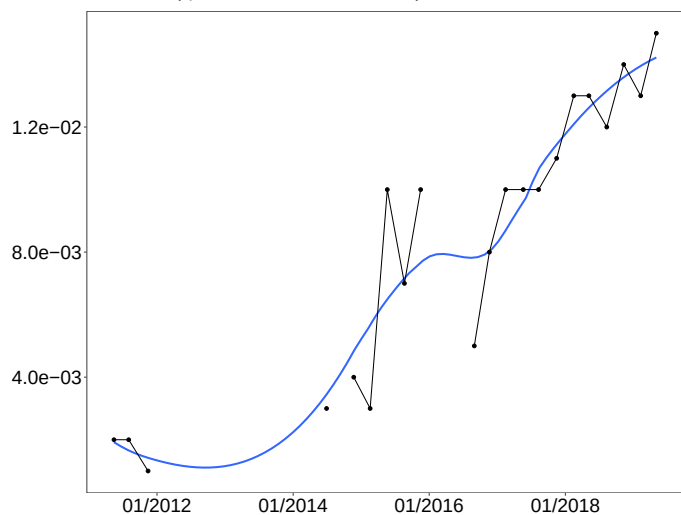
EC03 – Mercury (t.)
 $\tau = -0.629$ | p-value = 0.000262 | Negative trend



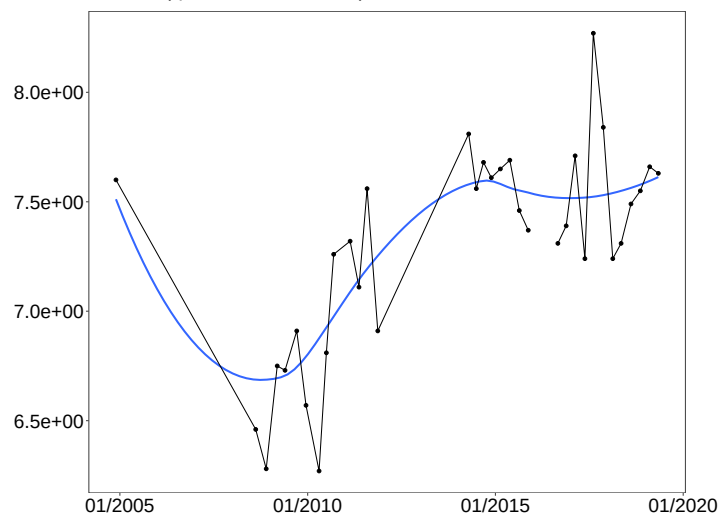
EC03 – Molybdenum (d.)
 $\tau = 0.8$ | p-value = 0 | Positive trend



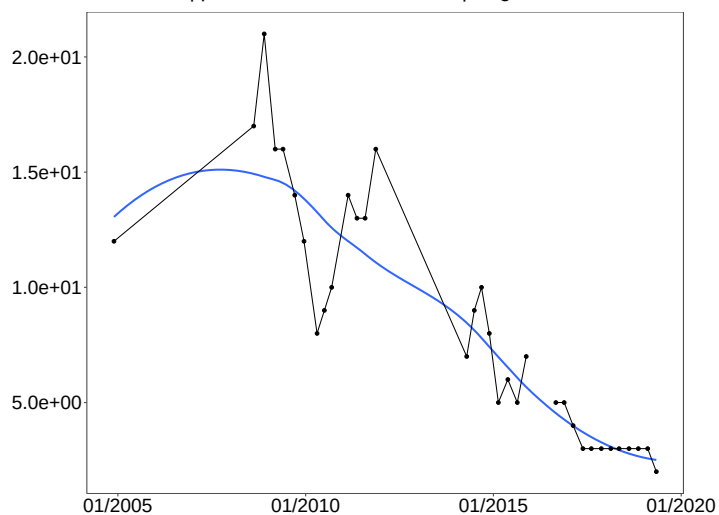
EC03 – Molybdenum (t.)
 $\tau = 0.845$ | p-value = 0.000000238 | Positive trend



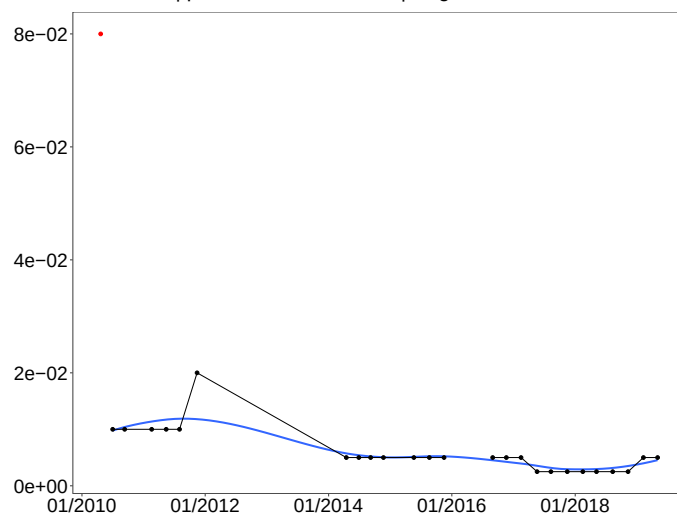
EC03 – pH
 $\tau = 0.42$ | p-value = 0.00052 | Positive trend



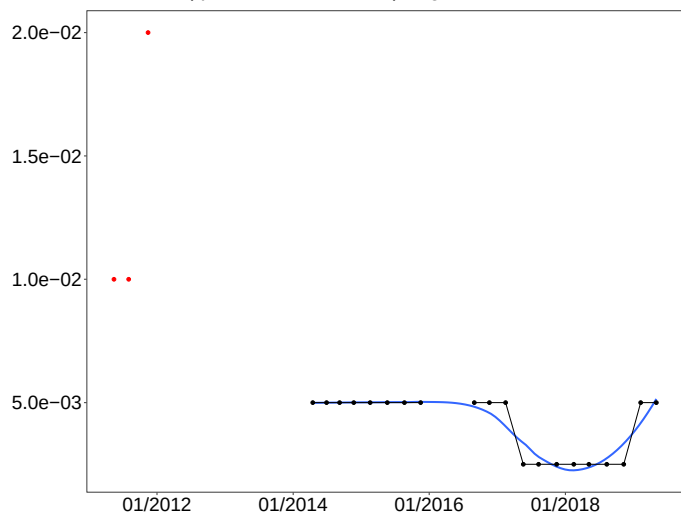
EC03 – Potassium
 $\tau = -0.797$ | p-value = 0.00000000151 | Negative trend



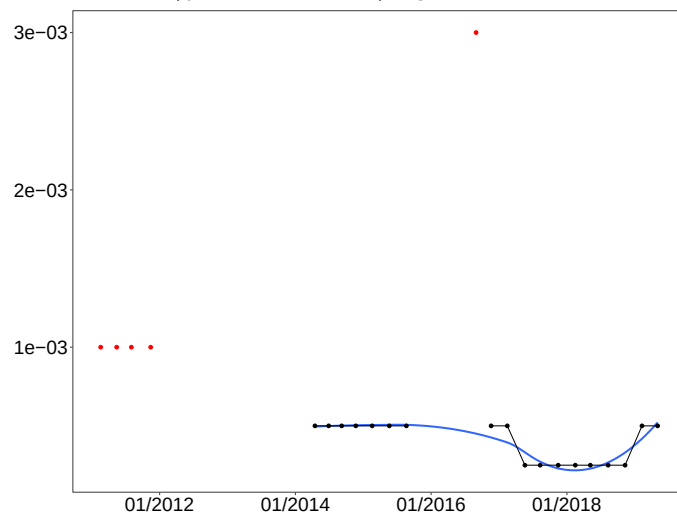
EC03 – Selenium (d.)
 $\tau = -0.698$ | p-value = 0.00000768 | Negative trend



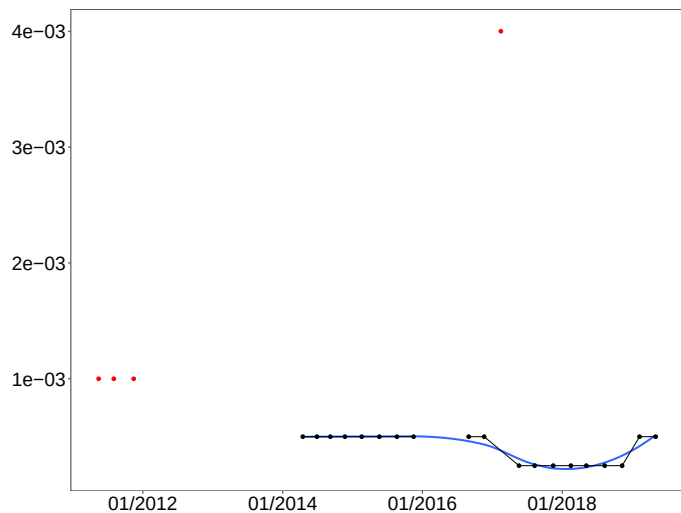
EC03 – Selenium (t.)
 $\tau = -0.615$ | p-value = 0.000336 | Negative trend



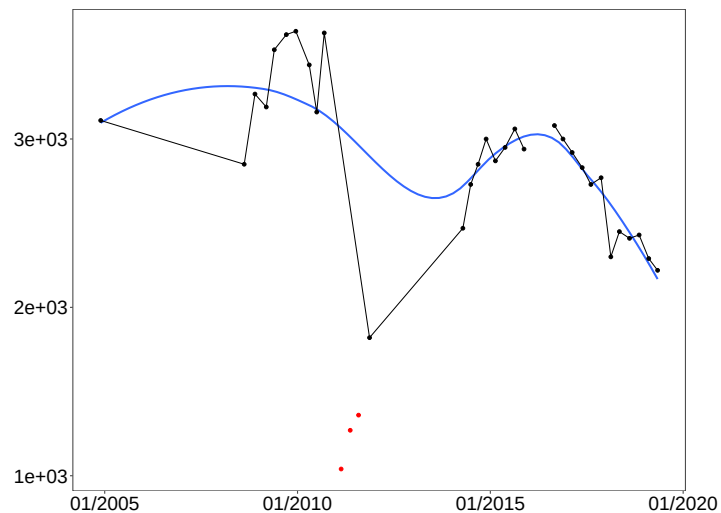
EC03 – Silver (d.)
 $\tau = -0.582$ | p-value = 0.000578 | Negative trend



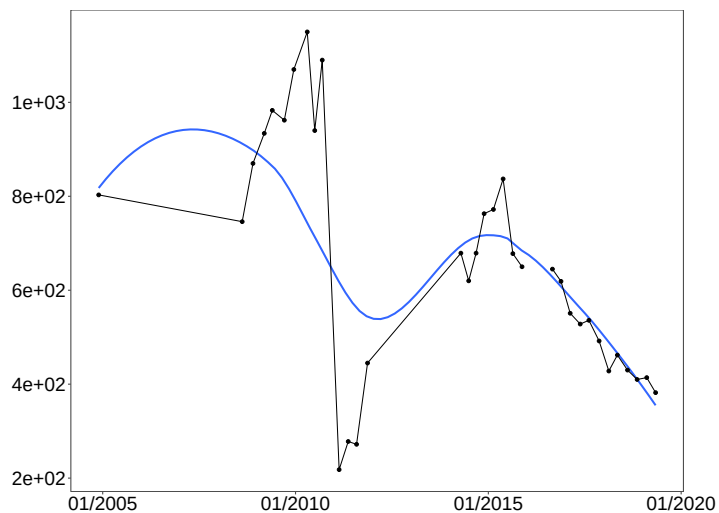
EC03 – Silver (t.)

 $\tau = -0.537$ | p-value = 0.00161 | Negative trend

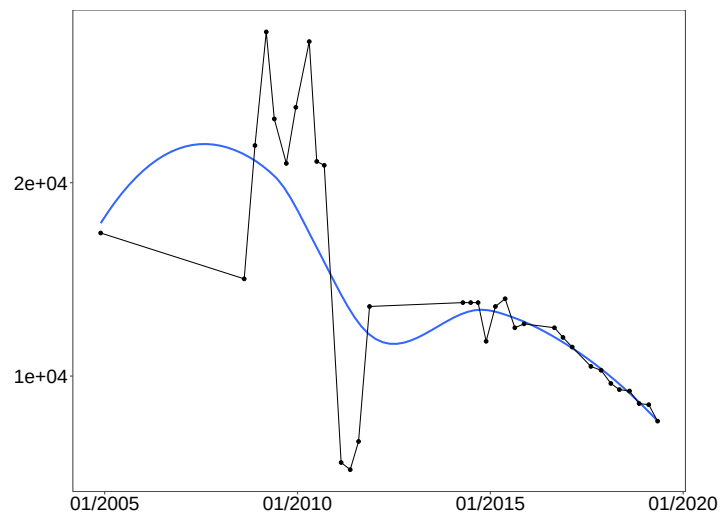
EC03 – Sodium

 $\tau = -0.361$ | p-value = 0.00288 | Negative trend

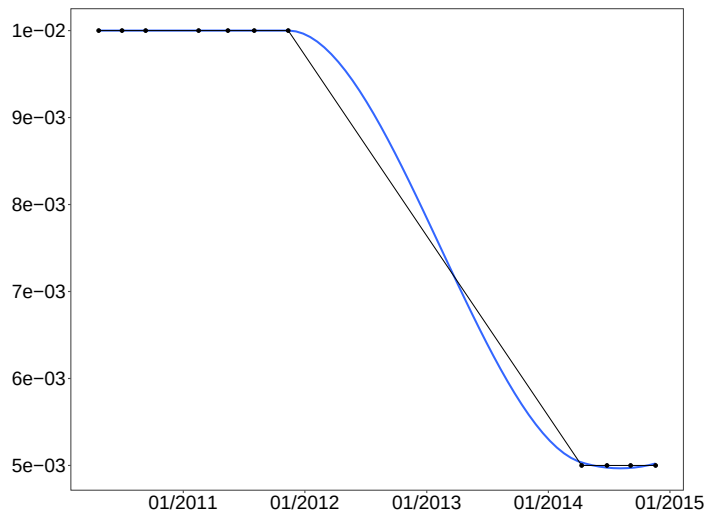
EC03 – Sulphate

 $\tau = -0.492$ | p-value = 0.0000456 | Negative trend

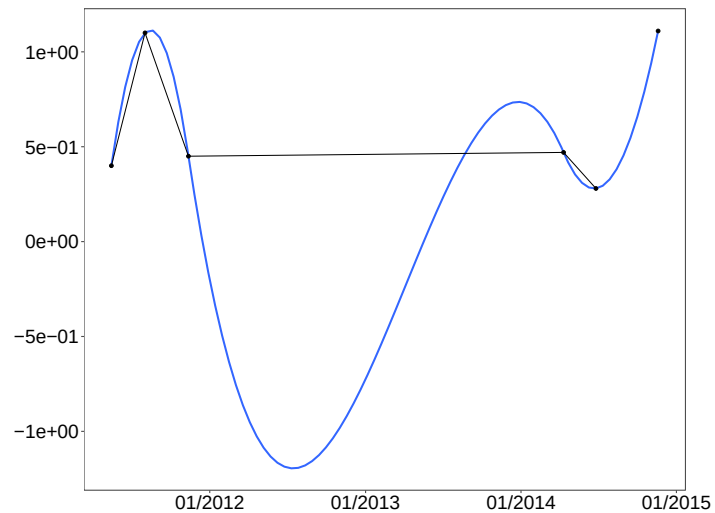
EC03 – TDS

 $\tau = -0.603$ | p-value = 0.00000096 | Negative trend

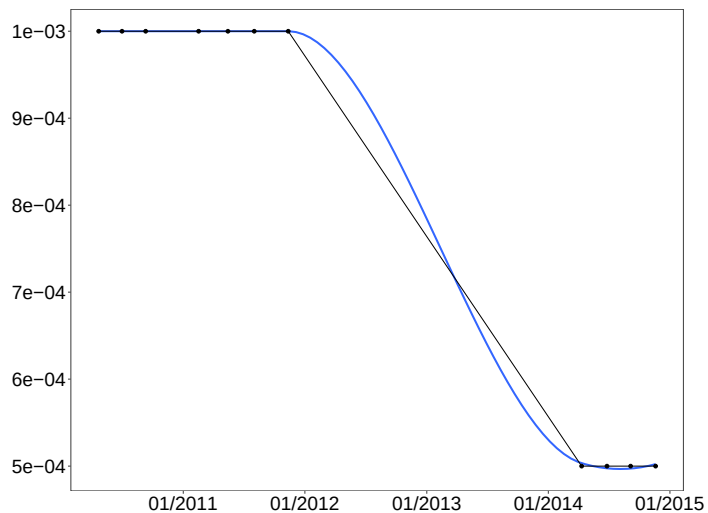
EC04 – Aluminium (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

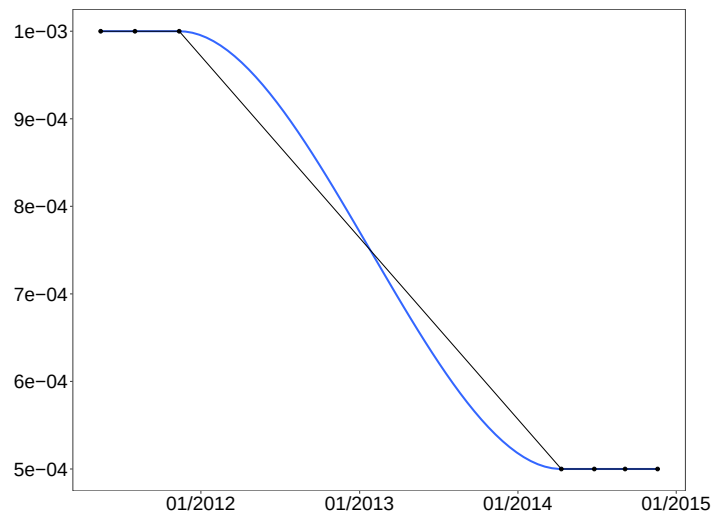
EC04 – Aluminium (t.)

 $\tau = 0.2$ | p-value = 0.707 | No trend

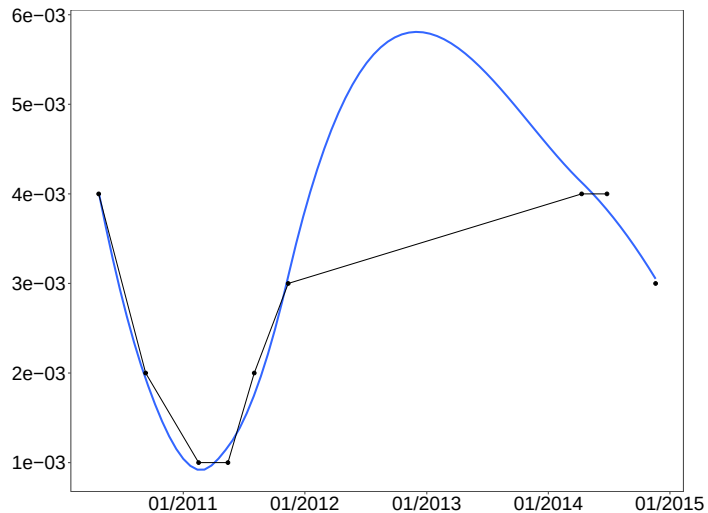
EC04 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



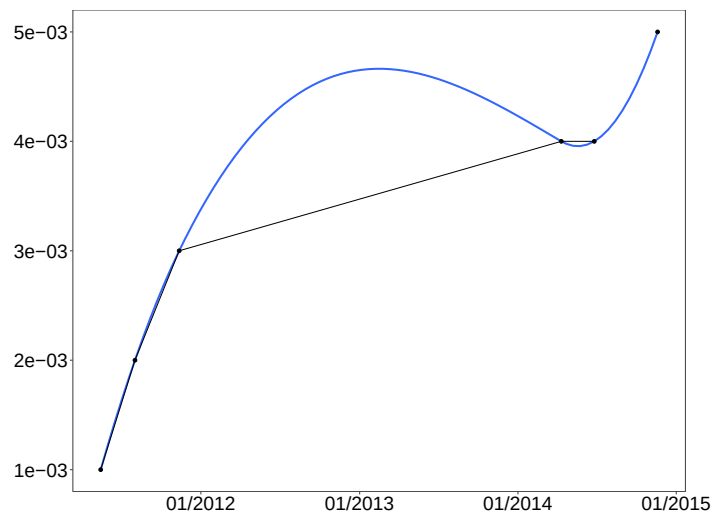
EC04 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



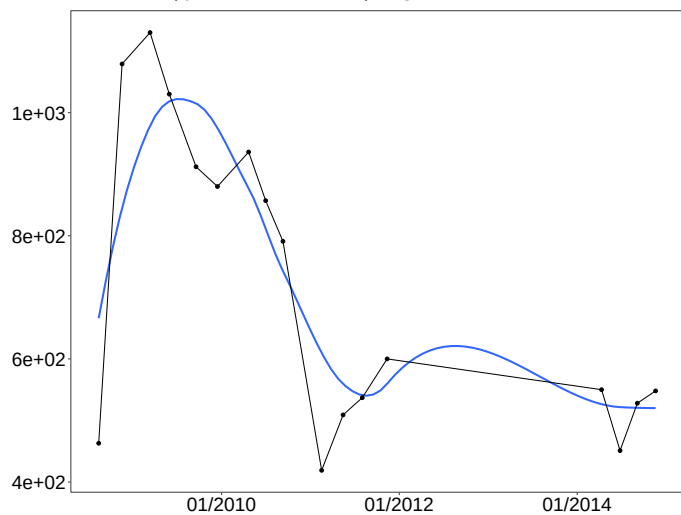
EC04 – Arsenic (d.)
 $\tau = 0.304$ | p-value = 0.33 | No trend



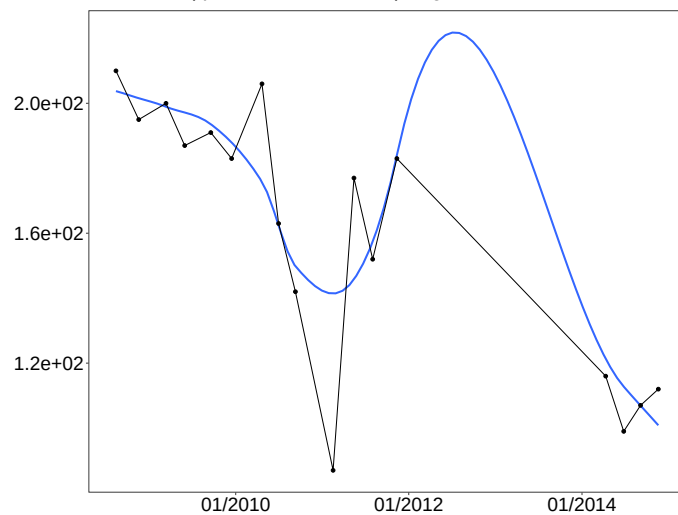
EC04 – Arsenic (t.)
 $\tau = 0.966$ | p-value = 0.0129 | Positive trend



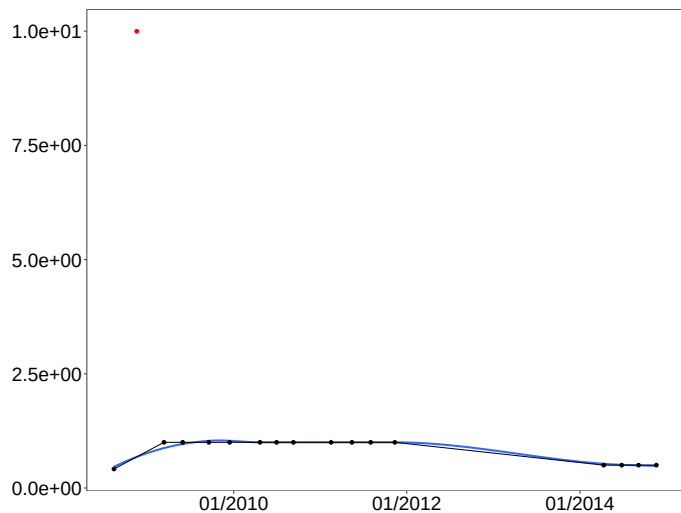
EC04 – Bicarbonate
 $\tau = -0.485$ | p-value = 0.00742 | Negative trend



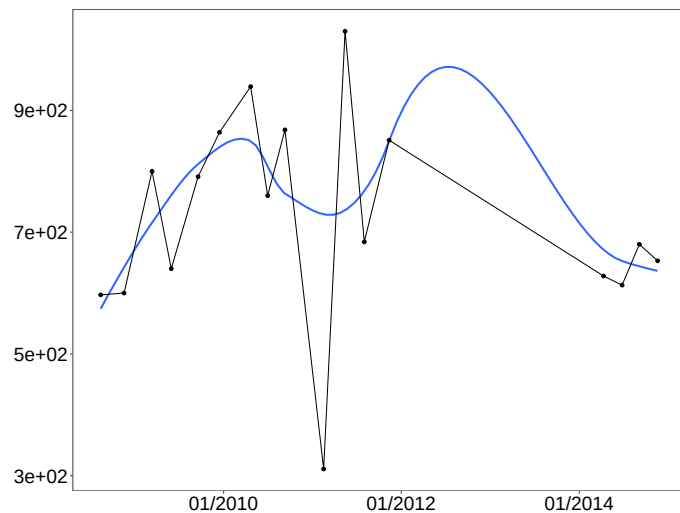
EC04 – Calcium
 $\tau = -0.642$ | p-value = 0.000392 | Negative trend



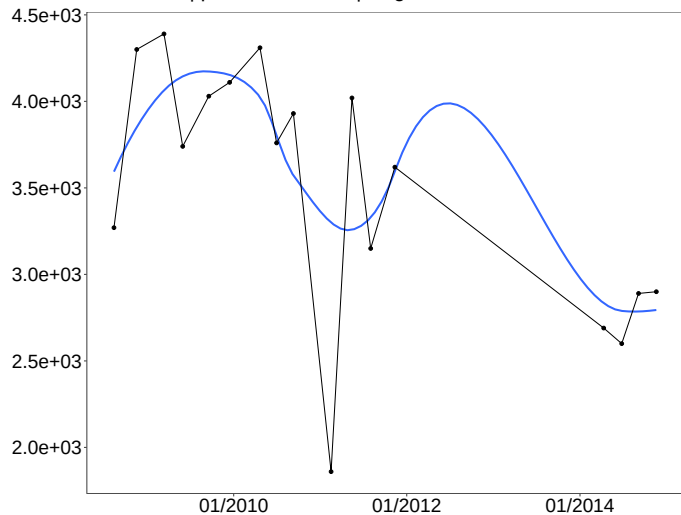
EC04 – Carbonate
 $\tau = -0.426$ | p-value = 0.0394 | Negative trend



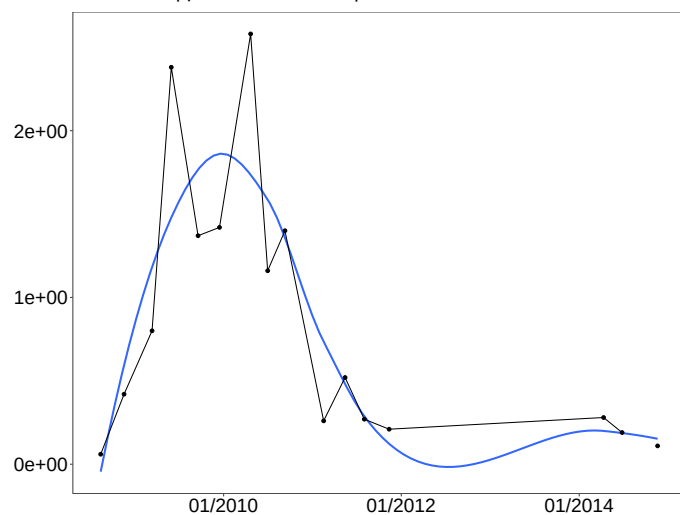
EC04 – Chloride
 $\tau = 0.0147$ | p-value = 0.967 | No trend



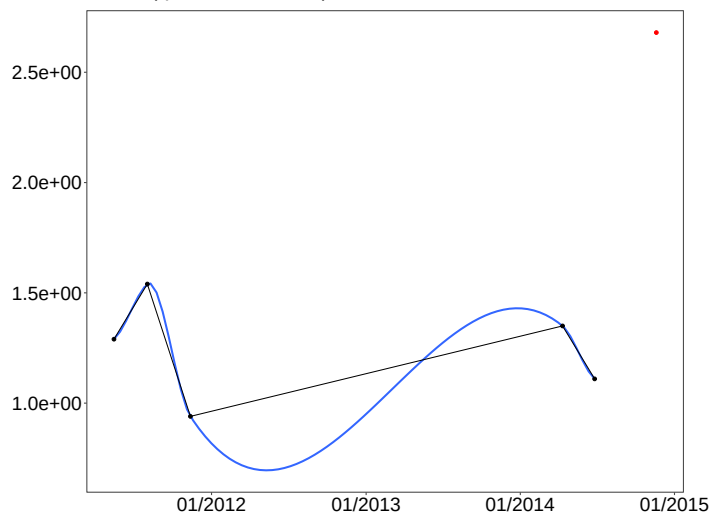
EC04 – Electrical Conductivity
 $\tau = -0.456$ | p-value = 0.012 | Negative trend



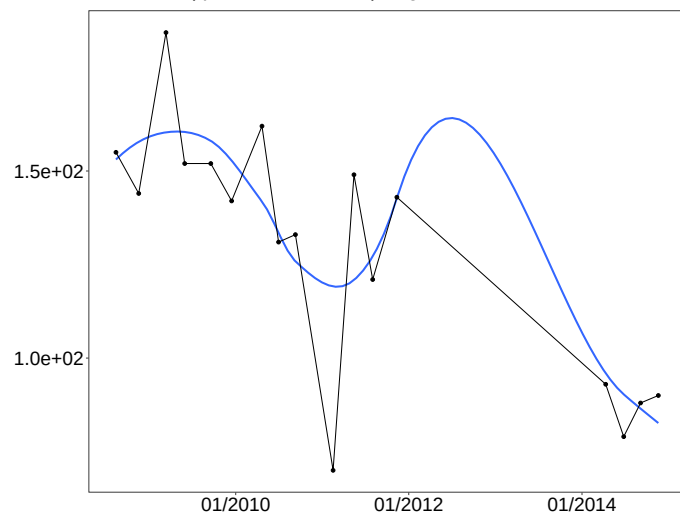
EC04 – Iron (d.)
 $\tau = -0.333$ | p-value = 0.0791 | No trend



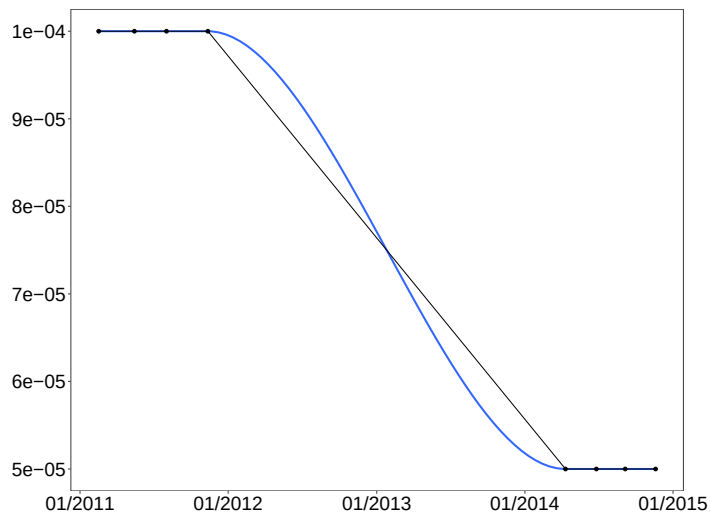
EC04 – Iron (t.)
 $\tau = 0.2$ | p-value = 0.707 | No trend



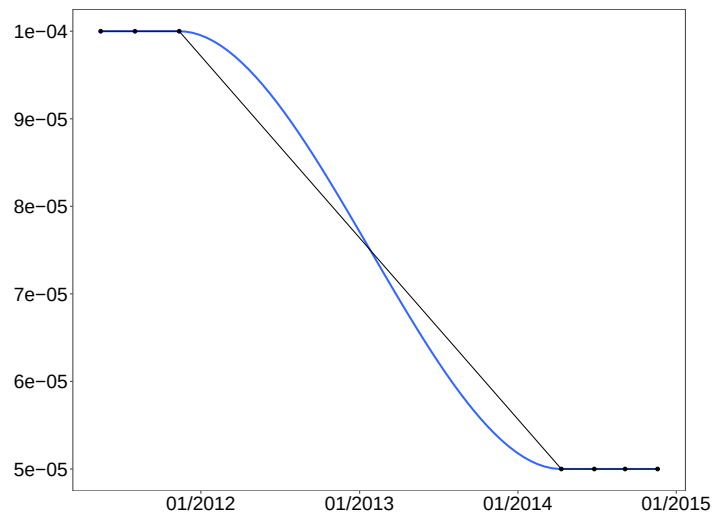
EC04 – Magnesium
 $\tau = -0.583$ | p-value = 0.0013 | Negative trend



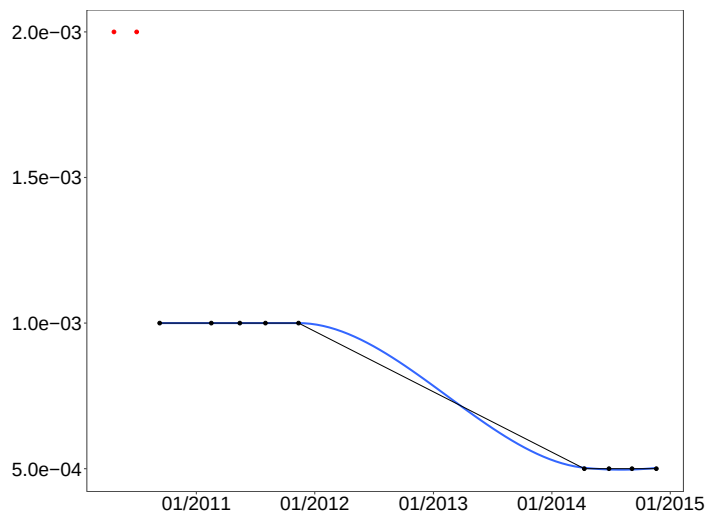
EC04 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



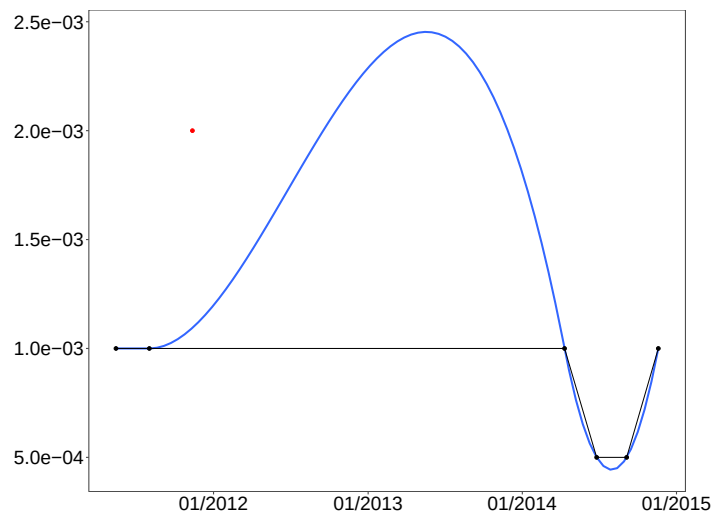
EC04 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



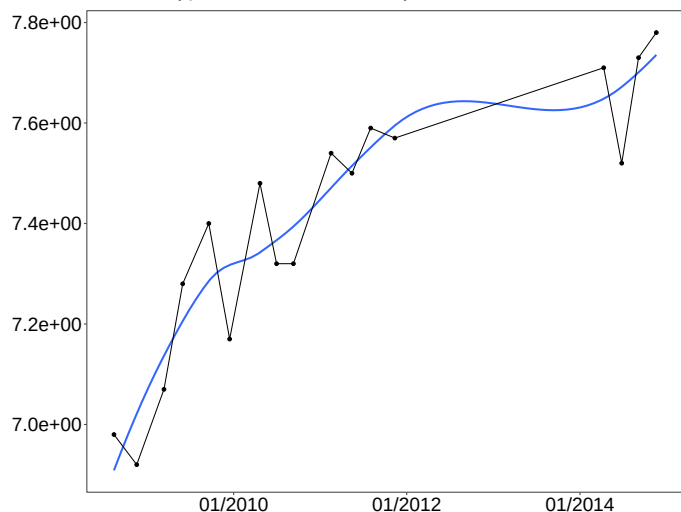
EC04 – Molybdenum (d.)
 $\tau = -0.831$ | p-value = 0.00168 | Negative trend



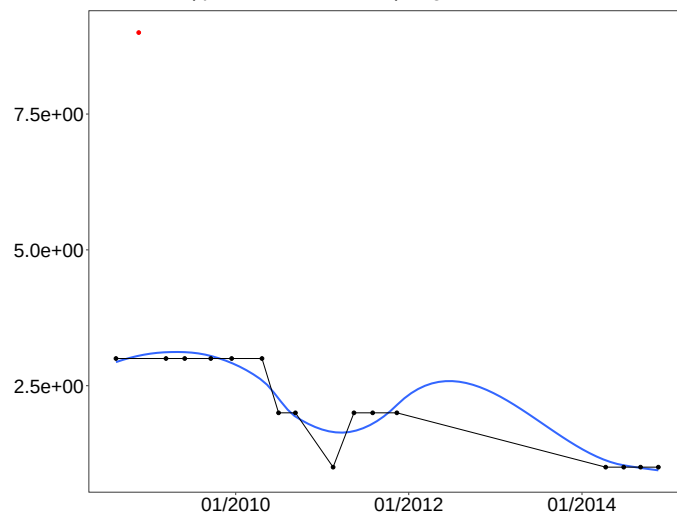
EC04 – Molybdenum (t.)
 $\tau = -0.35$ | p-value = 0.396 | No trend



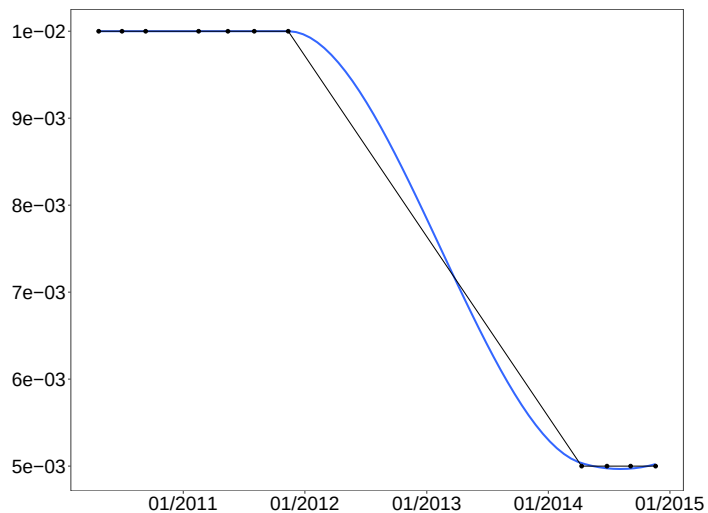
EC04 – pH
 $\tau = 0.804$ | p-value = 0.00000846 | Positive trend



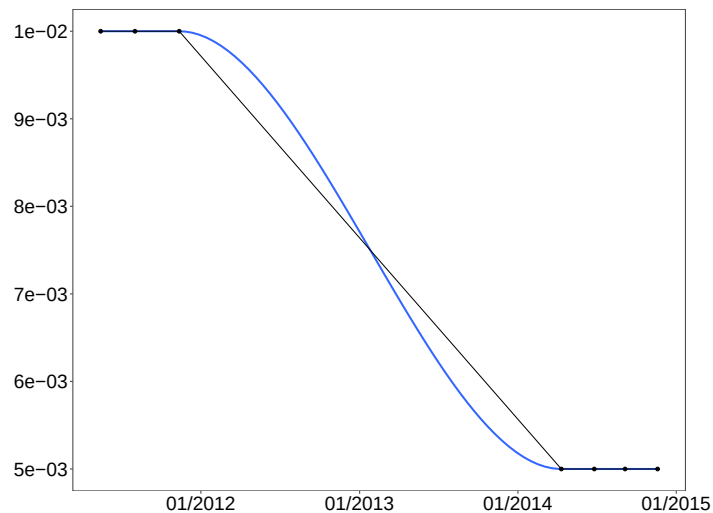
EC04 – Potassium
 $\tau = -0.794$ | p-value = 0.000062 | Negative trend



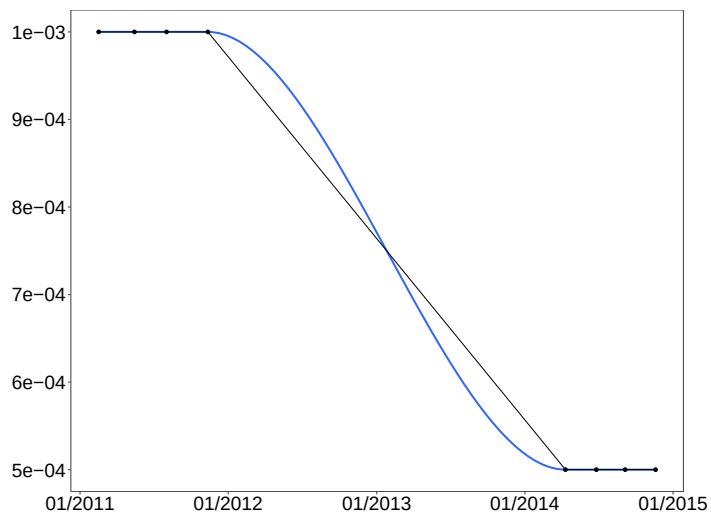
EC04 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



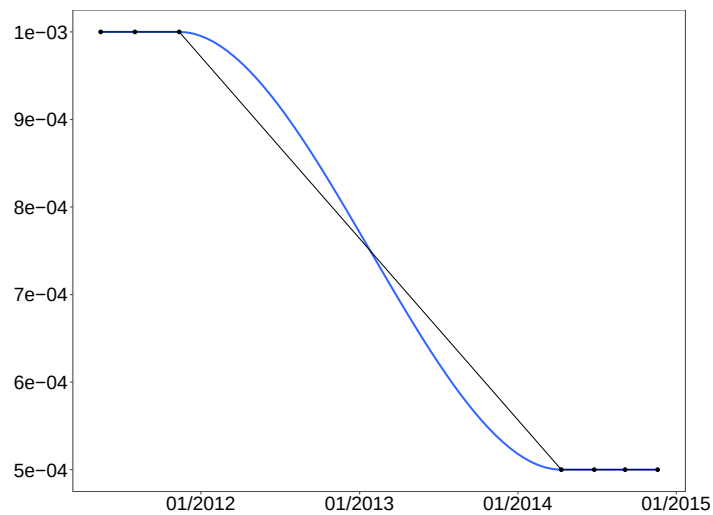
EC04 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



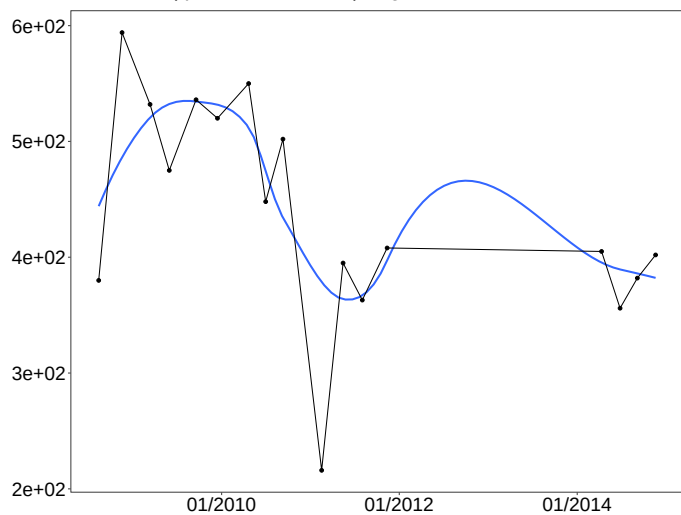
EC04 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



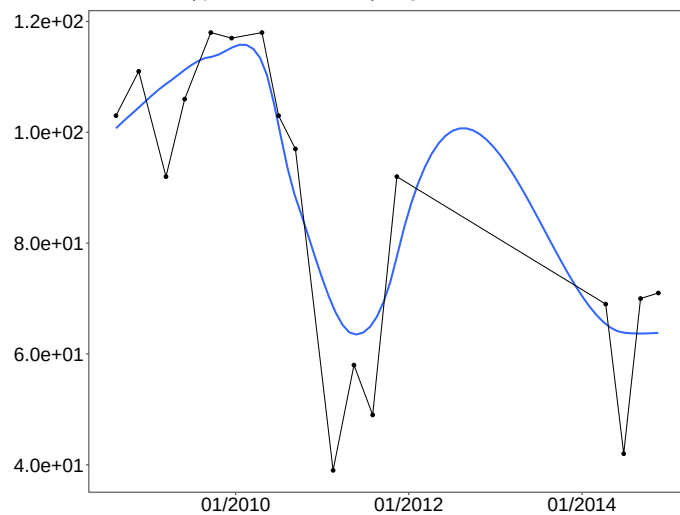
EC04 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



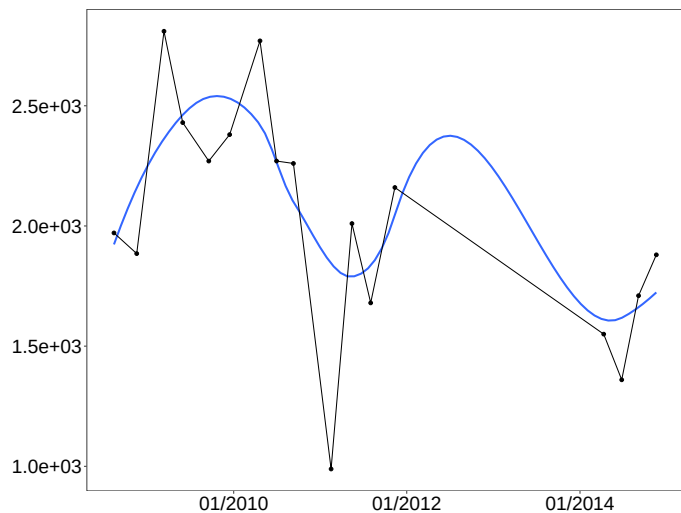
EC04 – Sodium
 $\tau = -0.426$ | p-value = 0.0189 | Negative trend



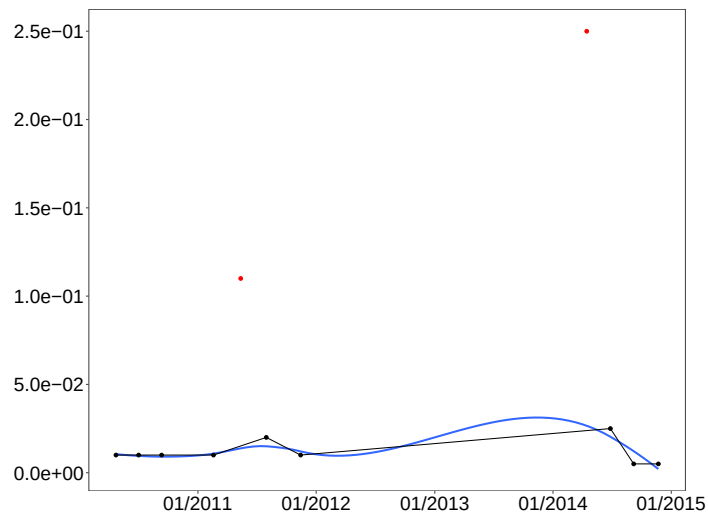
EC04 – Sulphate
 $\tau = -0.424$ | p-value = 0.0207 | Negative trend



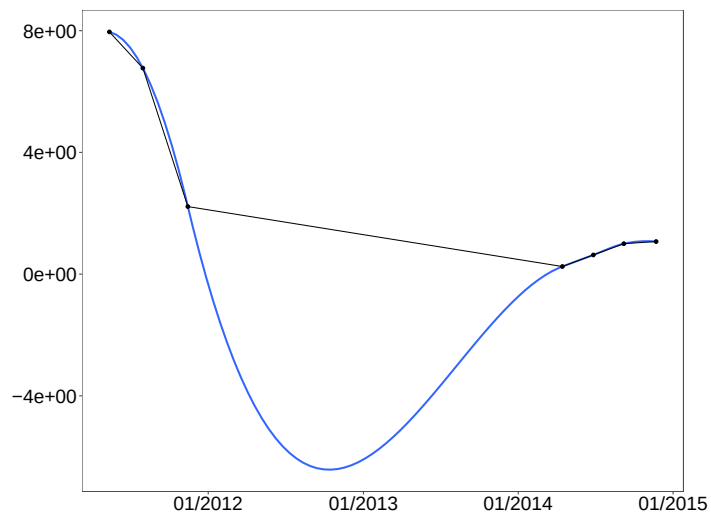
EC04 – TDS

 $\tau = -0.435$ | p-value = 0.0168 | Negative trend

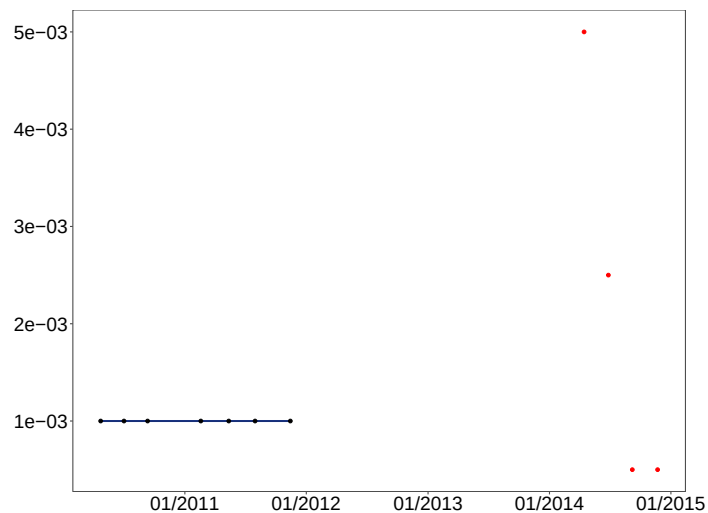
EC05 – Aluminium (d.)

 $\tau = -0.0407$ | p-value = 0.934 | No trend

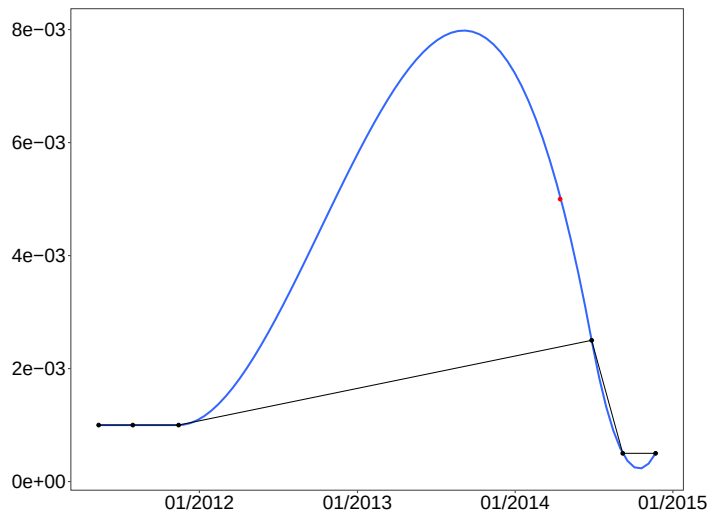
EC05 – Aluminium (t.)

 $\tau = -0.429$ | p-value = 0.23 | No trend

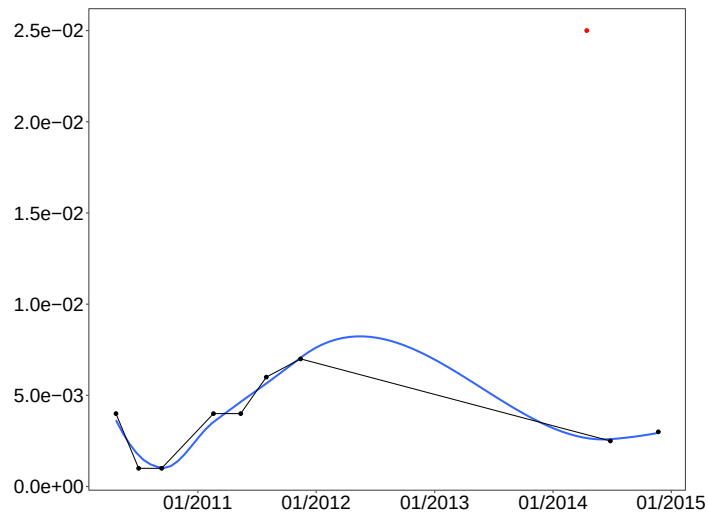
EC05 – Antimony (d.)

 $\tau = -0.117$ | p-value = 0.715 | No trend

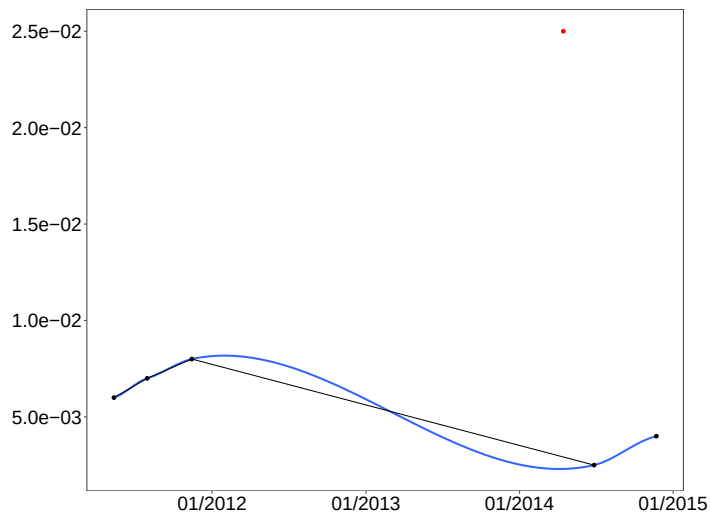
EC05 – Antimony (t.)

 $\tau = -0.265$ | p-value = 0.525 | No trend

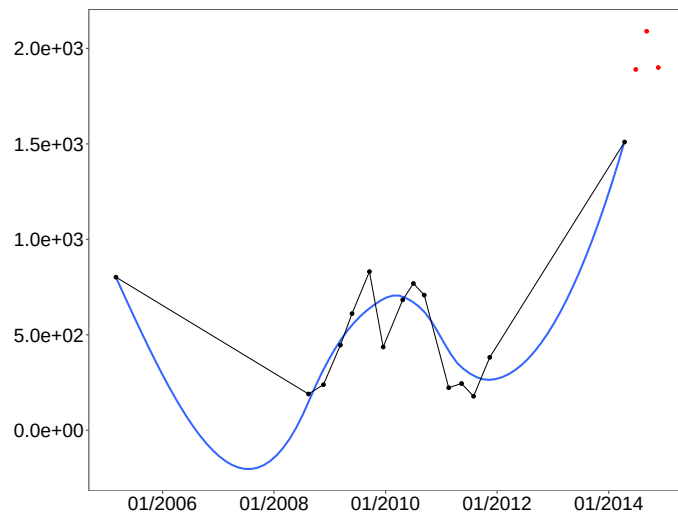
EC05 – Arsenic (d.)

 $\tau = 0.303$ | p-value = 0.274 | No trend

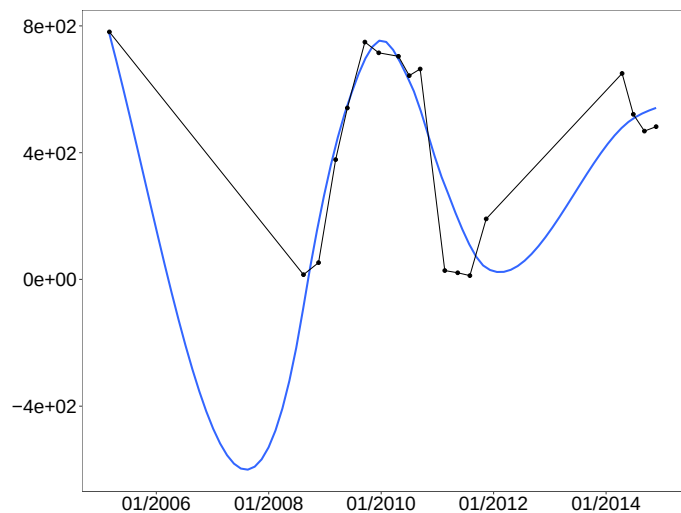
EC05 – Arsenic (t.)
 $\tau = -0.0667$ | p-value = 1 | No trend



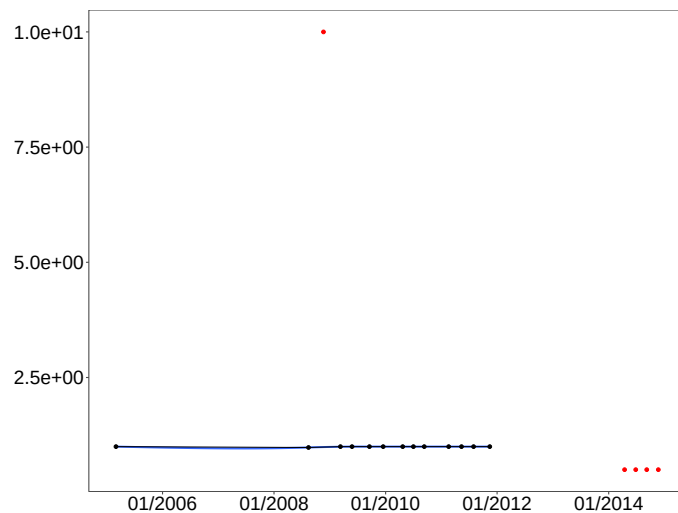
EC05 – Bicarbonate
 $\tau = 0.307$ | p-value = 0.0814 | No trend



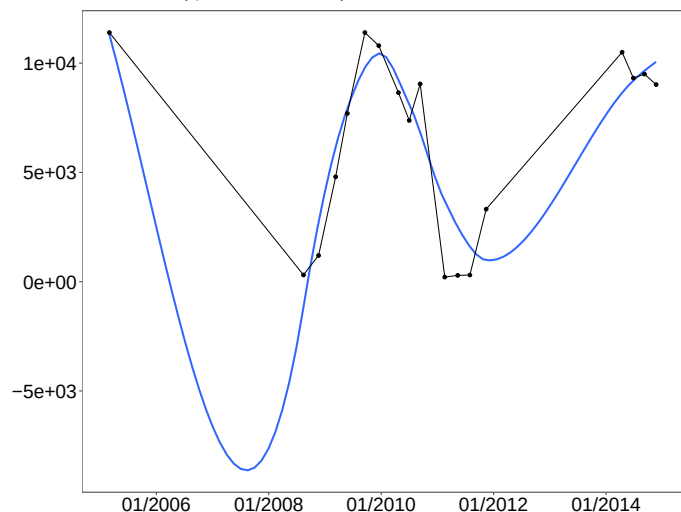
EC05 – Calcium
 $\tau = -0.15$ | p-value = 0.405 | No trend



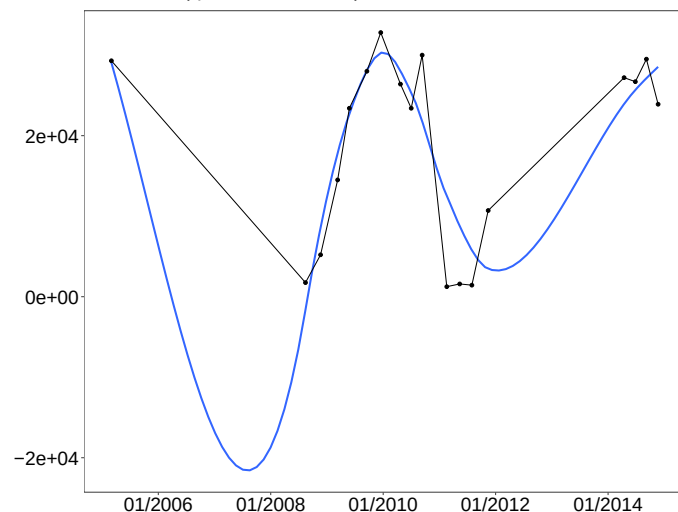
EC05 – Carbonate
 $\tau = -0.494$ | p-value = 0.0133 | Negative trend



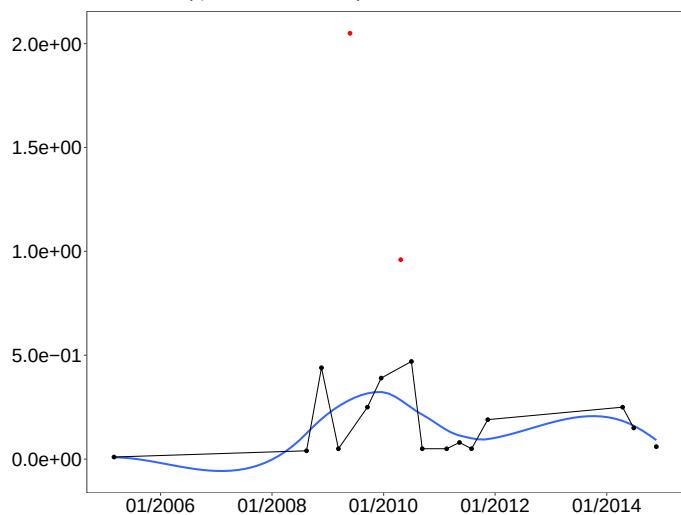
EC05 – Chloride
 $\tau = 0.0393$ | p-value = 0.85 | No trend



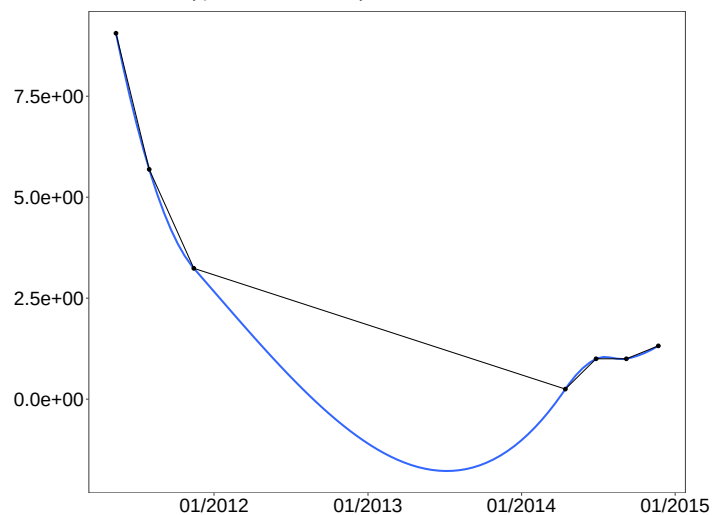
EC05 – Electrical Conductivity
 $\tau = 0.0656$ | p-value = 0.733 | No trend



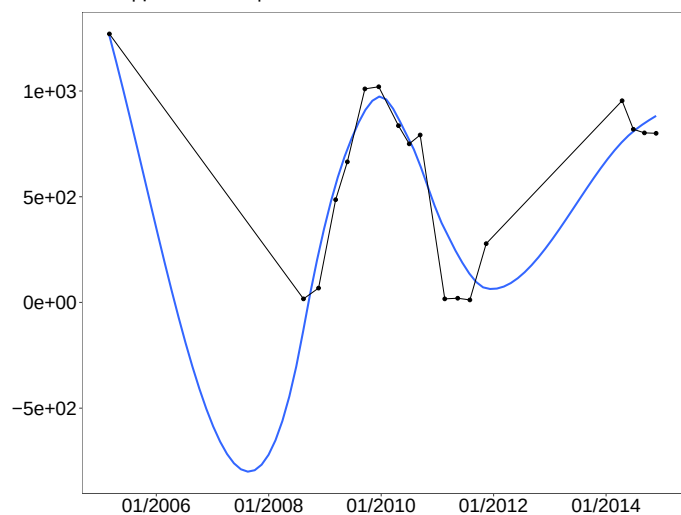
EC05 – Iron (d.)
 $\tau = 0.0377$ | p-value = 0.868 | No trend



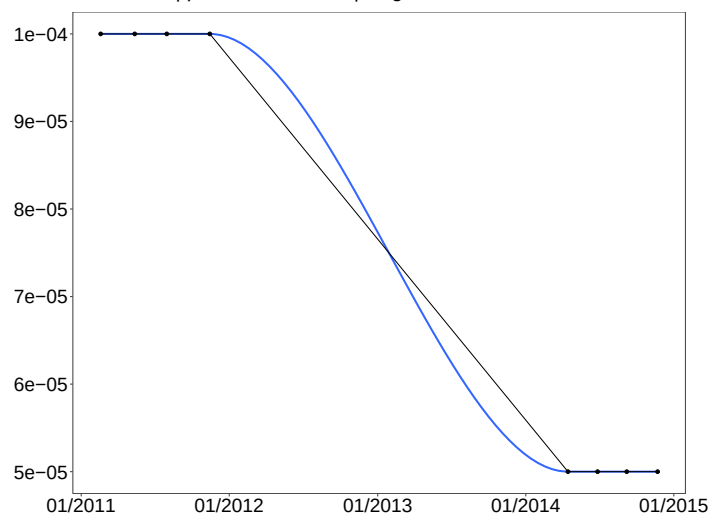
EC05 – Iron (t.)
 $\tau = -0.488$ | p-value = 0.172 | No trend



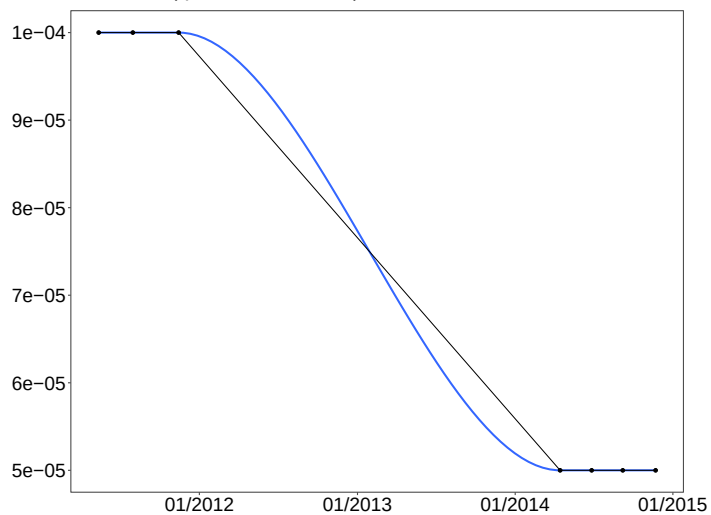
EC05 – Magnesium
 $\tau = 0$ | p-value = 1 | No trend



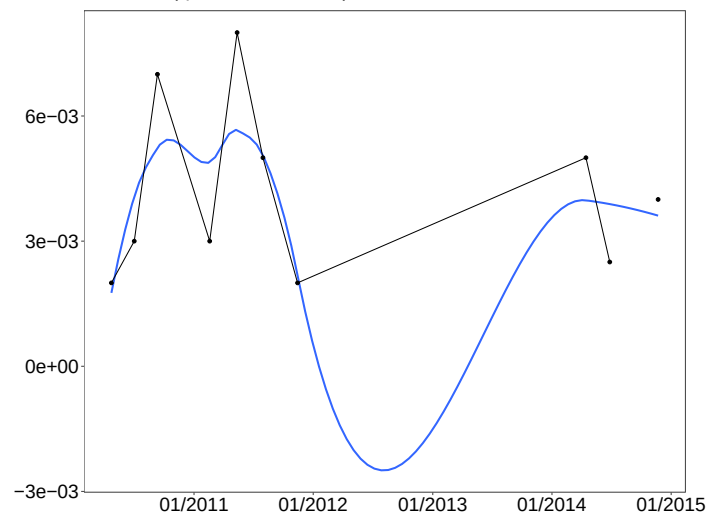
EC05 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



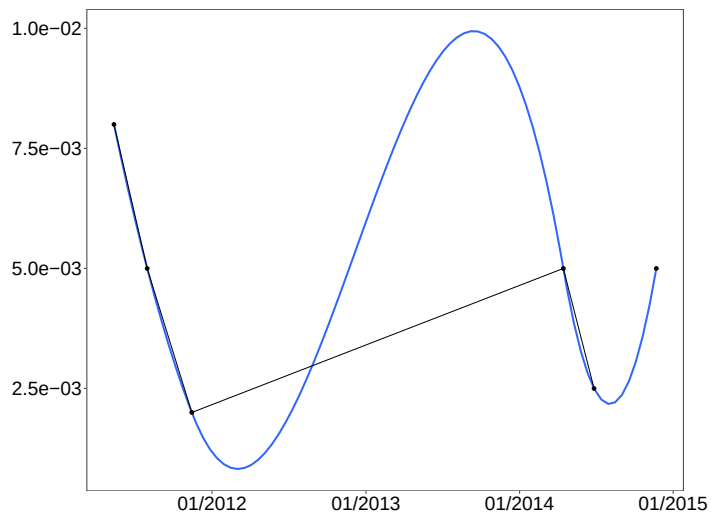
EC05 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



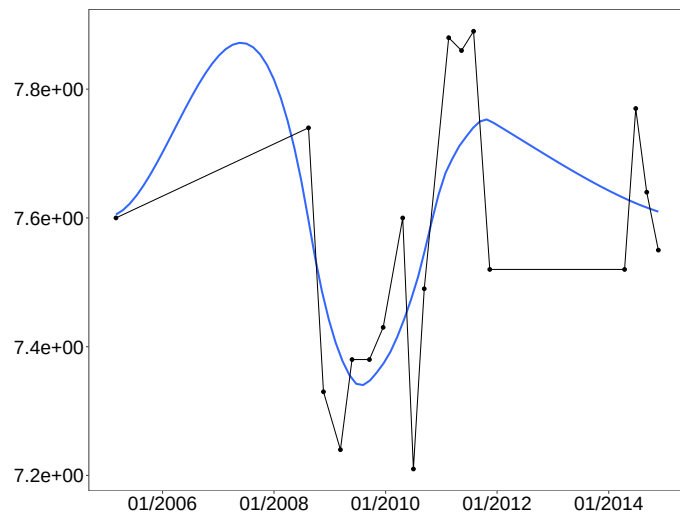
EC05 – Molybdenum (d.)
 $\tau = 0.046$ | p-value = 0.928 | No trend



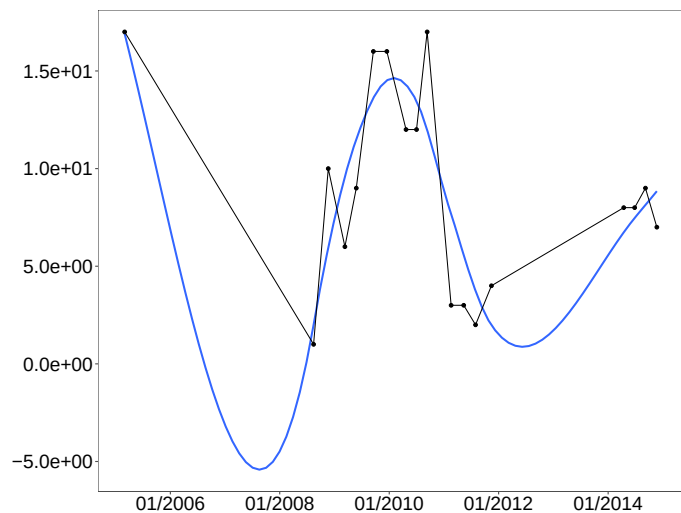
EC05 – Molybdenum (t.)
 $\tau = -0.298$ | p-value = 0.546 | No trend



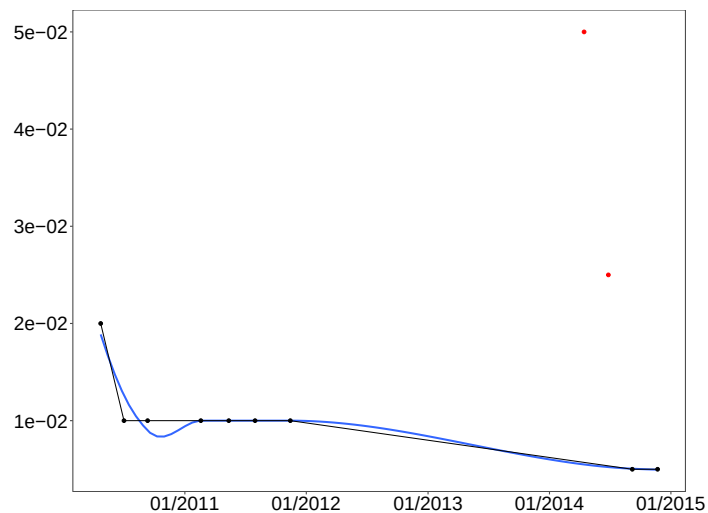
EC05 – pH
 $\tau = 0.304$ | p-value = 0.0876 | No trend



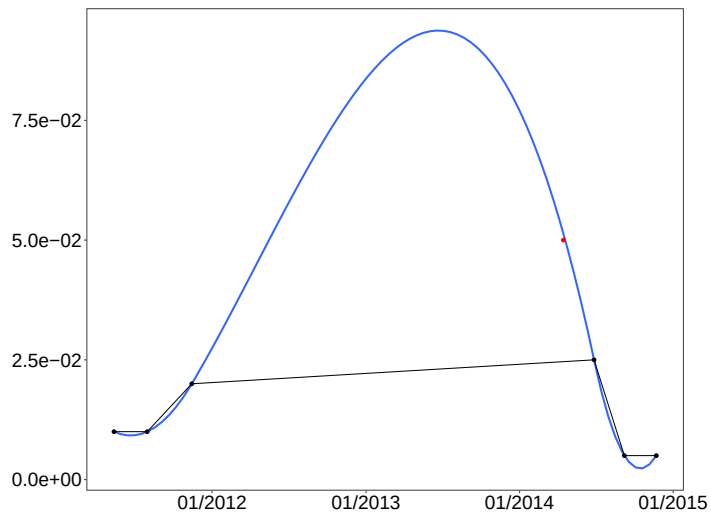
EC05 – Potassium
 $\tau = -0.167$ | p-value = 0.361 | No trend



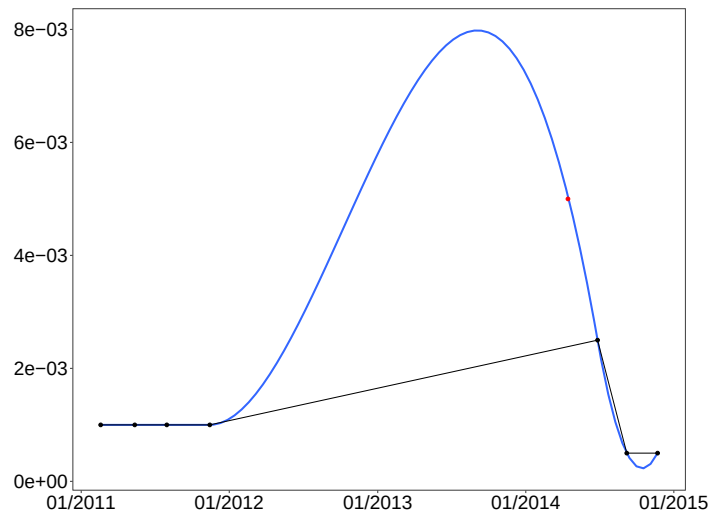
EC05 – Selenium (d.)
 $\tau = -0.238$ | p-value = 0.391 | No trend



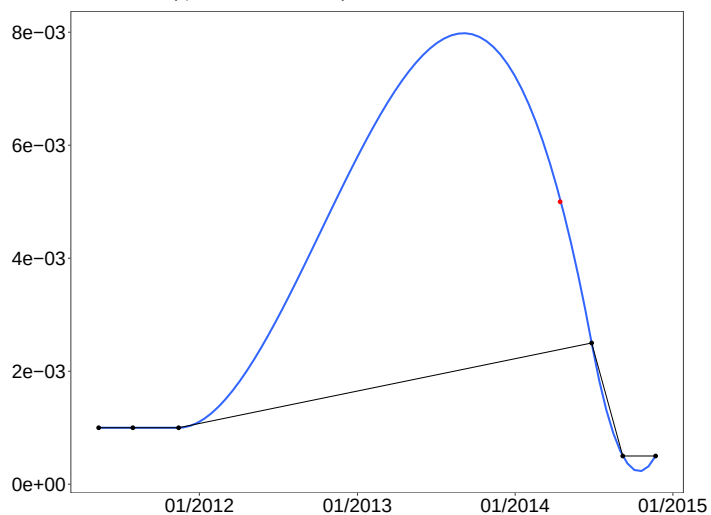
EC05 – Selenium (t.)
 $\tau = -0.15$ | p-value = 0.759 | No trend



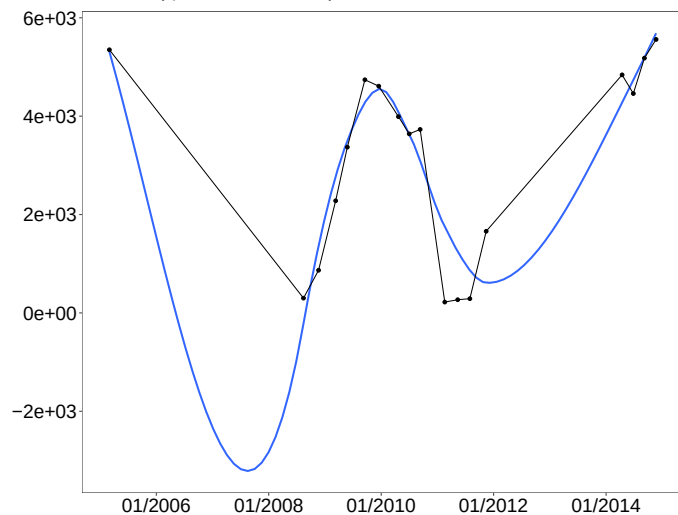
EC05 – Silver (d.)
 $\tau = -0.206$ | p-value = 0.592 | No trend



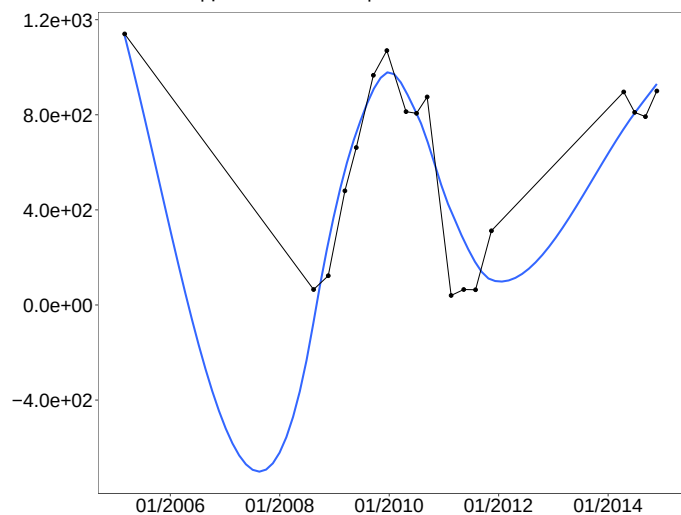
EC05 – Silver (t.)
 $\tau = -0.265$ | p-value = 0.525 | No trend



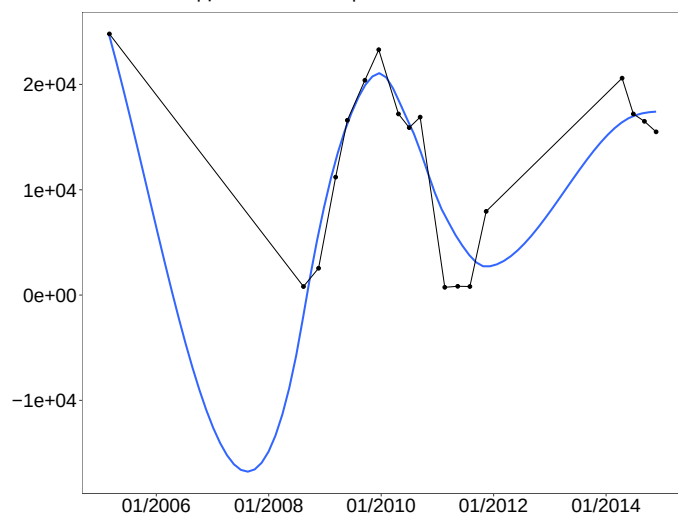
EC05 – Sodium
 $\tau = 0.19$ | p-value = 0.289 | No trend



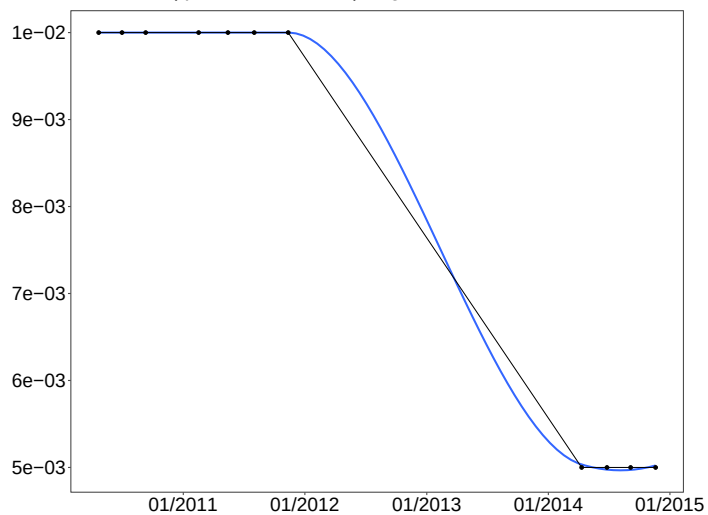
EC05 – Sulphate
 $\tau = 0.0262$ | p-value = 0.909 | No trend



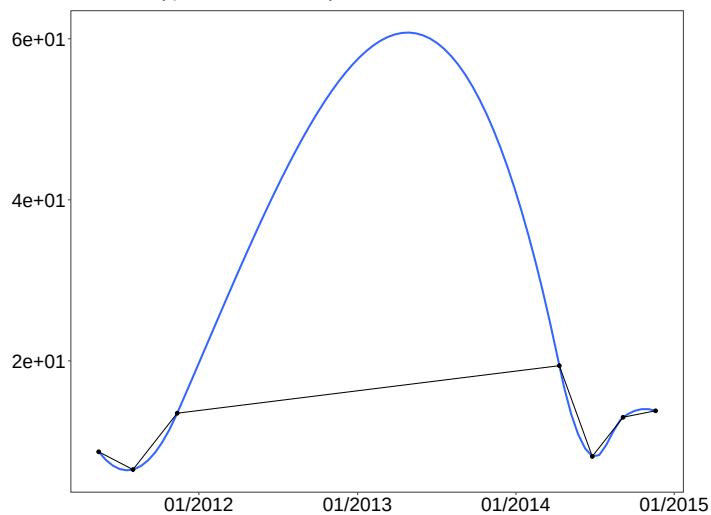
EC05 – TDS
 $\tau = -0.0393$ | p-value = 0.85 | No trend



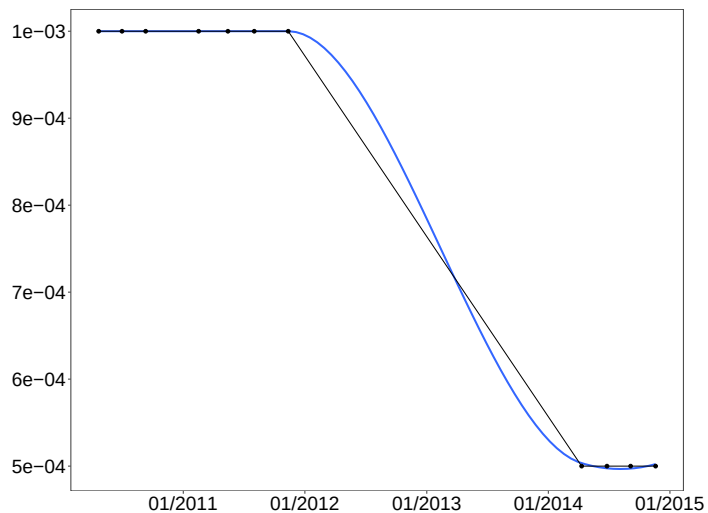
EC06 – Aluminium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



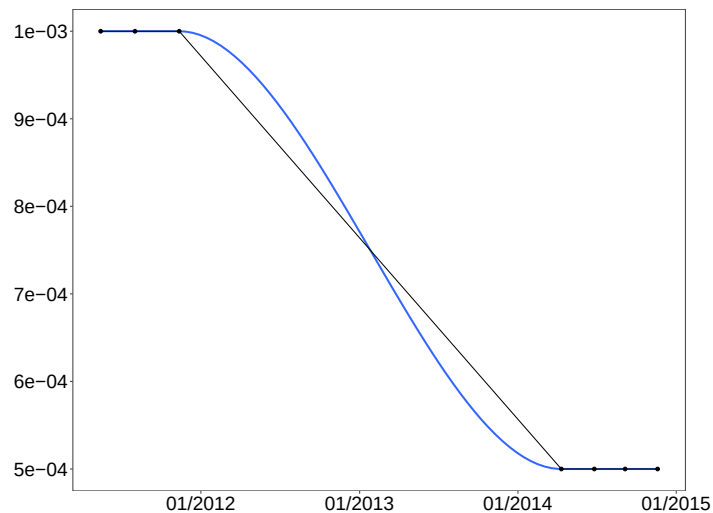
EC06 – Aluminium (t.)
 $\tau = 0.333$ | p-value = 0.368 | No trend



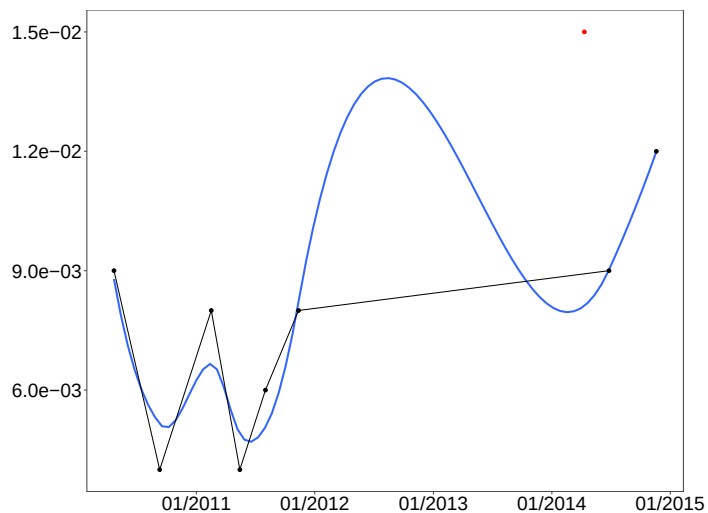
EC06 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



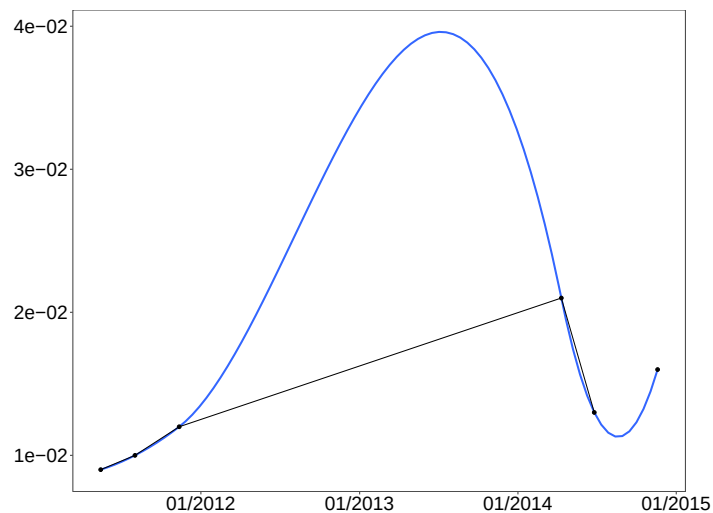
EC06 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



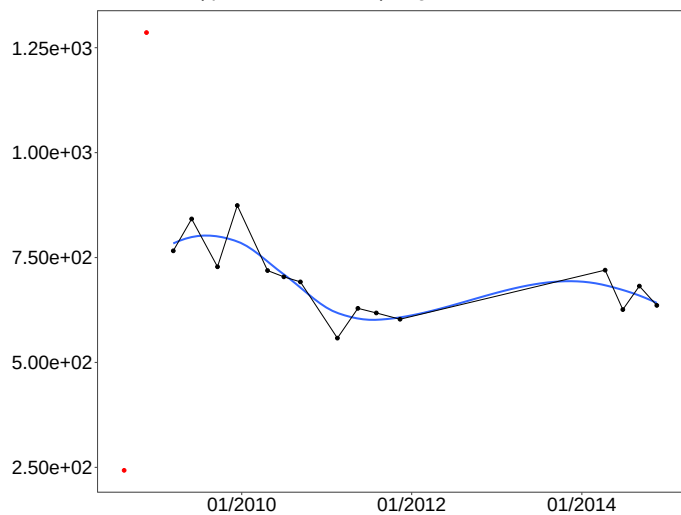
EC06 – Arsenic (d.)
 $\tau = 0.435$ | p-value = 0.138 | No trend



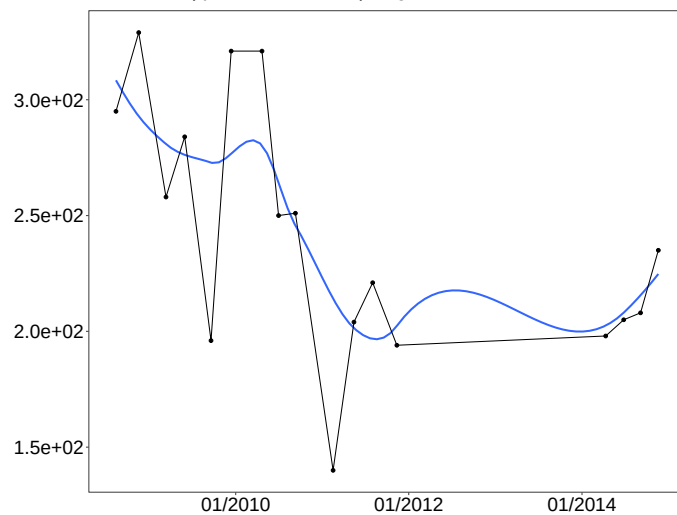
EC06 – Arsenic (t.)
 $\tau = 0.733$ | p-value = 0.0603 | No trend



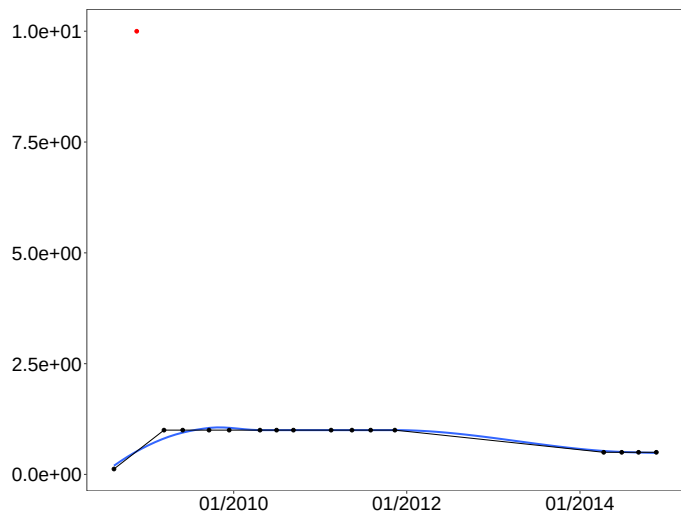
EC06 – Bicarbonate
 $\tau = -0.368$ | p-value = 0.0435 | Negative trend



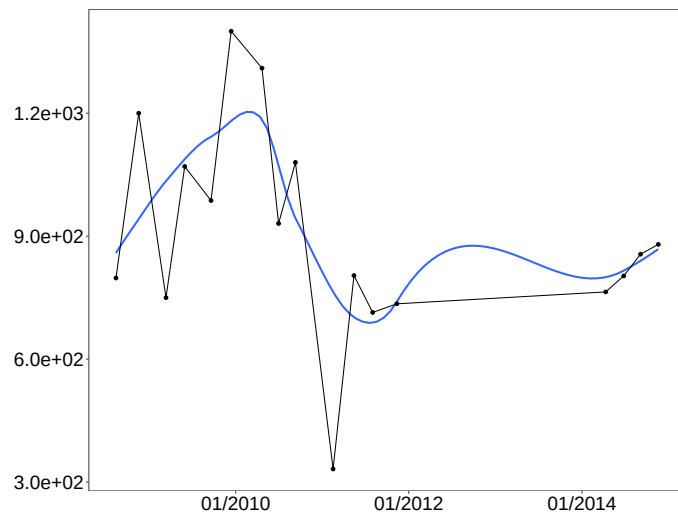
EC06 – Calcium
 $\tau = -0.391$ | p-value = 0.032 | Negative trend



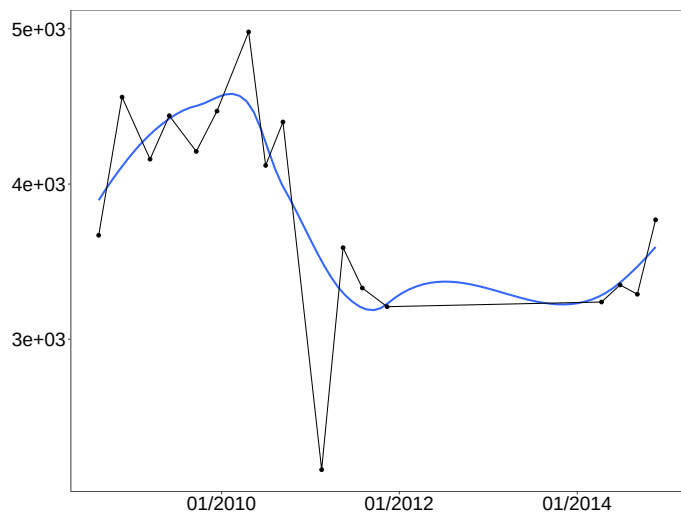
EC06 – Carbonate
 $\tau = -0.426$ | p-value = 0.0394 | Negative trend



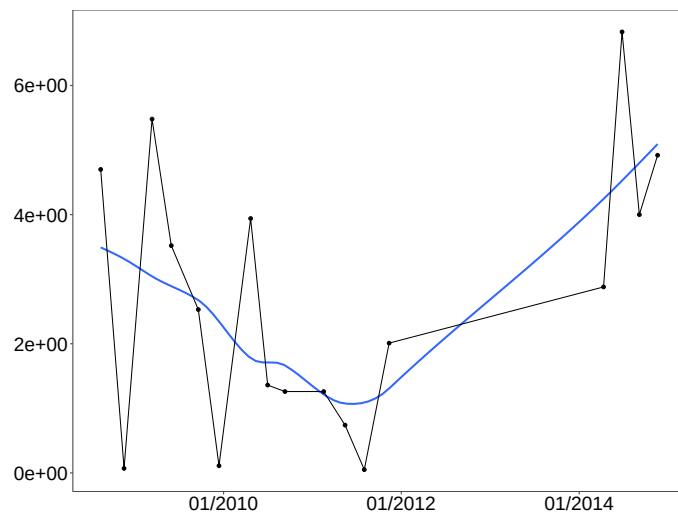
EC06 – Chloride
 $\tau = -0.191$ | p-value = 0.303 | No trend



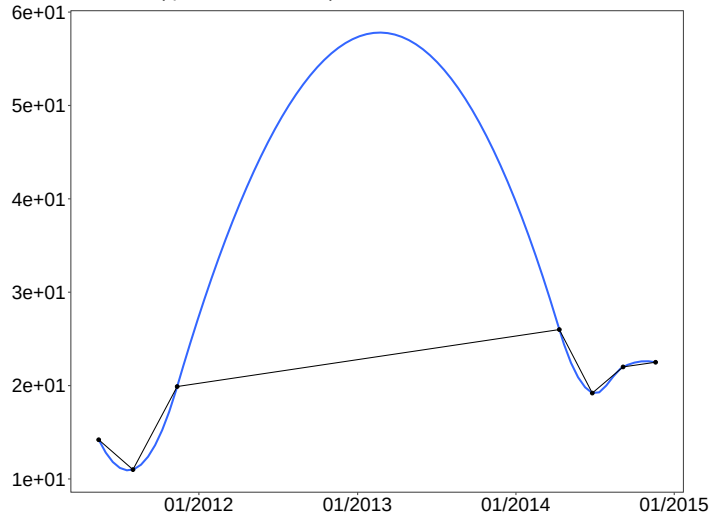
EC06 – Electrical Conductivity
 $\tau = -0.397$ | p-value = 0.029 | Negative trend



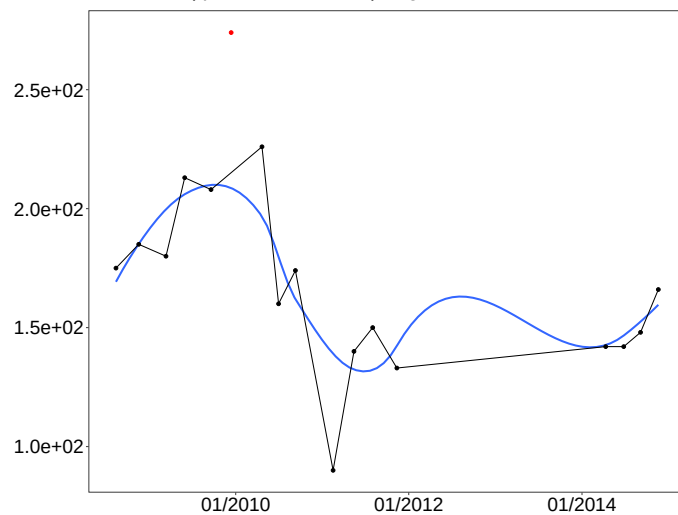
EC06 – Iron (d.)
 $\tau = 0.0812$ | p-value = 0.68 | No trend



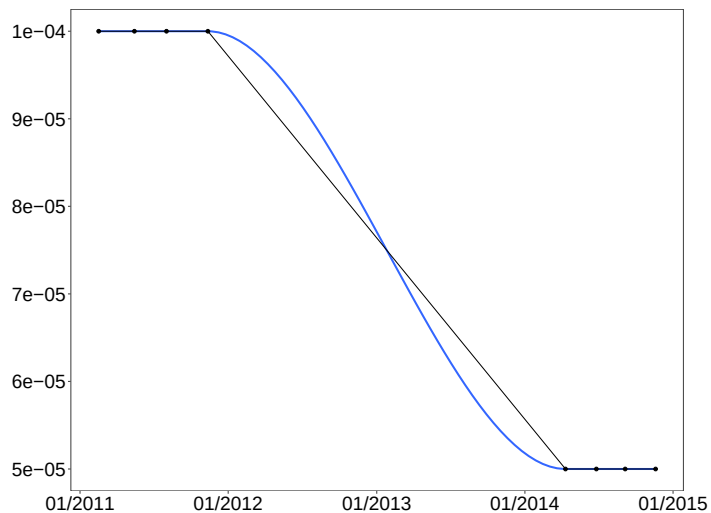
EC06 – Iron (t.)
 $\tau = 0.524$ | p-value = 0.133 | No trend



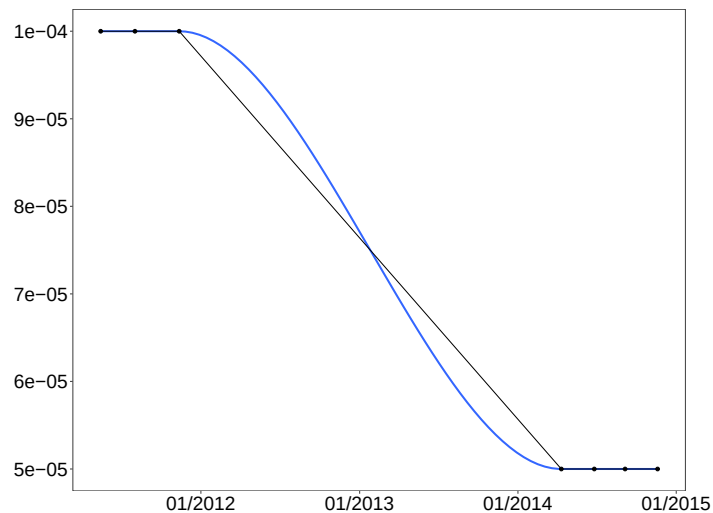
EC06 – Magnesium
 $\tau = -0.376$ | p-value = 0.0393 | Negative trend



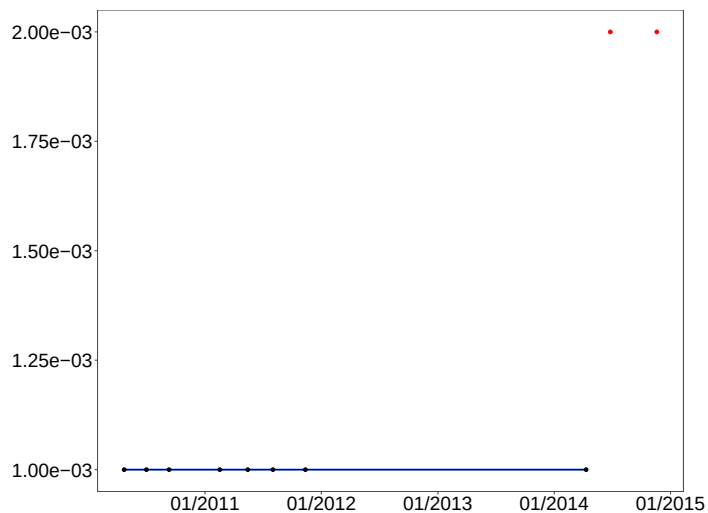
EC06 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



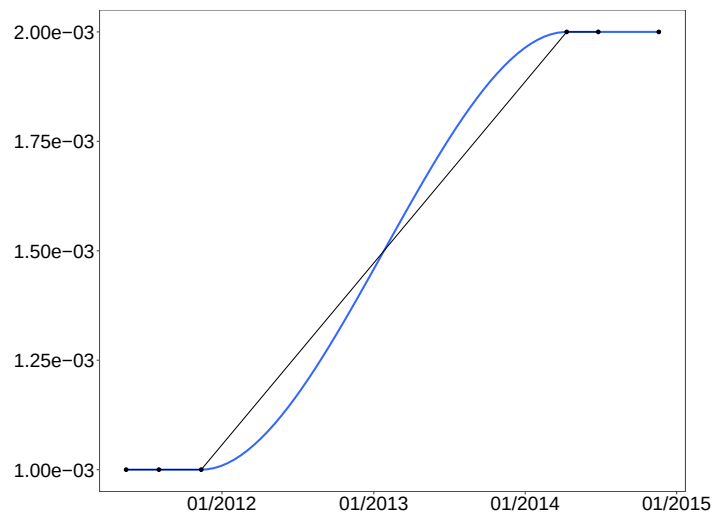
EC06 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



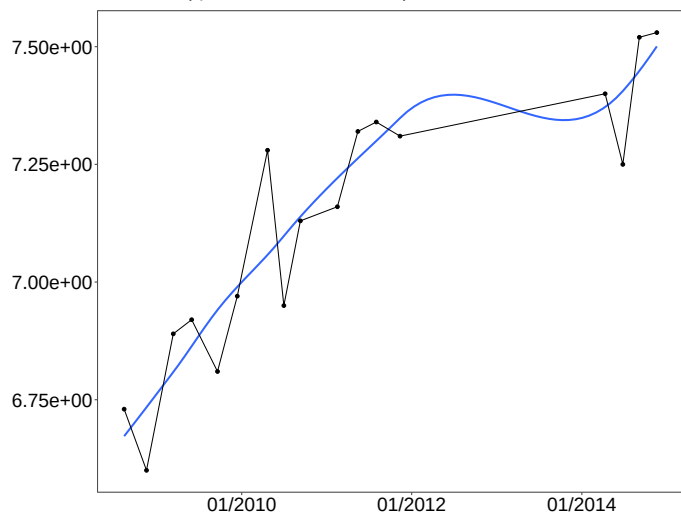
EC06 – Molybdenum (d.)
 $\tau = 0.596$ | p-value = 0.0502 | No trend



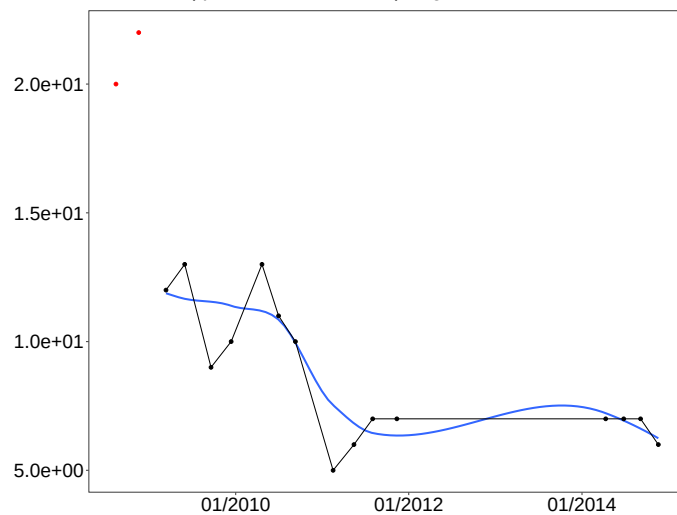
EC06 – Molybdenum (t.)
 $\tau = 0.775$ | p-value = 0.0809 | No trend



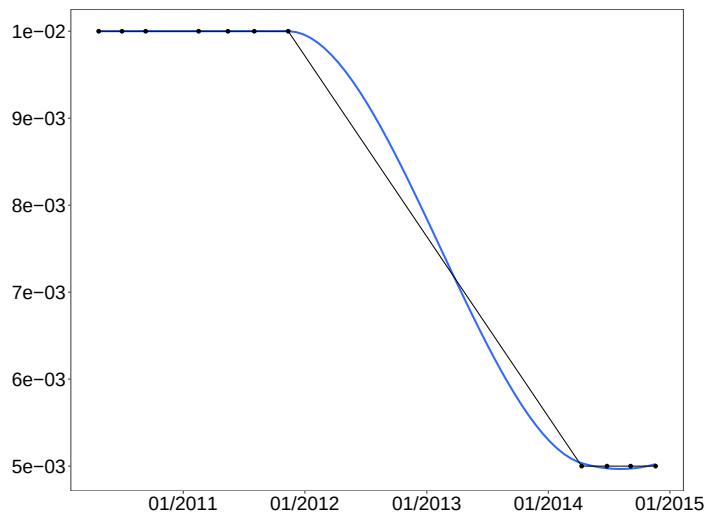
EC06 – pH
 $\tau = 0.794$ | p-value = 0.0000105 | Positive trend



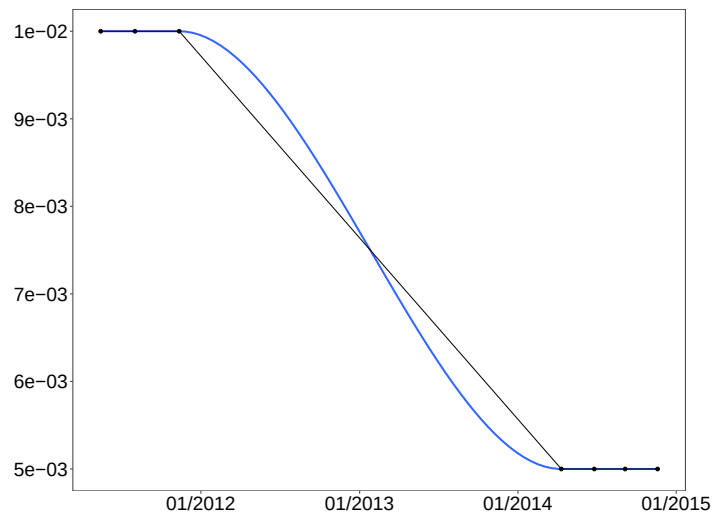
EC06 – Potassium
 $\tau = -0.626$ | p-value = 0.000803 | Negative trend



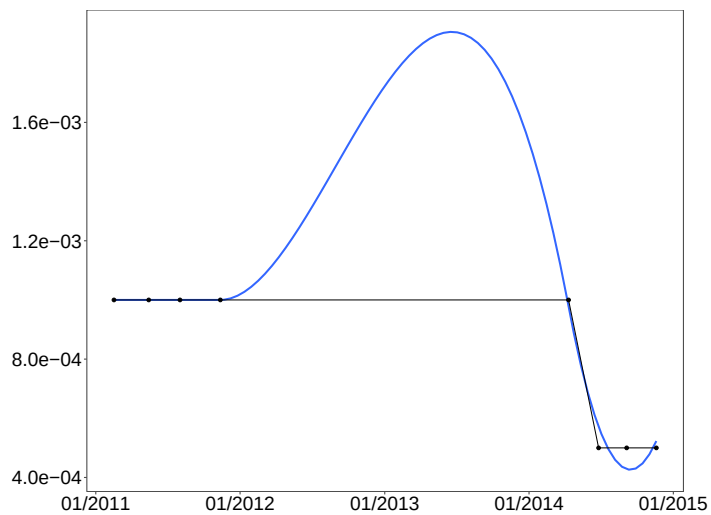
EC06 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



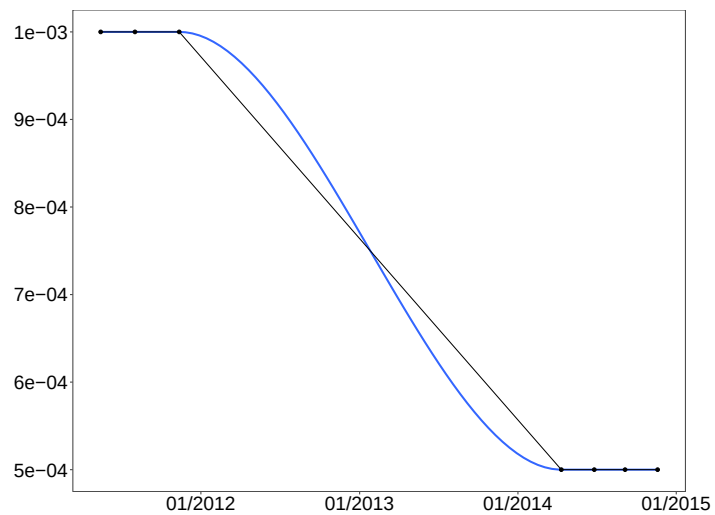
EC06 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



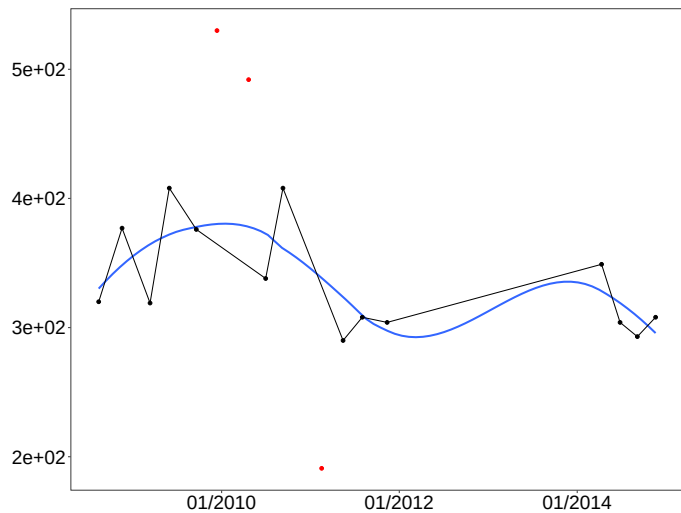
EC06 – Silver (d.)
 $\tau = -0.732$ | p-value = 0.0369 | Negative trend



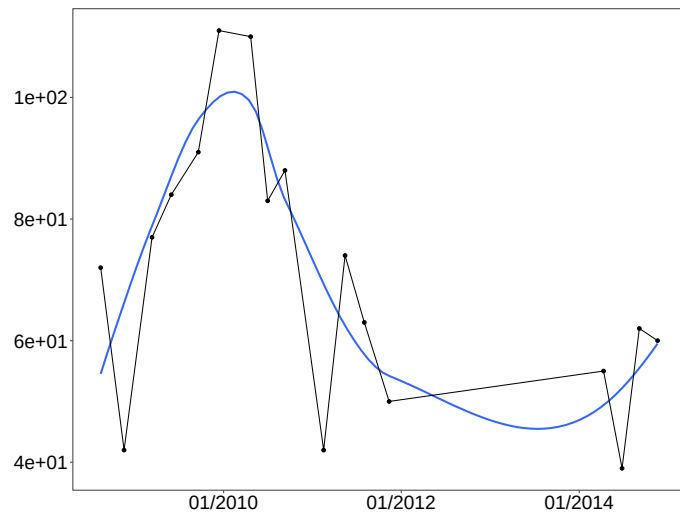
EC06 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



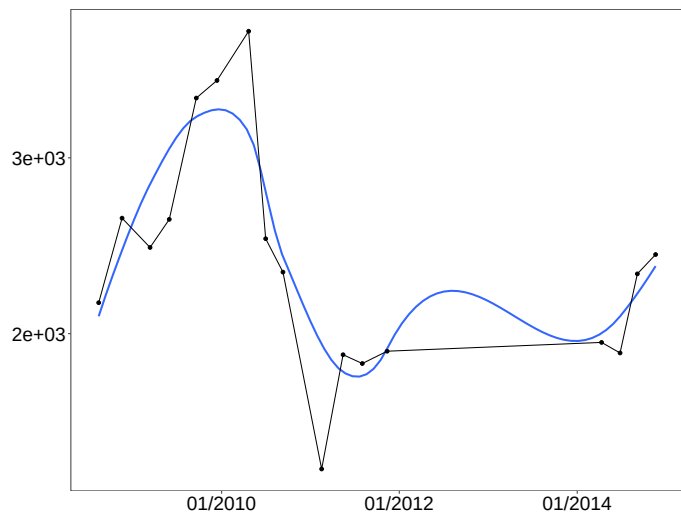
EC06 – Sodium
 $\tau = -0.335$ | p-value = 0.0692 | No trend



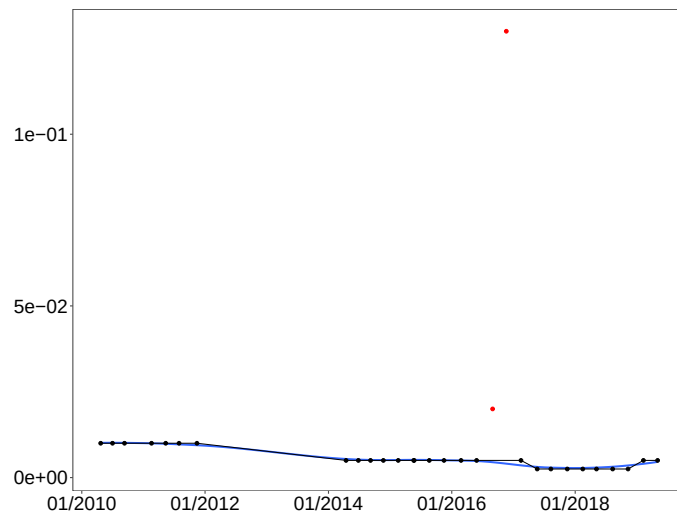
EC06 – Sulphate
 $\tau = -0.303$ | p-value = 0.0991 | No trend



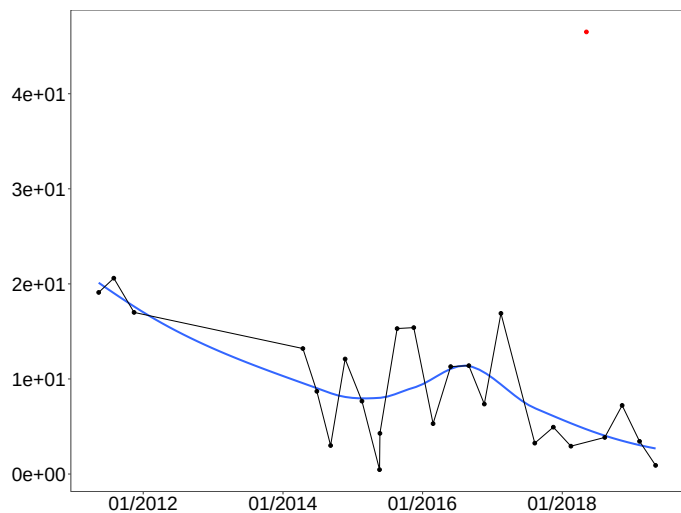
EC06 – TDS

 $\tau = -0.265$ | p-value = 0.149 | No trend

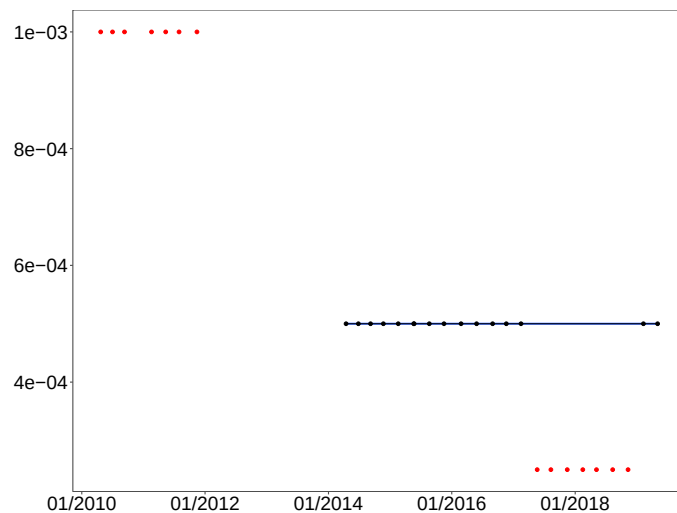
EC07 – Aluminium (d.)

 $\tau = -0.552$ | p-value = 0.000136 | Negative trend

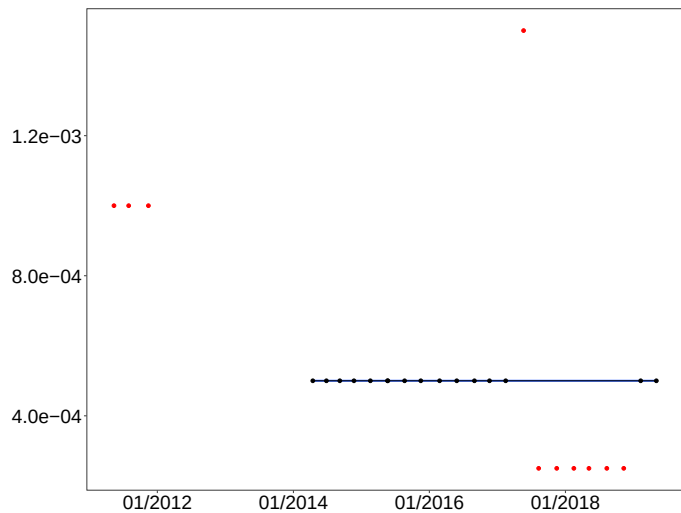
EC07 – Aluminium (t.)

 $\tau = -0.347$ | p-value = 0.0161 | Negative trend

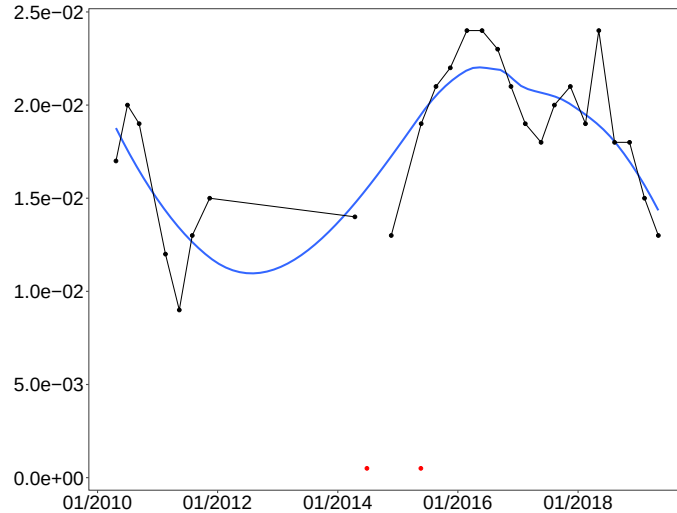
EC07 – Antimony (d.)

 $\tau = -0.711$ | p-value = 0.00000142 | Negative trend

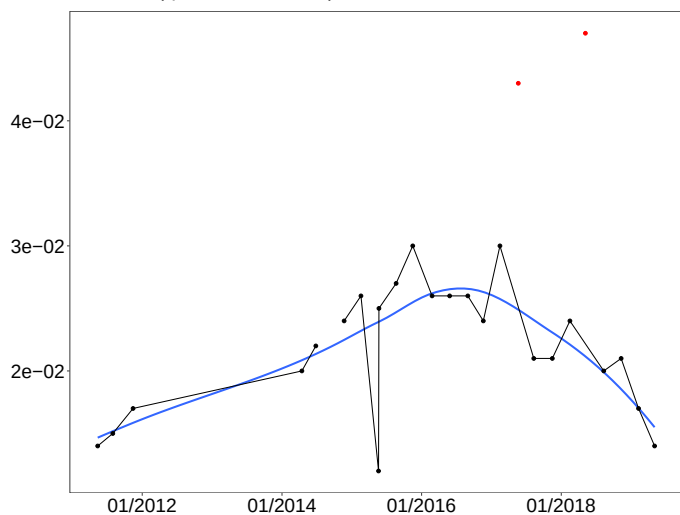
EC07 – Antimony (t.)

 $\tau = -0.523$ | p-value = 0.00108 | Negative trend

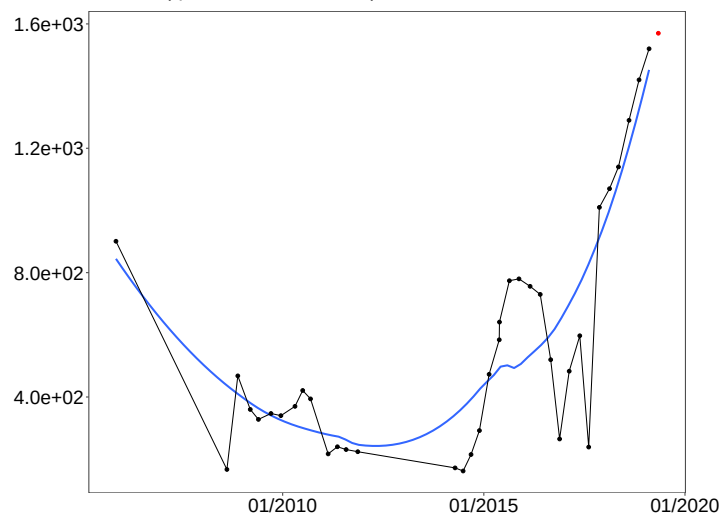
EC07 – Arsenic (d.)

 $\tau = 0.155$ | p-value = 0.266 | No trend

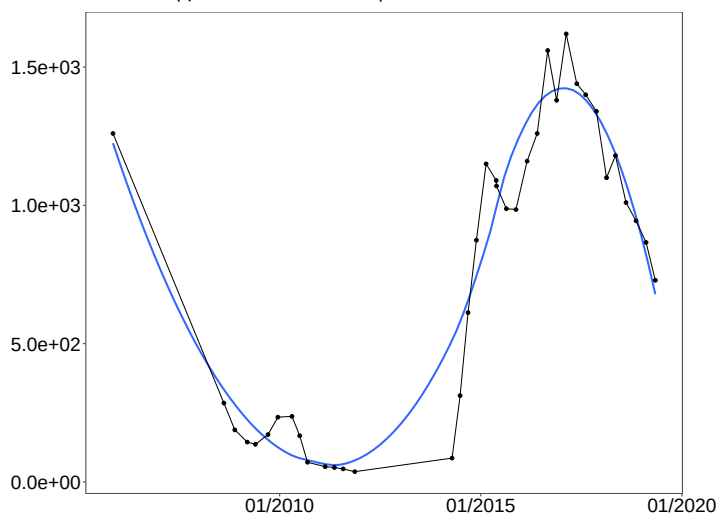
EC07 – Arsenic (t.)
 $\tau = 0.116$ | p-value = 0.438 | No trend



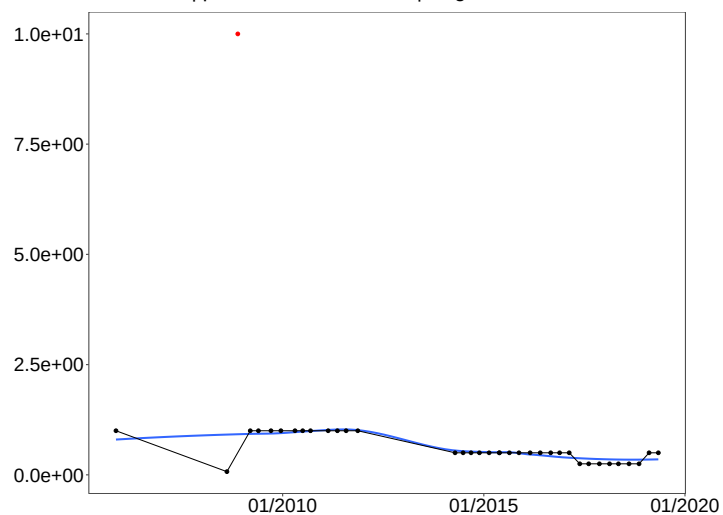
EC07 – Bicarbonate
 $\tau = 0.45$ | p-value = 0.000092 | Positive trend



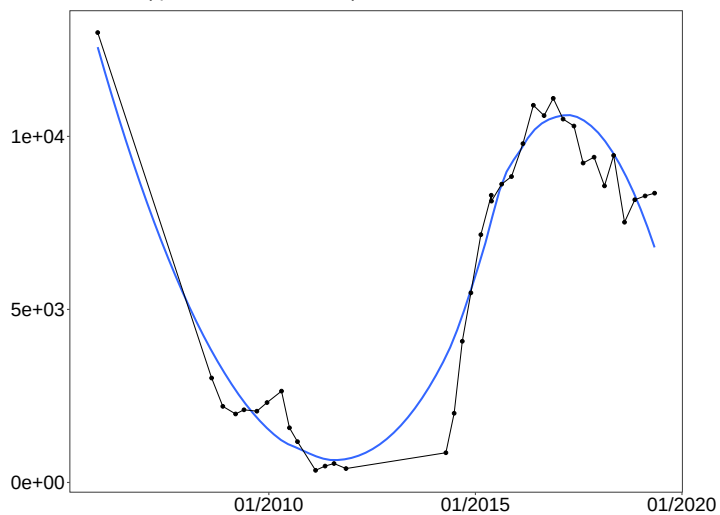
EC07 – Calcium
 $\tau = 0.383$ | p-value = 0.000893 | Positive trend



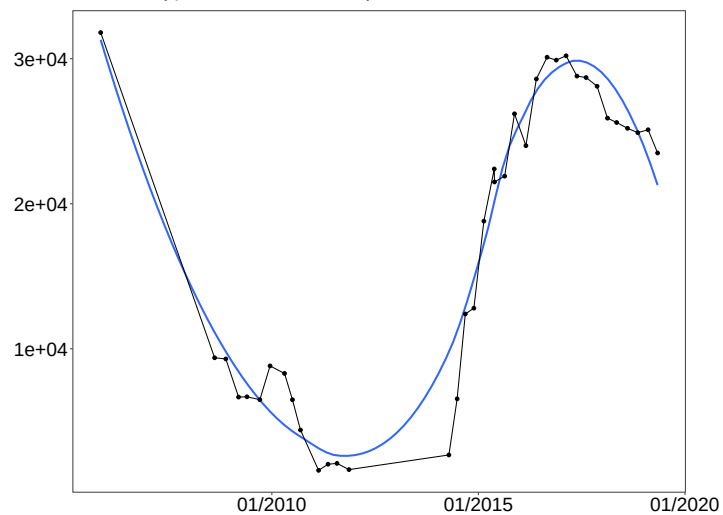
EC07 – Carbonate
 $\tau = -0.649$ | p-value = 0.00000053 | Negative trend



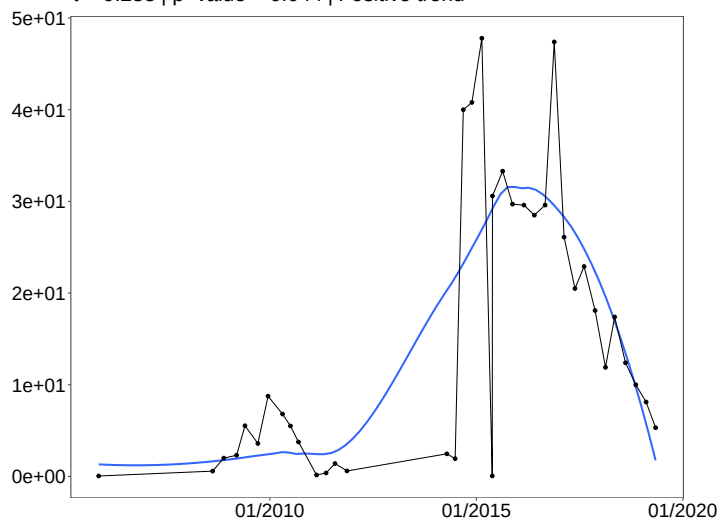
EC07 – Chloride
 $\tau = 0.39$ | p-value = 0.000705 | Positive trend



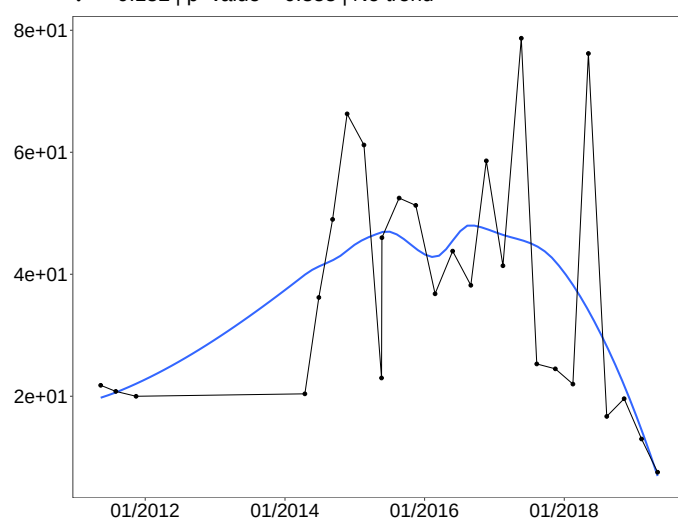
EC07 – Electrical Conductivity
 $\tau = 0.407$ | p-value = 0.000413 | Positive trend



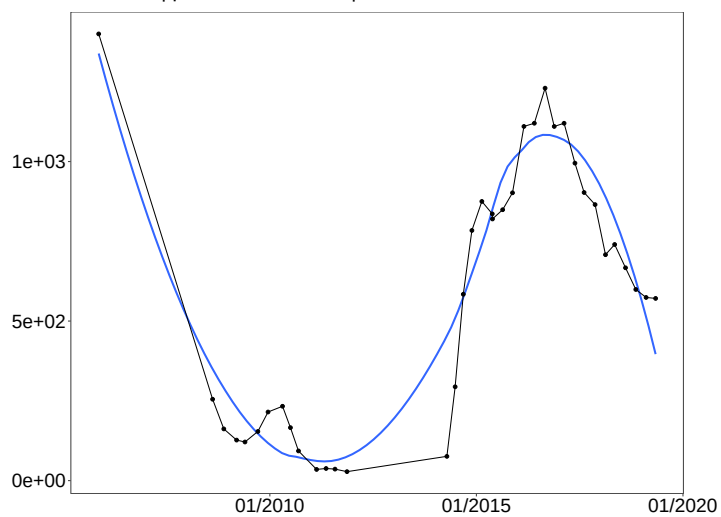
EC07 – Iron (d.)

 $\tau = 0.233$ | p-value = 0.044 | Positive trend

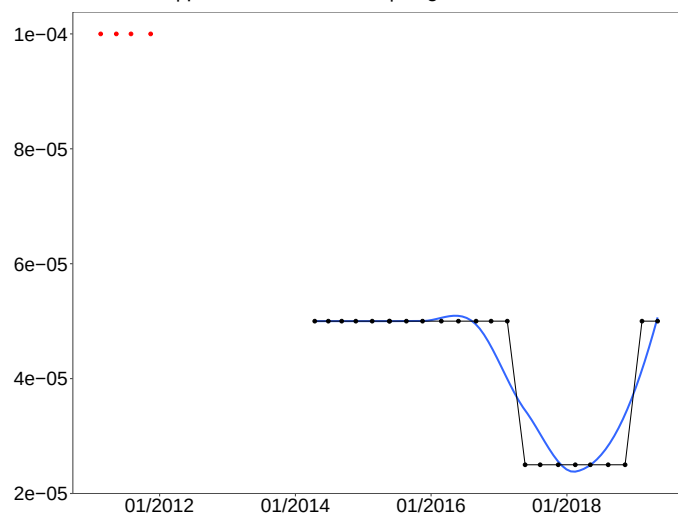
EC07 – Iron (t.)

 $\tau = -0.132$ | p-value = 0.355 | No trend

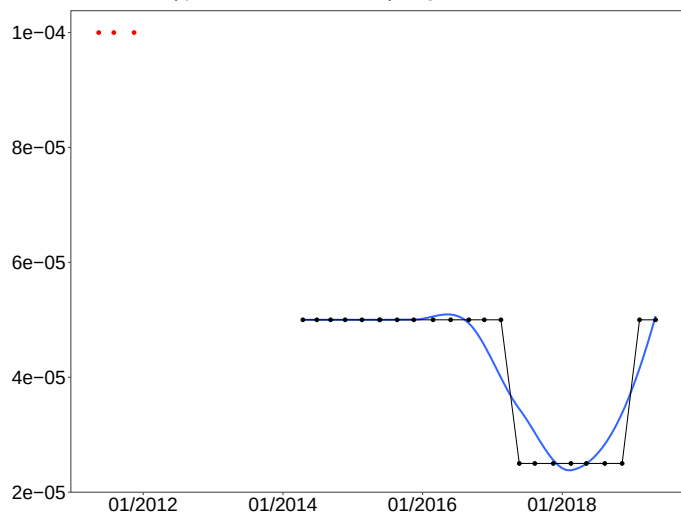
EC07 – Magnesium

 $\tau = 0.298$ | p-value = 0.00997 | Positive trend

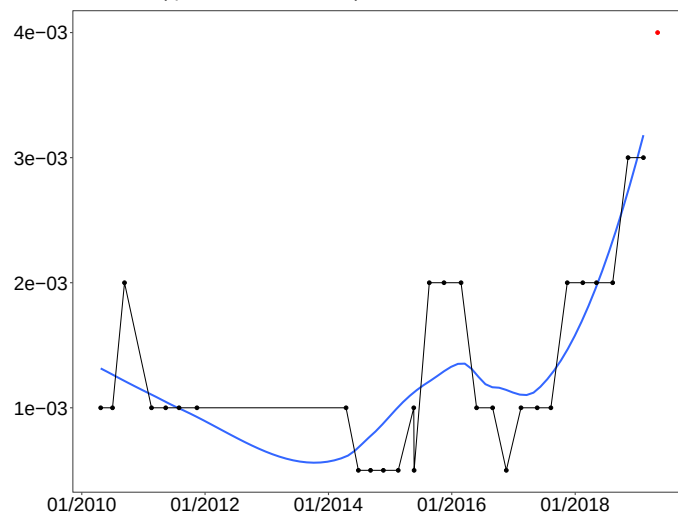
EC07 – Mercury (d.)

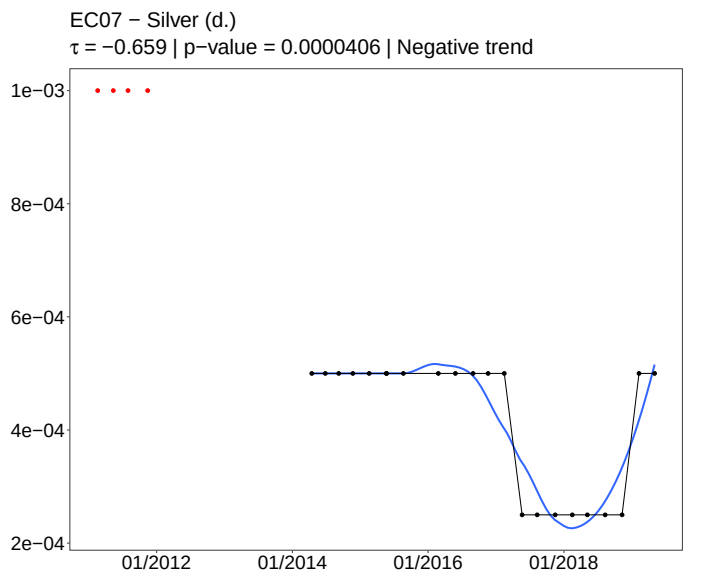
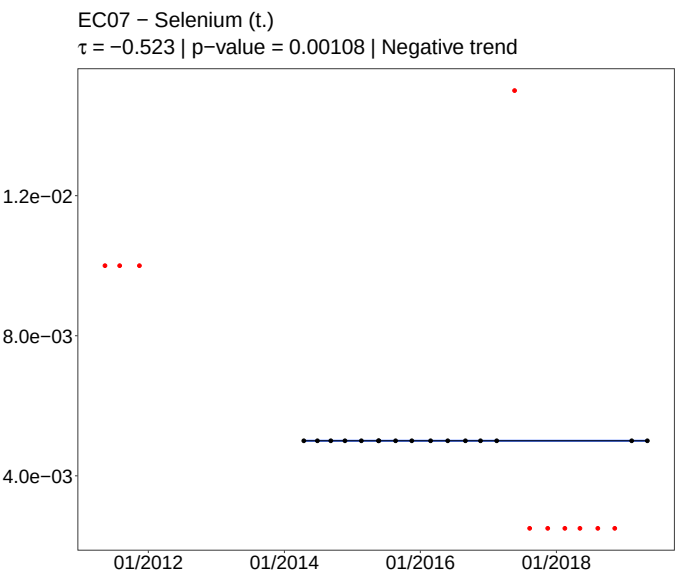
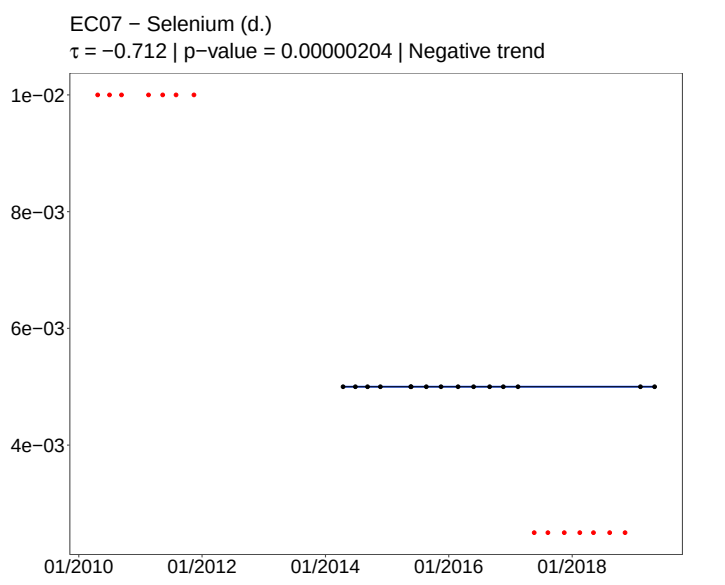
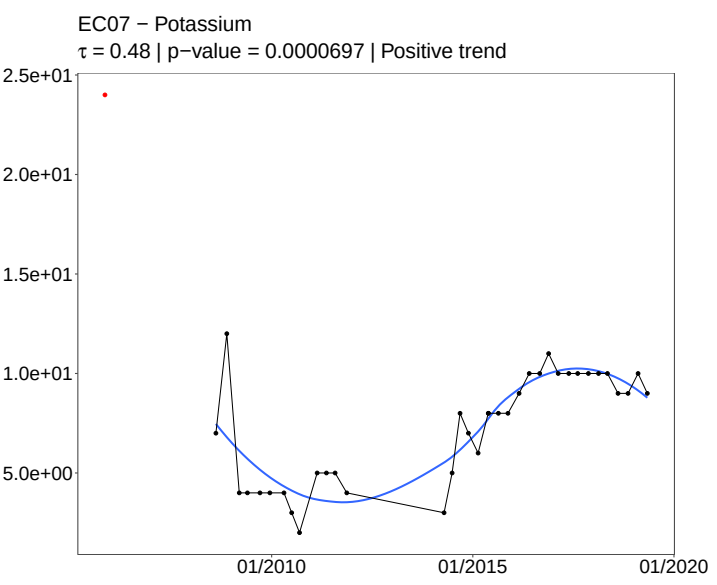
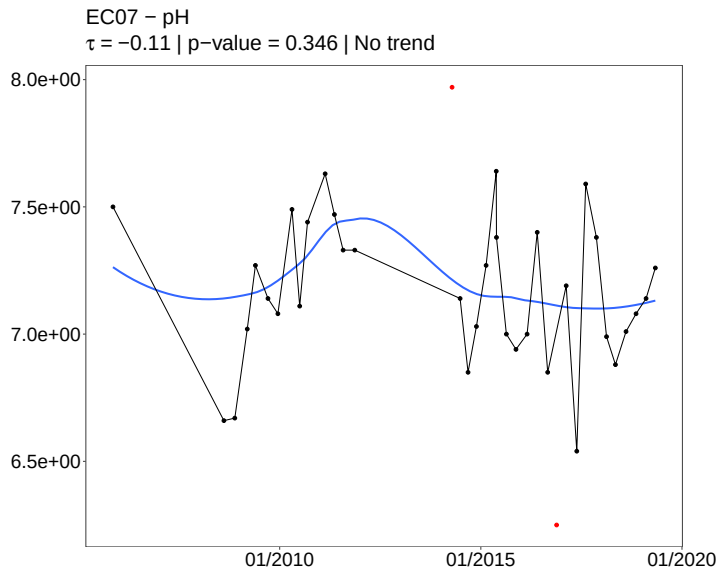
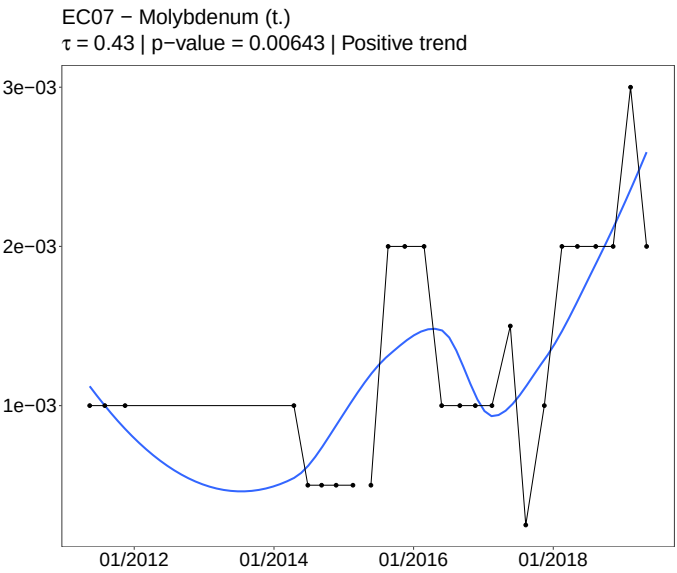
 $\tau = -0.658$ | p-value = 0.0000294 | Negative trend

EC07 – Mercury (t.)

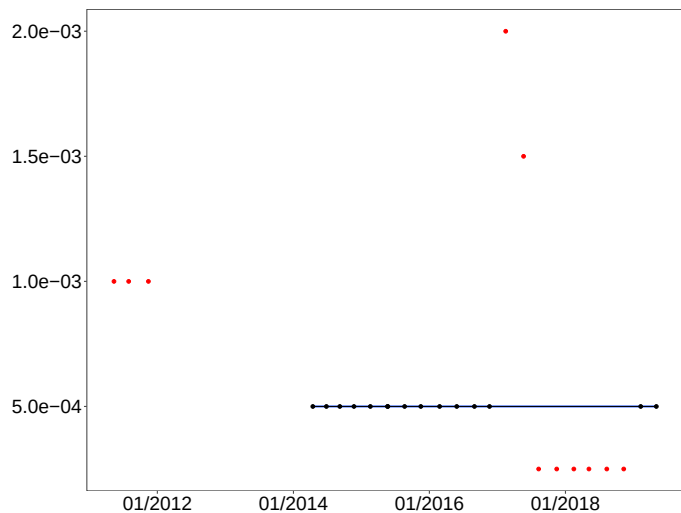
 $\tau = -0.631$ | p-value = 0.0000952 | Negative trend

EC07 – Molybdenum (d.)

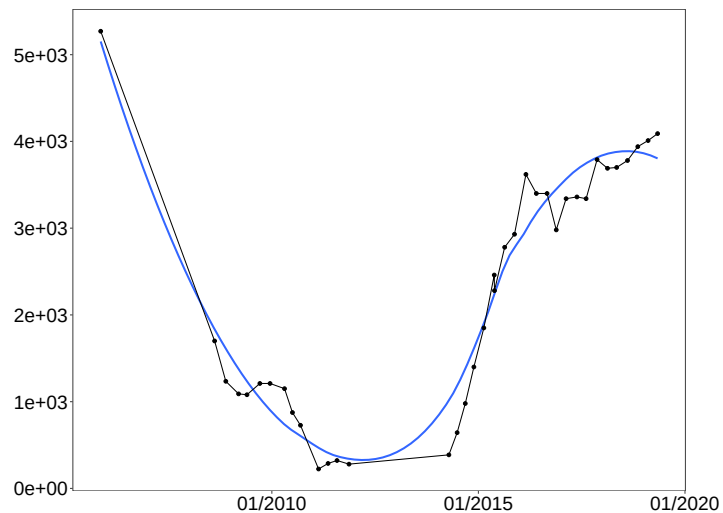
 $\tau = 0.409$ | p-value = 0.00443 | Positive trend



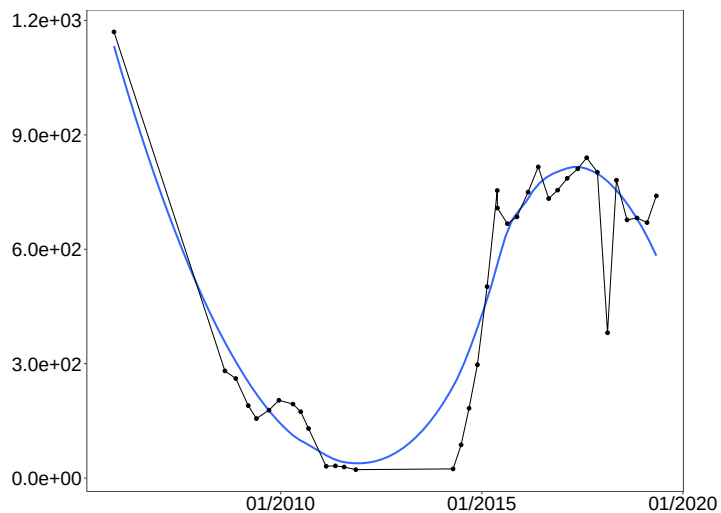
EC07 – Silver (t.)

 $\tau = -0.445$ | p-value = 0.00497 | Negative trend

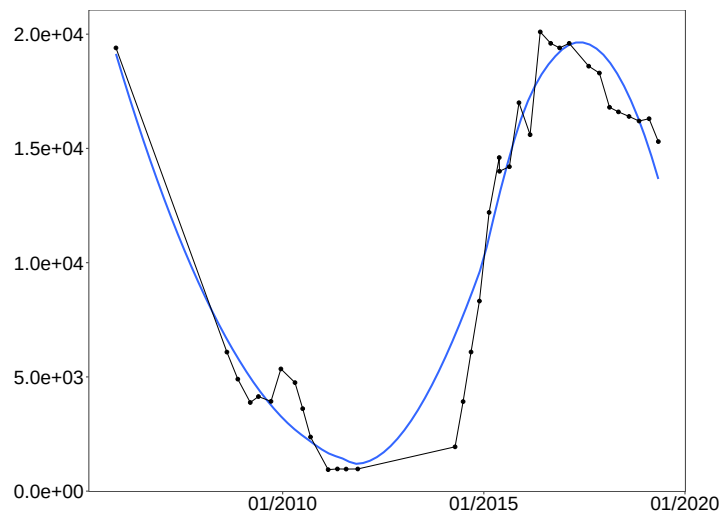
EC07 – Sodium

 $\tau = 0.552$ | p-value = 0.00000167 | Positive trend

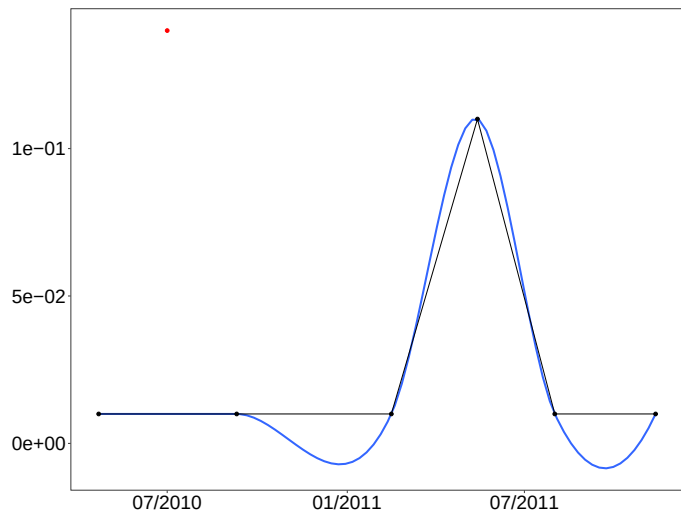
EC07 – Sulphate

 $\tau = 0.366$ | p-value = 0.00148 | Positive trend

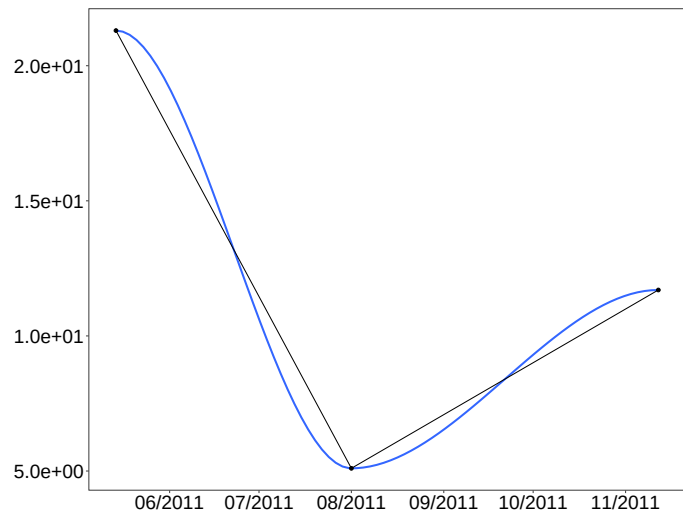
EC07 – TDS

 $\tau = 0.413$ | p-value = 0.000418 | Positive trend

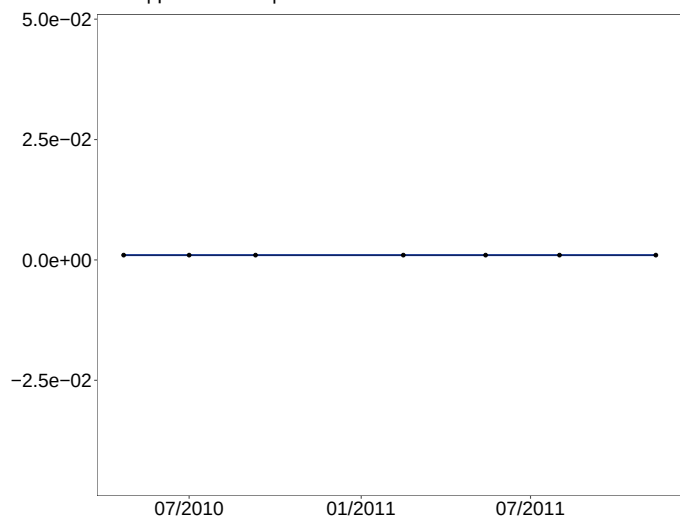
EC08 – Aluminium (d.)

 $\tau = -0.197$ | p-value = 0.704 | No trend

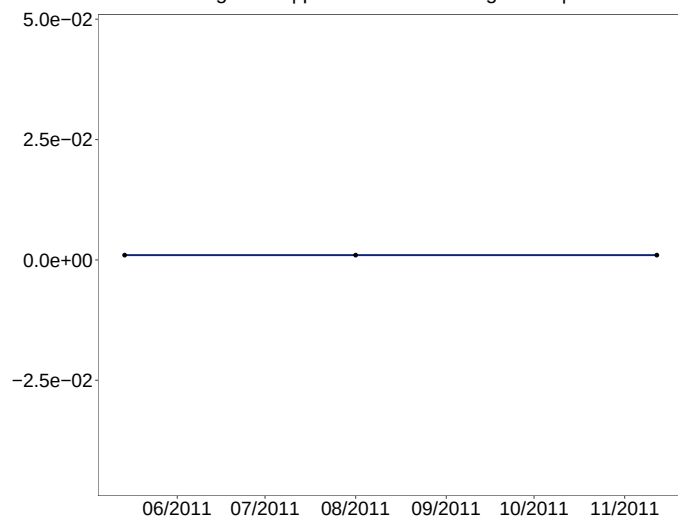
EC08 – Aluminium (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

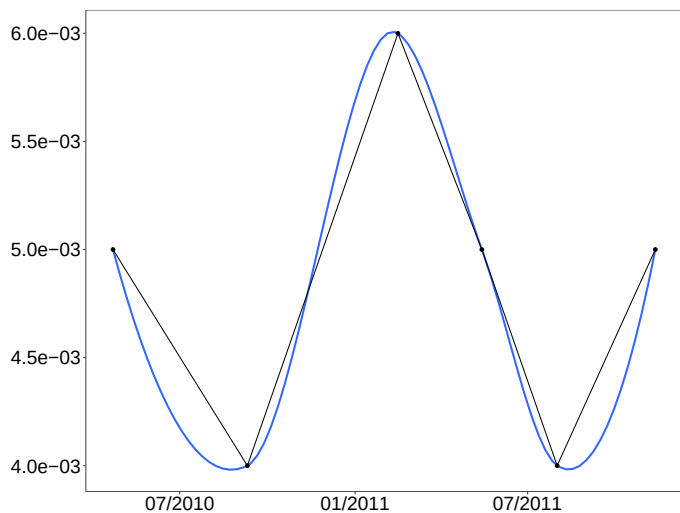
EC08 – Antimony (d.)
 $\tau = 1$ | p-value = 1 | No trend



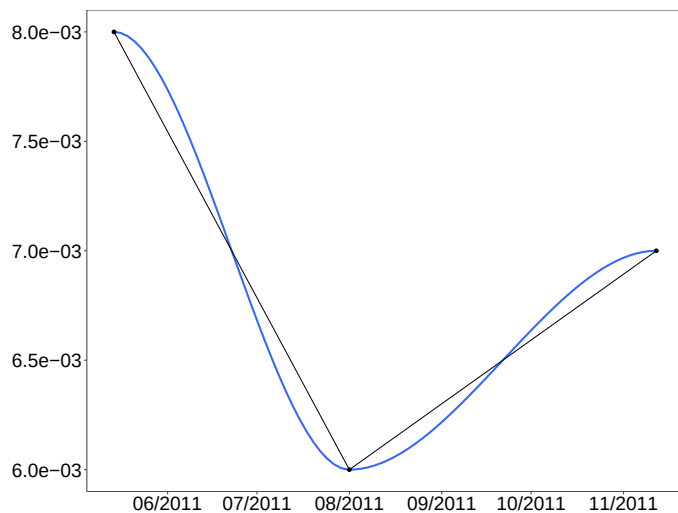
EC08 – Antimony (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



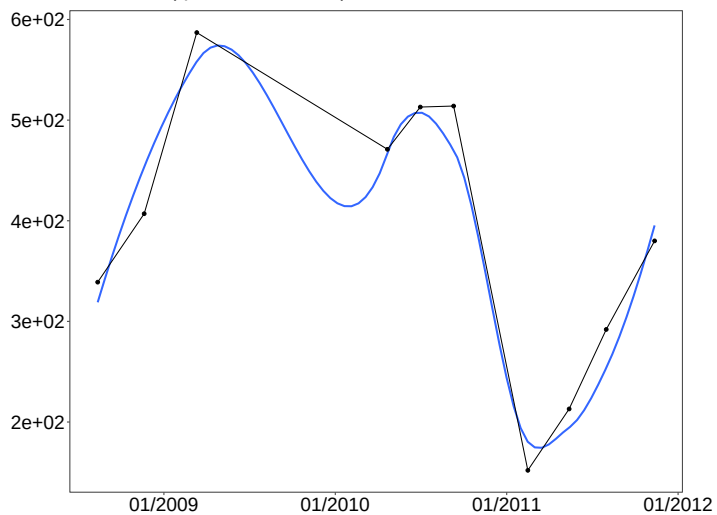
EC08 – Arsenic (d.)
 $\tau = -0.0778$ | p-value = 1 | No trend



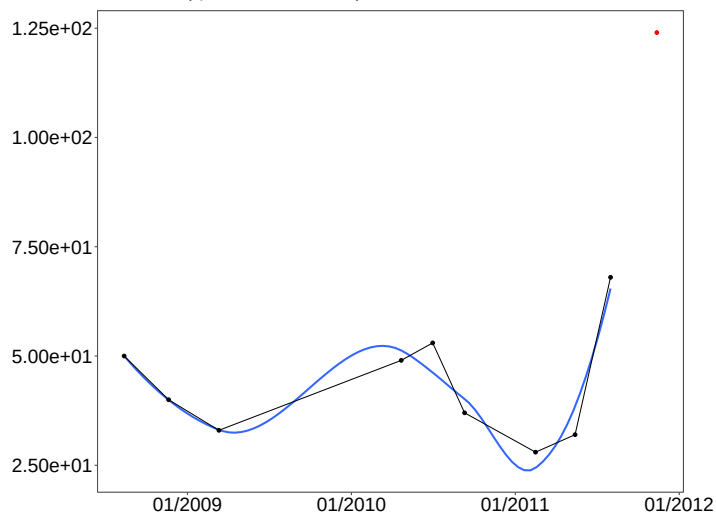
EC08 – Arsenic (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



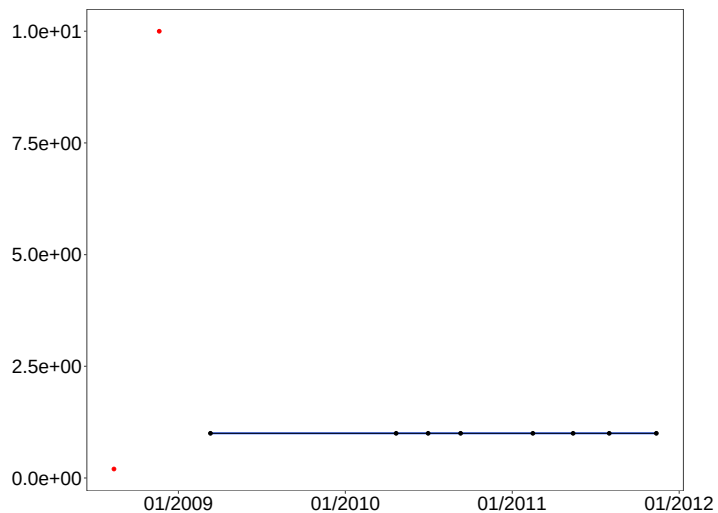
EC08 – Bicarbonate
 $\tau = -0.156$ | p-value = 0.592 | No trend



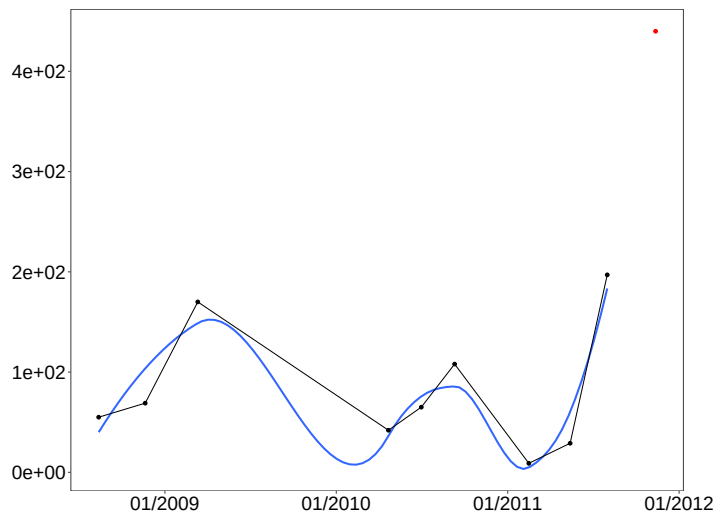
EC08 – Calcium
 $\tau = 0.111$ | p-value = 0.721 | No trend



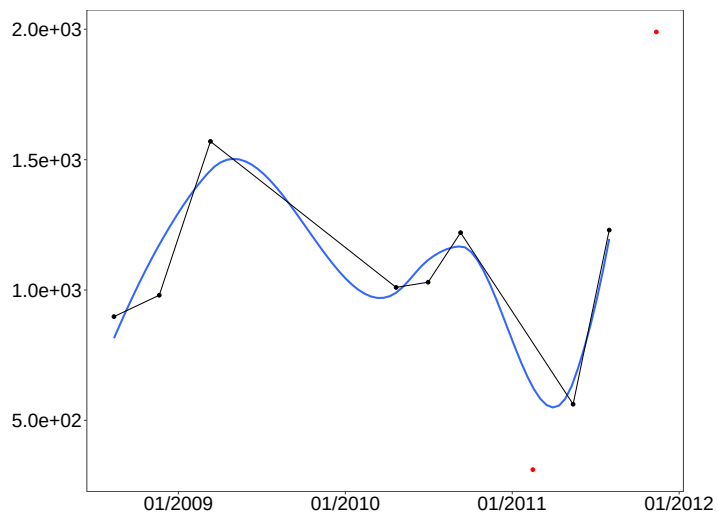
EC08 – Carbonate
 $\tau = 0.0362$ | p-value = 1 | No trend



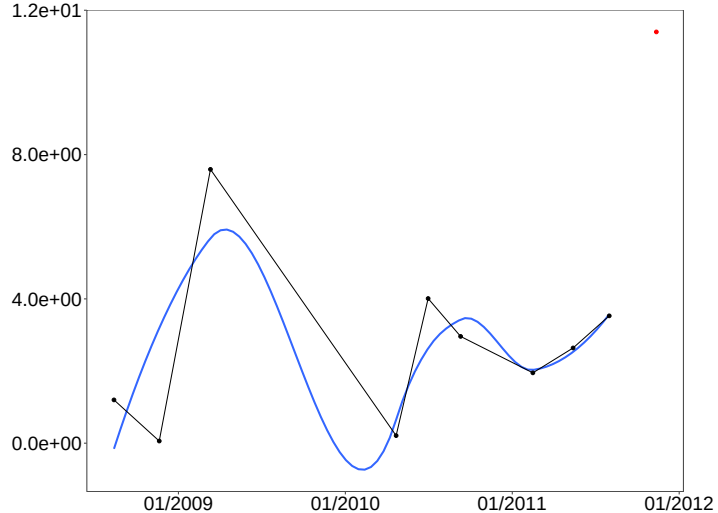
EC08 – Chloride
 $\tau = 0.2$ | p-value = 0.474 | No trend



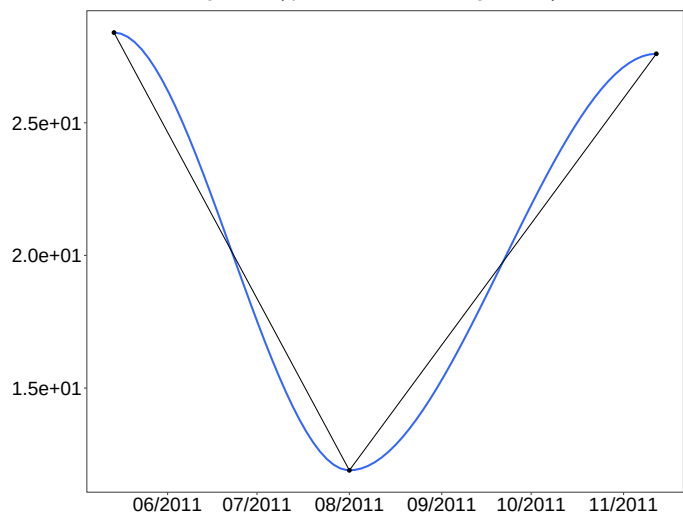
EC08 – Electrical Conductivity
 $\tau = 0.289$ | p-value = 0.283 | No trend



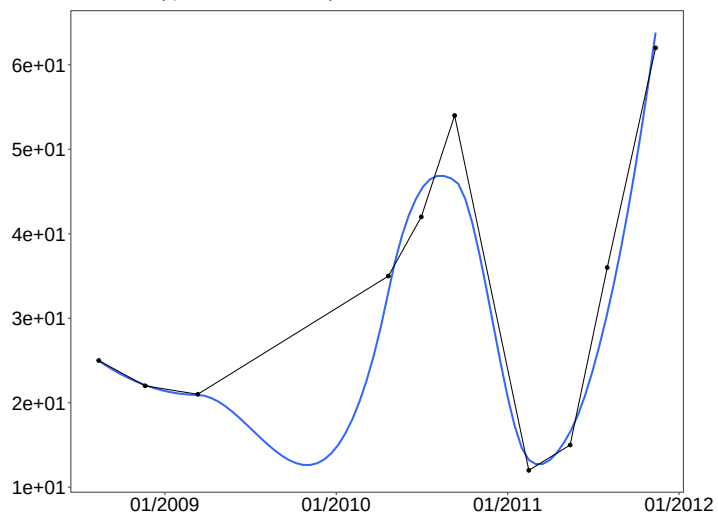
EC08 – Iron (d.)
 $\tau = 0.378$ | p-value = 0.152 | No trend



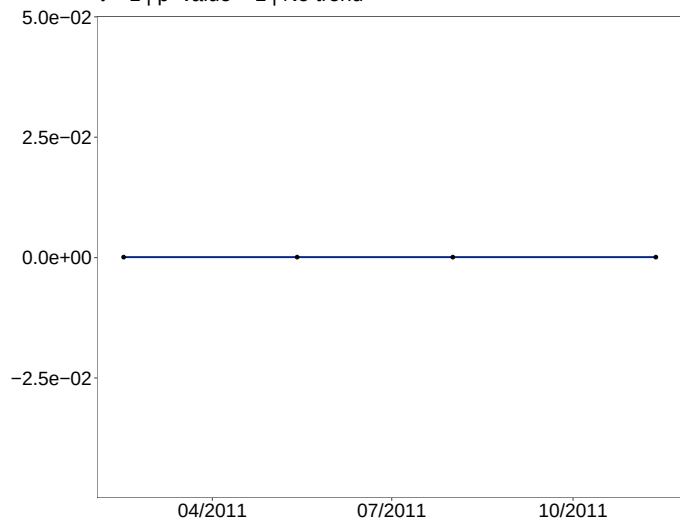
EC08 – Iron (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



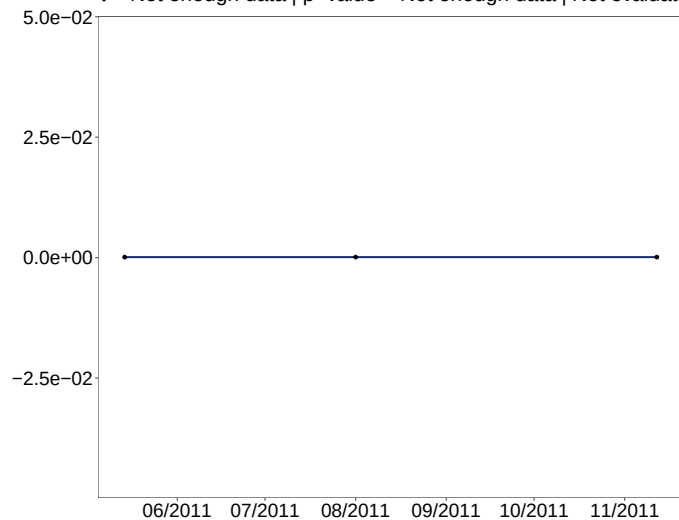
EC08 – Magnesium
 $\tau = 0.244$ | p-value = 0.371 | No trend



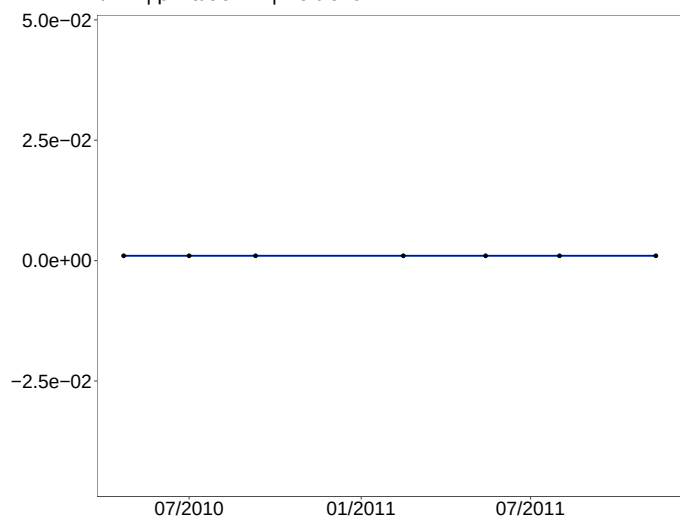
EC08 – Mercury (d.)
 $\tau = 1$ | p-value = 1 | No trend



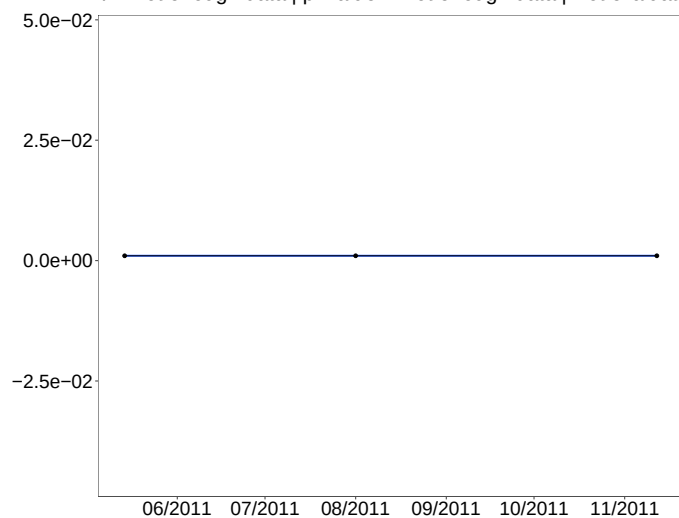
EC08 – Mercury (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



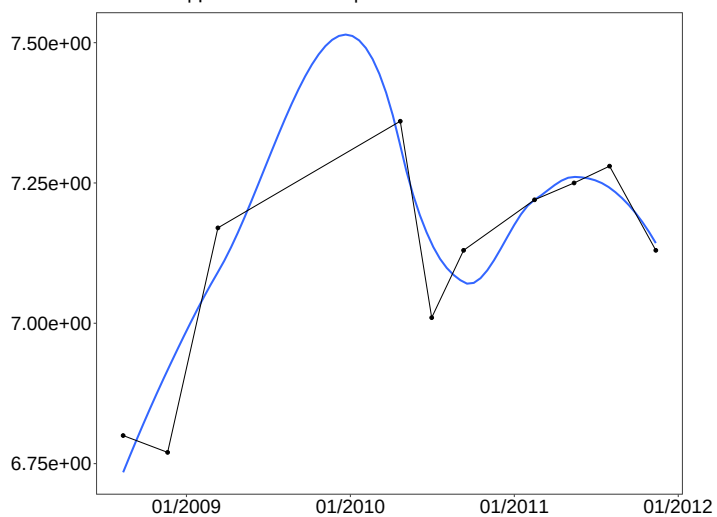
EC08 – Molybdenum (d.)
 $\tau = 1$ | p-value = 1 | No trend



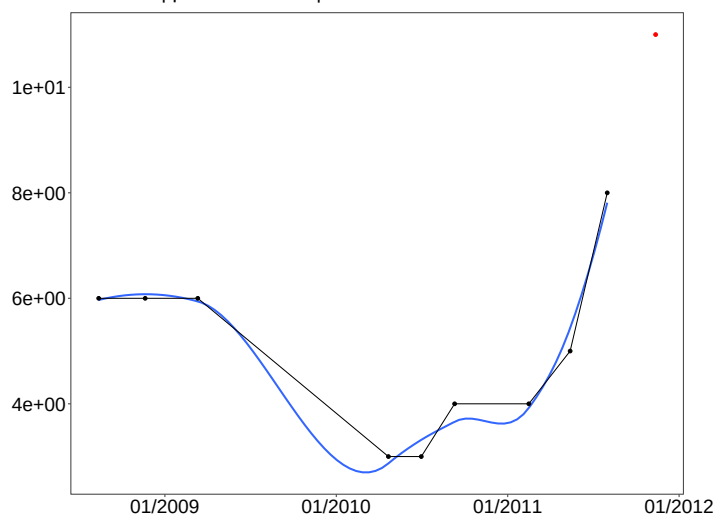
EC08 – Molybdenum (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



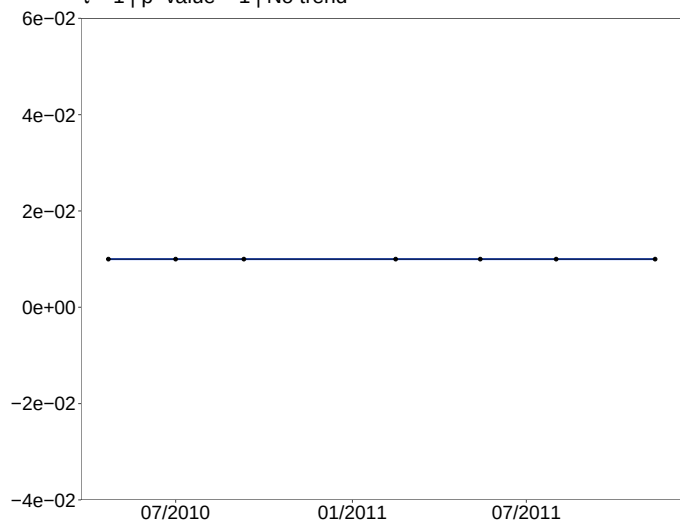
EC08 – pH
 $\tau = 0.405$ | p-value = 0.127 | No trend



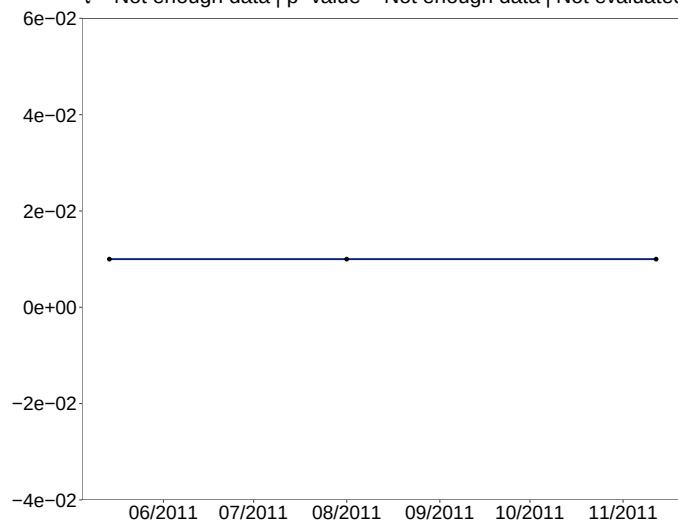
EC08 – Potassium
 $\tau = 0.236$ | p-value = 0.41 | No trend



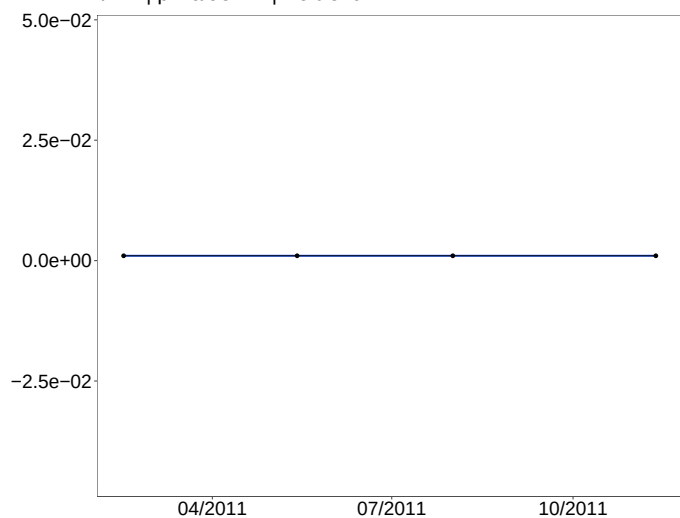
EC08 – Selenium (d.)
 $\tau = 1$ | p-value = 1 | No trend



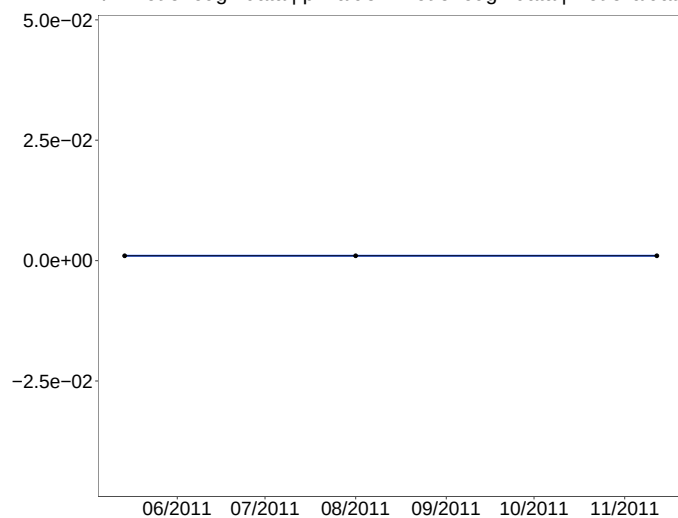
EC08 – Selenium (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



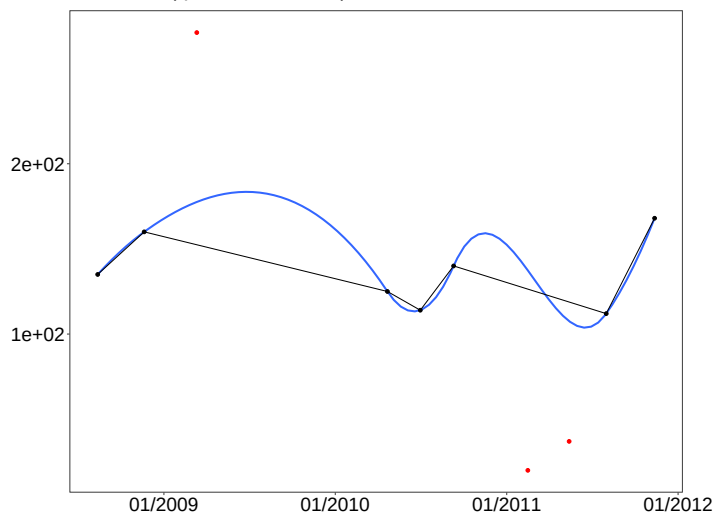
EC08 – Silver (d.)
 $\tau = 1$ | p-value = 1 | No trend



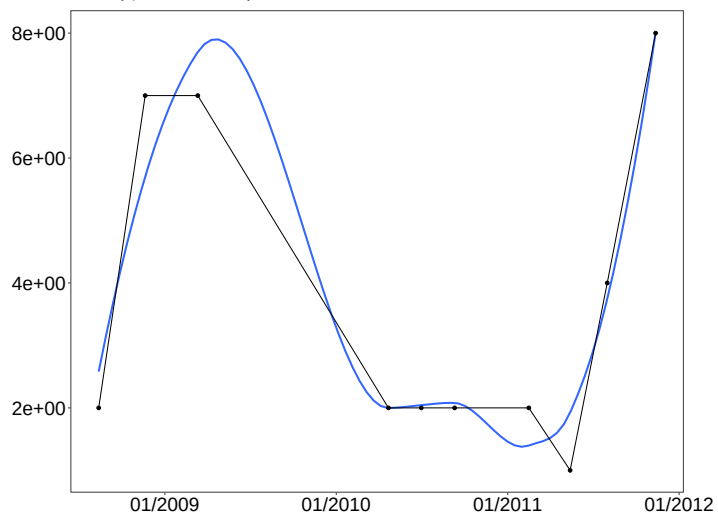
EC08 – Silver (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



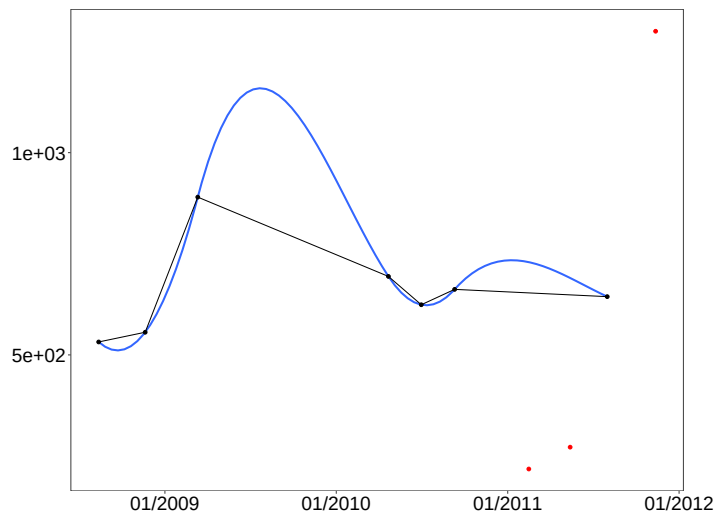
EC08 – Sodium
 $\tau = -0.244$ | p-value = 0.371 | No trend



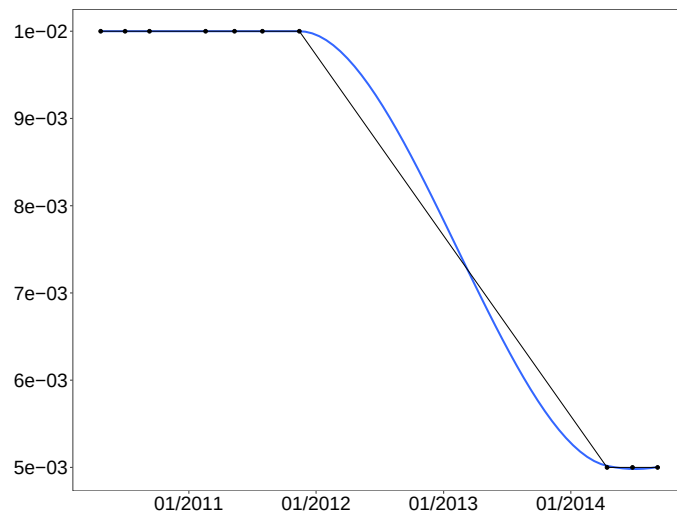
EC08 – Sulphate
 $\tau = 0$ | p-value = 1 | No trend



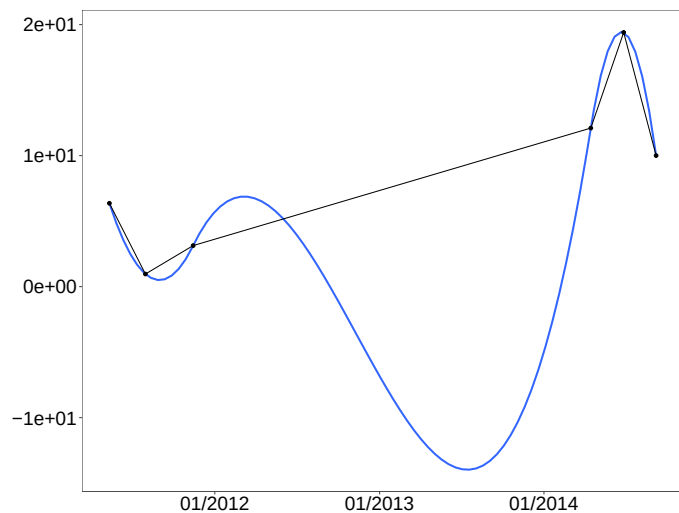
EC08 – TDS

 $\tau = 0.111$ | p-value = 0.721 | No trend

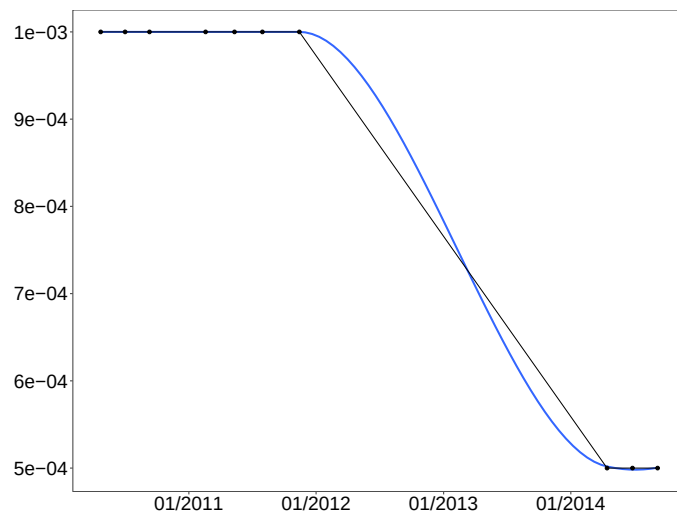
EC09 – Aluminium (d.)

 $\tau = -0.683$ | p-value = 0.0227 | Negative trend

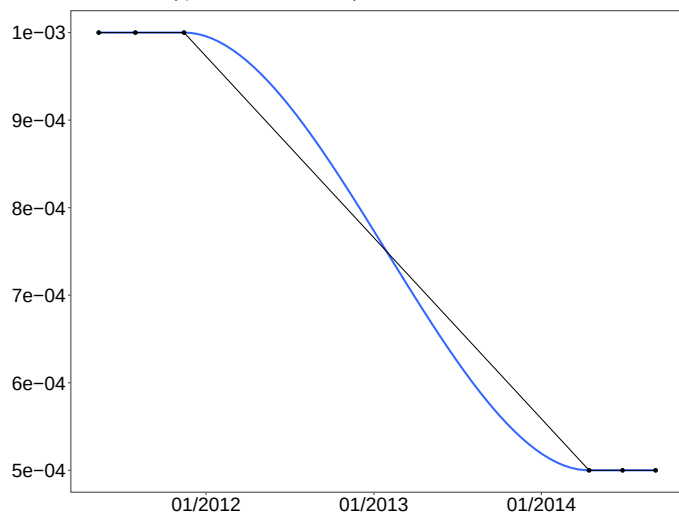
EC09 – Aluminium (t.)

 $\tau = 0.467$ | p-value = 0.26 | No trend

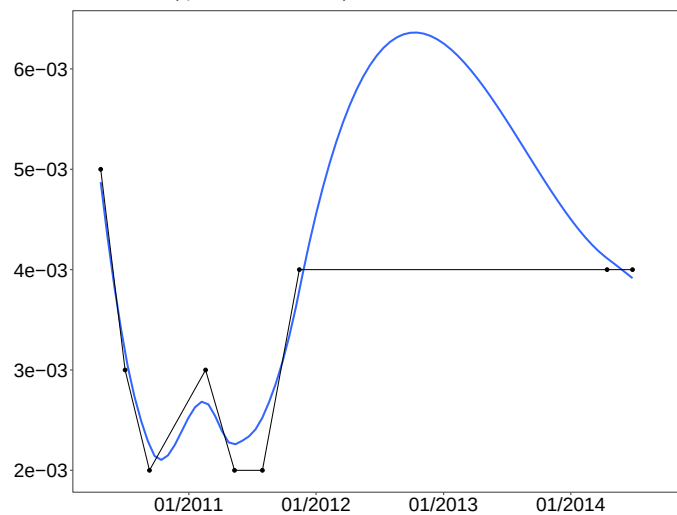
EC09 – Antimony (d.)

 $\tau = -0.683$ | p-value = 0.0227 | Negative trend

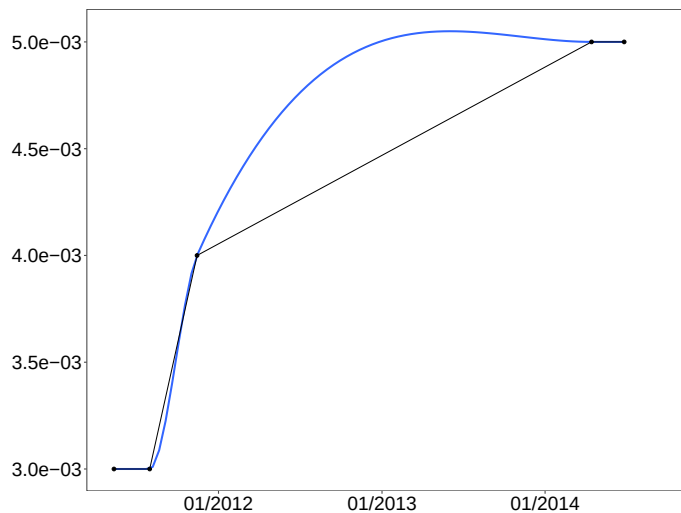
EC09 – Antimony (t.)

 $\tau = -0.775$ | p-value = 0.0809 | No trend

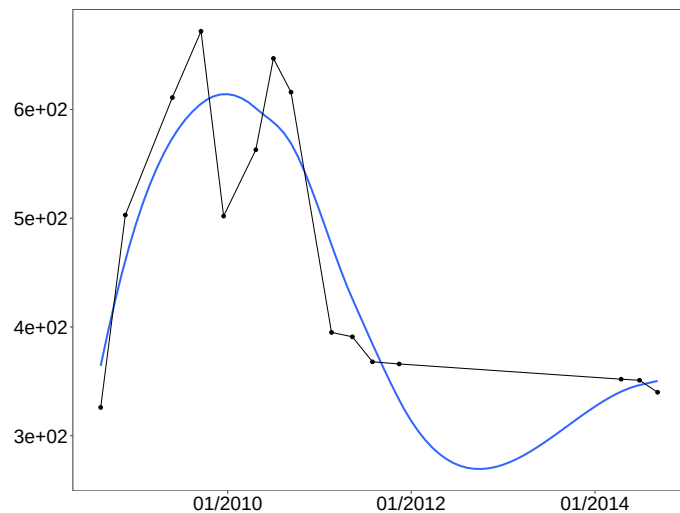
EC09 – Arsenic (d.)

 $\tau = 0.0928$ | p-value = 0.827 | No trend

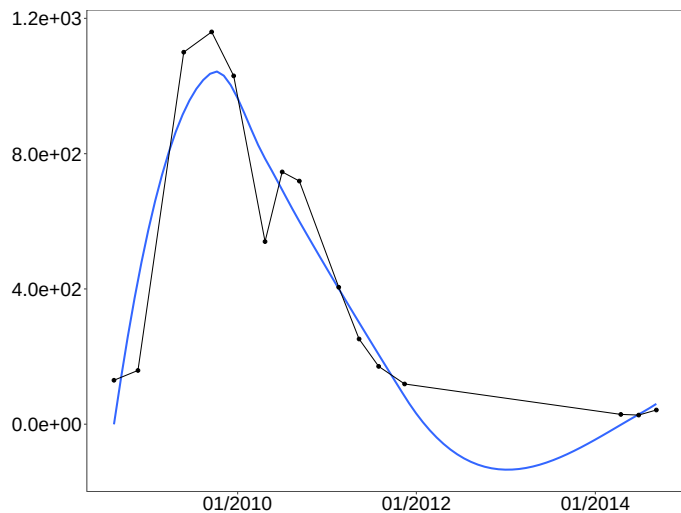
EC09 – Arsenic (t.)
 $\tau = 0.894$ | p-value = 0.0676 | No trend



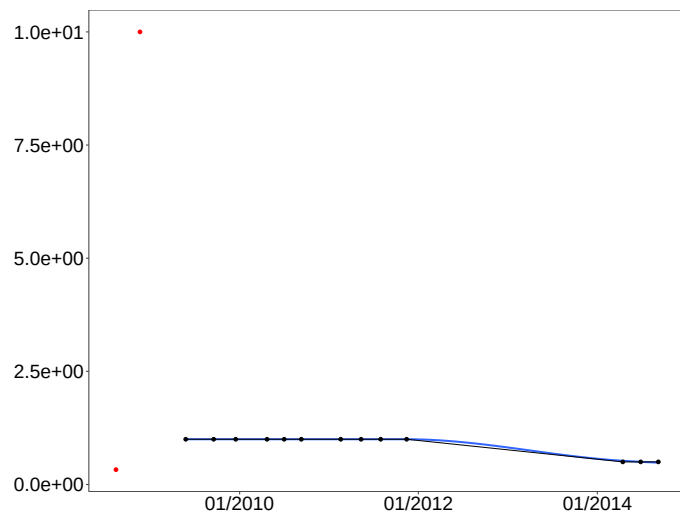
EC09 – Bicarbonate
 $\tau = -0.486$ | p-value = 0.0133 | Negative trend



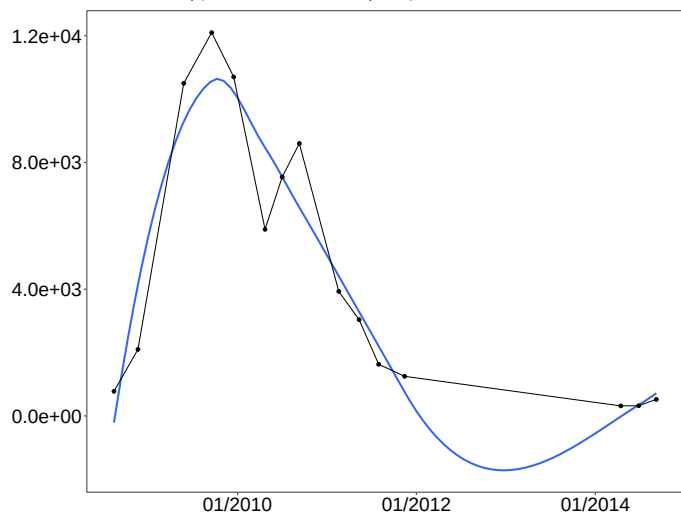
EC09 – Calcium
 $\tau = -0.543$ | p-value = 0.00558 | Negative trend



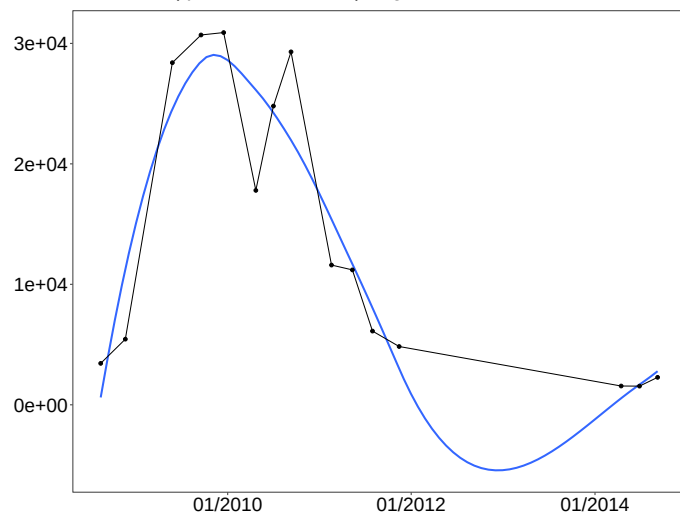
EC09 – Carbonate
 $\tau = -0.375$ | p-value = 0.0941 | No trend



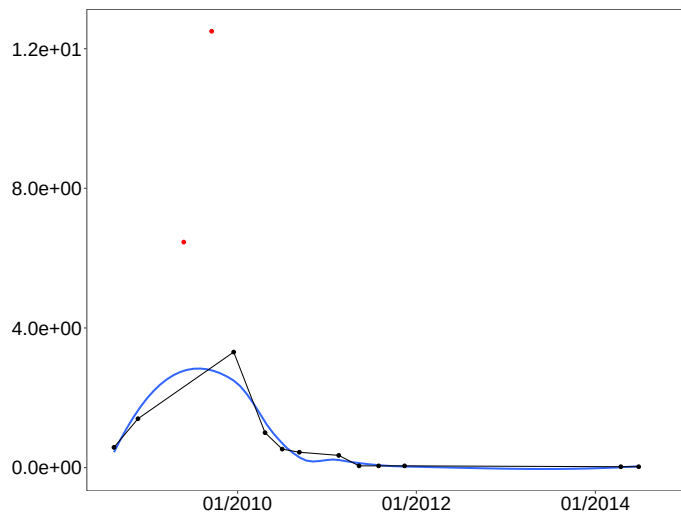
EC09 – Chloride
 $\tau = -0.486$ | p-value = 0.0133 | Negative trend



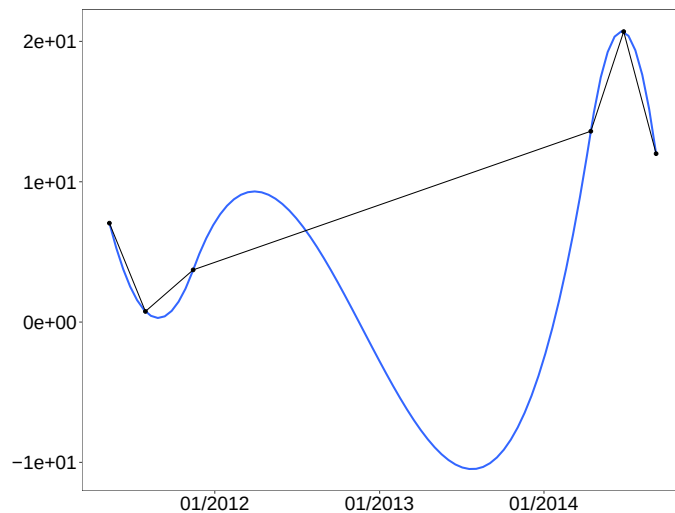
EC09 – Electrical Conductivity
 $\tau = -0.448$ | p-value = 0.0228 | Negative trend



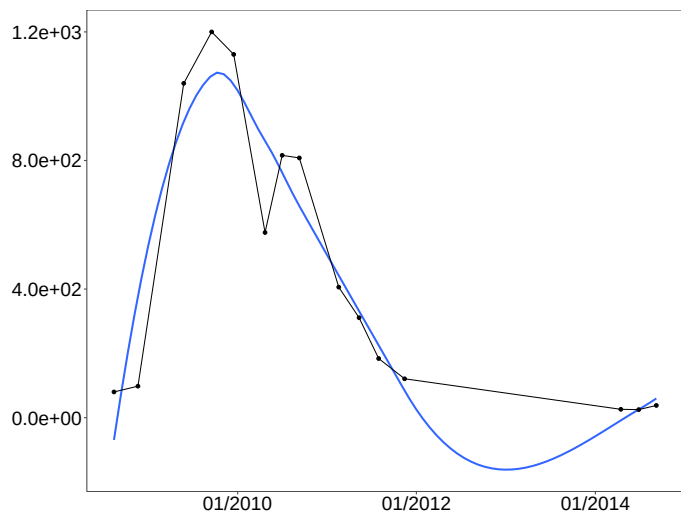
EC09 – Iron (d.)
 $\tau = -0.775$ | p-value = 0.000178 | Negative trend



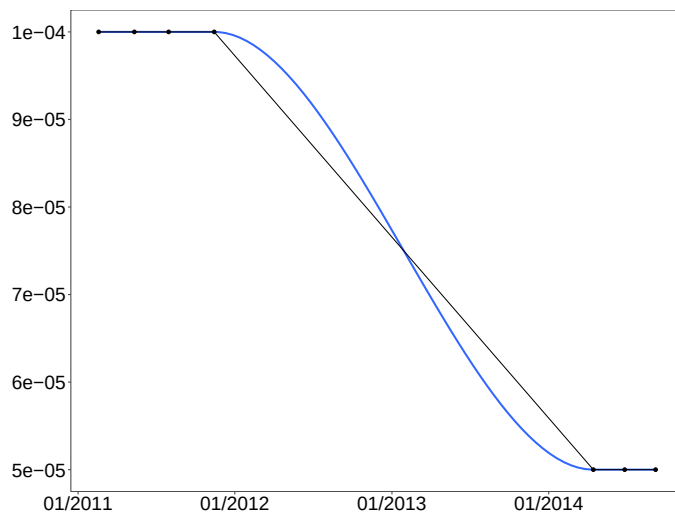
EC09 – Iron (t.)
 $\tau = 0.467$ | p-value = 0.26 | No trend



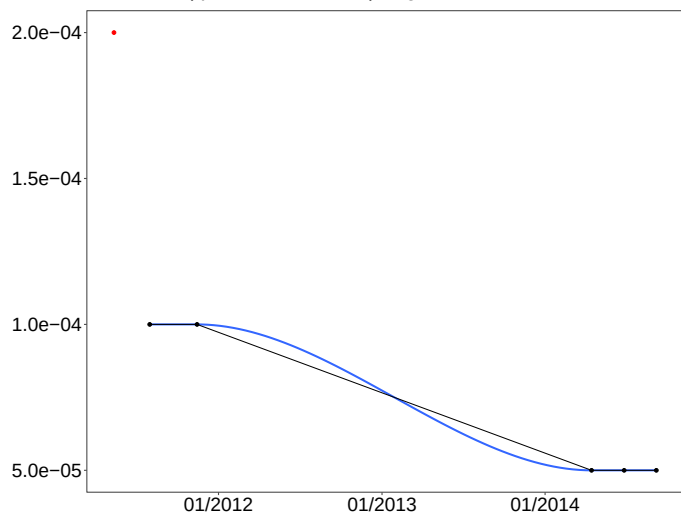
EC09 – Magnesium
 $\tau = -0.486$ | p-value = 0.0133 | Negative trend



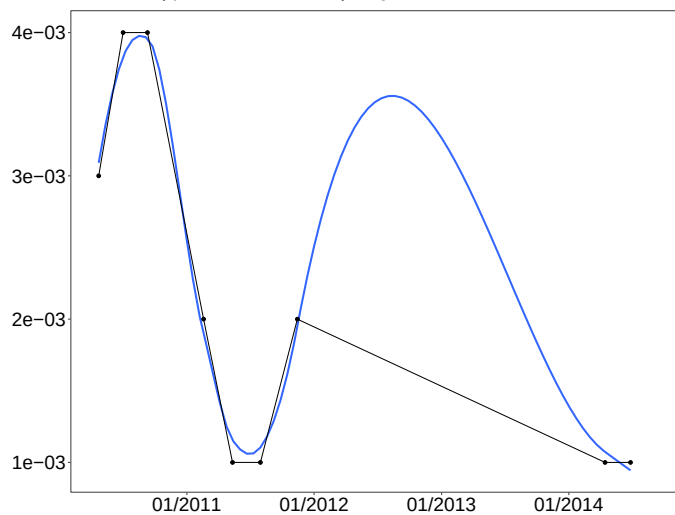
EC09 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



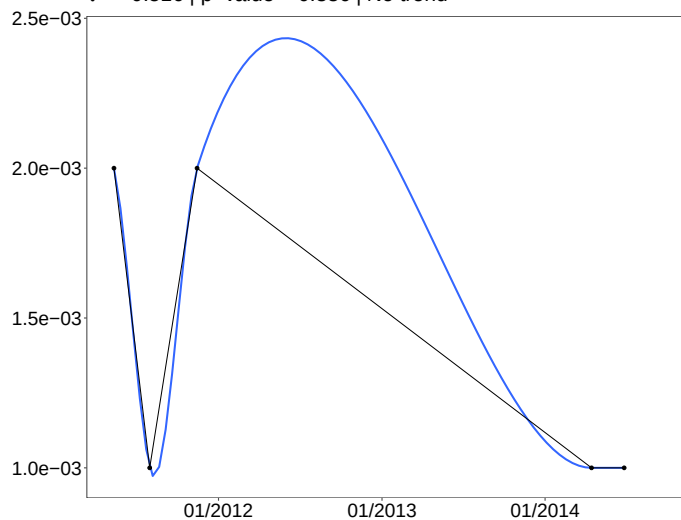
EC09 – Mercury (t.)
 $\tau = -0.856$ | p-value = 0.0398 | Negative trend



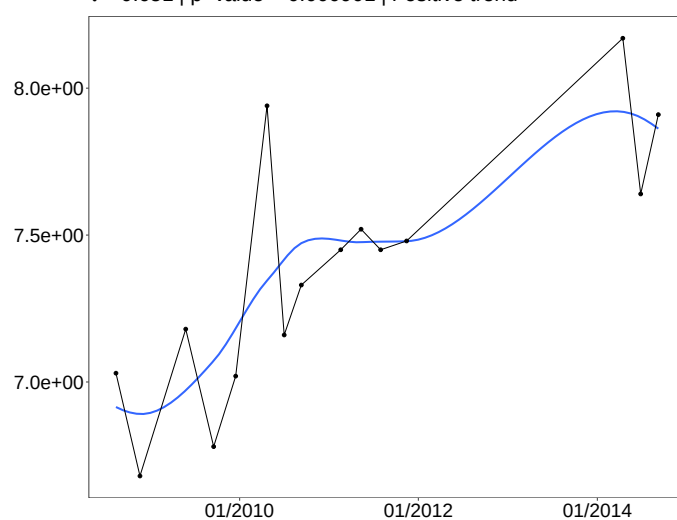
EC09 – Molybdenum (d.)
 $\tau = -0.63$ | p-value = 0.0351 | Negative trend



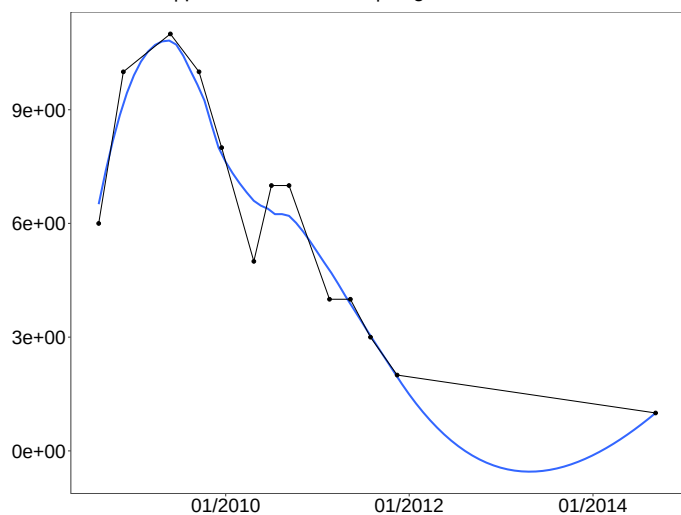
EC09 – Molybdenum (t.)

 $\tau = -0.516$ | p-value = 0.386 | No trend

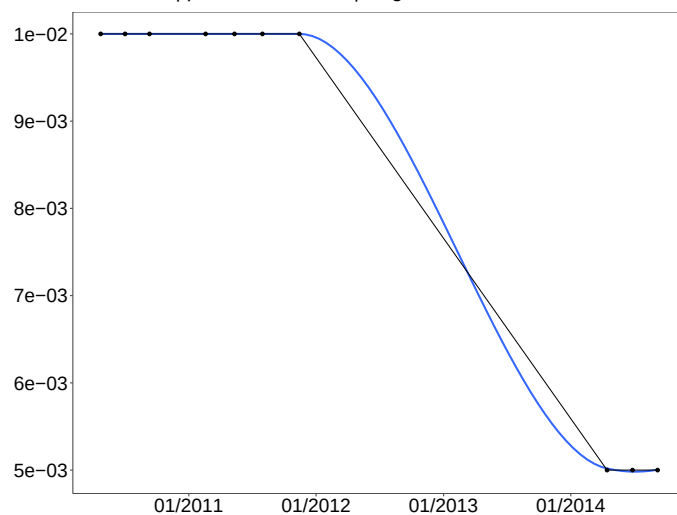
EC09 – pH

 $\tau = 0.651$ | p-value = 0.000901 | Positive trend

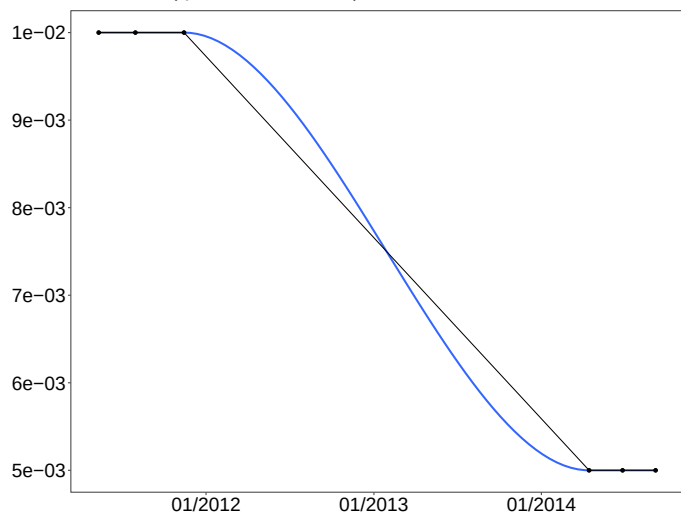
EC09 – Potassium

 $\tau = -0.745$ | p-value = 0.000591 | Negative trend

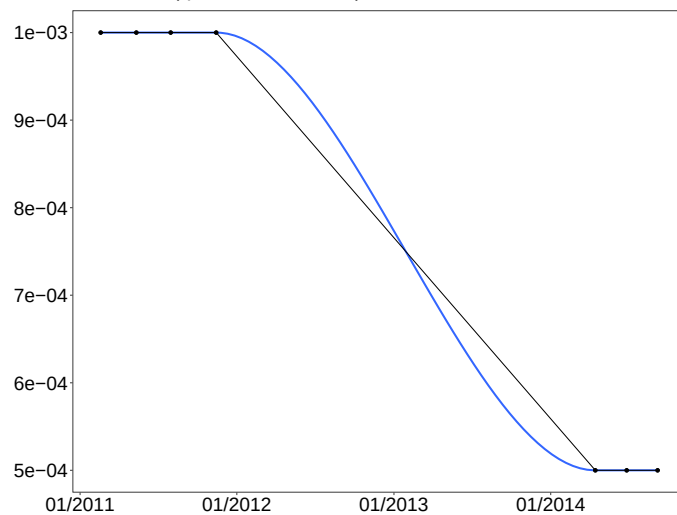
EC09 – Selenium (d.)

 $\tau = -0.683$ | p-value = 0.0227 | Negative trend

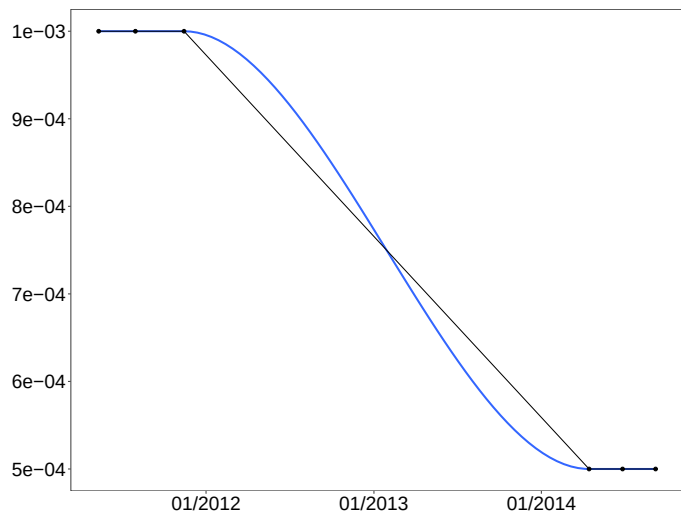
EC09 – Selenium (t.)

 $\tau = -0.775$ | p-value = 0.0809 | No trend

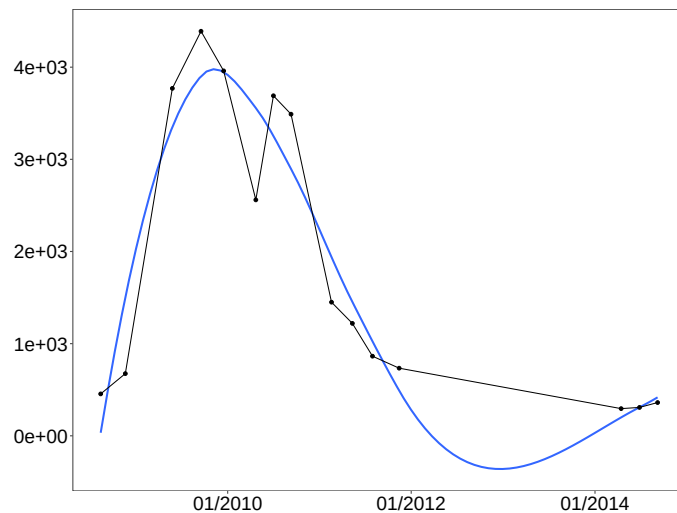
EC09 – Silver (d.)

 $\tau = -0.756$ | p-value = 0.0518 | No trend

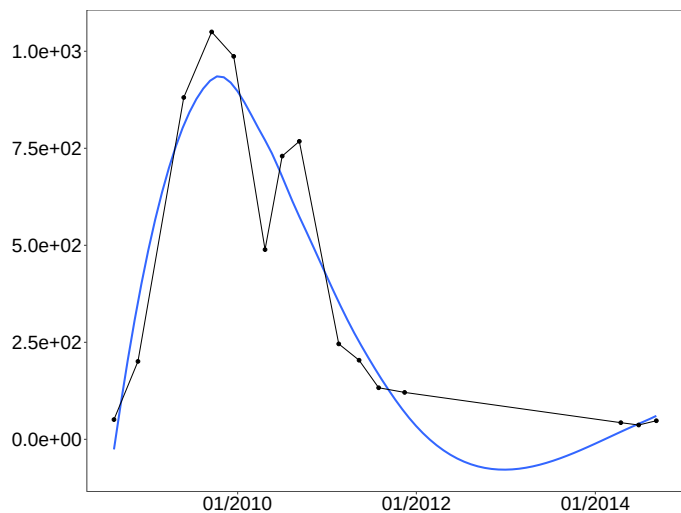
EC09 – Silver (t.)
 $\tau = -0.775$ | p-value = 0.0809 | No trend



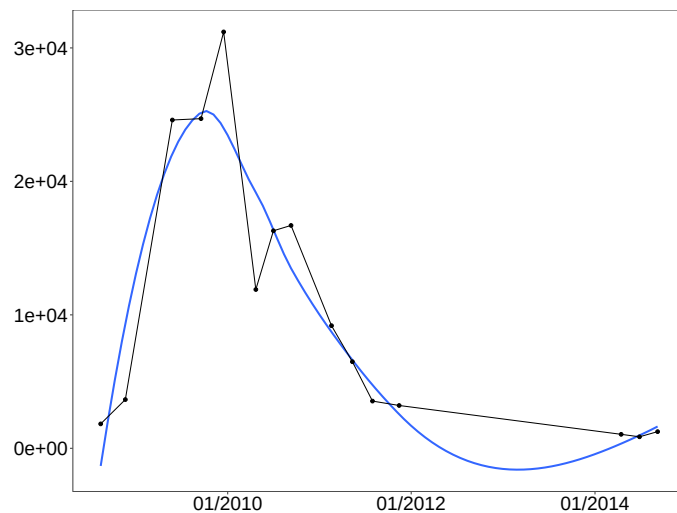
EC09 – Sodium
 $\tau = -0.467$ | p-value = 0.0175 | Negative trend



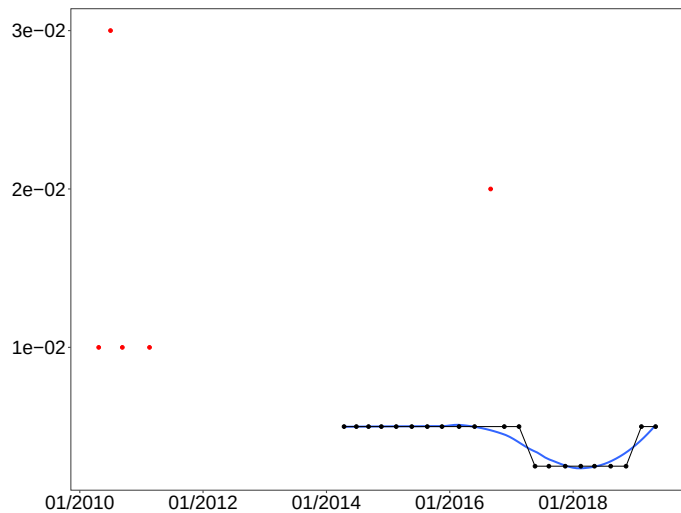
EC09 – Sulphate
 $\tau = -0.505$ | p-value = 0.0101 | Negative trend



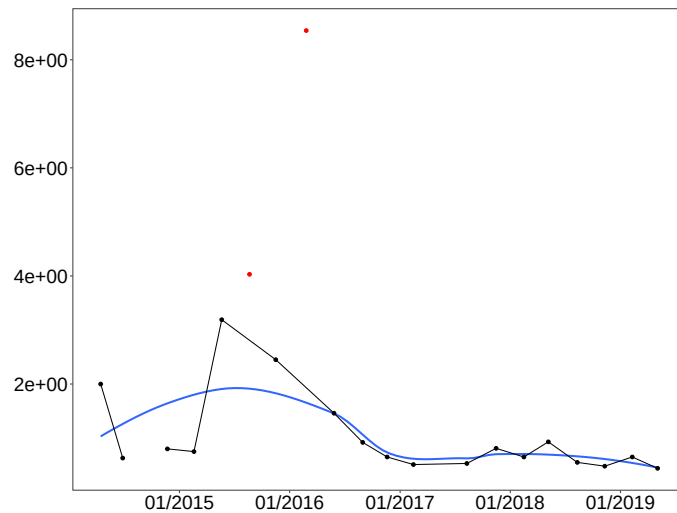
EC09 – TDS
 $\tau = -0.486$ | p-value = 0.0133 | Negative trend



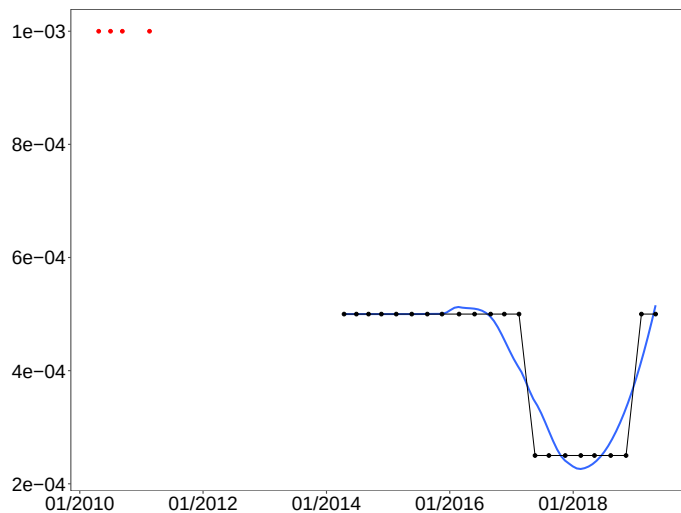
EC09A – Aluminium (d.)
 $\tau = -0.589$ | p-value = 0.000187 | Negative trend



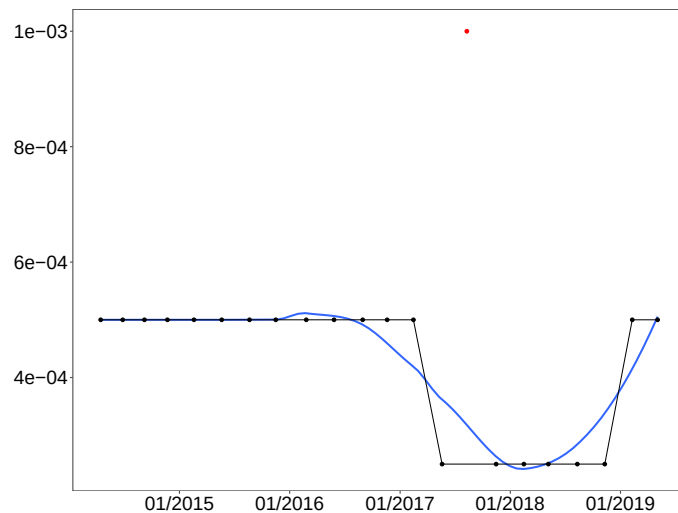
EC09A – Aluminium (t.)
 $\tau = -0.409$ | p-value = 0.0135 | Negative trend



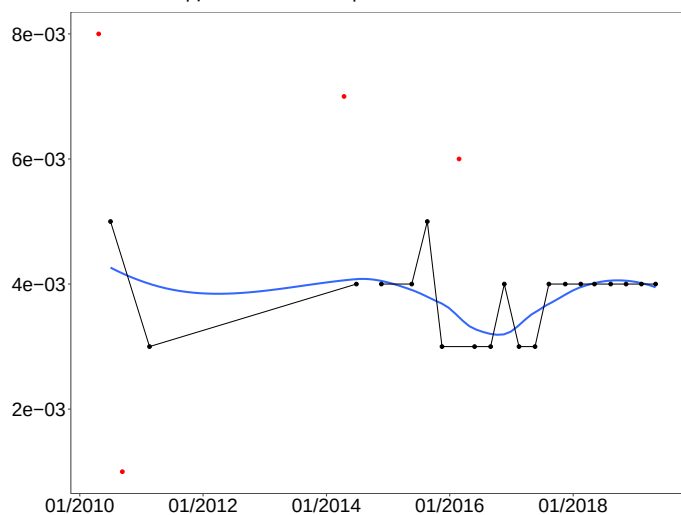
EC09A – Antimony (d.)
 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend



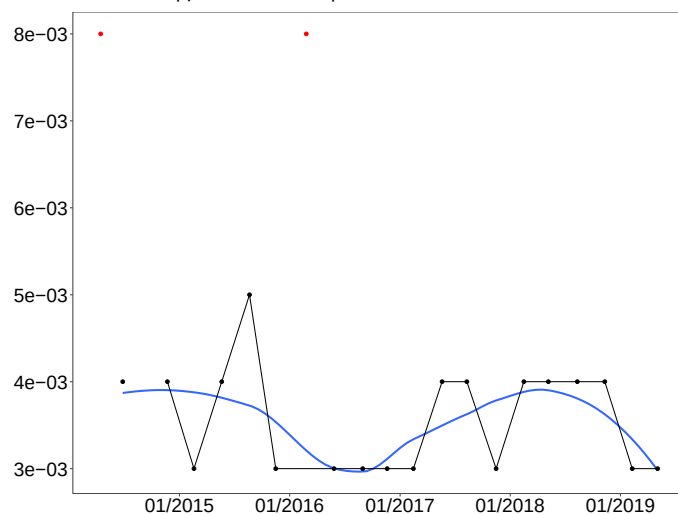
EC09A – Antimony (t.)
 $\tau = -0.368$ | p-value = 0.0429 | Negative trend



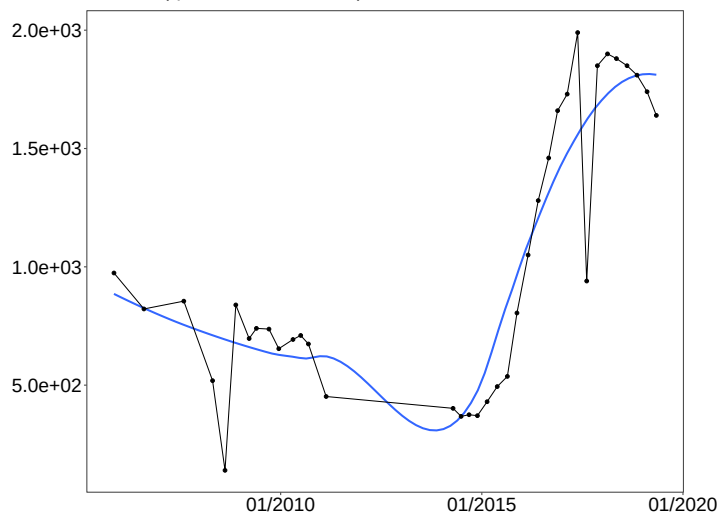
EC09A – Arsenic (d.)
 $\tau = -0.0691$ | p-value = 0.687 | No trend



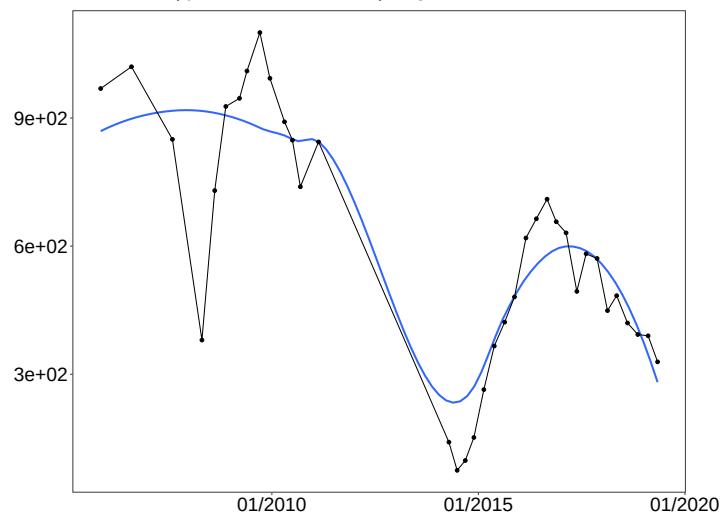
EC09A – Arsenic (t.)
 $\tau = -0.206$ | p-value = 0.26 | No trend



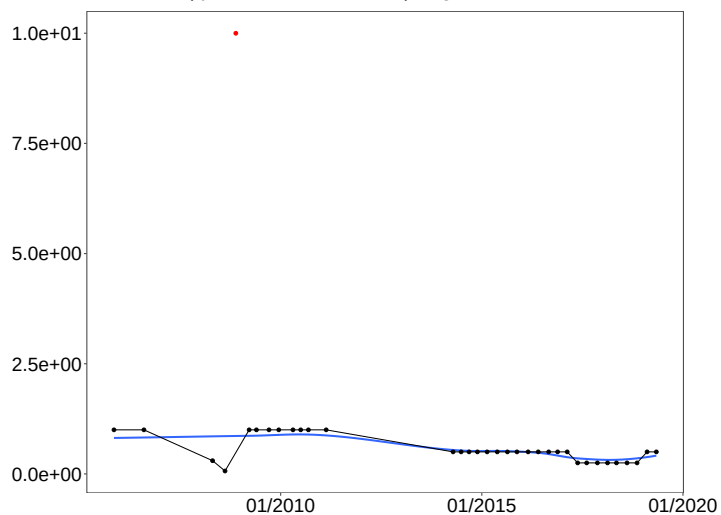
EC09A – Bicarbonate
 $\tau = 0.38$ | p-value = 0.00119 | Positive trend



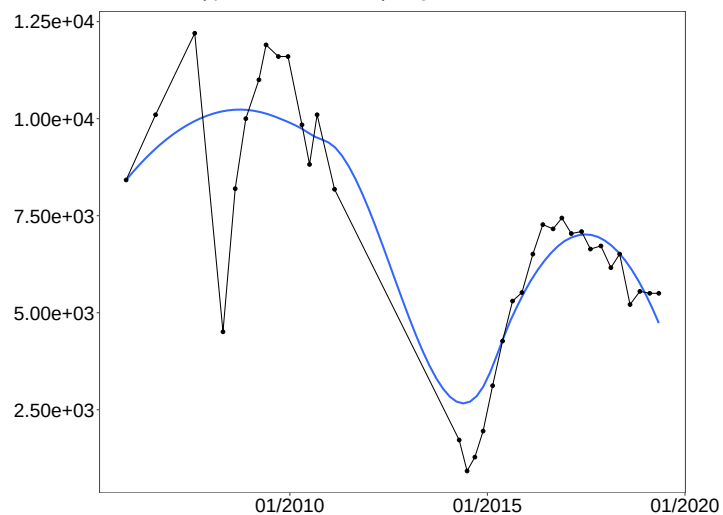
EC09A – Calcium
 $\tau = -0.397$ | p-value = 0.000695 | Negative trend



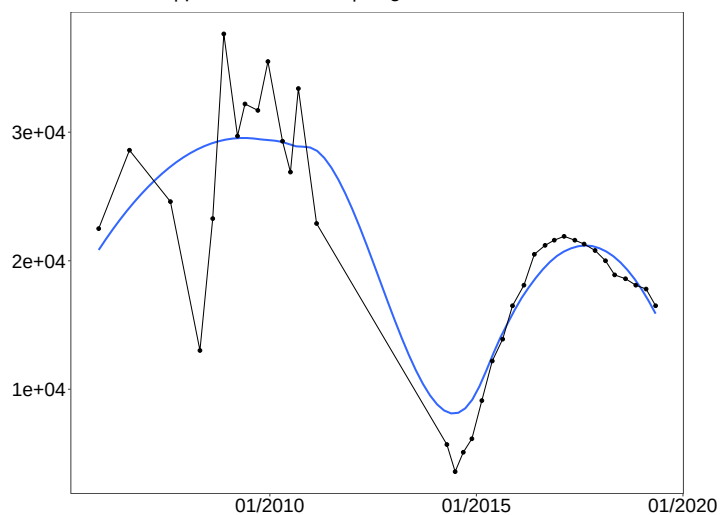
EC09A – Carbonate
 $\tau = -0.561$ | $p\text{-value} = 0.0000218$ | Negative trend



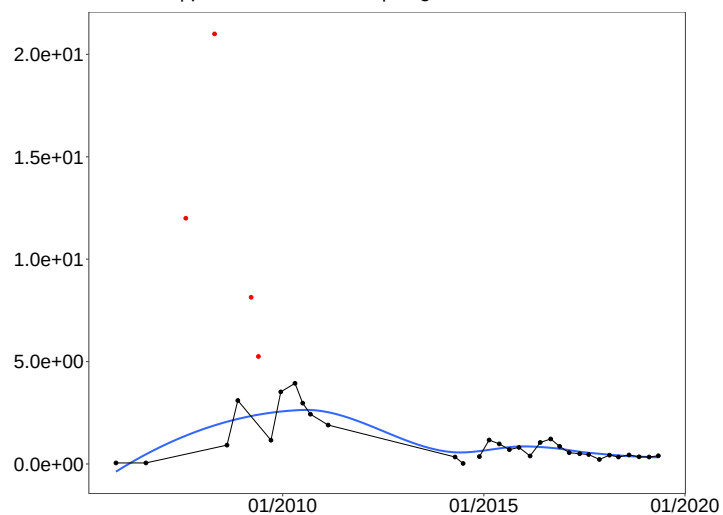
EC09A – Chloride
 $\tau = -0.334$ | $p\text{-value} = 0.0044$ | Negative trend



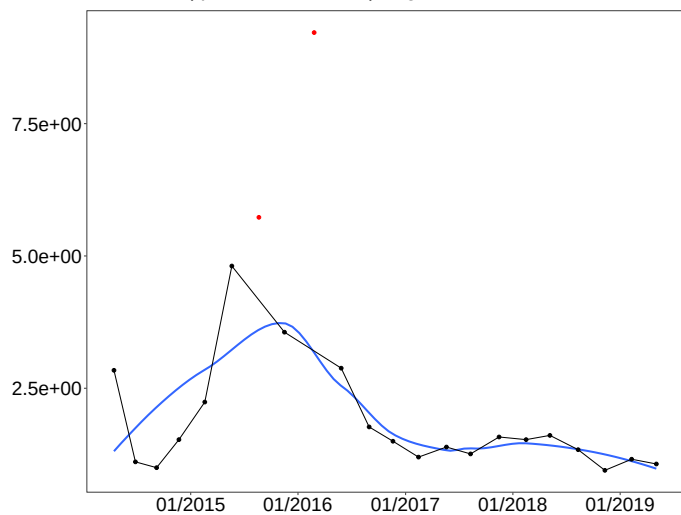
EC09A – Electrical Conductivity
 $\tau = -0.269$ | $p\text{-value} = 0.0221$ | Negative trend



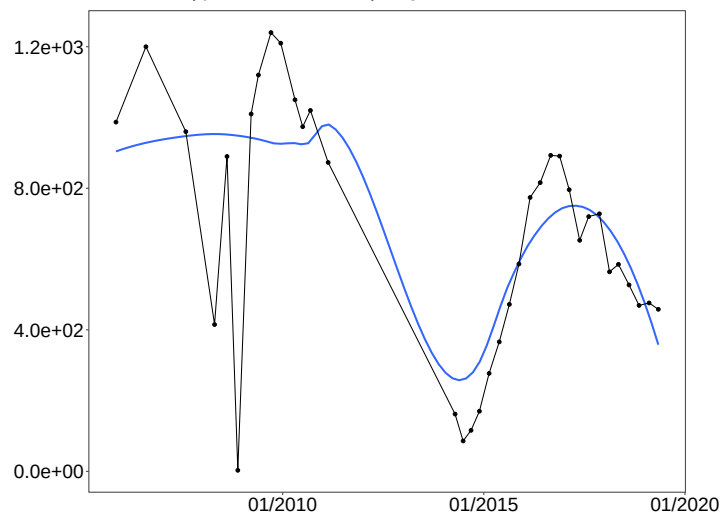
EC09A – Iron (d.)
 $\tau = -0.42$ | $p\text{-value} = 0.000426$ | Negative trend



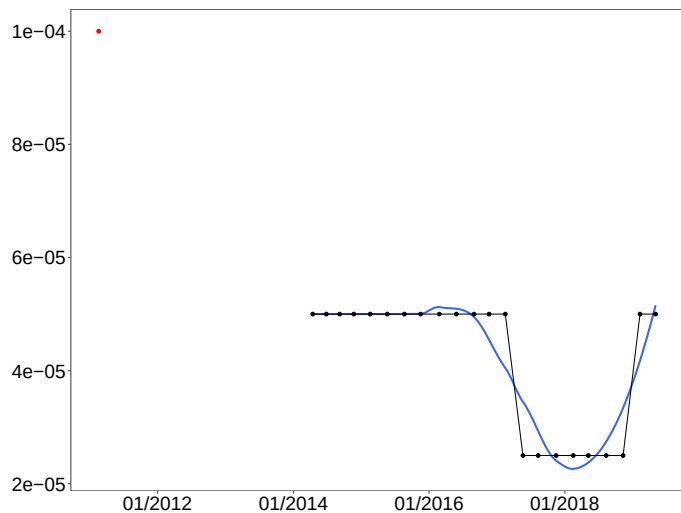
EC09A – Iron (t.)
 $\tau = -0.321$ | $p\text{-value} = 0.0395$ | Negative trend



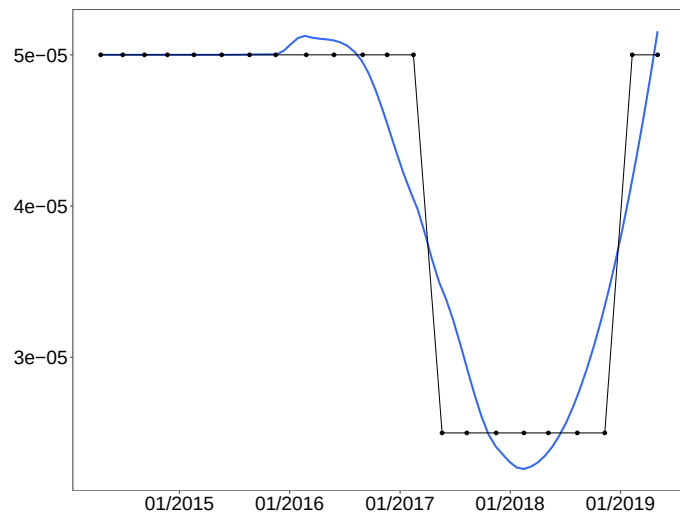
EC09A – Magnesium
 $\tau = -0.267$ | $p\text{-value} = 0.0229$ | Negative trend



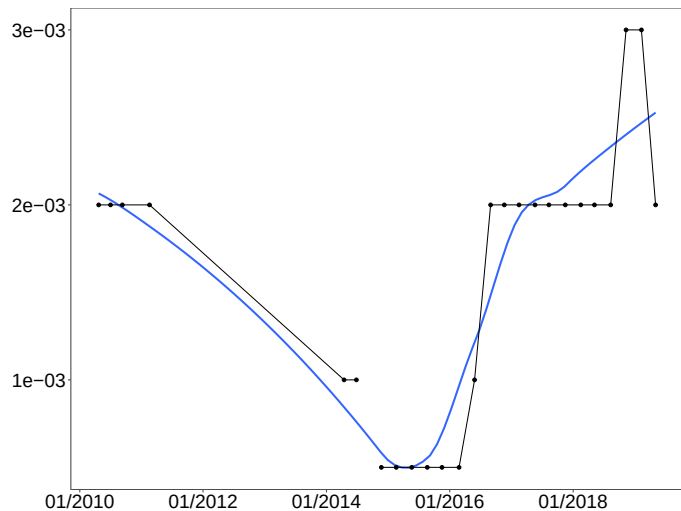
EC09A – Mercury (d.)

 $\tau = -0.552$ | p-value = 0.00175 | Negative trend

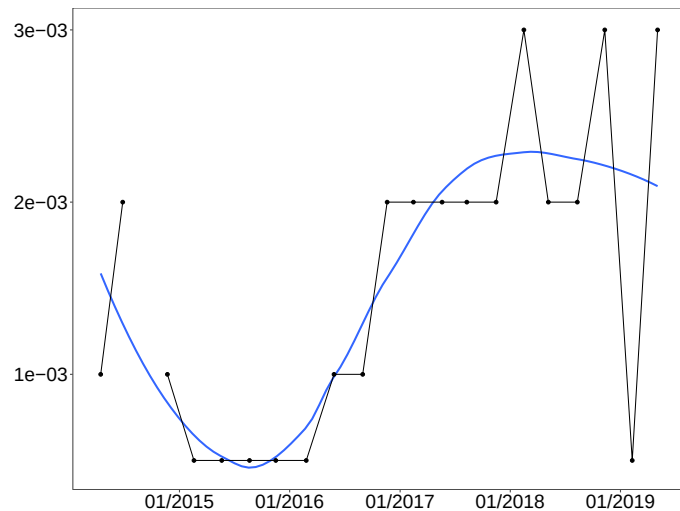
EC09A – Mercury (t.)

 $\tau = -0.494$ | p-value = 0.00739 | Negative trend

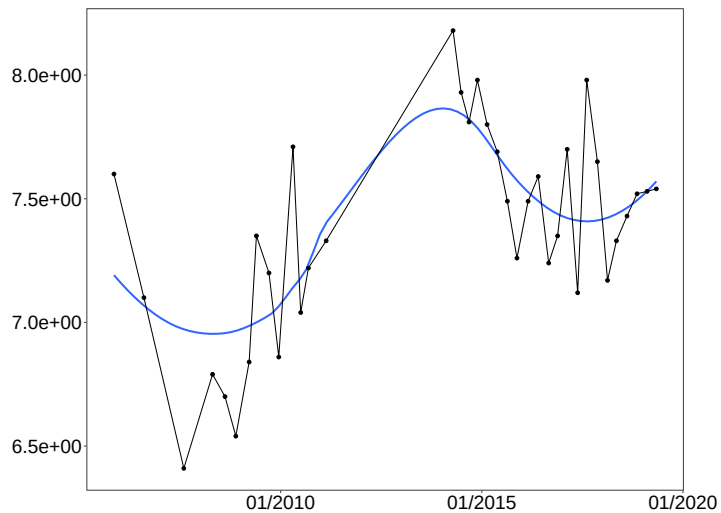
EC09A – Molybdenum (d.)

 $\tau = 0.377$ | p-value = 0.0201 | Positive trend

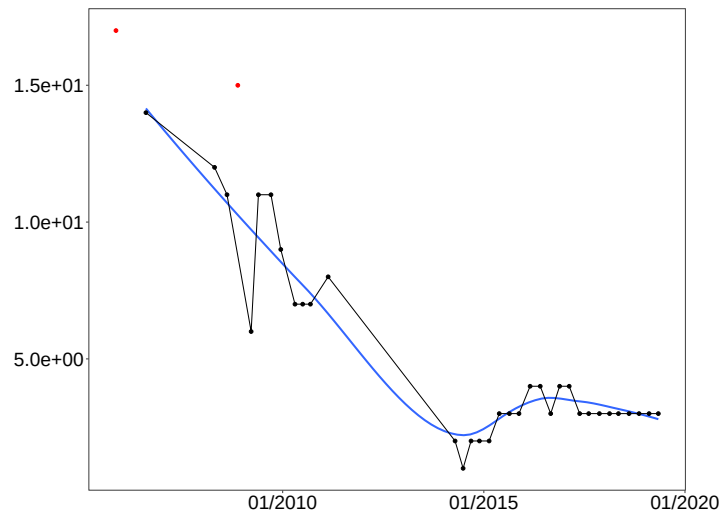
EC09A – Molybdenum (t.)

 $\tau = 0.494$ | p-value = 0.00469 | Positive trend

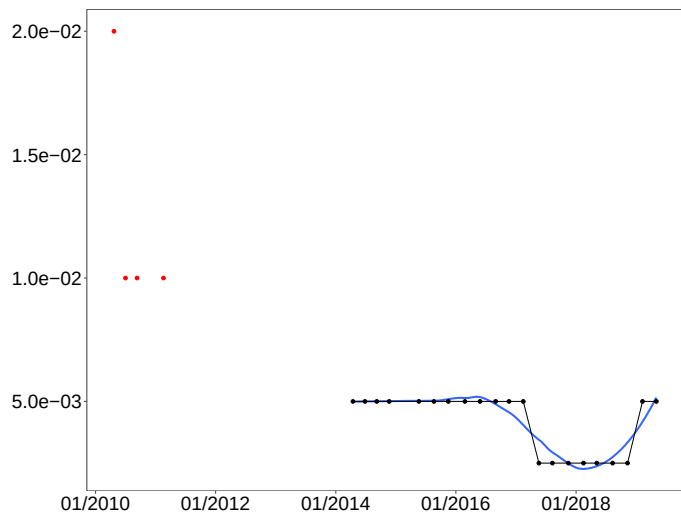
EC09A – pH

 $\tau = 0.271$ | p-value = 0.0213 | Positive trend

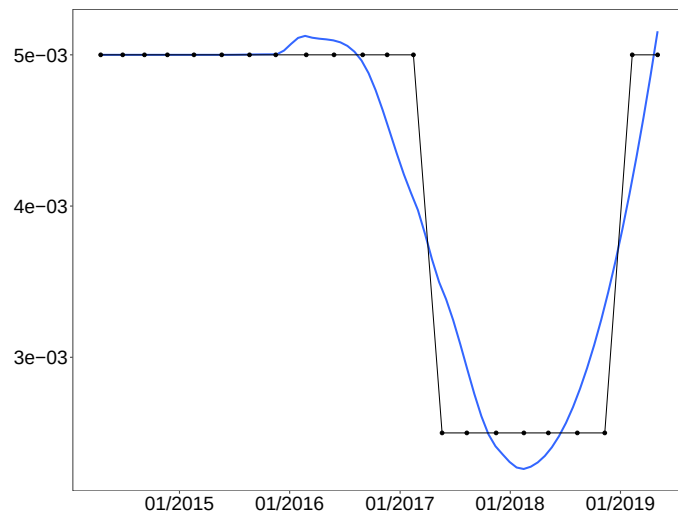
EC09A – Potassium

 $\tau = -0.494$ | p-value = 0.0000872 | Negative trend

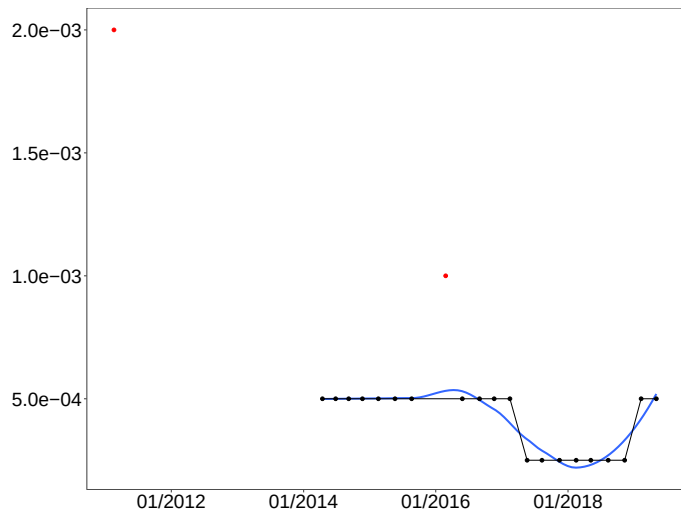
EC09A – Selenium (d.)

 $\tau = -0.666$ | p-value = 0.0000423 | Negative trend

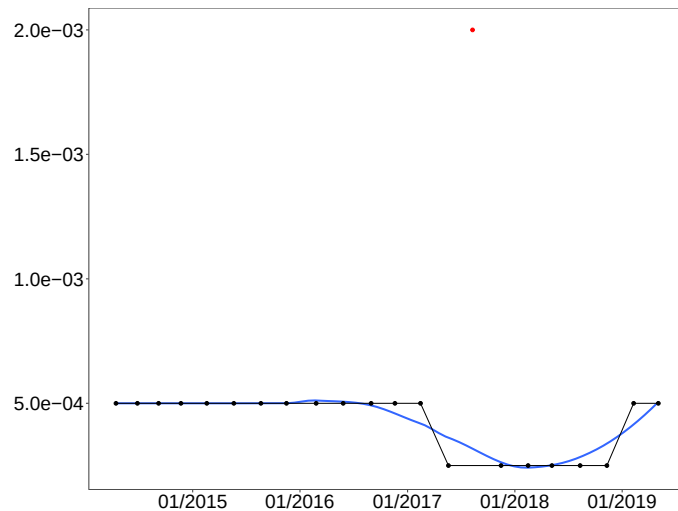
EC09A – Selenium (t.)

 $\tau = -0.494$ | p-value = 0.00739 | Negative trend

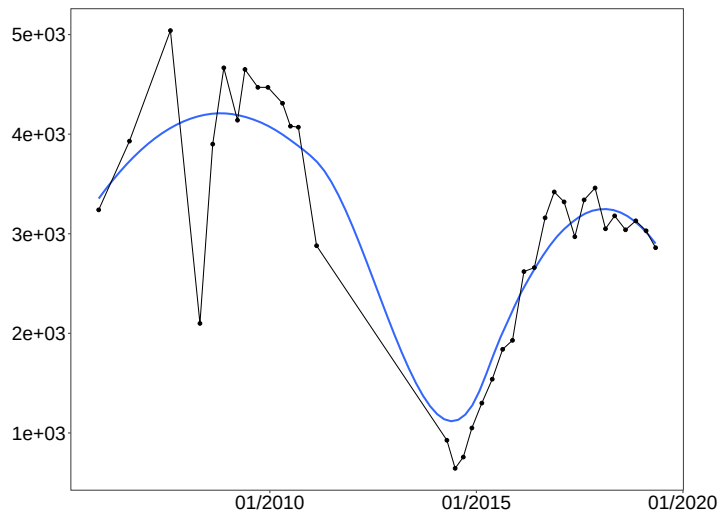
EC09A – Silver (d.)

 $\tau = -0.515$ | p-value = 0.00378 | Negative trend

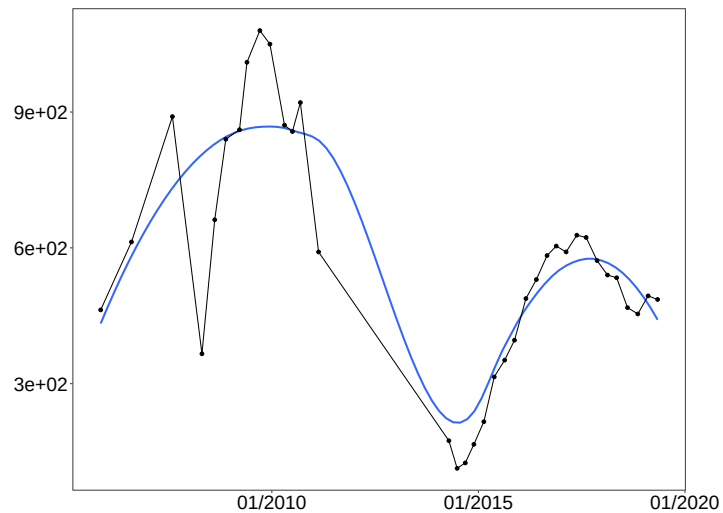
EC09A – Silver (t.)

 $\tau = -0.368$ | p-value = 0.0429 | Negative trend

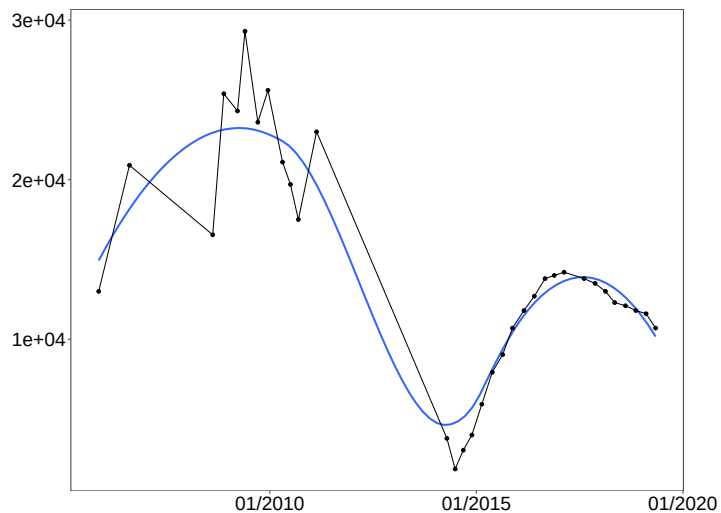
EC09A – Sodium

 $\tau = -0.195$ | p-value = 0.0965 | No trend

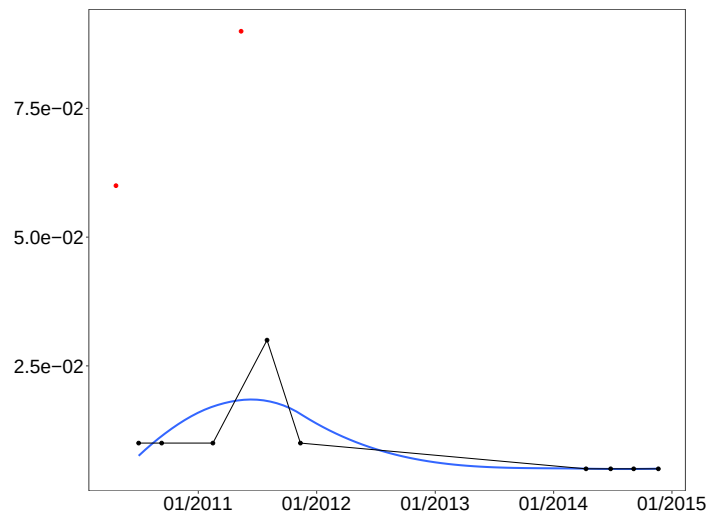
EC09A – Sulphate

 $\tau = -0.173$ | p-value = 0.141 | No trend

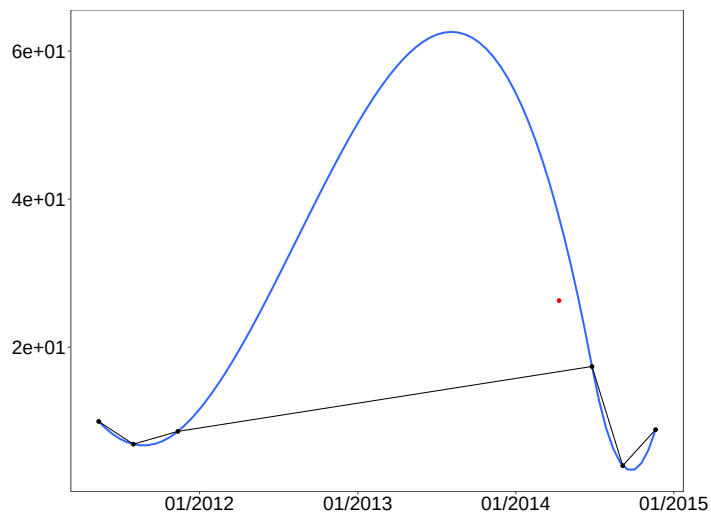
EC09A – TDS

 $\tau = -0.285$ | p-value = 0.0209 | Negative trend

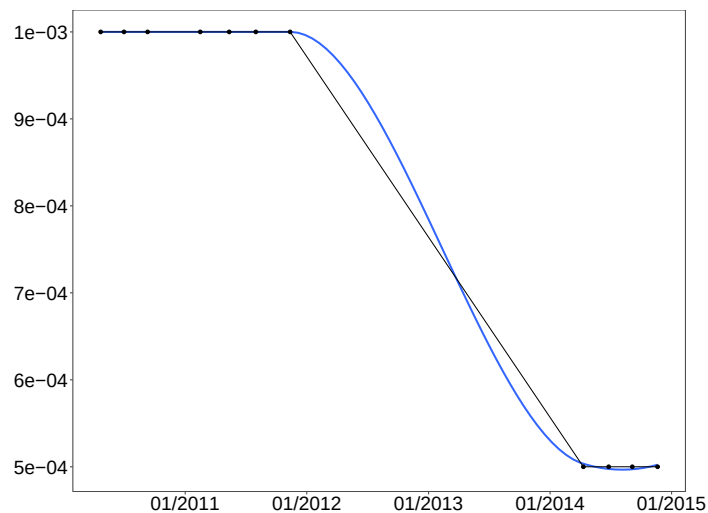
EC10 – Aluminium (d.)

 $\tau = -0.596$ | p-value = 0.0212 | Negative trend

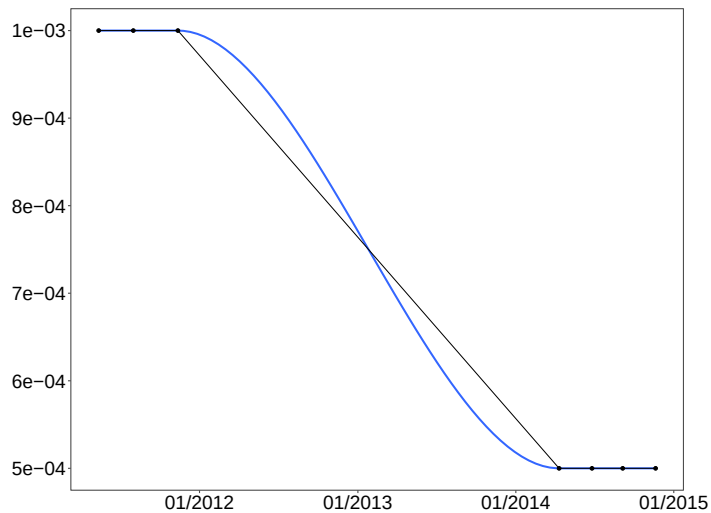
EC10 – Aluminium (t.)

 $\tau = -0.0476$ | p-value = 1 | No trend

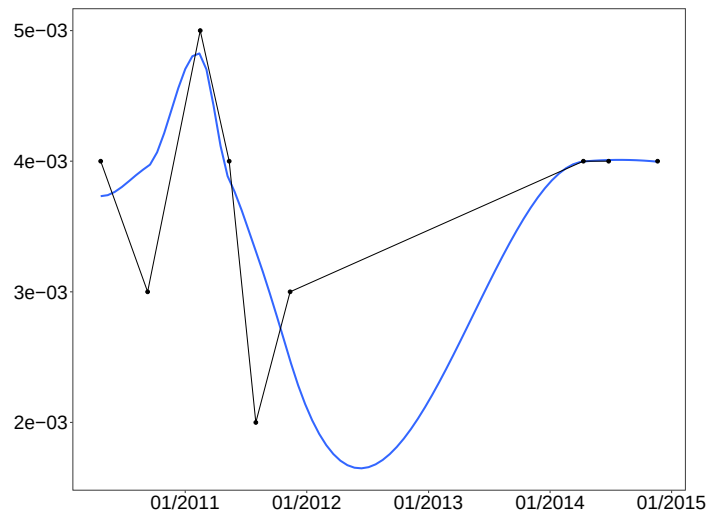
EC10 – Antimony (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

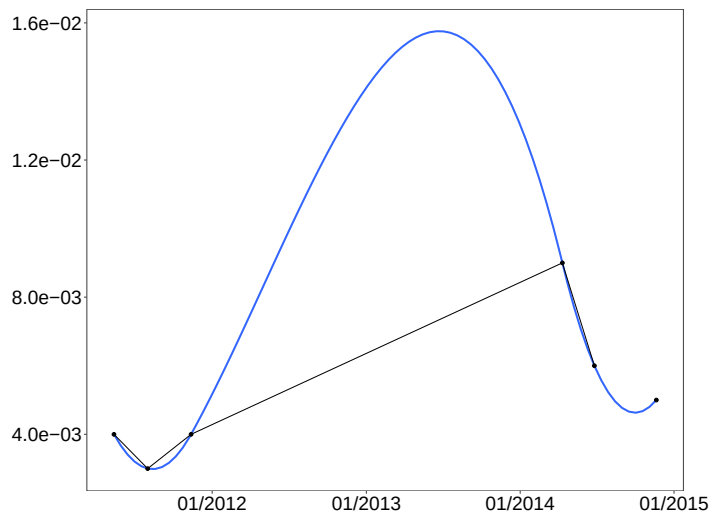
EC10 – Antimony (t.)

 $\tau = -0.756$ | p-value = 0.0518 | No trend

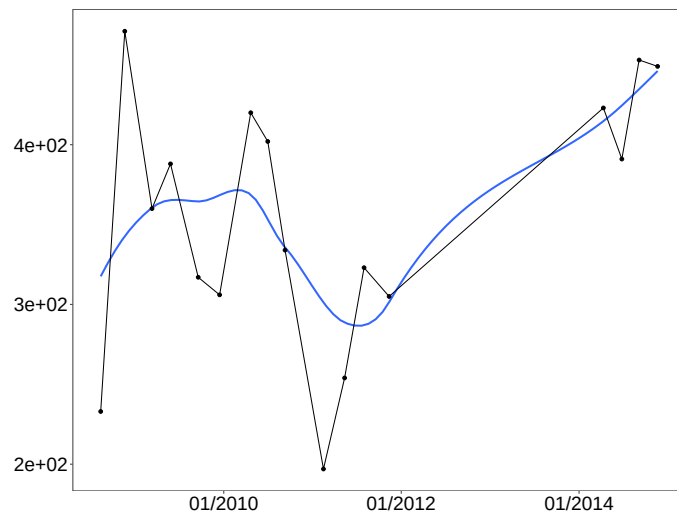
EC10 – Arsenic (d.)

 $\tau = 0.0333$ | p-value = 1 | No trend

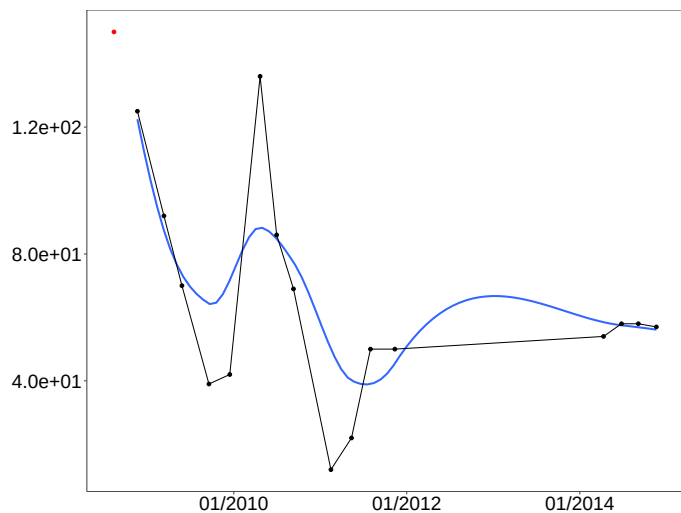
EC10 – Arsenic (t.)
 $\tau = 0.414$ | p-value = 0.339 | No trend



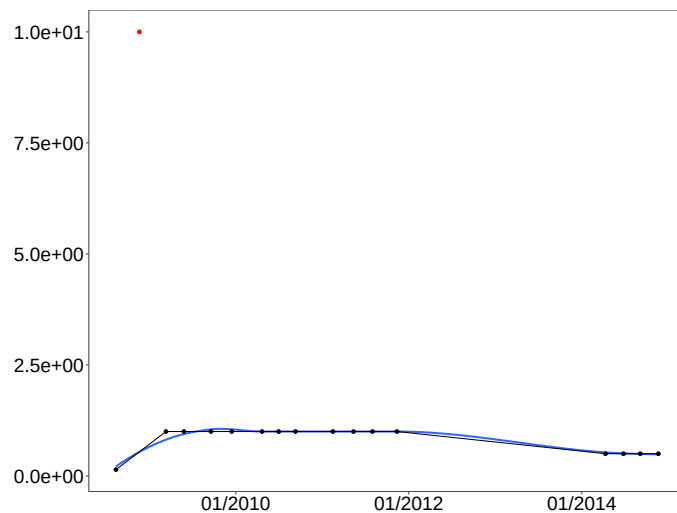
EC10 – Bicarbonate
 $\tau = 0.162$ | p-value = 0.387 | No trend



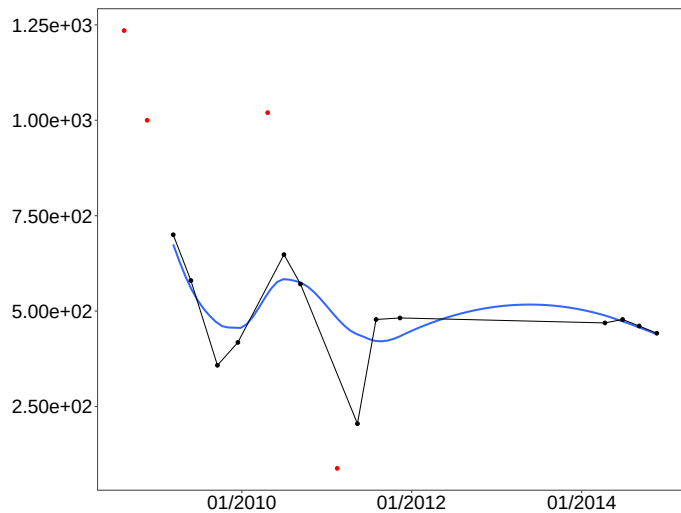
EC10 – Calcium
 $\tau = -0.296$ | p-value = 0.108 | No trend



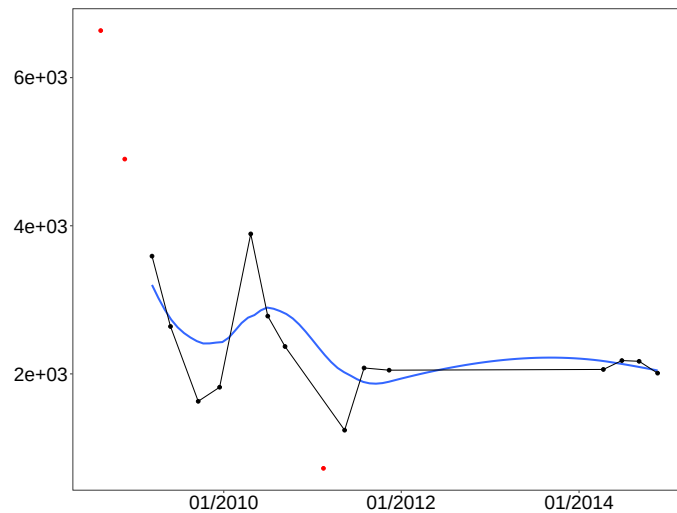
EC10 – Carbonate
 $\tau = -0.426$ | p-value = 0.0394 | Negative trend



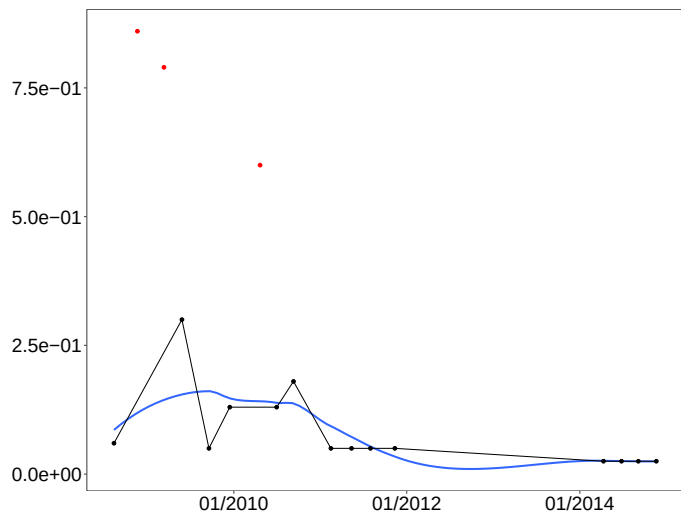
EC10 – Chloride
 $\tau = -0.435$ | p-value = 0.0168 | Negative trend



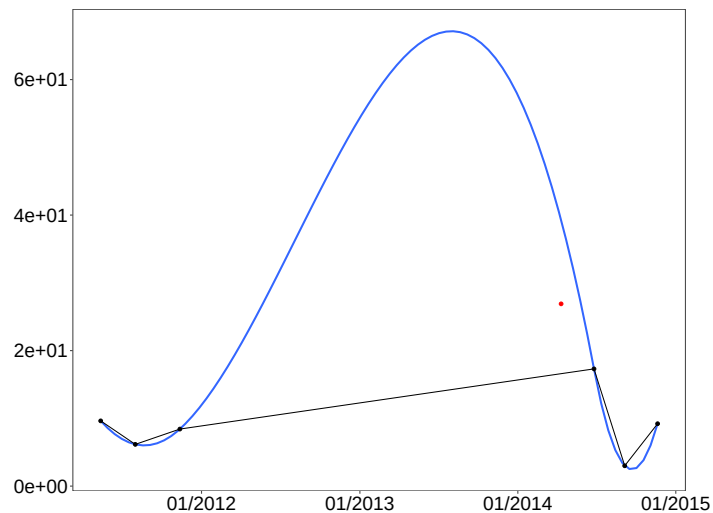
EC10 – Electrical Conductivity
 $\tau = -0.382$ | p-value = 0.0357 | Negative trend



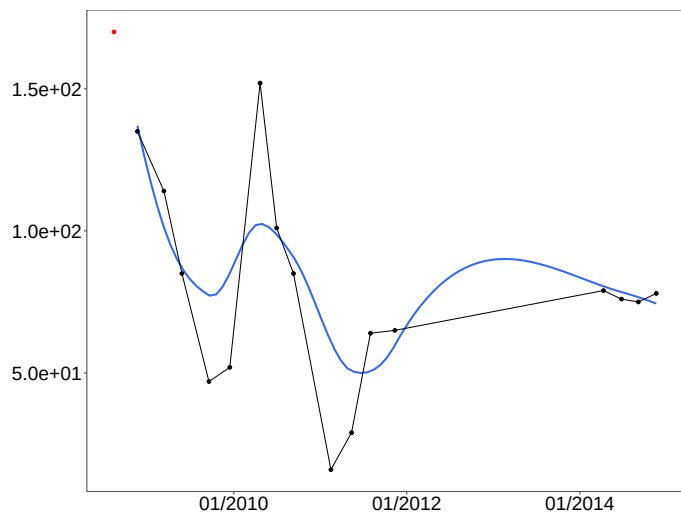
EC10 – Iron (d.)
 $\tau = -0.7$ | p-value = 0.000208 | Negative trend



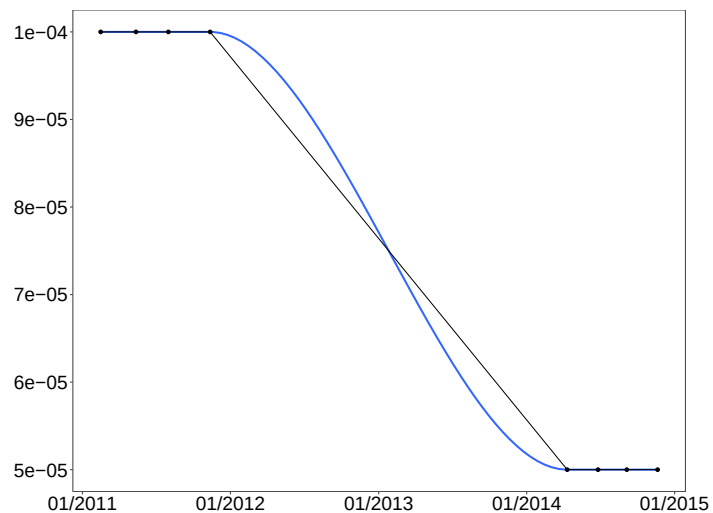
EC10 – Iron (t.)
 $\tau = -0.0476$ | p-value = 1 | No trend



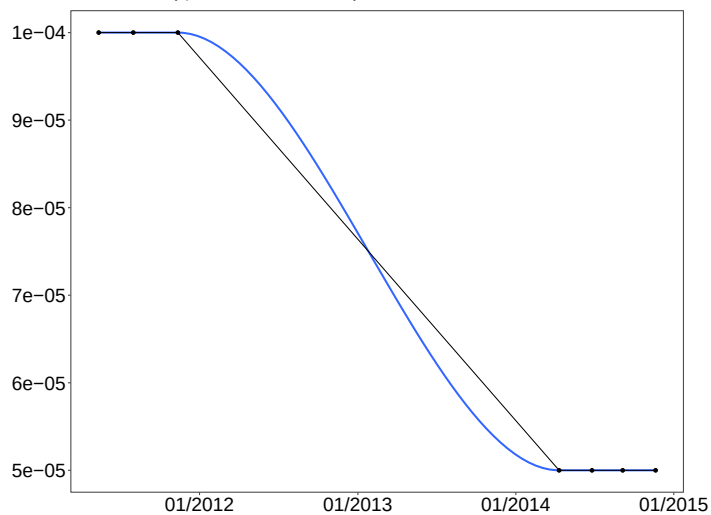
EC10 – Magnesium
 $\tau = -0.303$ | p-value = 0.0991 | No trend



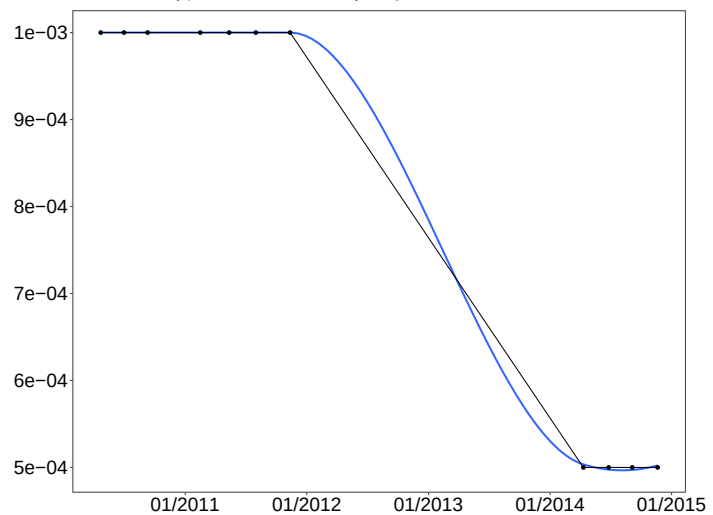
EC10 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



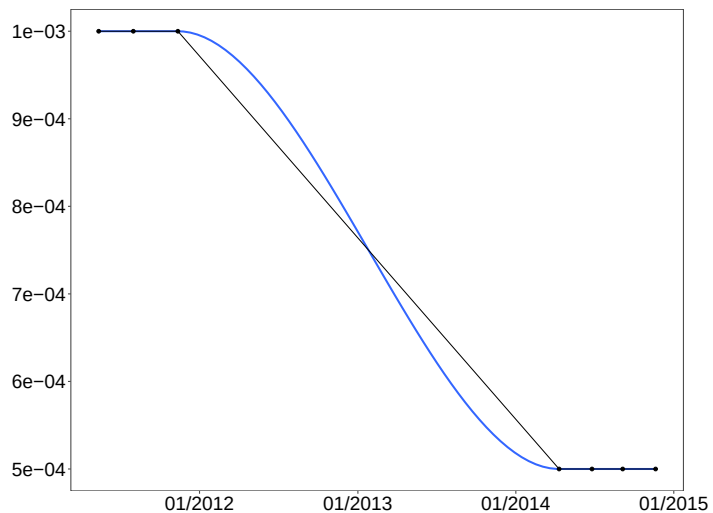
EC10 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



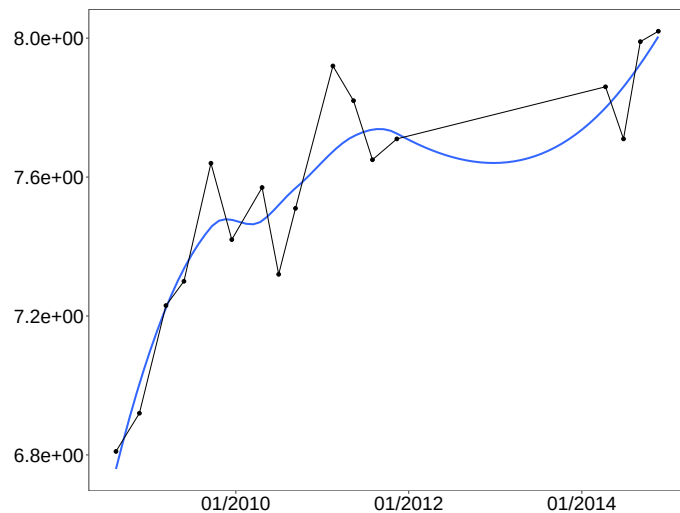
EC10 – Molybdenum (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



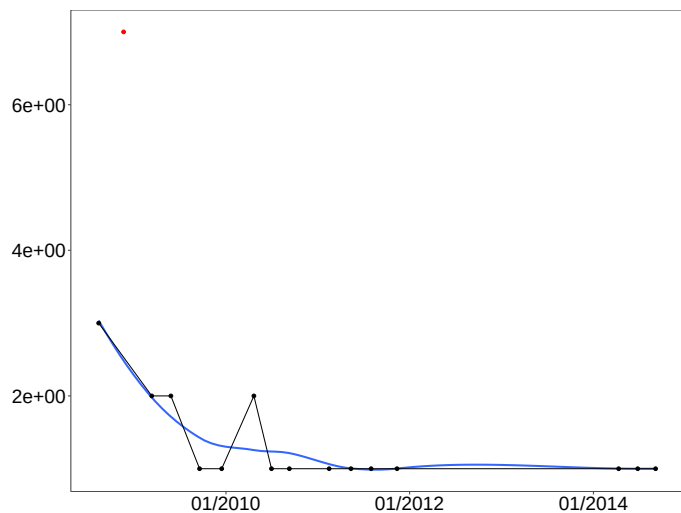
EC10 – Molybdenum (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



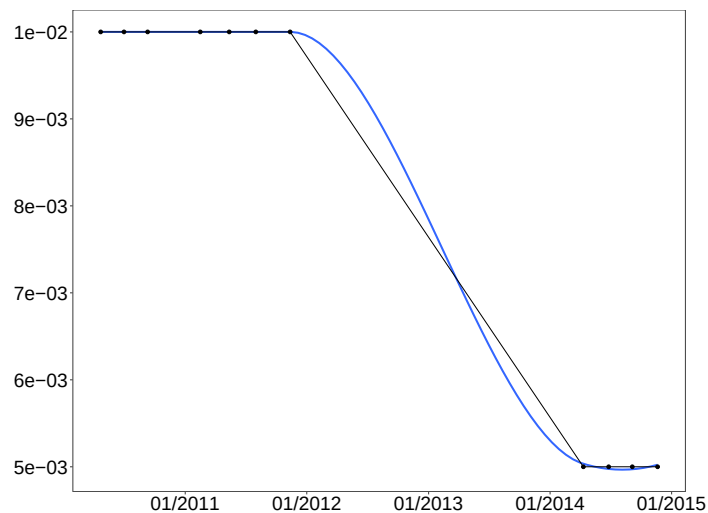
EC10 – pH
 $\tau = 0.76$ | p-value = 0.0000261 | Positive trend



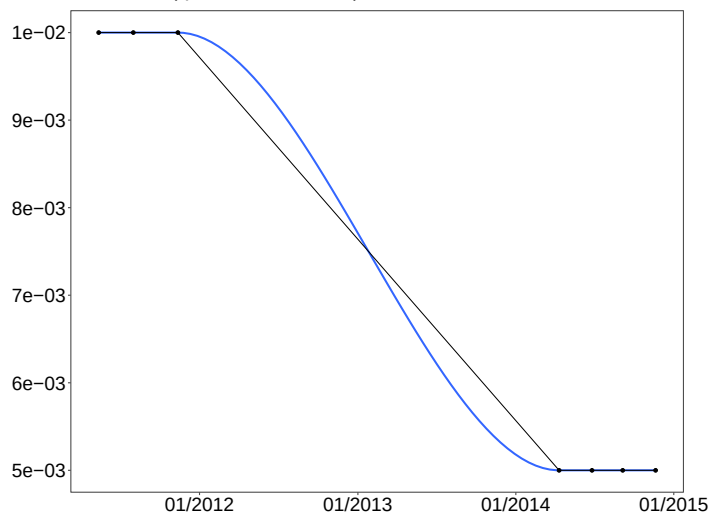
EC10 – Potassium
 $\tau = -0.649$ | p-value = 0.00227 | Negative trend



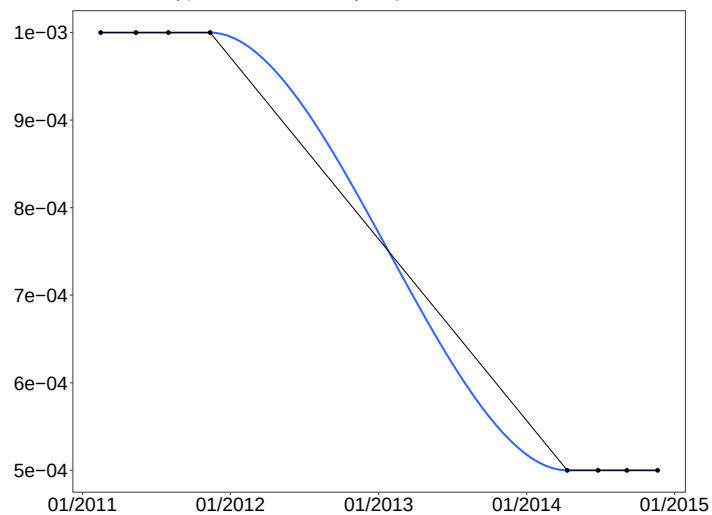
EC10 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



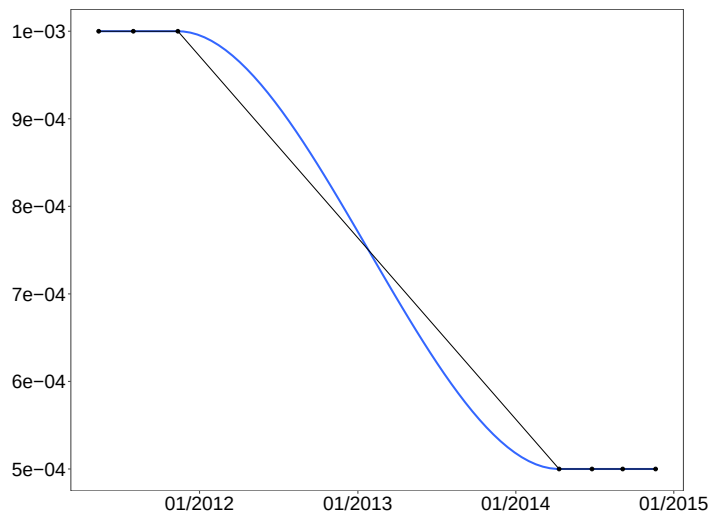
EC10 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



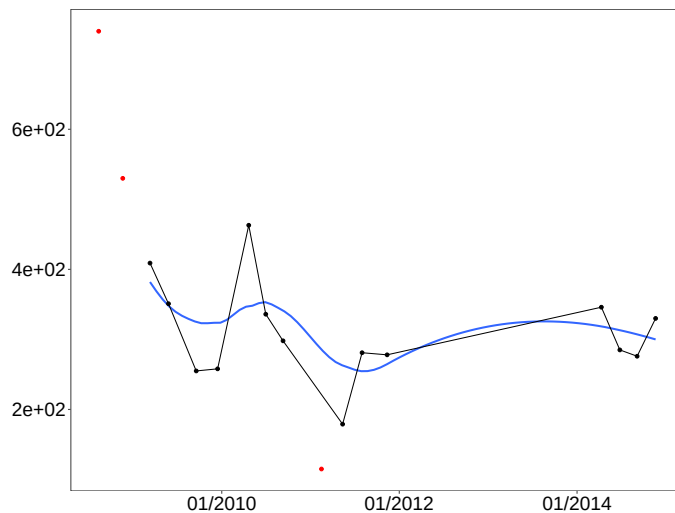
EC10 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



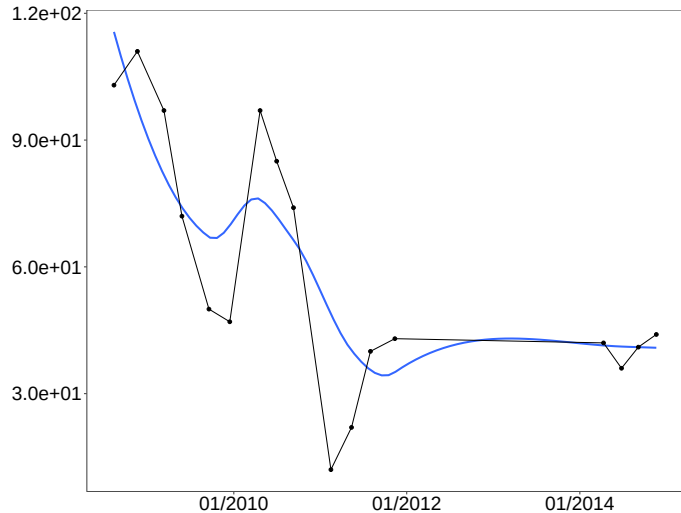
EC10 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



EC10 – Sodium
 $\tau = -0.338$ | p-value = 0.0638 | No trend



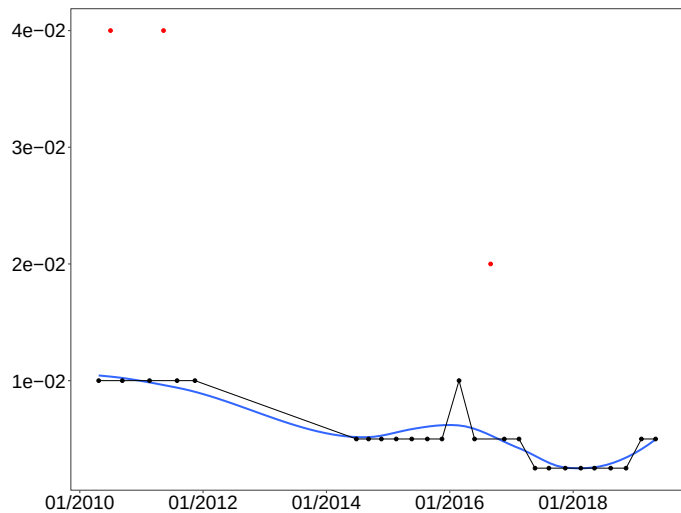
EC10 – Sulphate
 $\tau = -0.524$ | p-value = 0.0039 | Negative trend



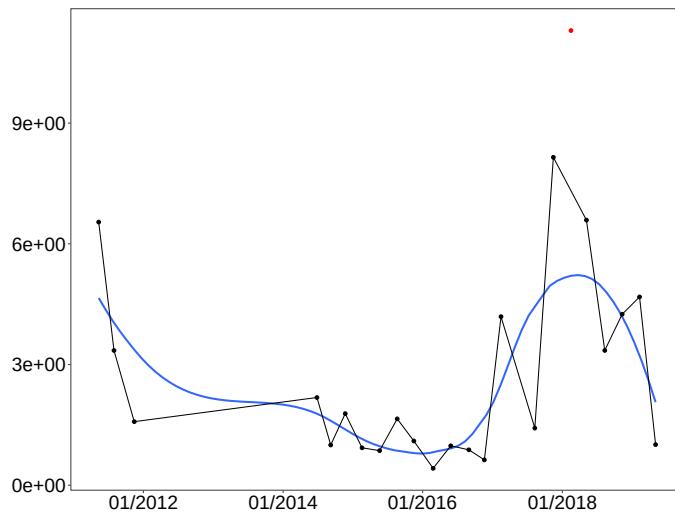
EC10 – TDS
 $\tau = -0.332$ | p-value = 0.0697 | No trend



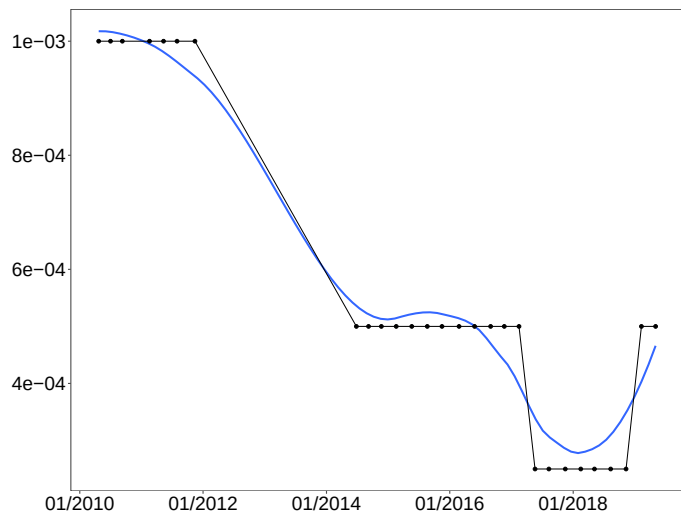
EC11 – Aluminium (d.)
 $\tau = -0.611$ | p-value = 0.0000398 | Negative trend



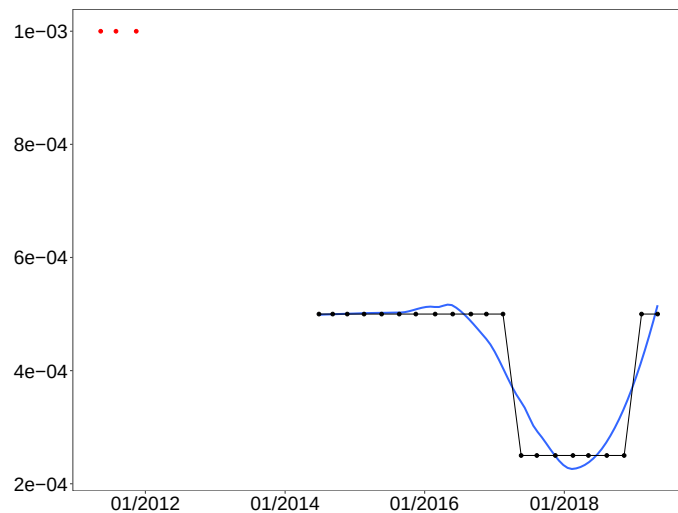
EC11 – Aluminium (t.)
 $\tau = 0.103$ | p-value = 0.509 | No trend



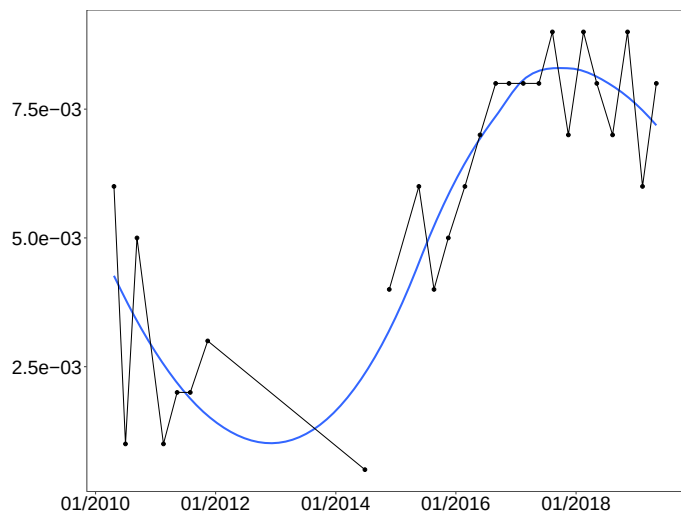
EC11 – Antimony (d.)

 $\tau = -0.713$ | p-value = 0.00000302 | Negative trend

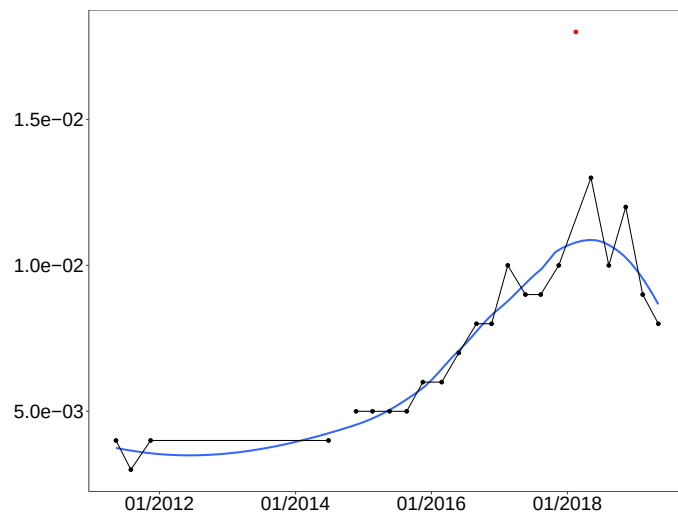
EC11 – Antimony (t.)

 $\tau = -0.631$ | p-value = 0.000182 | Negative trend

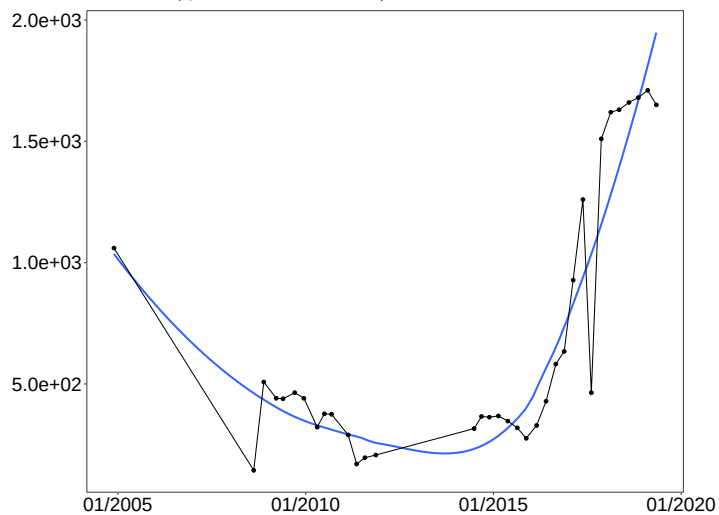
EC11 – Arsenic (d.)

 $\tau = 0.615$ | p-value = 0.0000249 | Positive trend

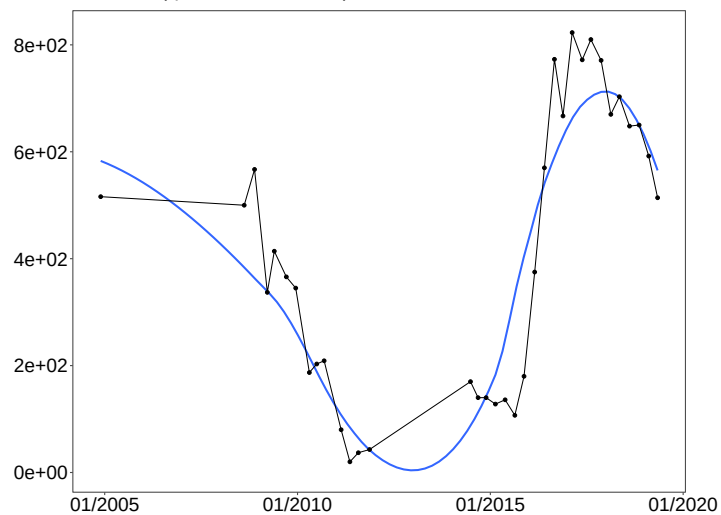
EC11 – Arsenic (t.)

 $\tau = 0.773$ | p-value = 0.000000596 | Positive trend

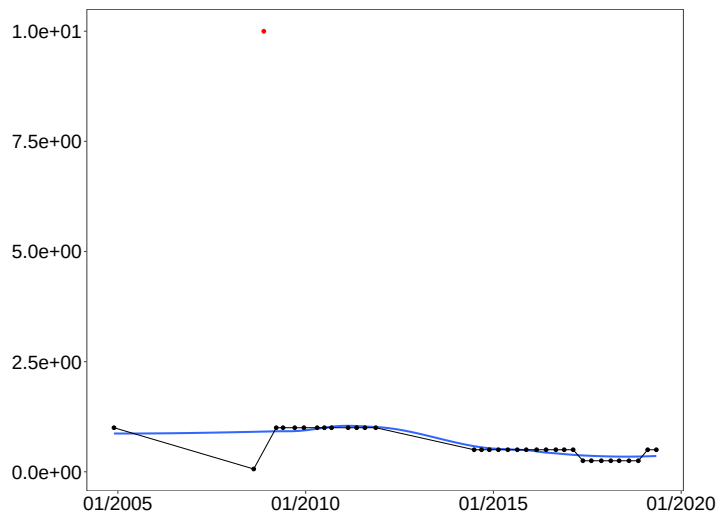
EC11 – Bicarbonate

 $\tau = 0.412$ | p-value = 0.000529 | Positive trend

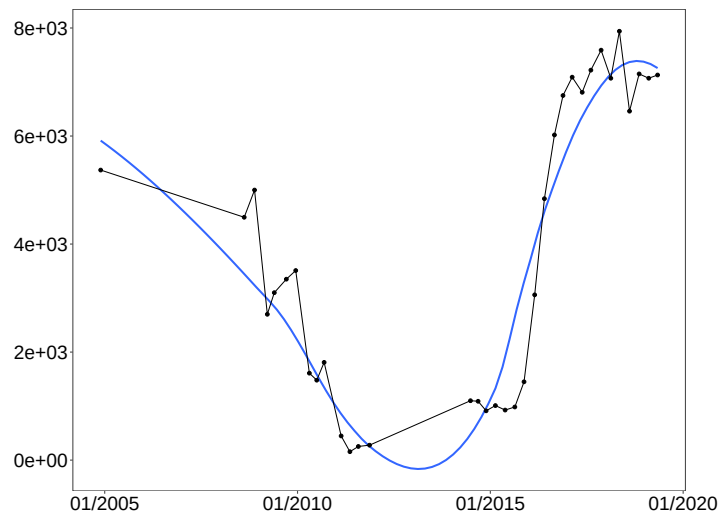
EC11 – Calcium

 $\tau = 0.242$ | p-value = 0.0423 | Positive trend

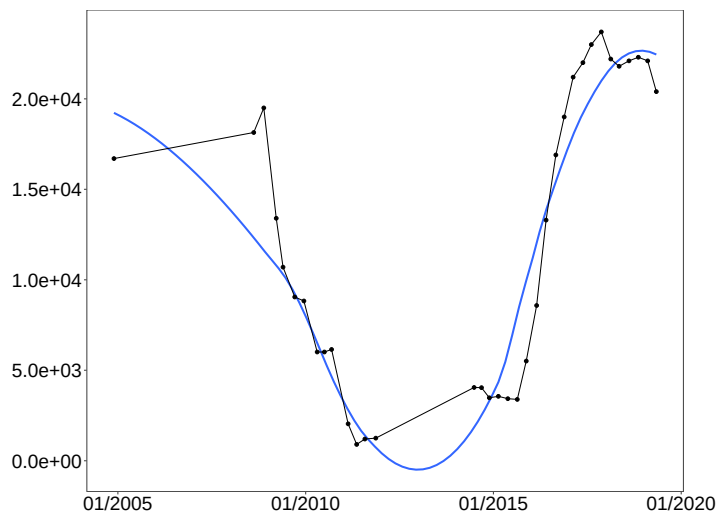
EC11 – Carbonate
 $\tau = -0.644$ | p-value = 0.00000129 | Negative trend



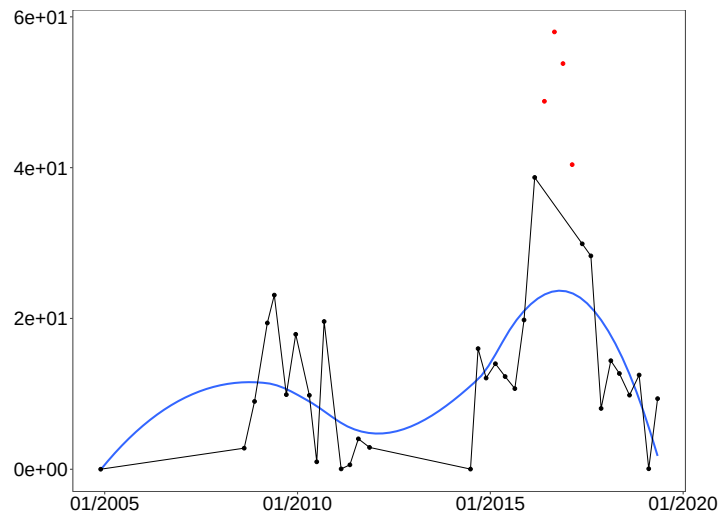
EC11 – Chloride
 $\tau = 0.357$ | p-value = 0.00273 | Positive trend



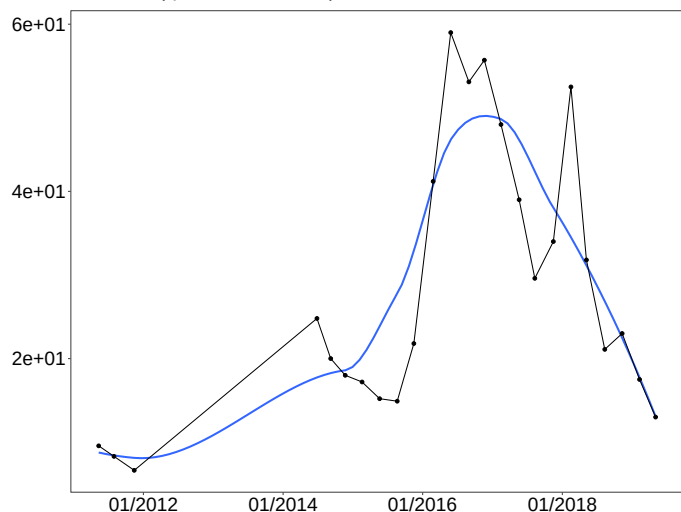
EC11 – Electrical Conductivity
 $\tau = 0.311$ | p-value = 0.00896 | Positive trend



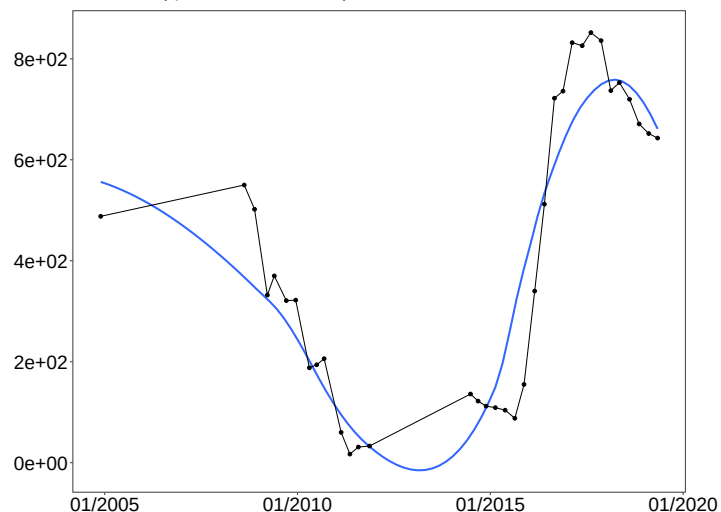
EC11 – Iron (d.)
 $\tau = 0.183$ | p-value = 0.125 | No trend



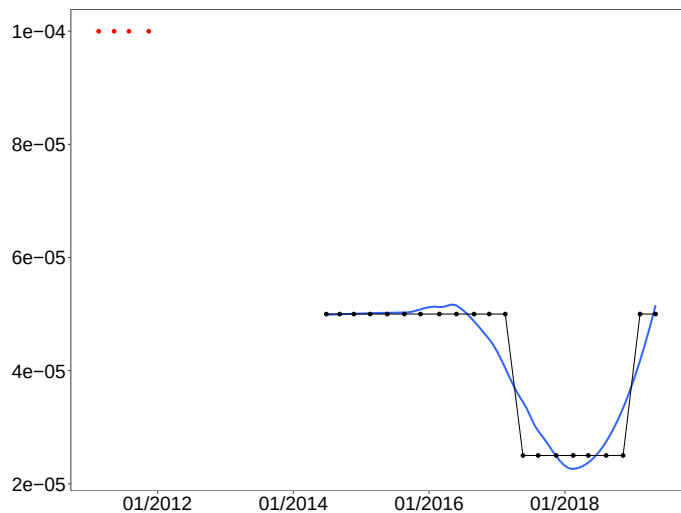
EC11 – Iron (t.)
 $\tau = 0.196$ | p-value = 0.189 | No trend



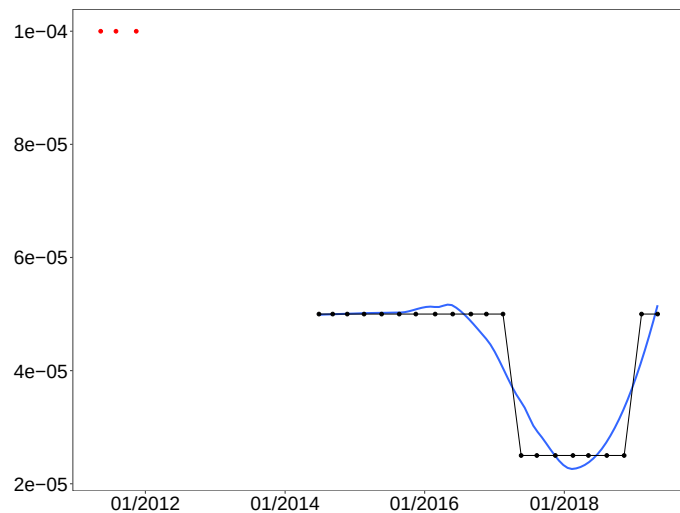
EC11 – Magnesium
 $\tau = 0.264$ | p-value = 0.0267 | Positive trend



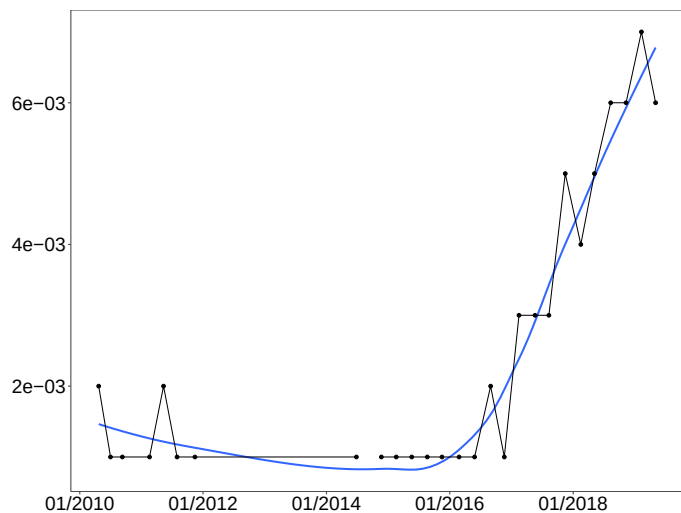
EC11 – Mercury (d.)

 $\tau = -0.659$ | p-value = 0.0000576 | Negative trend

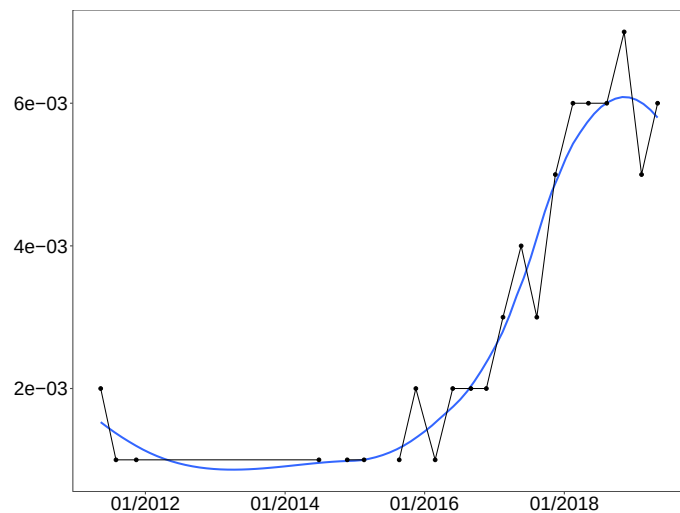
EC11 – Mercury (t.)

 $\tau = -0.631$ | p-value = 0.000182 | Negative trend

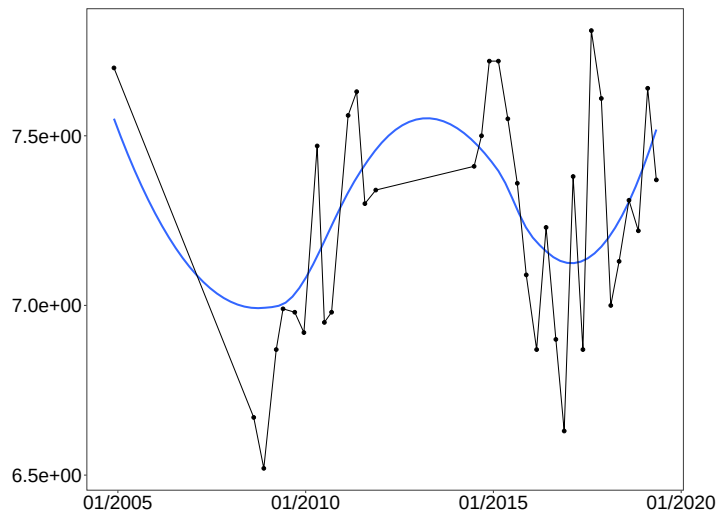
EC11 – Molybdenum (d.)

 $\tau = 0.655$ | p-value = 0.0000128 | Positive trend

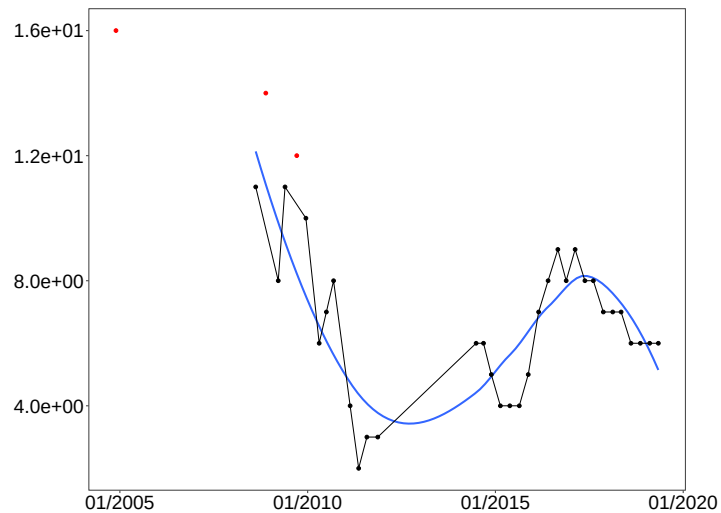
EC11 – Molybdenum (t.)

 $\tau = 0.779$ | p-value = 0.00000226 | Positive trend

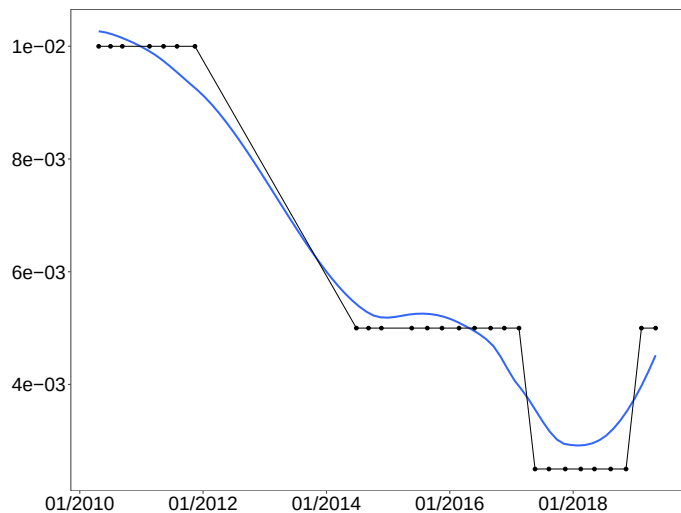
EC11 – pH

 $\tau = 0.155$ | p-value = 0.196 | No trend

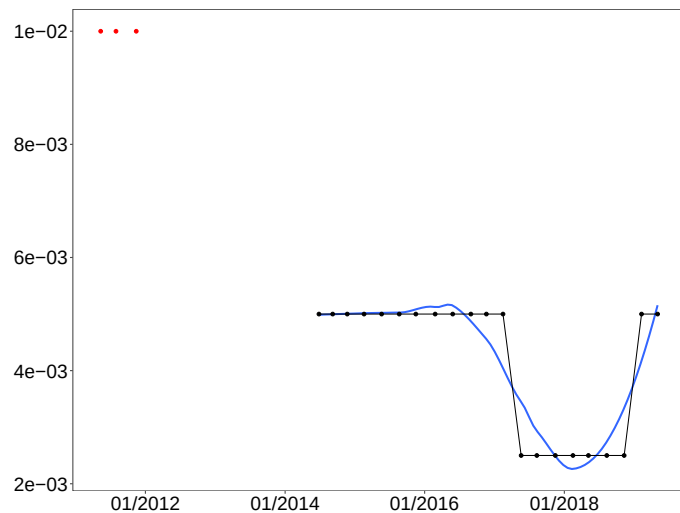
EC11 – Potassium

 $\tau = -0.196$ | p-value = 0.114 | No trend

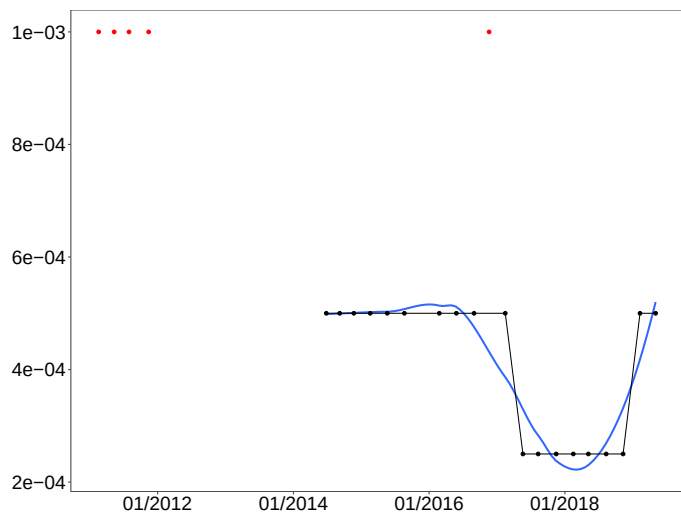
EC11 – Selenium (d.)

 $\tau = -0.713$ | p-value = 0.00000461 | Negative trend

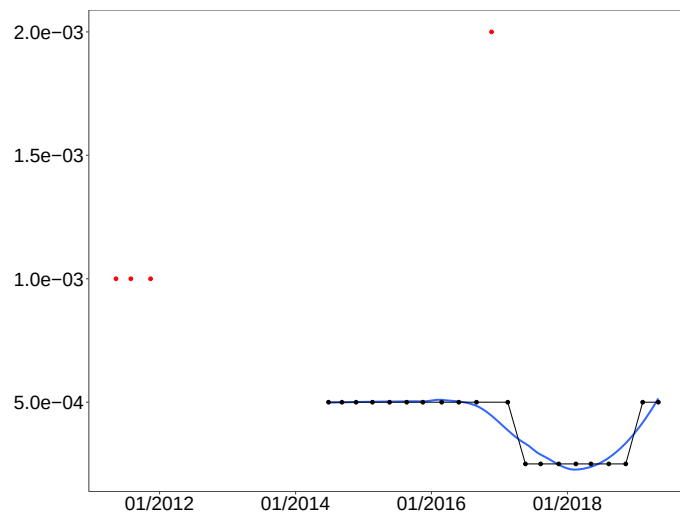
EC11 – Selenium (t.)

 $\tau = -0.631$ | p-value = 0.000182 | Negative trend

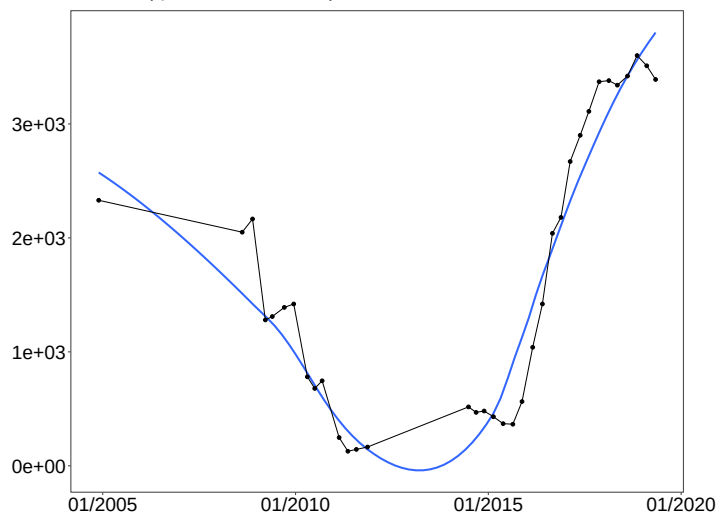
EC11 – Silver (d.)

 $\tau = -0.598$ | p-value = 0.00033 | Negative trend

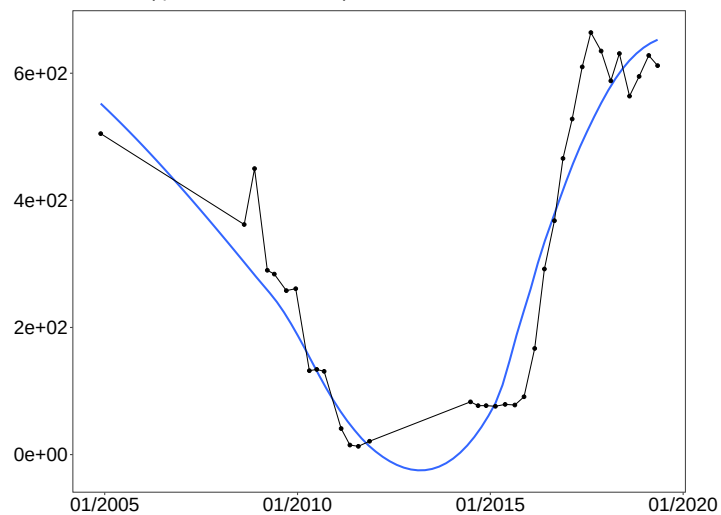
EC11 – Silver (t.)

 $\tau = -0.548$ | p-value = 0.001 | Negative trend

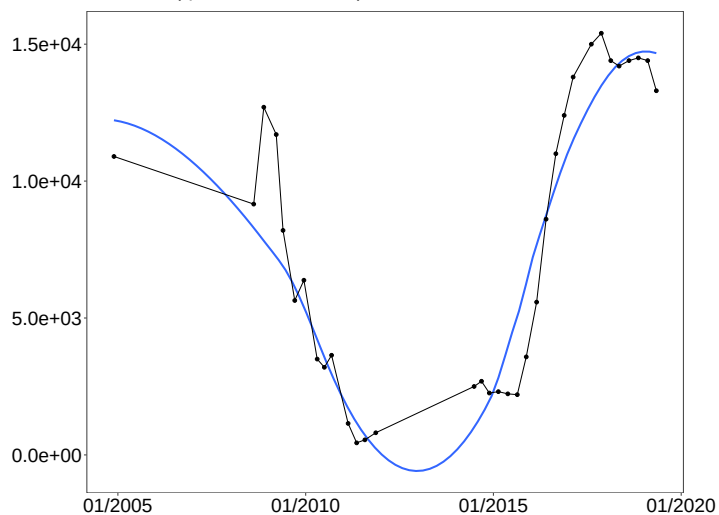
EC11 – Sodium

 $\tau = 0.38$ | p-value = 0.0014 | Positive trend

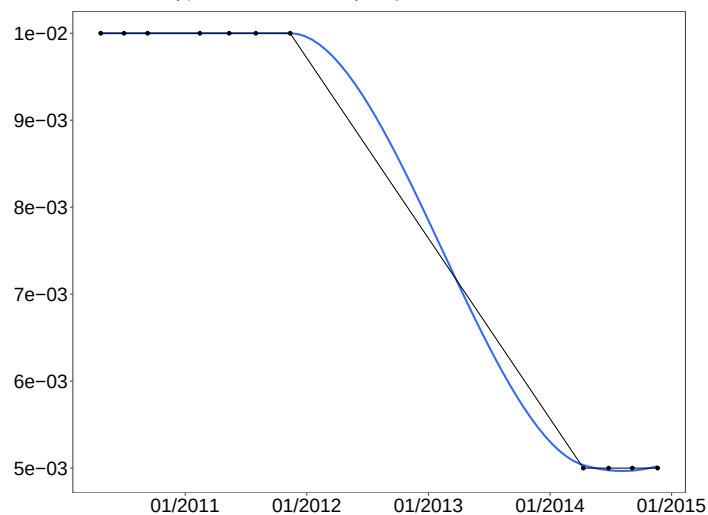
EC11 – Sulphate

 $\tau = 0.33$ | p-value = 0.00561 | Positive trend

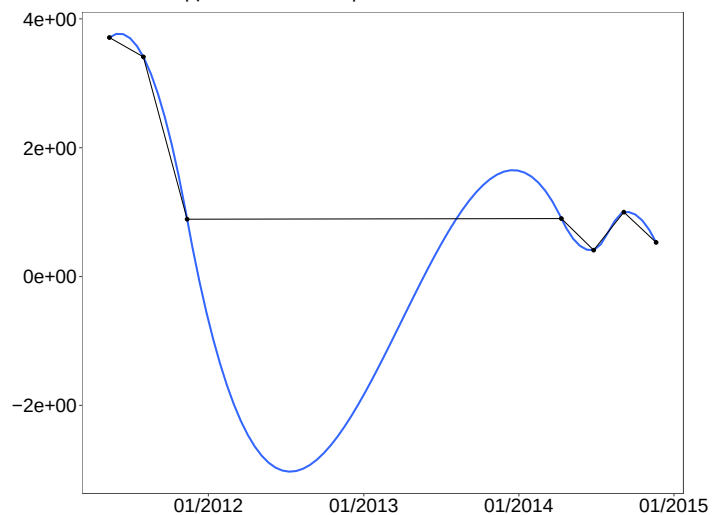
EC11 – TDS

 $\tau = 0.297$ | p-value = 0.0144 | Positive trend

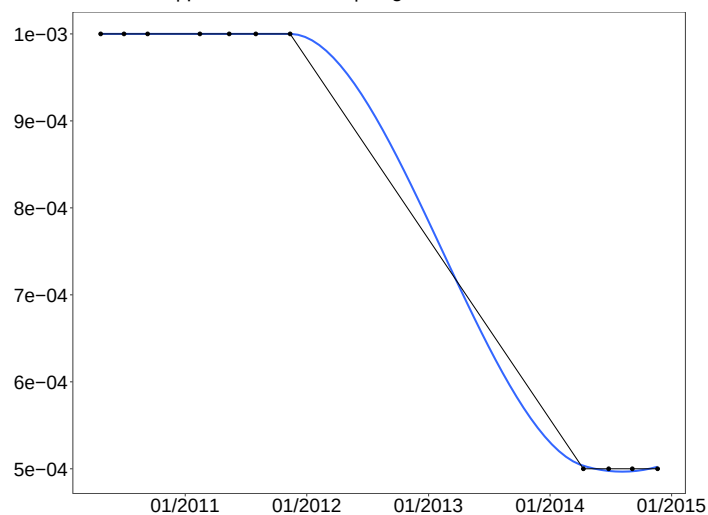
EC12 – Aluminium (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

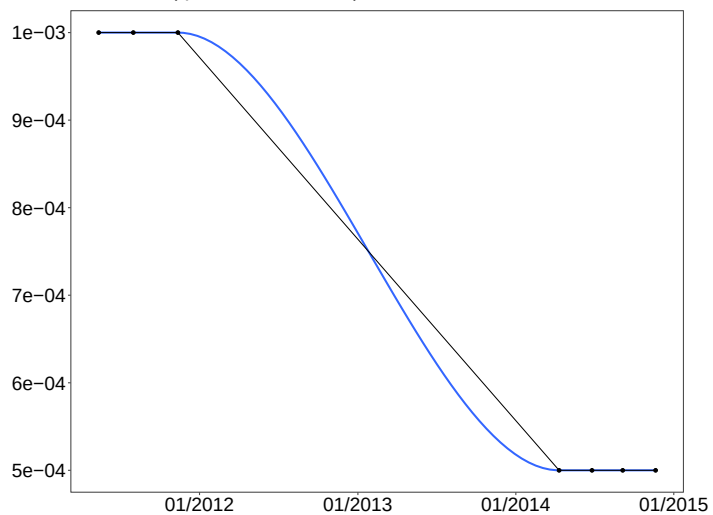
EC12 – Aluminium (t.)

 $\tau = -0.524$ | p-value = 0.133 | No trend

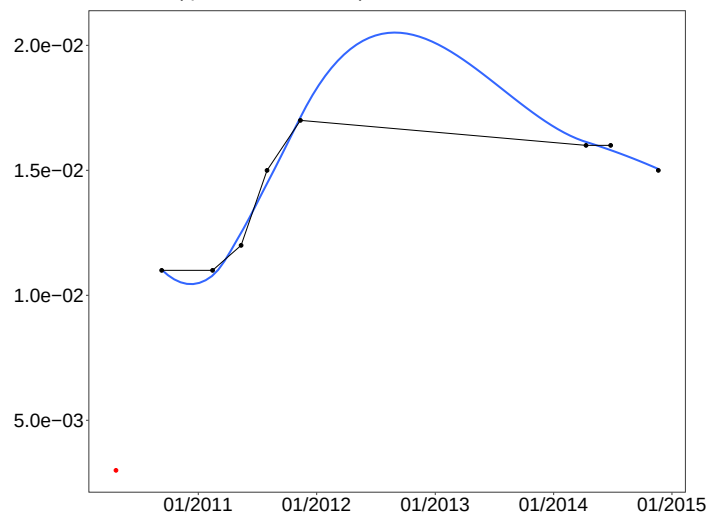
EC12 – Antimony (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

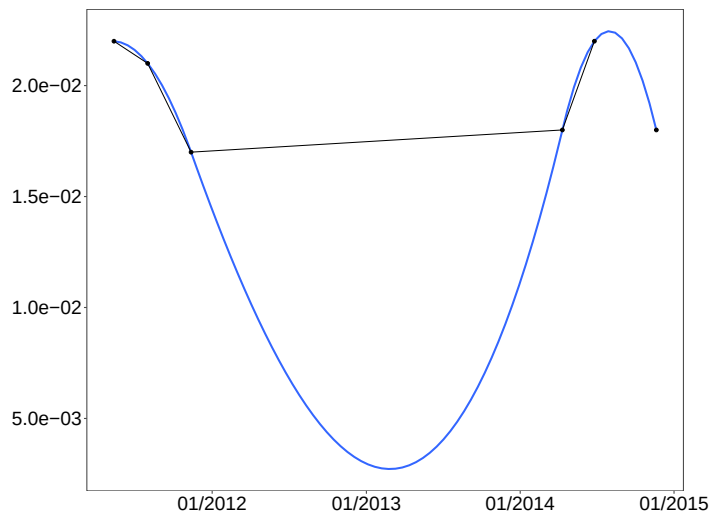
EC12 – Antimony (t.)

 $\tau = -0.756$ | p-value = 0.0518 | No trend

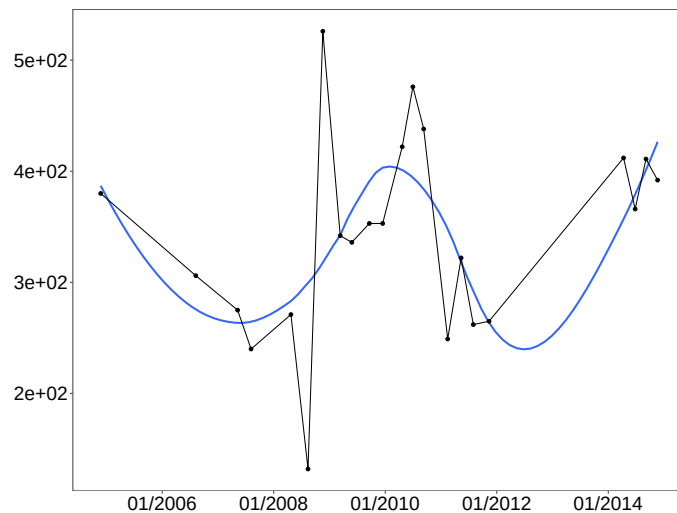
EC12 – Arsenic (d.)

 $\tau = 0.667$ | p-value = 0.0197 | Positive trend

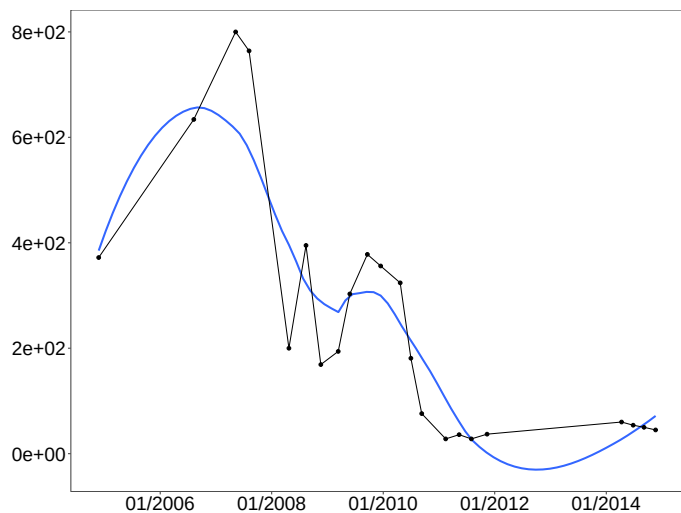
EC12 – Arsenic (t.)
 $\tau = -0.215$ | p-value = 0.697 | No trend



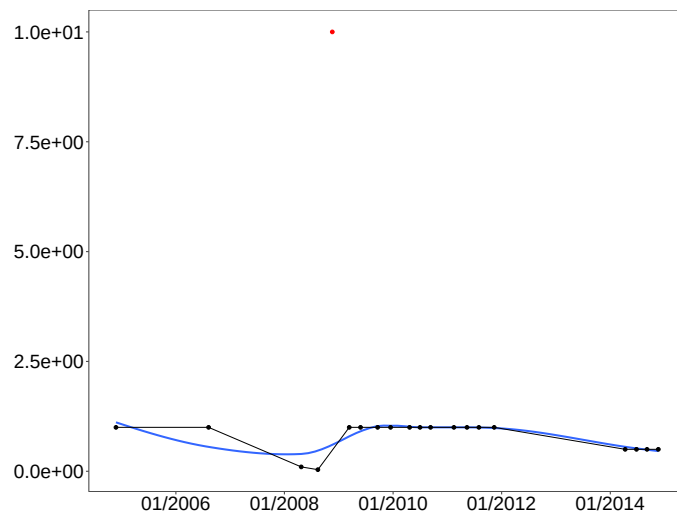
EC12 – Bicarbonate
 $\tau = 0.174$ | p-value = 0.271 | No trend



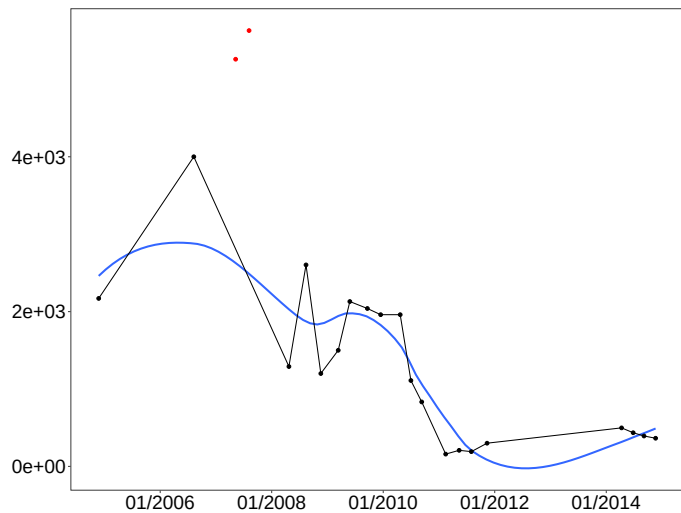
EC12 – Calcium
 $\tau = -0.607$ | p-value = 0.0000882 | Negative trend



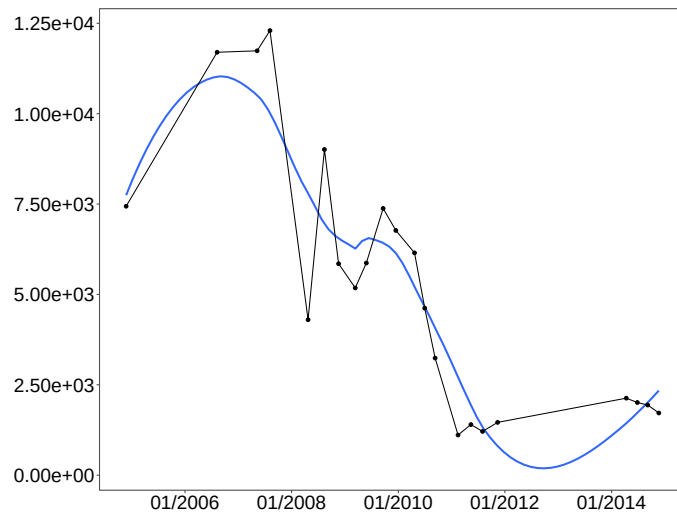
EC12 – Carbonate
 $\tau = -0.268$ | p-value = 0.154 | No trend



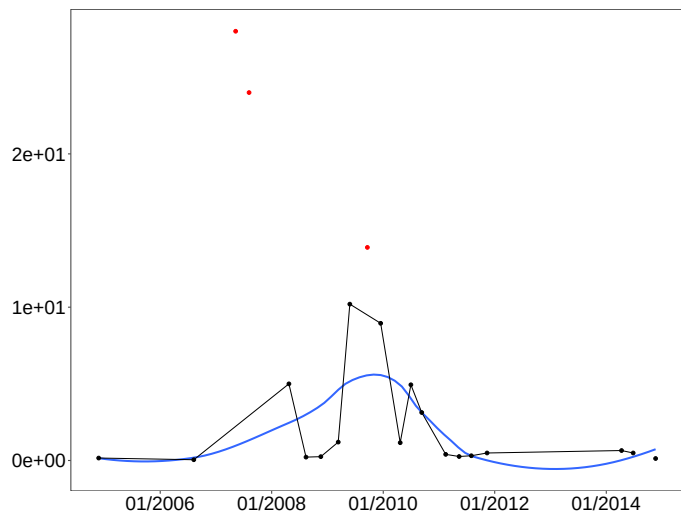
EC12 – Chloride
 $\tau = -0.625$ | p-value = 0.0000549 | Negative trend



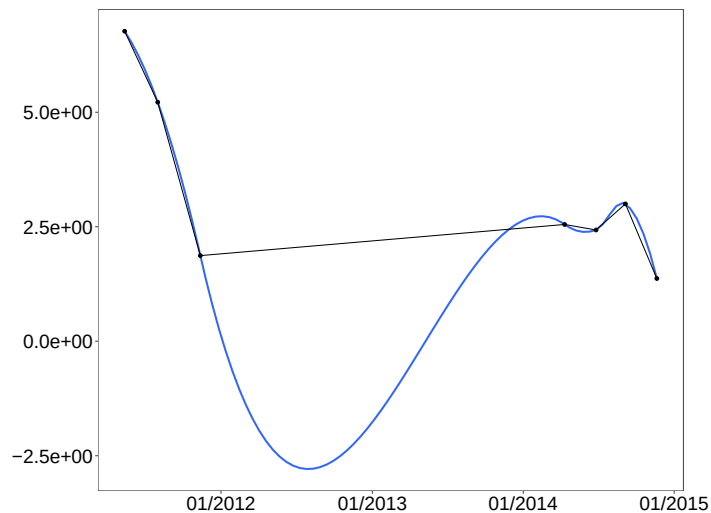
EC12 – Electrical Conductivity
 $\tau = -0.593$ | p-value = 0.000126 | Negative trend



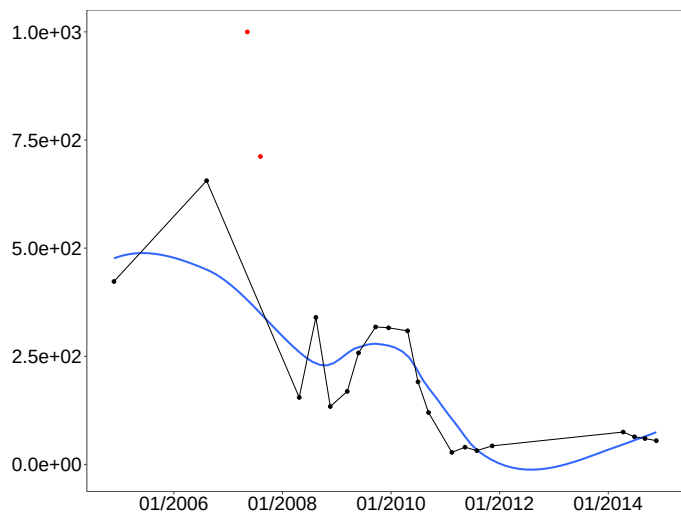
EC12 – Iron (d.)
 $\tau = -0.177$ | p-value = 0.277 | No trend



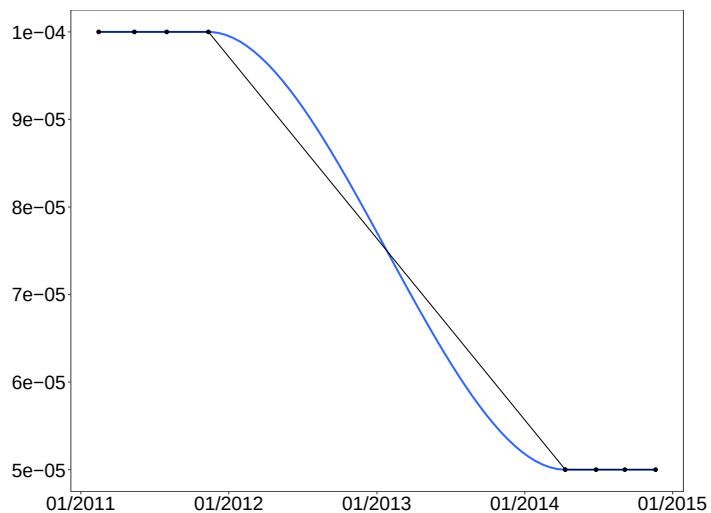
EC12 – Iron (t.)
 $\tau = -0.524$ | p-value = 0.133 | No trend



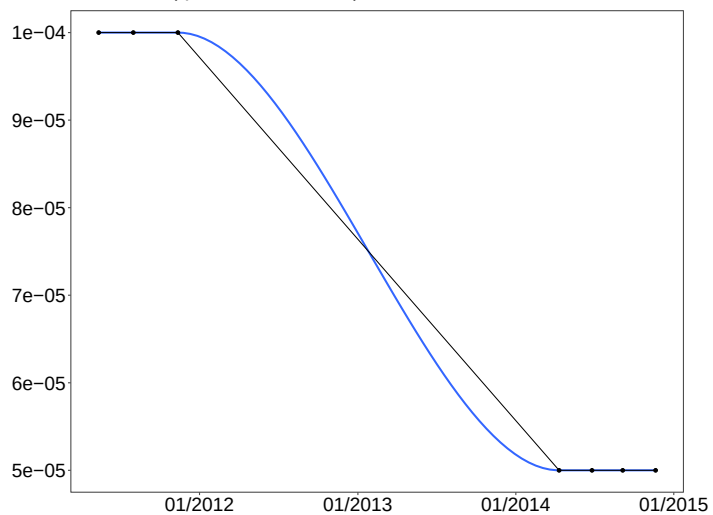
EC12 – Magnesium
 $\tau = -0.593$ | p-value = 0.000126 | Negative trend



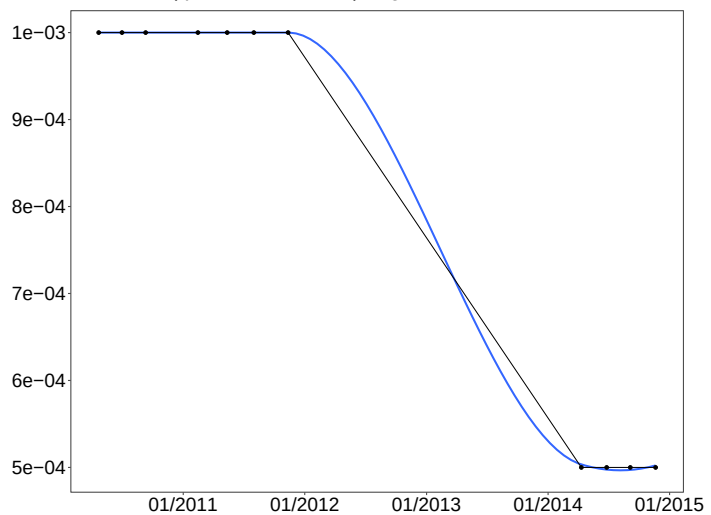
EC12 – Mercury (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



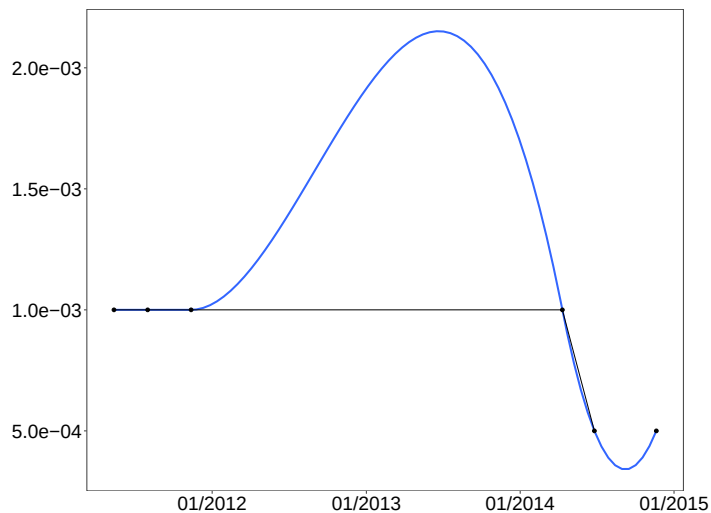
EC12 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



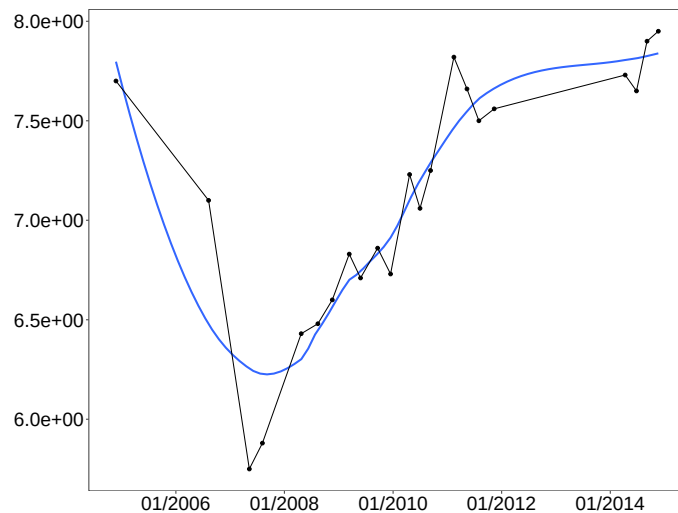
EC12 – Molybdenum (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



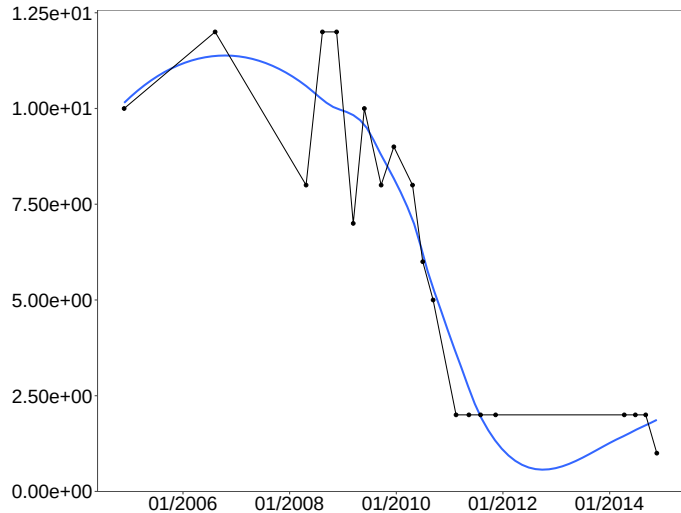
EC12 – Molybdenum (t.)
 $\tau = -0.73$ | p-value = 0.105 | No trend



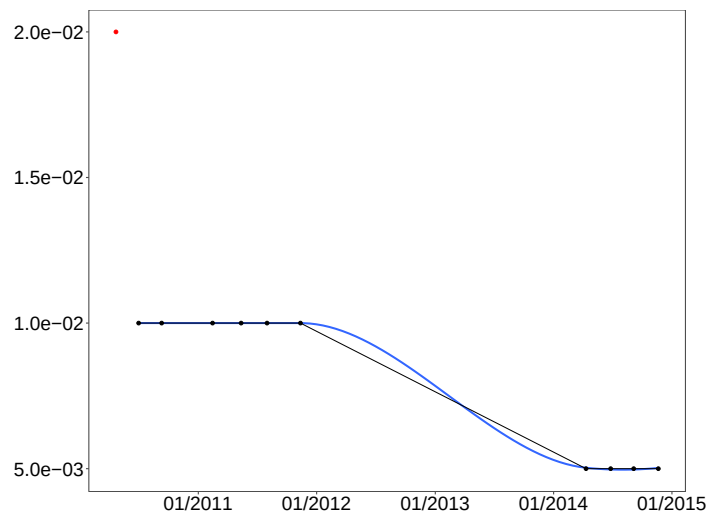
EC12 – pH
 $\tau = 0.654$ | p-value = 0.0000234 | Positive trend



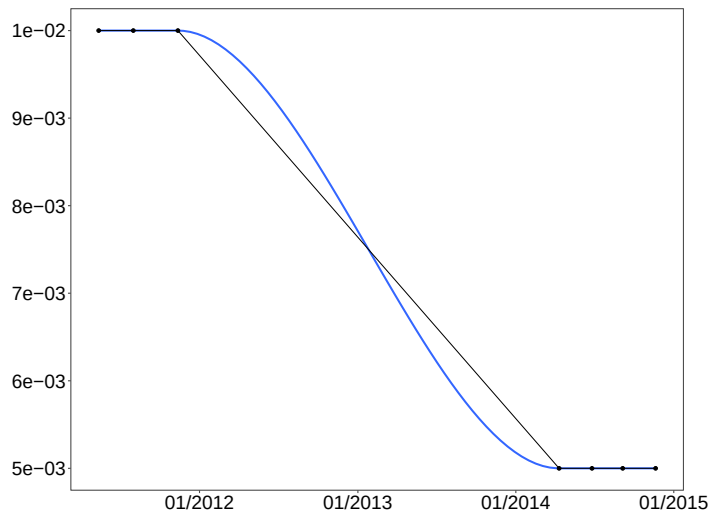
EC12 – Potassium
 $\tau = -0.787$ | p-value = 0.0000048 | Negative trend



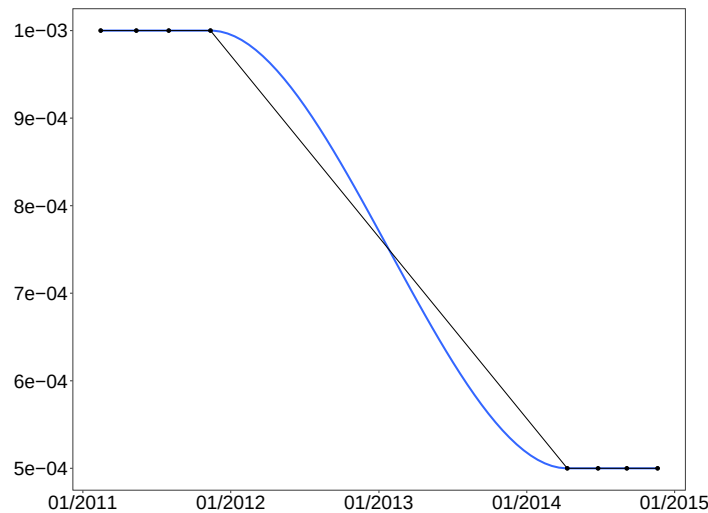
EC12 – Selenium (d.)
 $\tau = -0.786$ | p-value = 0.00354 | Negative trend



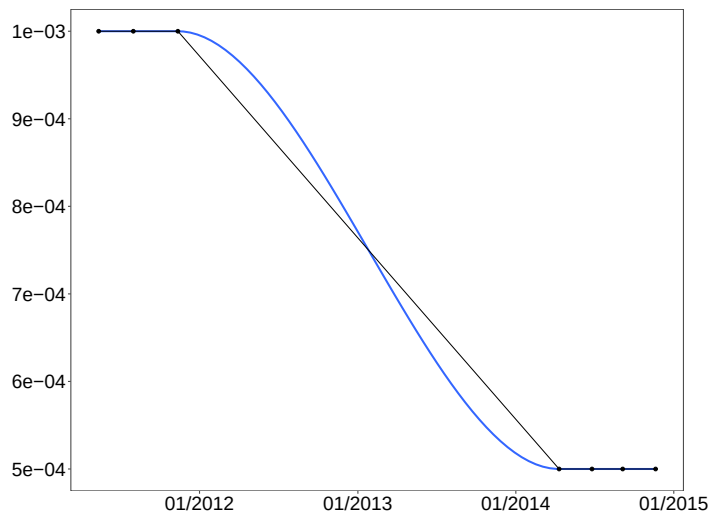
EC12 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



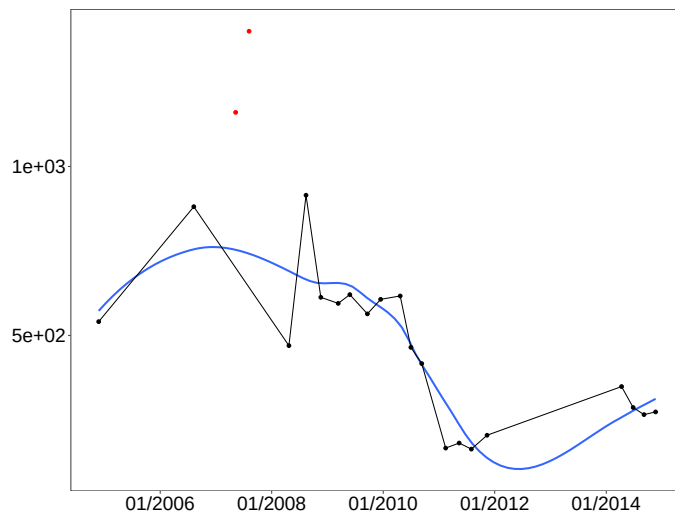
EC12 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



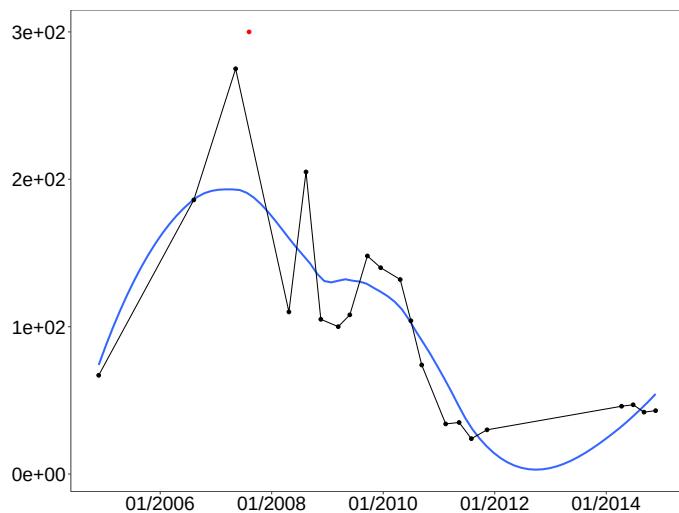
EC12 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



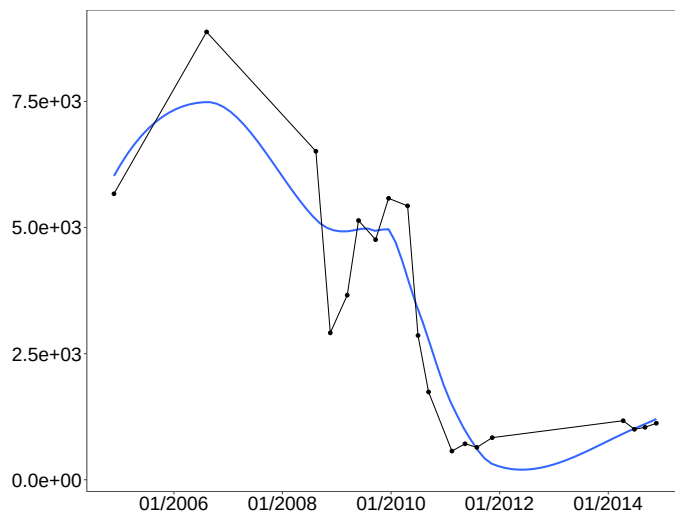
EC12 – Sodium
 $\tau = -0.567$ | p-value = 0.000247 | Negative trend



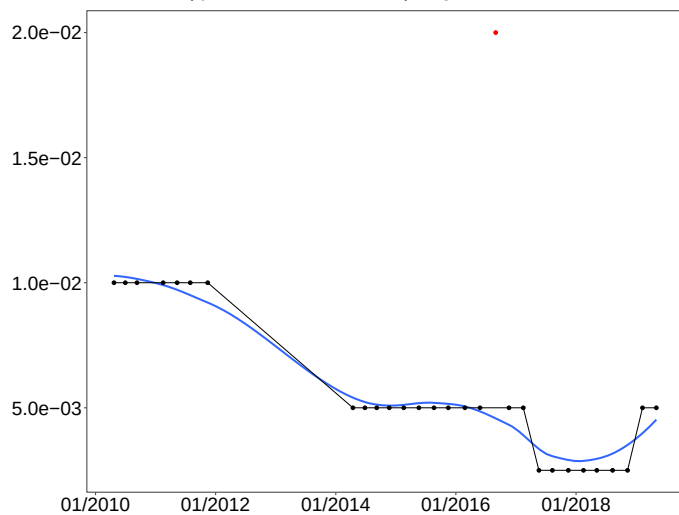
EC12 – Sulphate
 $\tau = -0.541$ | p-value = 0.000471 | Negative trend



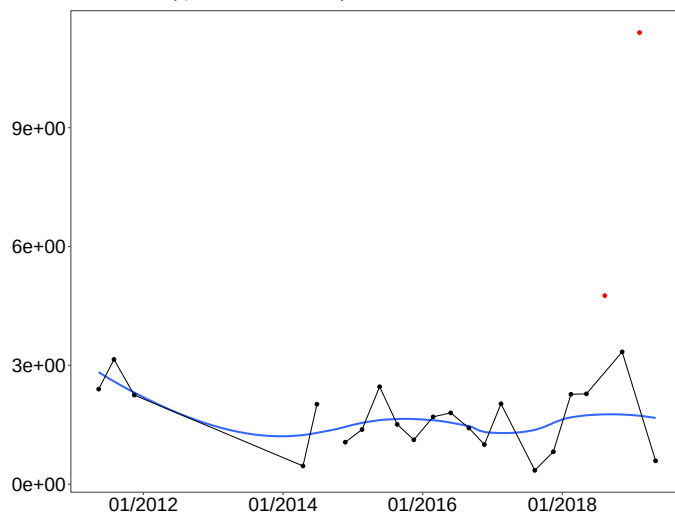
EC12 – TDS
 $\tau = -0.544$ | p-value = 0.00129 | Negative trend



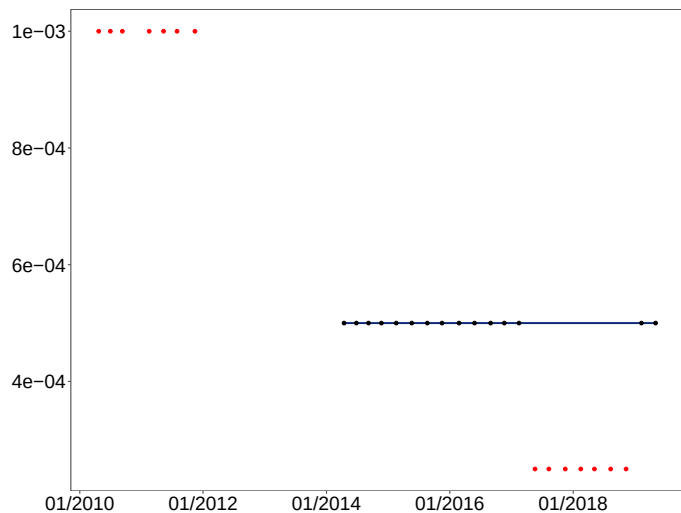
EC13 – Aluminium (d.)
 $\tau = -0.634$ | p-value = 0.0000196 | Negative trend



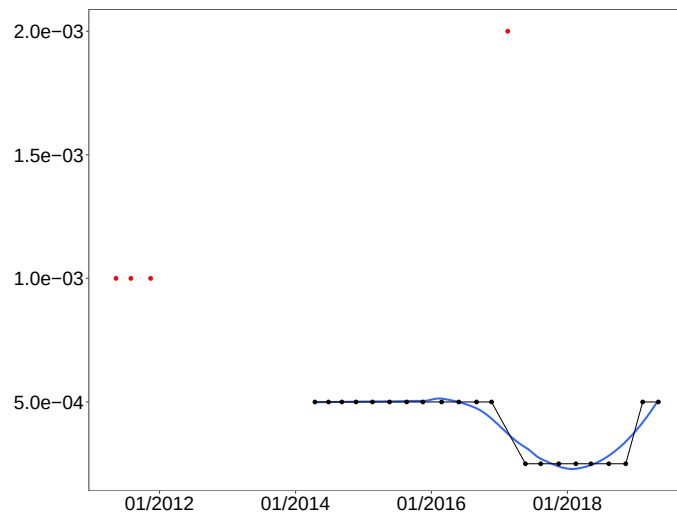
EC13 – Aluminium (t.)
 $\tau = 0.0593$ | p-value = 0.712 | No trend



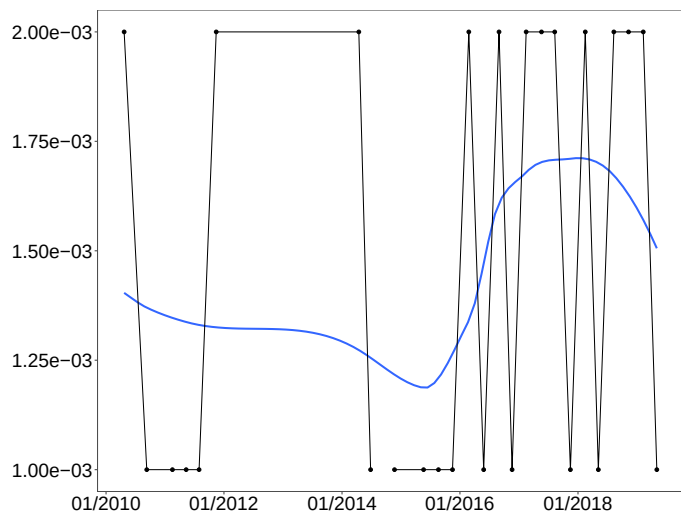
EC13 – Antimony (d.)

 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend

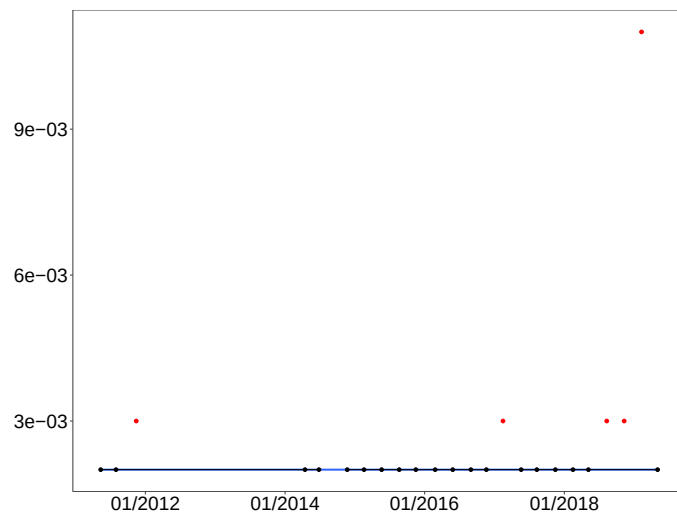
EC13 – Antimony (t.)

 $\tau = -0.539$ | p-value = 0.000943 | Negative trend

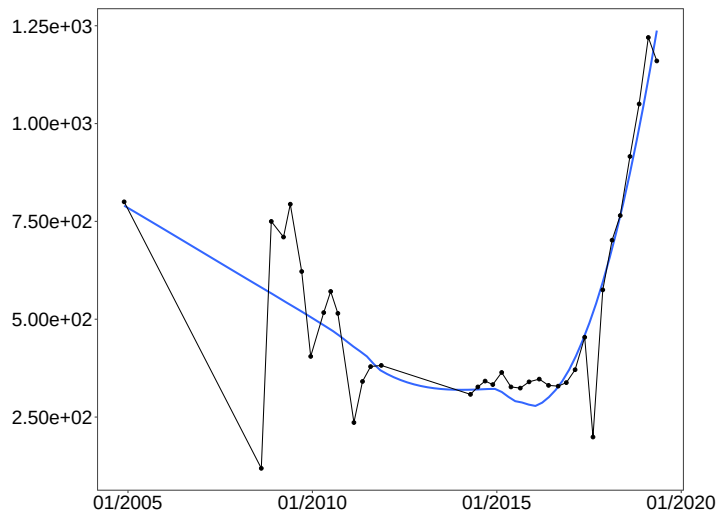
EC13 – Arsenic (d.)

 $\tau = 0.231$ | p-value = 0.173 | No trend

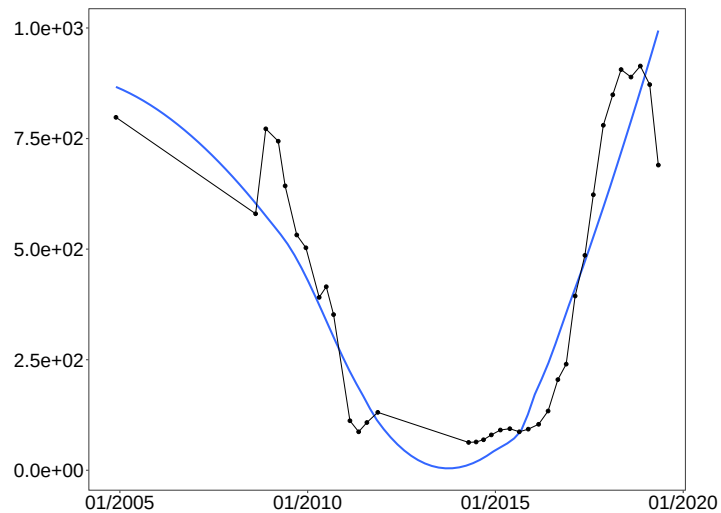
EC13 – Arsenic (t.)

 $\tau = 0.284$ | p-value = 0.104 | No trend

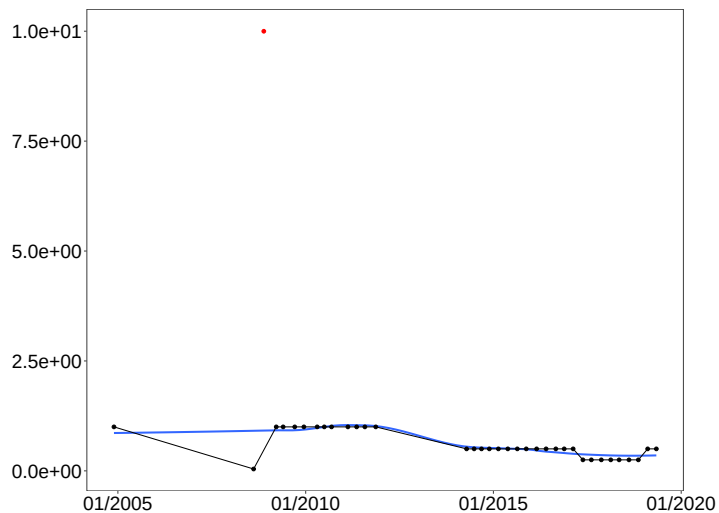
EC13 – Bicarbonate

 $\tau = 0.0683$ | p-value = 0.567 | No trend

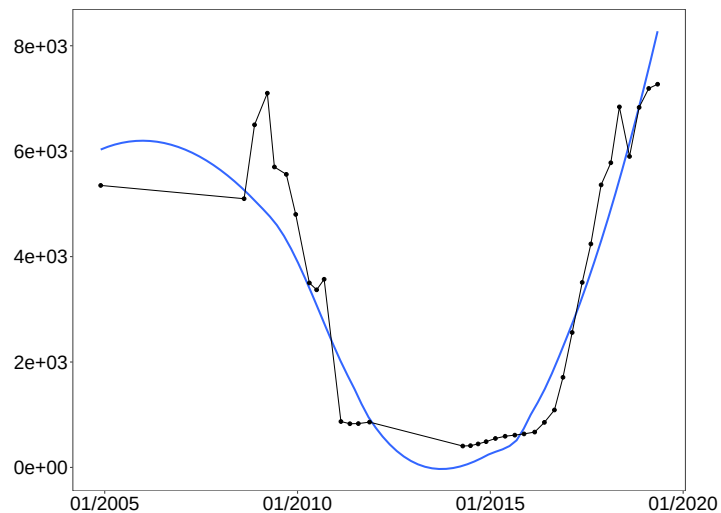
EC13 – Calcium

 $\tau = 0.141$ | p-value = 0.231 | No trend

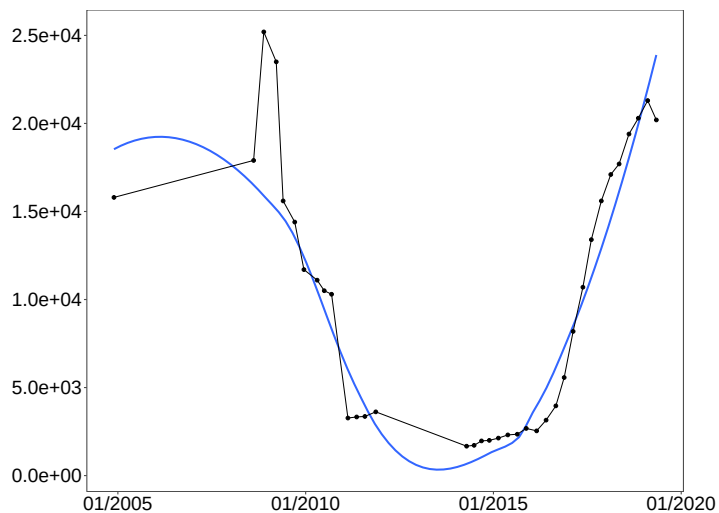
EC13 – Carbonate
 $\tau = -0.647$ | p-value = 0.000000814 | Negative trend



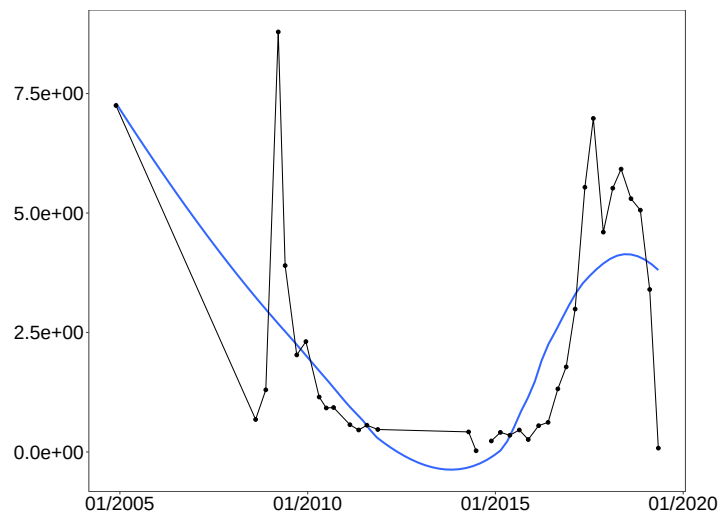
EC13 – Chloride
 $\tau = 0.137$ | p-value = 0.247 | No trend



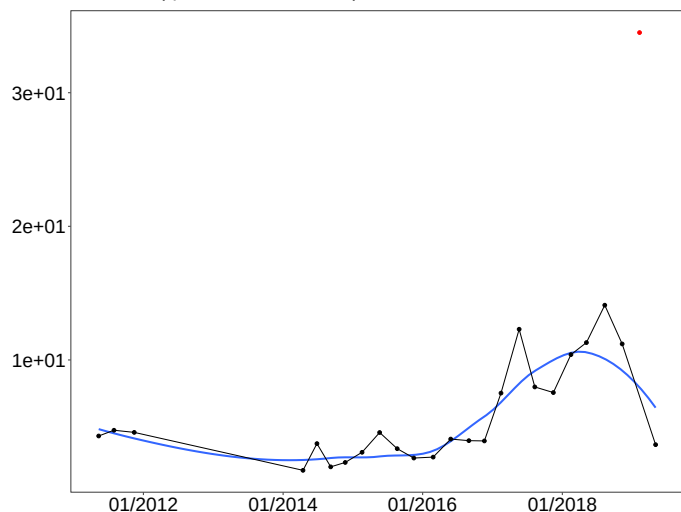
EC13 – Electrical Conductivity
 $\tau = 0.0937$ | p-value = 0.429 | No trend



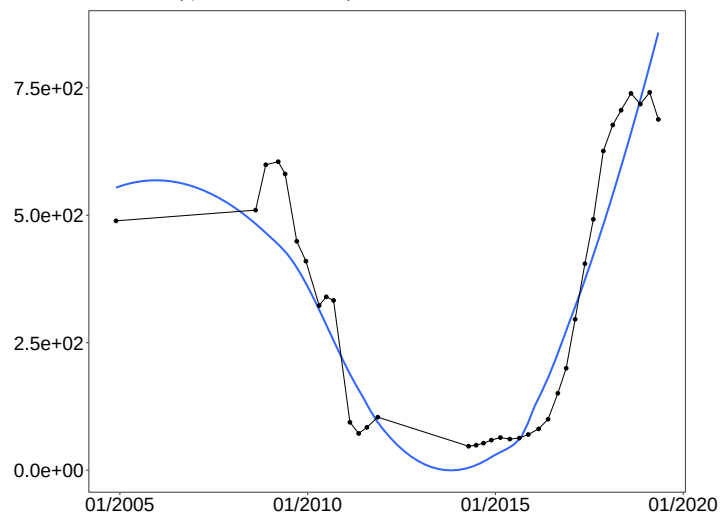
EC13 – Iron (d.)
 $\tau = 0.037$ | p-value = 0.766 | No trend



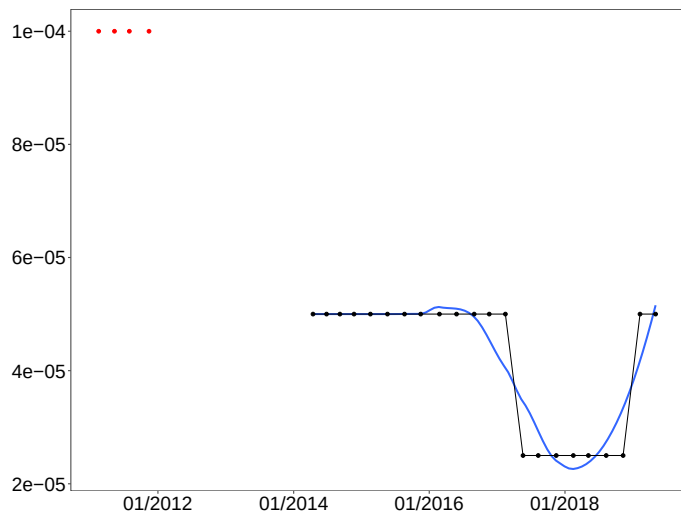
EC13 – Iron (t.)
 $\tau = 0.467$ | p-value = 0.00117 | Positive trend



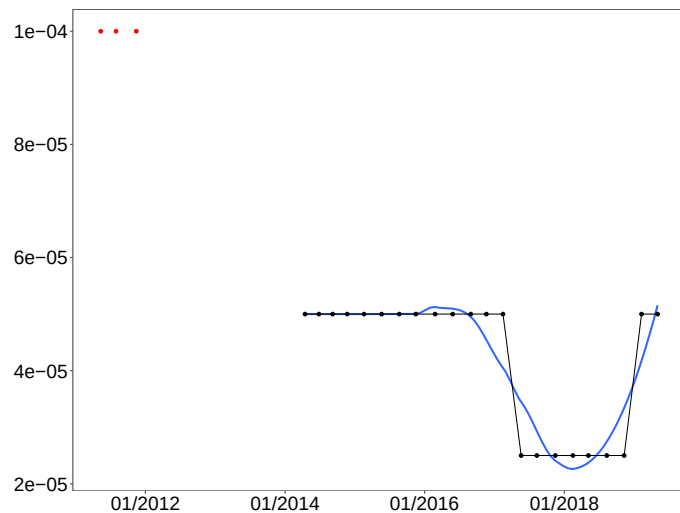
EC13 – Magnesium
 $\tau = 0.171$ | p-value = 0.145 | No trend



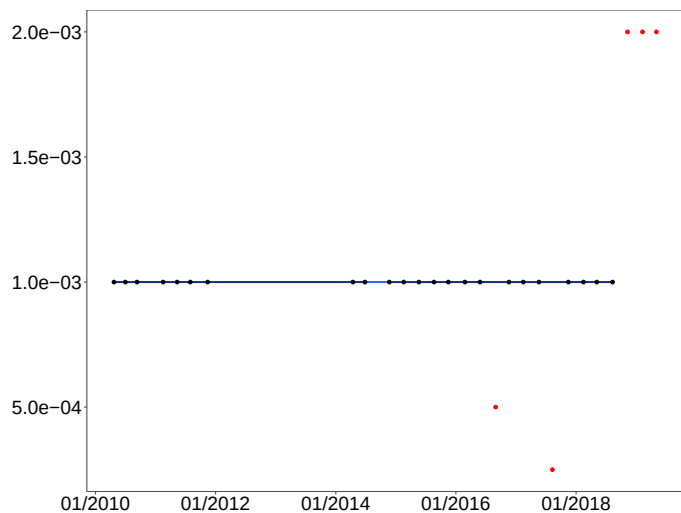
EC13 – Mercury (d.)

 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend

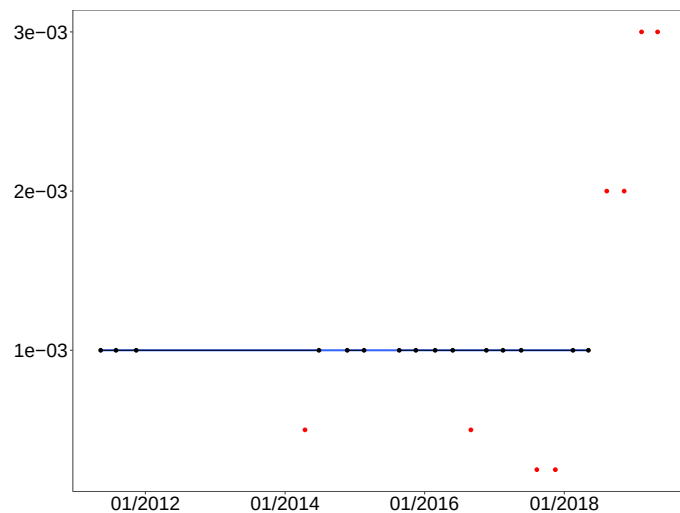
EC13 – Mercury (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

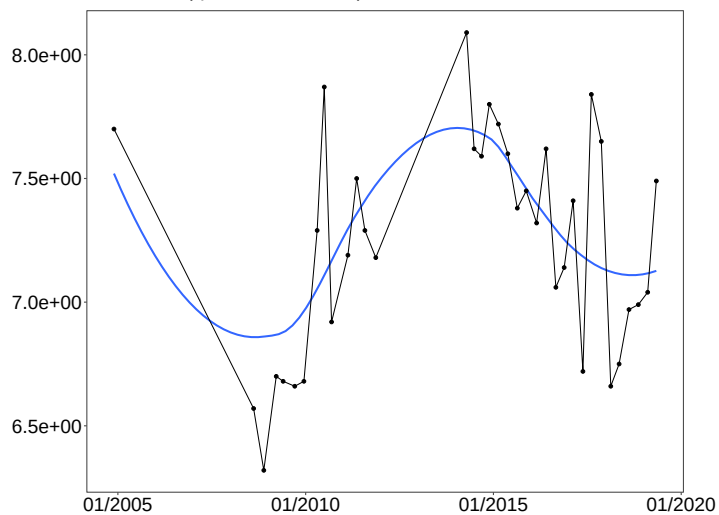
EC13 – Molybdenum (d.)

 $\tau = 0.233$ | p-value = 0.144 | No trend

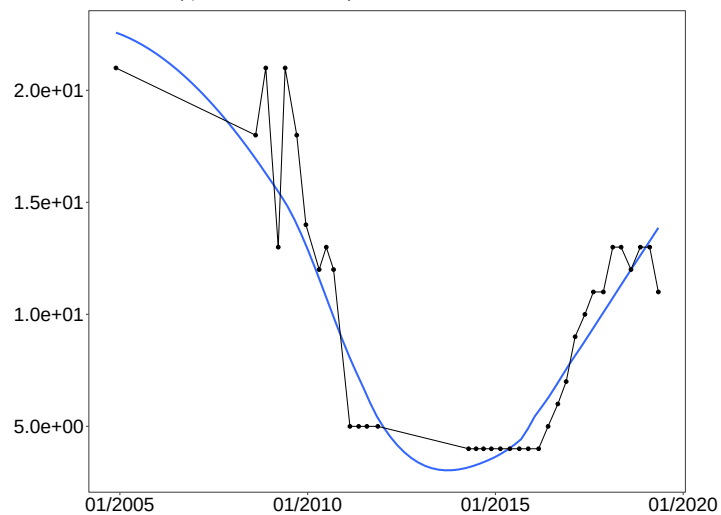
EC13 – Molybdenum (t.)

 $\tau = 0.304$ | p-value = 0.0745 | No trend

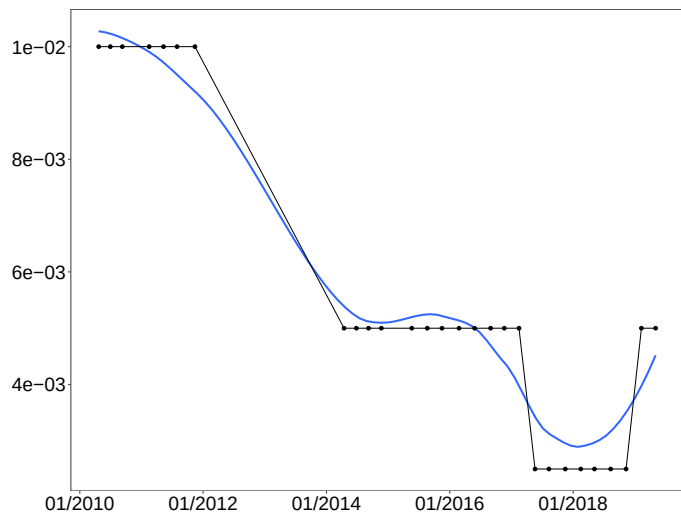
EC13 – pH

 $\tau = 0.0955$ | p-value = 0.421 | No trend

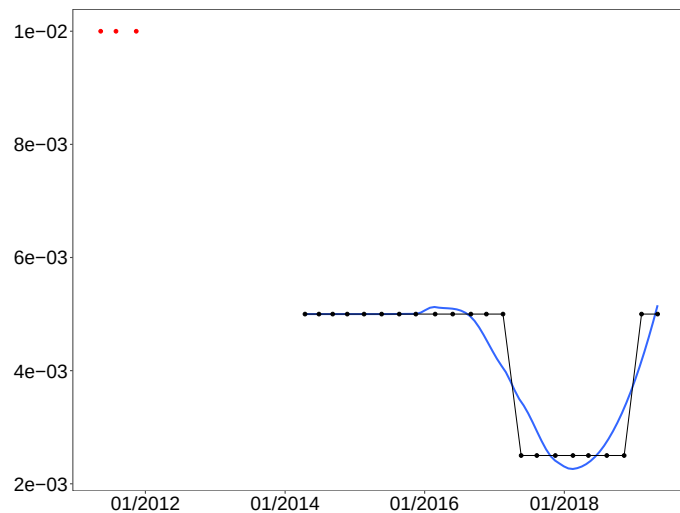
EC13 – Potassium

 $\tau = -0.13$ | p-value = 0.294 | No trend

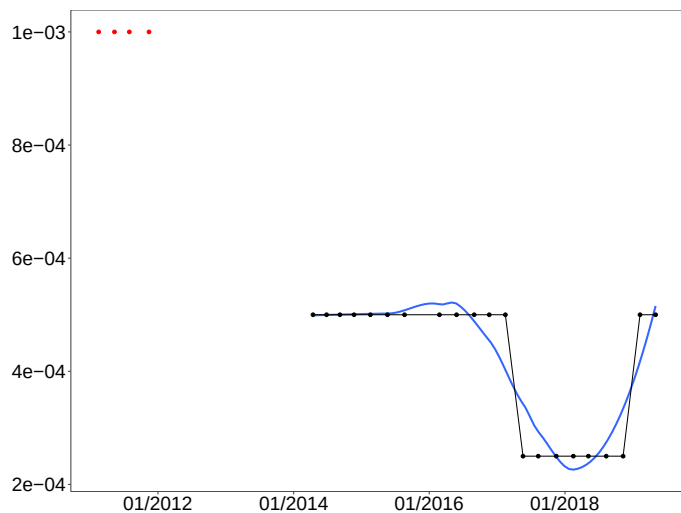
EC13 – Selenium (d.)

 $\tau = -0.713$ | p-value = 0.00000302 | Negative trend

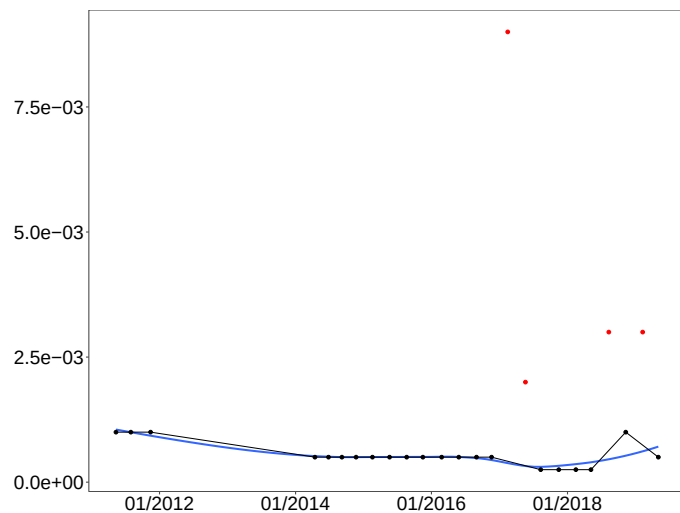
EC13 – Selenium (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

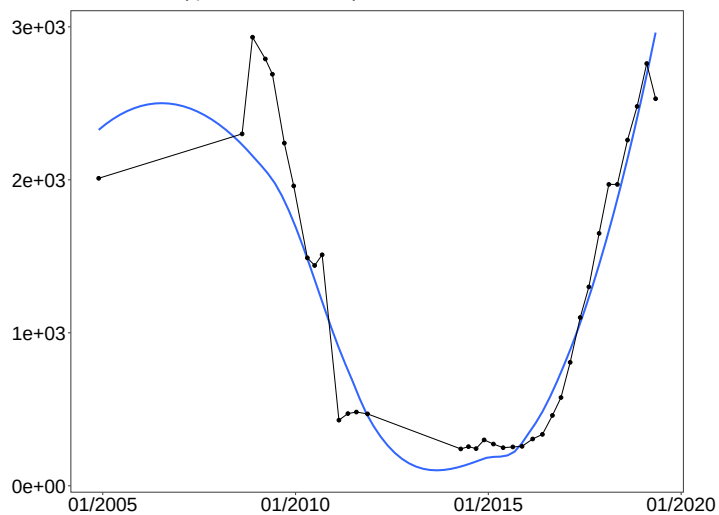
EC13 – Silver (d.)

 $\tau = -0.659$ | p-value = 0.0000576 | Negative trend

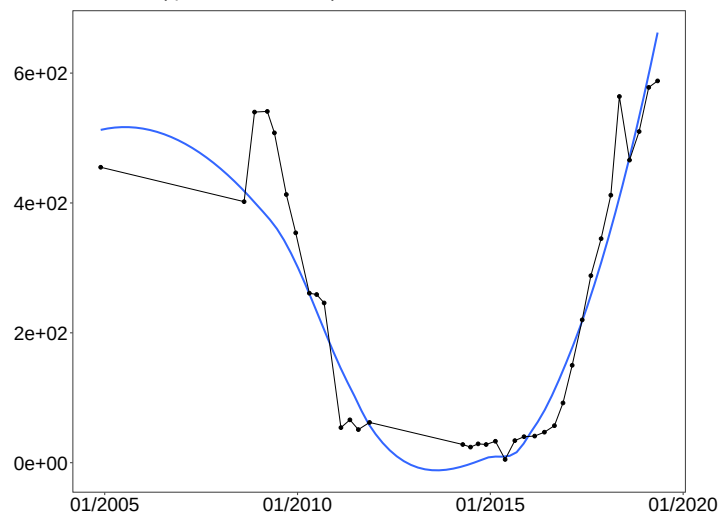
EC13 – Silver (t.)

 $\tau = -0.108$ | p-value = 0.508 | No trend

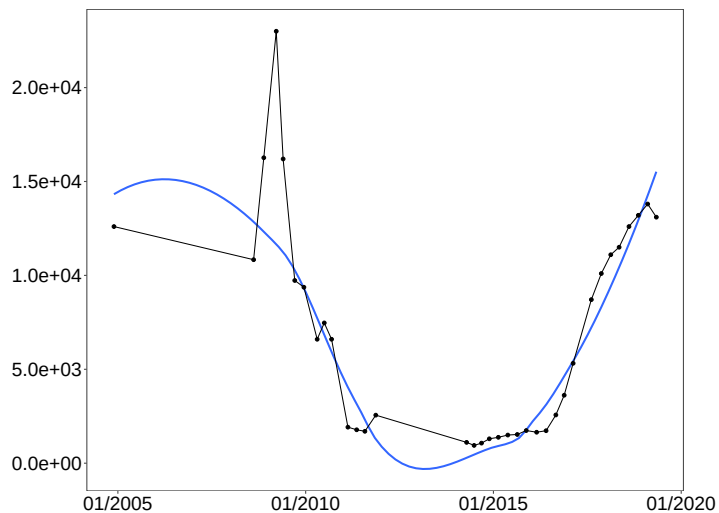
EC13 – Sodium

 $\tau = 0.00794$ | p-value = 0.957 | No trend

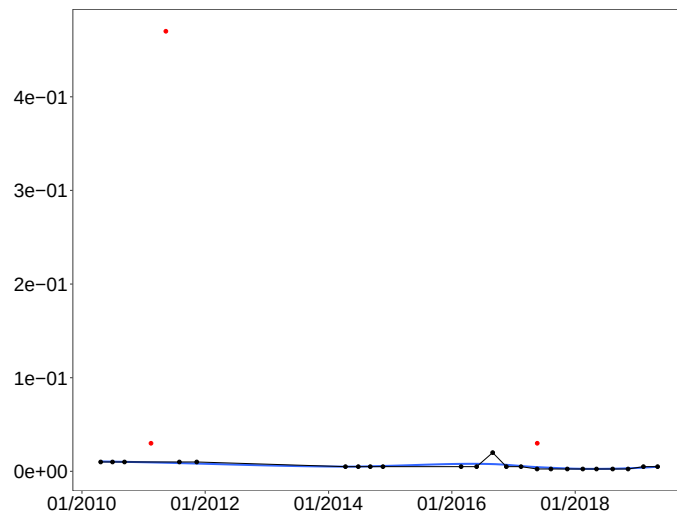
EC13 – Sulphate

 $\tau = 0.062$ | p-value = 0.605 | No trend

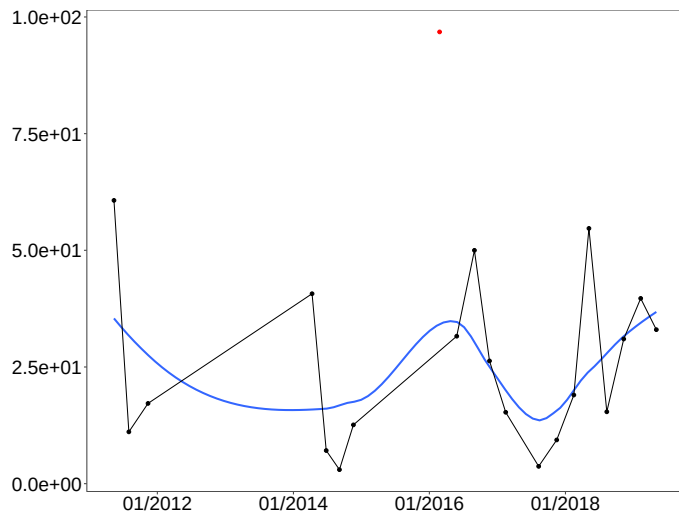
EC13 – TDS

 $\tau = 0.0387$ | p-value = 0.755 | No trend

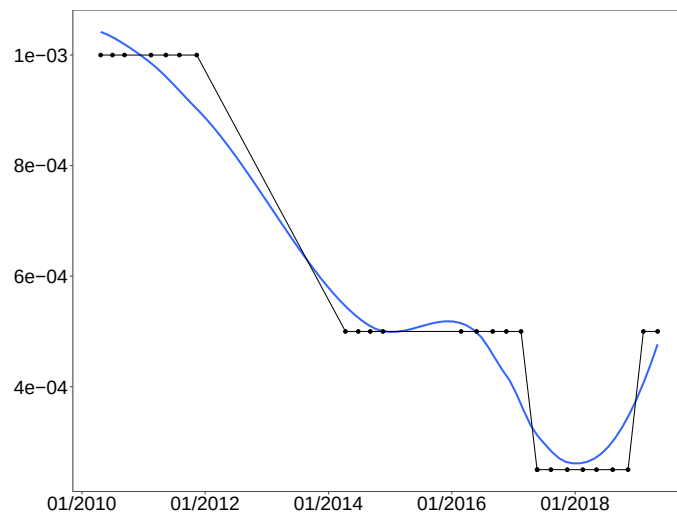
EC14 – Aluminium (d.)

 $\tau = -0.542$ | p-value = 0.000405 | Negative trend

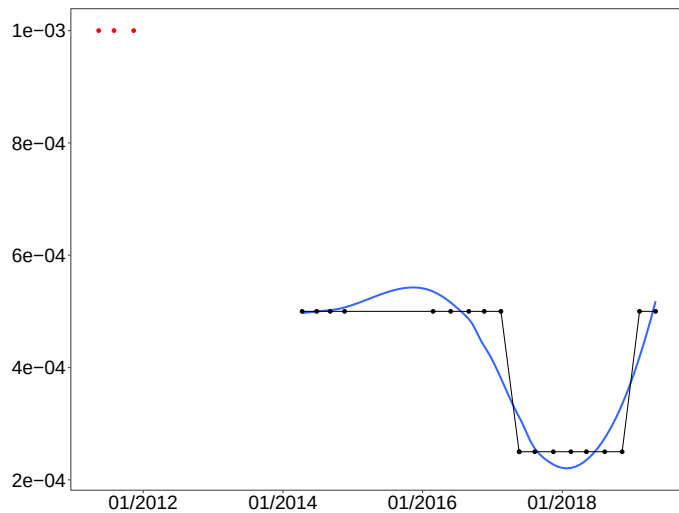
EC14 – Aluminium (t.)

 $\tau = 0.0842$ | p-value = 0.626 | No trend

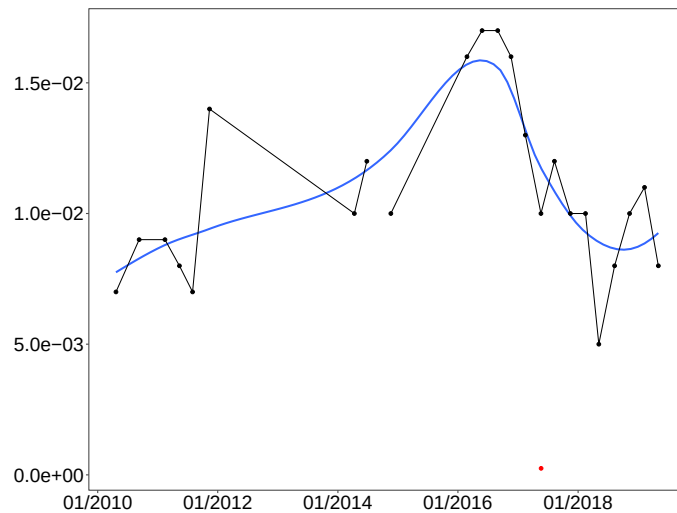
EC14 – Antimony (d.)

 $\tau = -0.705$ | p-value = 0.00000853 | Negative trend

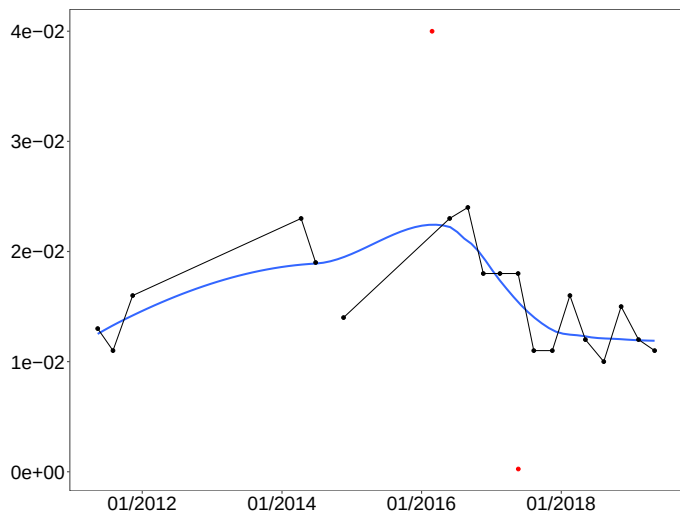
EC14 – Antimony (t.)

 $\tau = -0.617$ | p-value = 0.000464 | Negative trend

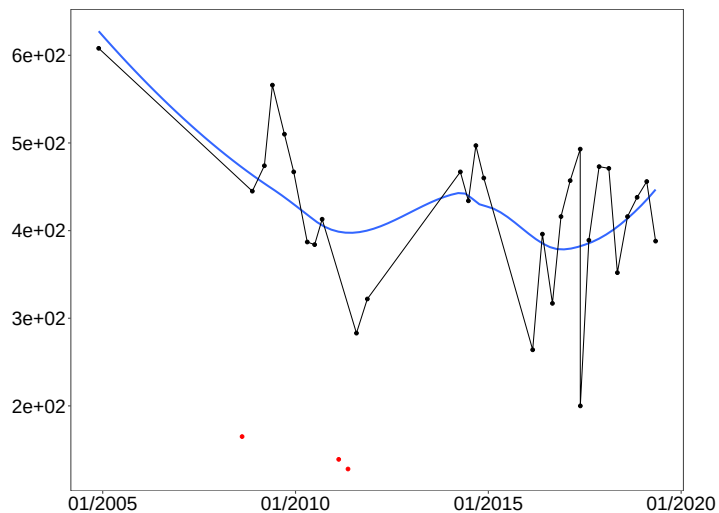
EC14 – Arsenic (d.)

 $\tau = 0.00378$ | p-value = 1 | No trend

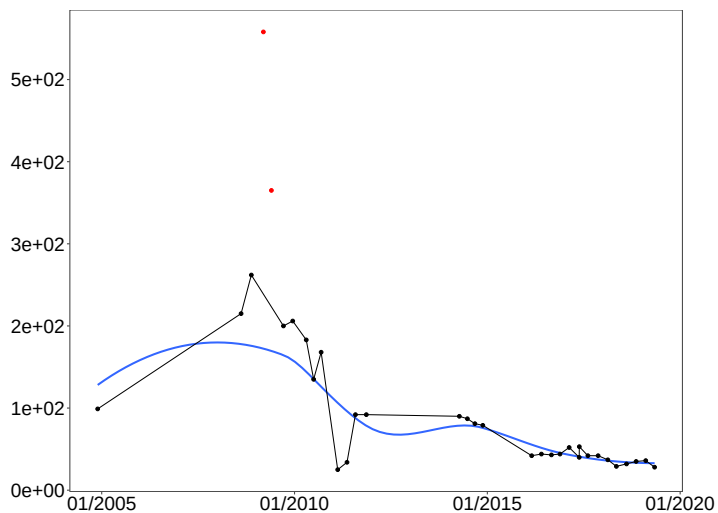
EC14 – Arsenic (t.)

 $\tau = -0.304$ | p-value = 0.0636 | No trend

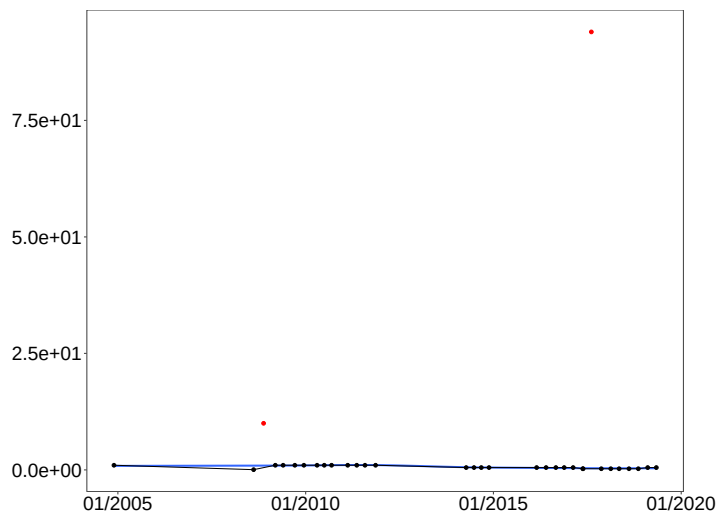
EC14 – Bicarbonate

 $\tau = -0.0683$ | p-value = 0.588 | No trend

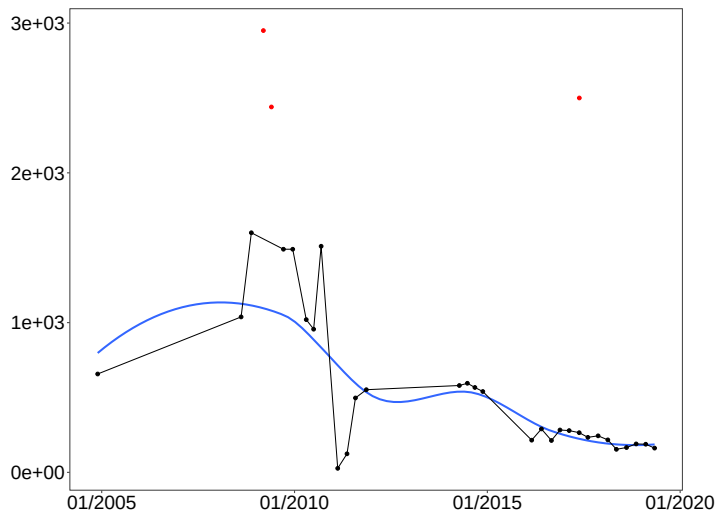
EC14 – Calcium

 $\tau = -0.698$ | p-value = 0.0000000139 | Negative trend

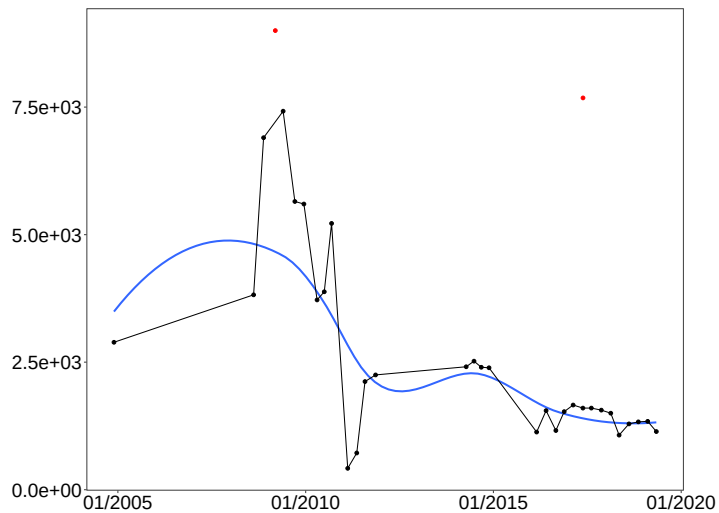
EC14 – Carbonate

 $\tau = -0.545$ | p-value = 0.0000622 | Negative trend

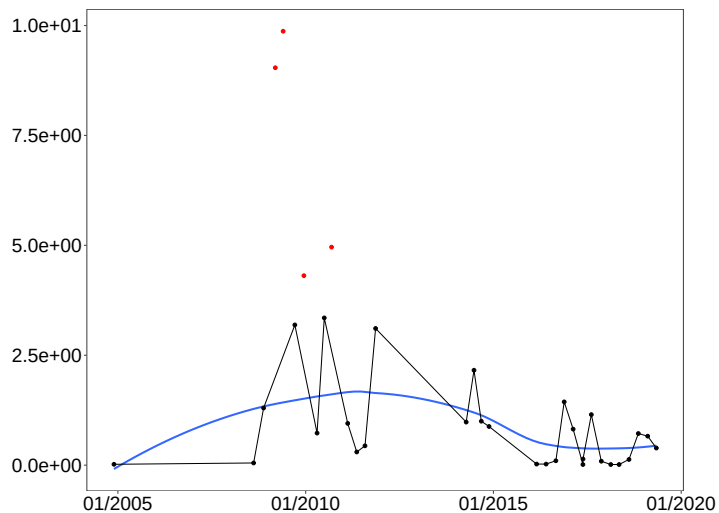
EC14 – Chloride

 $\tau = -0.567$ | p-value = 0.00000388 | Negative trend

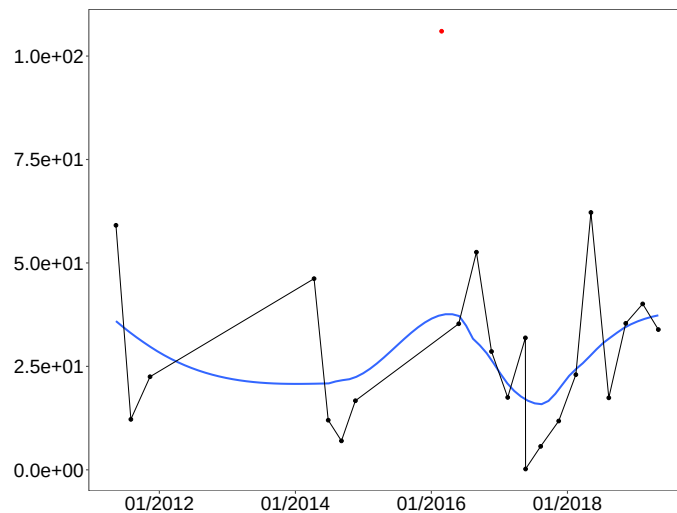
EC14 – Electrical Conductivity

 $\tau = -0.502$ | p-value = 0.0000429 | Negative trend

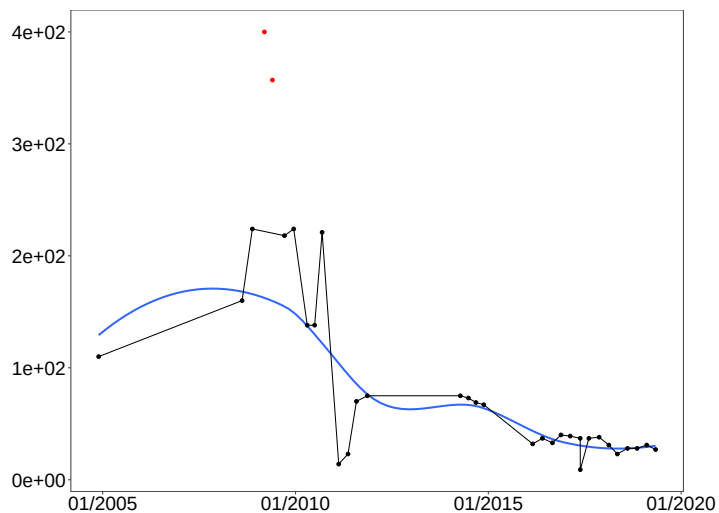
EC14 – Iron (d.)
 $\tau = -0.342$ | p-value = 0.00552 | Negative trend



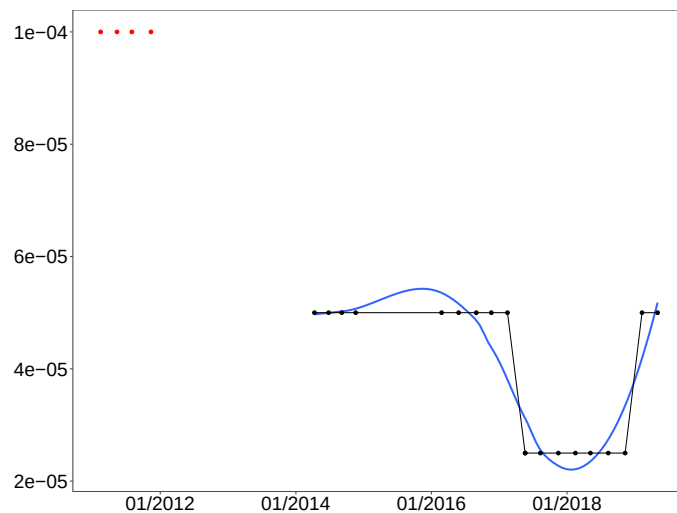
EC14 – Iron (t.)
 $\tau = 0.0303$ | p-value = 0.866 | No trend



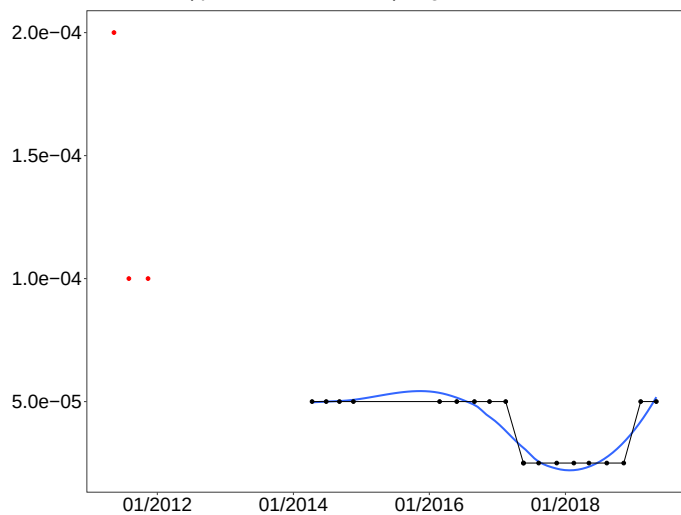
EC14 – Magnesium
 $\tau = -0.628$ | p-value = 0.000000362 | Negative trend



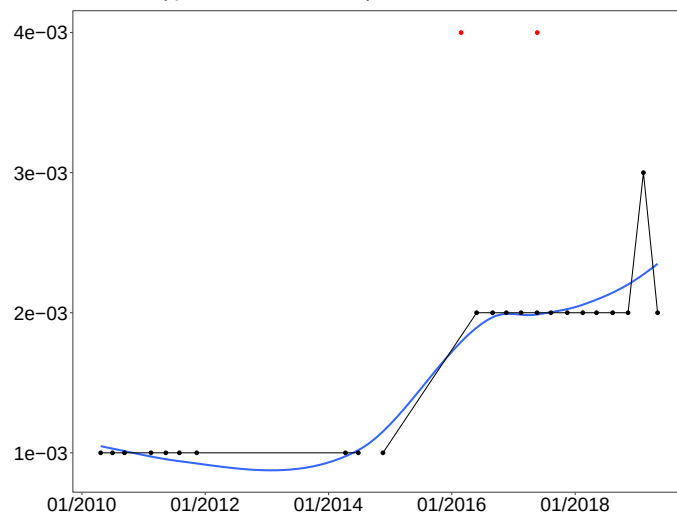
EC14 – Mercury (d.)
 $\tau = -0.648$ | p-value = 0.000151 | Negative trend



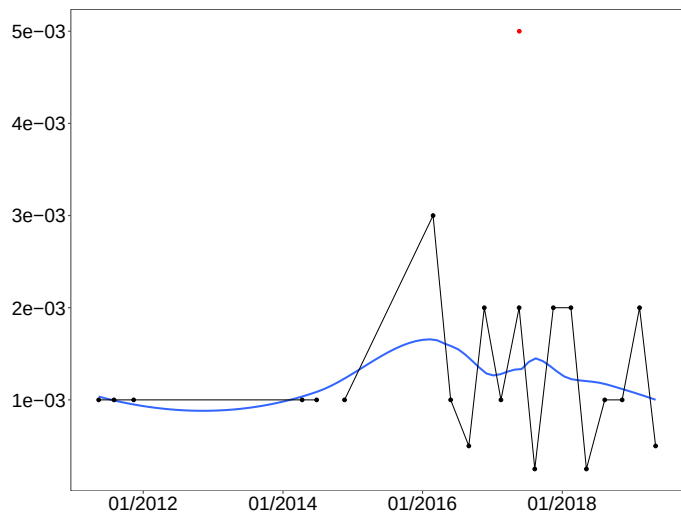
EC14 – Mercury (t.)
 $\tau = -0.624$ | p-value = 0.000373 | Negative trend



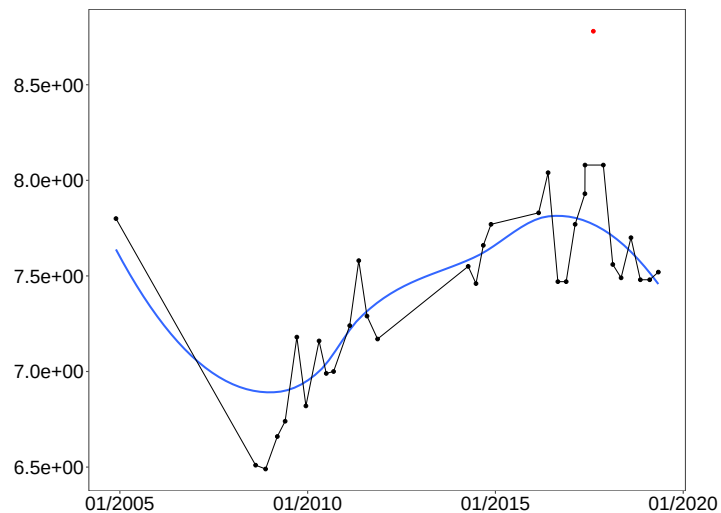
EC14 – Molybdenum (d.)
 $\tau = 0.606$ | p-value = 0.000217 | Positive trend



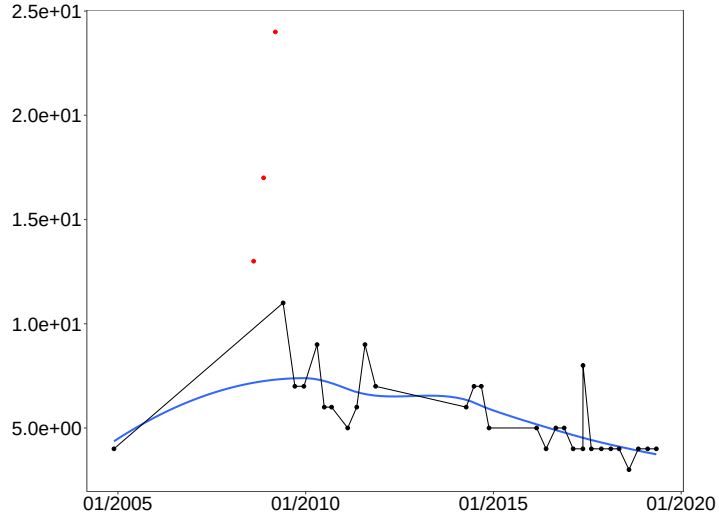
EC14 – Molybdenum (t.)
 $\tau = 0.00558$ | $p\text{-value} = 1$ | No trend



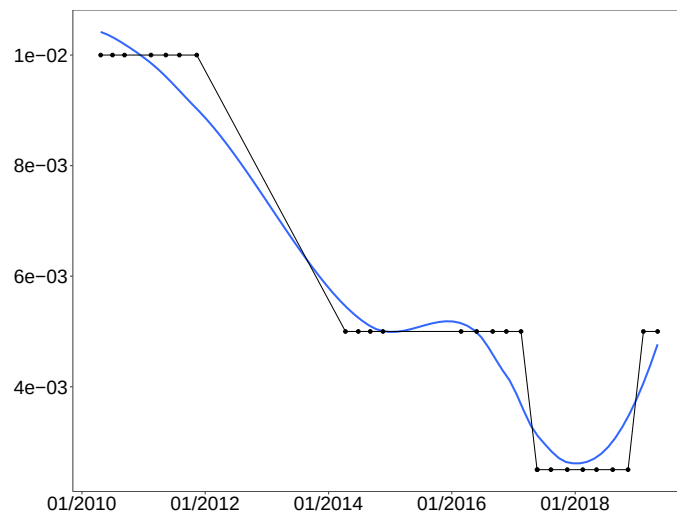
EC14 – pH
 $\tau = 0.51$ | $p\text{-value} = 0.0000349$ | Positive trend



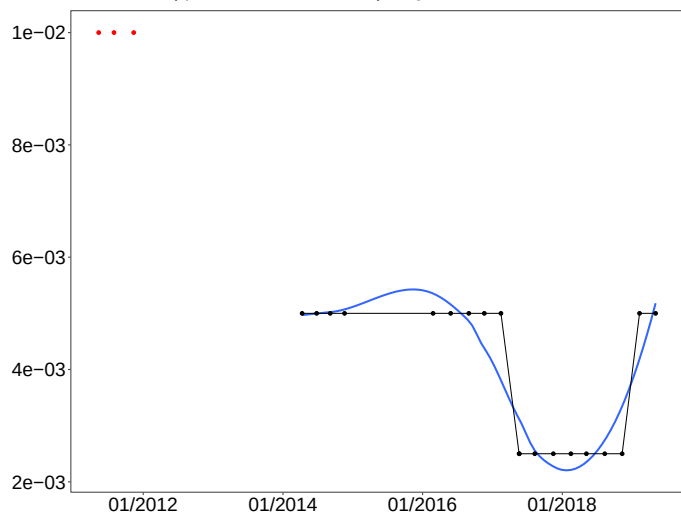
EC14 – Potassium
 $\tau = -0.631$ | $p\text{-value} = 0.00000124$ | Negative trend



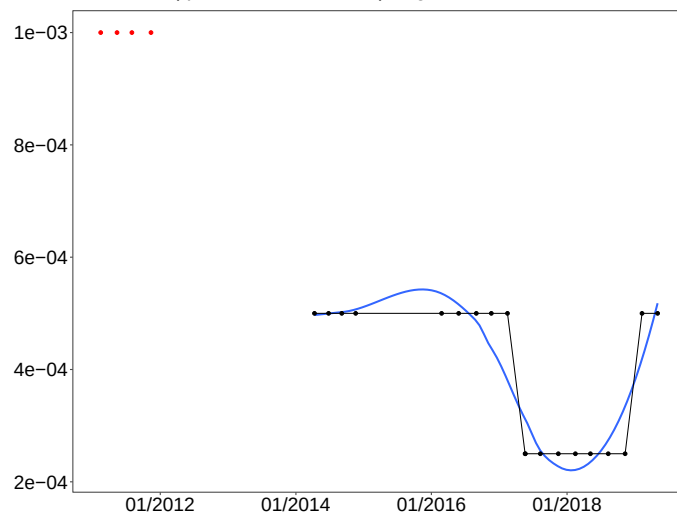
EC14 – Selenium (d.)
 $\tau = -0.705$ | $p\text{-value} = 0.00000853$ | Negative trend



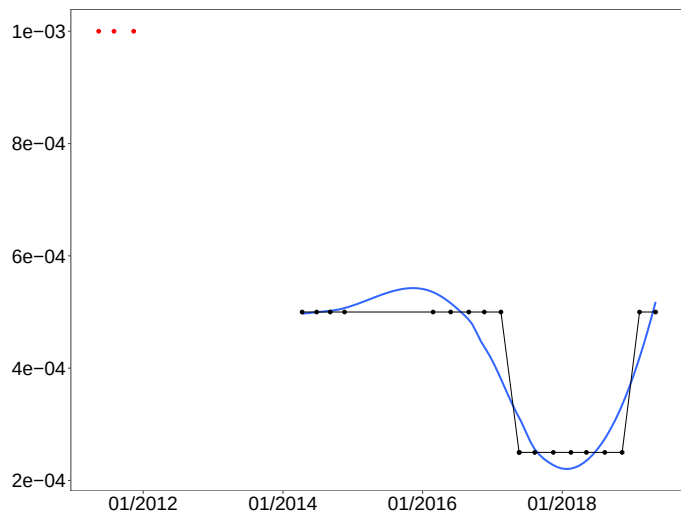
EC14 – Selenium (t.)
 $\tau = -0.617$ | $p\text{-value} = 0.000464$ | Negative trend



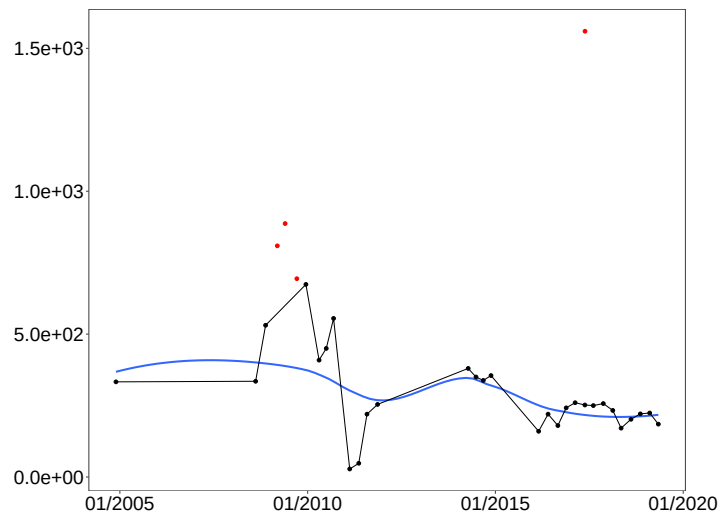
EC14 – Silver (d.)
 $\tau = -0.648$ | $p\text{-value} = 0.000151$ | Negative trend



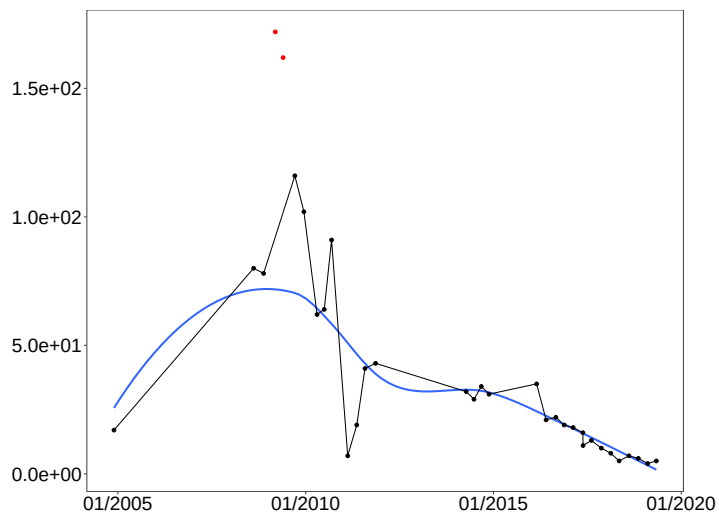
EC14 – Silver (t.)

 $\tau = -0.617$ | p-value = 0.000464 | Negative trend

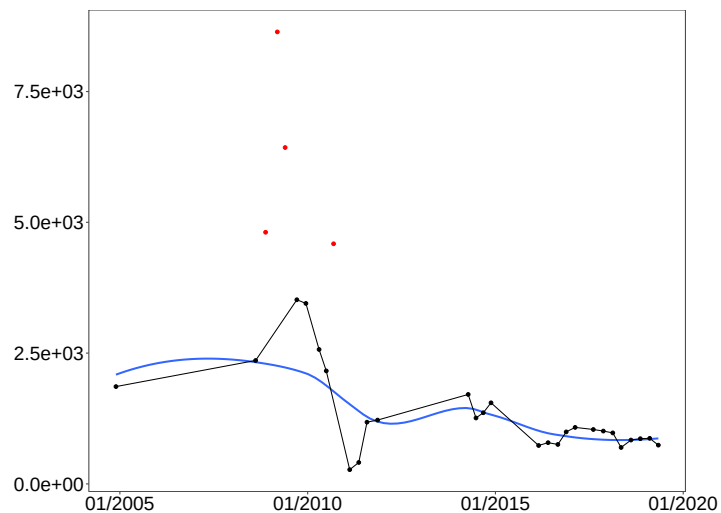
EC14 – Sodium

 $\tau = -0.377$ | p-value = 0.00215 | Negative trend

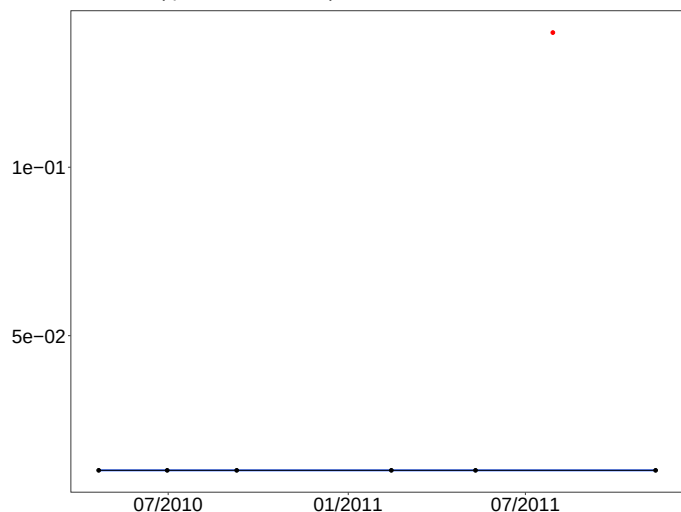
EC14 – Sulphate

 $\tau = -0.72$ | p-value = 0.00000000466 | Negative trend

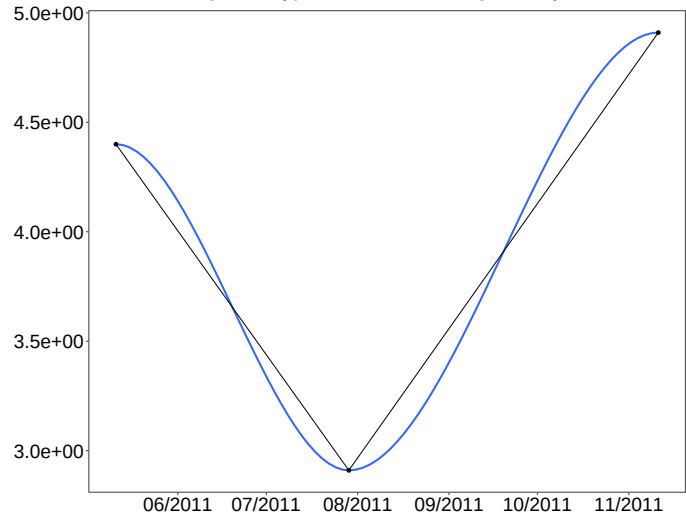
EC14 – TDS

 $\tau = -0.527$ | p-value = 0.0000337 | Negative trend

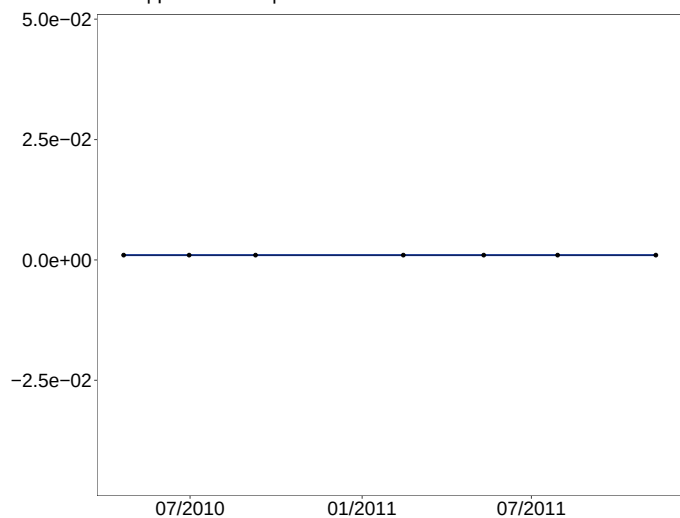
EC15 – Aluminium (d.)

 $\tau = 0.356$ | p-value = 0.453 | No trend

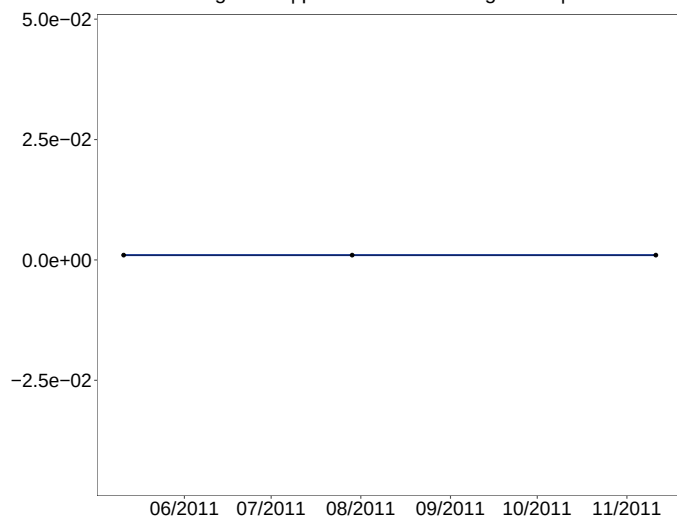
EC15 – Aluminium (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

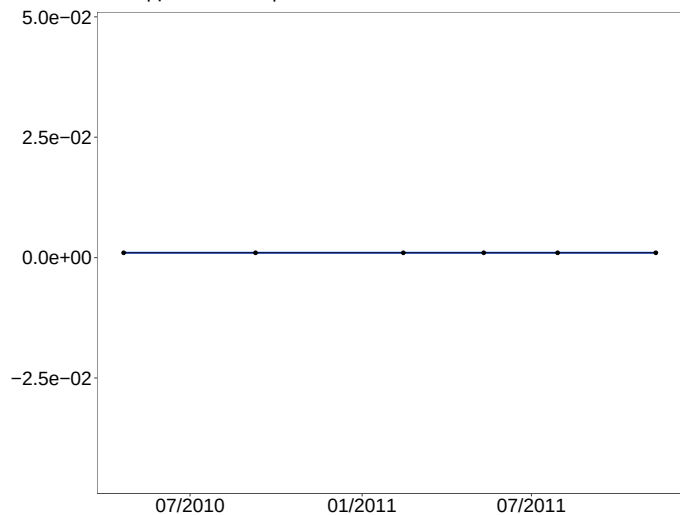
EC15 – Antimony (d.)
 $\tau = 1$ | p-value = 1 | No trend



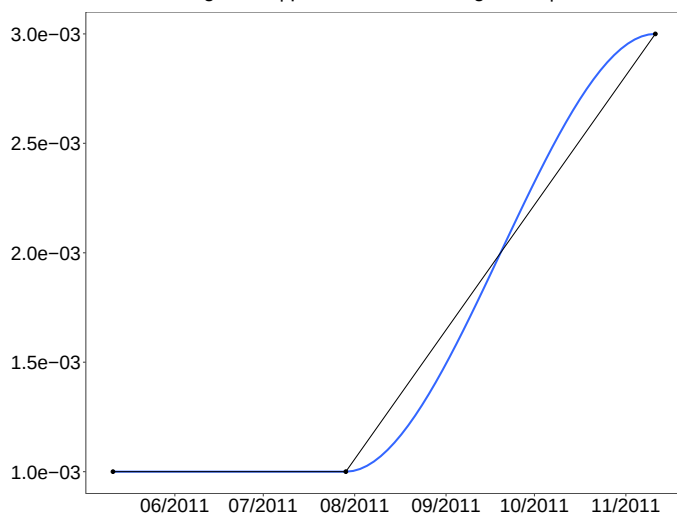
EC15 – Antimony (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



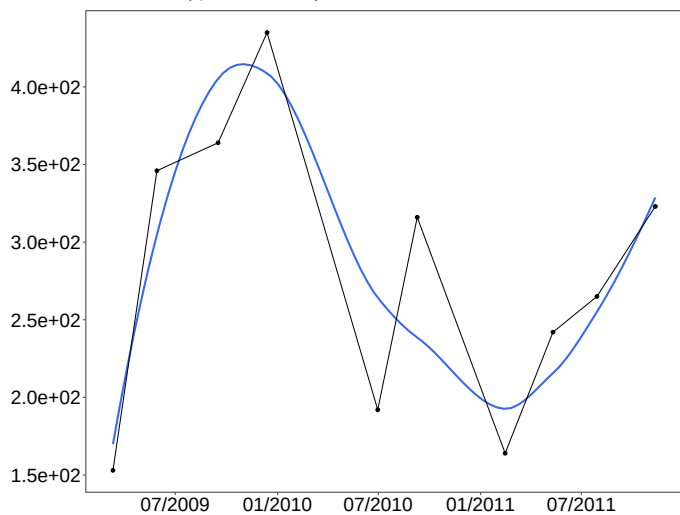
EC15 – Arsenic (d.)
 $\tau = 1$ | p-value = 1 | No trend



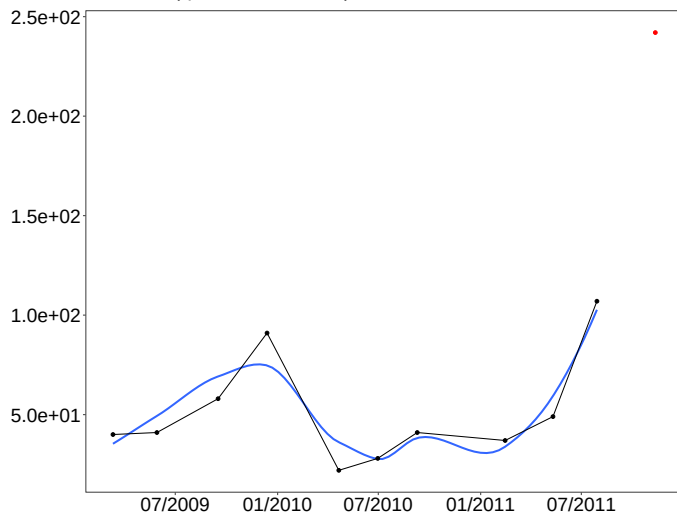
EC15 – Arsenic (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



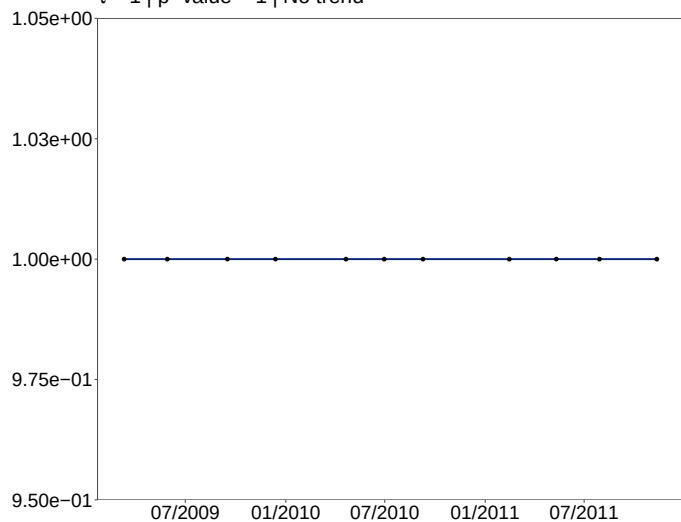
EC15 – Bicarbonate
 $\tau = 0.0222$ | p-value = 1 | No trend



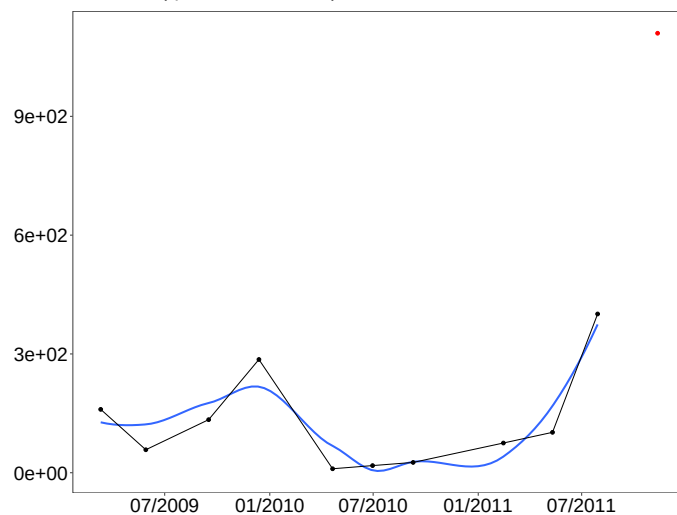
EC15 – Calcium
 $\tau = 0.367$ | p-value = 0.138 | No trend



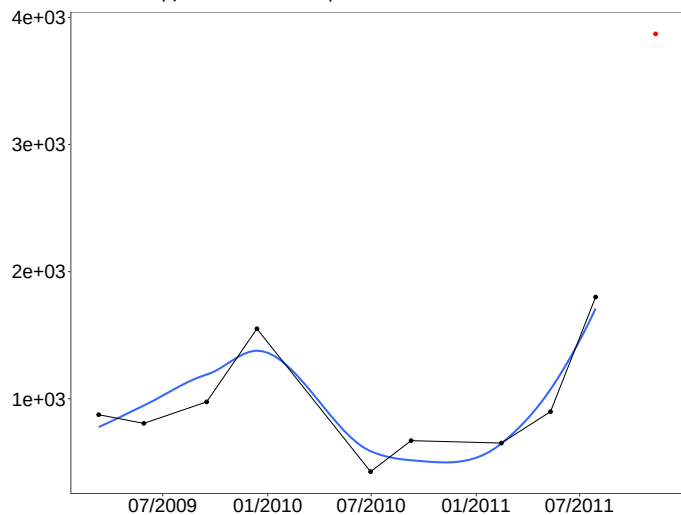
EC15 – Carbonate
 $\tau = 1$ | p-value = 1 | No trend



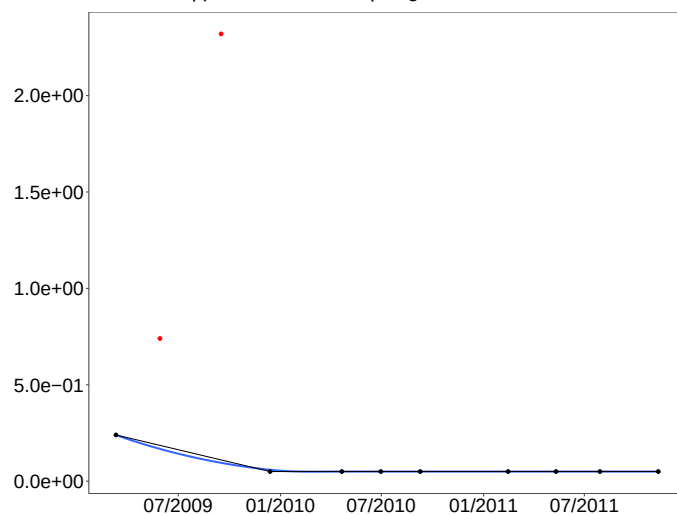
EC15 – Chloride
 $\tau = 0.273$ | p-value = 0.276 | No trend



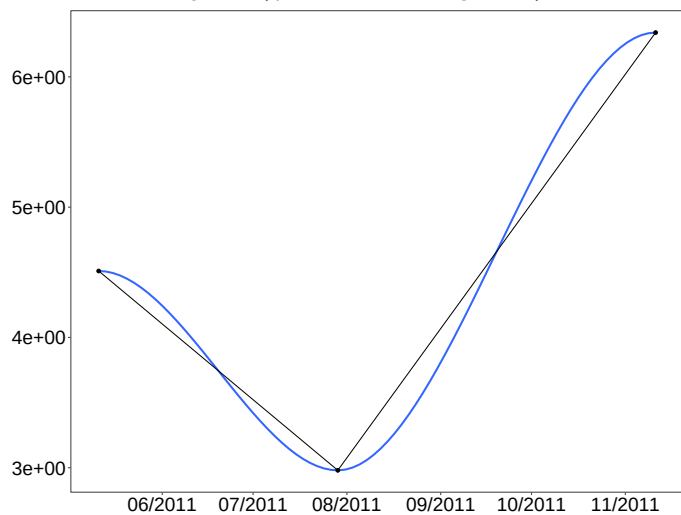
EC15 – Electrical Conductivity
 $\tau = 0.289$ | p-value = 0.283 | No trend



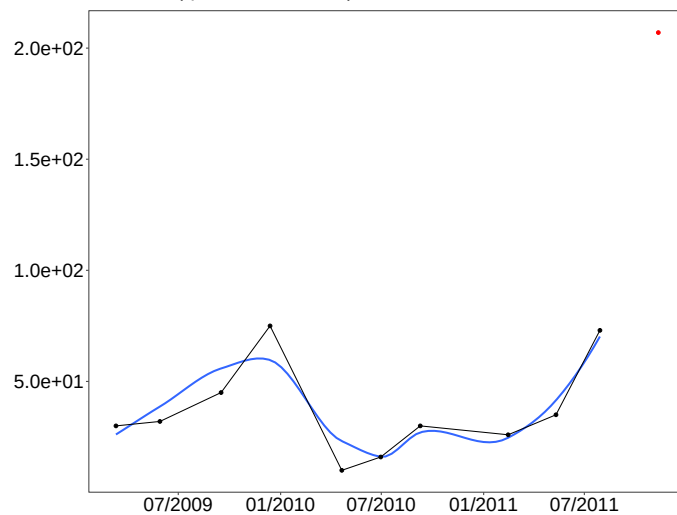
EC15 – Iron (d.)
 $\tau = -0.545$ | p-value = 0.0451 | Negative trend



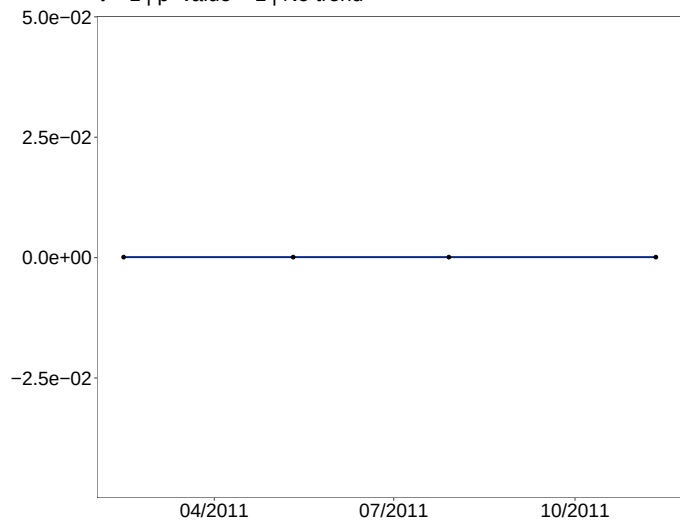
EC15 – Iron (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



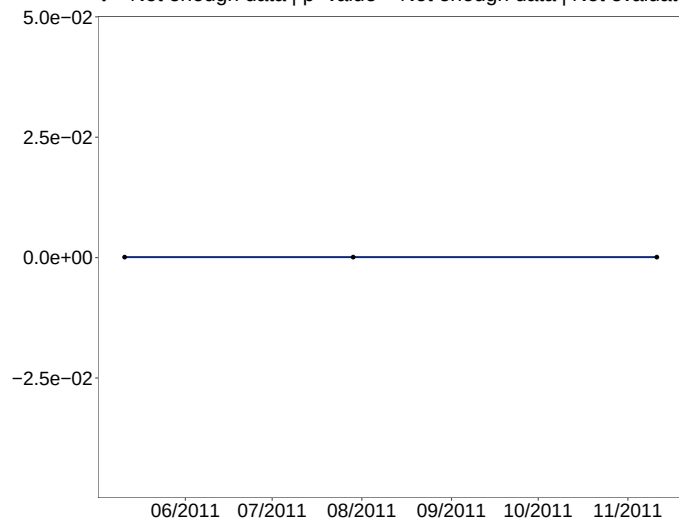
EC15 – Magnesium
 $\tau = 0.294$ | p-value = 0.241 | No trend



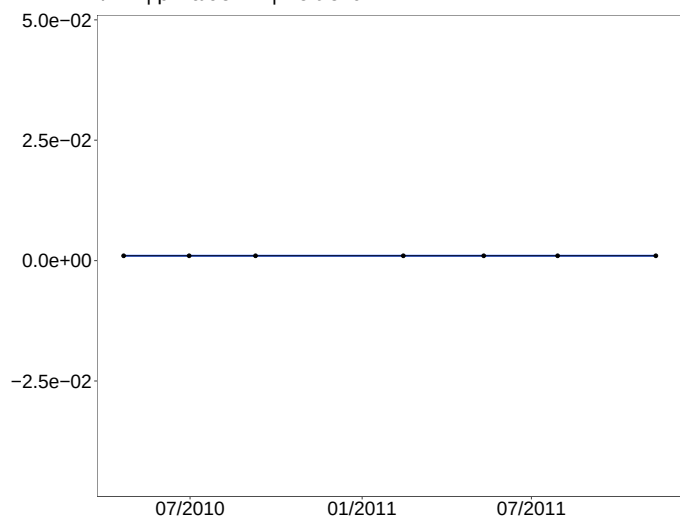
EC15 – Mercury (d.)
 $\tau = 1$ | p-value = 1 | No trend



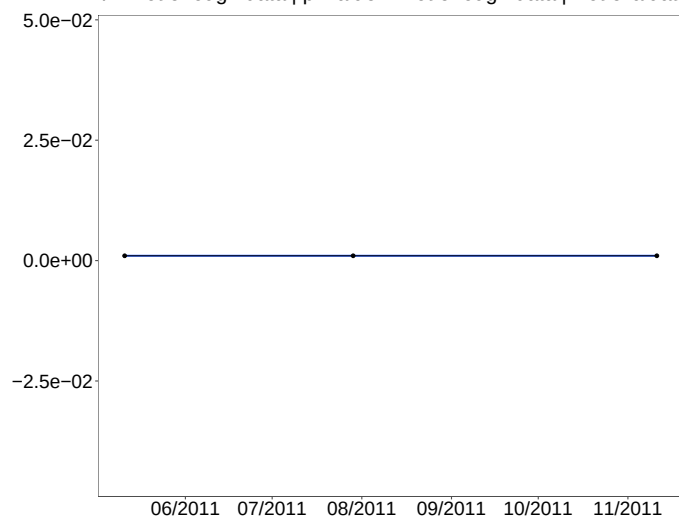
EC15 – Mercury (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



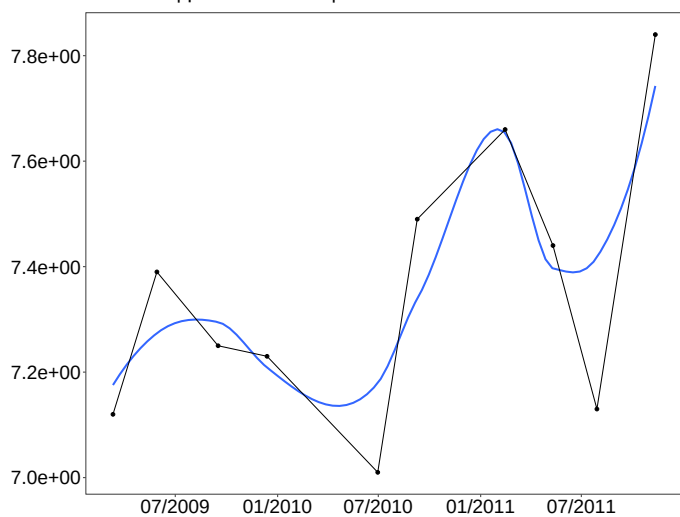
EC15 – Molybdenum (d.)
 $\tau = 1$ | p-value = 1 | No trend



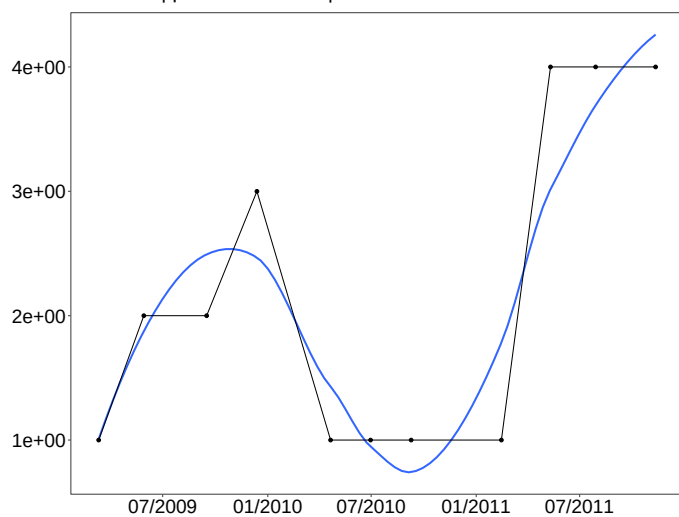
EC15 – Molybdenum (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



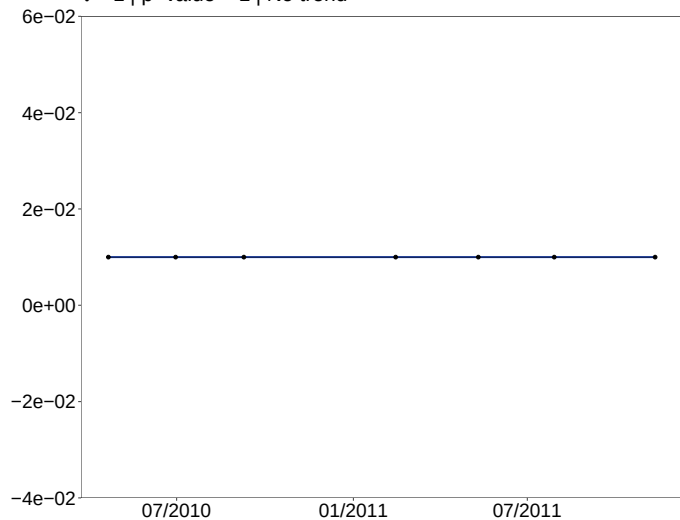
EC15 – pH
 $\tau = 0.333$ | p-value = 0.21 | No trend



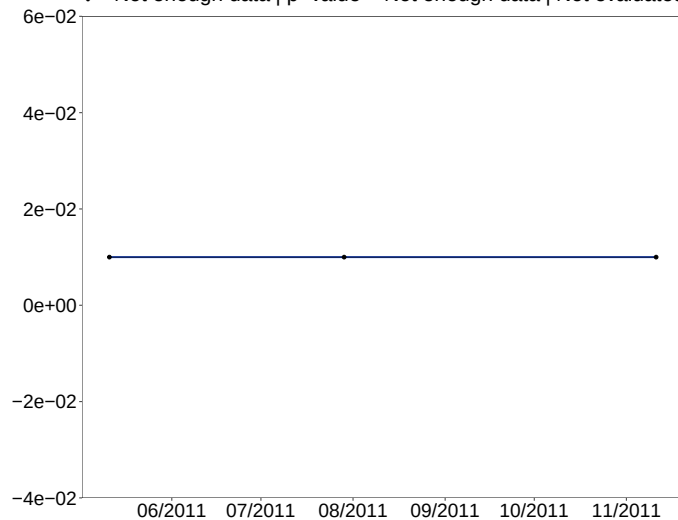
EC15 – Potassium
 $\tau = 0.358$ | p-value = 0.182 | No trend



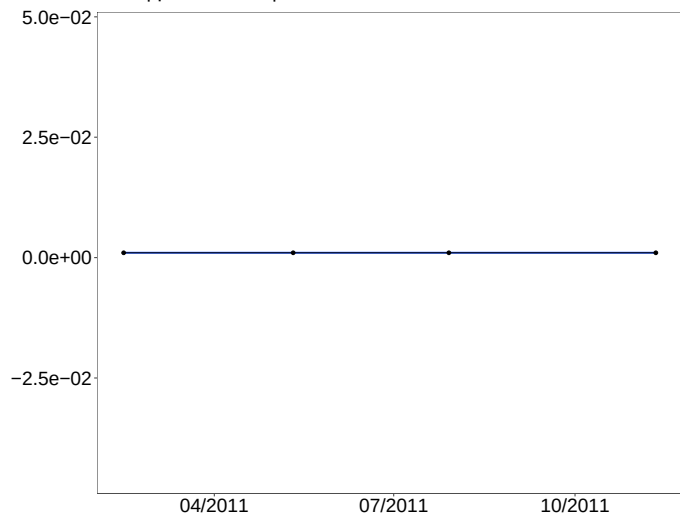
EC15 – Selenium (d.)
 $\tau = 1$ | p-value = 1 | No trend



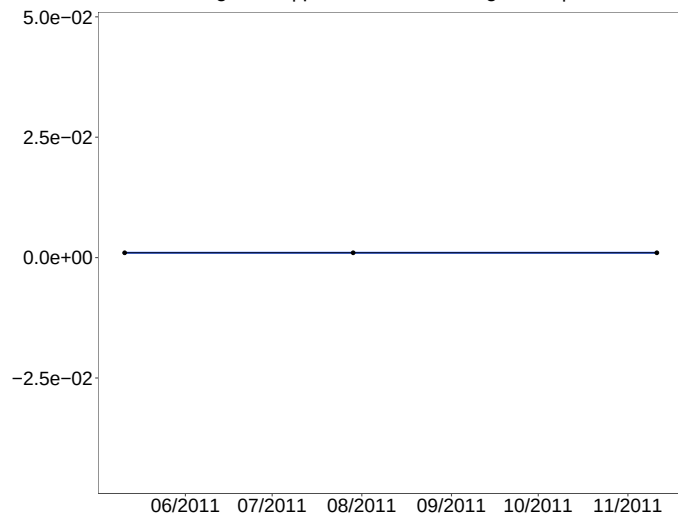
EC15 – Selenium (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



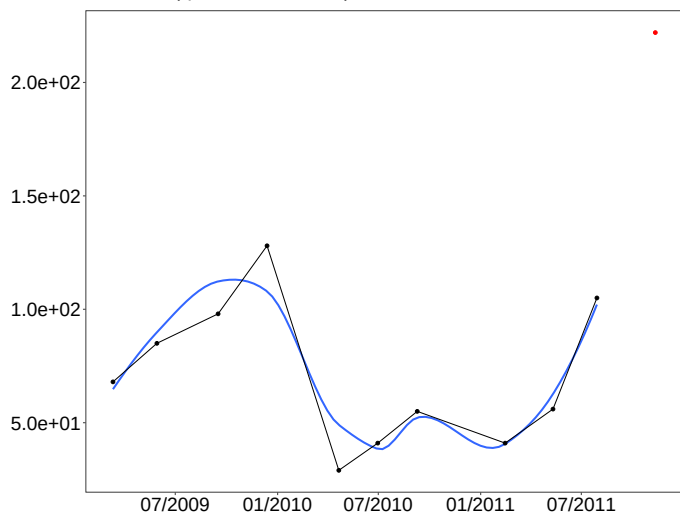
EC15 – Silver (d.)
 $\tau = 1$ | p-value = 1 | No trend



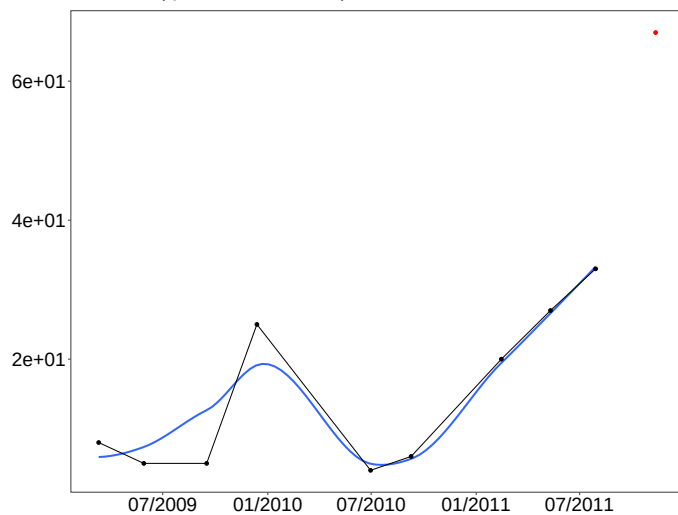
EC15 – Silver (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



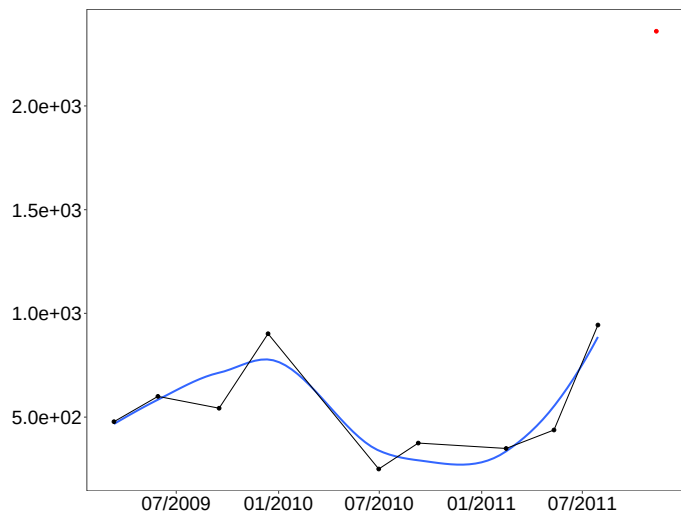
EC15 – Sodium
 $\tau = 0.183$ | p-value = 0.482 | No trend



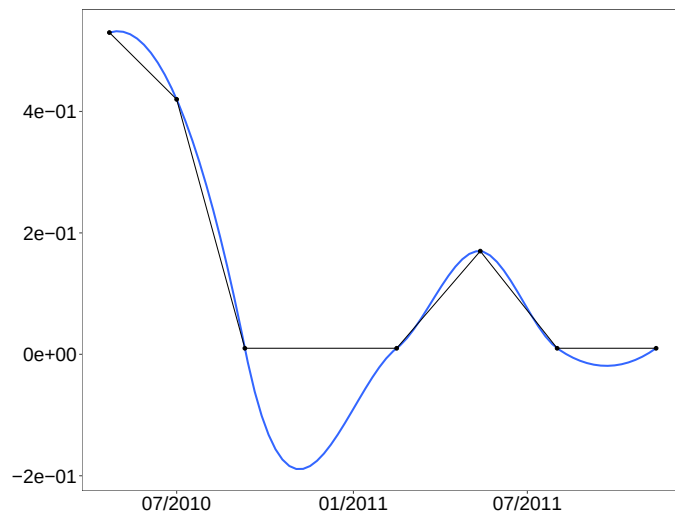
EC15 – Sulphate
 $\tau = 0.584$ | p-value = 0.0248 | Positive trend



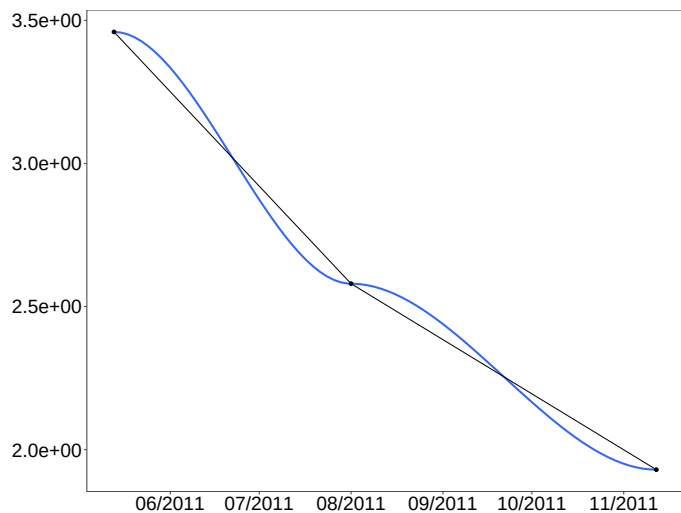
EC15 – TDS
 $\tau = 0.2$ | p-value = 0.474 | No trend



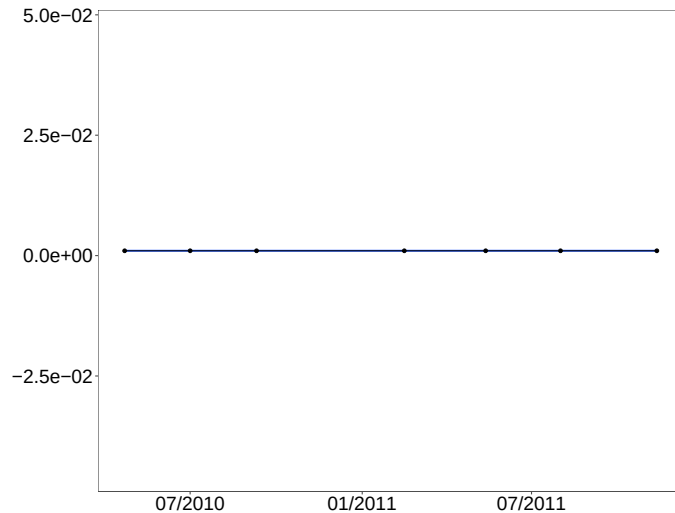
EC16 – Aluminium (d.)
 $\tau = -0.62$ | p-value = 0.094 | No trend



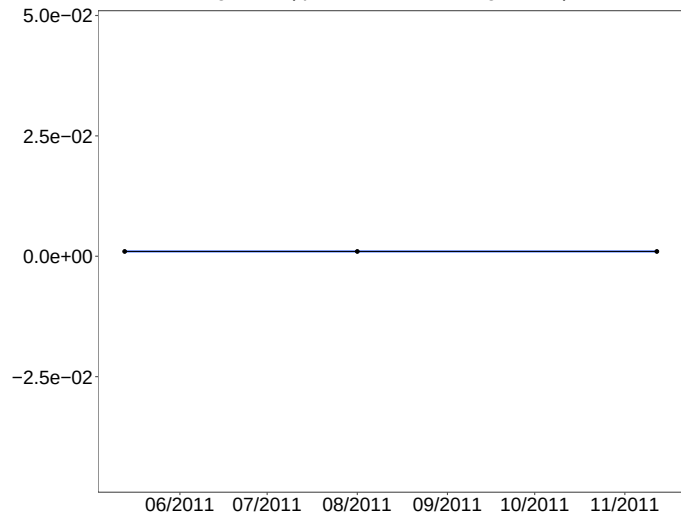
EC16 – Aluminium (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



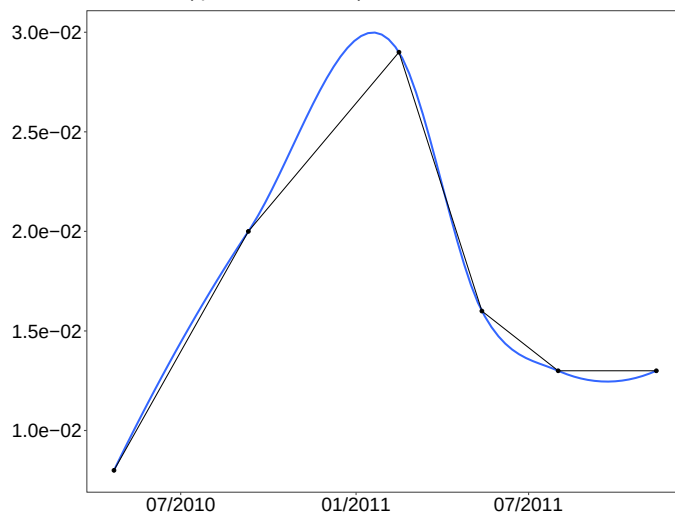
EC16 – Antimony (d.)
 $\tau = 1$ | p-value = 1 | No trend



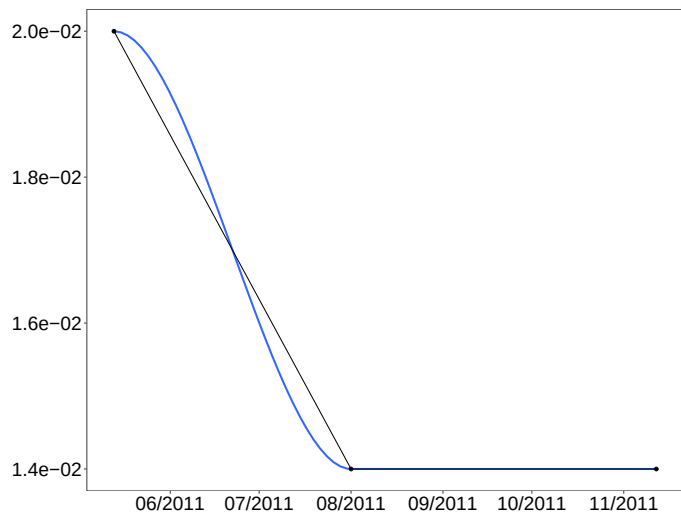
EC16 – Antimony (t.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



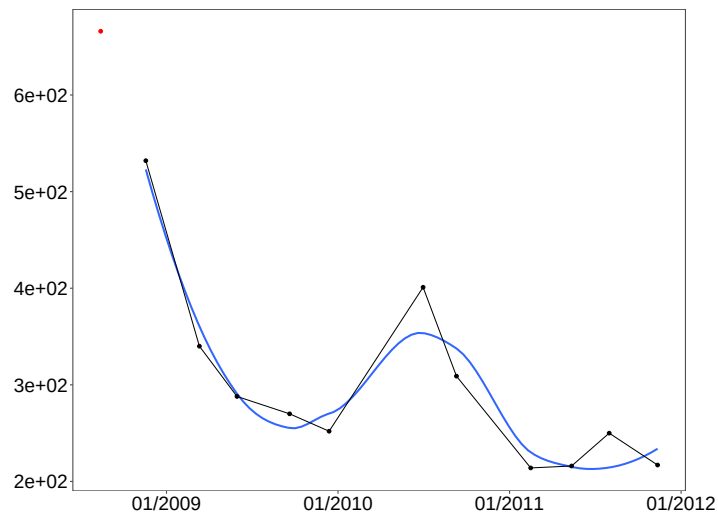
EC16 – Arsenic (d.)
 $\tau = -0.138$ | p-value = 0.848 | No trend



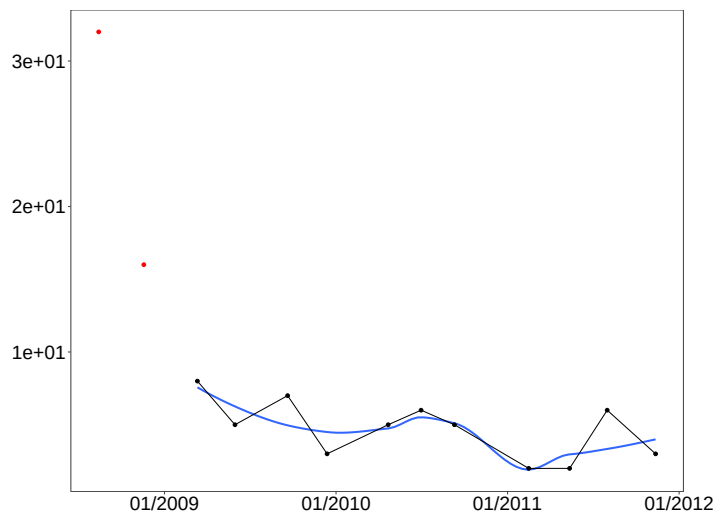
EC16 – Arsenic (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

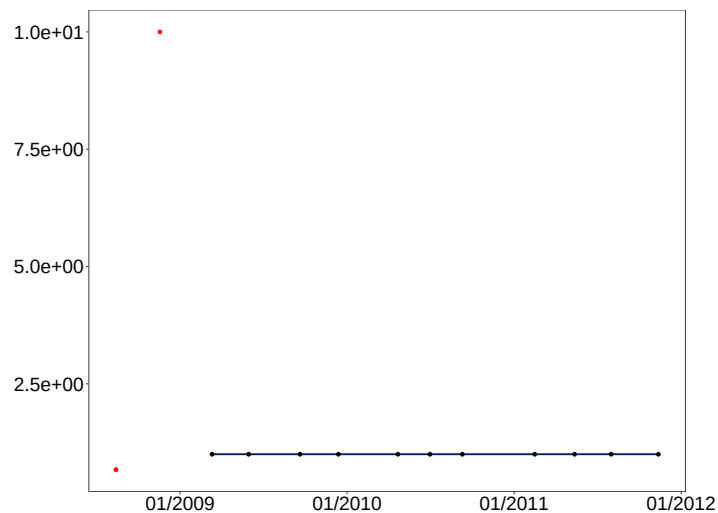
EC16 – Bicarbonate

 τ = -0.636 | p-value = 0.00493 | Negative trend

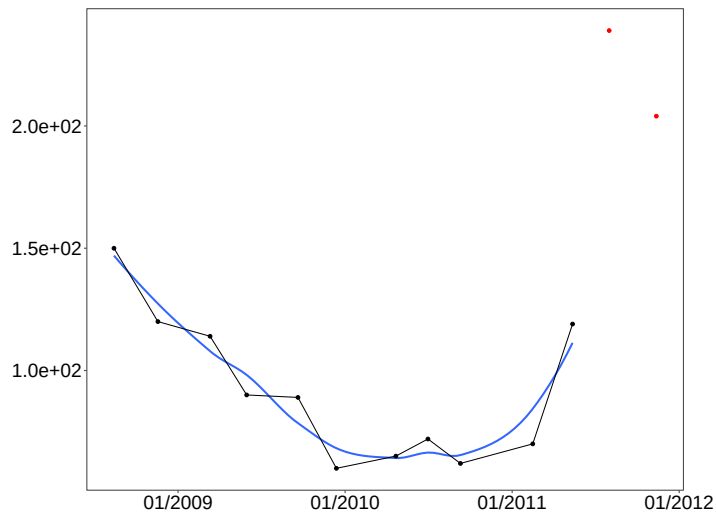
EC16 – Calcium

 τ = -0.587 | p-value = 0.00789 | Negative trend

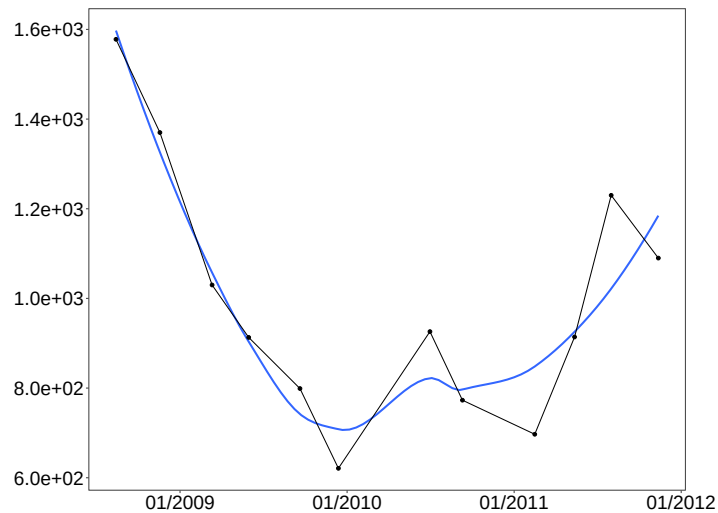
EC16 – Carbonate

 τ = 0.0236 | p-value = 1 | No trend

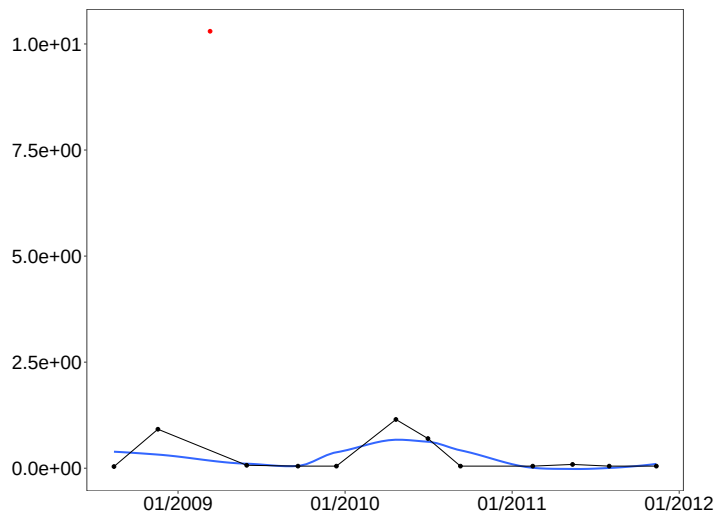
EC16 – Chloride

 τ = -0.0513 | p-value = 0.855 | No trend

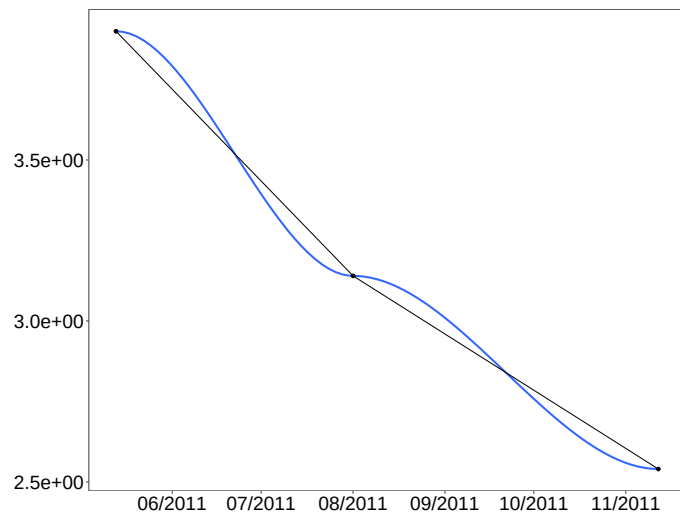
EC16 – Electrical Conductivity

 τ = -0.212 | p-value = 0.373 | No trend

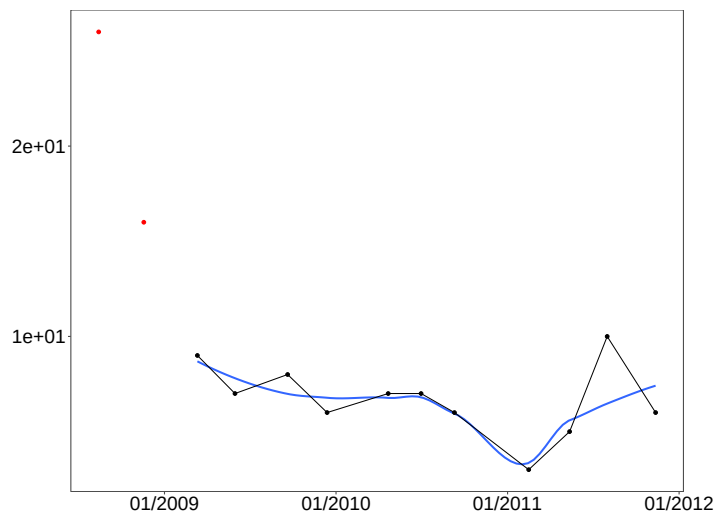
EC16 – Iron (d.)

 $\tau = -0.185$ | p-value = 0.439 | No trend

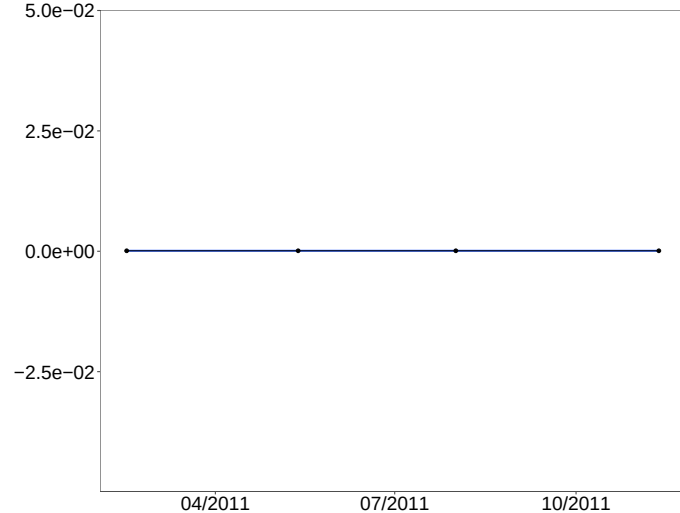
EC16 – Iron (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

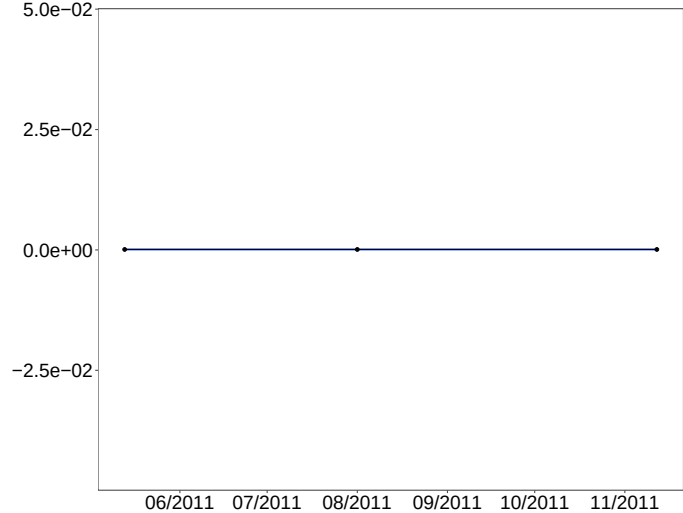
EC16 – Magnesium

 $\tau = -0.56$ | p-value = 0.0112 | Negative trend

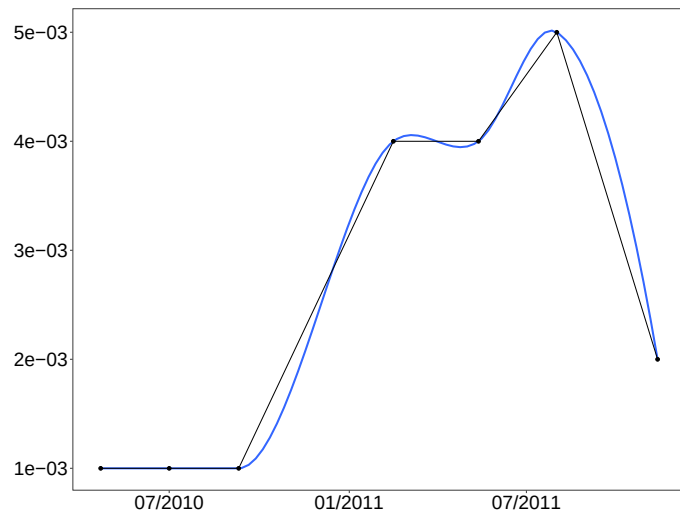
EC16 – Mercury (d.)

 $\tau = 1$ | p-value = 1 | No trend

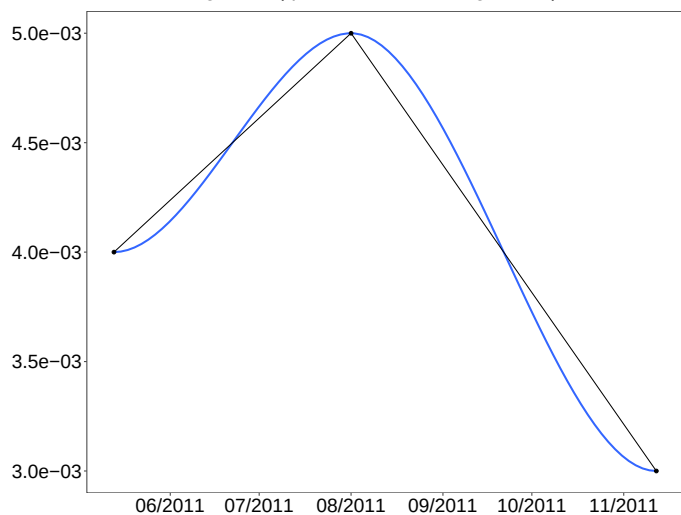
EC16 – Mercury (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

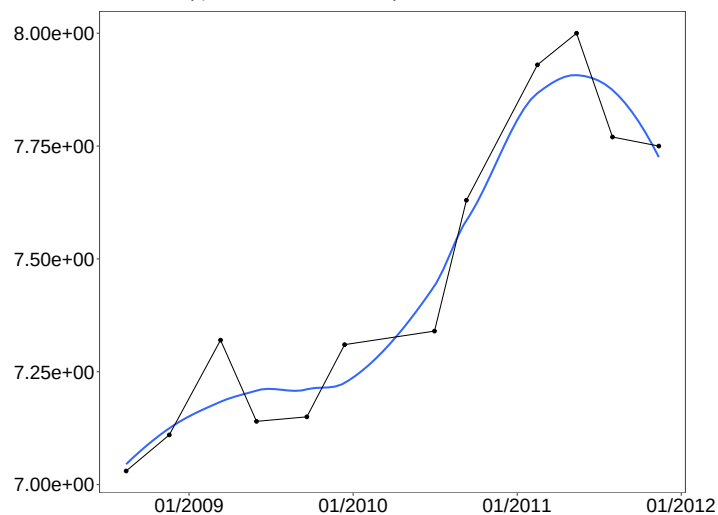
EC16 – Molybdenum (d.)

 $\tau = 0.582$ | p-value = 0.112 | No trend

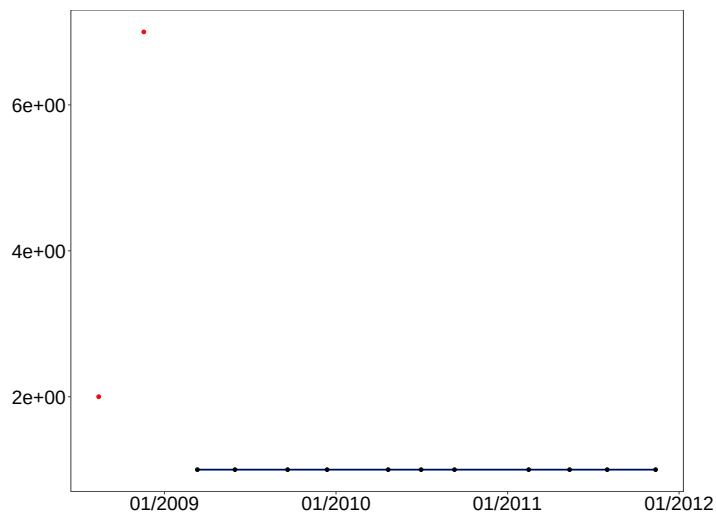
EC16 – Molybdenum (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

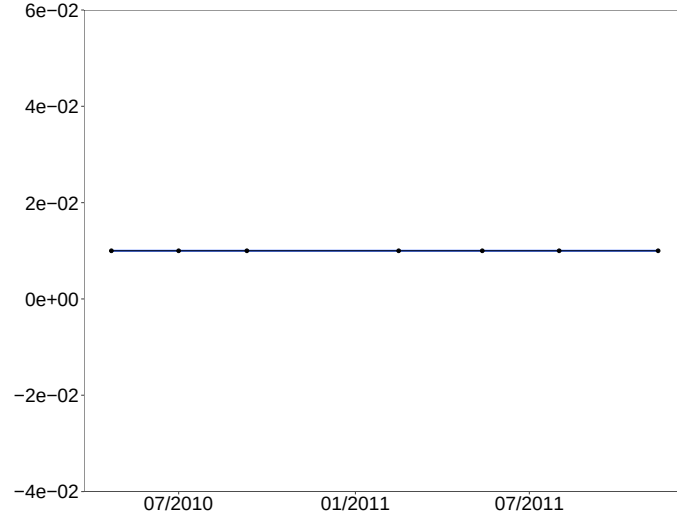
EC16 – pH

 τ = 0.758 | p-value = 0.000779 | Positive trend

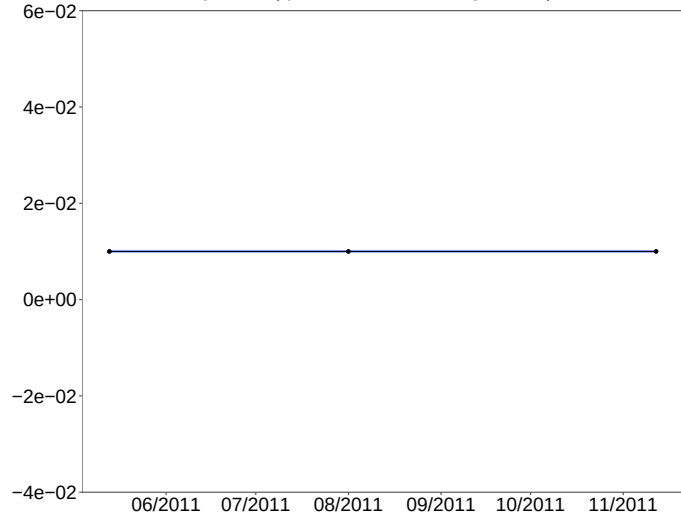
EC16 – Potassium

 τ = -0.496 | p-value = 0.0495 | Negative trend

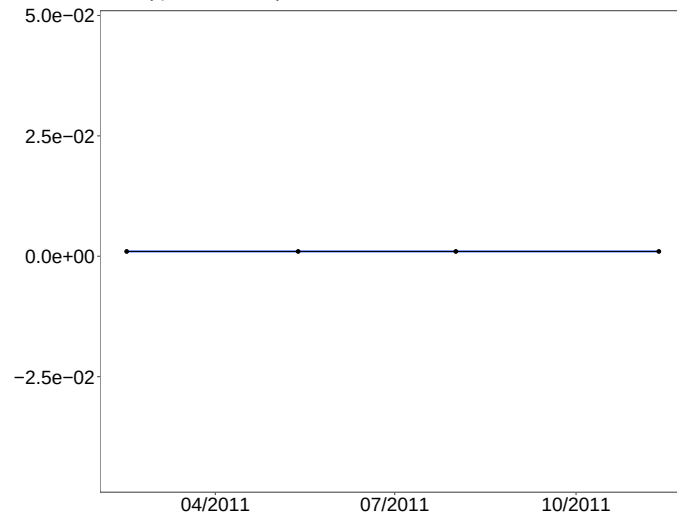
EC16 – Selenium (d.)

 τ = 1 | p-value = 1 | No trend

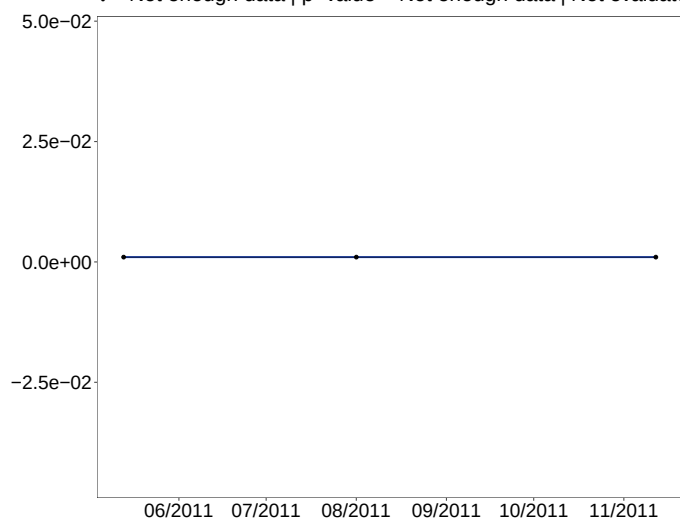
EC16 – Selenium (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

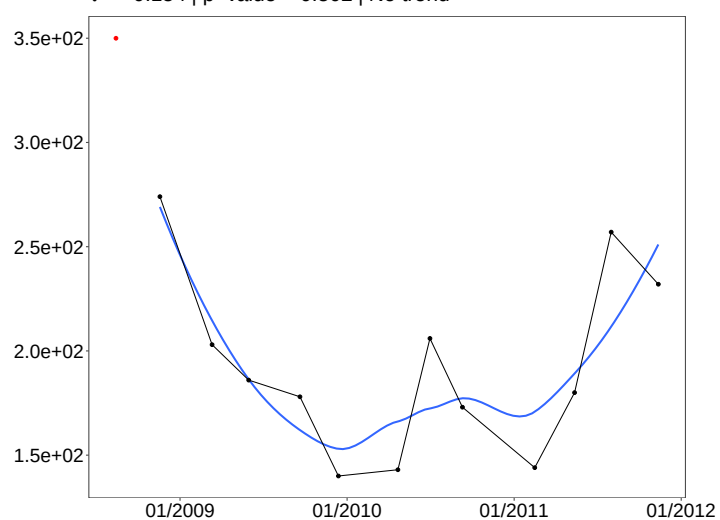
EC16 – Silver (d.)

 τ = 1 | p-value = 1 | No trend

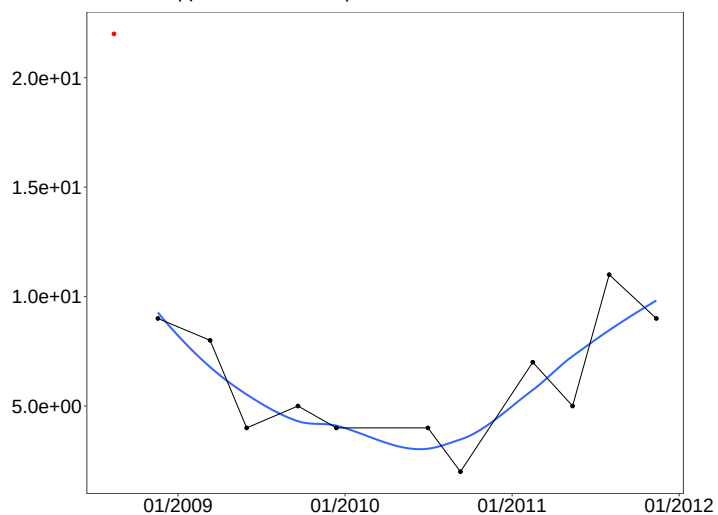
EC16 – Silver (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

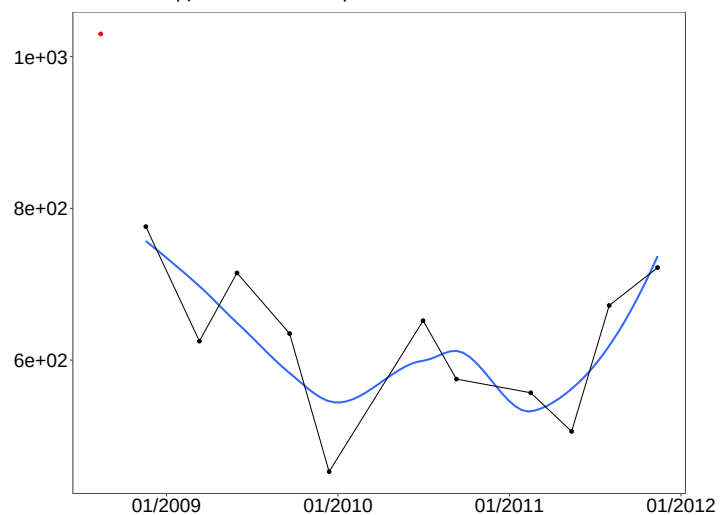
EC16 – Sodium

 τ = -0.154 | p-value = 0.502 | No trend

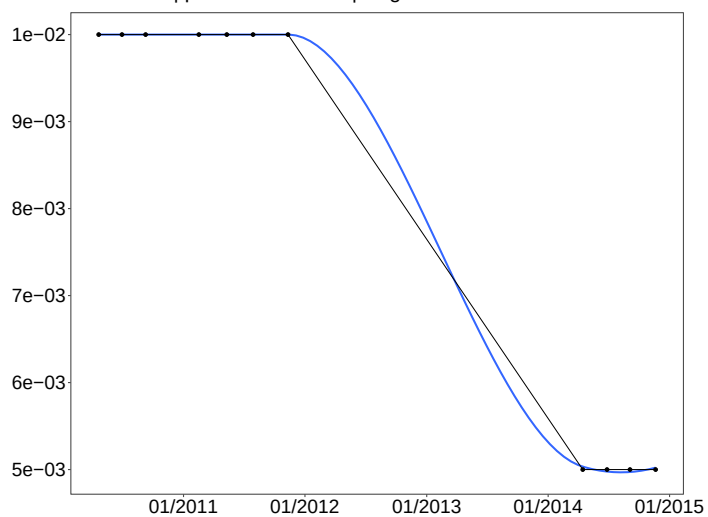
EC16 – Sulphate

 τ = -0.11 | p-value = 0.677 | No trend

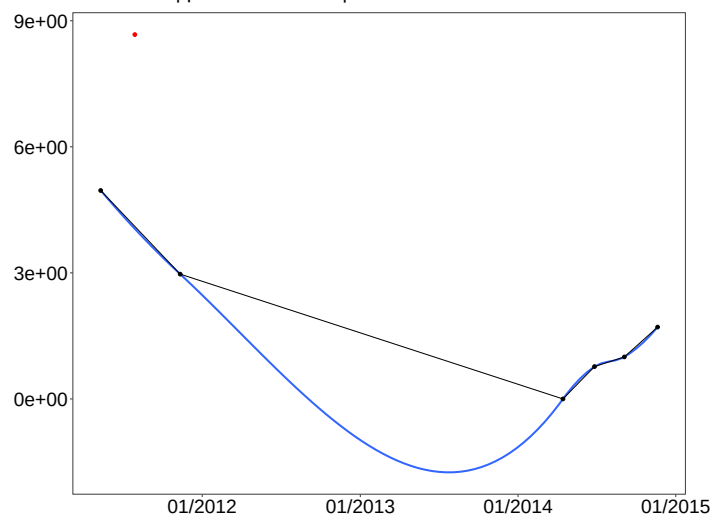
EC16 – TDS

 τ = -0.273 | p-value = 0.244 | No trend

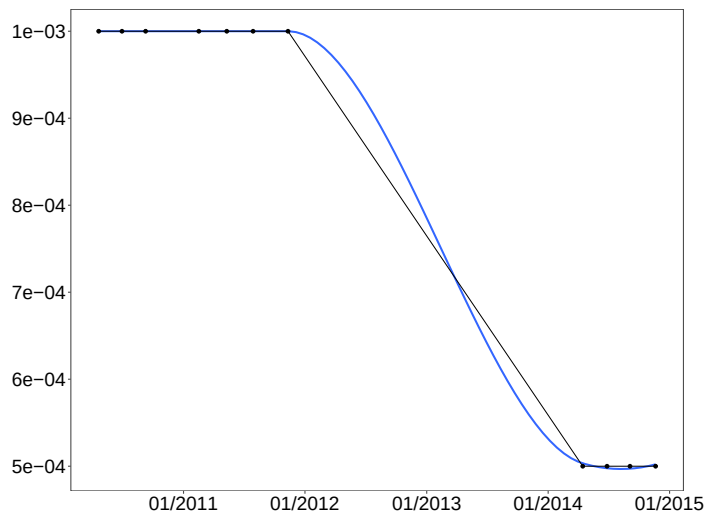
EC17 – Aluminium (d.)

 τ = -0.714 | p-value = 0.0107 | Negative trend

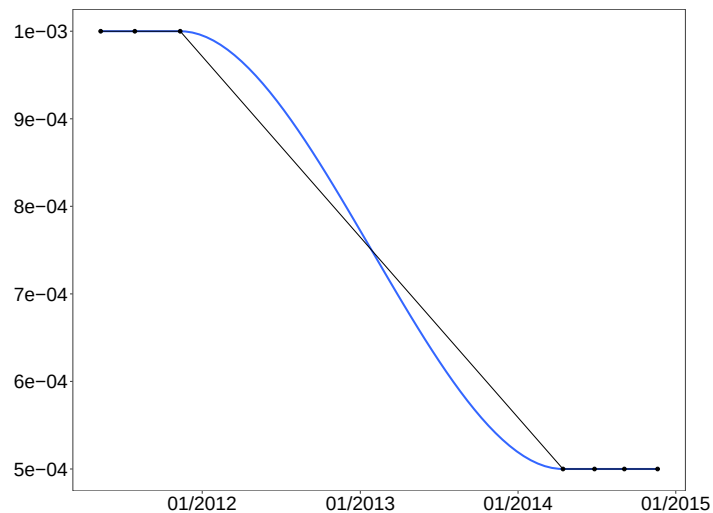
EC17 – Aluminium (t.)

 τ = -0.333 | p-value = 0.368 | No trend

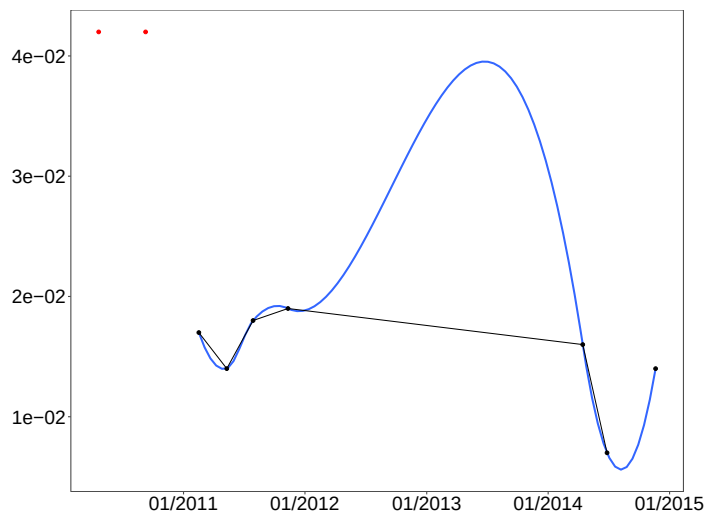
EC17 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



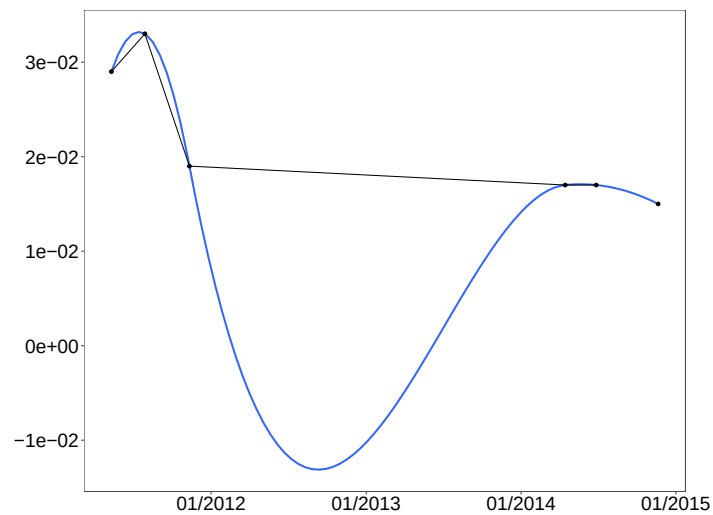
EC17 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



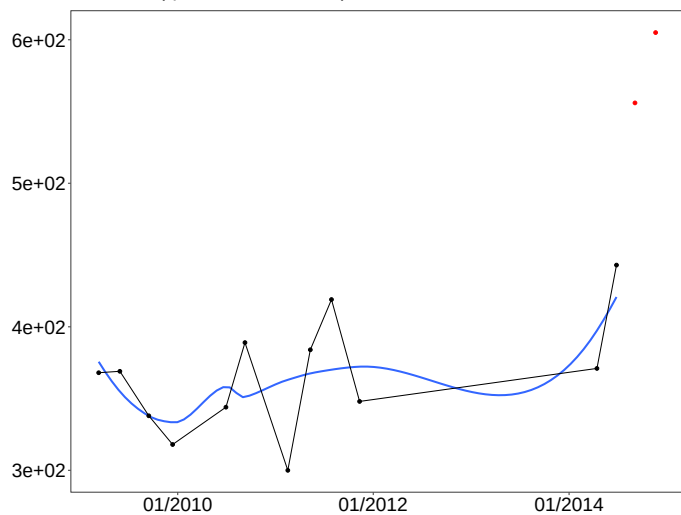
EC17 – Arsenic (d.)
 $\tau = -0.572$ | p-value = 0.0452 | Negative trend



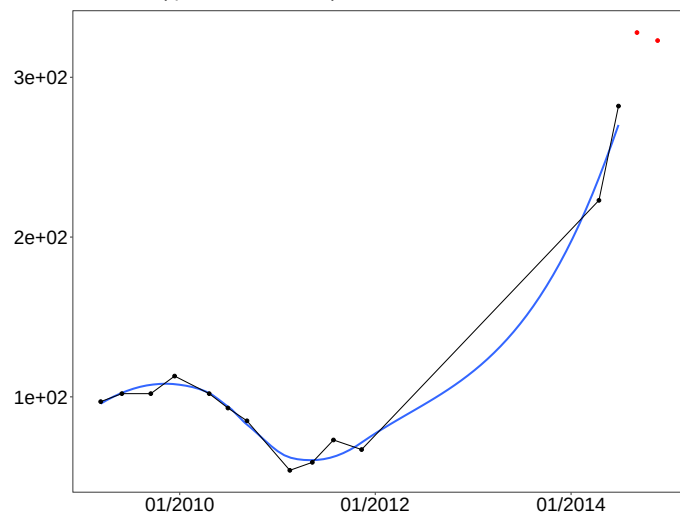
EC17 – Arsenic (t.)
 $\tau = -0.828$ | p-value = 0.0354 | Negative trend



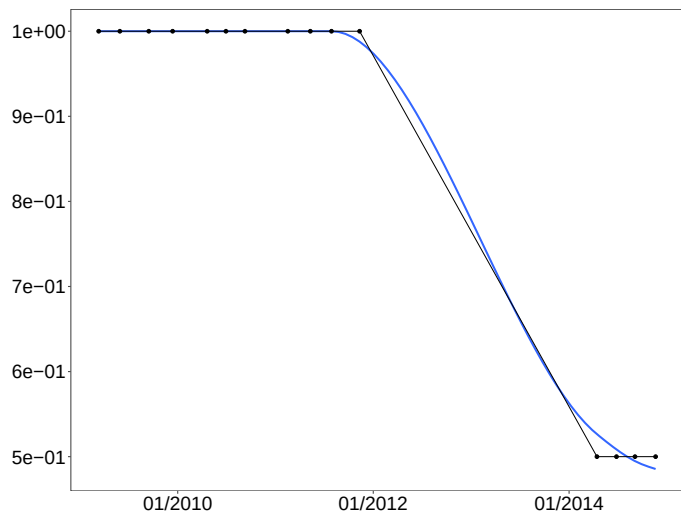
EC17 – Bicarbonate
 $\tau = 0.516$ | p-value = 0.0118 | Positive trend



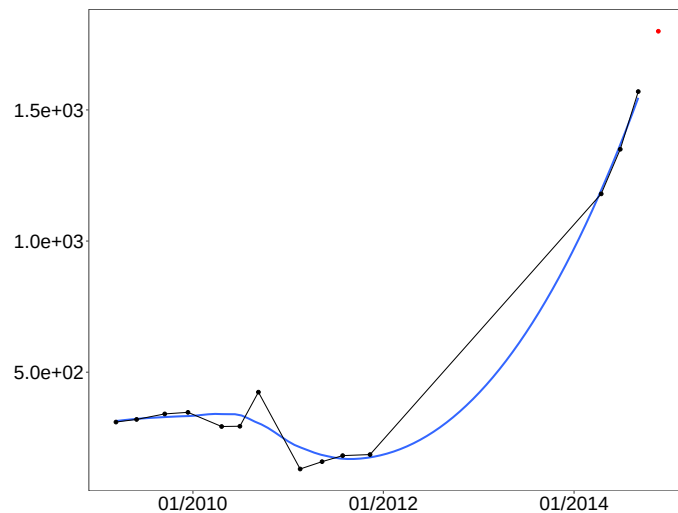
EC17 – Calcium
 $\tau = 0.174$ | p-value = 0.398 | No trend



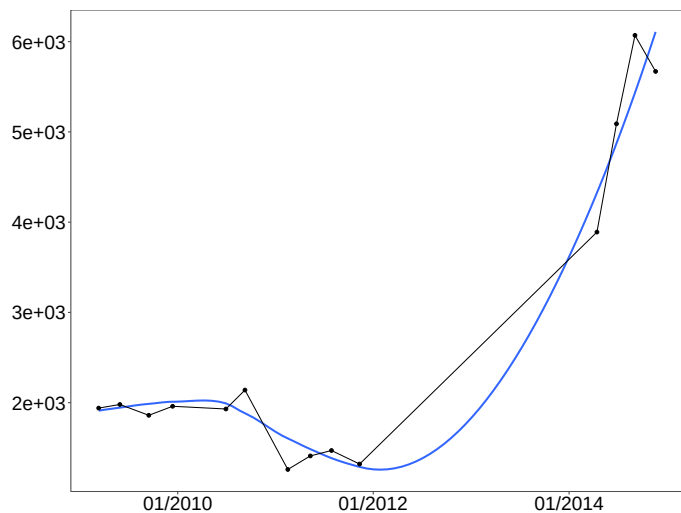
EC17 – Carbonate
 $\tau = -0.647$ | p-value = 0.005 | Negative trend



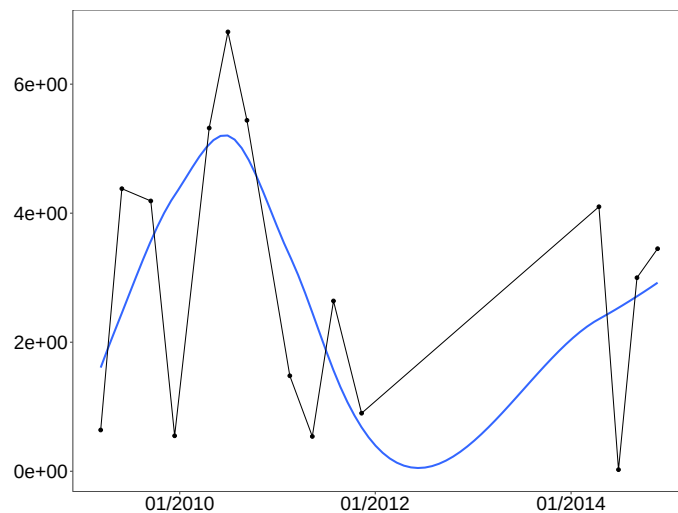
EC17 – Chloride
 $\tau = 0.314$ | p-value = 0.113 | No trend



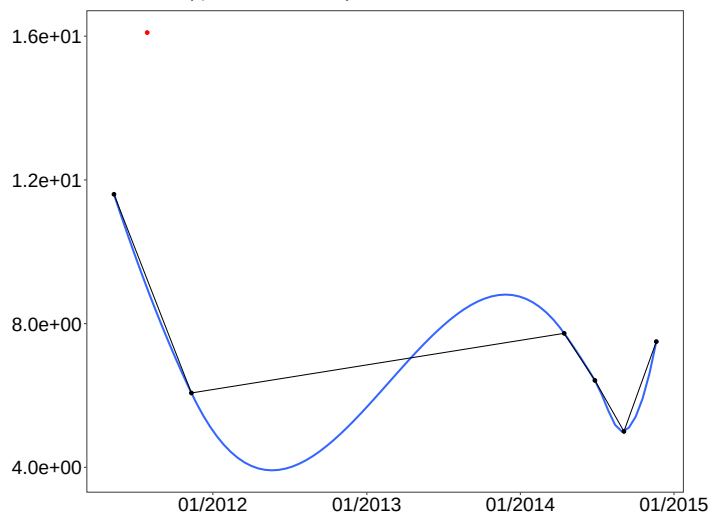
EC17 – Electrical Conductivity
 $\tau = 0.275$ | p-value = 0.189 | No trend



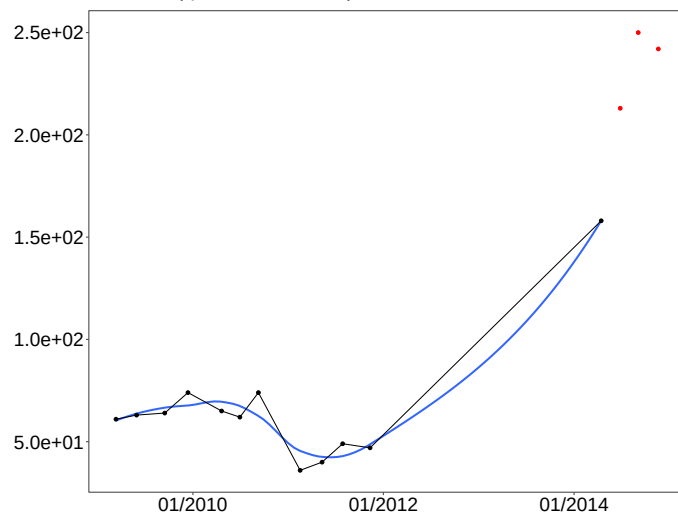
EC17 – Iron (d.)
 $\tau = -0.124$ | p-value = 0.553 | No trend



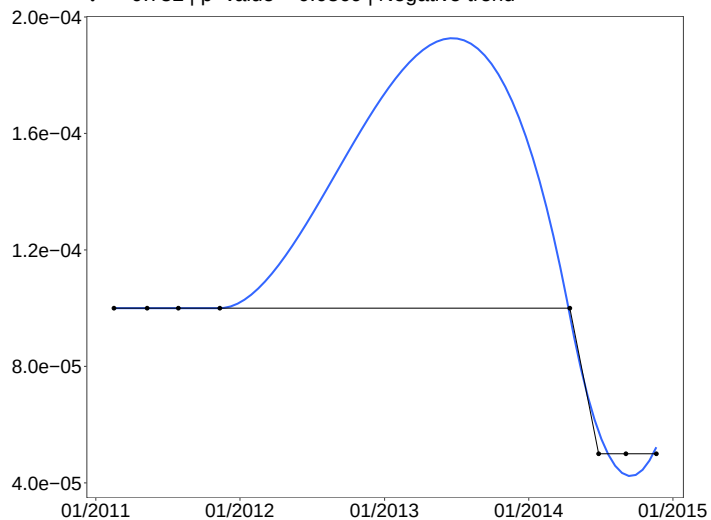
EC17 – Iron (t.)
 $\tau = -0.429$ | p-value = 0.23 | No trend



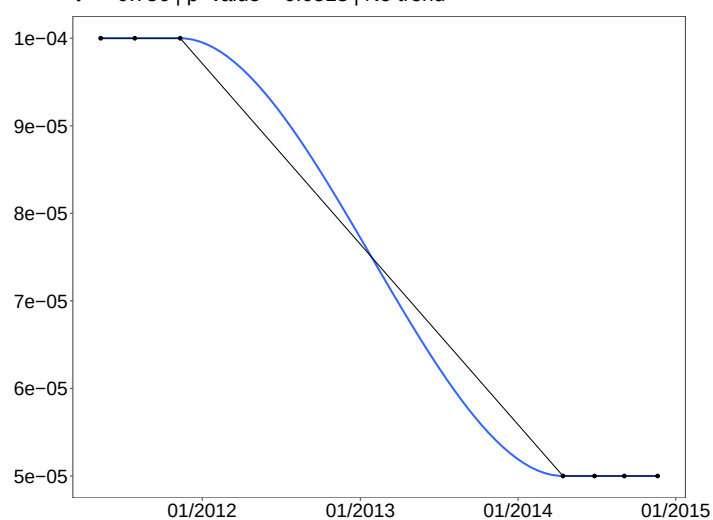
EC17 – Magnesium
 $\tau = 0.325$ | p-value = 0.102 | No trend



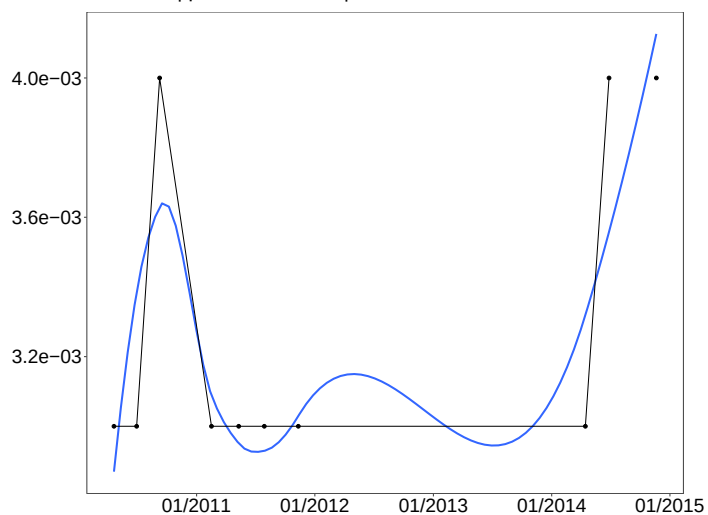
EC17 – Mercury (d.)
 $\tau = -0.732$ | p-value = 0.0369 | Negative trend



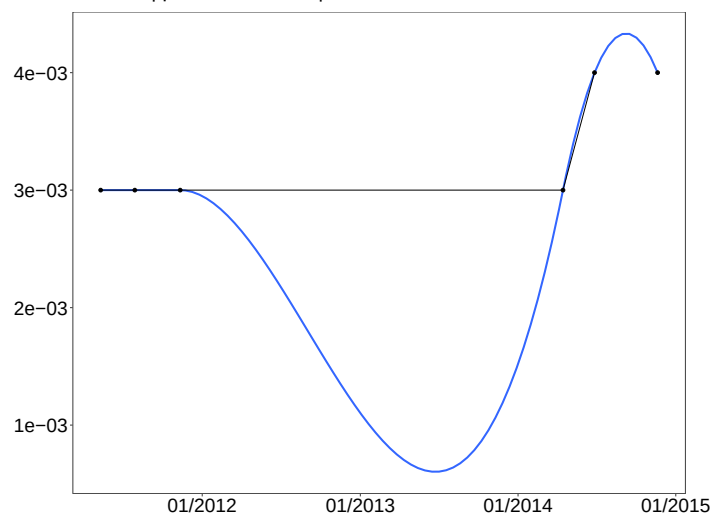
EC17 – Mercury (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



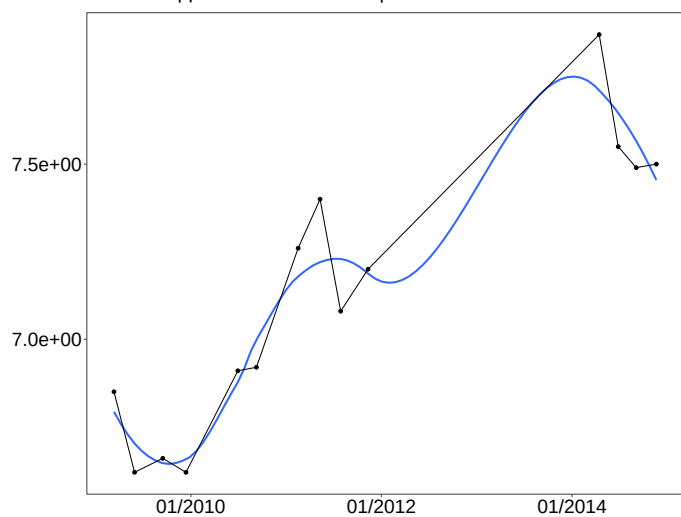
EC17 – Molybdenum (d.)
 $\tau = 0.358$ | p-value = 0.254 | No trend



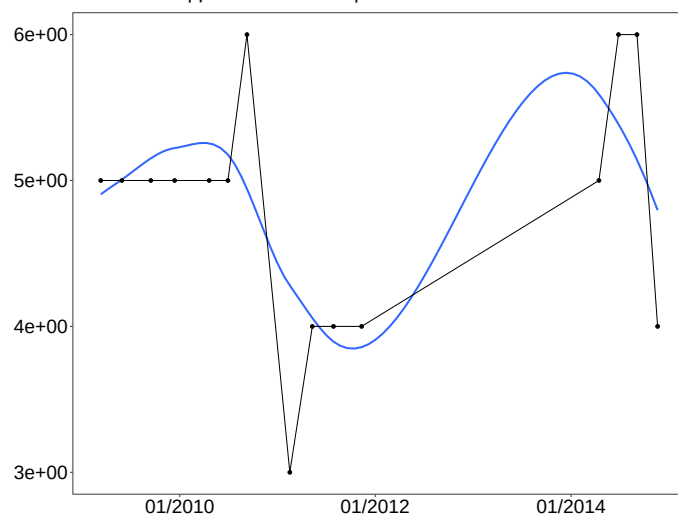
EC17 – Molybdenum (t.)
 $\tau = 0.73$ | p-value = 0.105 | No trend



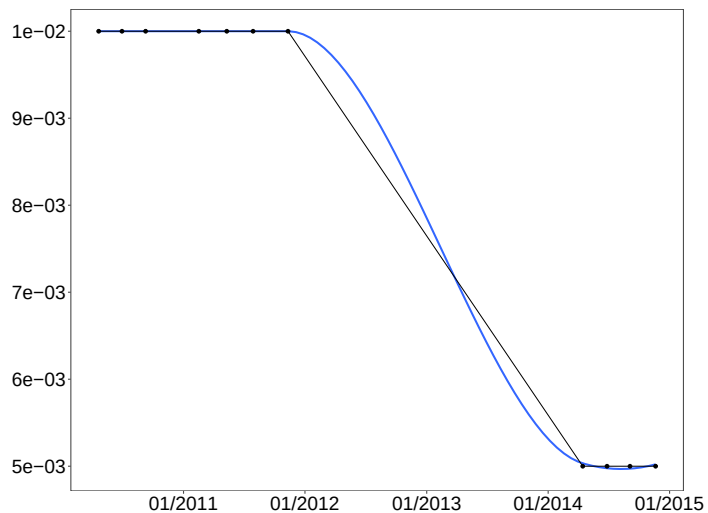
EC17 – pH
 $\tau = 0.707$ | p-value = 0.000552 | Positive trend



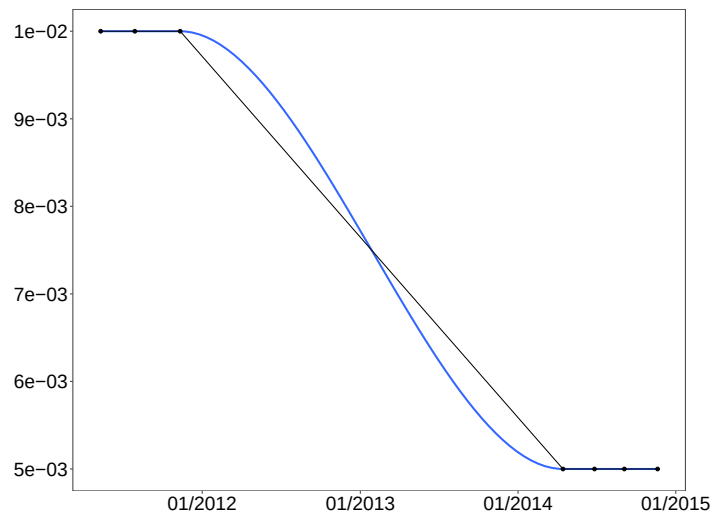
EC17 – Potassium
 $\tau = -0.0338$ | p-value = 0.915 | No trend



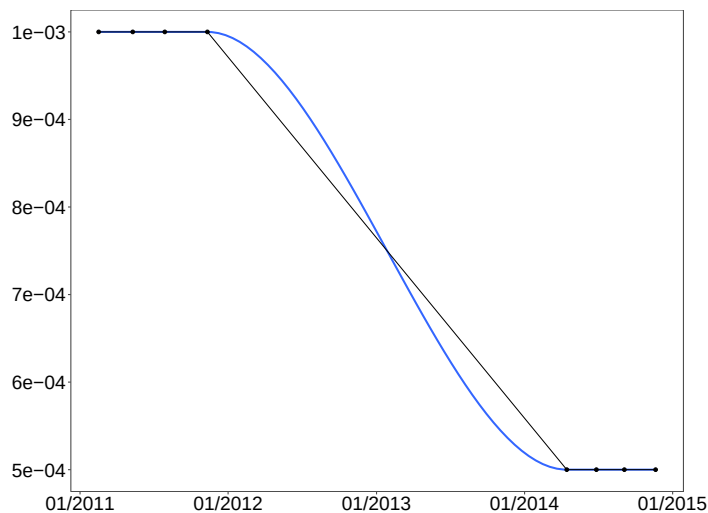
EC17 – Selenium (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



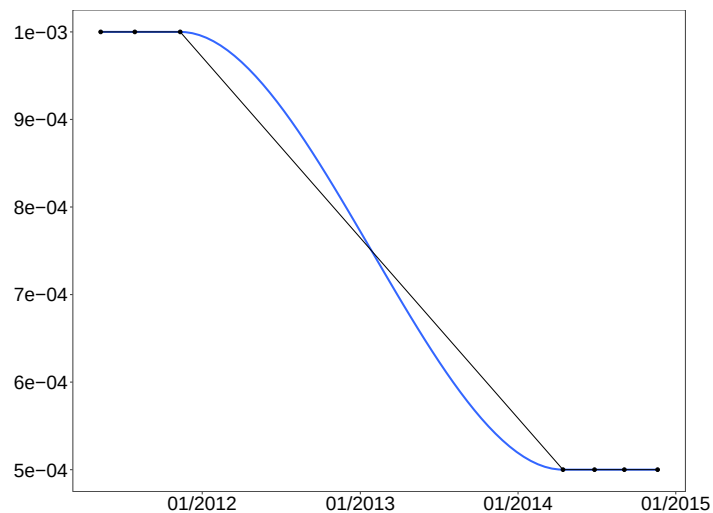
EC17 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



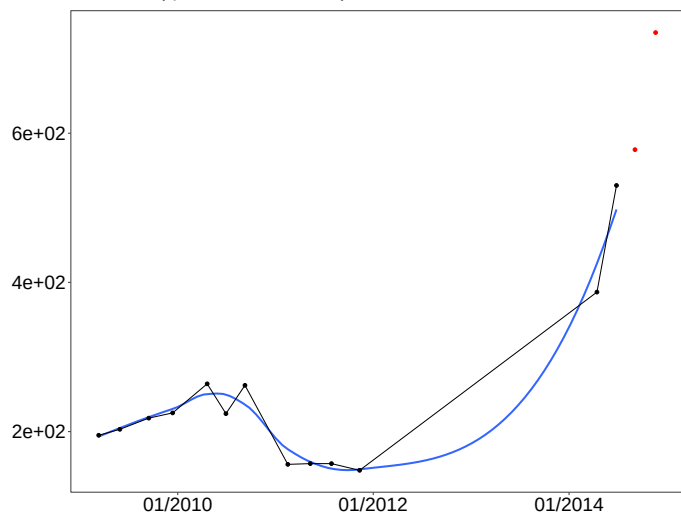
EC17 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



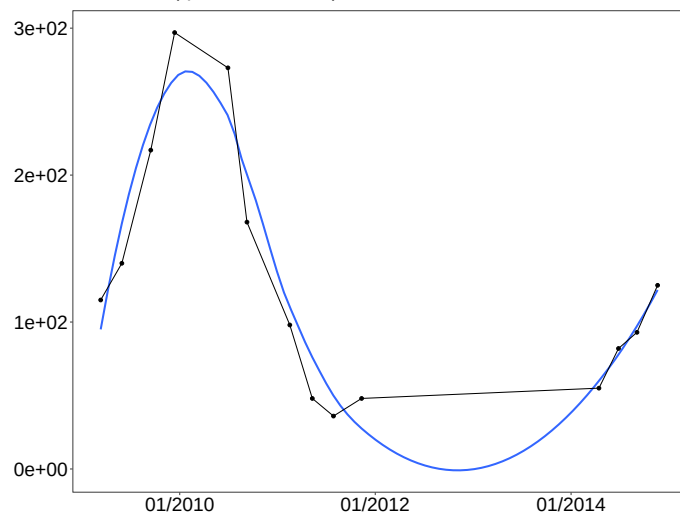
EC17 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



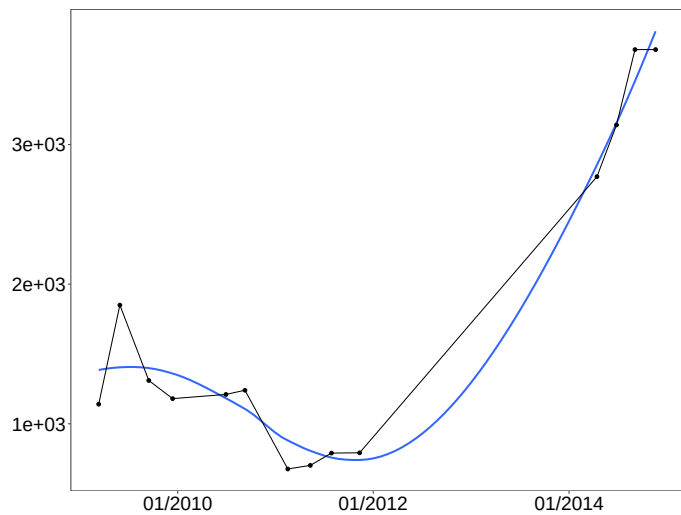
EC17 – Sodium
 $\tau = 0.345$ | p-value = 0.0829 | No trend



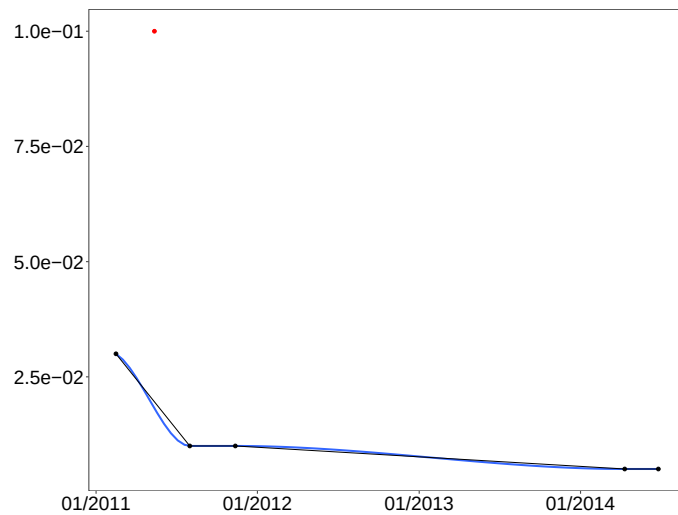
EC17 – Sulphate
 $\tau = -0.287$ | p-value = 0.17 | No trend



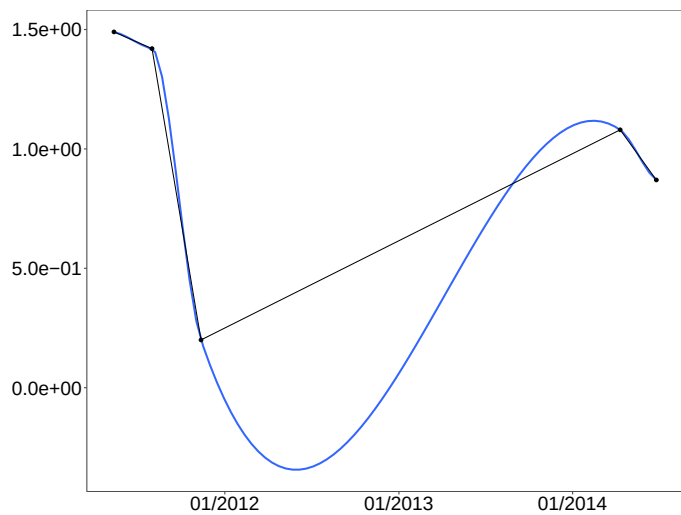
EC17 – TDS

 $\tau = 0.309$ | p-value = 0.139 | No trend

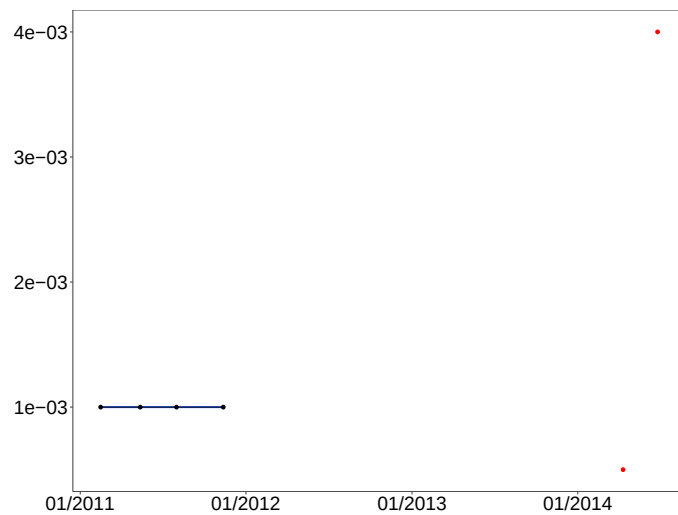
EC19 – Aluminium (d.)

 $\tau = -0.788$ | p-value = 0.0513 | No trend

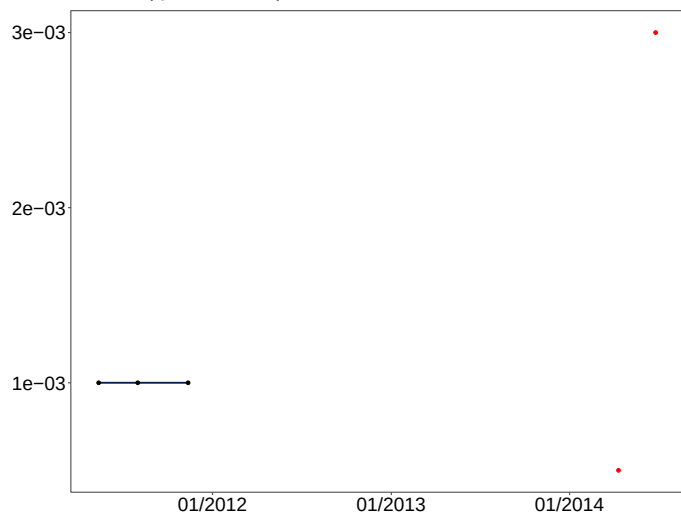
EC19 – Aluminium (t.)

 $\tau = -0.6$ | p-value = 0.221 | No trend

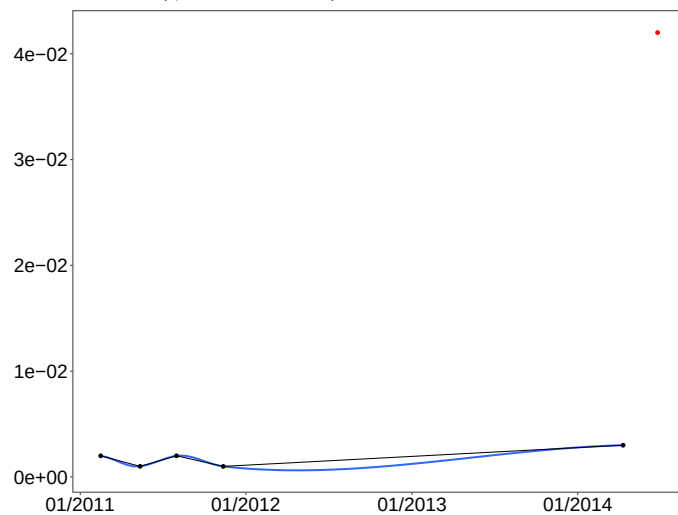
EC19 – Antimony (d.)

 $\tau = 0.0861$ | p-value = 1 | No trend

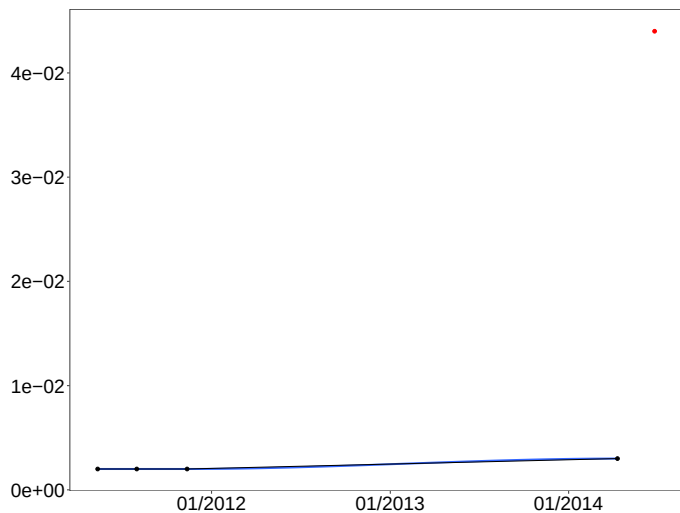
EC19 – Antimony (t.)

 $\tau = 0.12$ | p-value = 1 | No trend

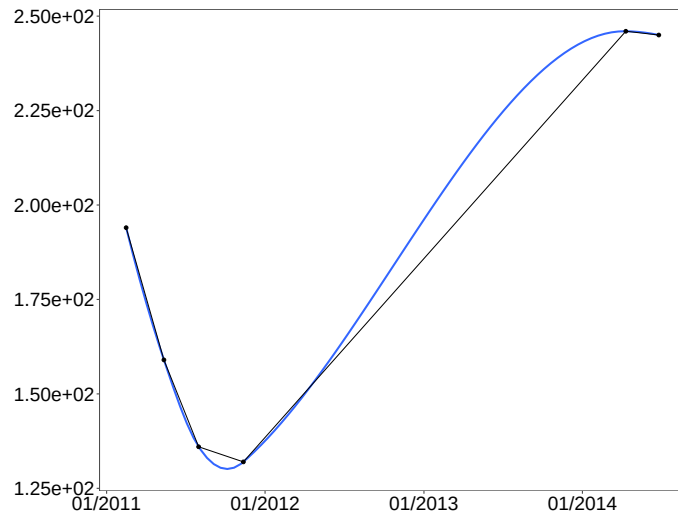
EC19 – Arsenic (d.)

 $\tau = 0.501$ | p-value = 0.242 | No trend

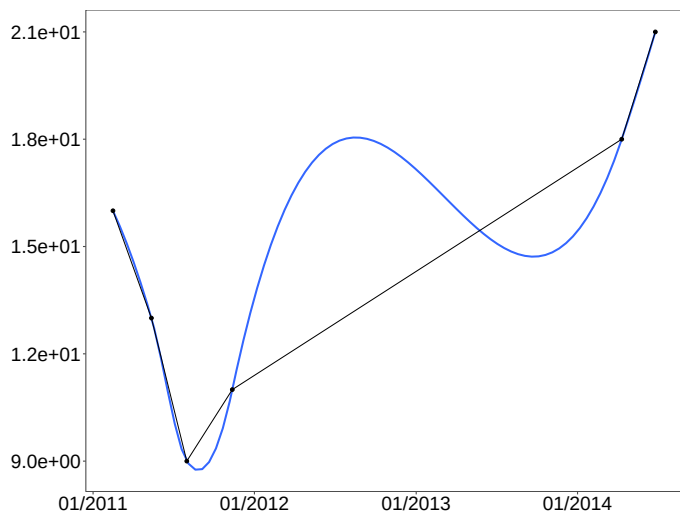
EC19 – Arsenic (t.)
 $\tau = 0.837$ | p-value = 0.0961 | No trend



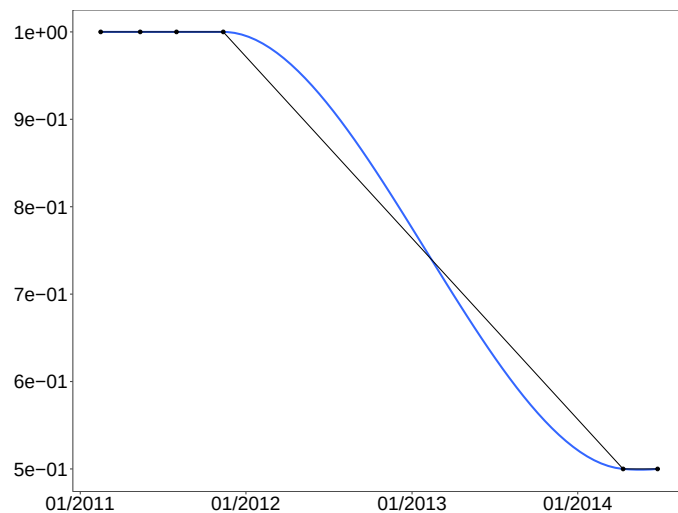
EC19 – Bicarbonate
 $\tau = 0.0667$ | p-value = 1 | No trend



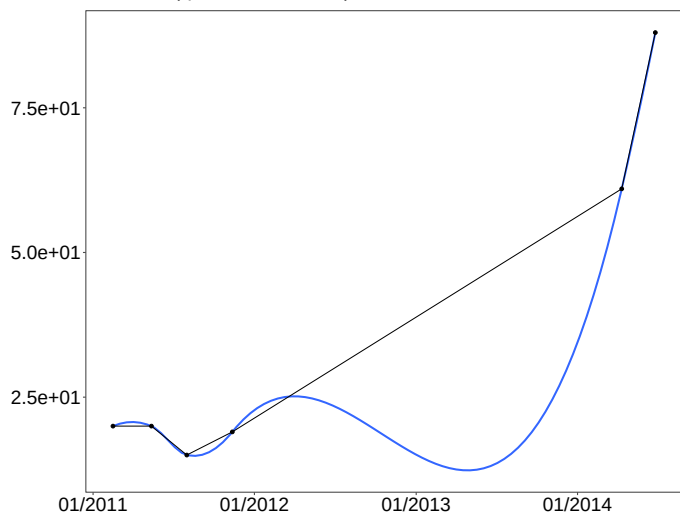
EC19 – Calcium
 $\tau = 0.333$ | p-value = 0.452 | No trend



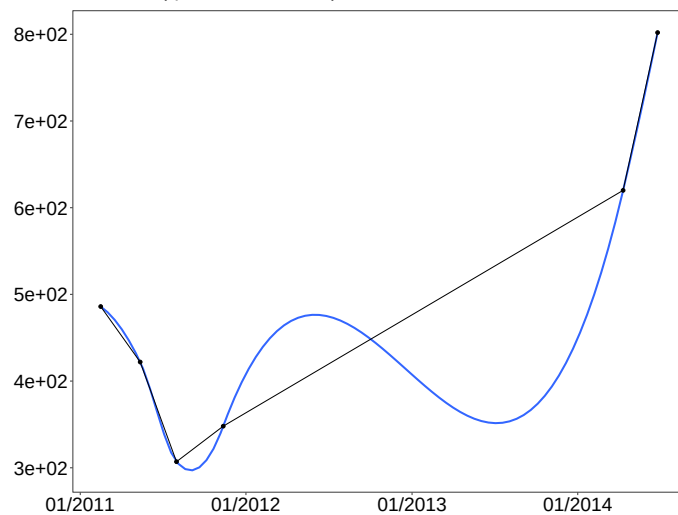
EC19 – Carbonate
 $\tau = -0.73$ | p-value = 0.105 | No trend



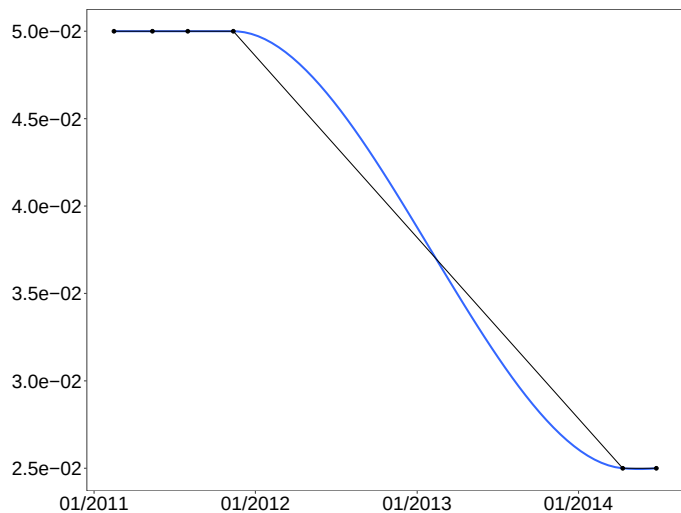
EC19 – Chloride
 $\tau = 0.414$ | p-value = 0.339 | No trend



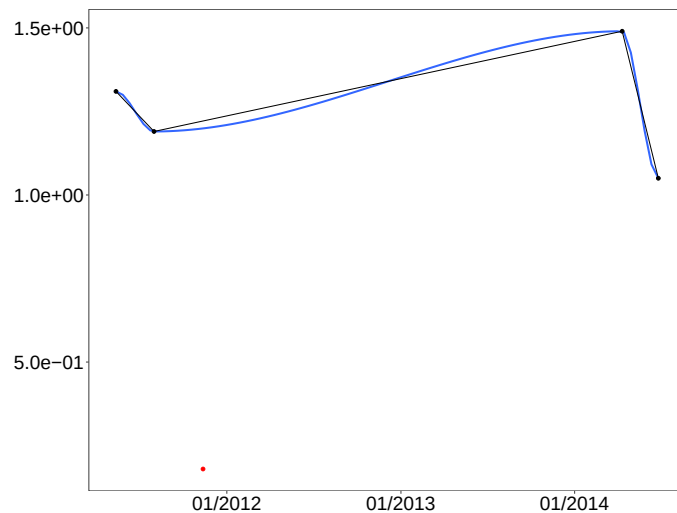
EC19 – Electrical Conductivity
 $\tau = 0.333$ | p-value = 0.452 | No trend



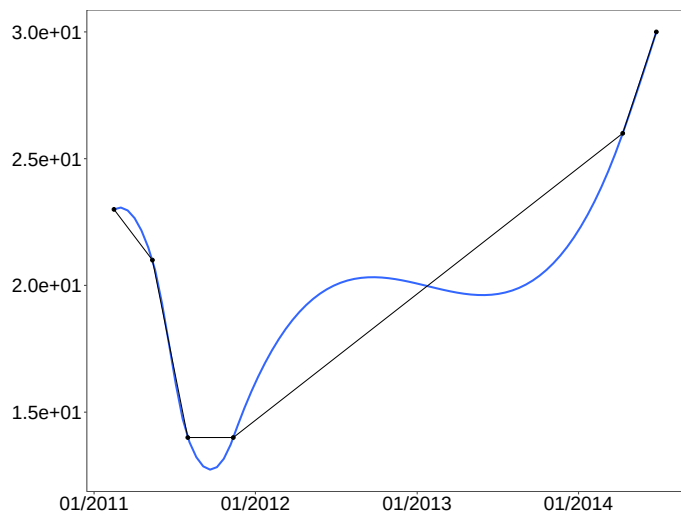
EC19 – Iron (d.)
 $\tau = -0.73$ | p-value = 0.105 | No trend



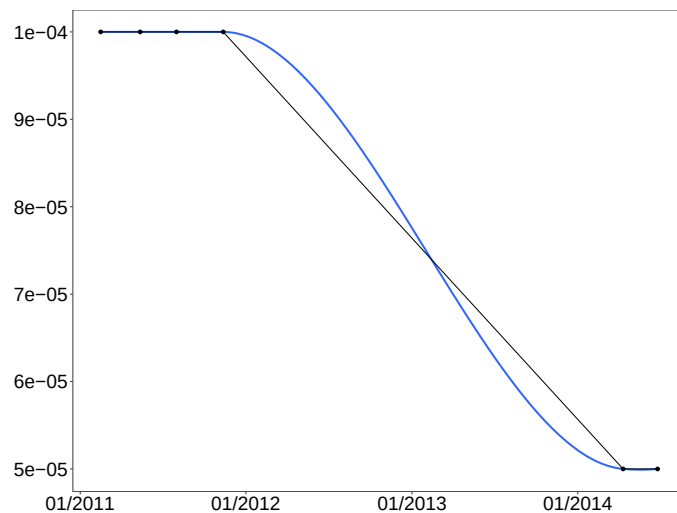
EC19 – Iron (t.)
 $\tau = -0.2$ | p-value = 0.806 | No trend



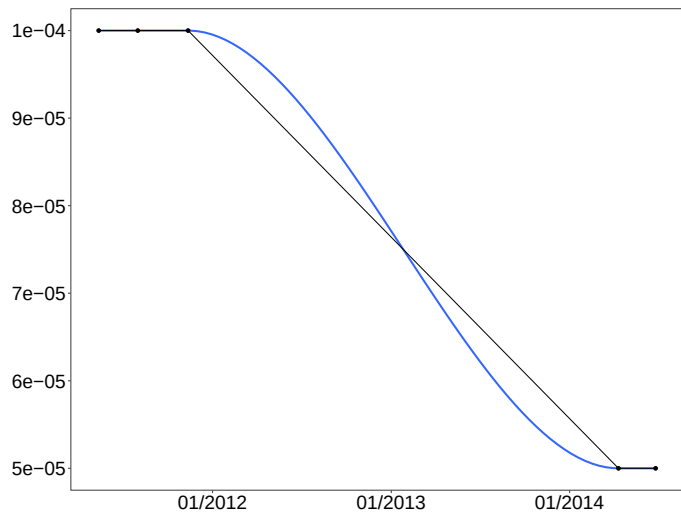
EC19 – Magnesium
 $\tau = 0.276$ | p-value = 0.566 | No trend



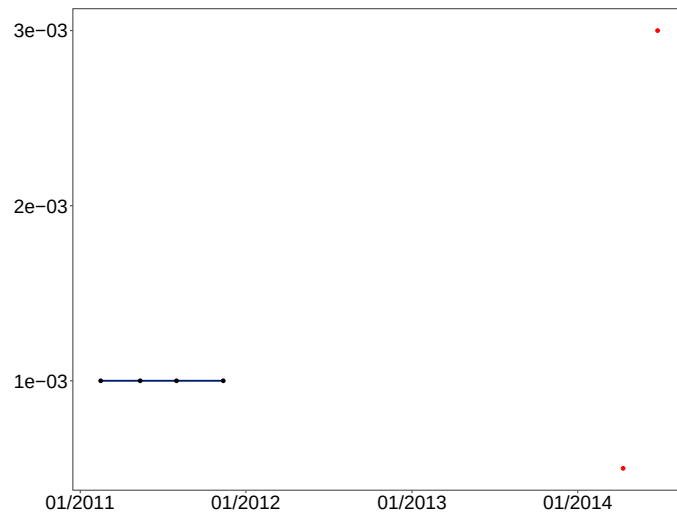
EC19 – Mercury (d.)
 $\tau = -0.73$ | p-value = 0.105 | No trend



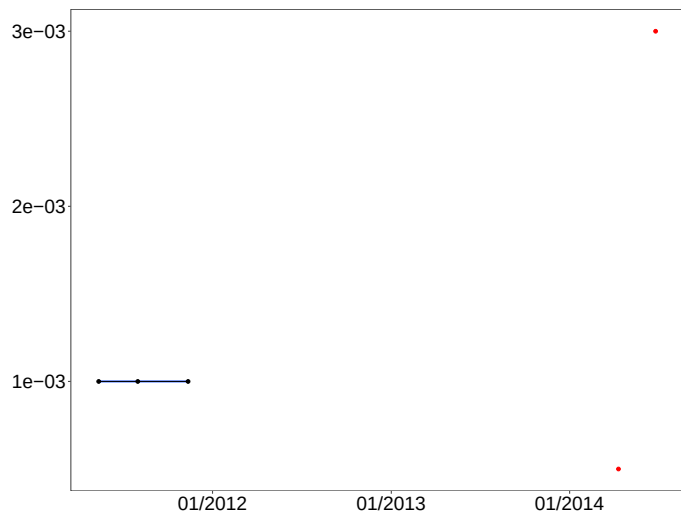
EC19 – Mercury (t.)
 $\tau = -0.775$ | p-value = 0.149 | No trend



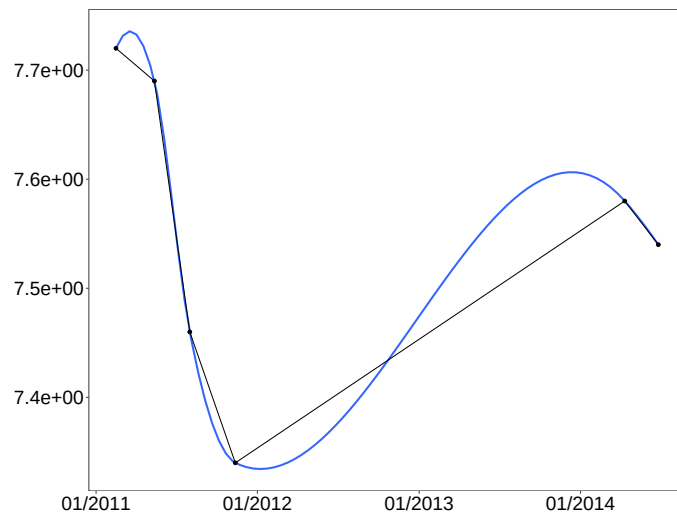
EC19 – Molybdenum (d.)
 $\tau = 0.0861$ | p-value = 1 | No trend



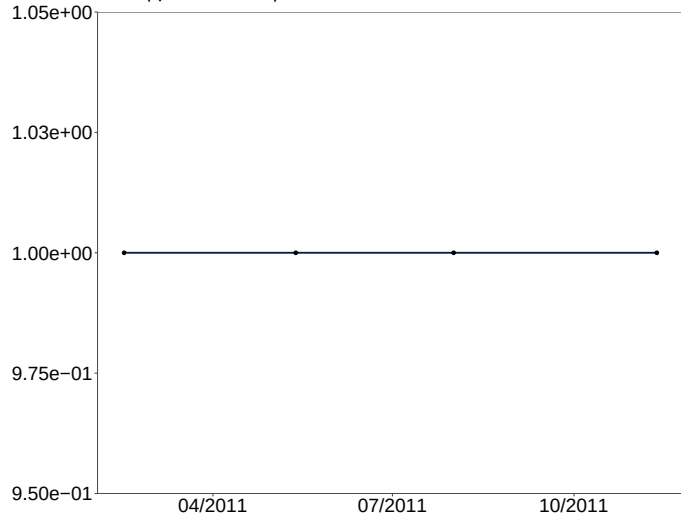
EC19 – Molybdenum (t.)
 $\tau = 0.12$ | p-value = 1 | No trend



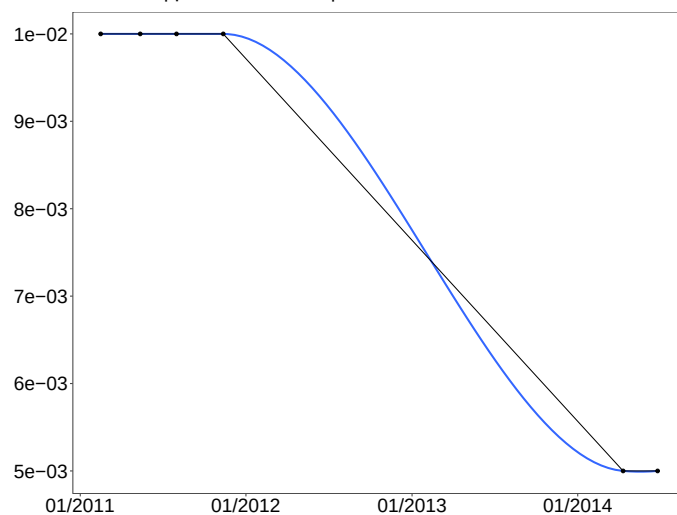
EC19 – pH
 $\tau = -0.467$ | p-value = 0.26 | No trend



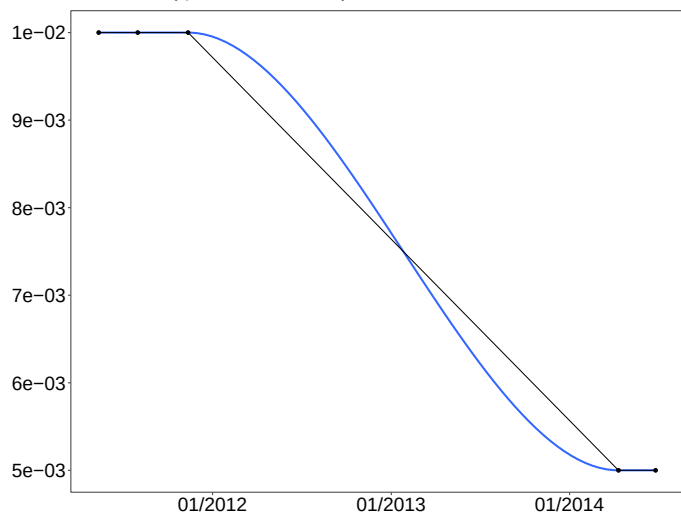
EC19 – Potassium
 $\tau = 1$ | p-value = 1 | No trend



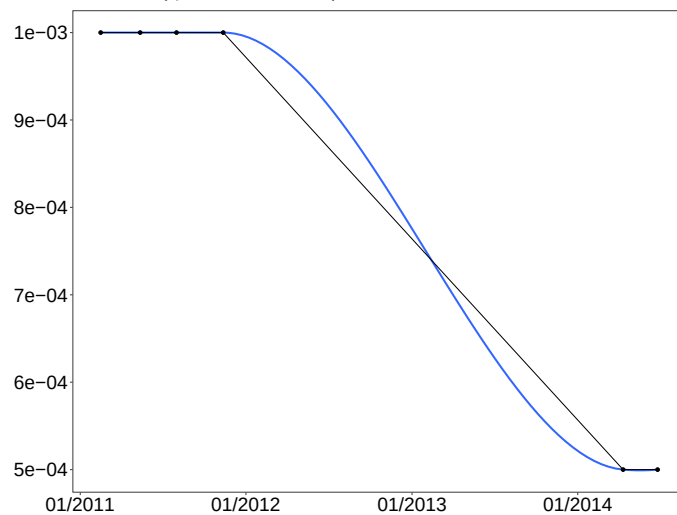
EC19 – Selenium (d.)
 $\tau = -0.73$ | p-value = 0.105 | No trend



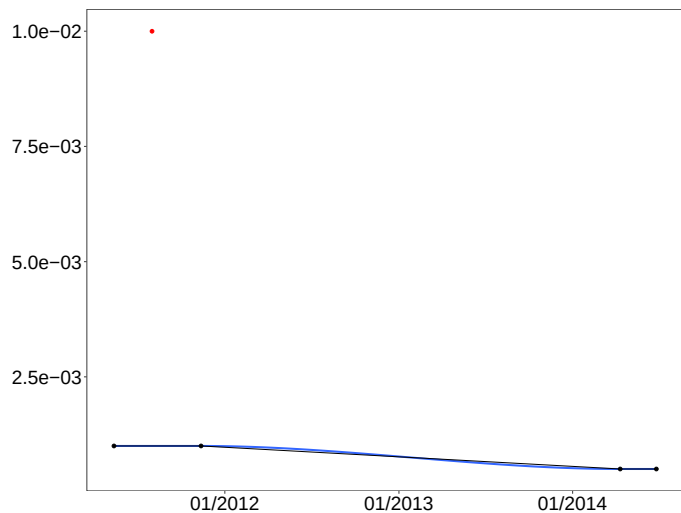
EC19 – Selenium (t.)
 $\tau = -0.775$ | p-value = 0.149 | No trend



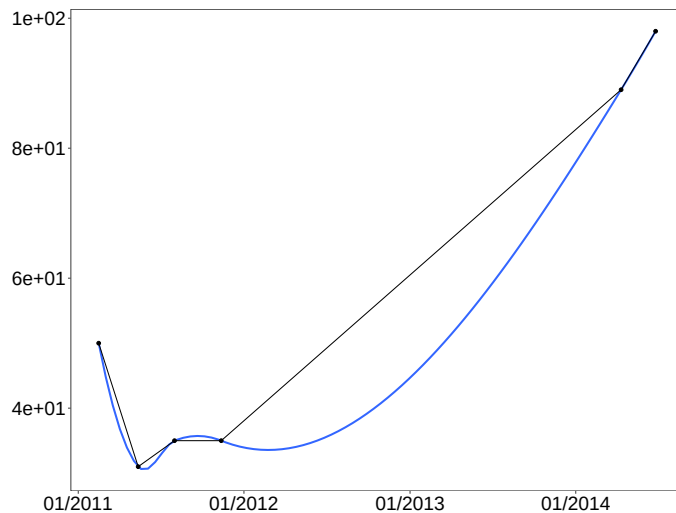
EC19 – Silver (d.)
 $\tau = -0.73$ | p-value = 0.105 | No trend



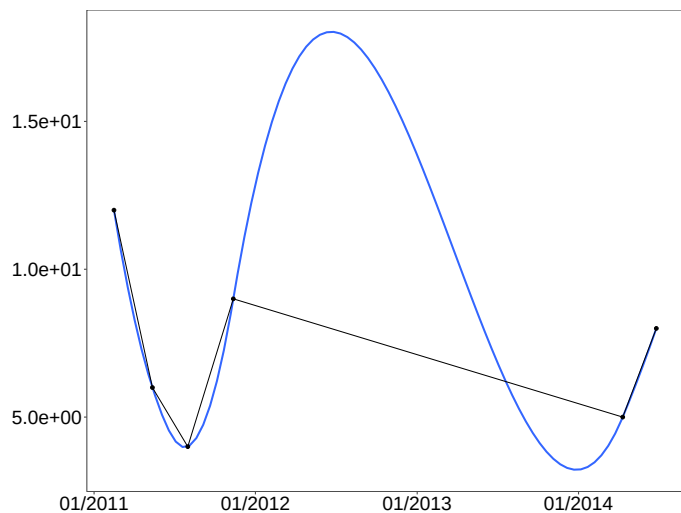
EC19 – Silver (t.)

 $\tau = -0.671$ | p-value = 0.192 | No trend

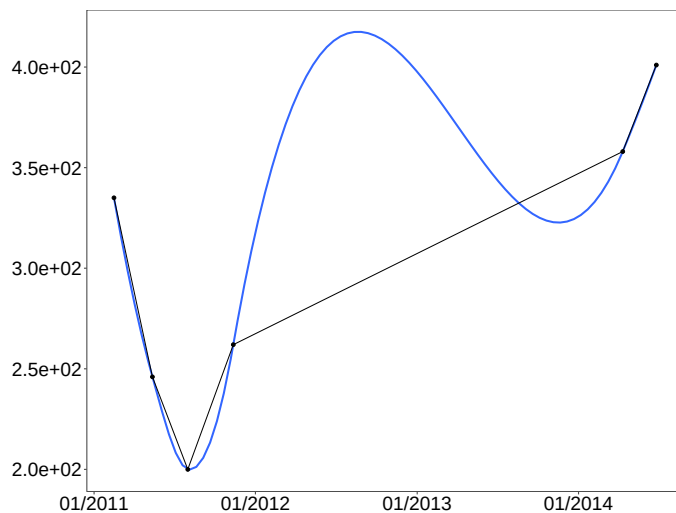
EC19 – Sodium

 $\tau = 0.552$ | p-value = 0.181 | No trend

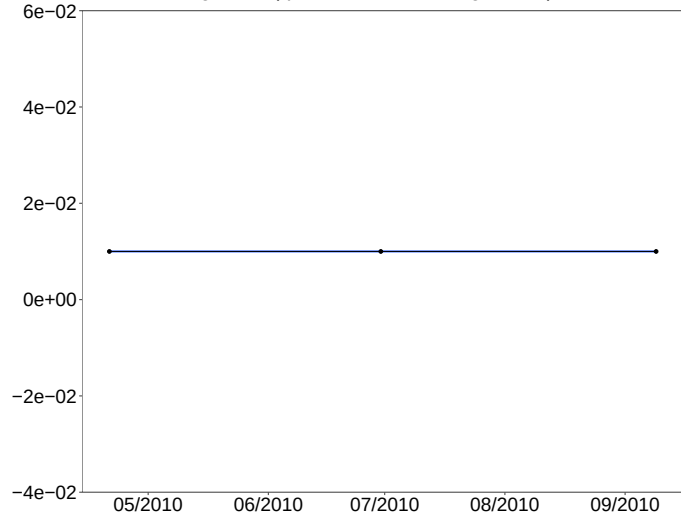
EC19 – Sulphate

 $\tau = -0.2$ | p-value = 0.707 | No trend

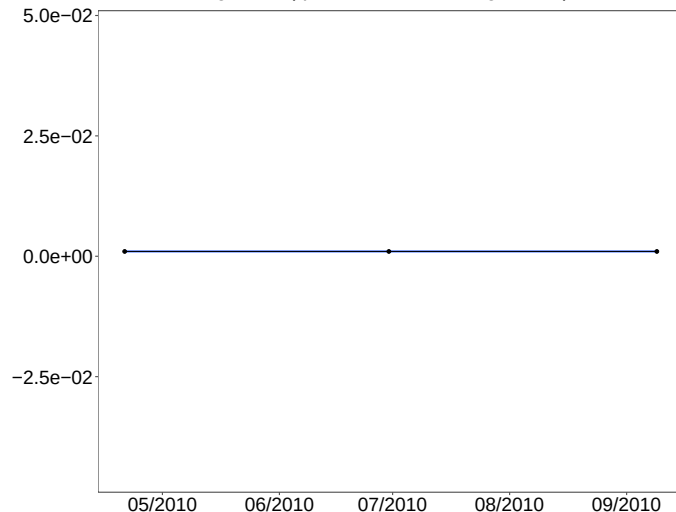
EC19 – TDS

 $\tau = 0.467$ | p-value = 0.26 | No trend

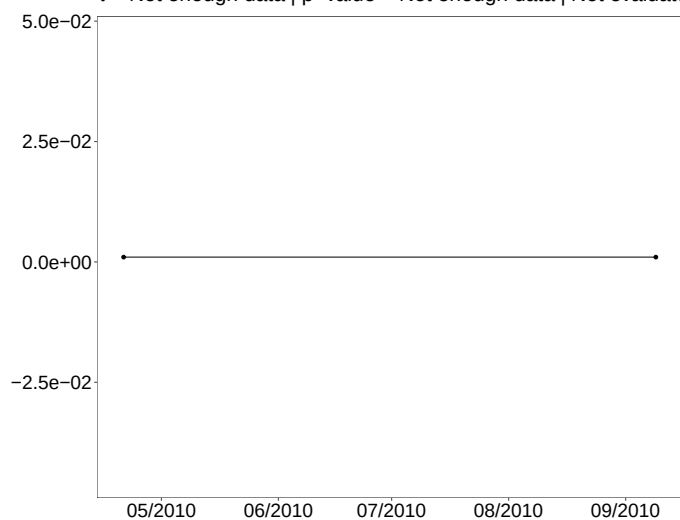
EC20 – Aluminium (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

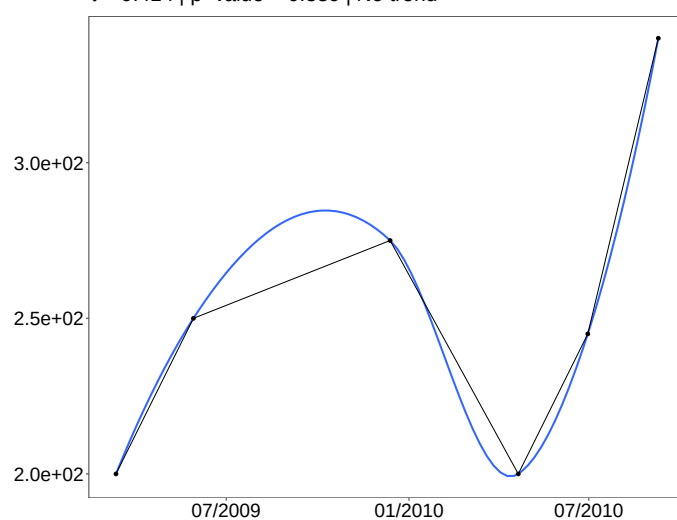
EC20 – Antimony (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

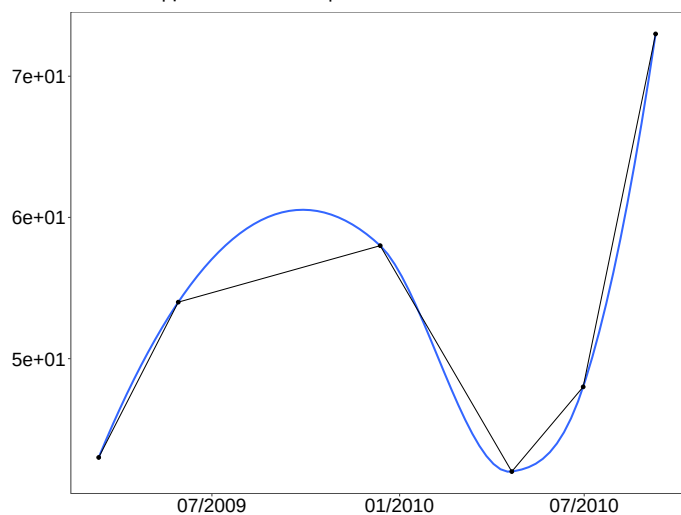
EC20 – Arsenic (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

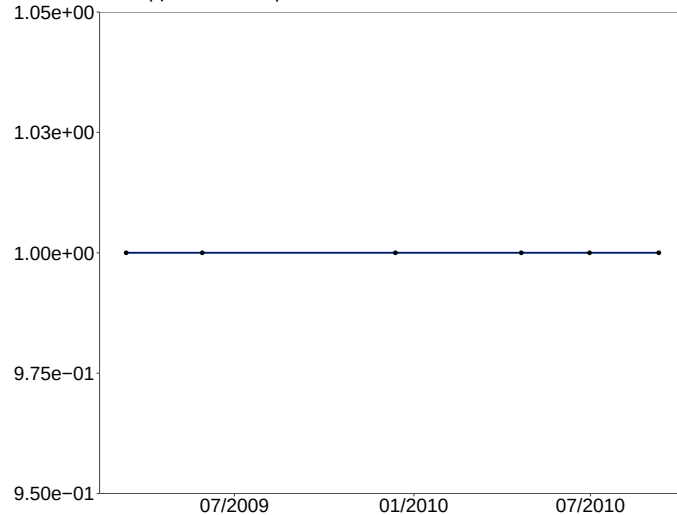
EC20 – Bicarbonate

 τ = 0.414 | p-value = 0.339 | No trend

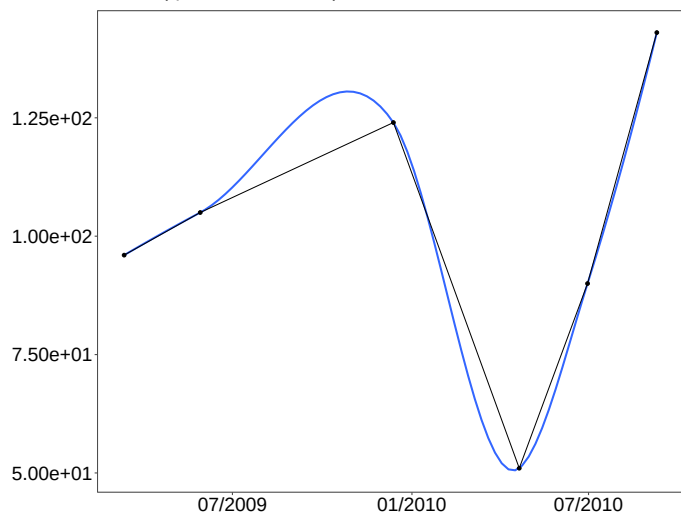
EC20 – Calcium

 τ = 0.333 | p-value = 0.452 | No trend

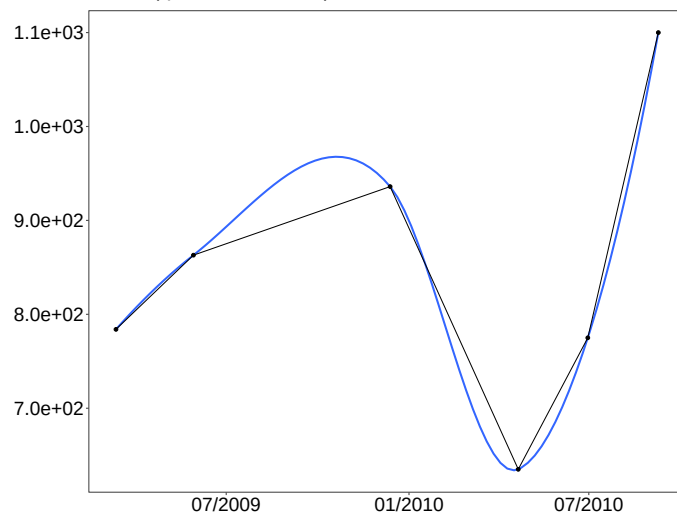
EC20 – Carbonate

 τ = 1 | p-value = 1 | No trend

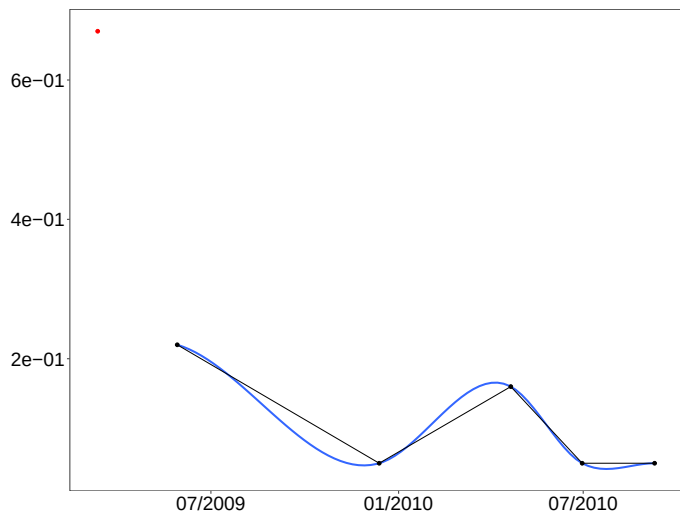
EC20 – Chloride

 τ = 0.2 | p-value = 0.707 | No trend

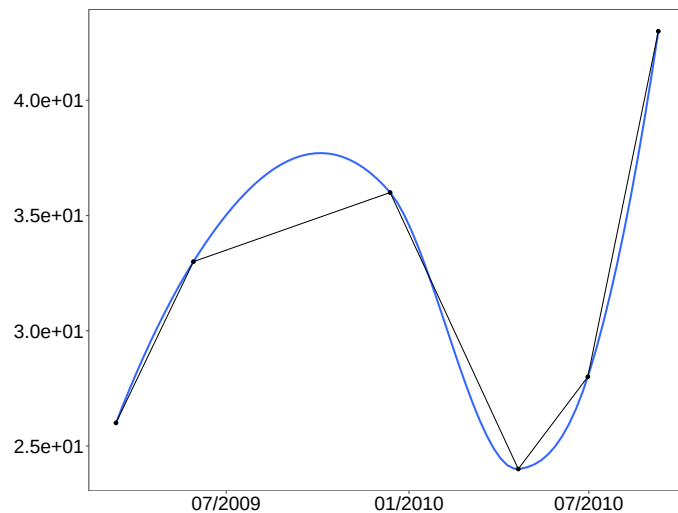
EC20 – Electrical Conductivity

 τ = 0.2 | p-value = 0.707 | No trend

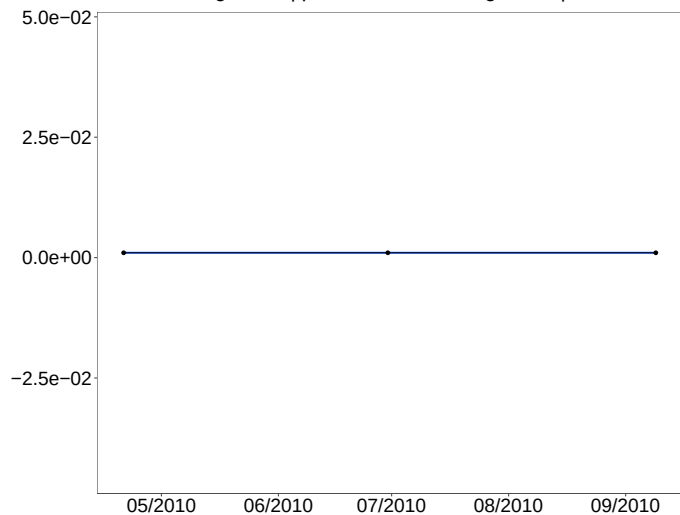
EC20 – Iron (d.)

 $\tau = -0.745$ | p-value = 0.07 | No trend

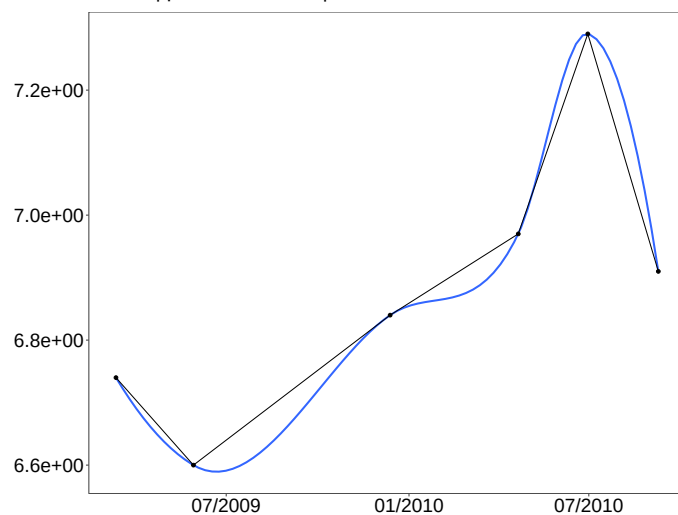
EC20 – Magnesium

 $\tau = 0.333$ | p-value = 0.452 | No trend

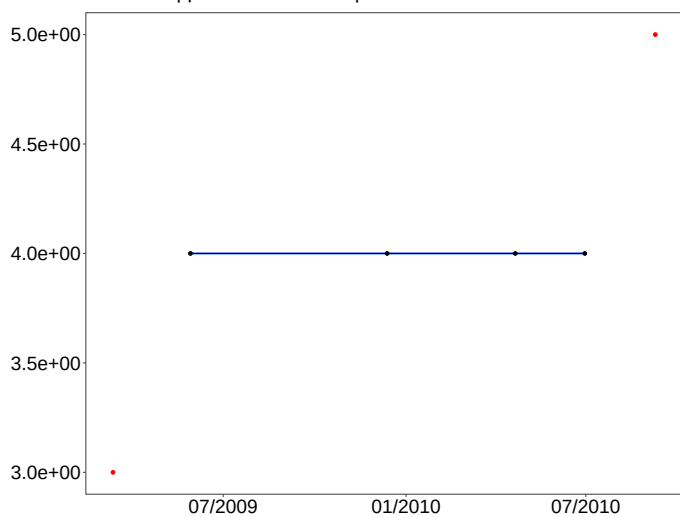
EC20 – Molybdenum (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

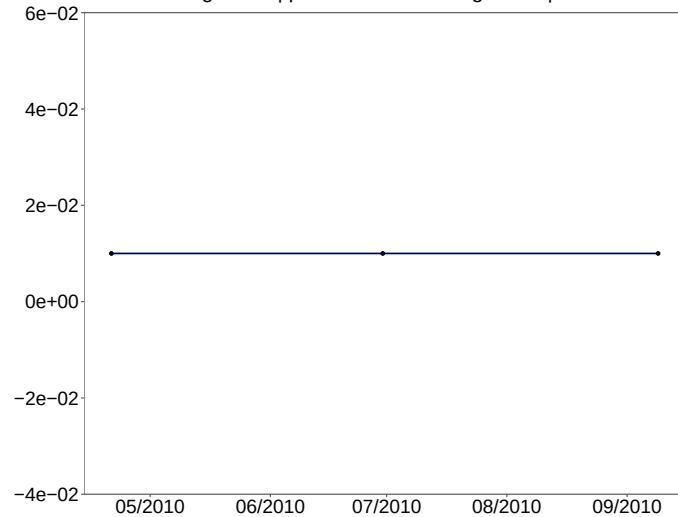
EC20 – pH

 $\tau = 0.6$ | p-value = 0.133 | No trend

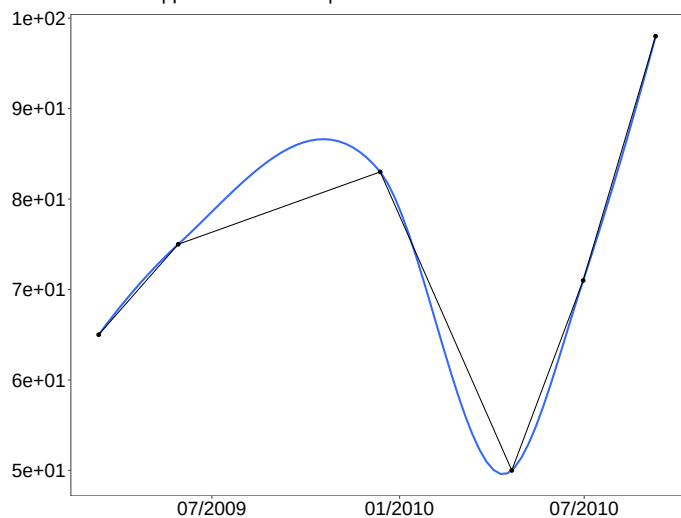
EC20 – Potassium

 $\tau = 0.775$ | p-value = 0.0712 | No trend

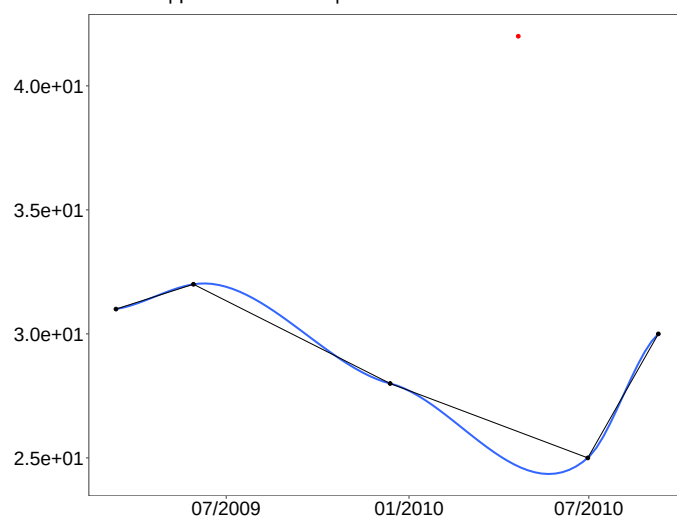
EC20 – Selenium (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

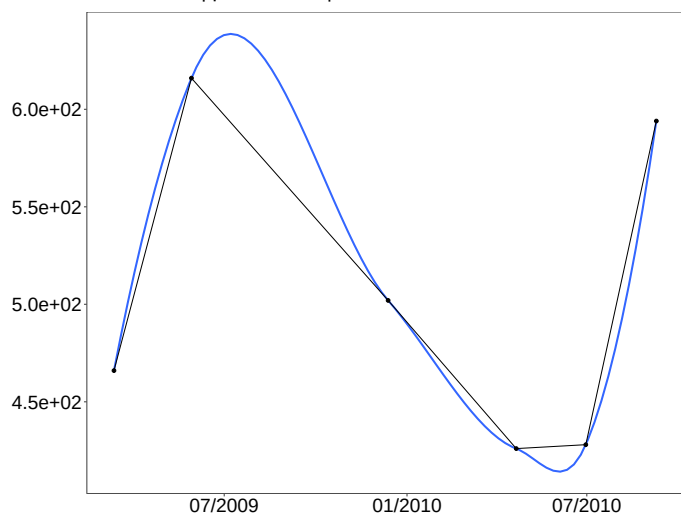
EC20 – Sodium
 $\tau = 0.333$ | p-value = 0.452 | No trend



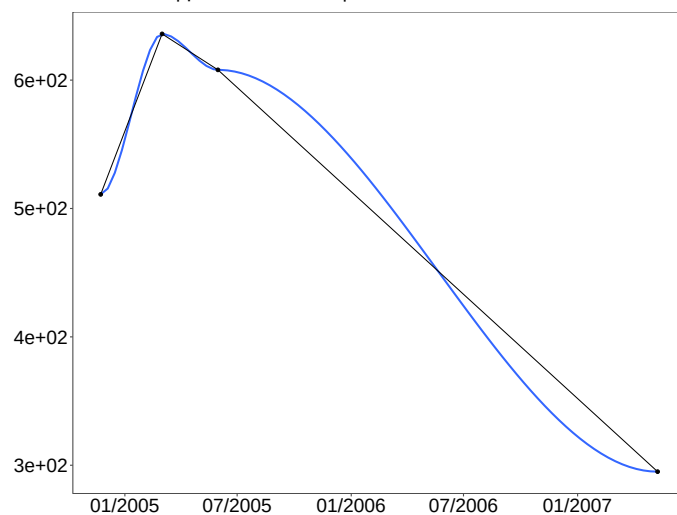
EC20 – Sulphate
 $\tau = -0.2$ | p-value = 0.707 | No trend



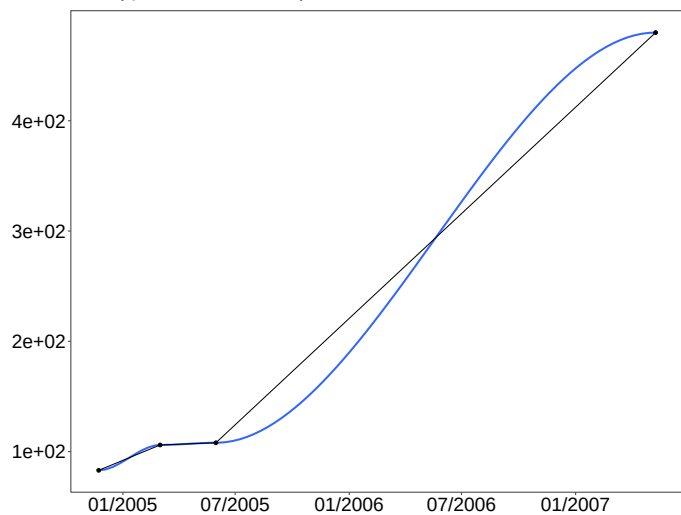
EC20 – TDS
 $\tau = -0.0667$ | p-value = 1 | No trend



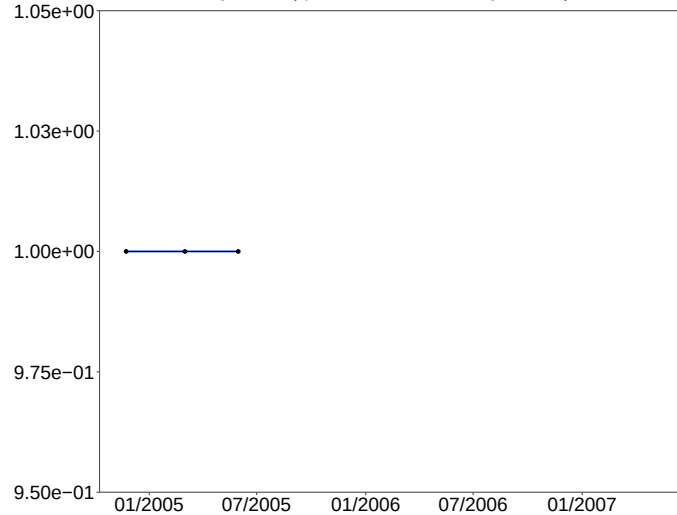
EC21 – Bicarbonate
 $\tau = -0.333$ | p-value = 0.734 | No trend



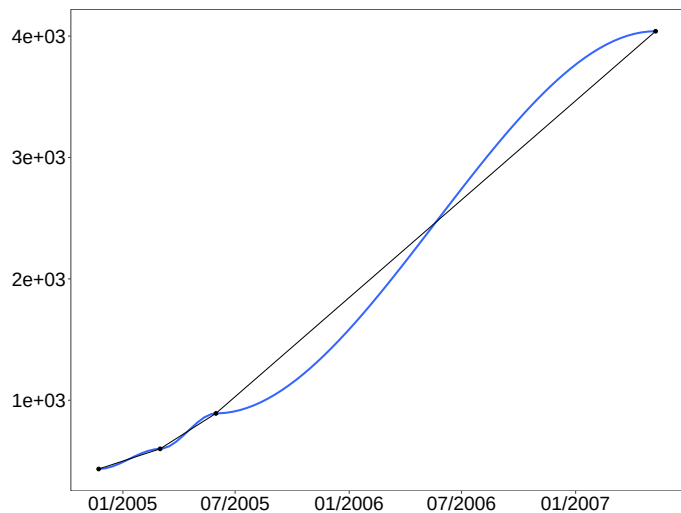
EC21 – Calcium
 $\tau = 1$ | p-value = 0.0894 | No trend



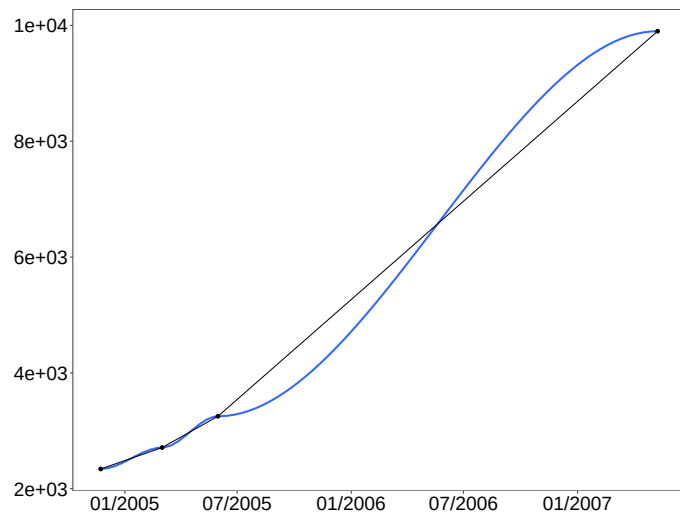
EC21 – Carbonate
 $\tau = \text{Not enough data}$ | p-value = Not enough data | Not evaluated



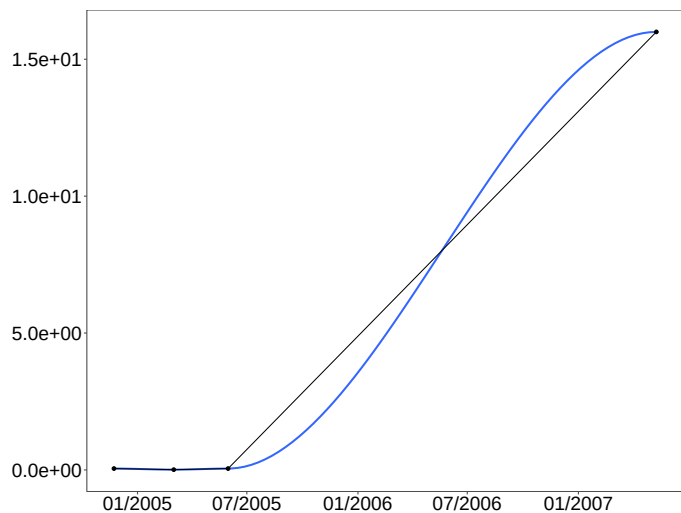
EC21 – Chloride
 $\tau = 1$ | p-value = 0.0894 | No trend



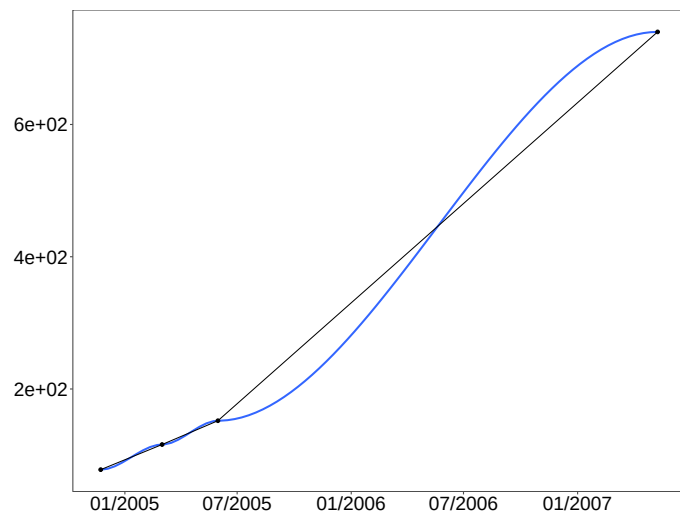
EC21 – Electrical Conductivity
 $\tau = 1$ | p-value = 0.0894 | No trend



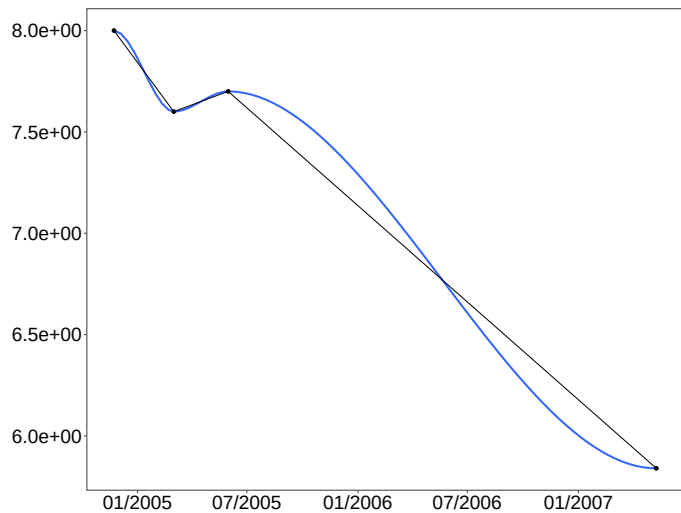
EC21 – Iron (d.)
 $\tau = 0.548$ | p-value = 0.47 | No trend



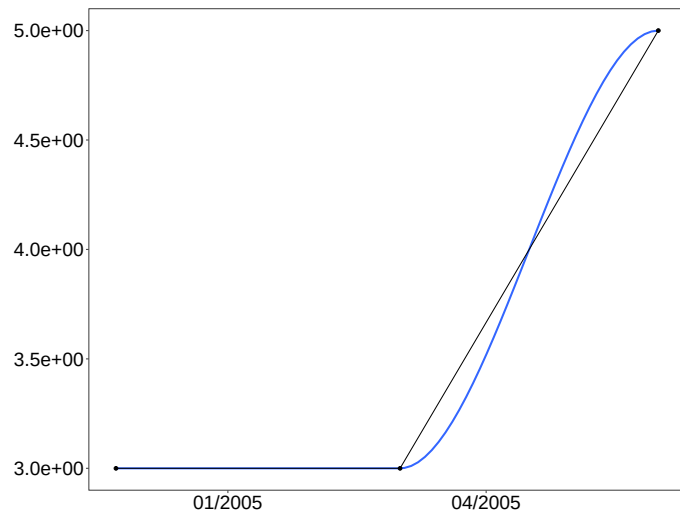
EC21 – Magnesium
 $\tau = 1$ | p-value = 0.0894 | No trend



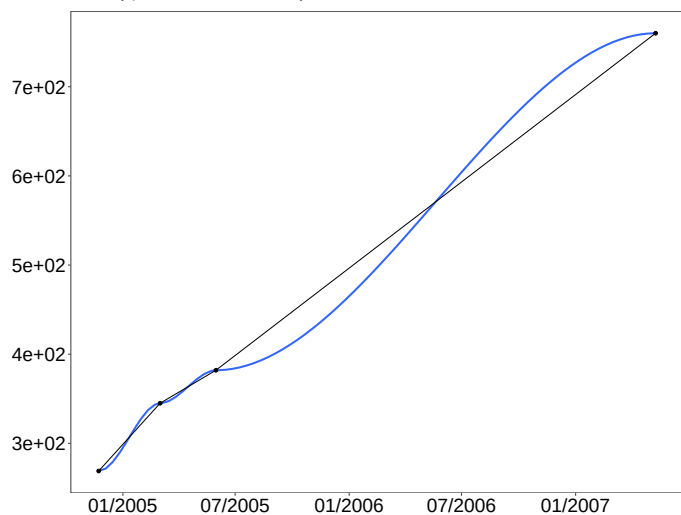
EC21 – pH
 $\tau = -0.667$ | p-value = 0.308 | No trend



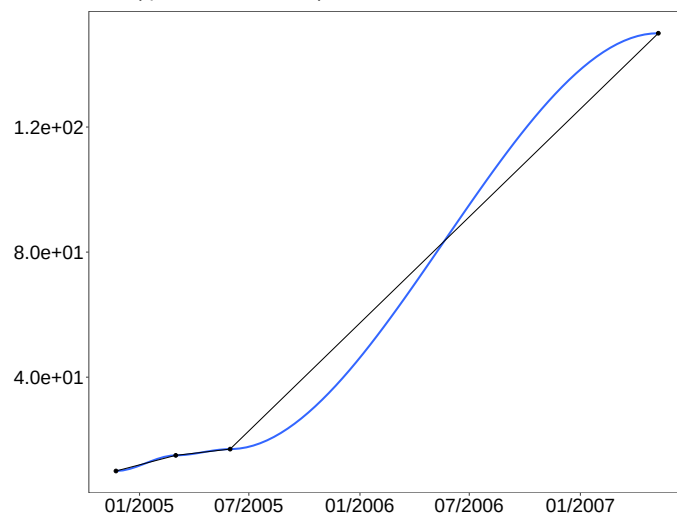
EC21 – Potassium
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



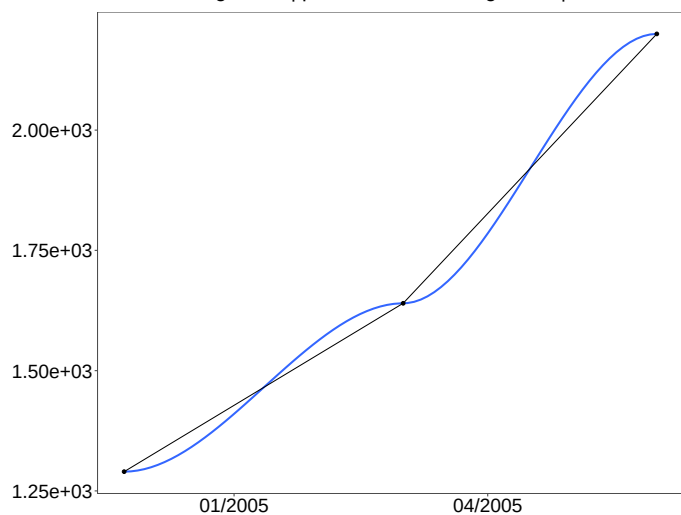
EC21 – Sodium
 $\tau = 1$ | p-value = 0.0894 | No trend



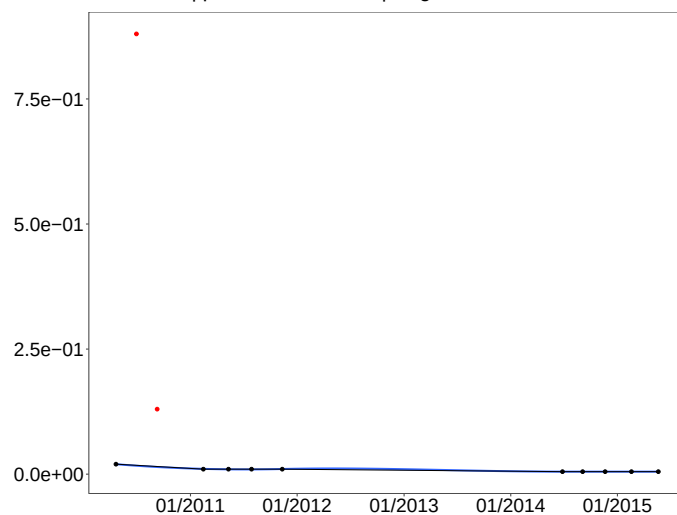
EC21 – Sulphate
 $\tau = 1$ | p-value = 0.0894 | No trend



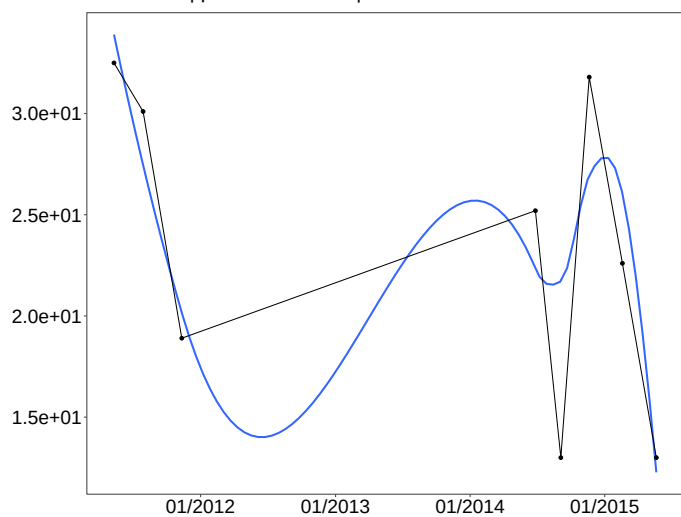
EC21 – TDS
 τ = Not enough data | p-value = Not enough data | Not evaluated



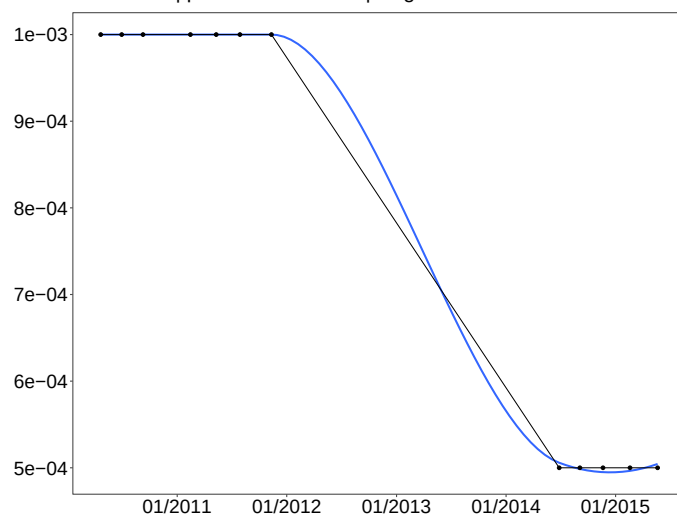
EC22 – Aluminium (d.)
 $\tau = -0.801$ | p-value = 0.00101 | Negative trend



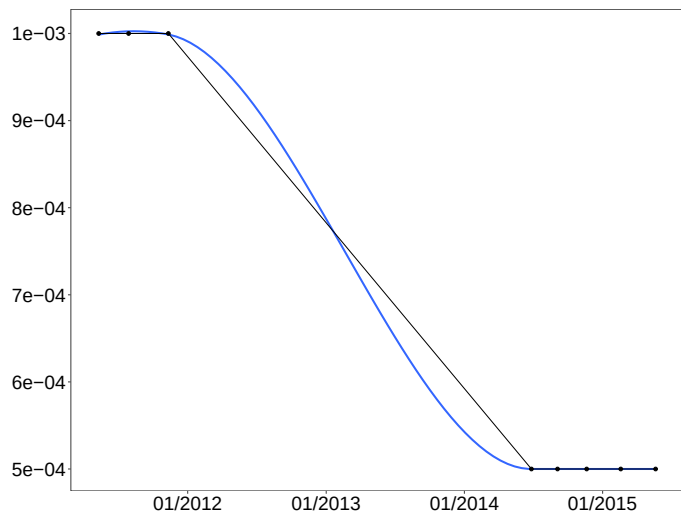
EC22 – Aluminium (t.)
 $\tau = -0.473$ | p-value = 0.135 | No trend



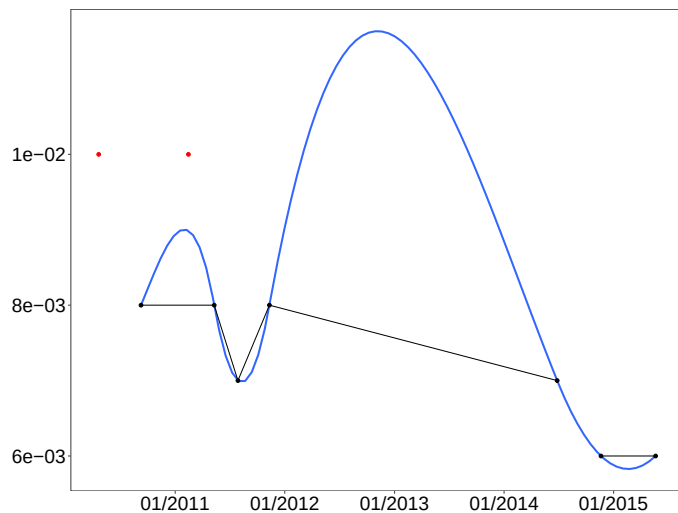
EC22 – Antimony (d.)
 $\tau = -0.728$ | p-value = 0.00577 | Negative trend



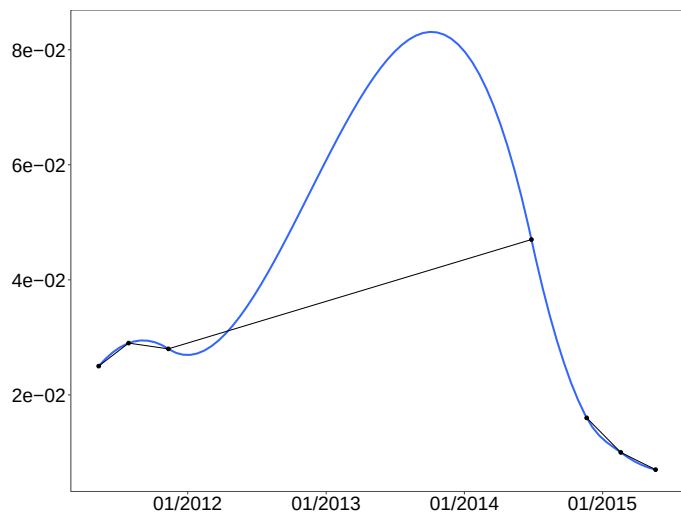
EC22 – Antimony (t.)
 $\tau = -0.732$ | p-value = 0.0369 | Negative trend



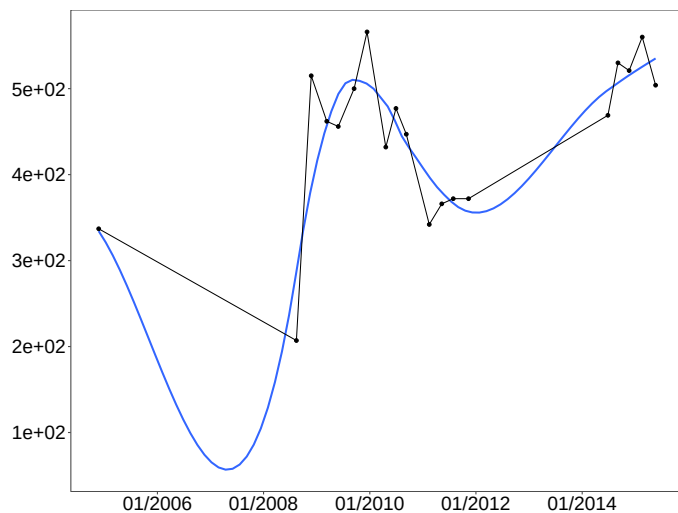
EC22 – Arsenic (d.)
 $\tau = -0.791$ | p-value = 0.0068 | Negative trend



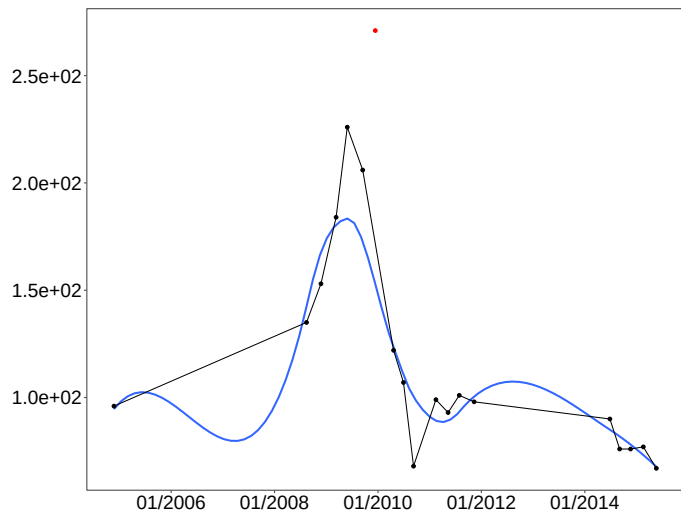
EC22 – Arsenic (t.)
 $\tau = -0.524$ | p-value = 0.133 | No trend



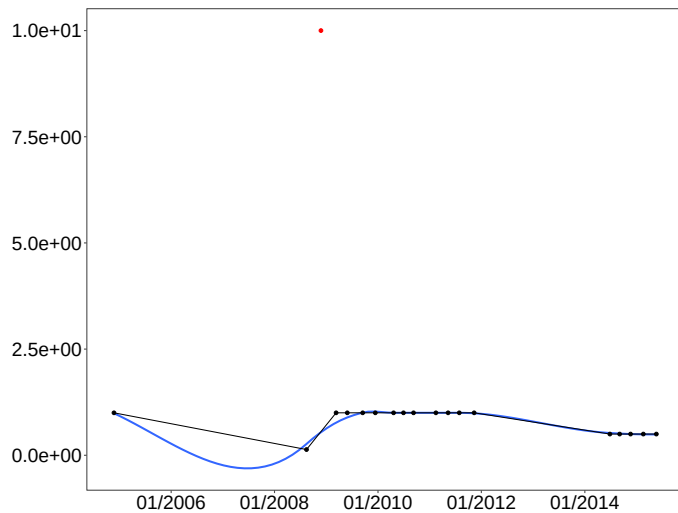
EC22 – Bicarbonate
 $\tau = 0.246$ | p-value = 0.151 | No trend



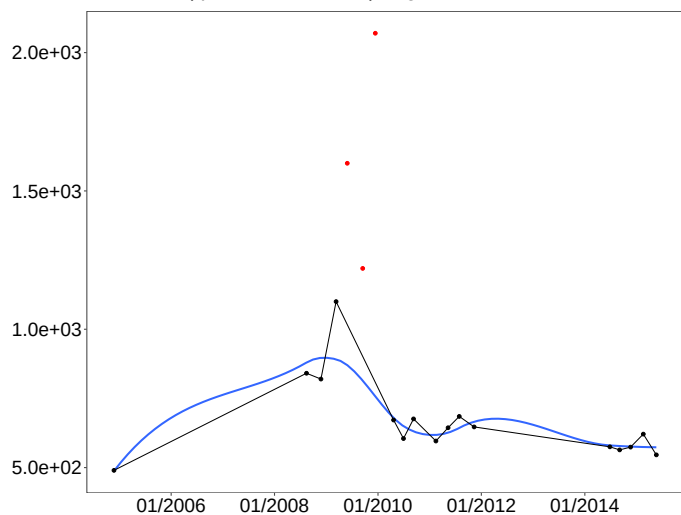
EC22 – Calcium
 $\tau = -0.551$ | p-value = 0.00113 | Negative trend



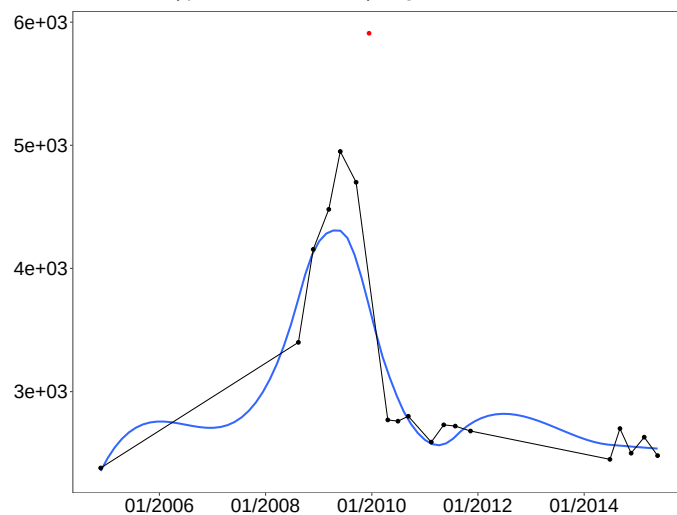
EC22 – Carbonate
 $\tau = -0.463$ | p-value = 0.0167 | Negative trend



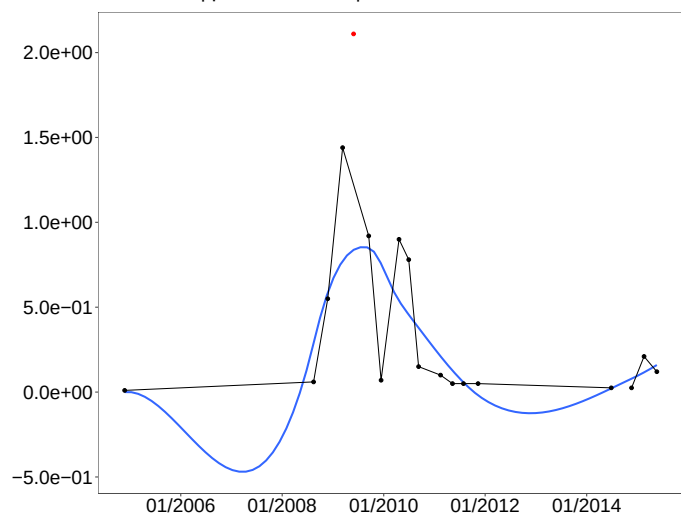
EC22 – Chloride
 $\tau = -0.427$ | p-value = 0.0118 | Negative trend



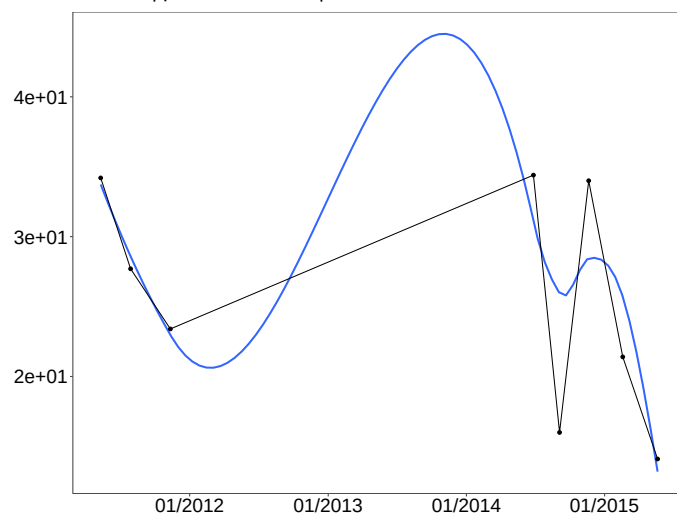
EC22 – Electrical Conductivity
 $\tau = -0.474$ | p-value = 0.00513 | Negative trend



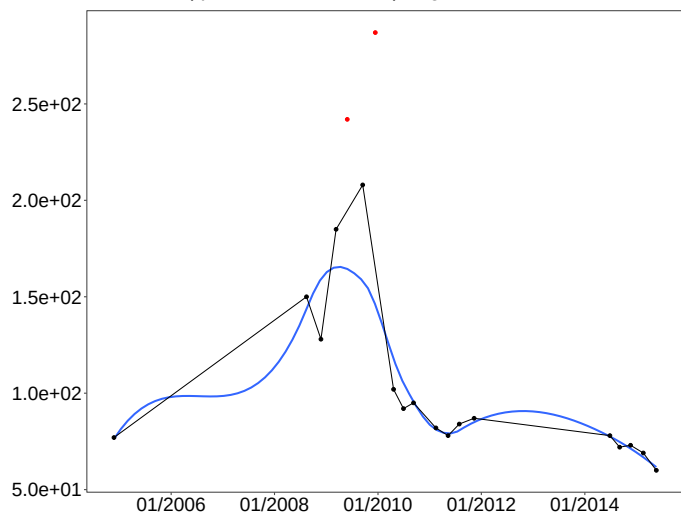
EC22 – Iron (d.)
 $\tau = -0.285$ | p-value = 0.11 | No trend



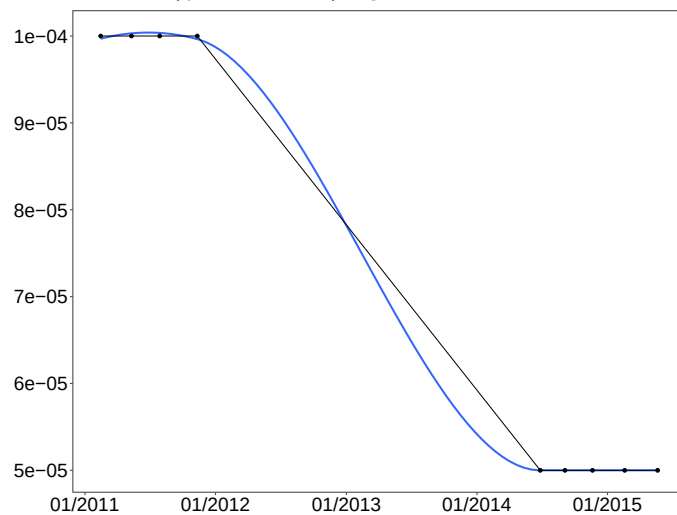
EC22 – Iron (t.)
 $\tau = -0.5$ | p-value = 0.108 | No trend



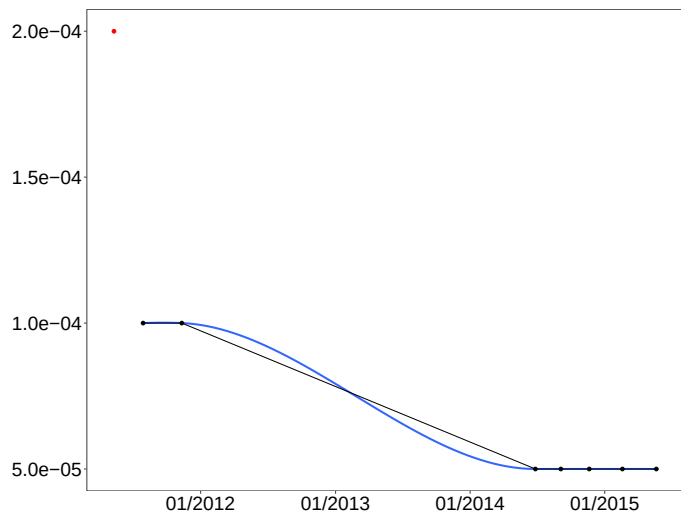
EC22 – Magnesium
 $\tau = -0.598$ | p-value = 0.000407 | Negative trend



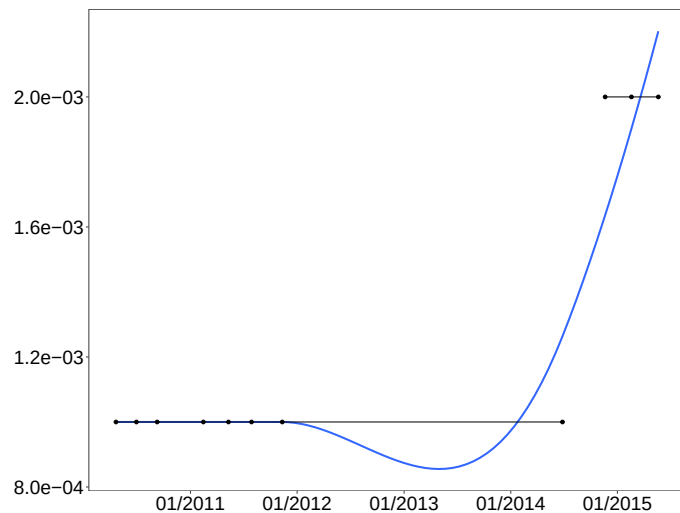
EC22 – Mercury (d.)
 $\tau = -0.745$ | p-value = 0.02 | Negative trend



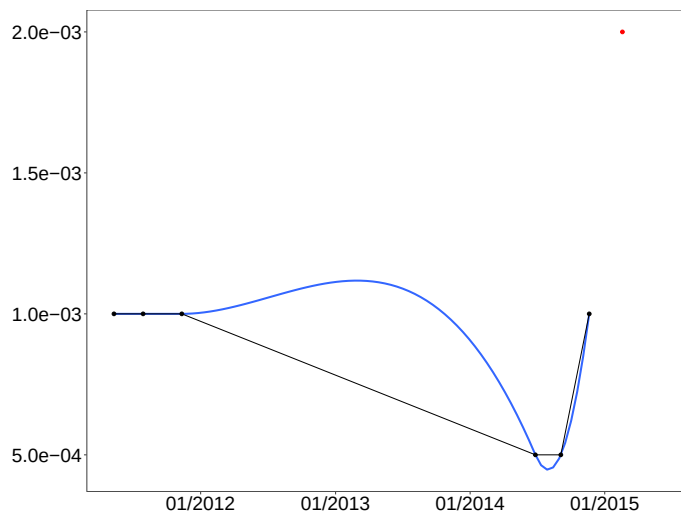
EC22 – Mercury (t.)

 $\tau = -0.779$ | p-value = 0.0205 | Negative trend

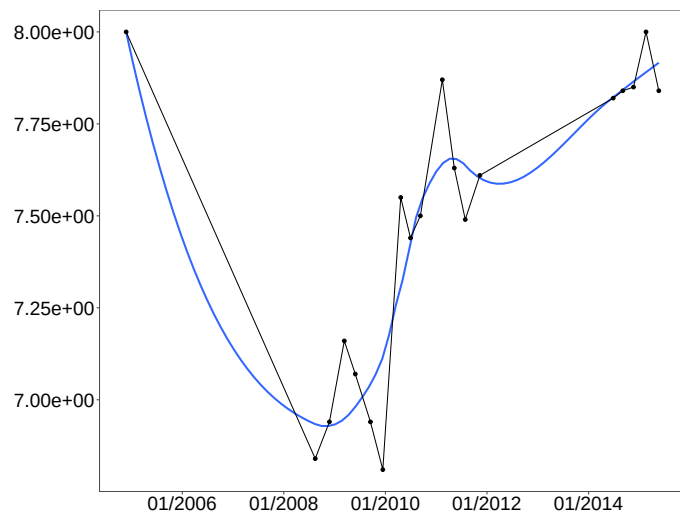
EC22 – Molybdenum (d.)

 $\tau = 0.661$ | p-value = 0.0189 | Positive trend

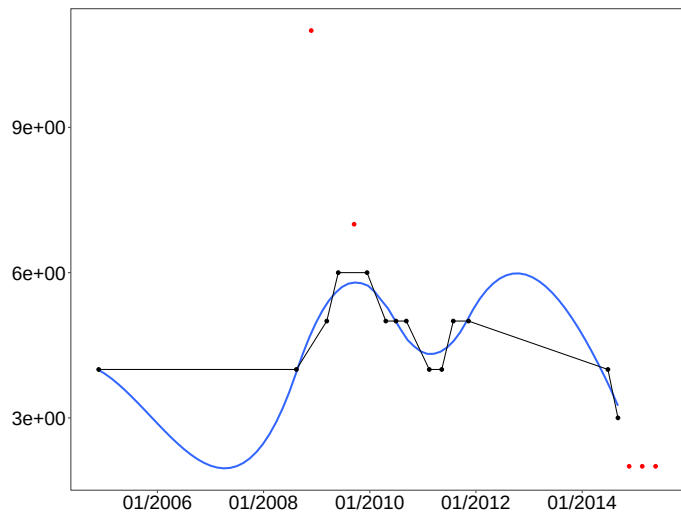
EC22 – Molybdenum (t.)

 $\tau = 0.117$ | p-value = 0.865 | No trend

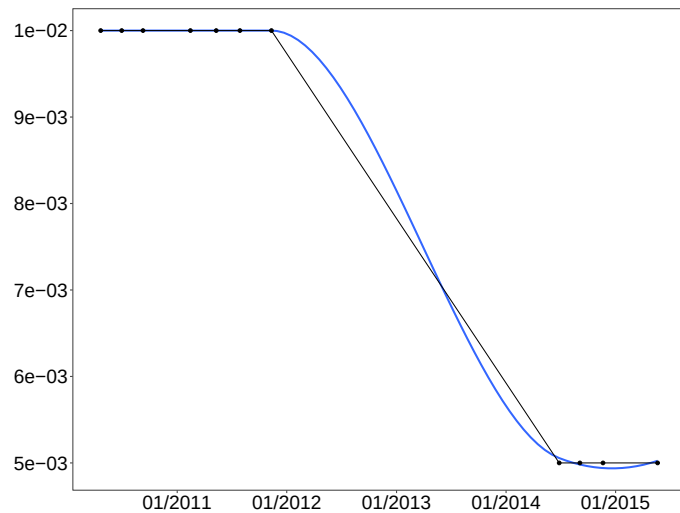
EC22 – pH

 $\tau = 0.519$ | p-value = 0.00229 | Positive trend

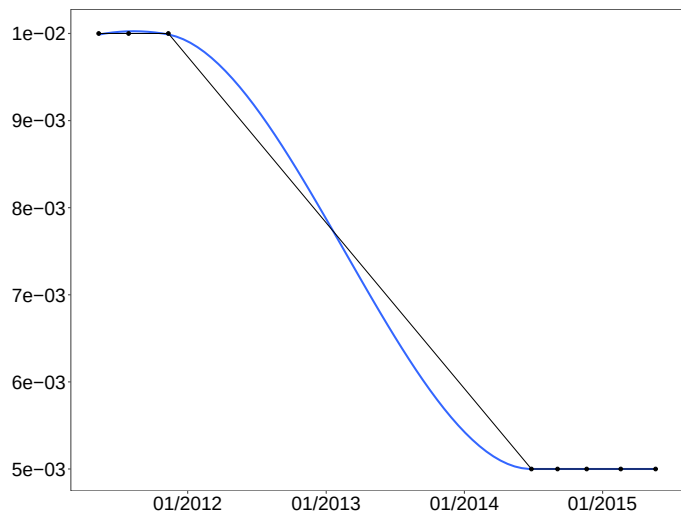
EC22 – Potassium

 $\tau = -0.552$ | p-value = 0.00215 | Negative trend

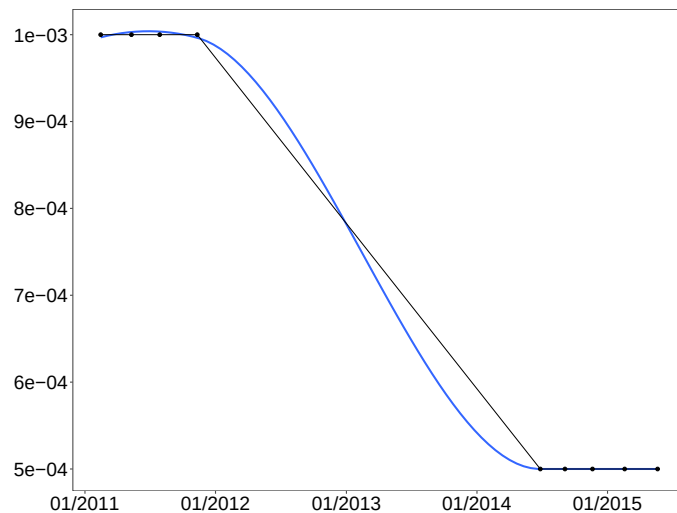
EC22 – Selenium (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

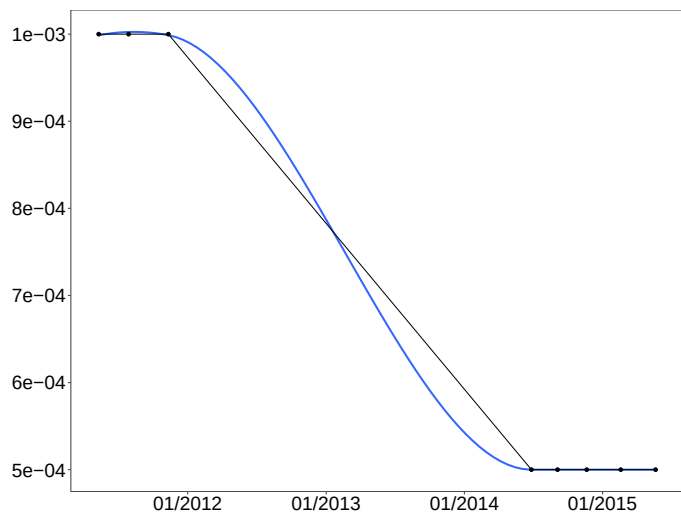
EC22 – Selenium (t.)
 $\tau = -0.732$ | p-value = 0.0369 | Negative trend



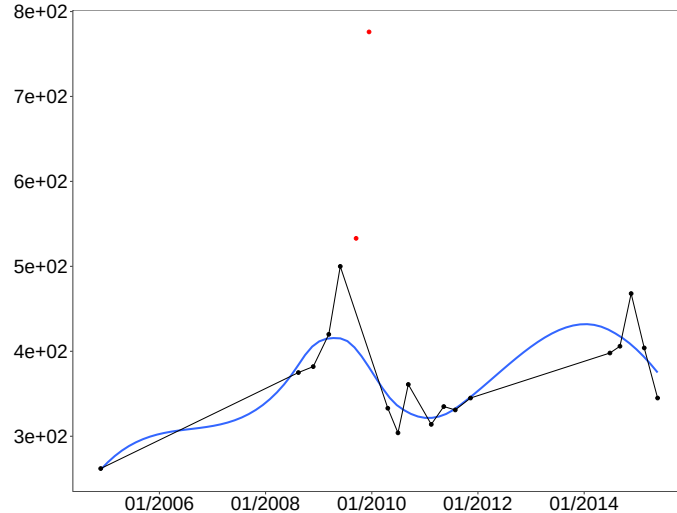
EC22 – Silver (d.)
 $\tau = -0.745$ | p-value = 0.02 | Negative trend



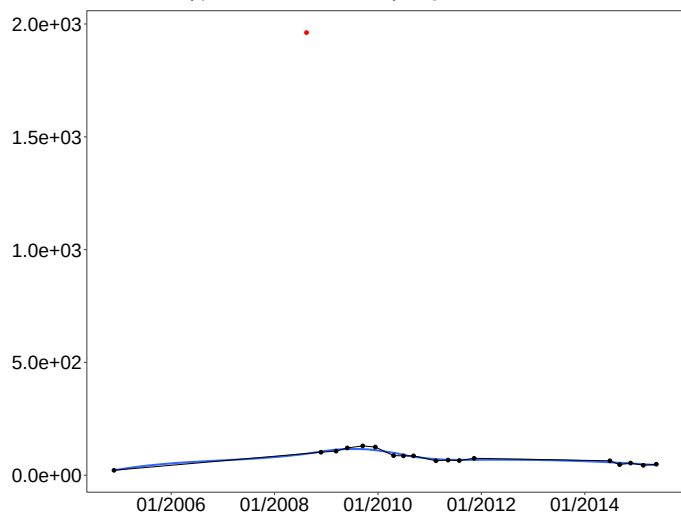
EC22 – Silver (t.)
 $\tau = -0.732$ | p-value = 0.0369 | Negative trend



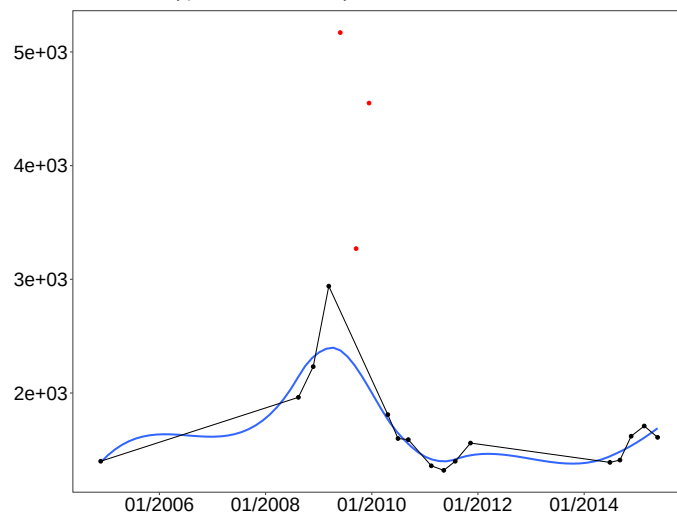
EC22 – Sodium
 $\tau = 0.0821$ | p-value = 0.649 | No trend



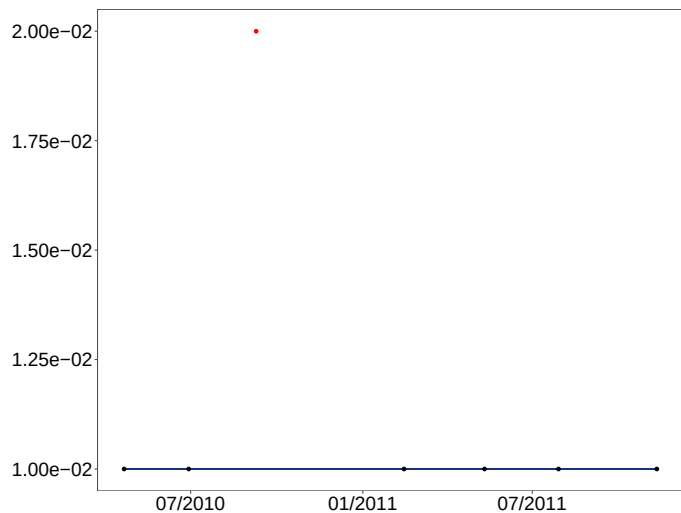
EC22 – Sulphate
 $\tau = -0.582$ | p-value = 0.000597 | Negative trend



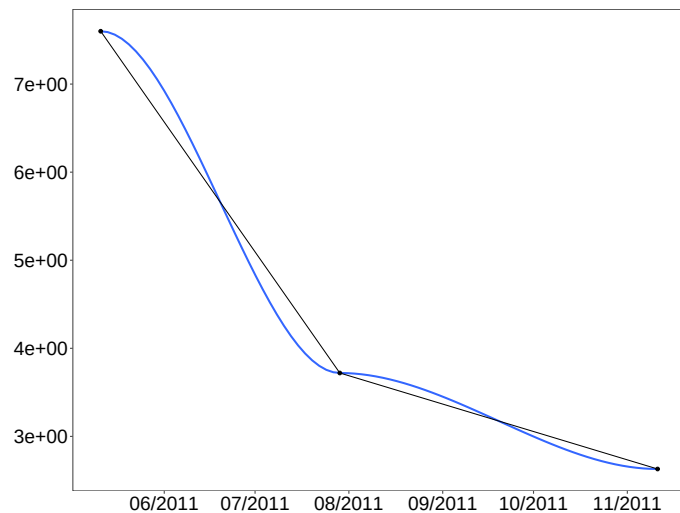
EC22 – TDS
 $\tau = -0.258$ | p-value = 0.132 | No trend



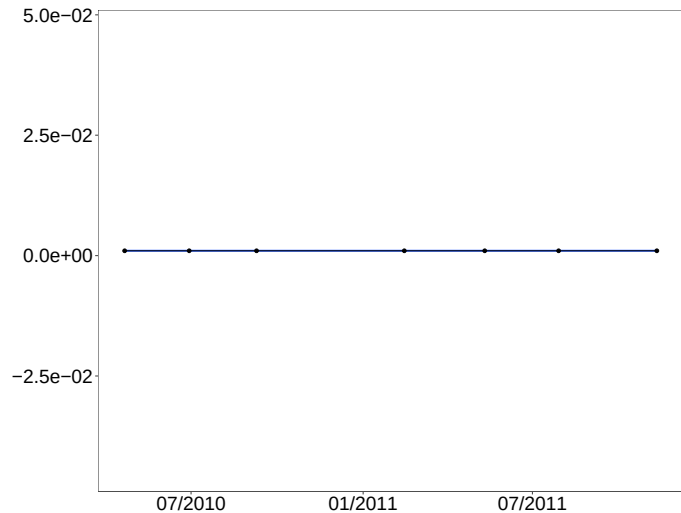
EC23 – Aluminium (d.)

 $\tau = -0.178$ | p-value = 0.803 | No trend

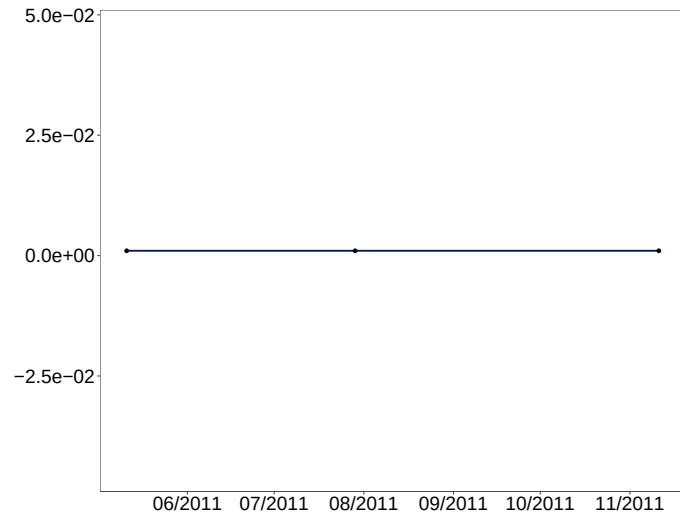
EC23 – Aluminium (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

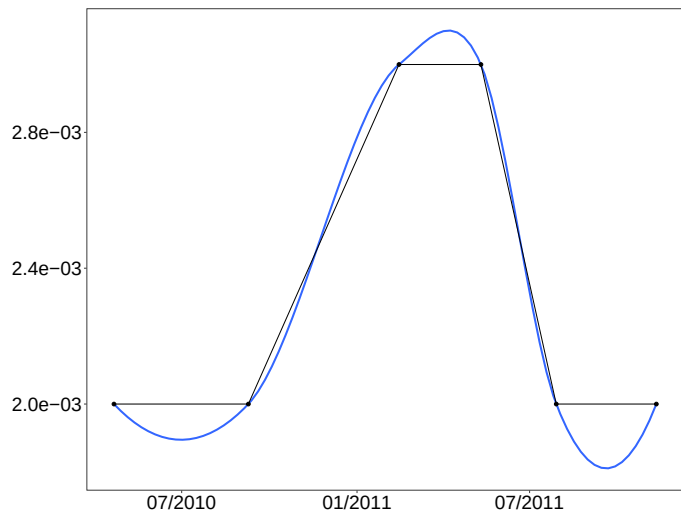
EC23 – Antimony (d.)

 $\tau = 1$ | p-value = 1 | No trend

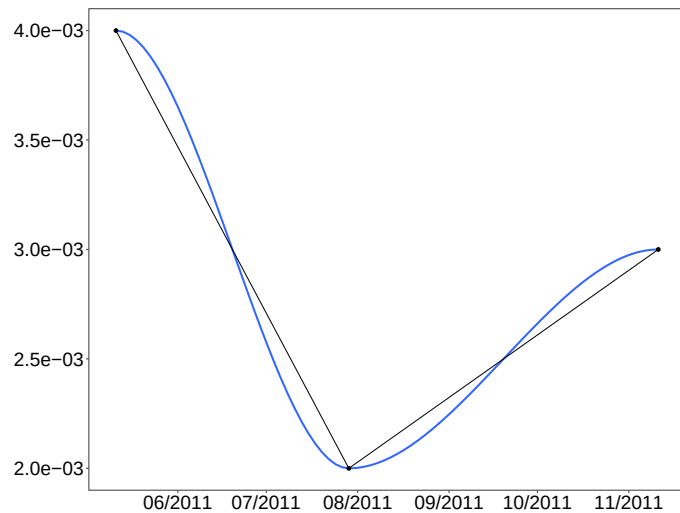
EC23 – Antimony (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

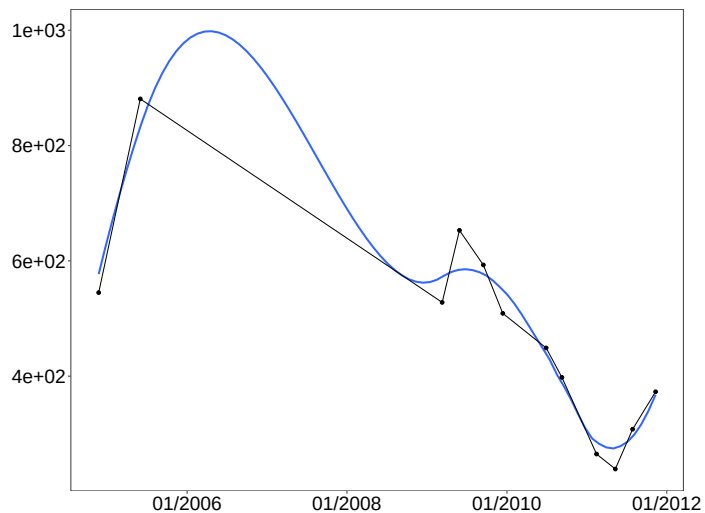
EC23 – Arsenic (d.)

 $\tau = 0$ | p-value = 1 | No trend

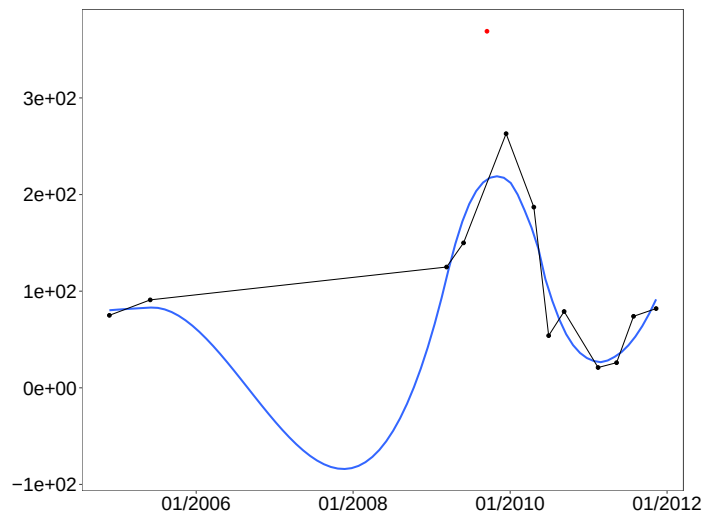
EC23 – Arsenic (t.)

 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated

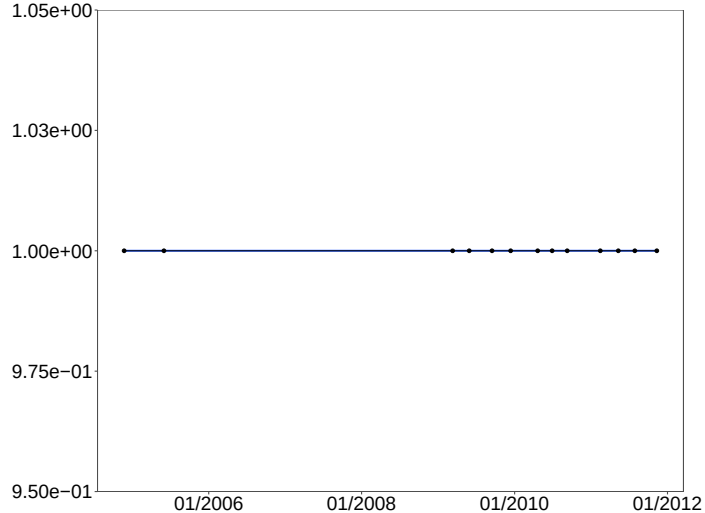
EC23 – Bicarbonate
 $\tau = -0.697$ | $p\text{-value} = 0.00203$ | Negative trend



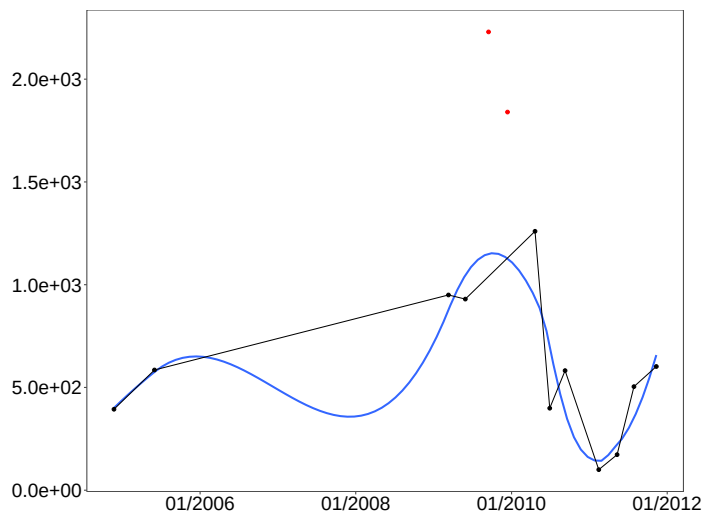
EC23 – Calcium
 $\tau = -0.231$ | $p\text{-value} = 0.3$ | No trend



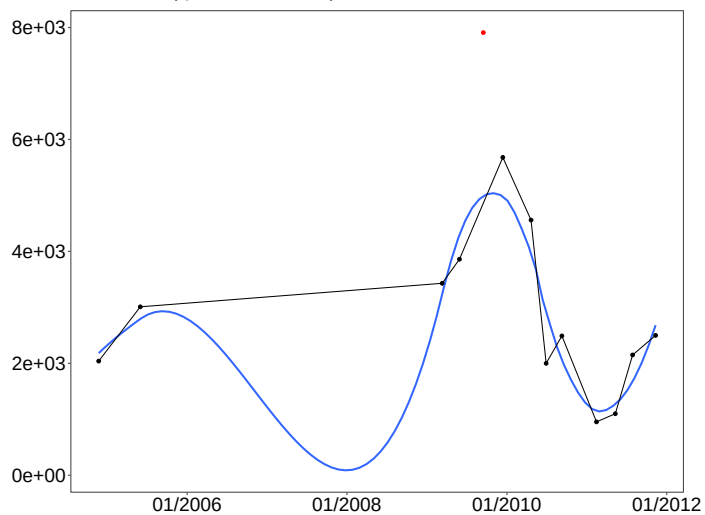
EC23 – Carbonate
 $\tau = 1$ | $p\text{-value} = 1$ | No trend



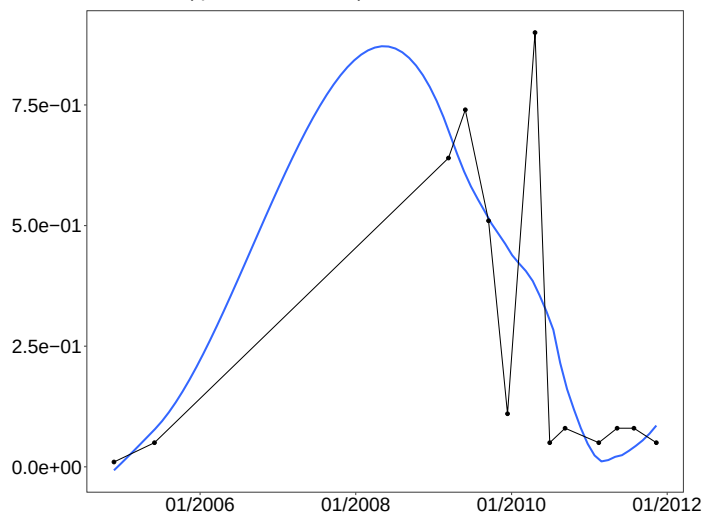
EC23 – Chloride
 $\tau = -0.179$ | $p\text{-value} = 0.428$ | No trend



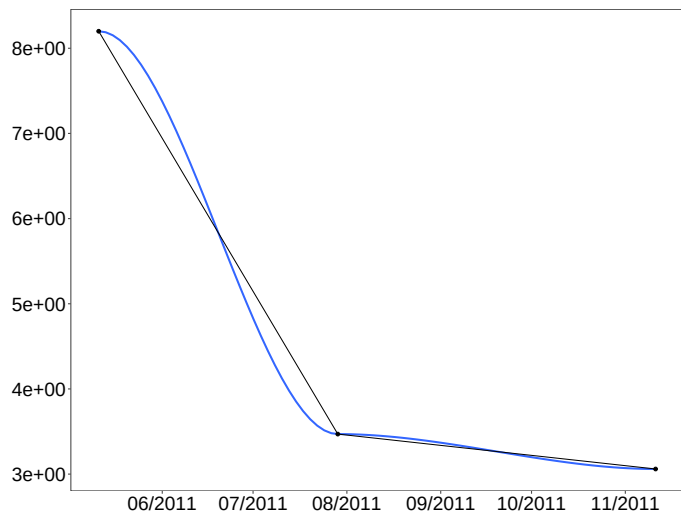
EC23 – Electrical Conductivity
 $\tau = -0.205$ | $p\text{-value} = 0.36$ | No trend



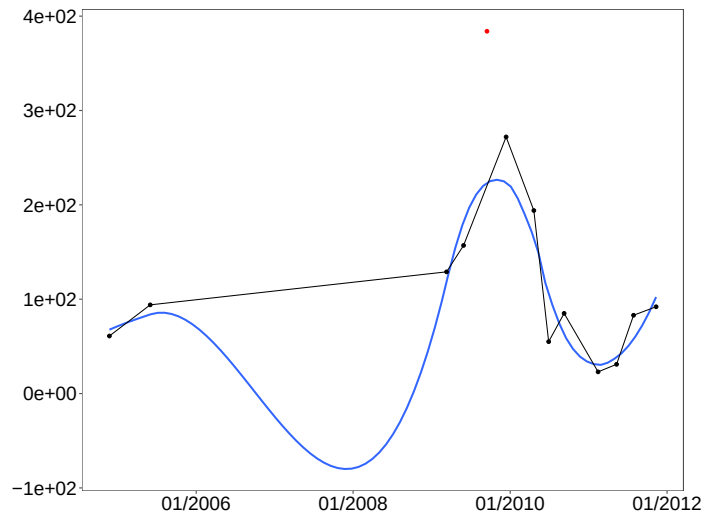
EC23 – Iron (d.)
 $\tau = -0.123$ | $p\text{-value} = 0.617$ | No trend



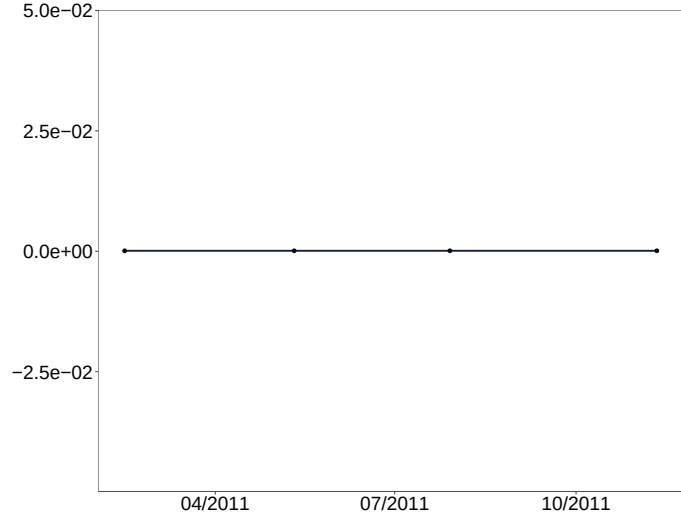
EC23 – Iron (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

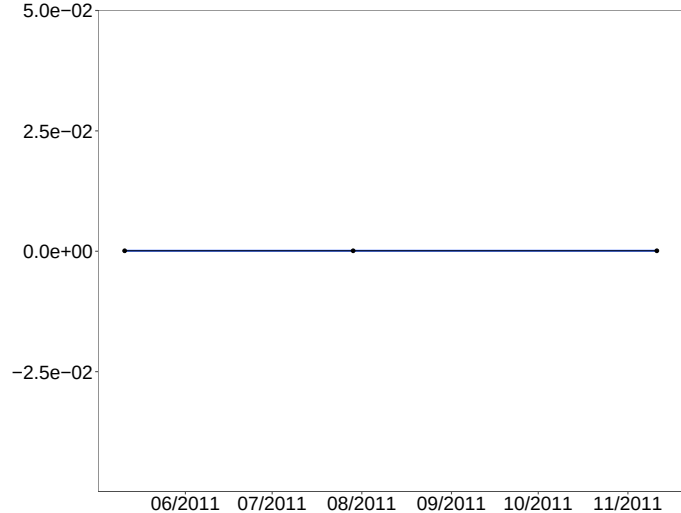
EC23 – Magnesium

 τ = -0.205 | p-value = 0.36 | No trend

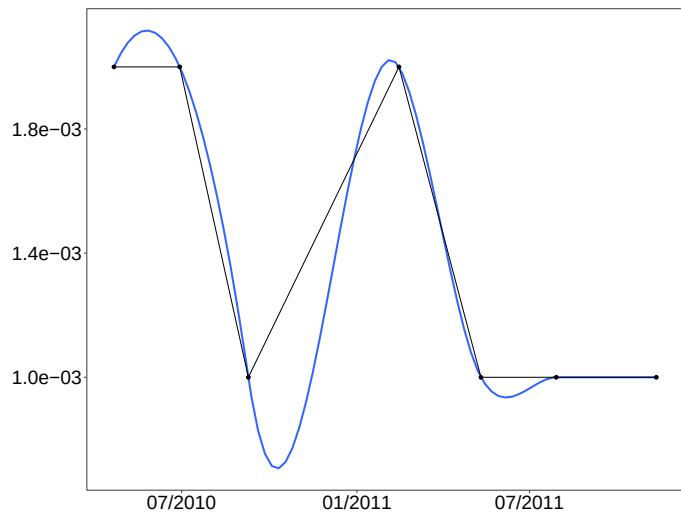
EC23 – Mercury (d.)

 τ = 1 | p-value = 1 | No trend

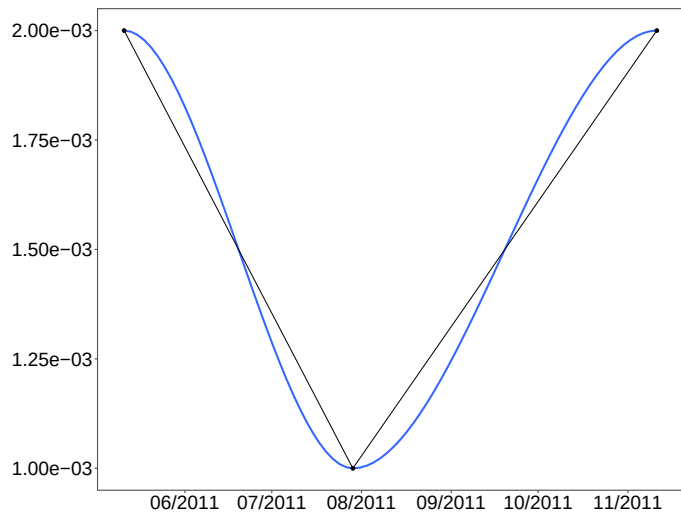
EC23 – Mercury (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

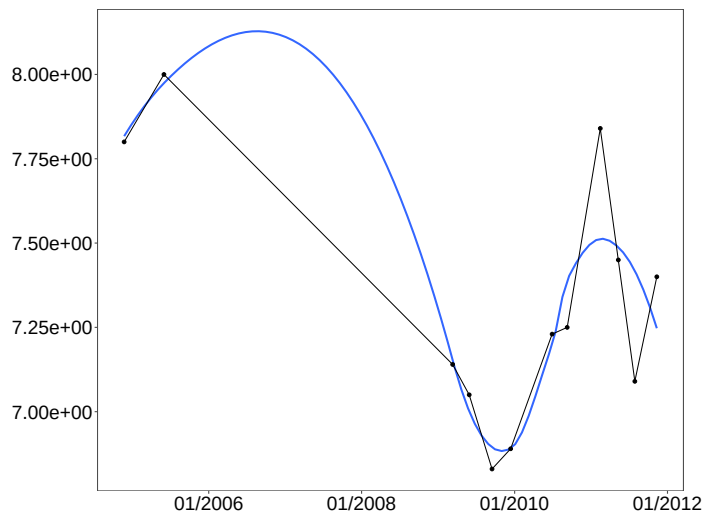
EC23 – Molybdenum (d.)

 τ = -0.63 | p-value = 0.112 | No trend

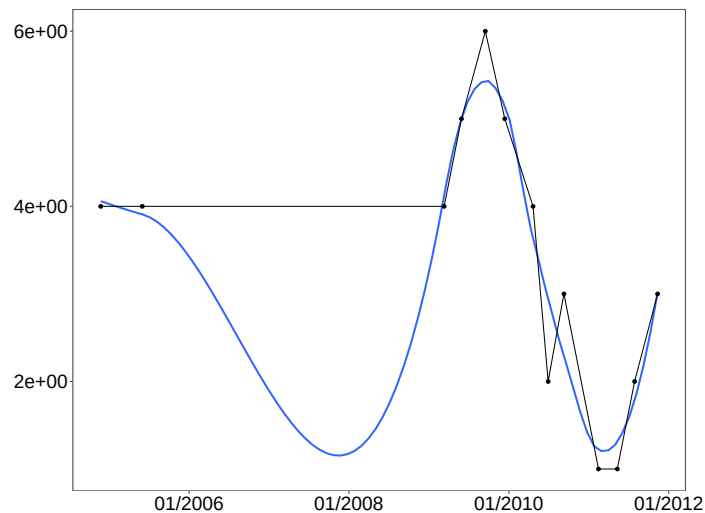
EC23 – Molybdenum (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

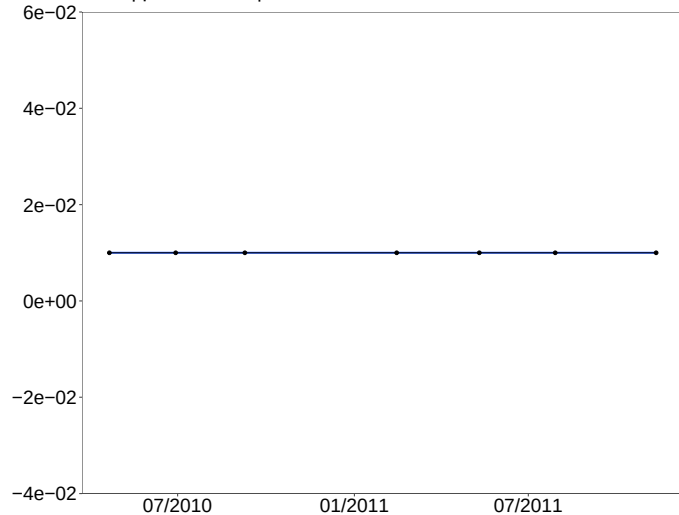
EC23 – pH
 $\tau = 0.0303$ | p-value = 0.945 | No trend



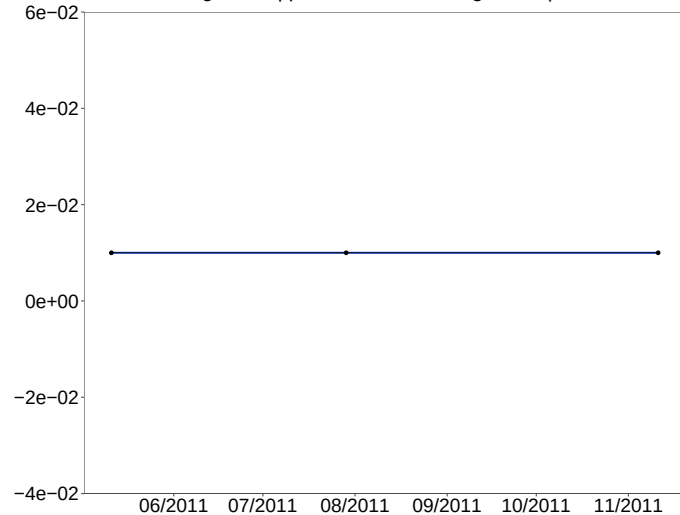
EC23 – Potassium
 $\tau = -0.467$ | p-value = 0.0392 | Negative trend



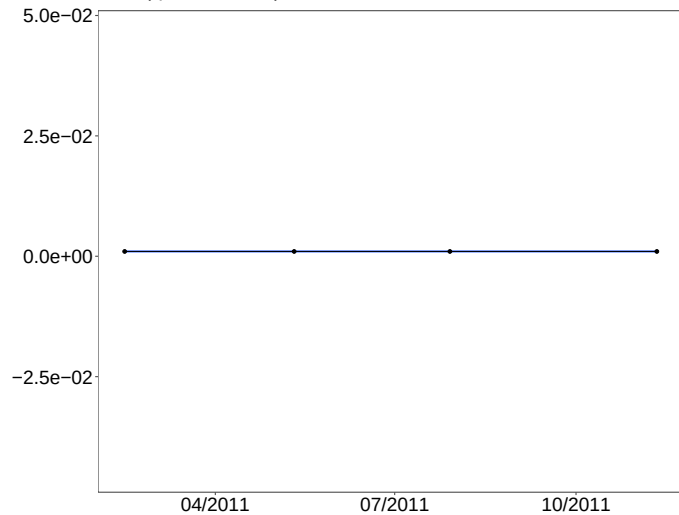
EC23 – Selenium (d.)
 $\tau = 1$ | p-value = 1 | No trend



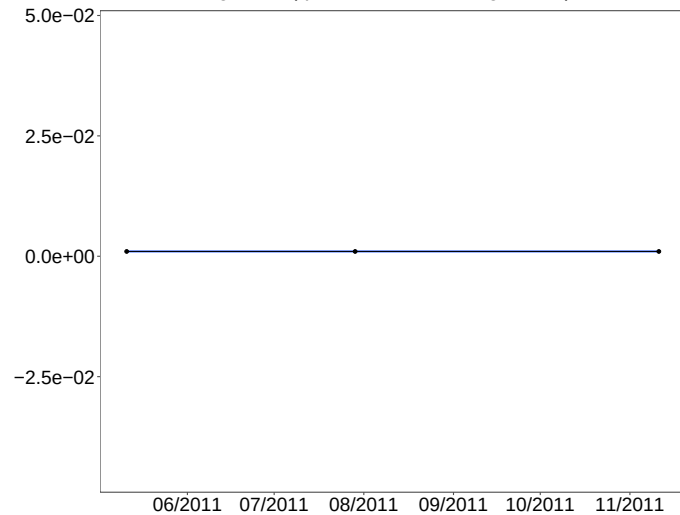
EC23 – Selenium (t.)
 $\tau = \text{Not enough data}$ | p-value = Not enough data | Not evaluated



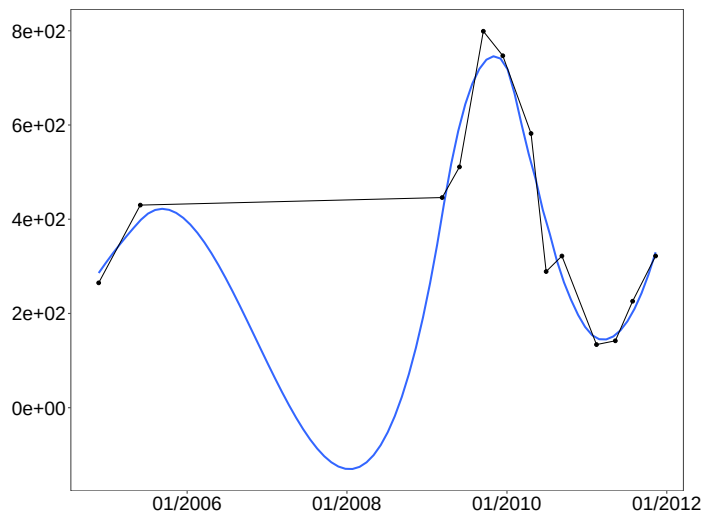
EC23 – Silver (d.)
 $\tau = 1$ | p-value = 1 | No trend



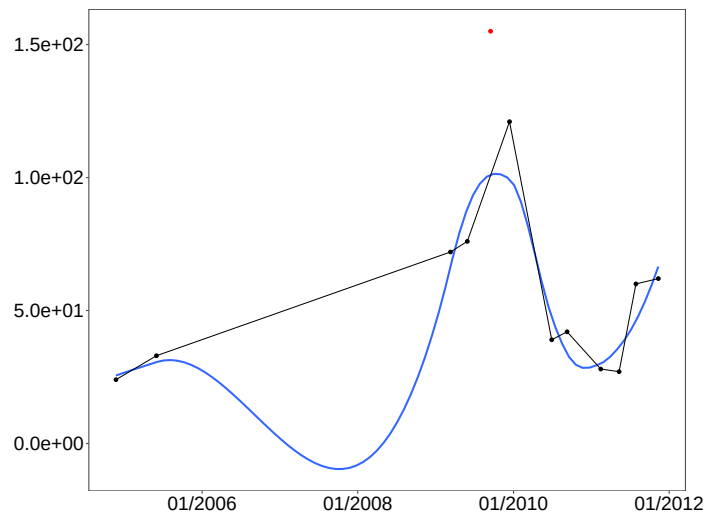
EC23 – Silver (t.)
 $\tau = \text{Not enough data}$ | p-value = Not enough data | Not evaluated



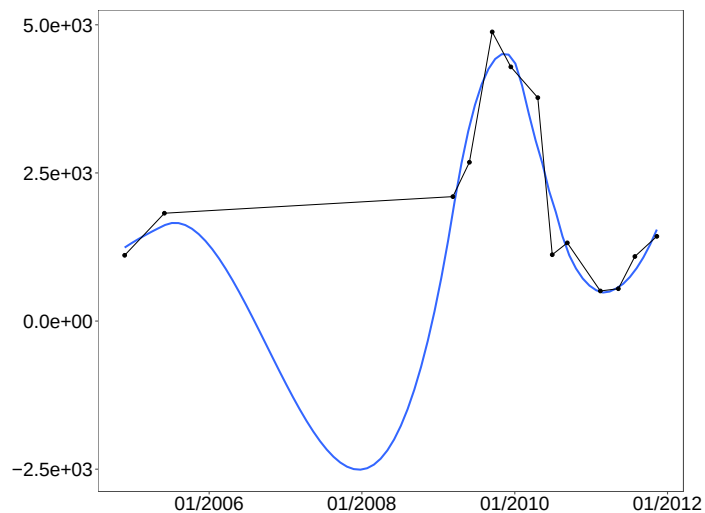
EC23 – Sodium
 $\tau = -0.245$ | p-value = 0.271 | No trend



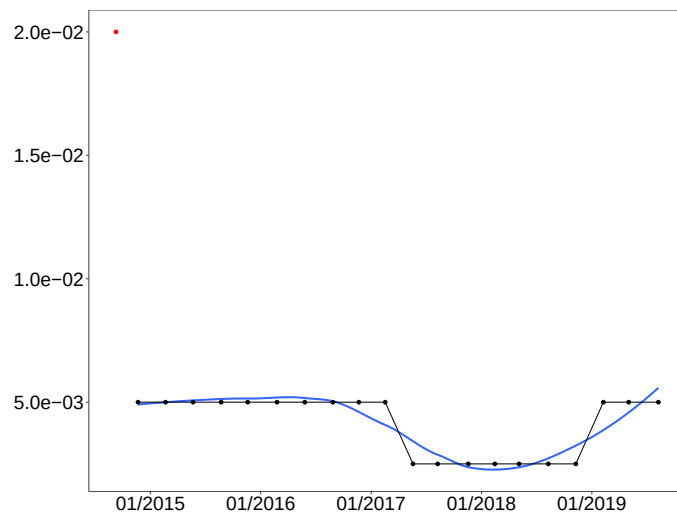
EC23 – Sulphate
 $\tau = 0.0303$ | p-value = 0.945 | No trend



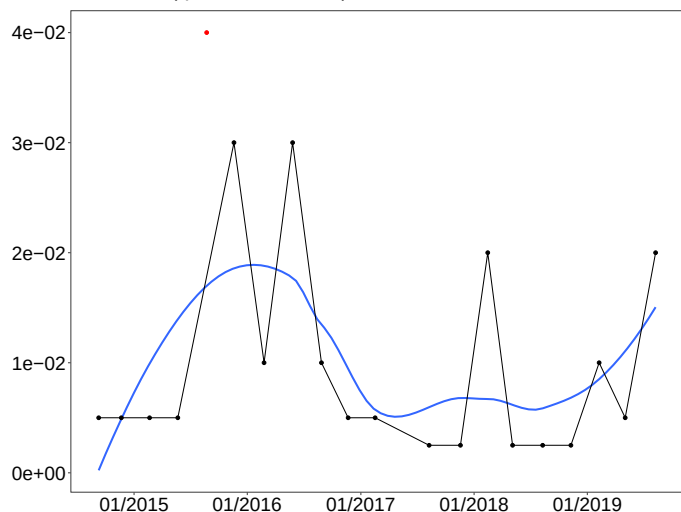
EC23 – TDS
 $\tau = -0.231$ | p-value = 0.3 | No trend



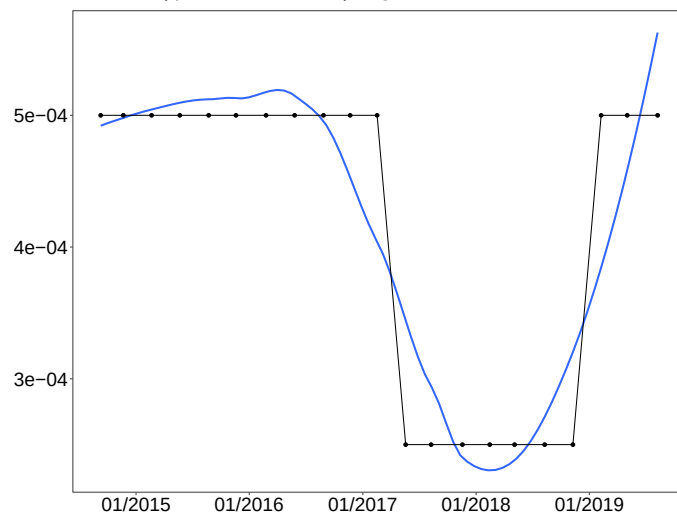
Fairhill Bore – Aluminium (d.)
 $\tau = -0.452$ | p-value = 0.0151 | Negative trend



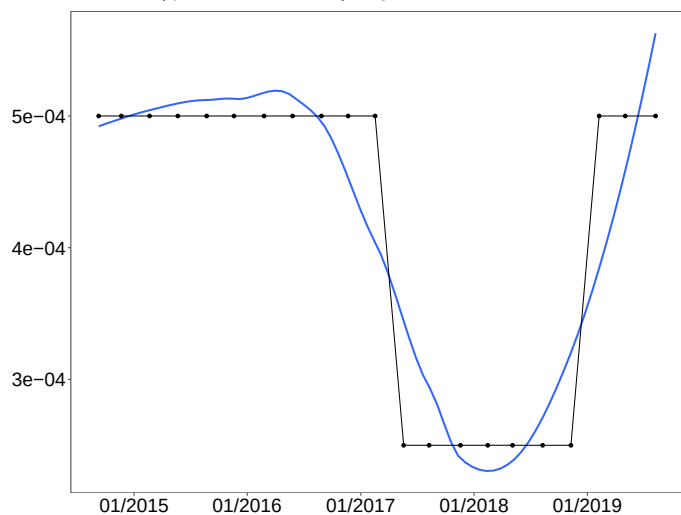
Fairhill Bore – Aluminium (t.)
 $\tau = -0.175$ | p-value = 0.329 | No trend



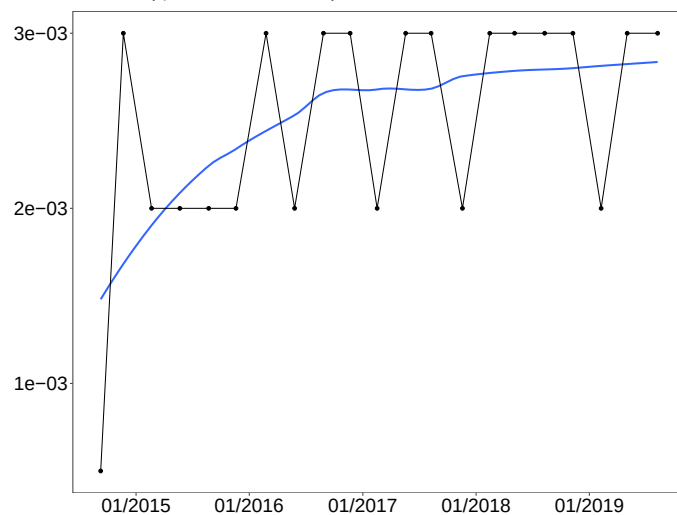
Fairhill Bore – Antimony (d.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



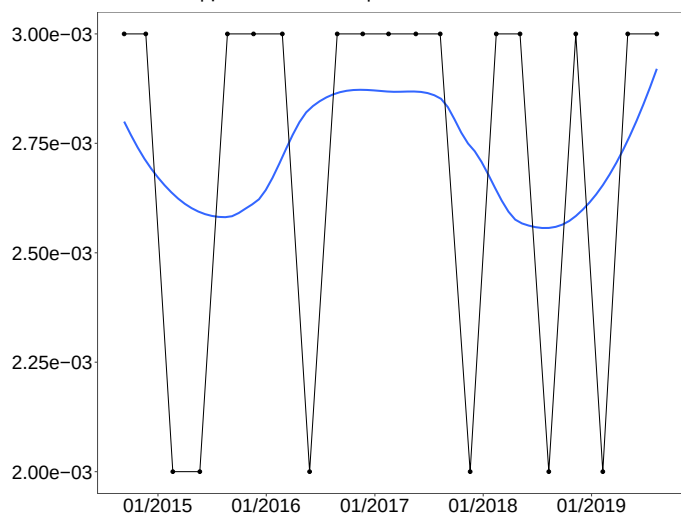
Fairhill Bore – Antimony (t.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



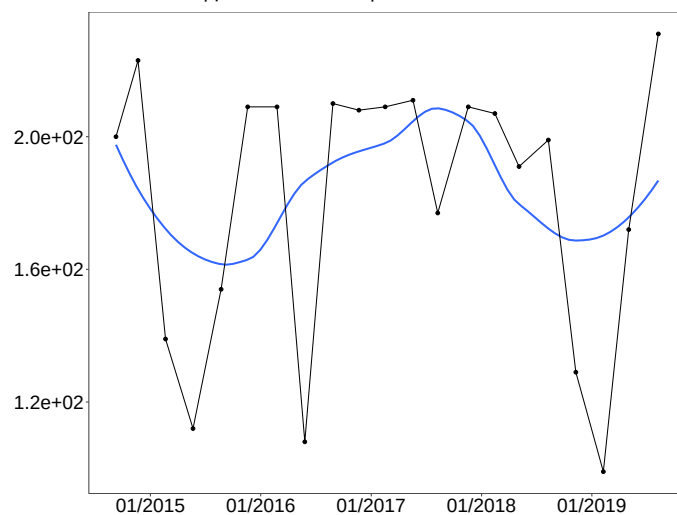
Fairhill Bore – Arsenic (d.)
 $\tau = 0.41$ | p-value = 0.0277 | Positive trend



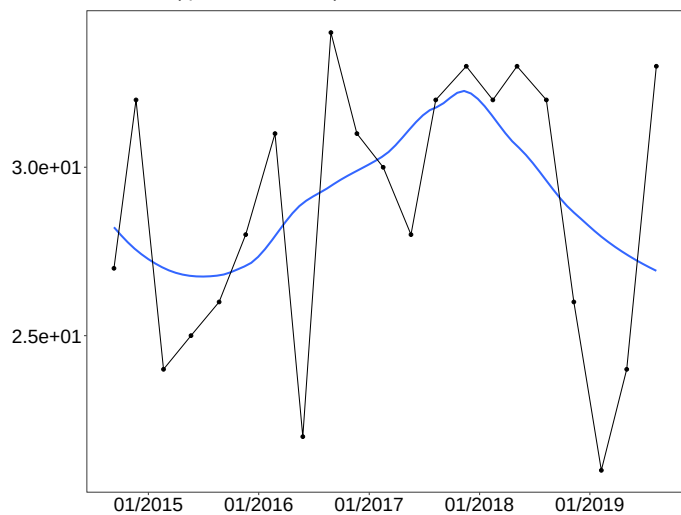
Fairhill Bore – Arsenic (t.)
 $\tau = 0.0145$ | p-value = 0.969 | No trend



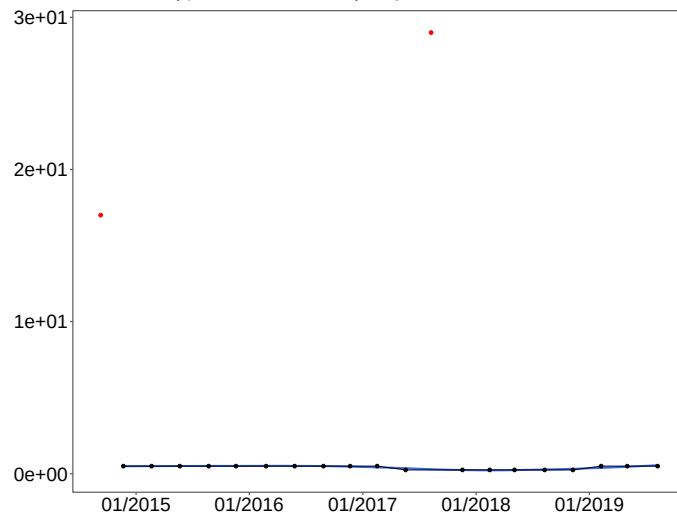
Fairhill Bore – Bicarbonate
 $\tau = -0.0676$ | p-value = 0.693 | No trend



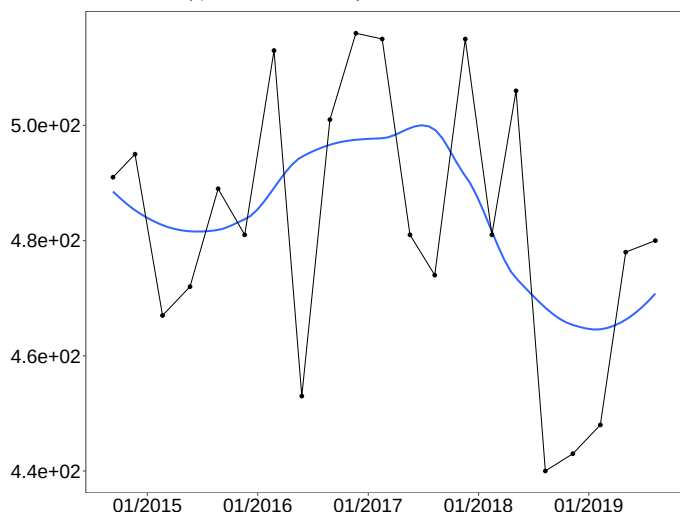
Fairhill Bore – Calcium
 $\tau = 0.162$ | p-value = 0.33 | No trend



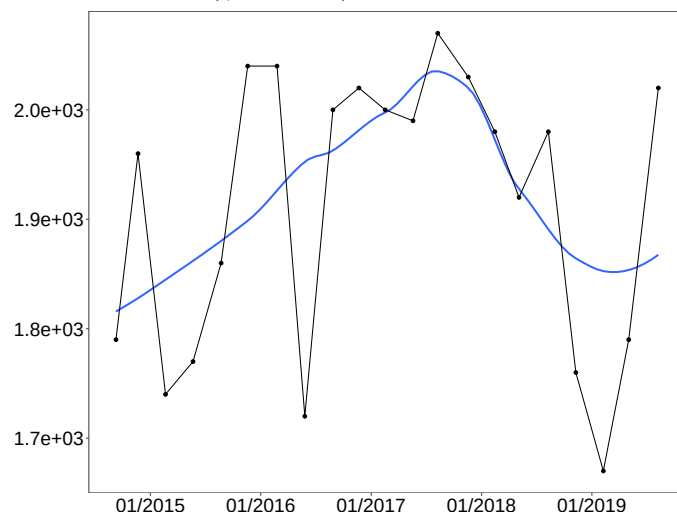
Fairhill Bore – Carbonate
 $\tau = -0.364$ | p-value = 0.0477 | Negative trend



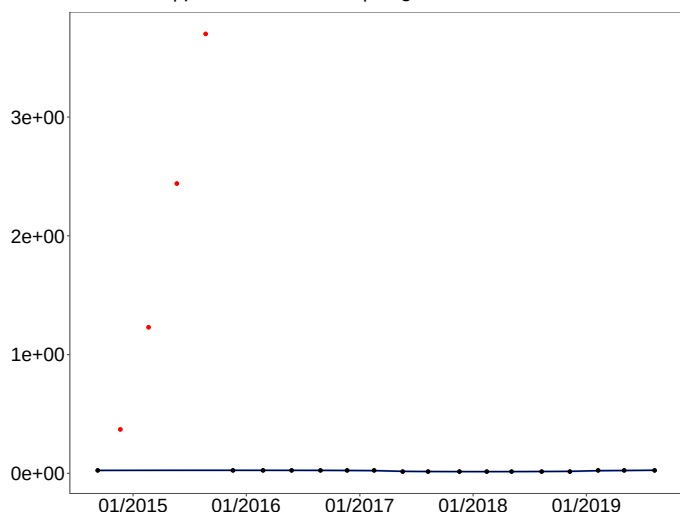
Fairhill Bore – Chloride
 $\tau = -0.154$ | $p\text{-value} = 0.348$ | No trend



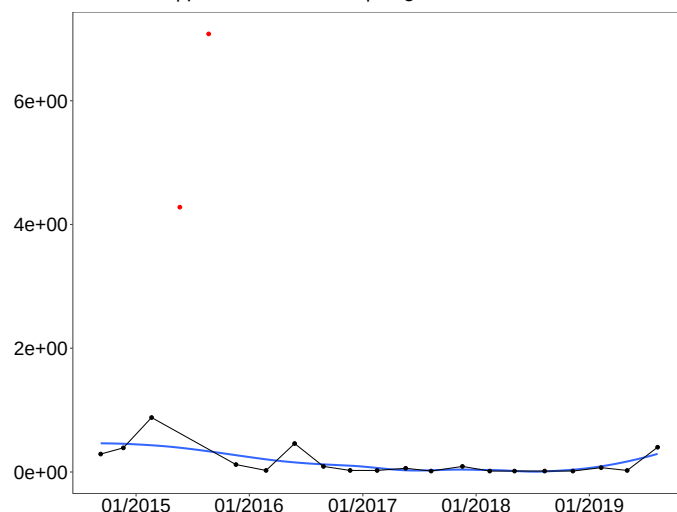
Fairhill Bore – Electrical Conductivity
 $\tau = -0.00482$ | $p\text{-value} = 1$ | No trend



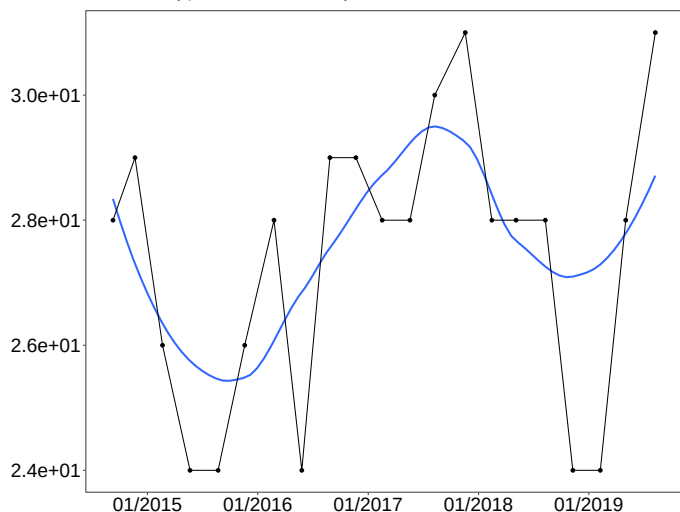
Fairhill Bore – Iron (d.)
 $\tau = -0.472$ | $p\text{-value} = 0.00782$ | Negative trend



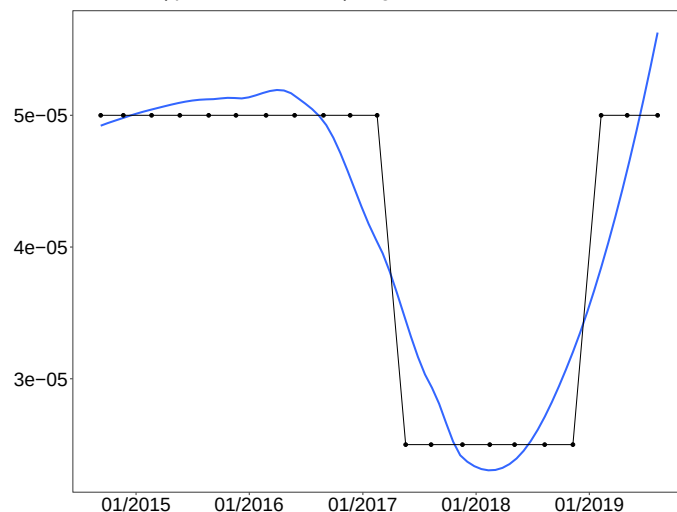
Fairhill Bore – Iron (t.)
 $\tau = -0.432$ | $p\text{-value} = 0.00857$ | Negative trend



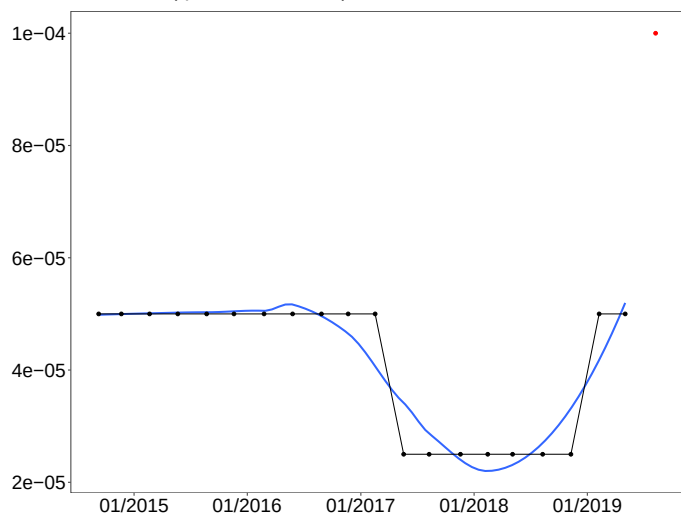
Fairhill Bore – Magnesium
 $\tau = 0.144$ | $p\text{-value} = 0.413$ | No trend



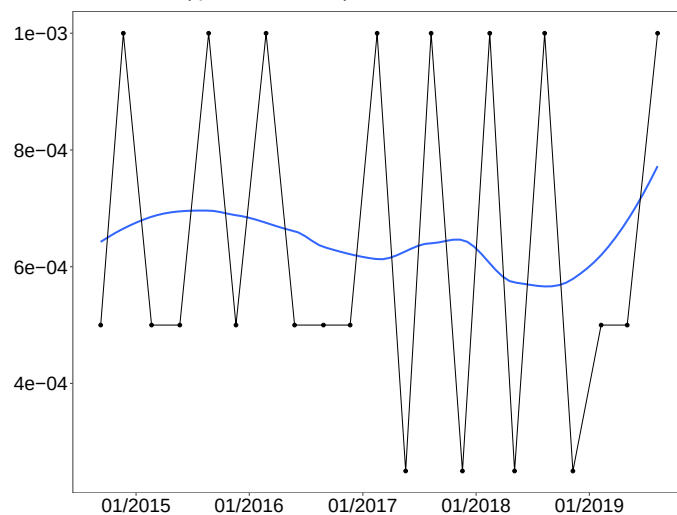
Fairhill Bore – Mercury (d.)
 $\tau = -0.39$ | $p\text{-value} = 0.0402$ | Negative trend



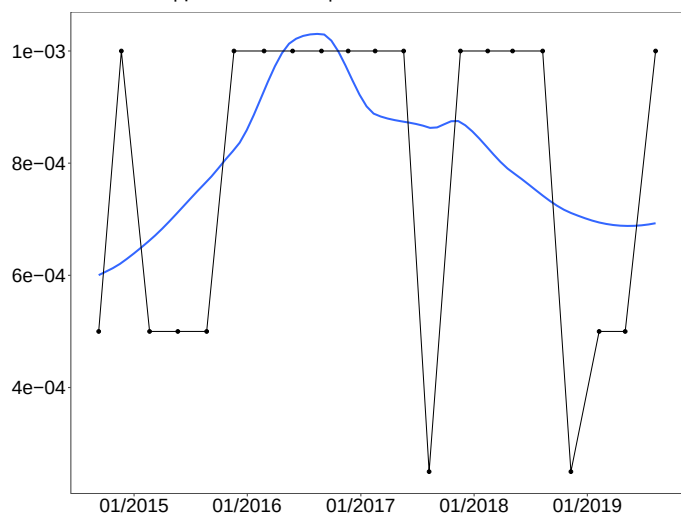
Fairhill Bore – Mercury (t.)
 $\tau = -0.282$ | p-value = 0.134 | No trend



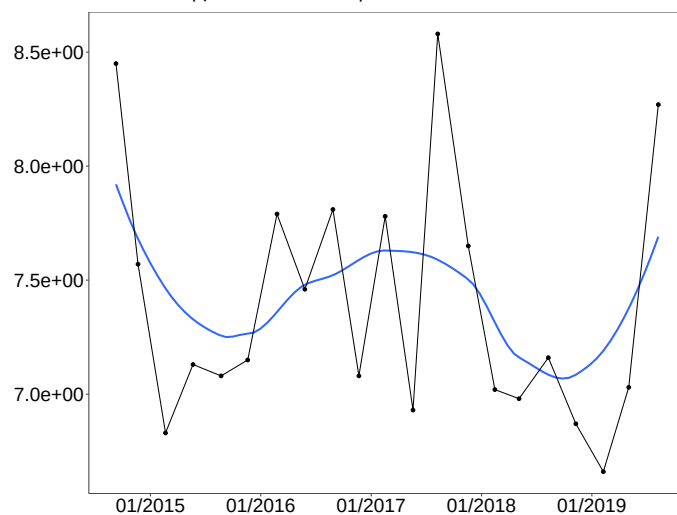
Fairhill Bore – Molybdenum (d.)
 $\tau = -0.0816$ | p-value = 0.67 | No trend



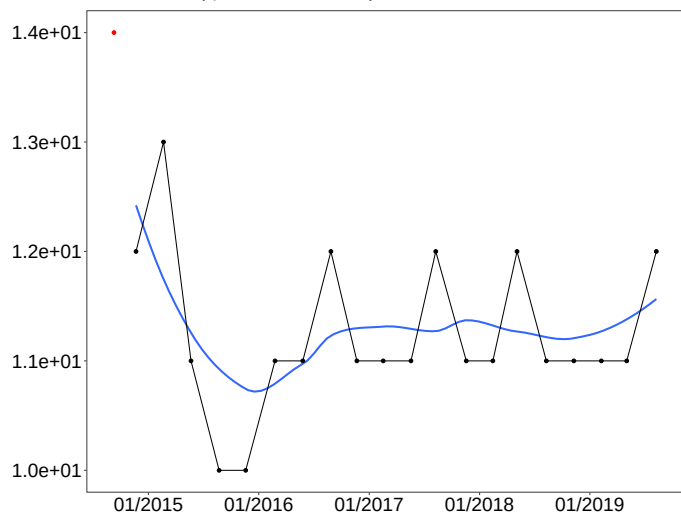
Fairhill Bore – Molybdenum (t.)
 $\tau = 0.0384$ | p-value = 0.86 | No trend



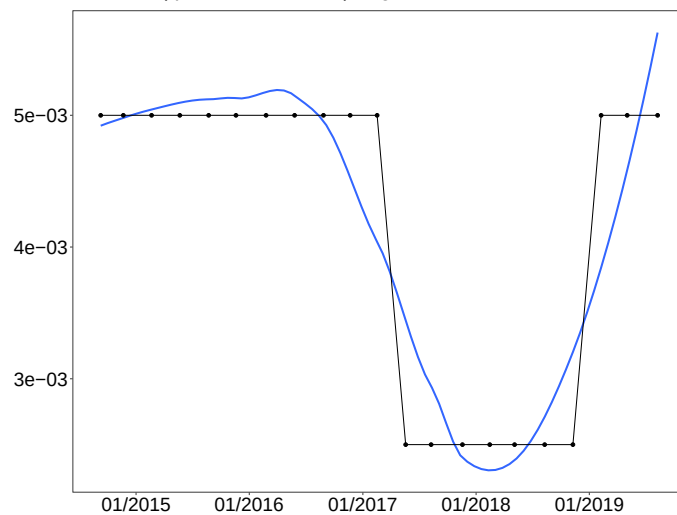
Fairhill Bore – pH
 $\tau = -0.167$ | p-value = 0.304 | No trend



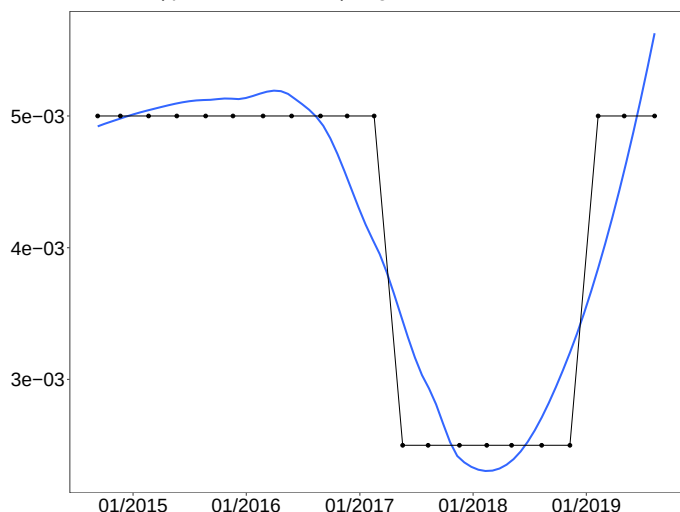
Fairhill Bore – Potassium
 $\tau = -0.0778$ | p-value = 0.683 | No trend



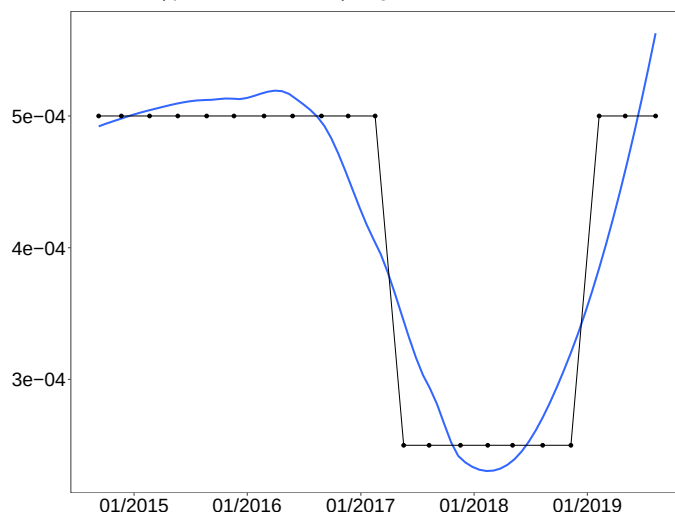
Fairhill Bore – Selenium (d.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



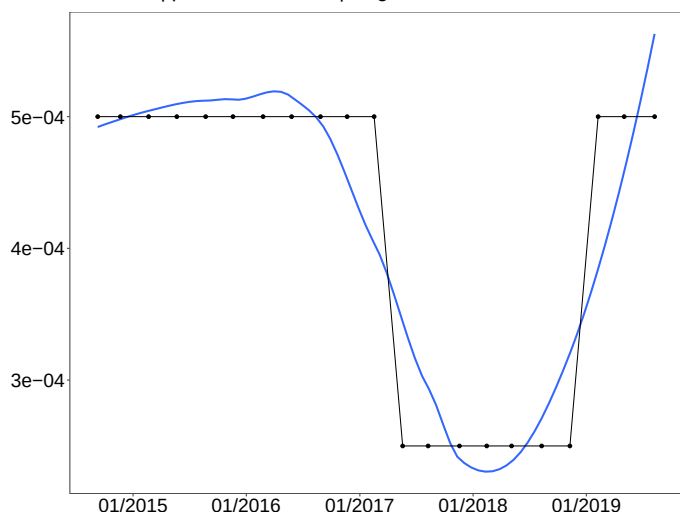
Fairhill Bore – Selenium (t.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



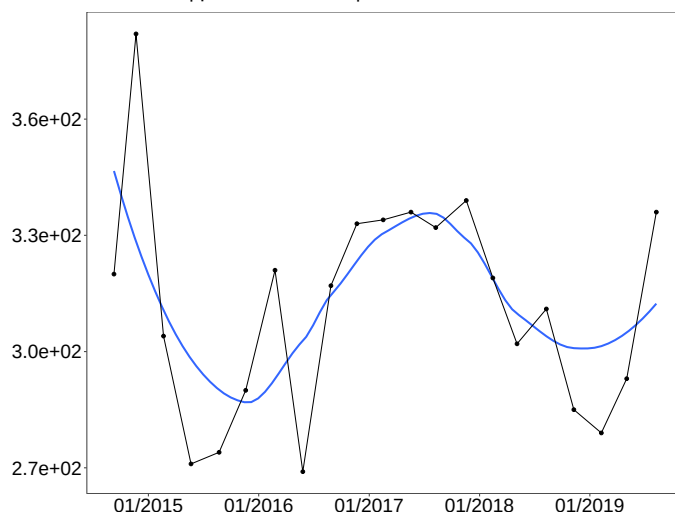
Fairhill Bore – Silver (d.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



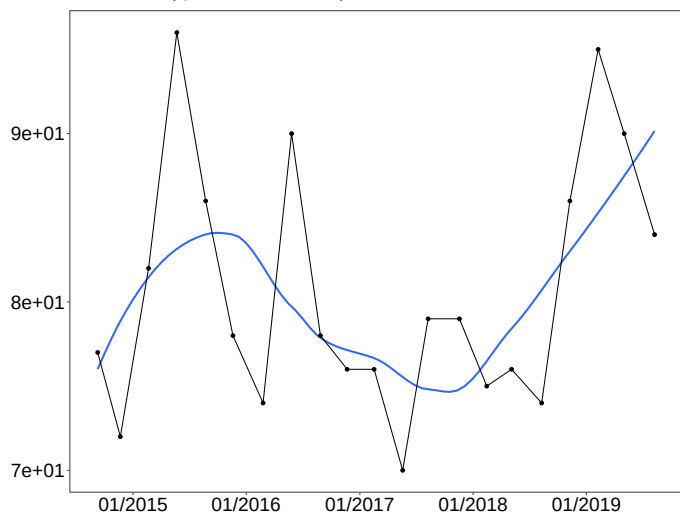
Fairhill Bore – Silver (t.)
 $\tau = -0.39$ | p-value = 0.0402 | Negative trend



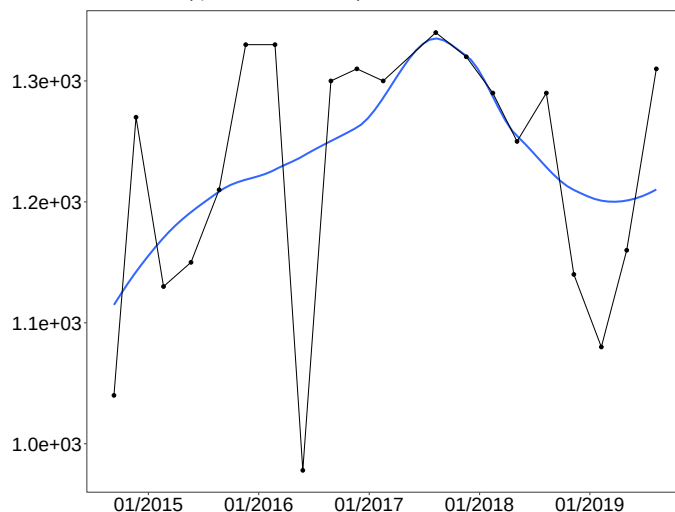
Fairhill Bore – Sodium
 $\tau = 0.0143$ | p-value = 0.952 | No trend



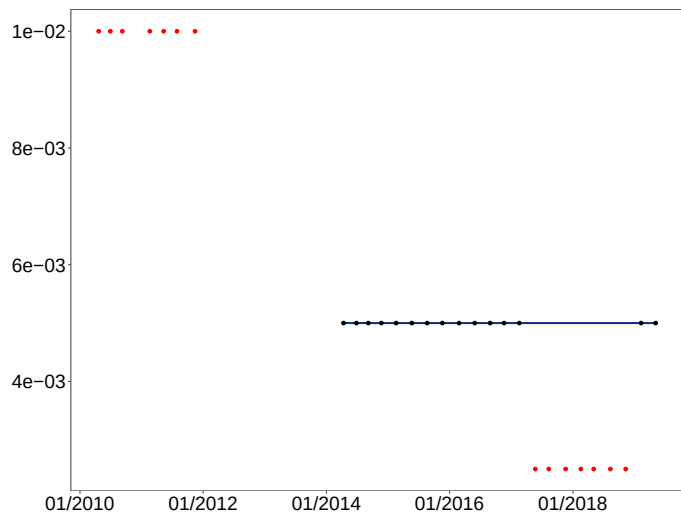
Fairhill Bore – Sulphate
 $\tau = 0.0874$ | p-value = 0.606 | No trend



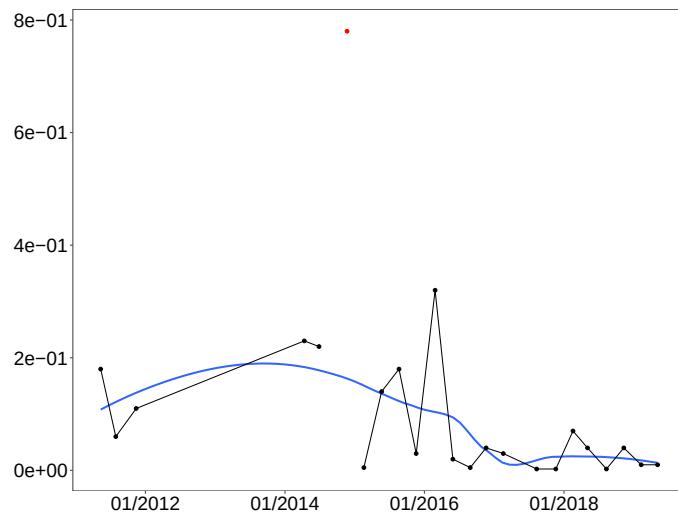
Fairhill Bore – TDS
 $\tau = 0.0638$ | p-value = 0.721 | No trend



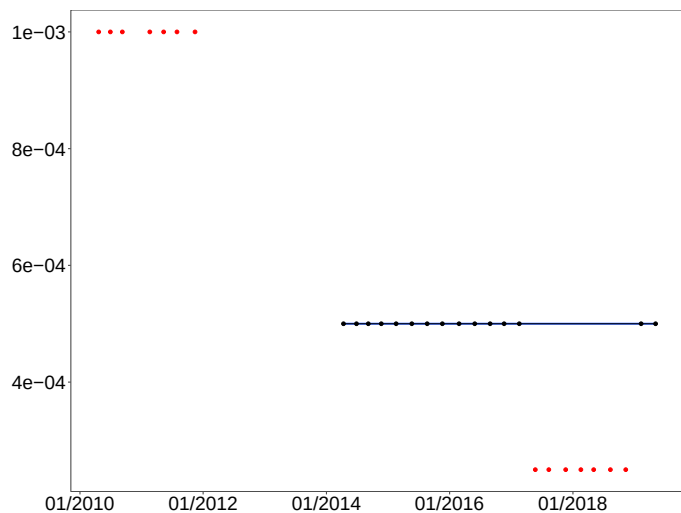
GW01 – Aluminium (d.)

 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend

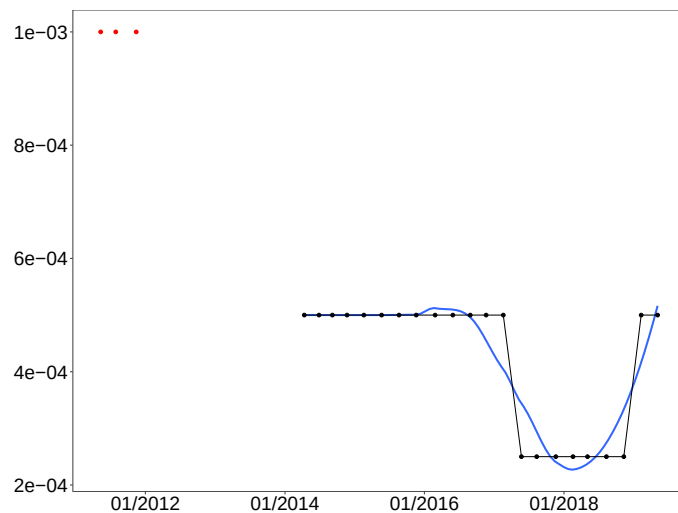
GW01 – Aluminium (t.)

 $\tau = -0.407$ | p-value = 0.00801 | Negative trend

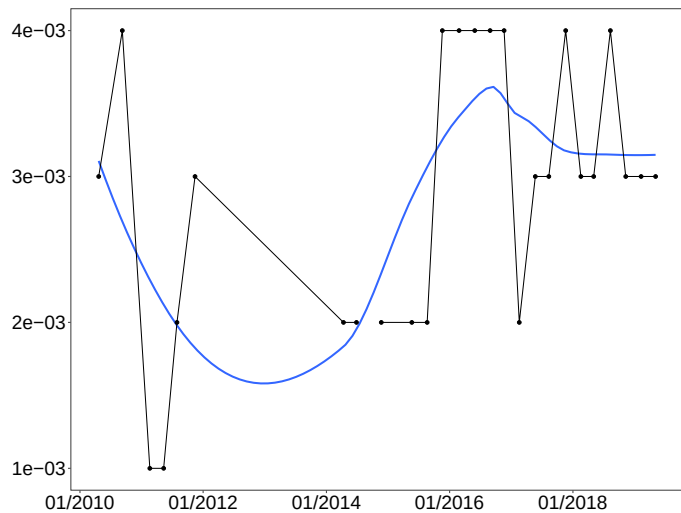
GW01 – Antimony (d.)

 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend

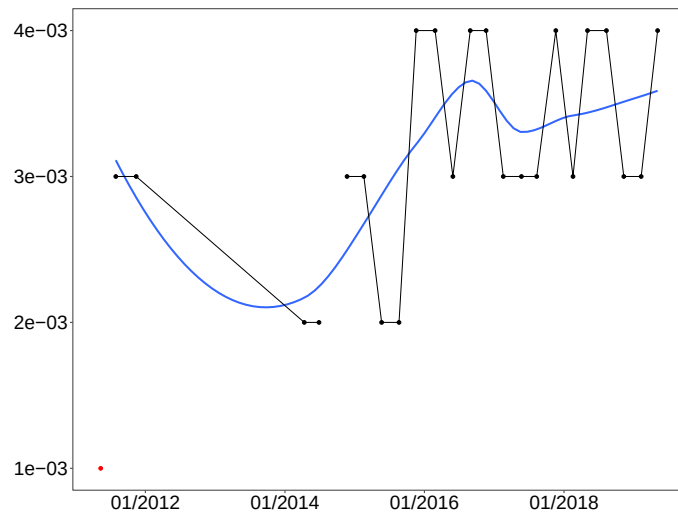
GW01 – Antimony (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

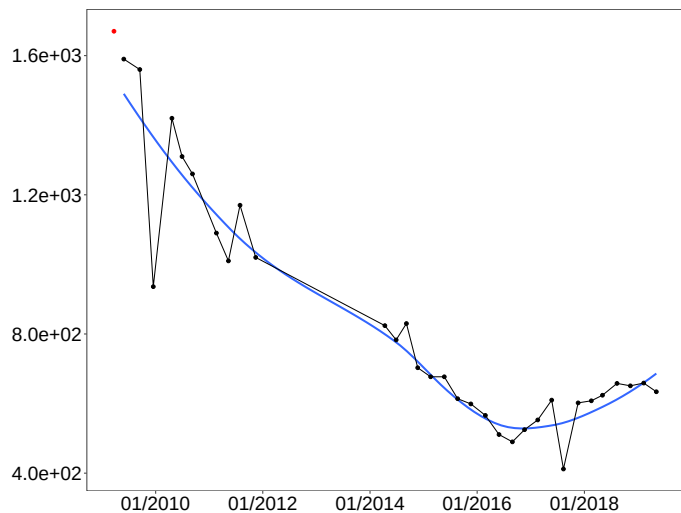
GW01 – Arsenic (d.)

 $\tau = 0.283$ | p-value = 0.0702 | No trend

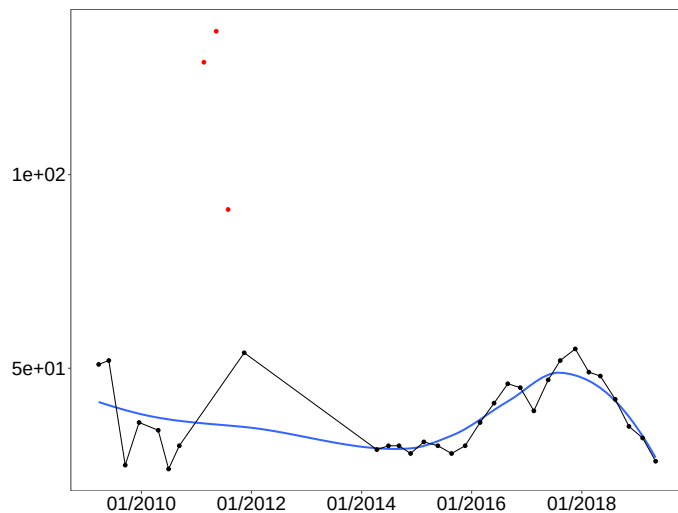
GW01 – Arsenic (t.)

 $\tau = 0.427$ | p-value = 0.00993 | Positive trend

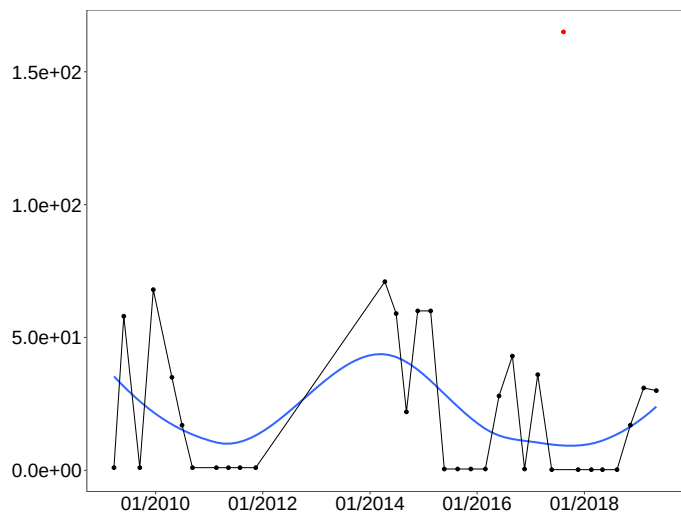
GW01 – Bicarbonate
 $\tau = -0.624$ | p-value = 0.000000372 | Negative trend



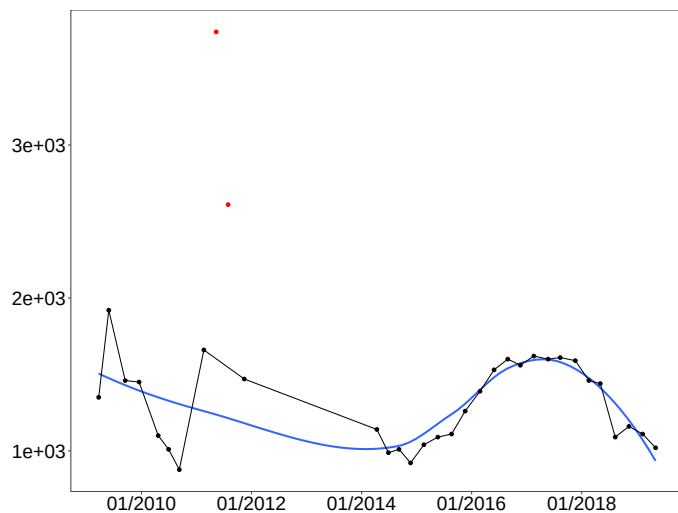
GW01 – Calcium
 $\tau = 0.0556$ | p-value = 0.664 | No trend



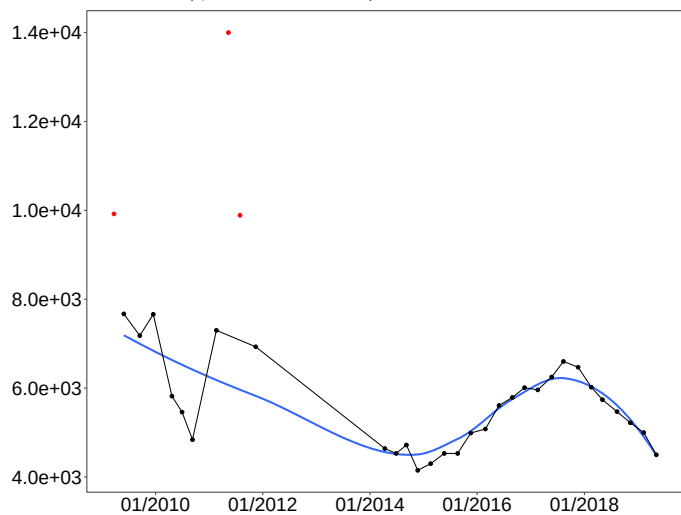
GW01 – Carbonate
 $\tau = -0.211$ | p-value = 0.0972 | No trend



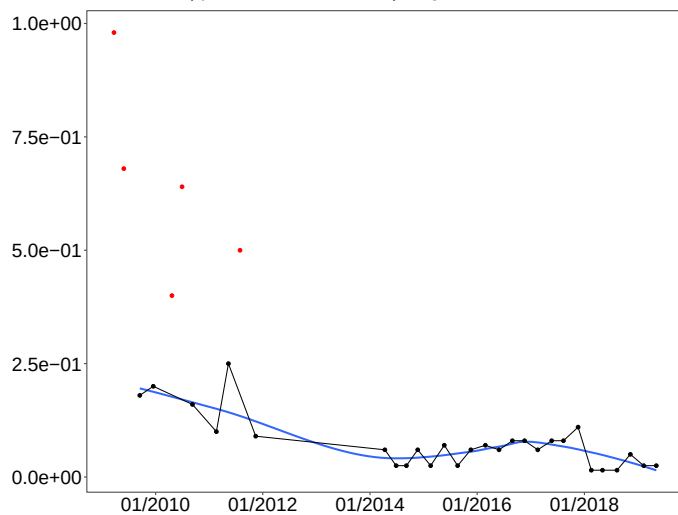
GW01 – Chloride
 $\tau = 0.0019$ | p-value = 1 | No trend



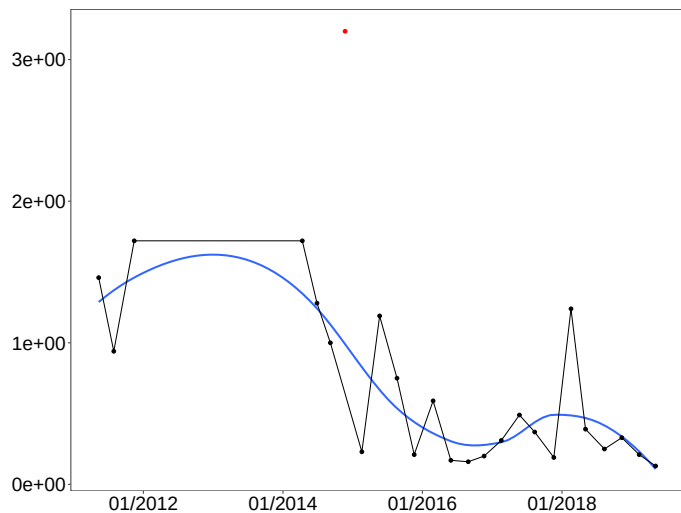
GW01 – Electrical Conductivity
 $\tau = -0.207$ | p-value = 0.0941 | No trend



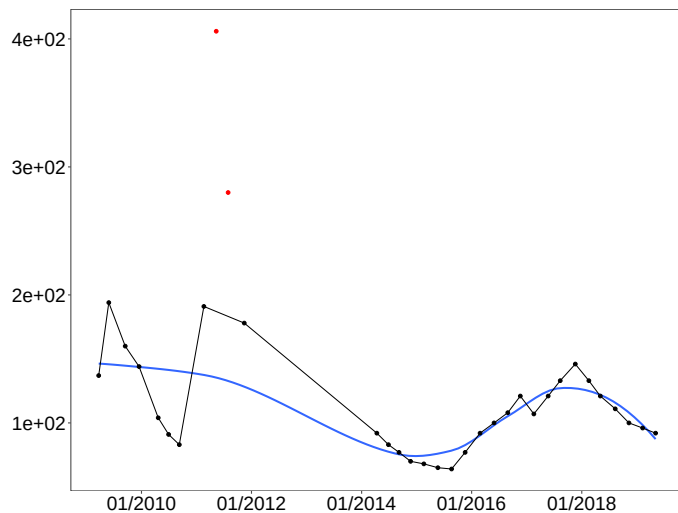
GW01 – Iron (d.)
 $\tau = -0.519$ | p-value = 0.000038 | Negative trend



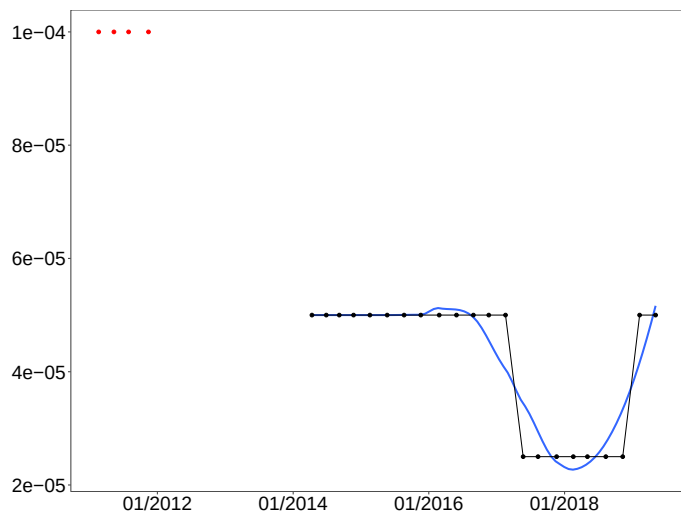
GW01 – Iron (t.)

 $\tau = -0.468$ | p-value = 0.00116 | Negative trend

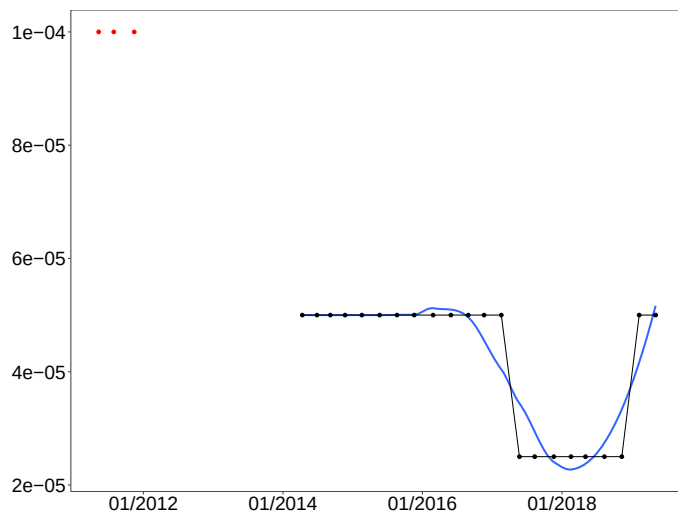
GW01 – Magnesium

 $\tau = -0.122$ | p-value = 0.328 | No trend

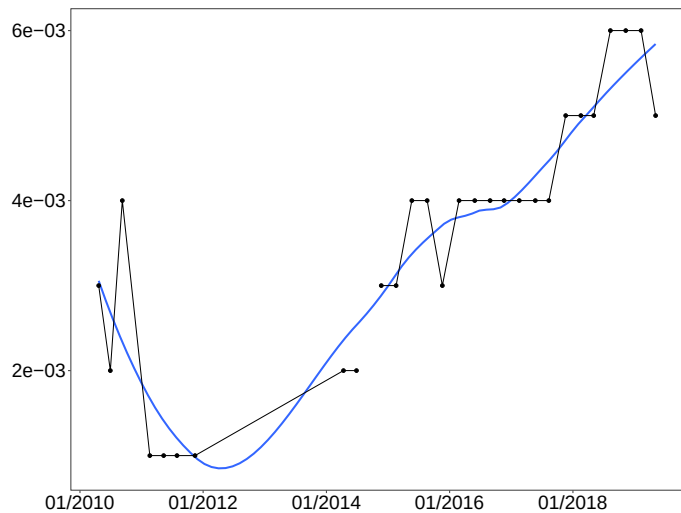
GW01 – Mercury (d.)

 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend

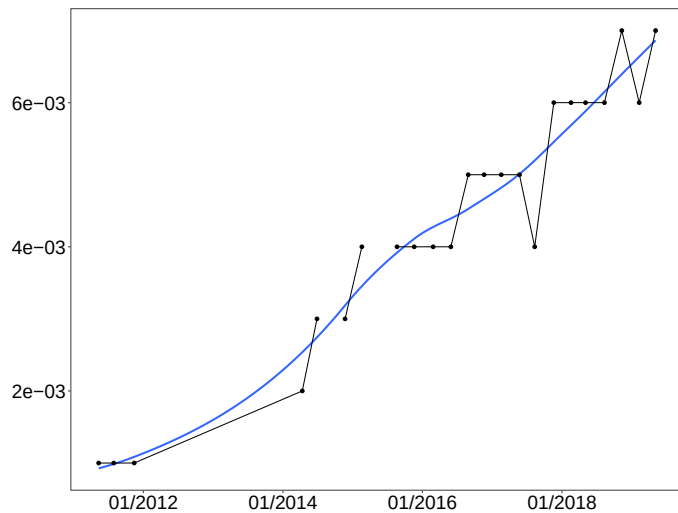
GW01 – Mercury (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

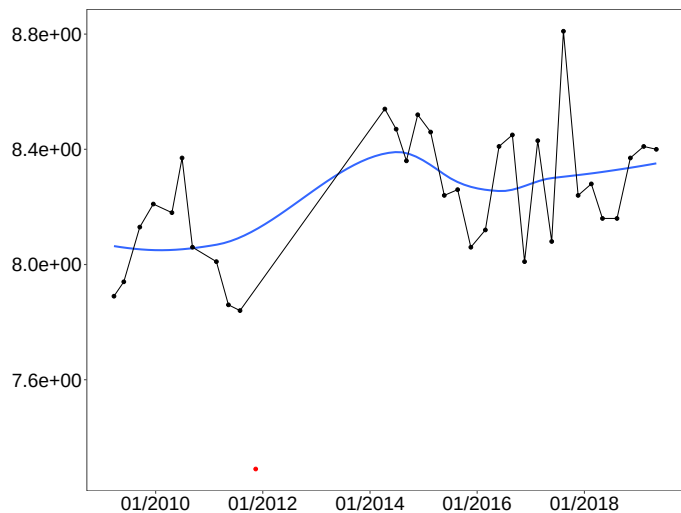
GW01 – Molybdenum (d.)

 $\tau = 0.758$ | p-value = 0.000000119 | Positive trend

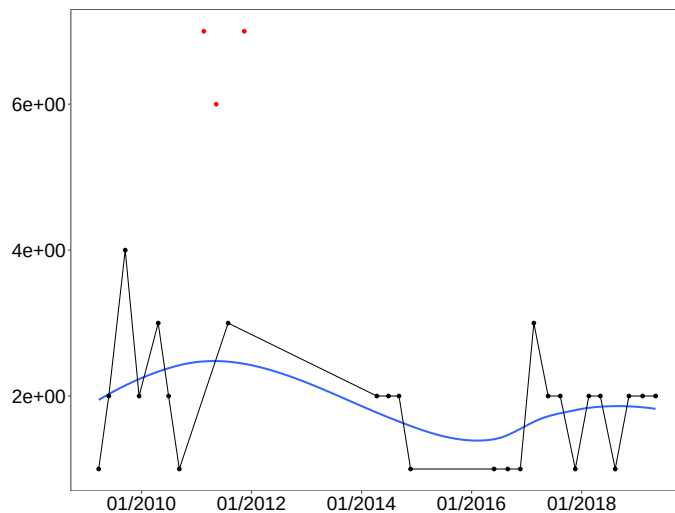
GW01 – Molybdenum (t.)

 $\tau = 0.883$ | p-value = 0 | Positive trend

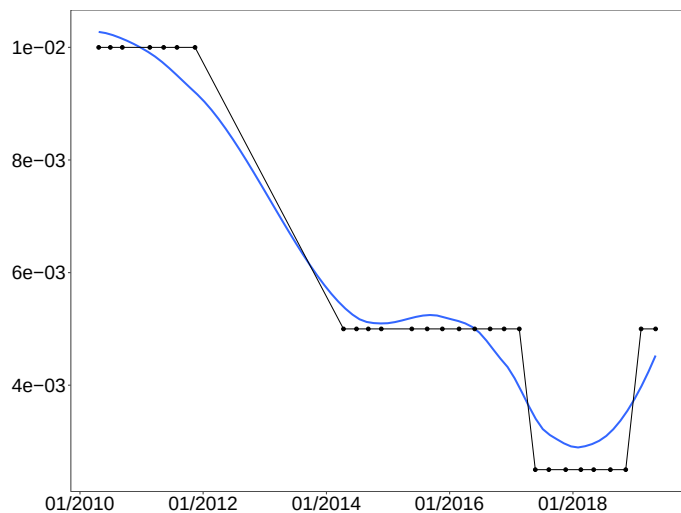
GW01 – pH
 $\tau = 0.232$ | p-value = 0.0606 | No trend



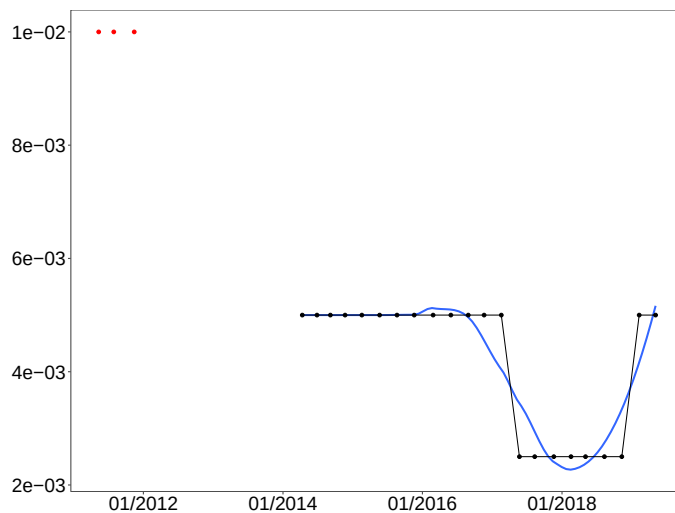
GW01 – Potassium
 $\tau = -0.189$ | p-value = 0.211 | No trend



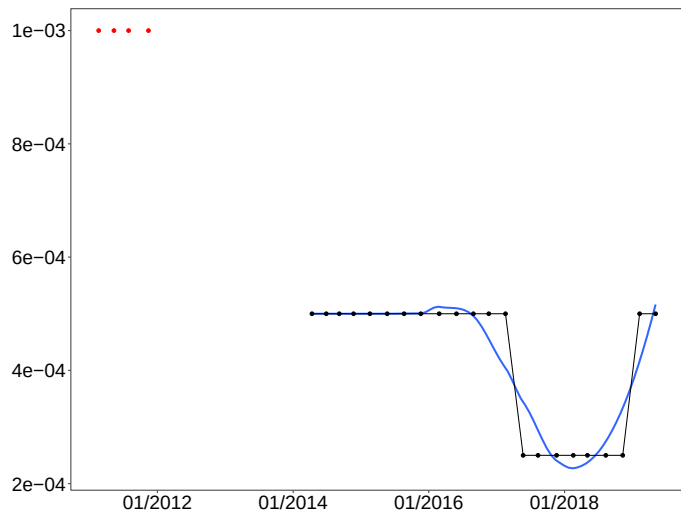
GW01 – Selenium (d.)
 $\tau = -0.713$ | p-value = 0.00000302 | Negative trend



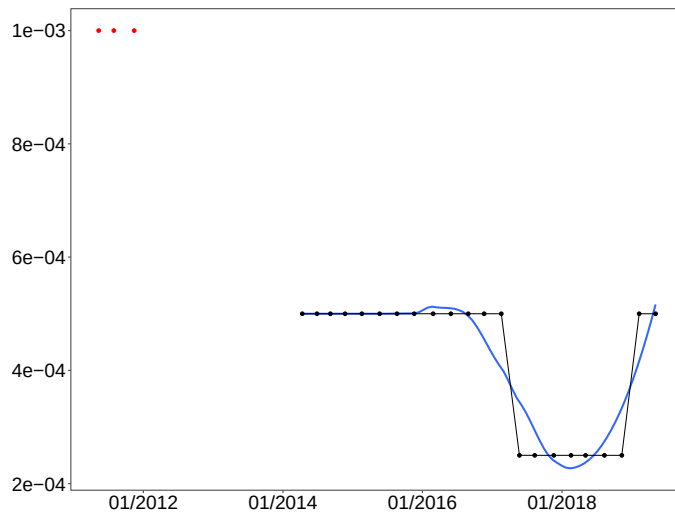
GW01 – Selenium (t.)
 $\tau = -0.631$ | p-value = 0.00013 | Negative trend



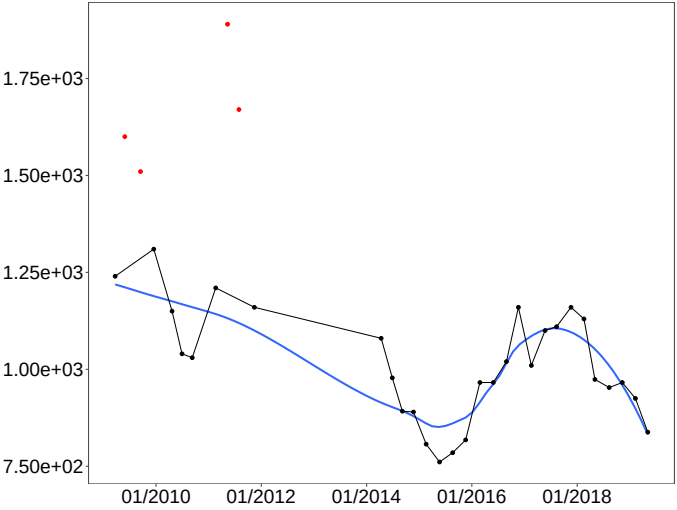
GW01 – Silver (d.)
 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend



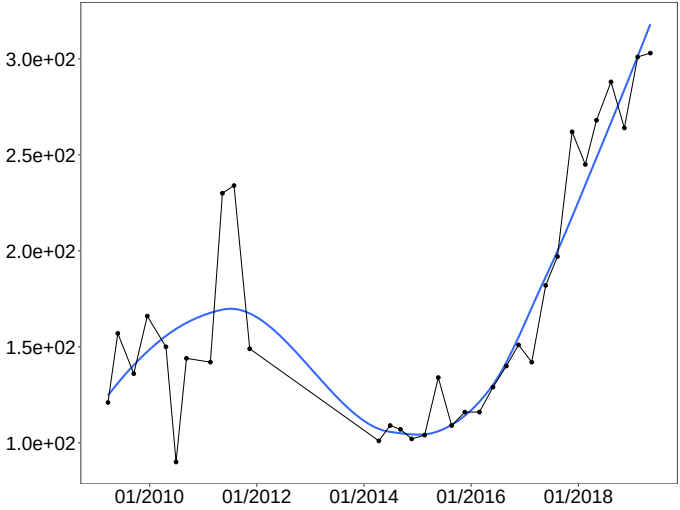
GW01 – Silver (t.)
 $\tau = -0.631$ | p-value = 0.00013 | Negative trend



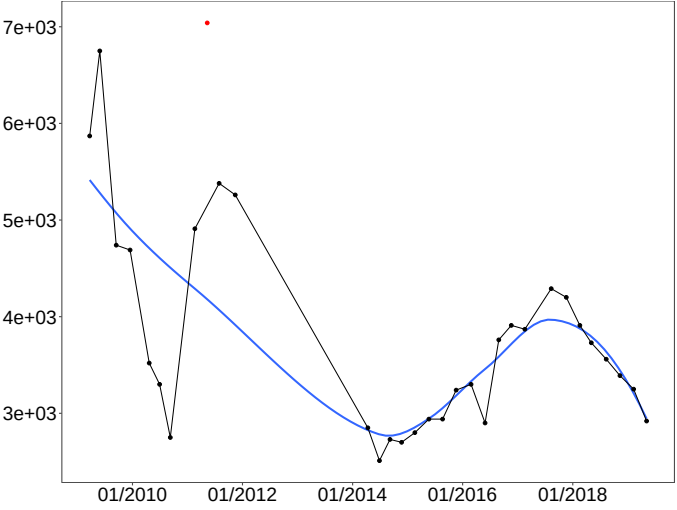
GW01 – Sodium
 $\tau = -0.354$ | p-value = 0.00412 | Negative trend



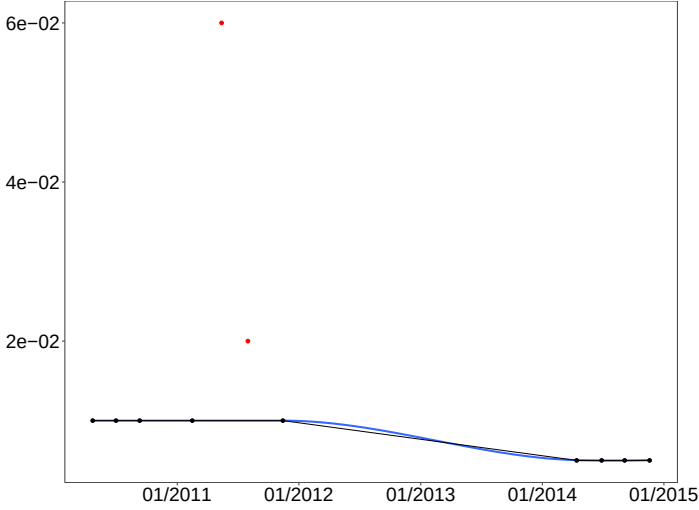
GW01 – Sulphate
 $\tau = 0.412$ | p-value = 0.000814 | Positive trend



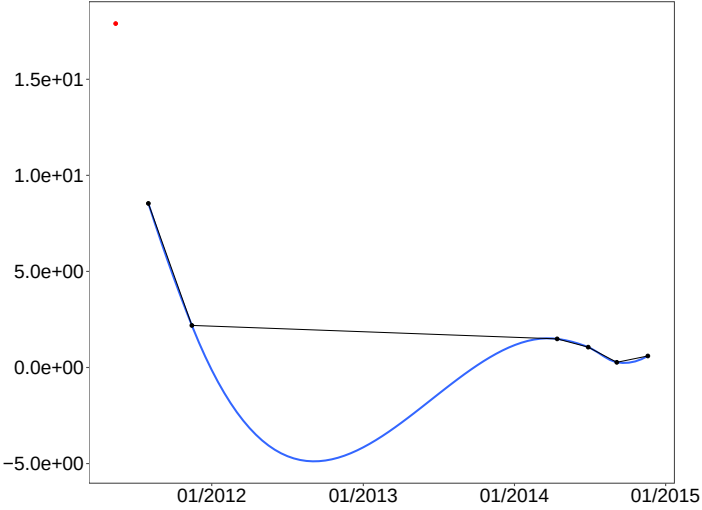
GW01 – TDS
 $\tau = -0.144$ | p-value = 0.256 | No trend



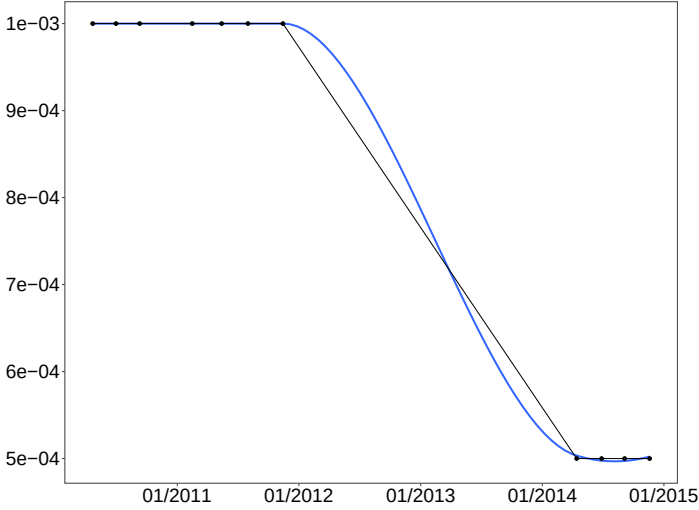
GW02 – Aluminium (d.)
 $\tau = -0.497$ | p-value = 0.0627 | No trend



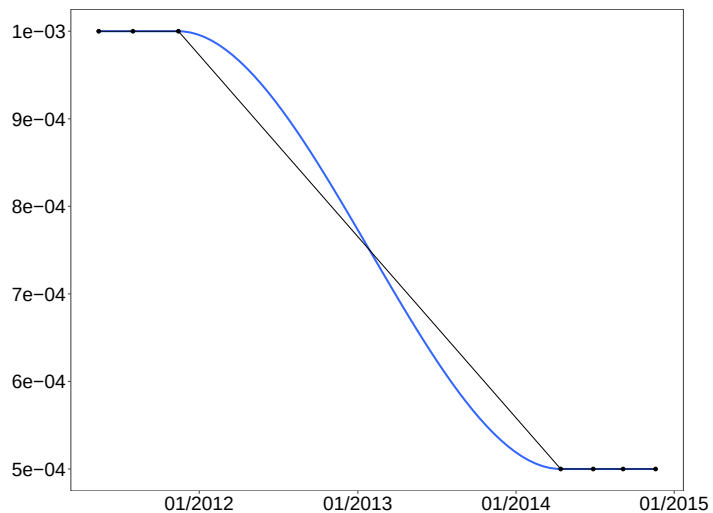
GW02 – Aluminium (t.)
 $\tau = -0.905$ | p-value = 0.00686 | Negative trend



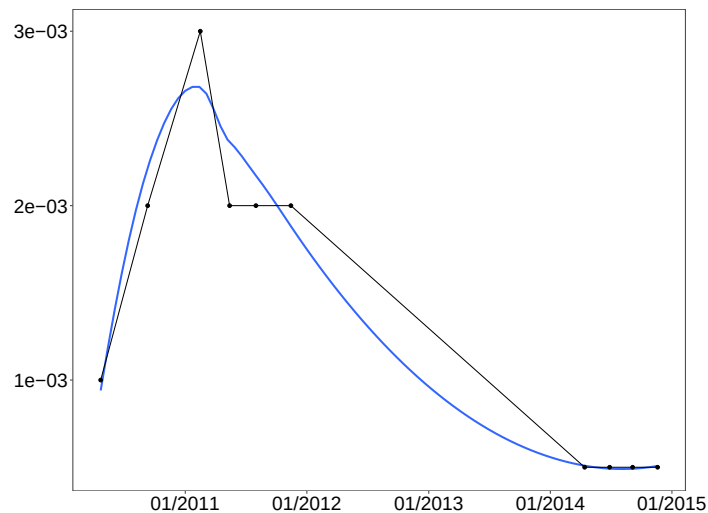
GW02 – Antimony (d.)
 $\tau = -0.714$ | p-value = 0.0107 | Negative trend



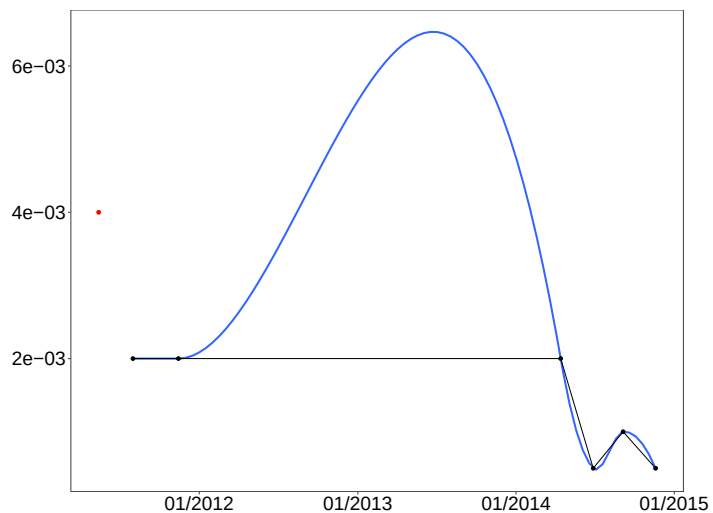
GW02 – Antimony (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



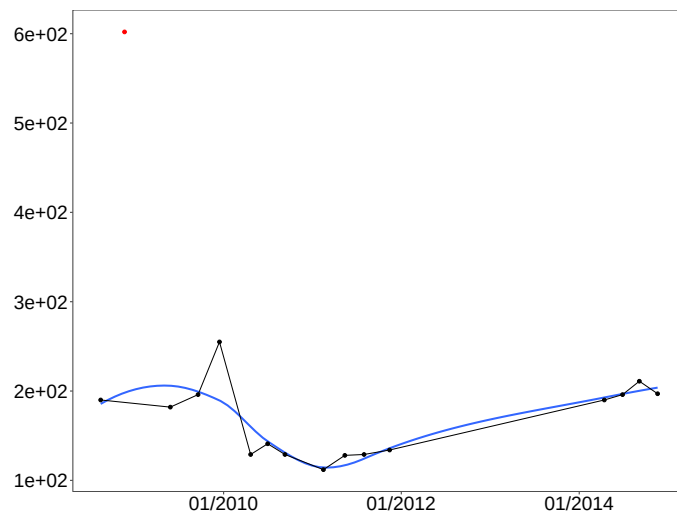
GW02 – Arsenic (d.)
 $\tau = -0.545$ | p-value = 0.0539 | No trend



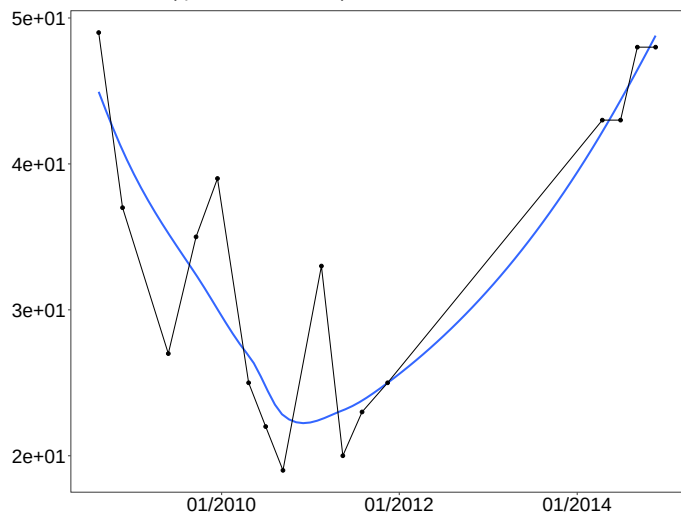
GW02 – Arsenic (t.)
 $\tau = -0.794$ | p-value = 0.0262 | Negative trend



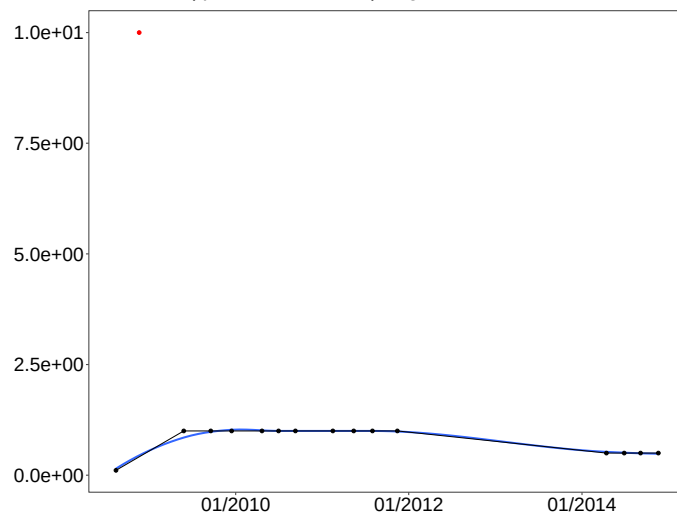
GW02 – Bicarbonate
 $\tau = -0.00851$ | p-value = 1 | No trend



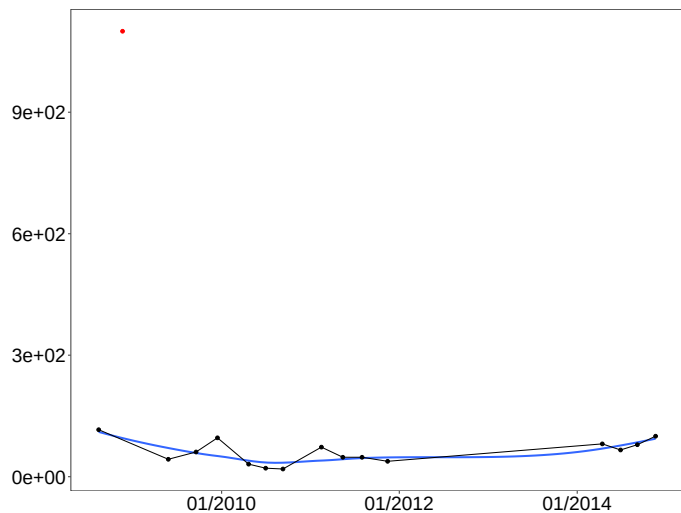
GW02 – Calcium
 $\tau = 0.0928$ | p-value = 0.652 | No trend



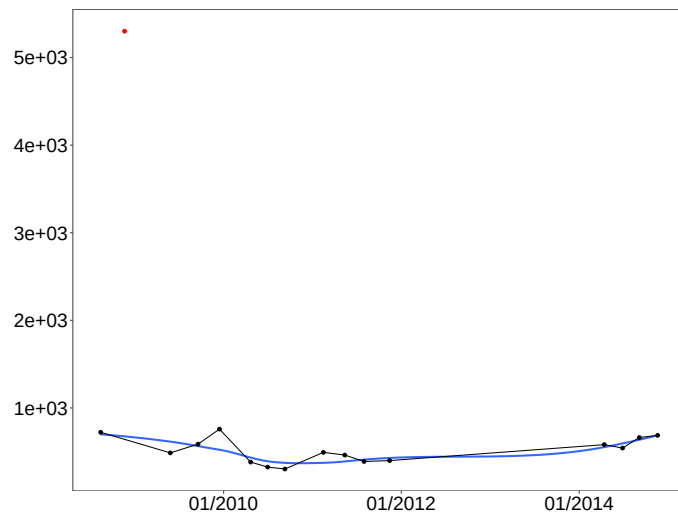
GW02 – Carbonate
 $\tau = -0.429$ | p-value = 0.0451 | Negative trend



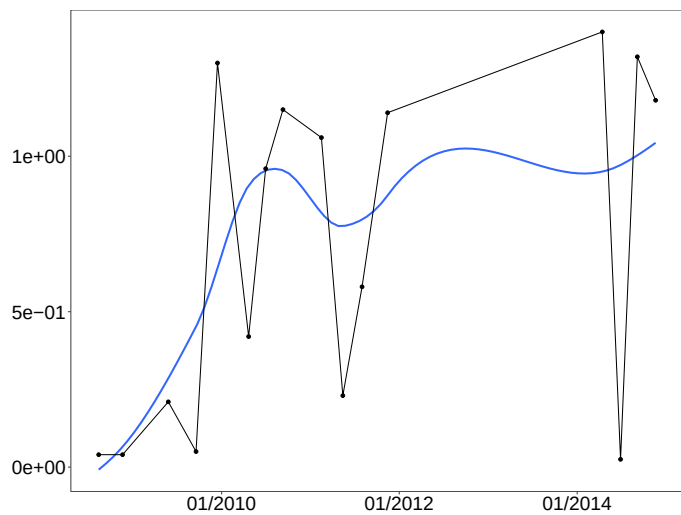
GW02 – Chloride
 $\tau = 0.00837$ | $p\text{-value} = 1$ | No trend



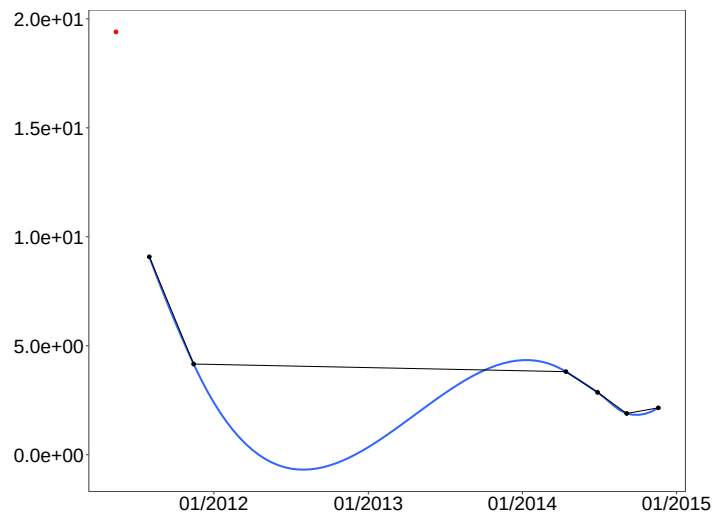
GW02 – Electrical Conductivity
 $\tau = -0.0333$ | $p\text{-value} = 0.893$ | No trend



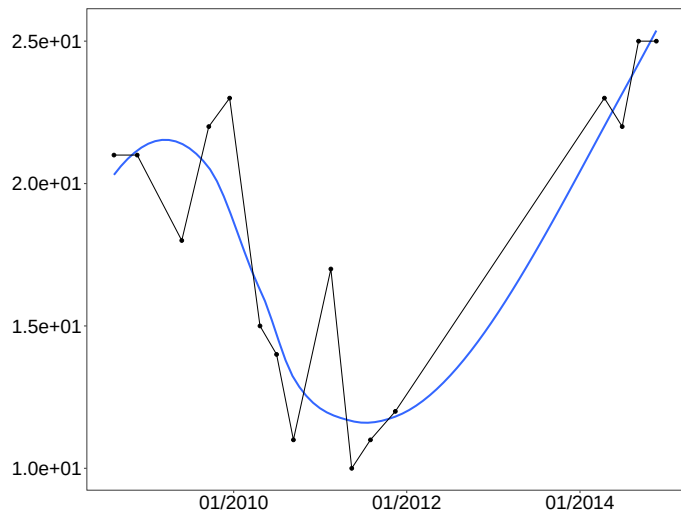
GW02 – Iron (d.)
 $\tau = 0.427$ | $p\text{-value} = 0.0242$ | Positive trend



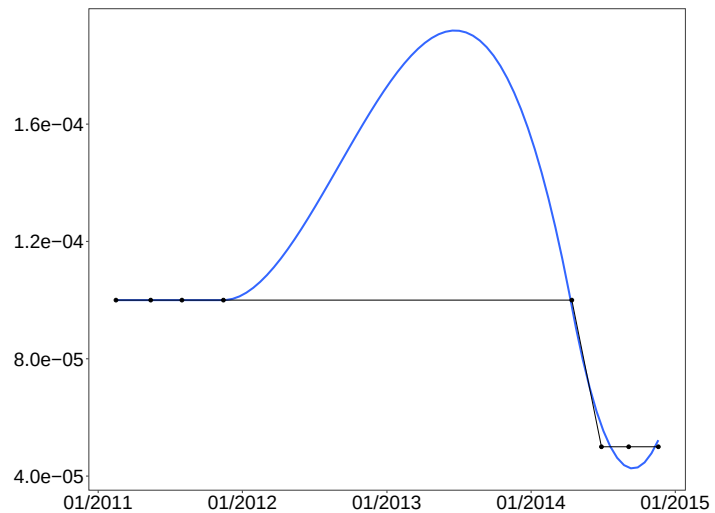
GW02 – Iron (t.)
 $\tau = -0.905$ | $p\text{-value} = 0.00686$ | Negative trend



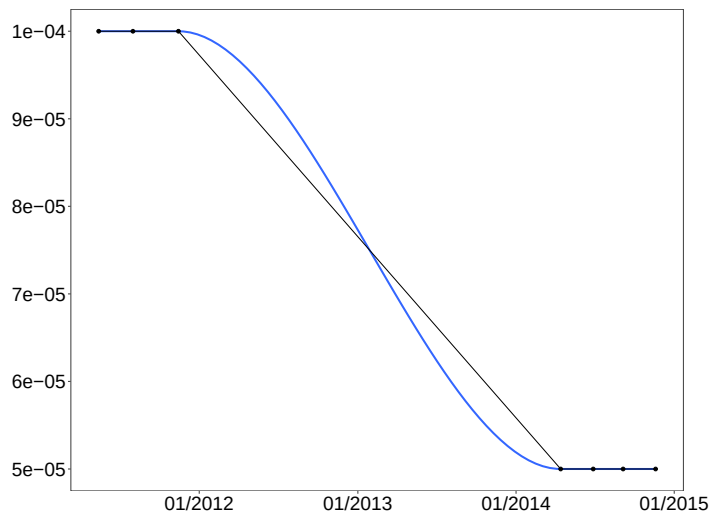
GW02 – Magnesium
 $\tau = 0.0936$ | $p\text{-value} = 0.651$ | No trend



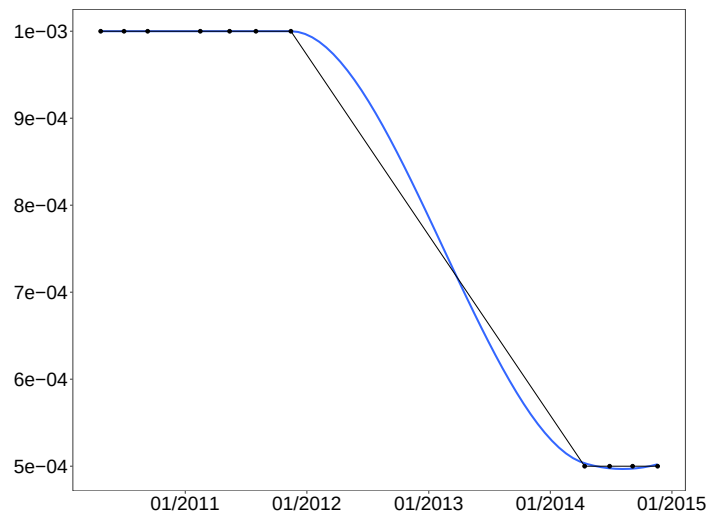
GW02 – Mercury (d.)
 $\tau = -0.732$ | $p\text{-value} = 0.0369$ | Negative trend



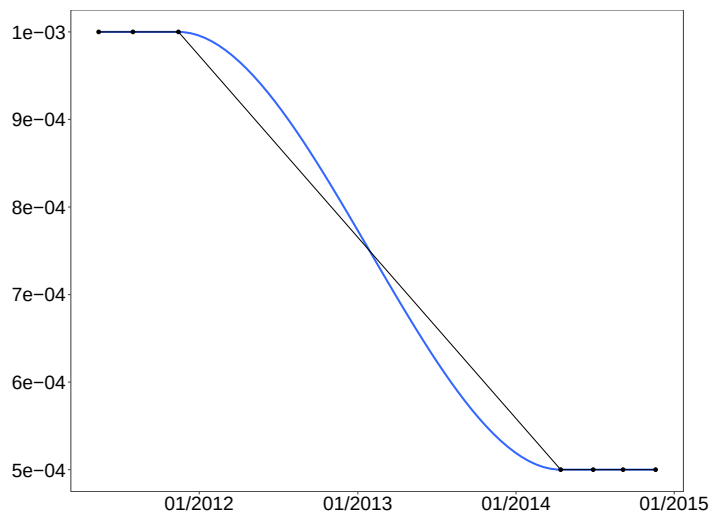
GW02 – Mercury (t.)

 $\tau = -0.756$ | p-value = 0.0518 | No trend

GW02 – Molybdenum (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

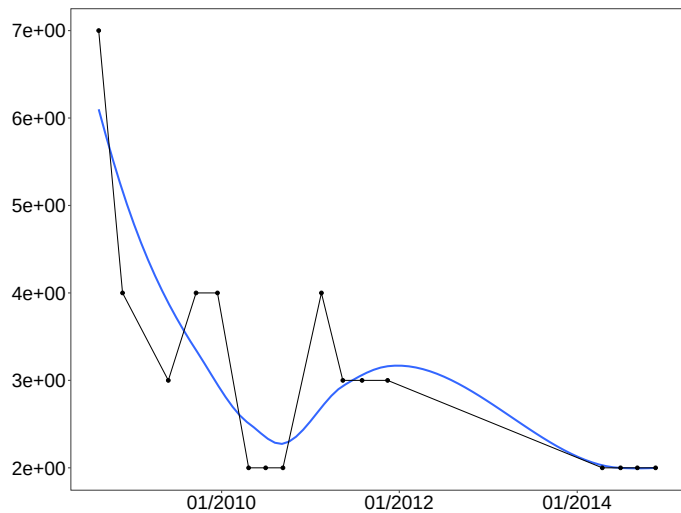
GW02 – Molybdenum (t.)

 $\tau = -0.756$ | p-value = 0.0518 | No trend

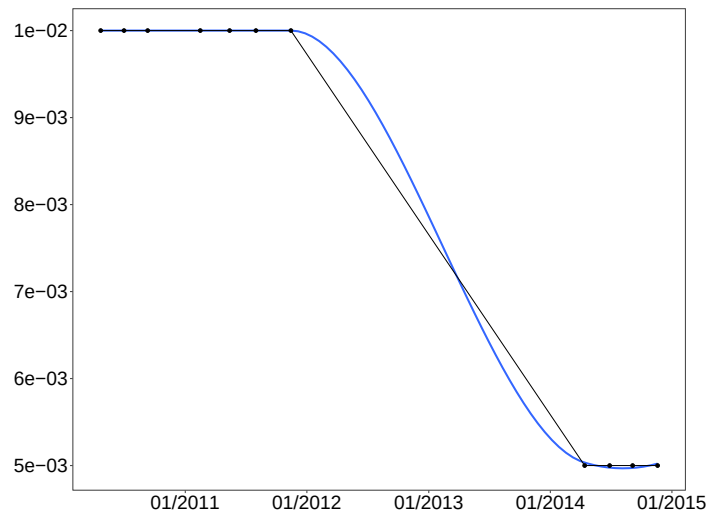
GW02 – pH

 $\tau = 0.628$ | p-value = 0.000853 | Positive trend

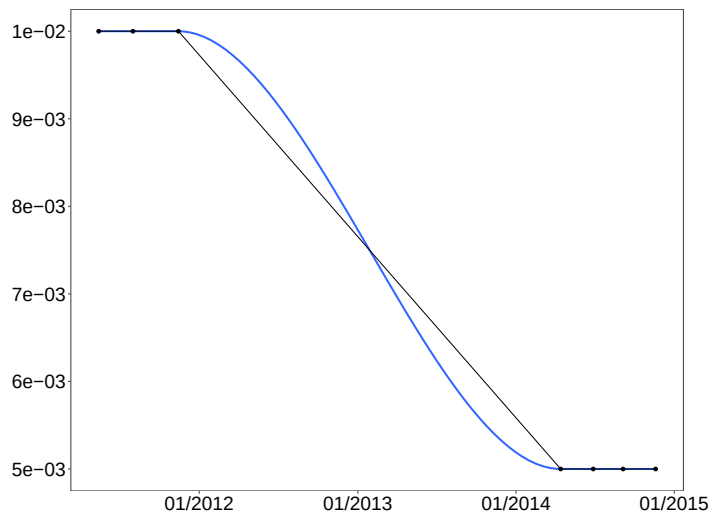
GW02 – Potassium

 $\tau = -0.558$ | p-value = 0.00703 | Negative trend

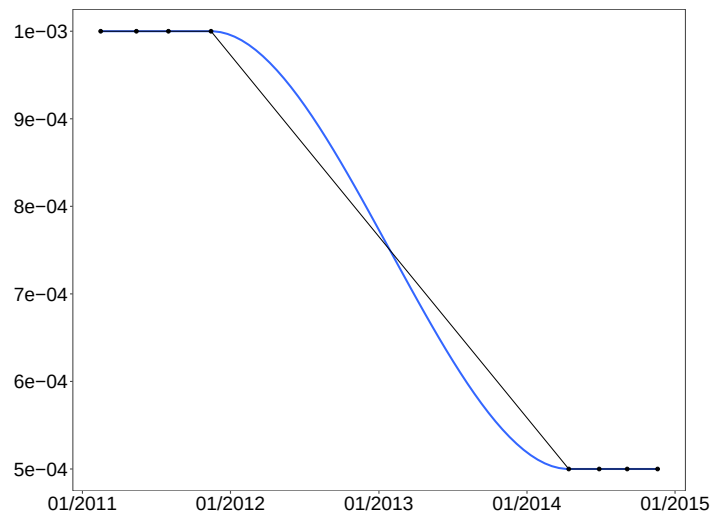
GW02 – Selenium (d.)

 $\tau = -0.714$ | p-value = 0.0107 | Negative trend

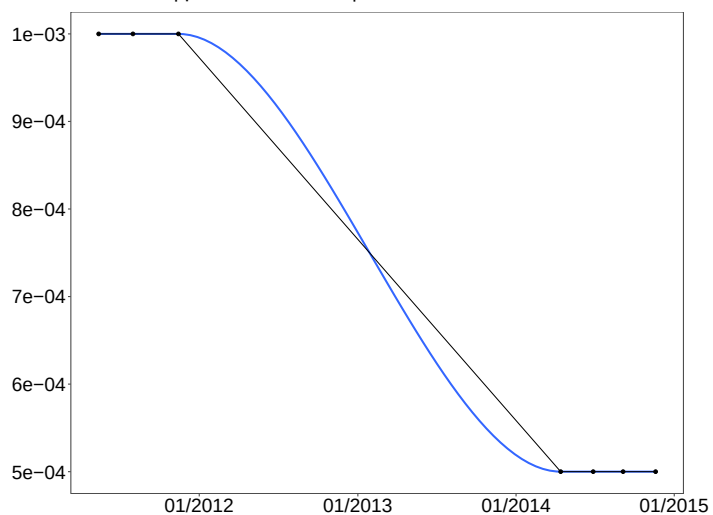
GW02 – Selenium (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



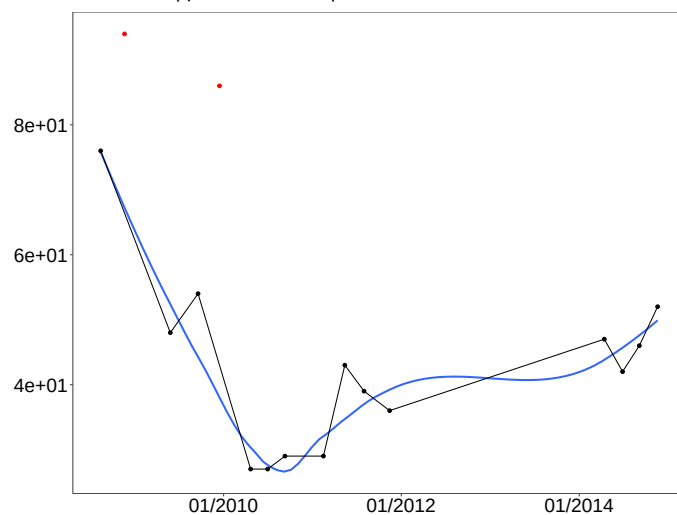
GW02 – Silver (d.)
 $\tau = -0.756$ | p-value = 0.0304 | Negative trend



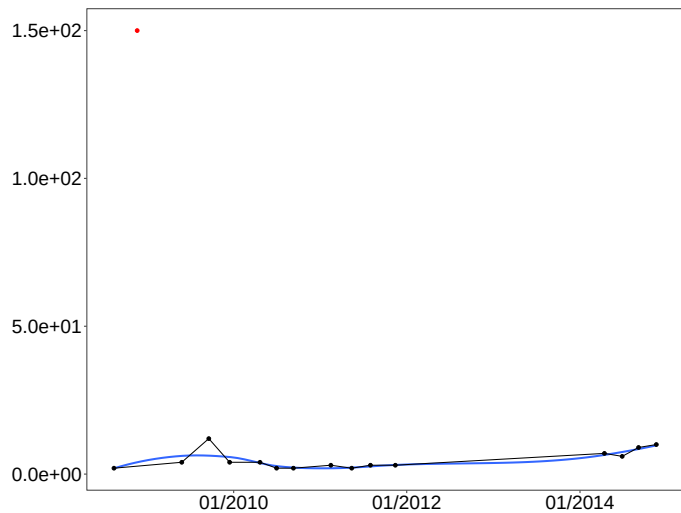
GW02 – Silver (t.)
 $\tau = -0.756$ | p-value = 0.0518 | No trend



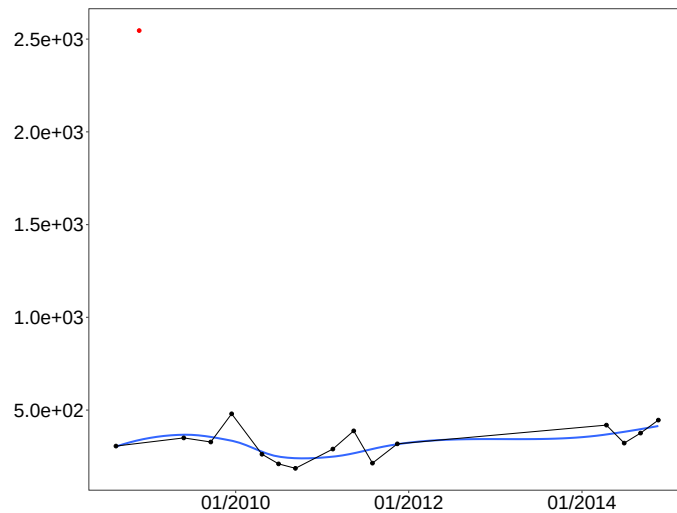
GW02 – Sodium
 $\tau = -0.101$ | p-value = 0.62 | No trend



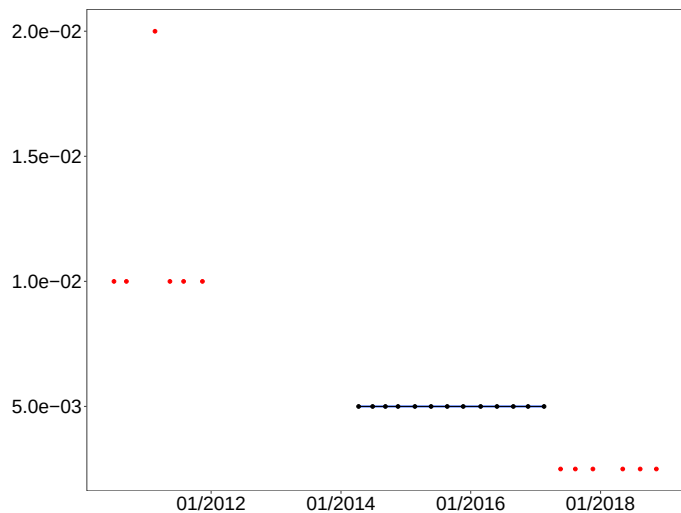
GW02 – Sulphate
 $\tau = 0.141$ | p-value = 0.492 | No trend



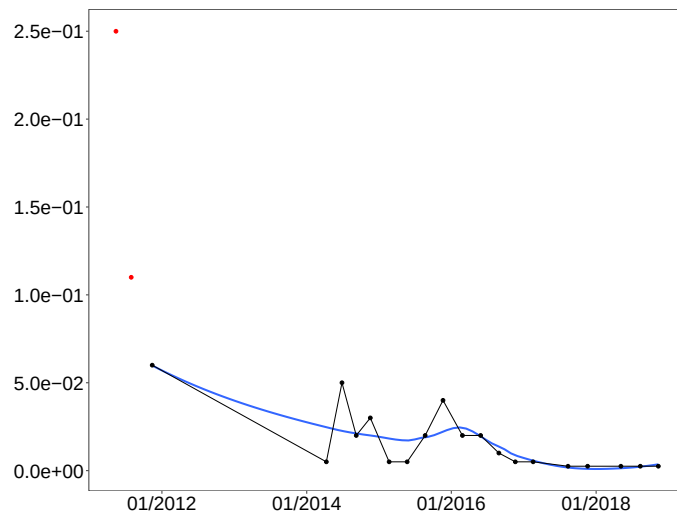
GW02 – TDS
 $\tau = 0.0667$ | p-value = 0.753 | No trend



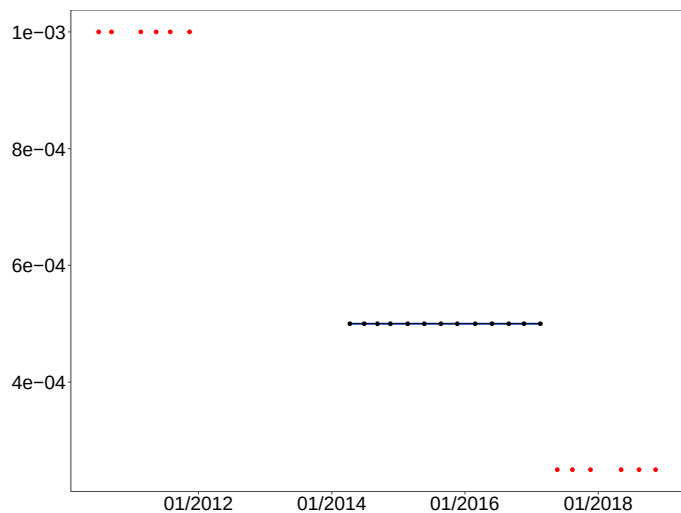
Jamar Bore – Aluminium (d.)

 $\tau = -0.794$ | p-value = 0.000000843 | Negative trend

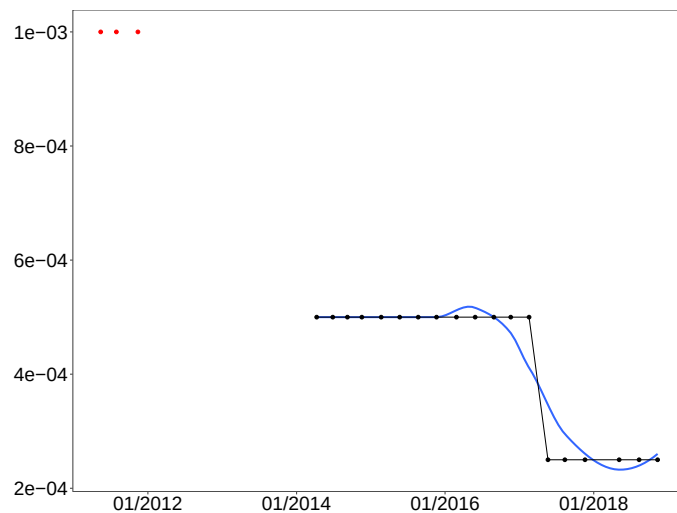
Jamar Bore – Aluminium (t.)

 $\tau = -0.712$ | p-value = 0.0000187 | Negative trend

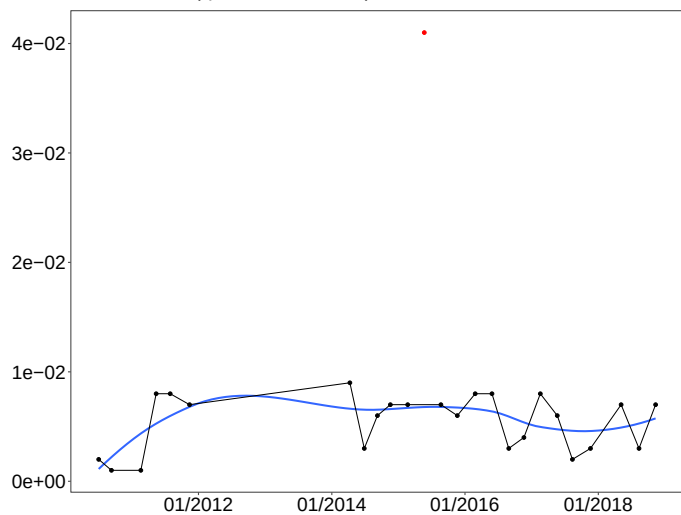
Jamar Bore – Antimony (d.)

 $\tau = -0.8$ | p-value = 0.000000872 | Negative trend

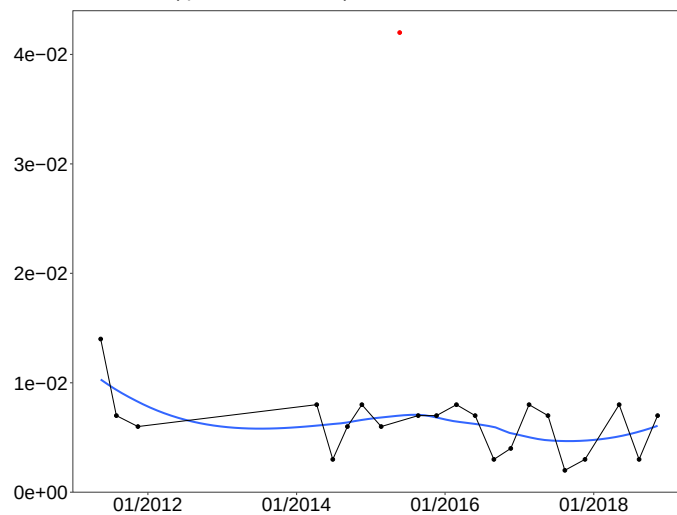
Jamar Bore – Antimony (t.)

 $\tau = -0.764$ | p-value = 0.0000148 | Negative trend

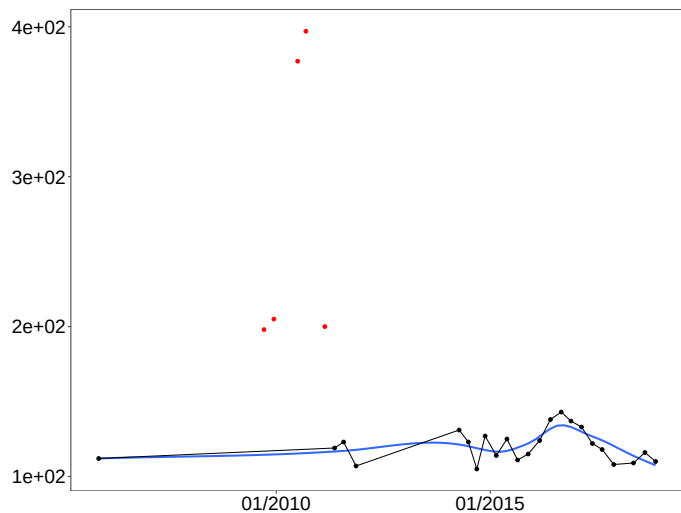
Jamar Bore – Arsenic (d.)

 $\tau = -0.00711$ | p-value = 0.981 | No trend

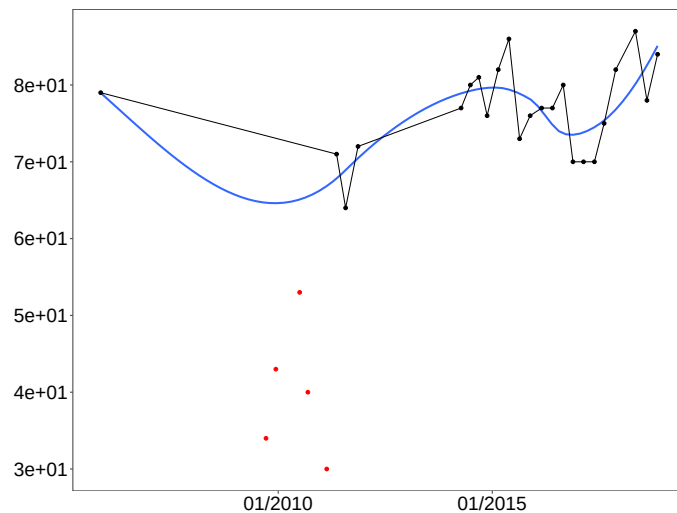
Jamar Bore – Arsenic (t.)

 $\tau = -0.202$ | p-value = 0.225 | No trend

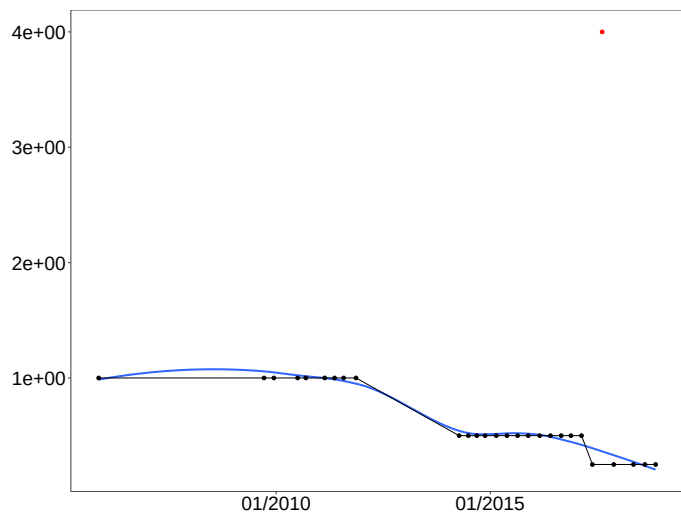
Jamar Bore – Bicarbonate
 $\tau = -0.273$ | p-value = 0.0438 | Negative trend



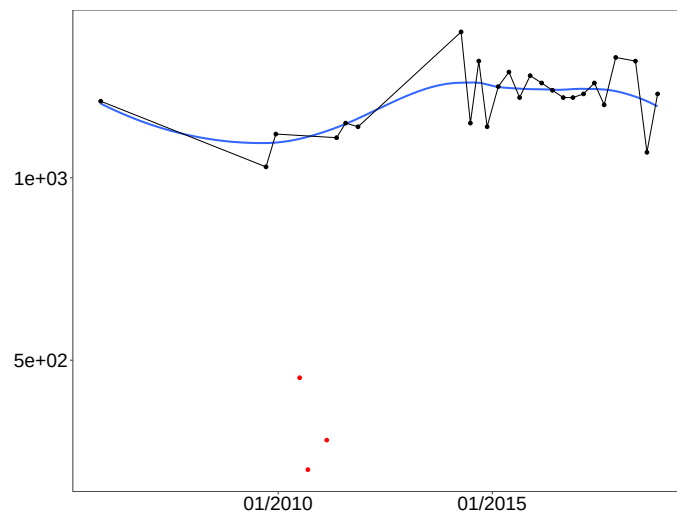
Jamar Bore – Calcium
 $\tau = 0.399$ | p-value = 0.00339 | Positive trend



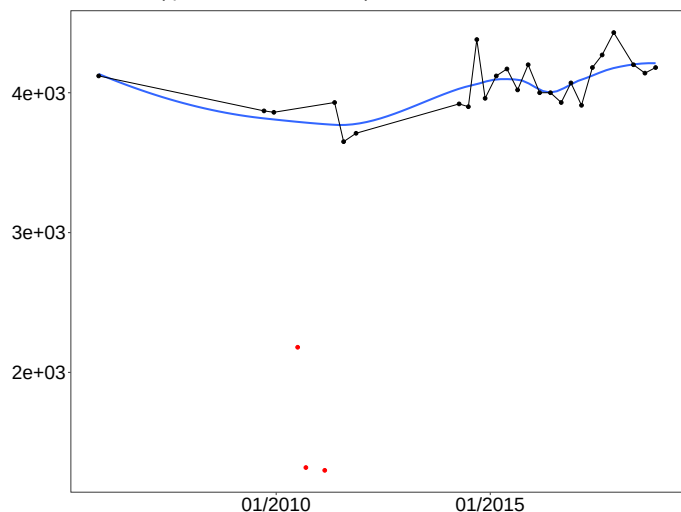
Jamar Bore – Carbonate
 $\tau = -0.671$ | p-value = 0.00000948 | Negative trend



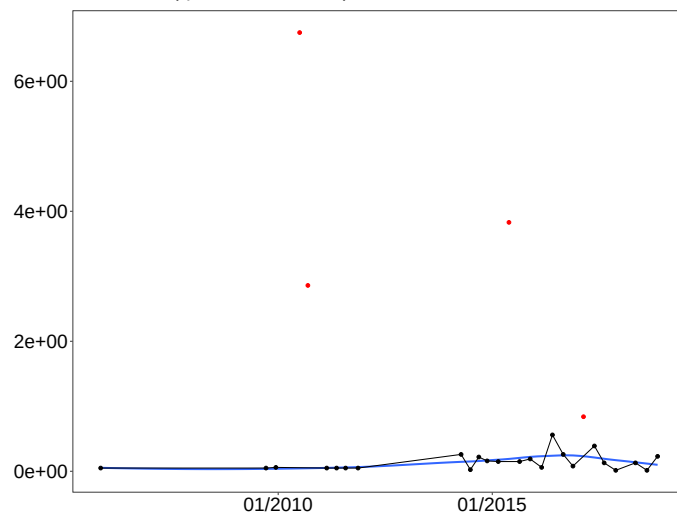
Jamar Bore – Chloride
 $\tau = 0.348$ | p-value = 0.0107 | Positive trend



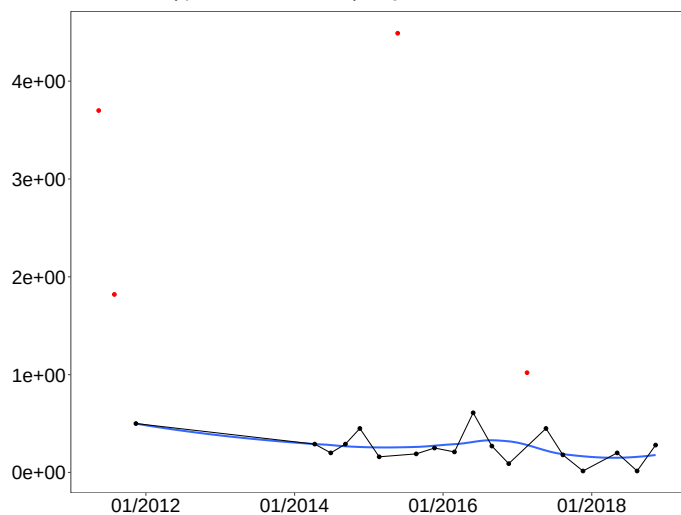
Jamar Bore – Electrical Conductivity
 $\tau = 0.487$ | p-value = 0.000319 | Positive trend



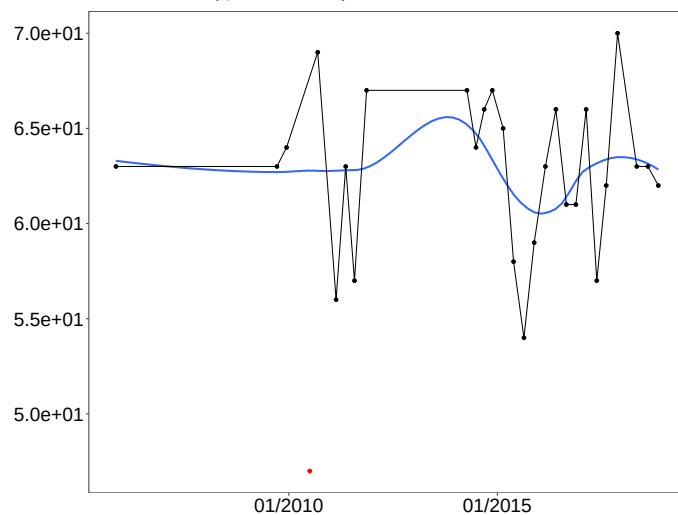
Jamar Bore – Iron (d.)
 $\tau = 0.0652$ | p-value = 0.647 | No trend



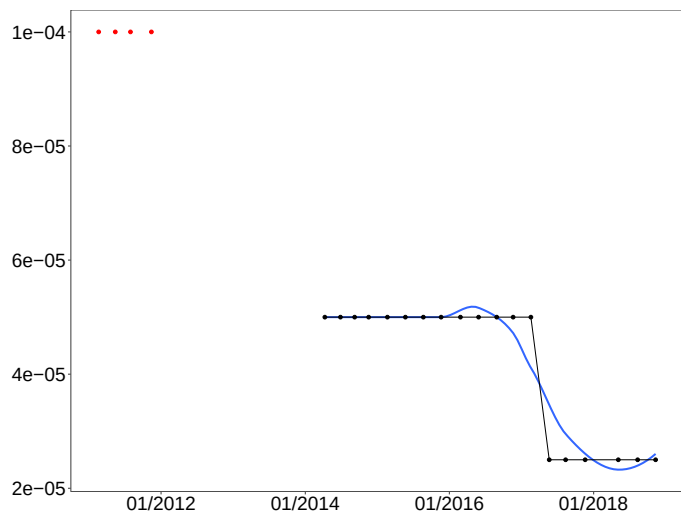
Jamar Bore – Iron (t.)

 $\tau = -0.362$ | p-value = 0.0206 | Negative trend

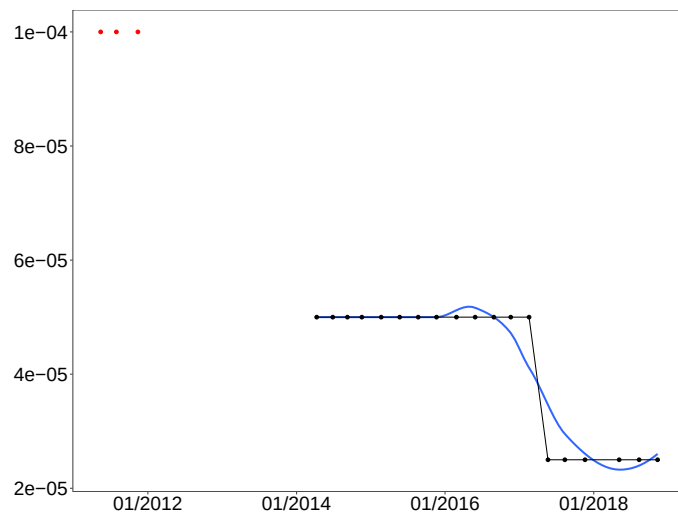
Jamar Bore – Magnesium

 $\tau = -0.00274$ | p-value = 1 | No trend

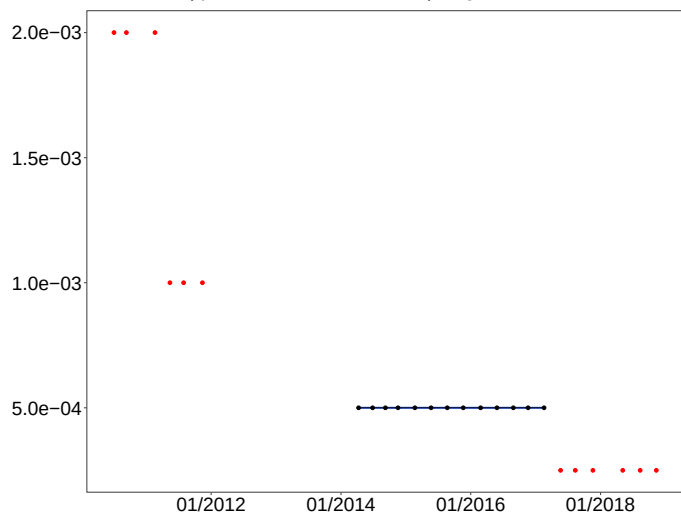
Jamar Bore – Mercury (d.)

 $\tau = -0.78$ | p-value = 0.00000523 | Negative trend

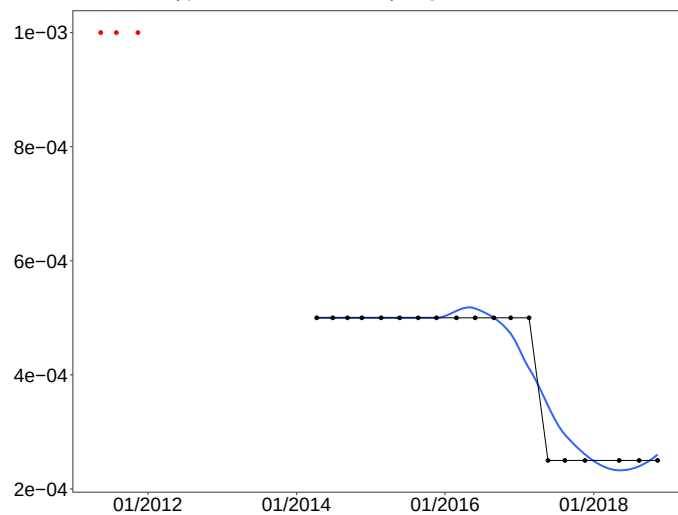
Jamar Bore – Mercury (t.)

 $\tau = -0.764$ | p-value = 0.0000148 | Negative trend

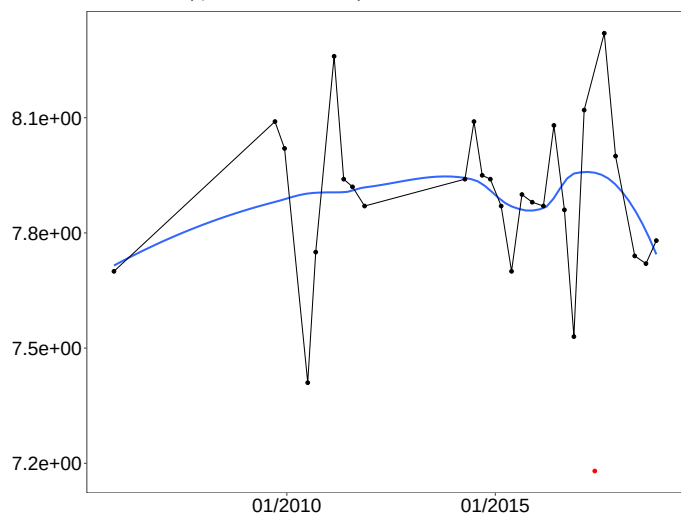
Jamar Bore – Molybdenum (d.)

 $\tau = -0.819$ | p-value = 0.000000314 | Negative trend

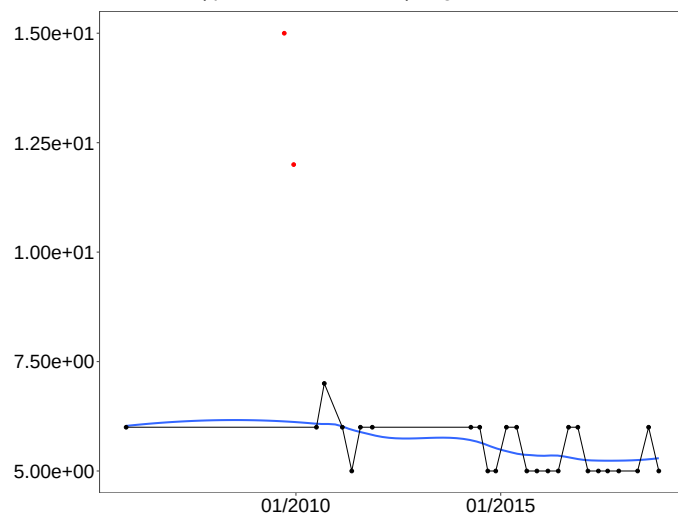
Jamar Bore – Molybdenum (t.)

 $\tau = -0.764$ | p-value = 0.0000148 | Negative trend

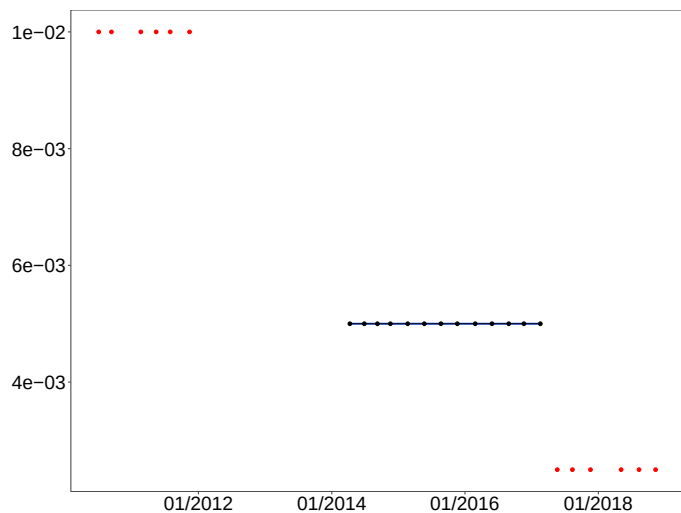
Jamar Bore – pH
 $\tau = -0.128$ | p-value = 0.352 | No trend



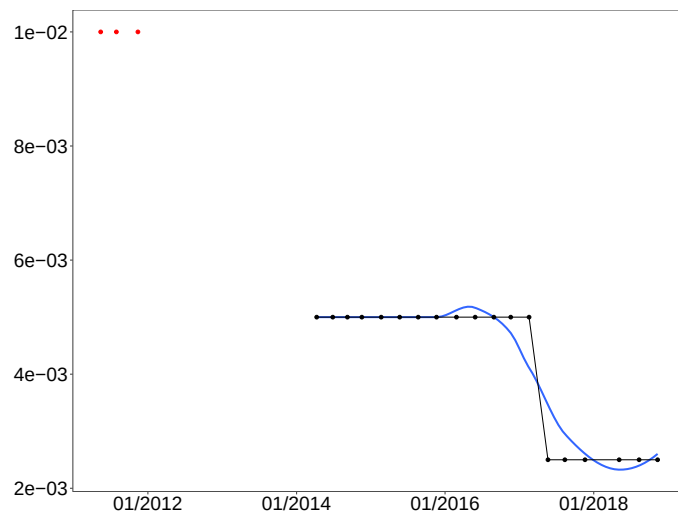
Jamar Bore – Potassium
 $\tau = -0.518$ | p-value = 0.000796 | Negative trend



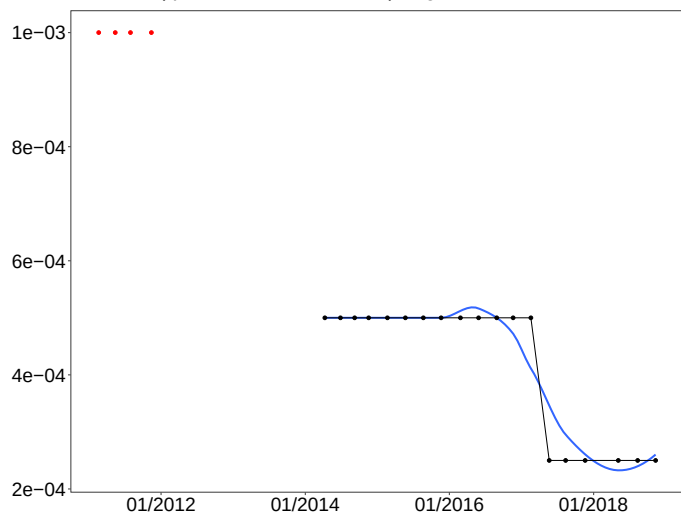
Jamar Bore – Selenium (d.)
 $\tau = -0.8$ | p-value = 0.000000872 | Negative trend



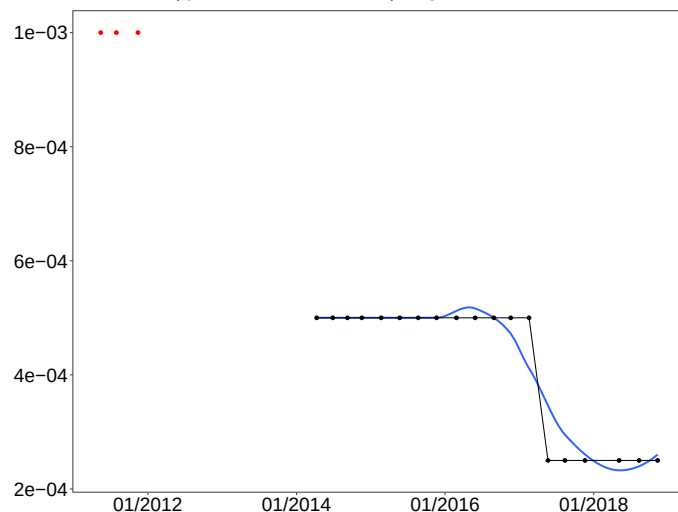
Jamar Bore – Selenium (t.)
 $\tau = -0.764$ | p-value = 0.0000148 | Negative trend



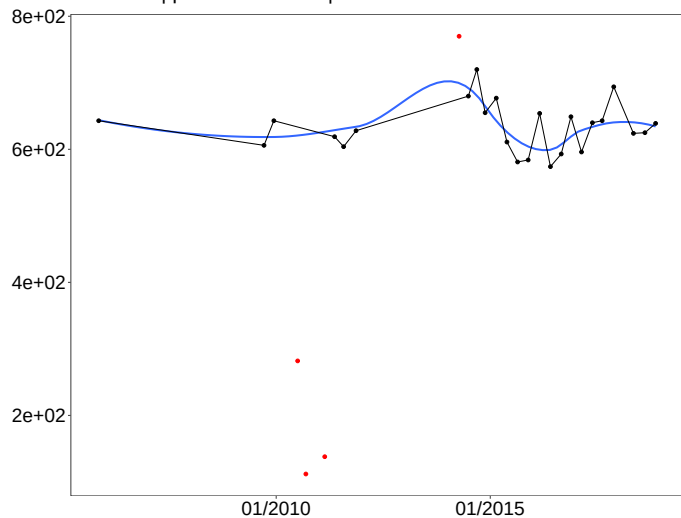
Jamar Bore – Silver (d.)
 $\tau = -0.78$ | p-value = 0.00000523 | Negative trend



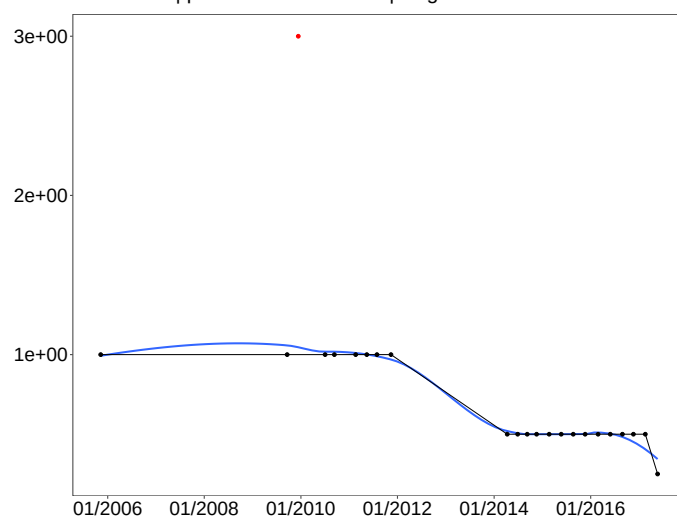
Jamar Bore – Silver (t.)
 $\tau = -0.764$ | p-value = 0.0000148 | Negative trend



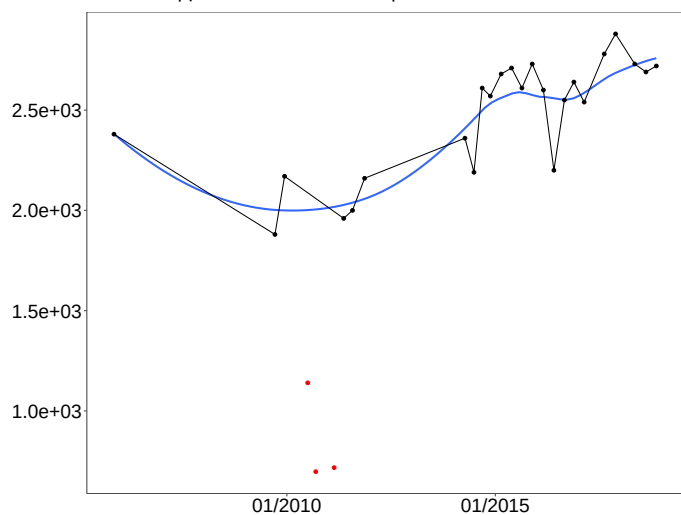
Jamar Bore – Sodium
 $\tau = 0.093$ | p-value = 0.501 | No trend



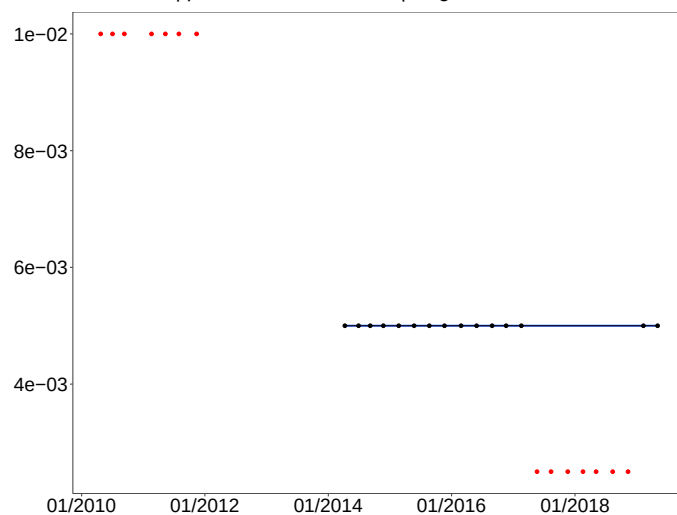
Jamar Bore – Sulphate
 $\tau = -0.742$ | p-value = 0.0000185 | Negative trend



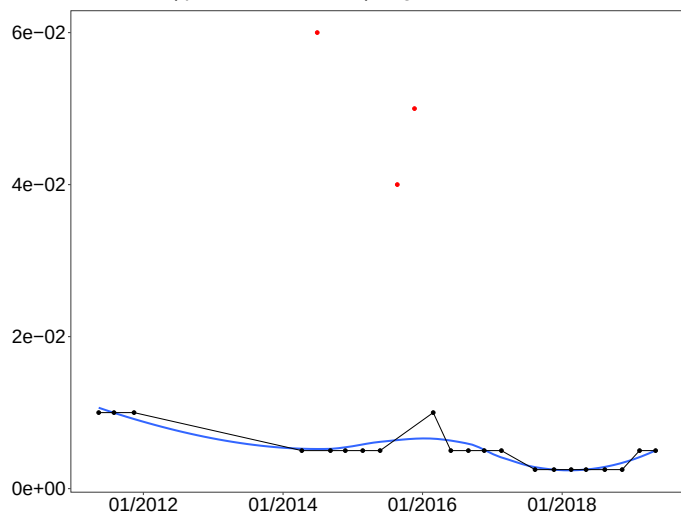
Jamar Bore – TDS
 $\tau = 0.603$ | p-value = 0.0000119 | Positive trend



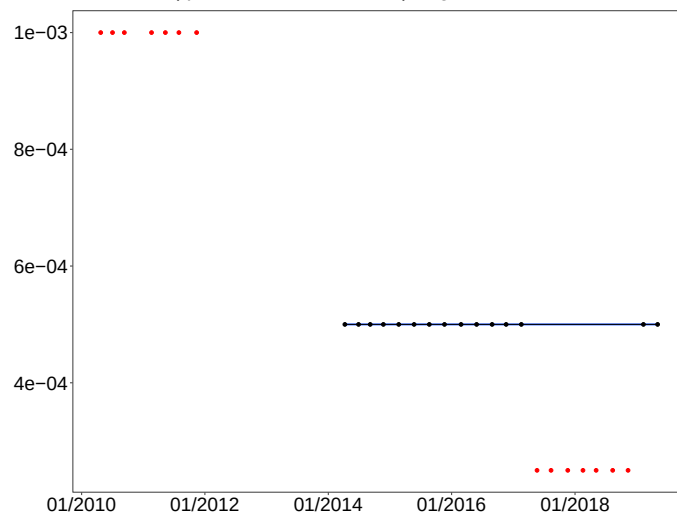
Karanga Bore – Aluminium (d.)
 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend



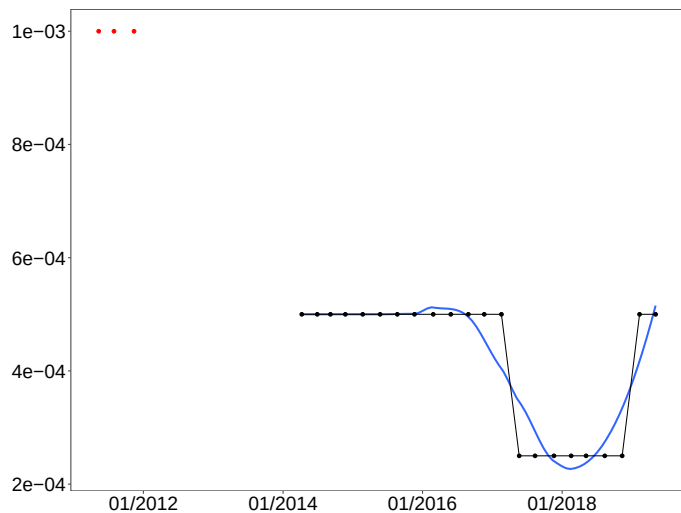
Karanga Bore – Aluminium (t.)
 $\tau = -0.528$ | p-value = 0.00111 | Negative trend



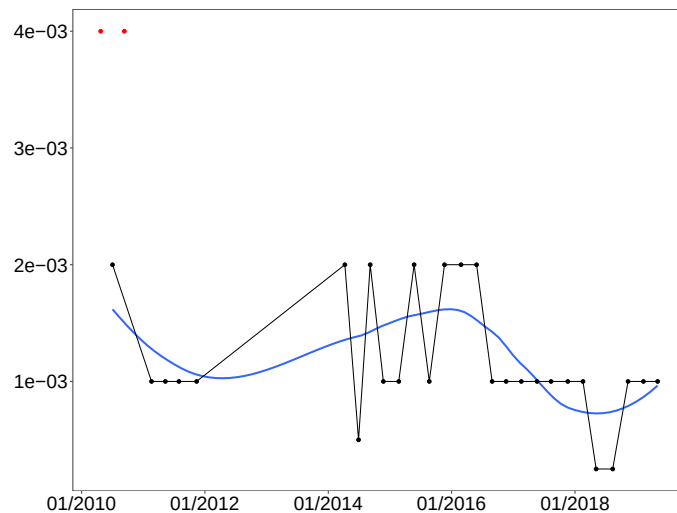
Karanga Bore – Antimony (d.)
 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend



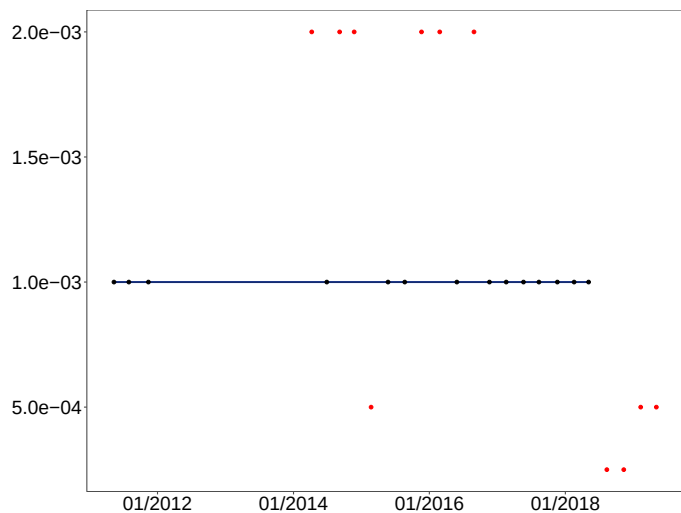
Karanga Bore – Antimony (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

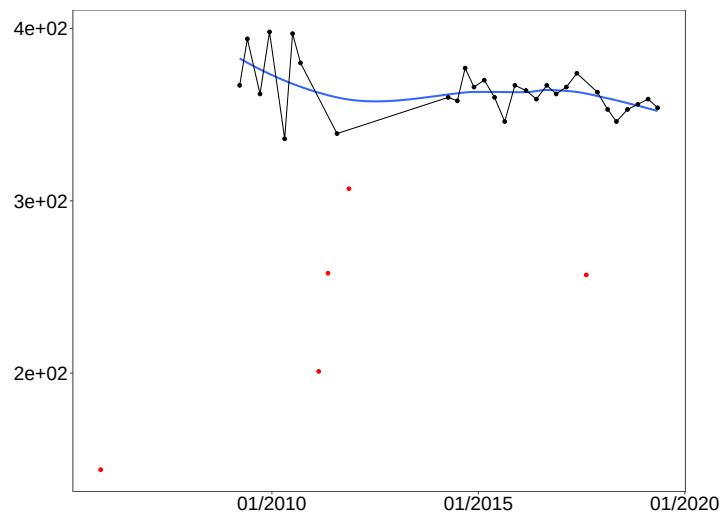
Karanga Bore – Arsenic (d.)

 $\tau = -0.401$ | p-value = 0.00731 | Negative trend

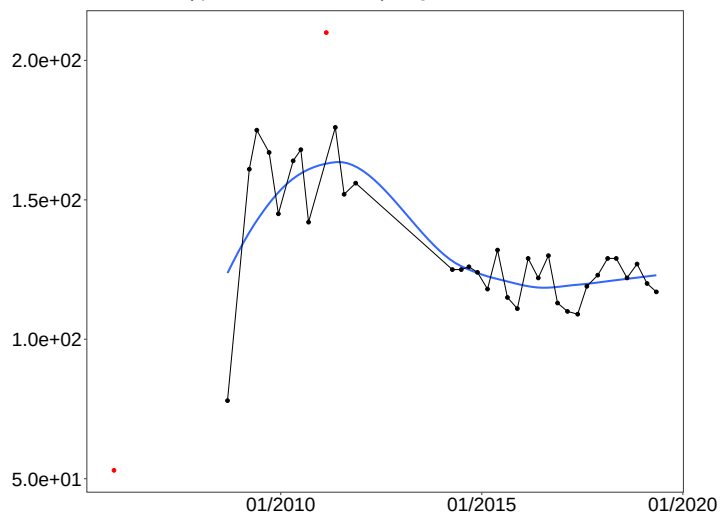
Karanga Bore – Arsenic (t.)

 $\tau = -0.402$ | p-value = 0.0131 | Negative trend

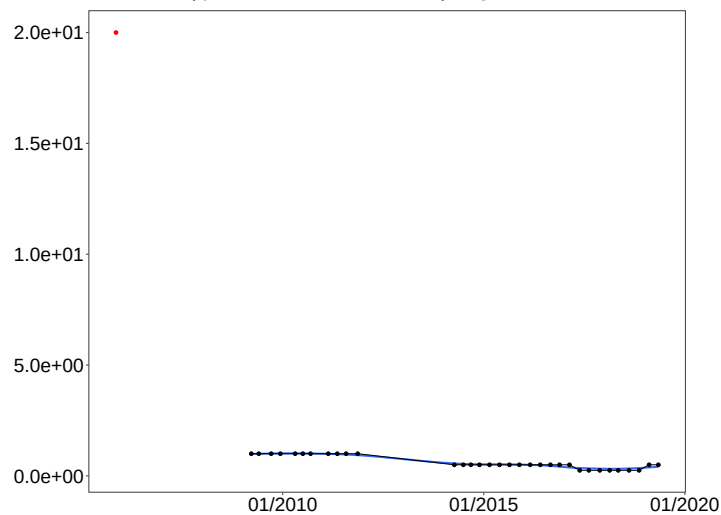
Karanga Bore – Bicarbonate

 $\tau = -0.101$ | p-value = 0.414 | No trend

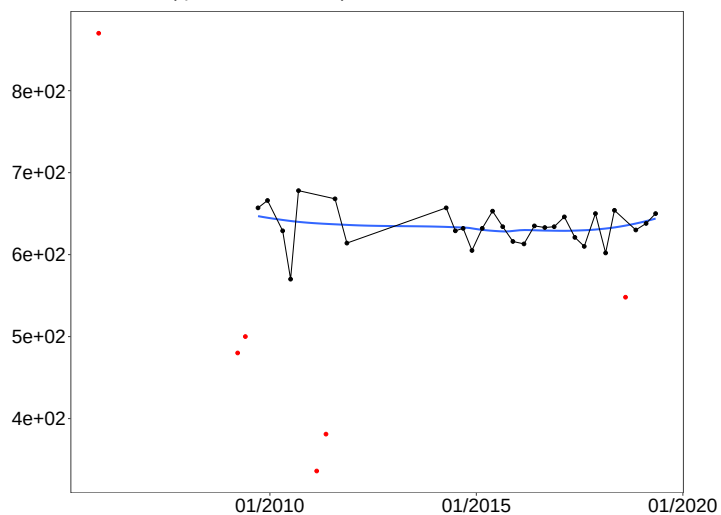
Karanga Bore – Calcium

 $\tau = -0.341$ | p-value = 0.00429 | Negative trend

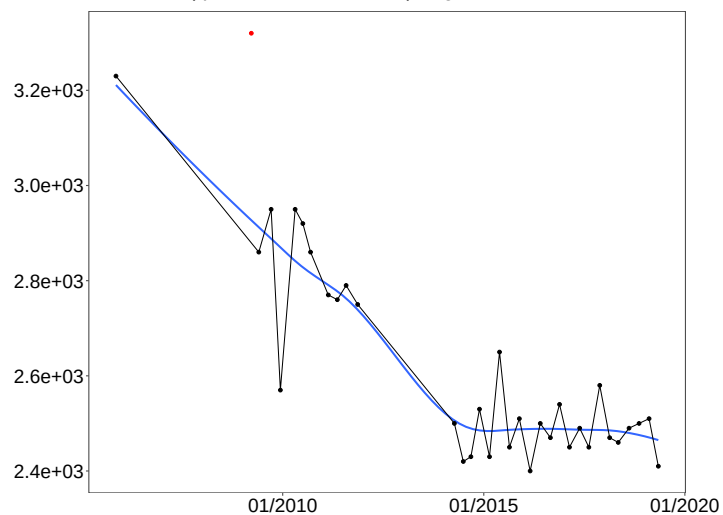
Karanga Bore – Carbonate

 $\tau = -0.762$ | p-value = 0.0000000218 | Negative trend

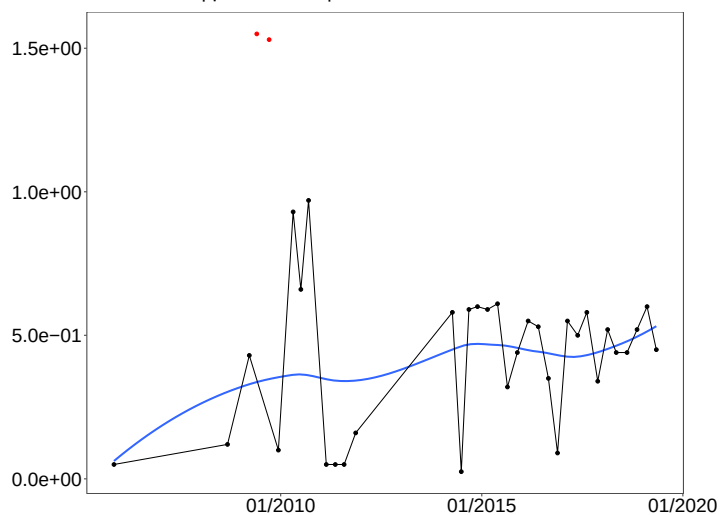
Karanga Bore – Chloride
 $\tau = 0.0286$ | p-value = 0.824 | No trend



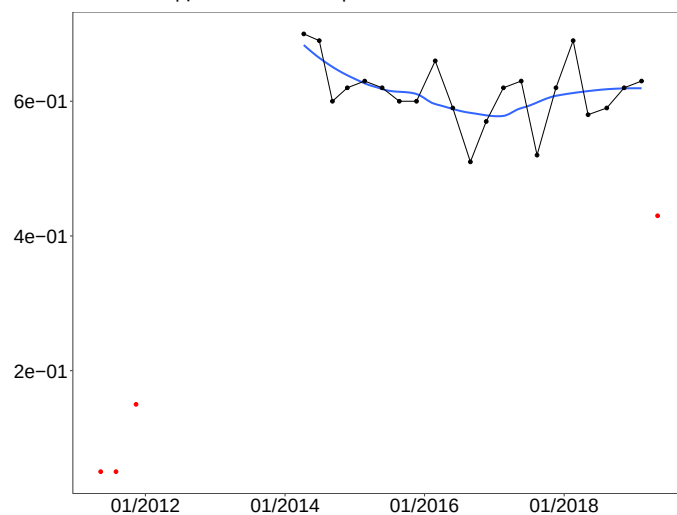
Karanga Bore – Electrical Conductivity
 $\tau = -0.506$ | p-value = 0.0000323 | Negative trend



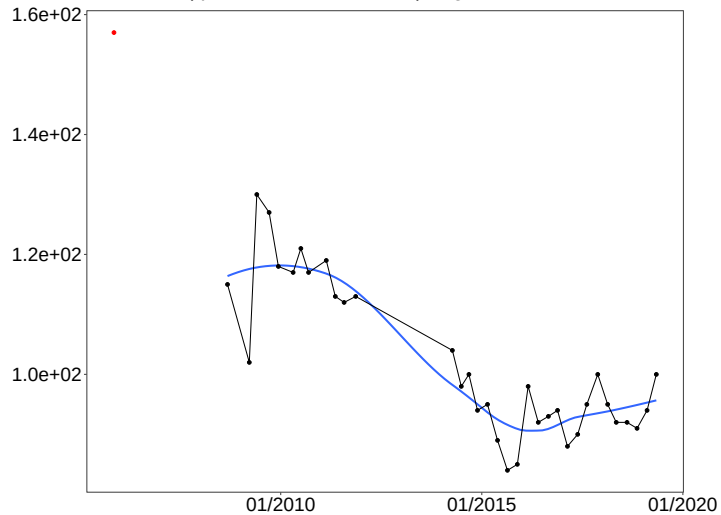
Karanga Bore – Iron (d.)
 $\tau = -0.0017$ | p-value = 1 | No trend



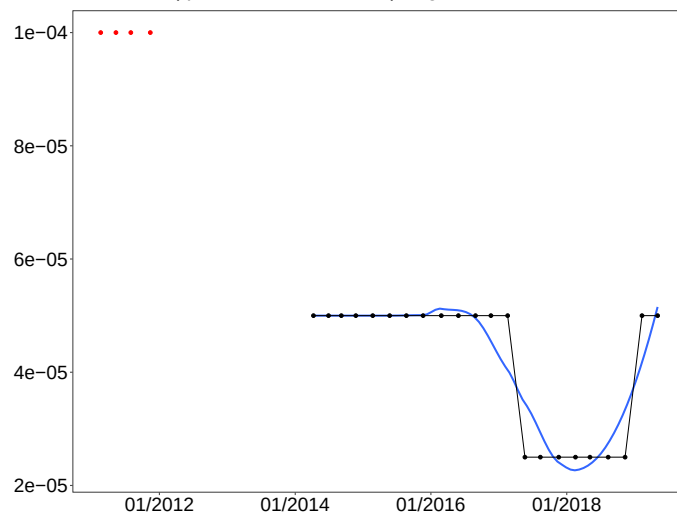
Karanga Bore – Iron (t.)
 $\tau = 0.0379$ | p-value = 0.814 | No trend



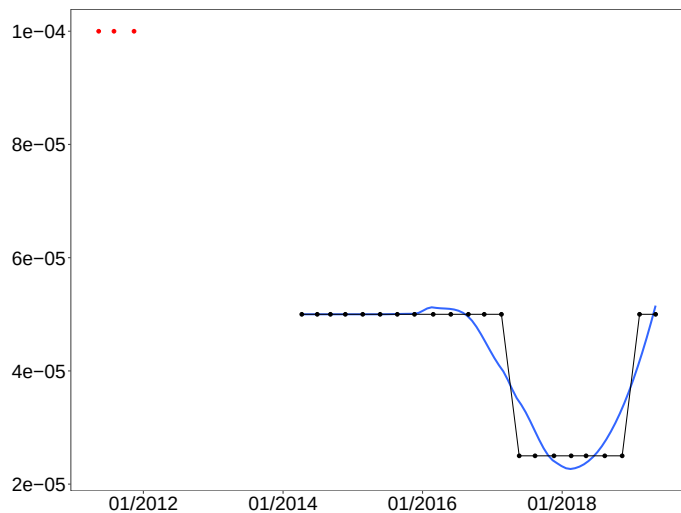
Karanga Bore – Magnesium
 $\tau = -0.565$ | p-value = 0.00000249 | Negative trend



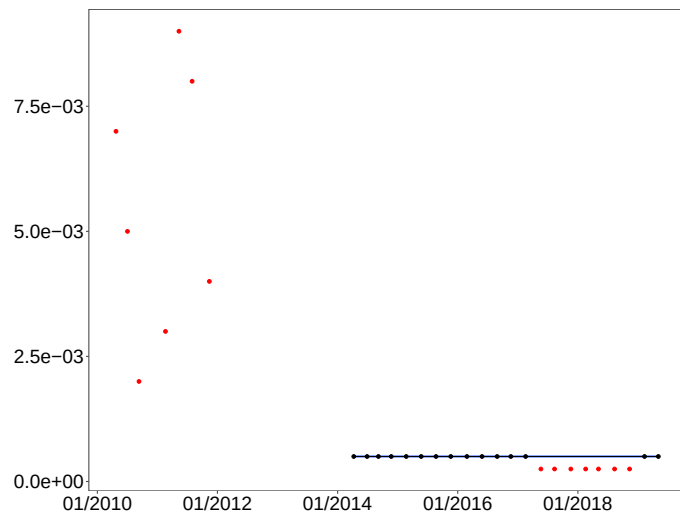
Karanga Bore – Mercury (d.)
 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend



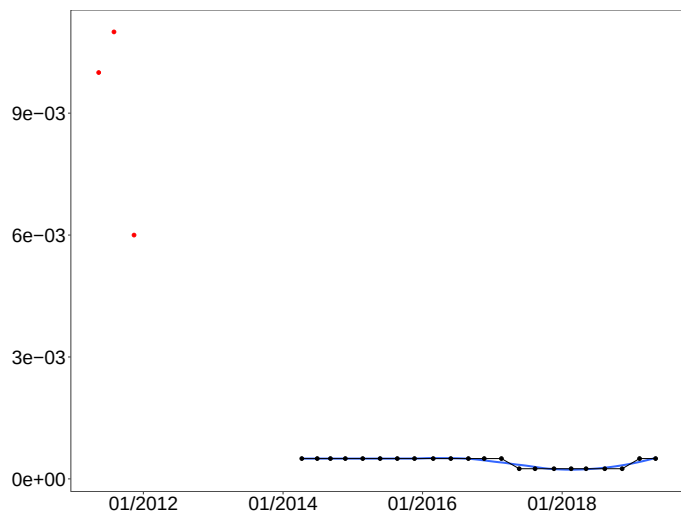
Karanga Bore – Mercury (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

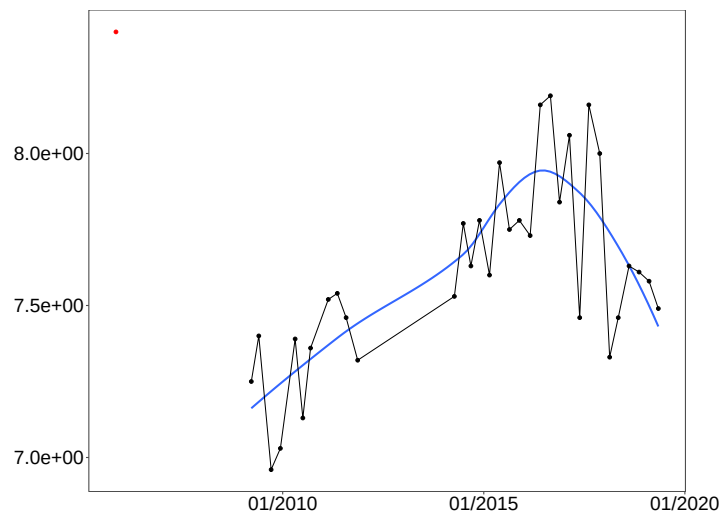
Karanga Bore – Molybdenum (d.)

 $\tau = -0.682$ | p-value = 0.0000028 | Negative trend

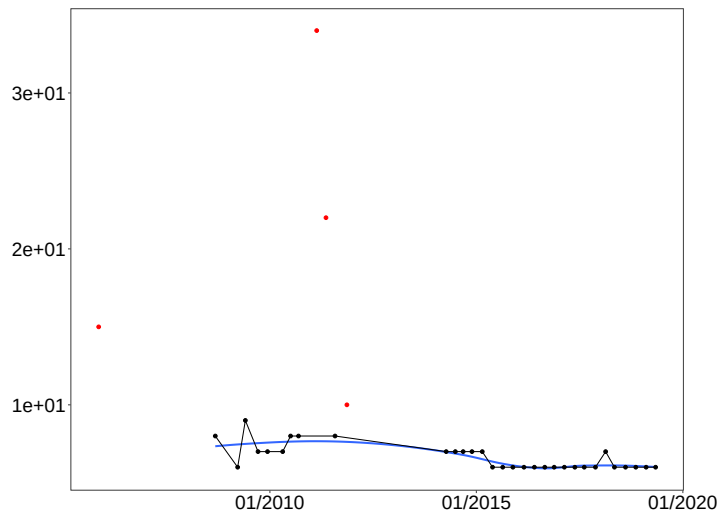
Karanga Bore – Molybdenum (t.)

 $\tau = -0.63$ | p-value = 0.000119 | Negative trend

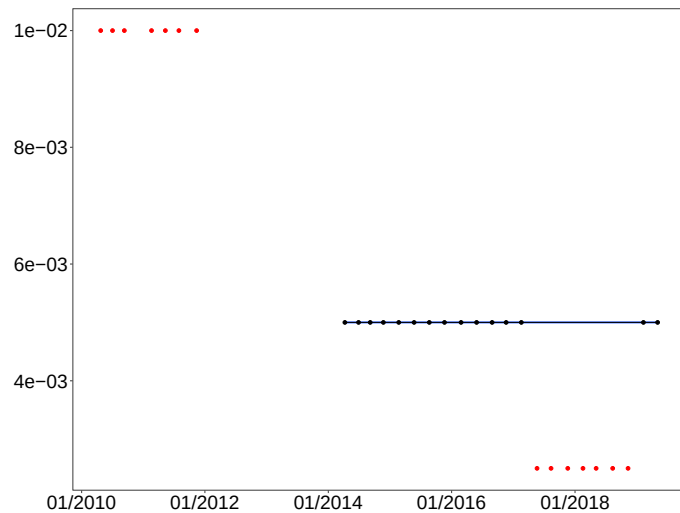
Karanga Bore – pH

 $\tau = 0.31$ | p-value = 0.0107 | Positive trend

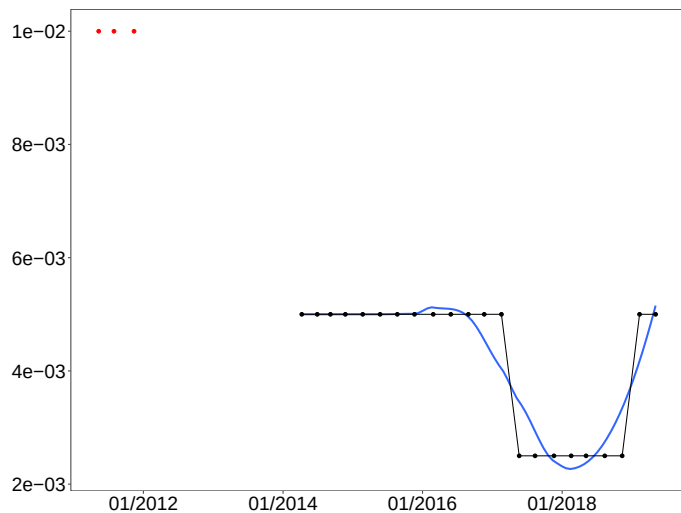
Karanga Bore – Potassium

 $\tau = -0.592$ | p-value = 0.00000679 | Negative trend

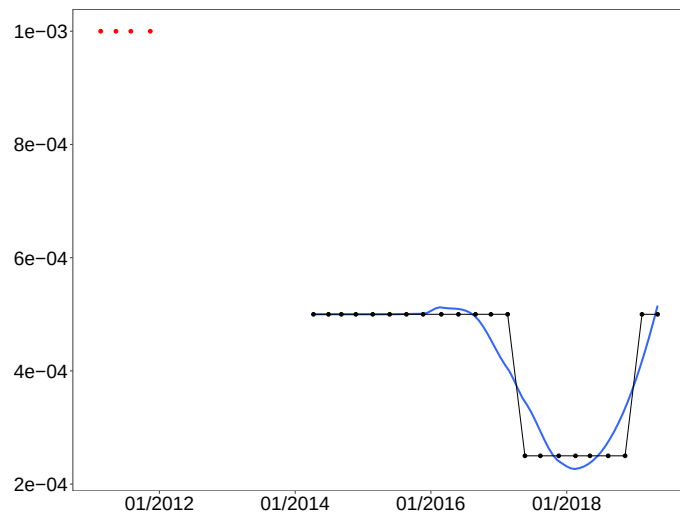
Karanga Bore – Selenium (d.)

 $\tau = -0.712$ | p-value = 0.00000204 | Negative trend

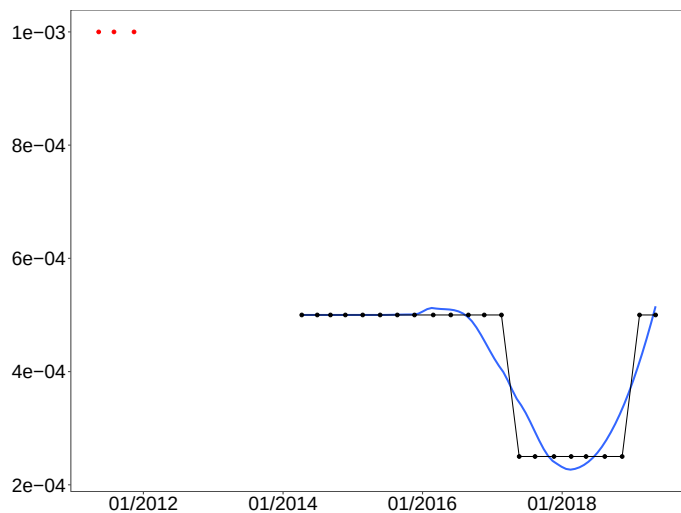
Karanga Bore – Selenium (t.)
 $\tau = -0.631$ | p-value = 0.00013 | Negative trend



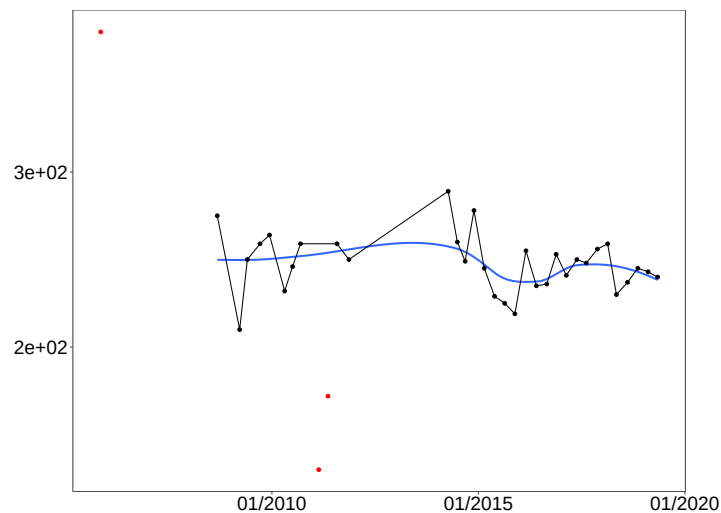
Karanga Bore – Silver (d.)
 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend



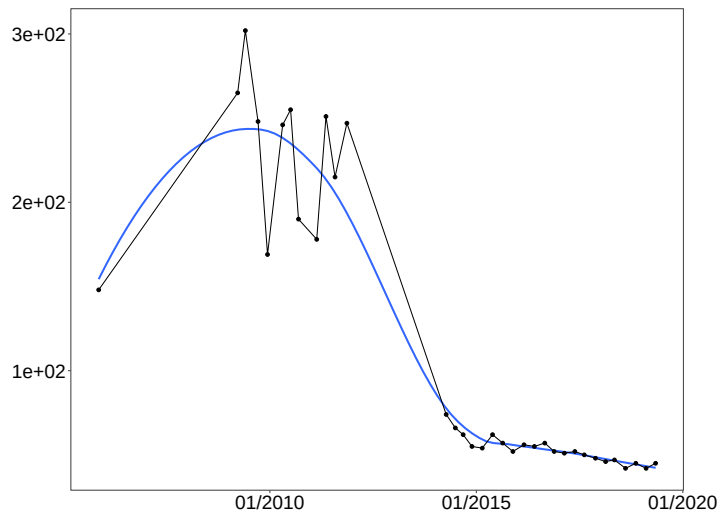
Karanga Bore – Silver (t.)
 $\tau = -0.631$ | p-value = 0.00013 | Negative trend



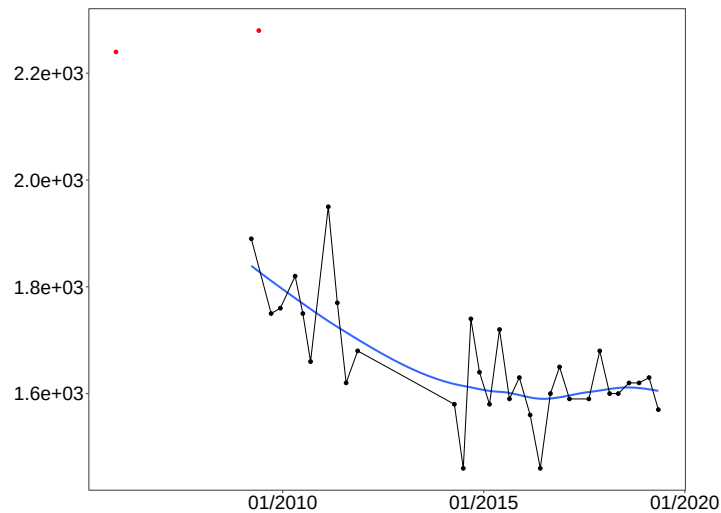
Karanga Bore – Sodium
 $\tau = -0.164$ | p-value = 0.172 | No trend



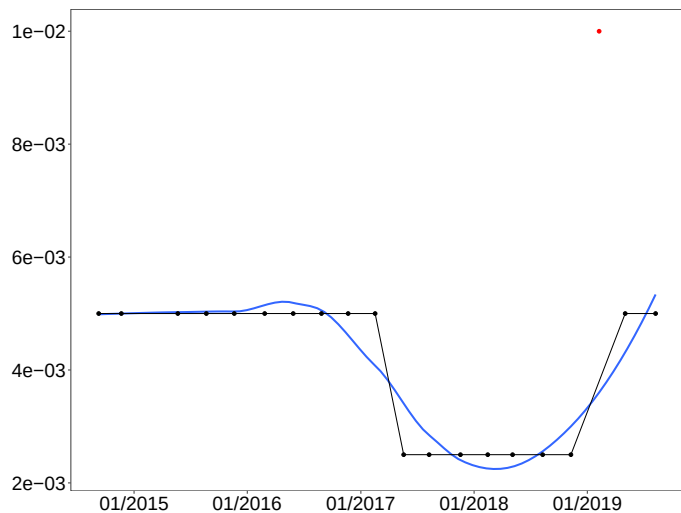
Karanga Bore – Sulphate
 $\tau = -0.813$ | p-value = 0.000000000199 | Negative trend



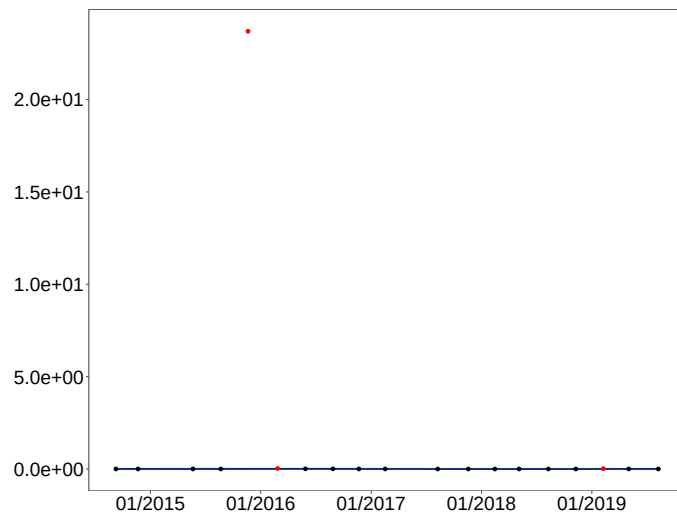
Karanga Bore – TDS
 $\tau = -0.461$ | p-value = 0.000207 | Negative trend



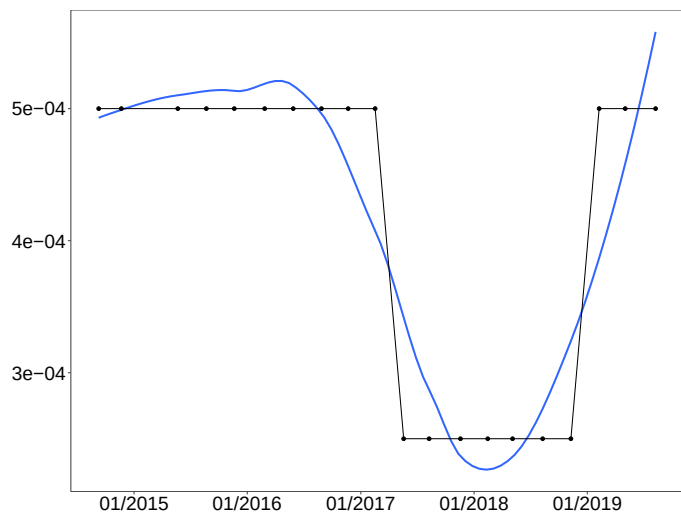
Railway Bore – Aluminium (d.)
 $\tau = -0.293$ | p-value = 0.129 | No trend



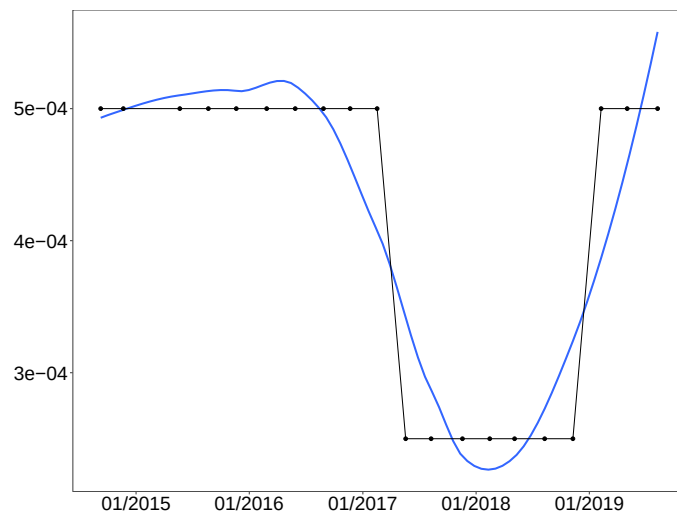
Railway Bore – Aluminium (t.)
 $\tau = -0.292$ | p-value = 0.118 | No trend



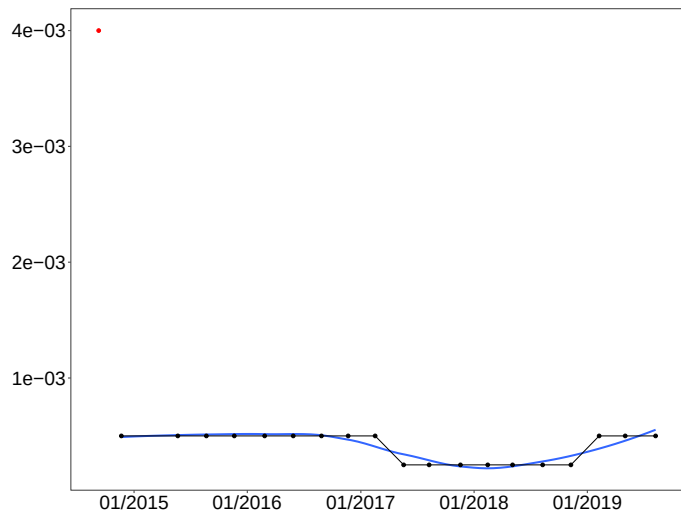
Railway Bore – Antimony (d.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



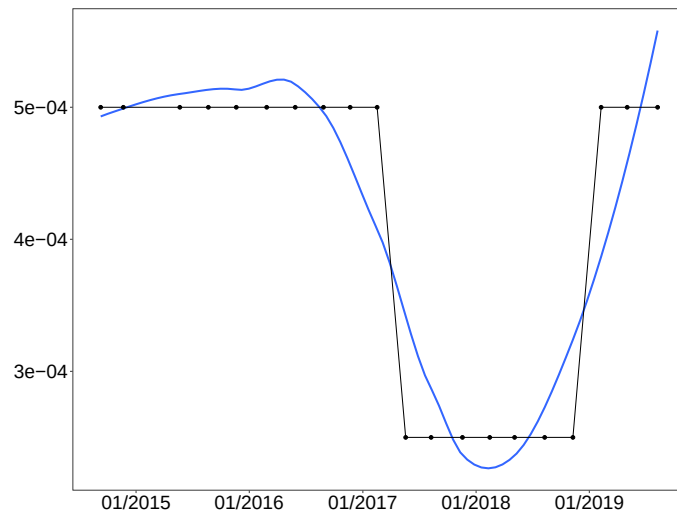
Railway Bore – Antimony (t.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



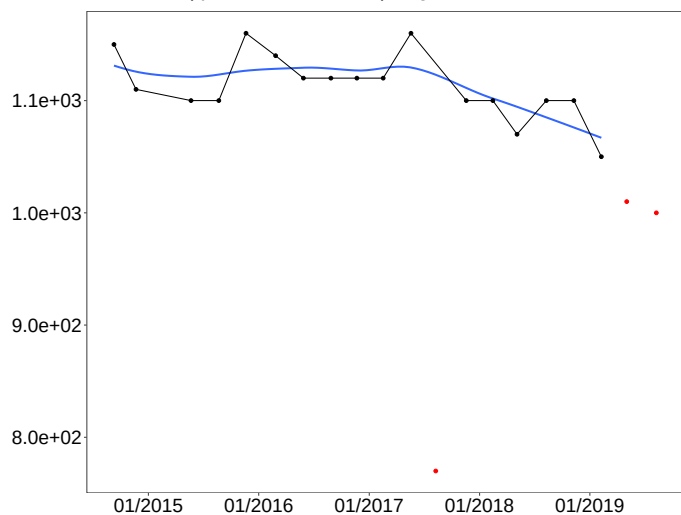
Railway Bore – Arsenic (d.)
 $\tau = -0.436$ | p-value = 0.0227 | Negative trend



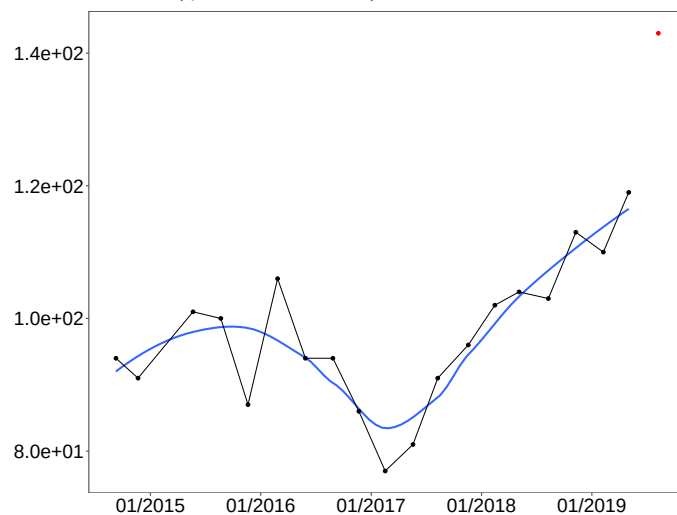
Railway Bore – Arsenic (t.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



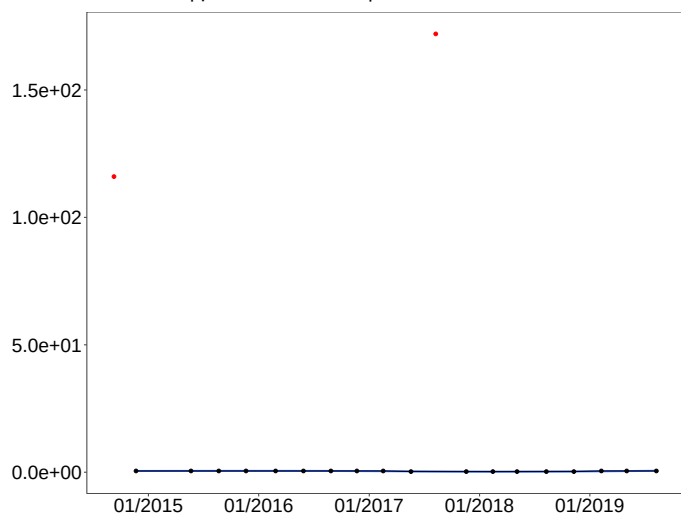
Railway Bore – Bicarbonate
 $\tau = -0.515$ | $p\text{-value} = 0.00258$ | Negative trend



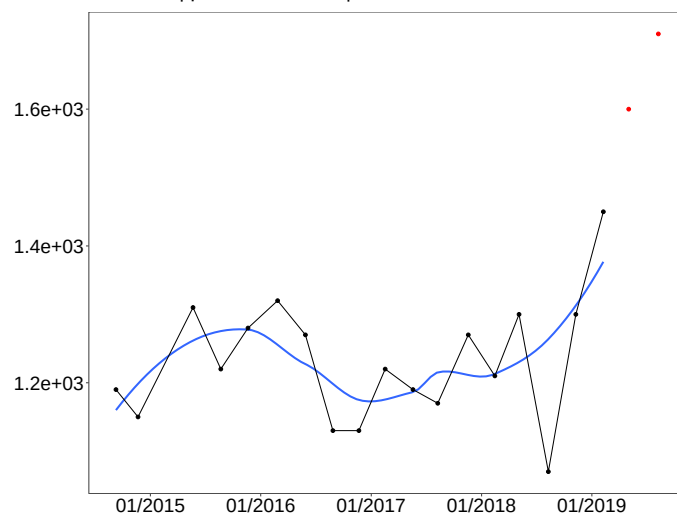
Railway Bore – Calcium
 $\tau = 0.436$ | $p\text{-value} = 0.00843$ | Positive trend



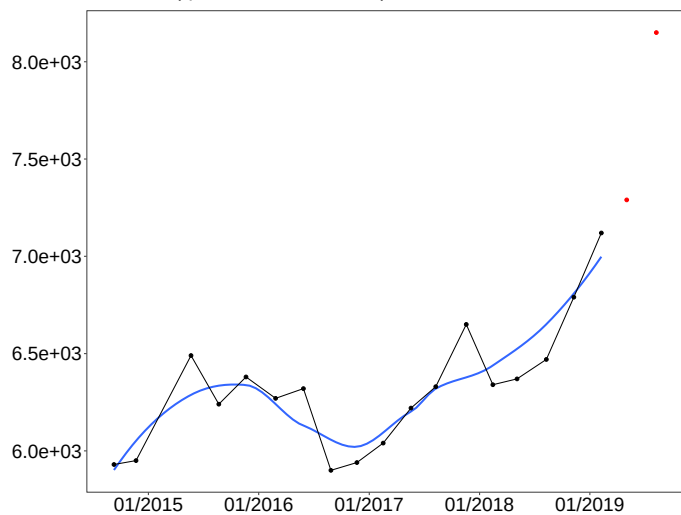
Railway Bore – Carbonate
 $\tau = -0.354$ | $p\text{-value} = 0.0604$ | No trend



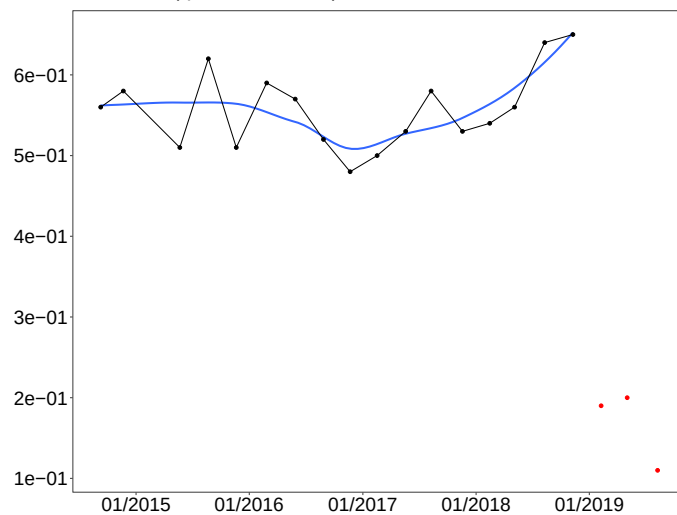
Railway Bore – Chloride
 $\tau = 0.272$ | $p\text{-value} = 0.104$ | No trend



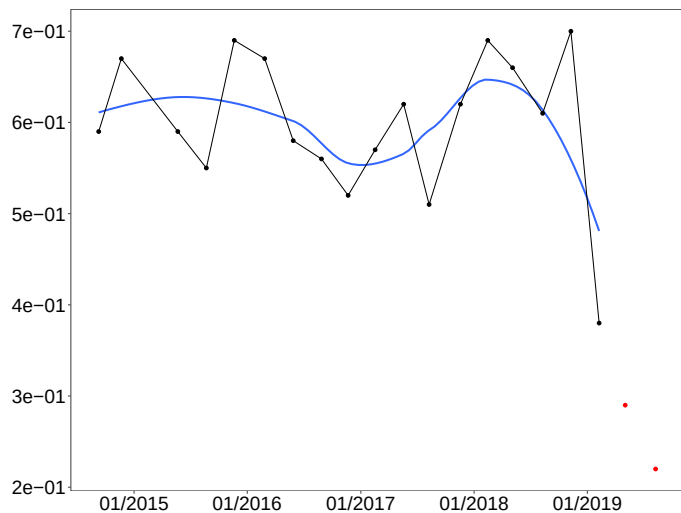
Railway Bore – Electrical Conductivity
 $\tau = 0.589$ | $p\text{-value} = 0.000317$ | Positive trend



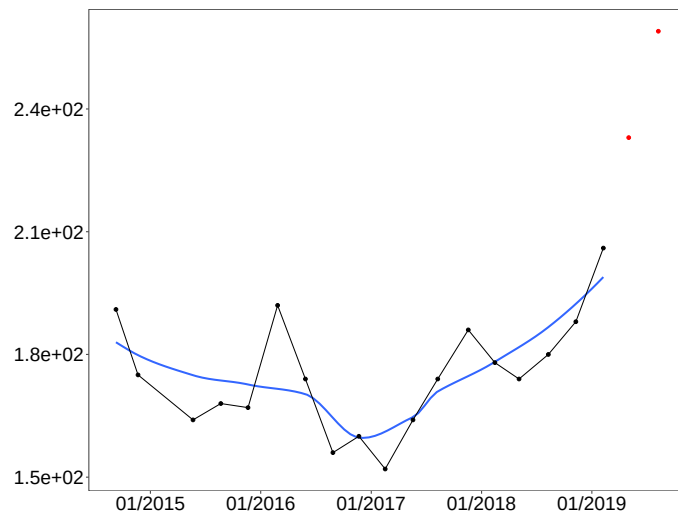
Railway Bore – Iron (d.)
 $\tau = -0.149$ | $p\text{-value} = 0.38$ | No trend



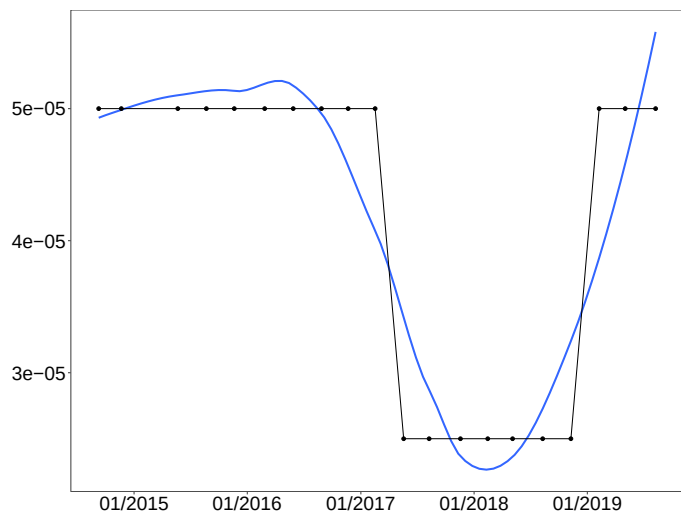
Railway Bore – Iron (t.)
 $\tau = -0.202$ | p-value = 0.229 | No trend



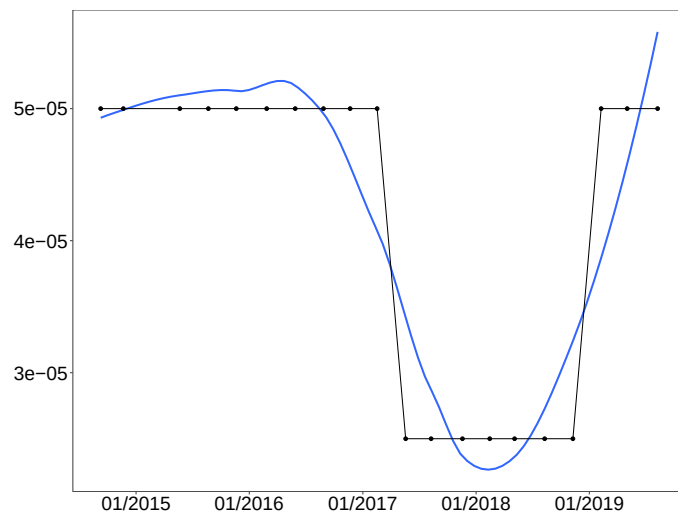
Railway Bore – Magnesium
 $\tau = 0.372$ | p-value = 0.0248 | Positive trend



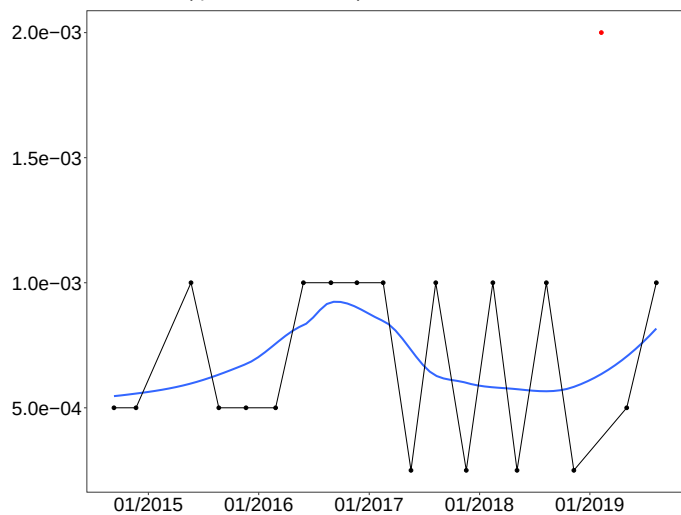
Railway Bore – Mercury (d.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



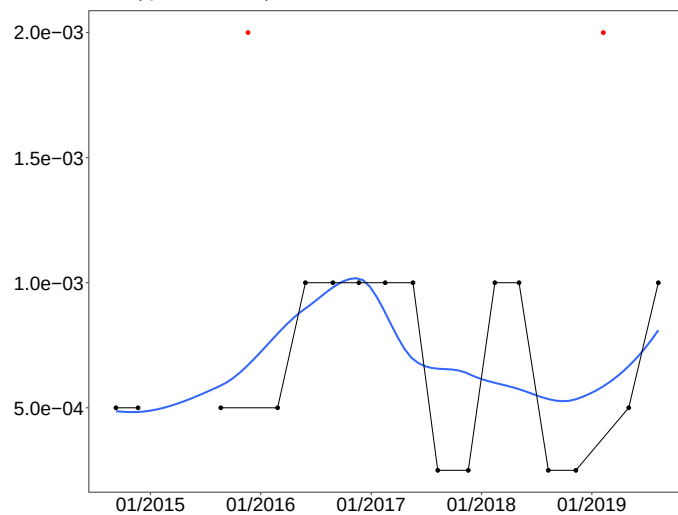
Railway Bore – Mercury (t.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



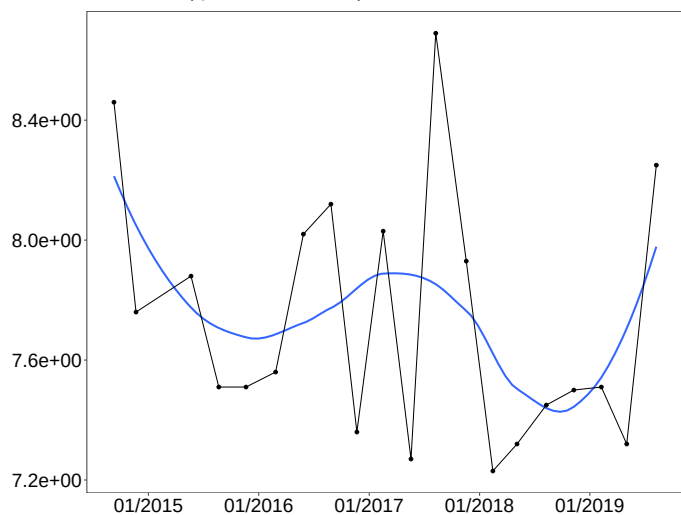
Railway Bore – Molybdenum (d.)
 $\tau = 0.0944$ | p-value = 0.625 | No trend



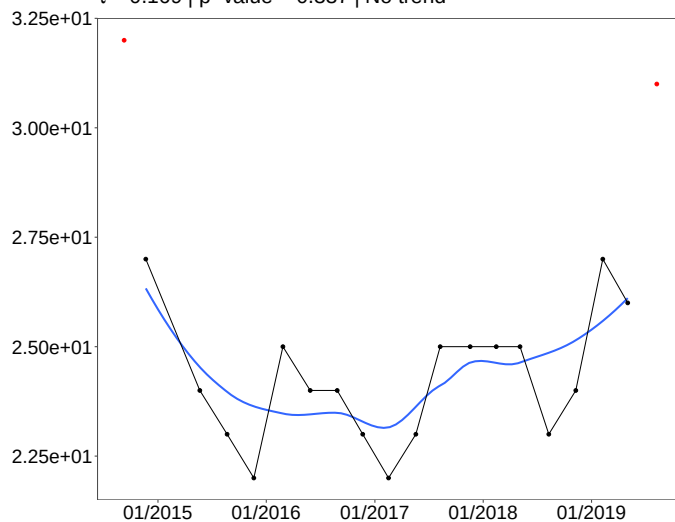
Railway Bore – Molybdenum (t.)
 $\tau = 0$ | p-value = 1 | No trend



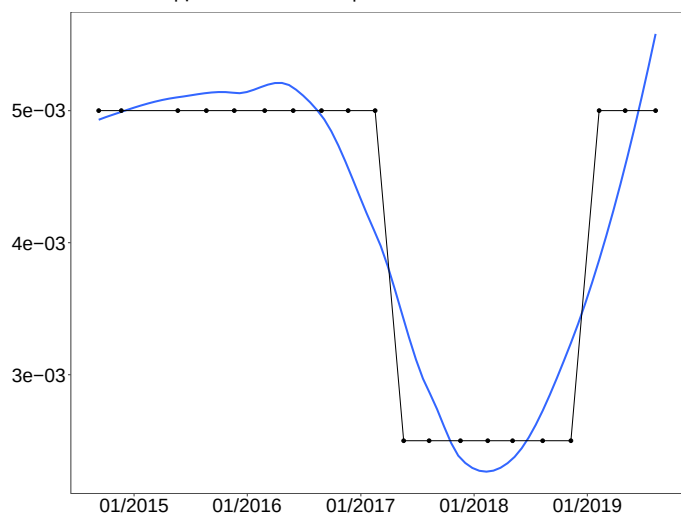
Railway Bore – pH
 $\tau = -0.192$ | p-value = 0.255 | No trend



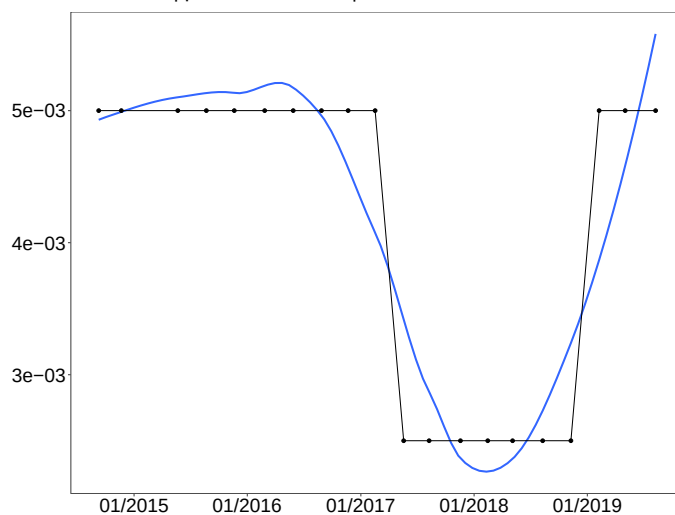
Railway Bore – Potassium
 $\tau = 0.169$ | p-value = 0.337 | No trend



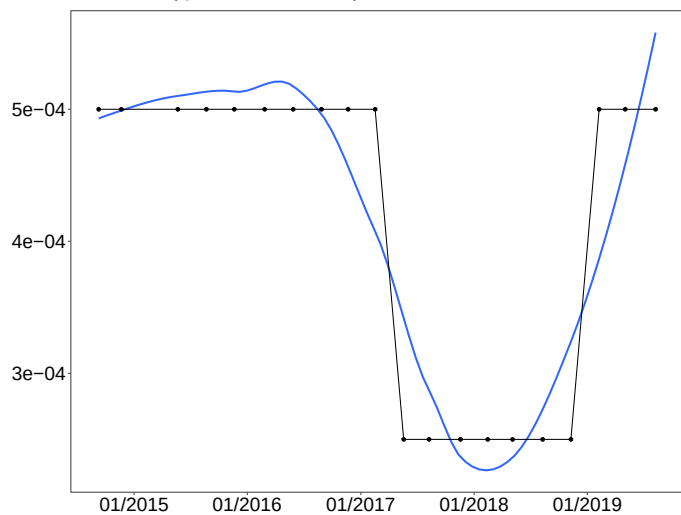
Railway Bore – Selenium (d.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



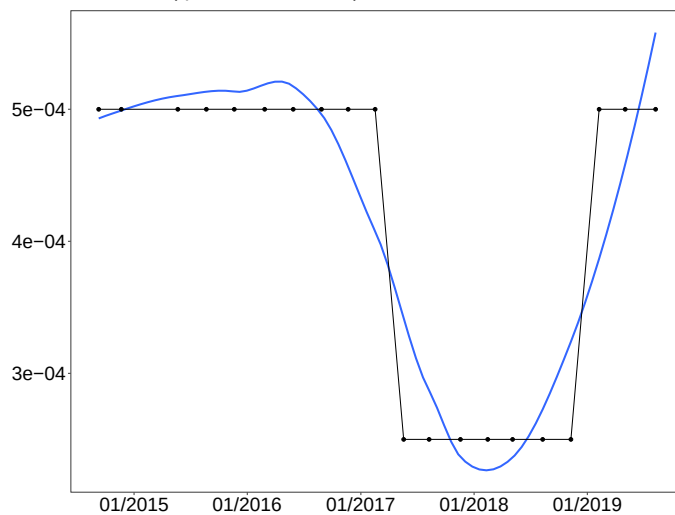
Railway Bore – Selenium (t.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



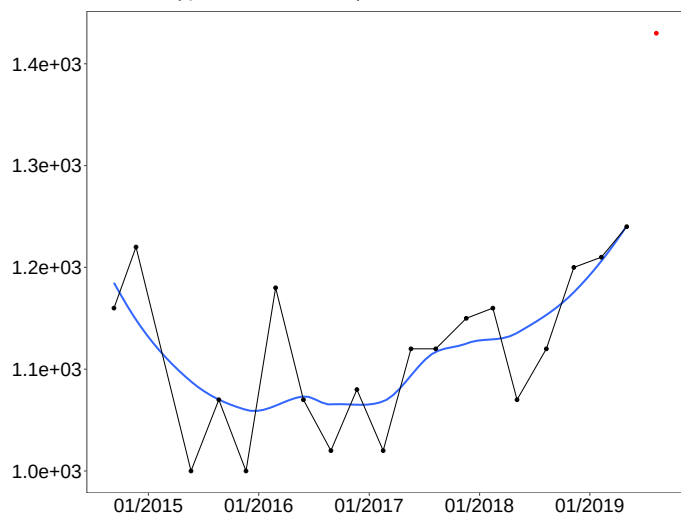
Railway Bore – Silver (d.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



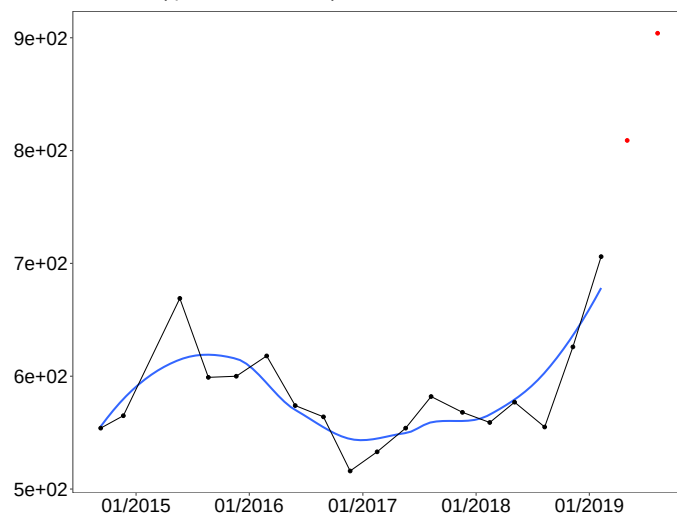
Railway Bore – Silver (t.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



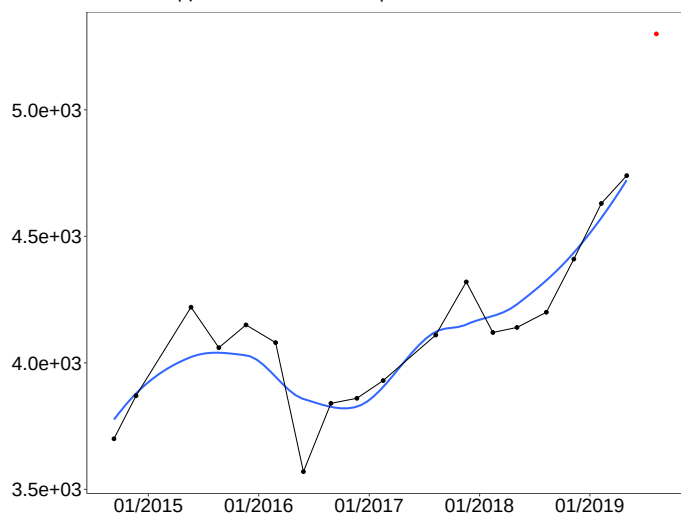
Railway Bore – Sodium
 $\tau = 0.426$ | p-value = 0.0109 | Positive trend



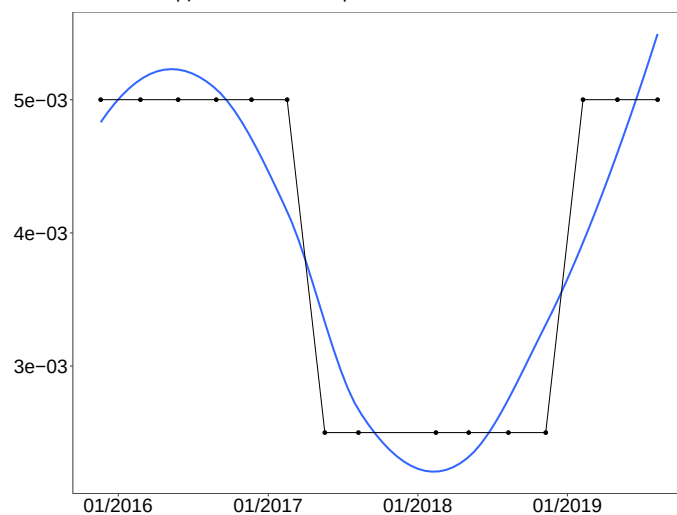
Railway Bore – Sulphate
 $\tau = 0.237$ | p-value = 0.153 | No trend



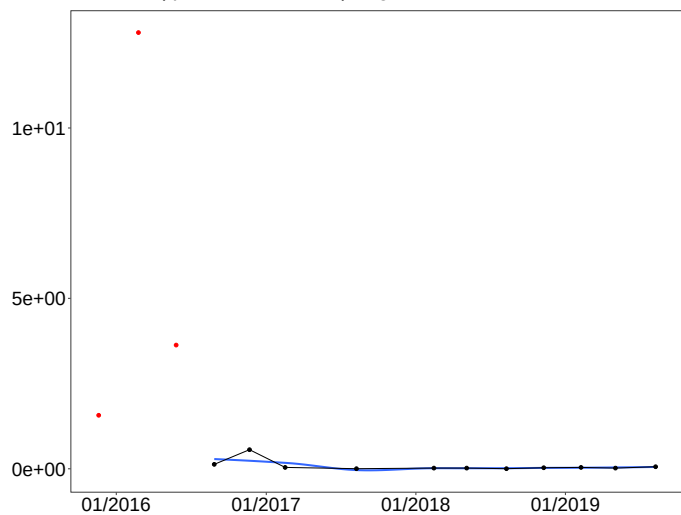
Railway Bore – TDS
 $\tau = 0.602$ | p-value = 0.000359 | Positive trend



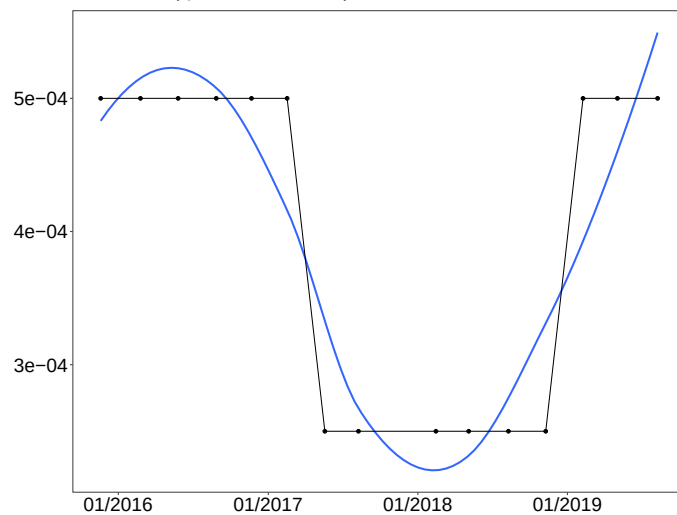
RB1 – Aluminium (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



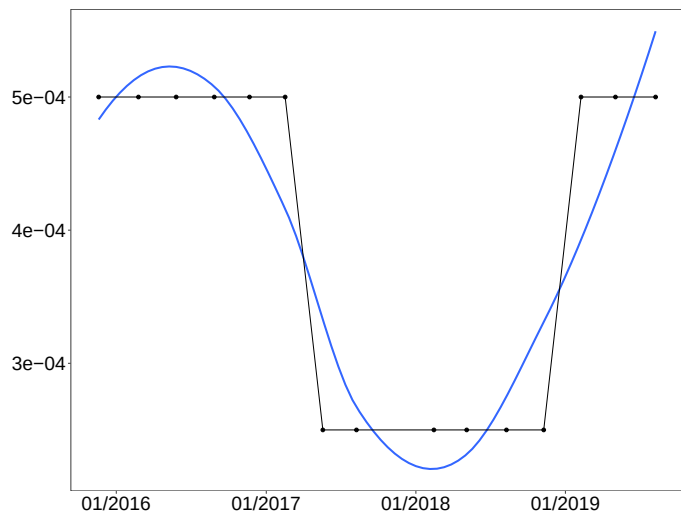
RB1 – Aluminium (t.)
 $\tau = -0.43$ | p-value = 0.0411 | Negative trend



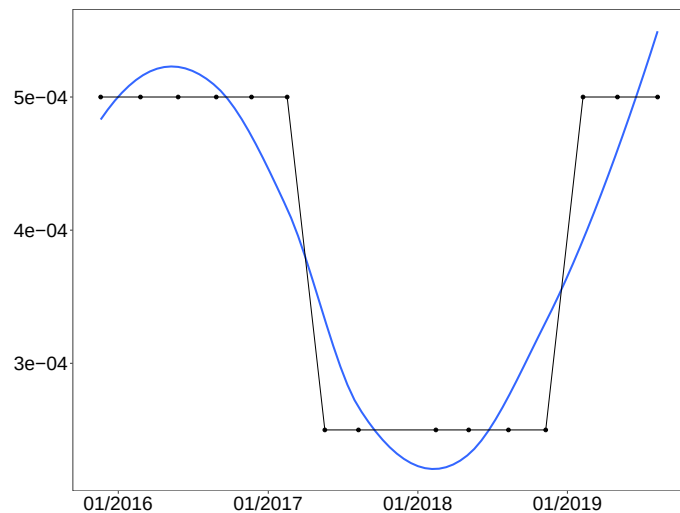
RB1 – Antimony (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



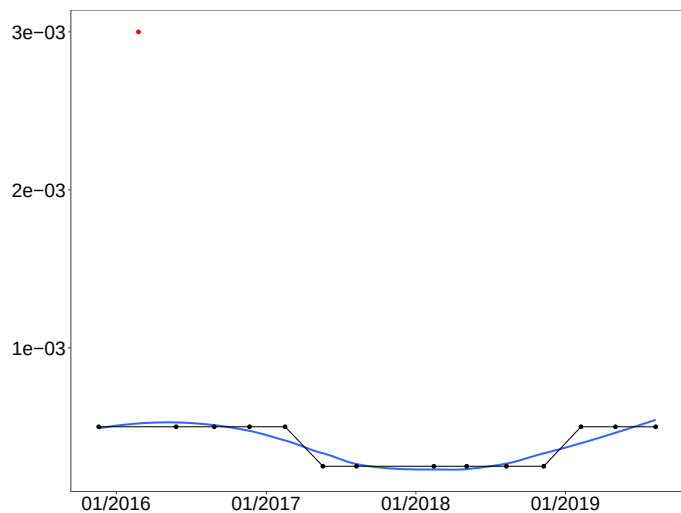
RB1 – Antimony (t.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



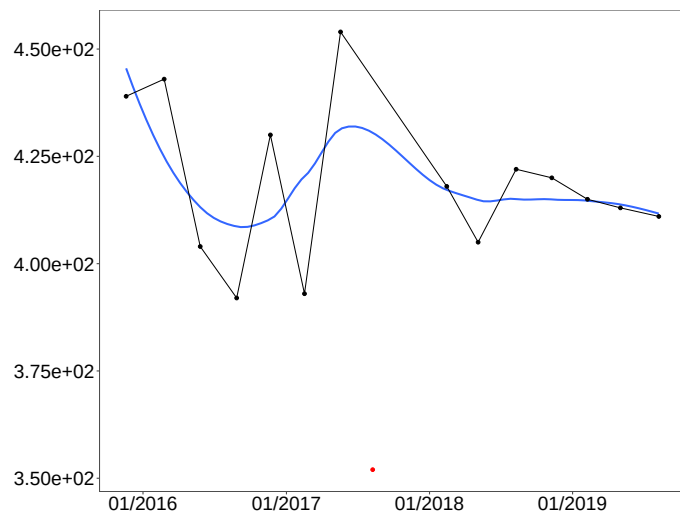
RB1 – Arsenic (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



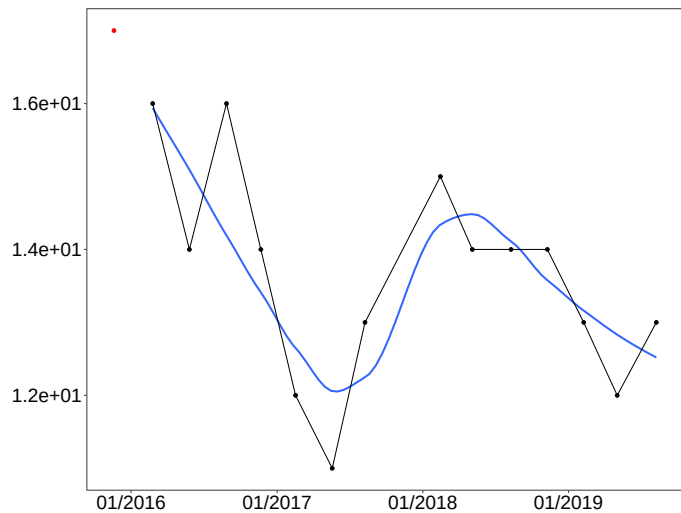
RB1 – Arsenic (t.)
 $\tau = -0.297$ | p-value = 0.195 | No trend



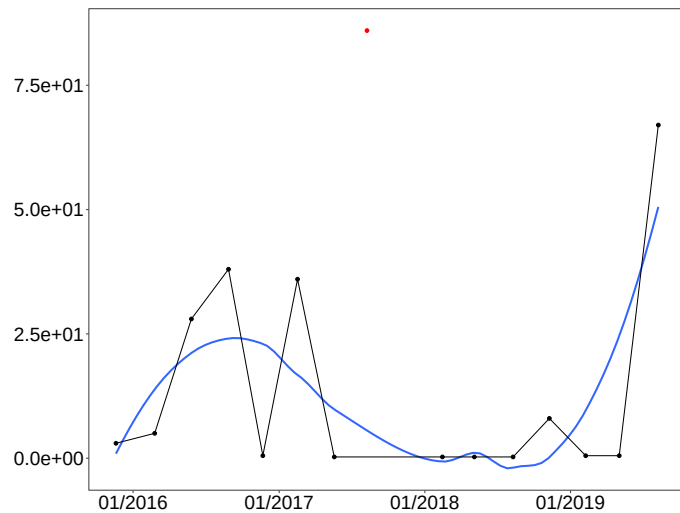
RB1 – Bicarbonate
 $\tau = -0.143$ | p-value = 0.488 | No trend



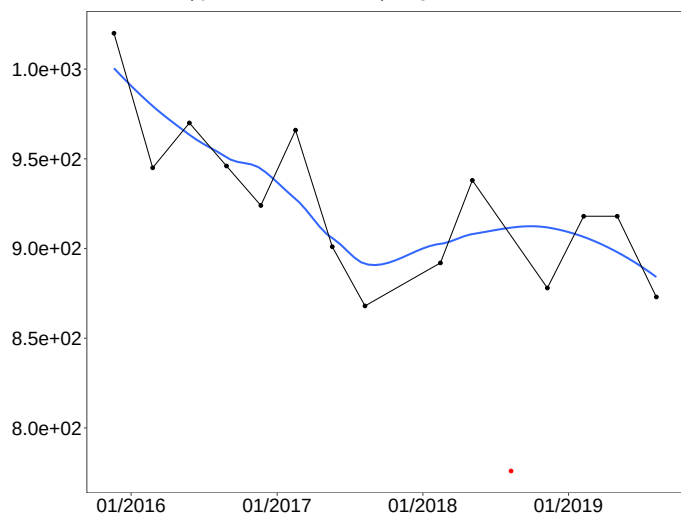
RB1 – Calcium
 $\tau = -0.453$ | p-value = 0.0286 | Negative trend



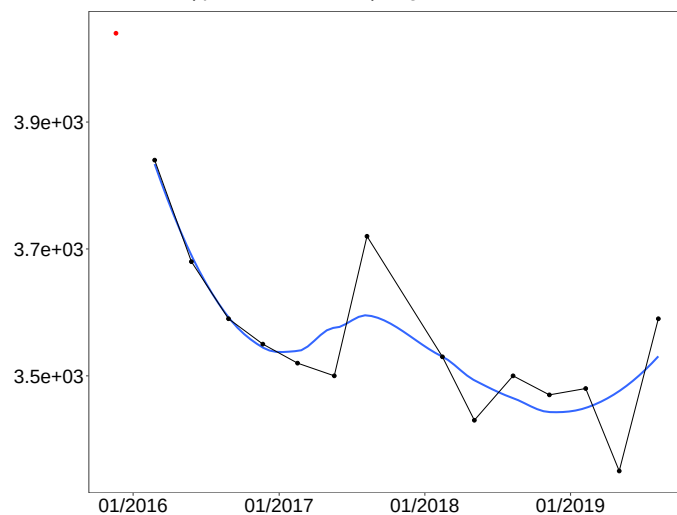
RB1 – Carbonate
 $\tau = -0.0598$ | p-value = 0.802 | No trend



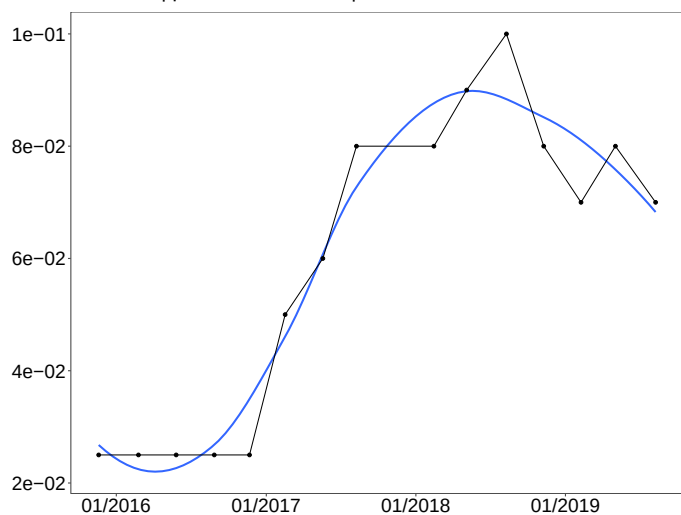
RB1 – Chloride
 $\tau = -0.536$ | p-value = 0.00643 | Negative trend



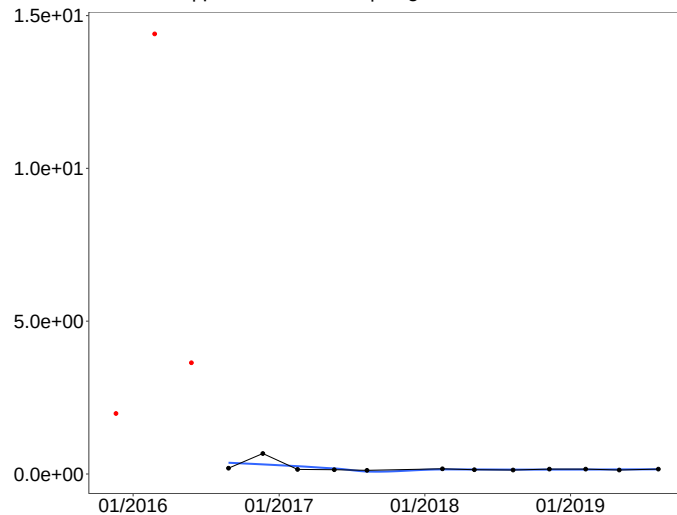
RB1 – Electrical Conductivity
 $\tau = -0.606$ | p-value = 0.0021 | Negative trend



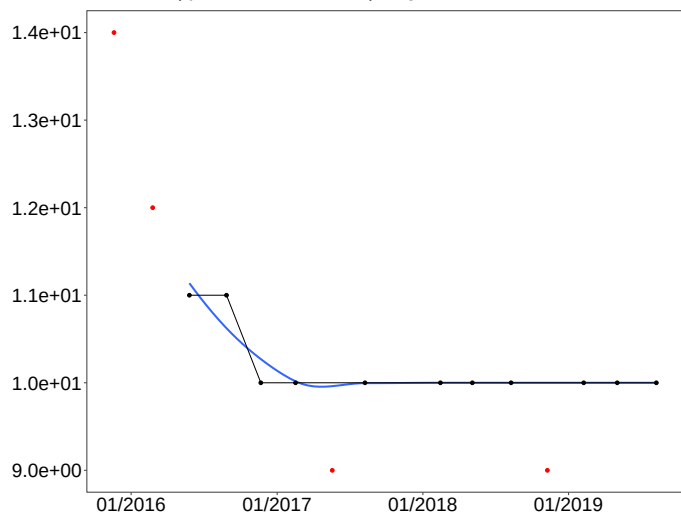
RB1 – Iron (d.)
 $\tau = 0.603$ | p-value = 0.00354 | Positive trend



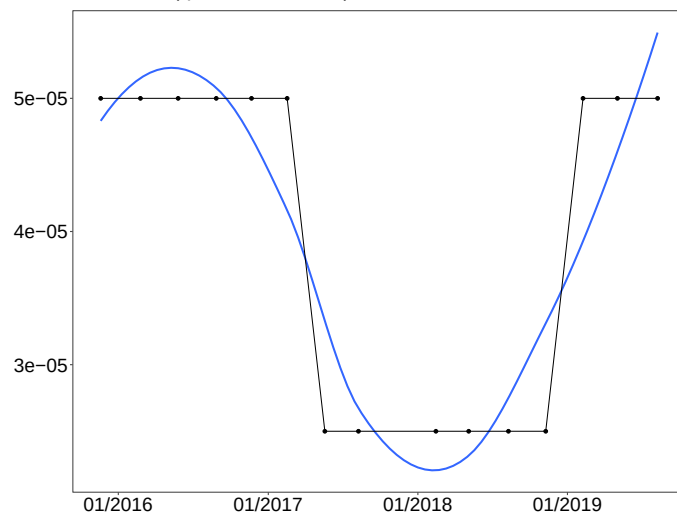
RB1 – Iron (t.)
 $\tau = -0.488$ | p-value = 0.0146 | Negative trend



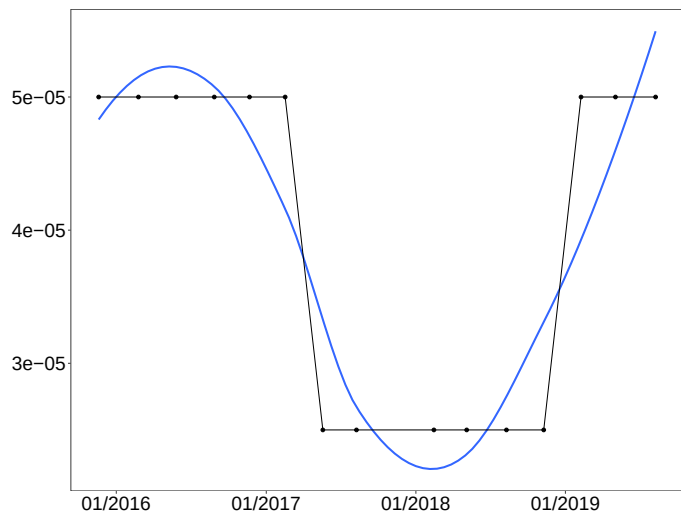
RB1 – Magnesium
 $\tau = -0.56$ | p-value = 0.00947 | Negative trend



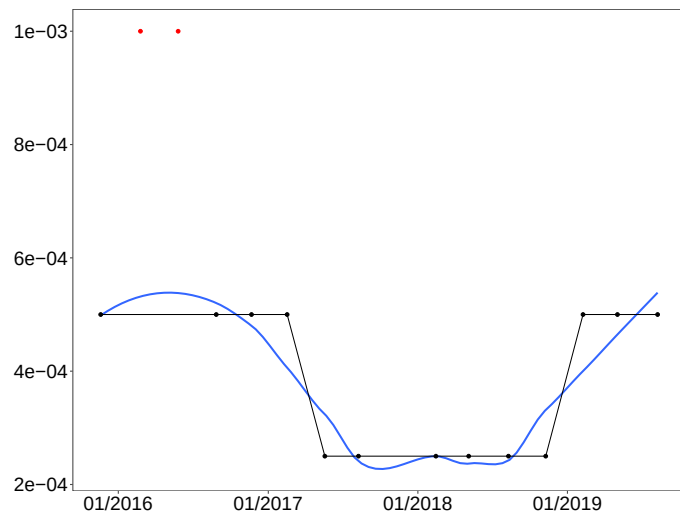
RB1 – Mercury (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



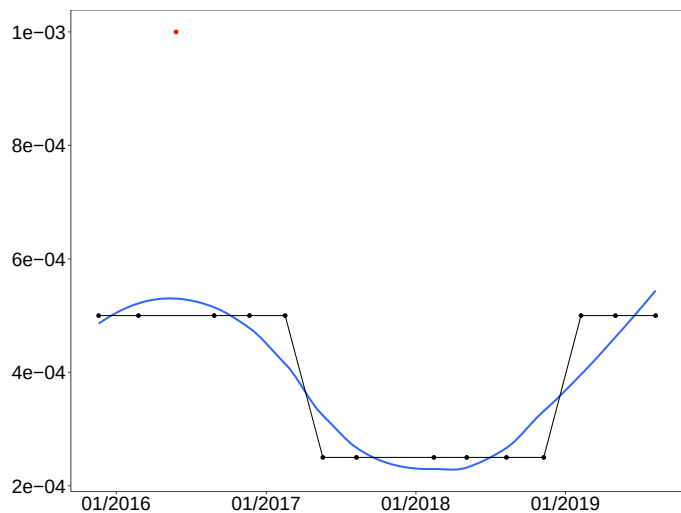
RB1 – Mercury (t.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



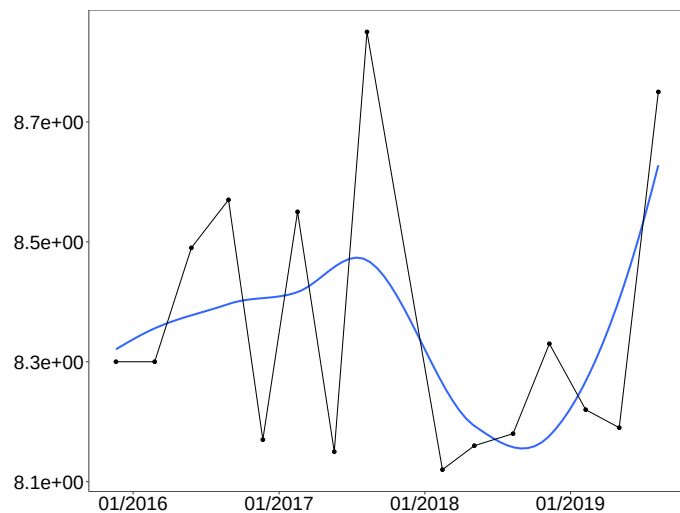
RB1 – Molybdenum (d.)
 $\tau = -0.331$ | p-value = 0.14 | No trend



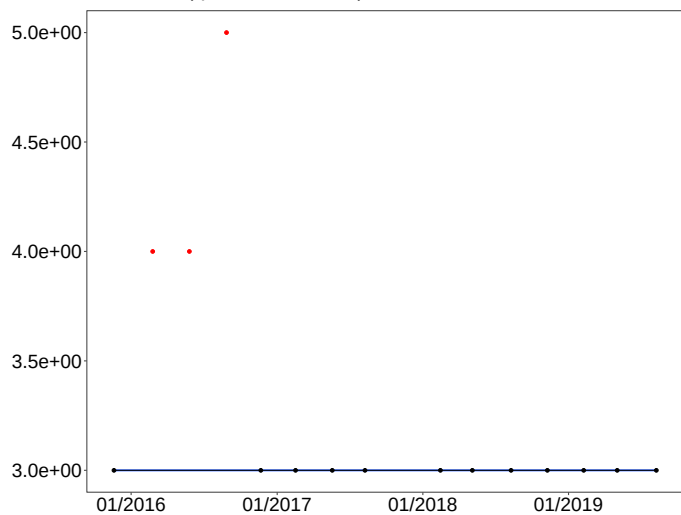
RB1 – Molybdenum (t.)
 $\tau = -0.273$ | p-value = 0.236 | No trend



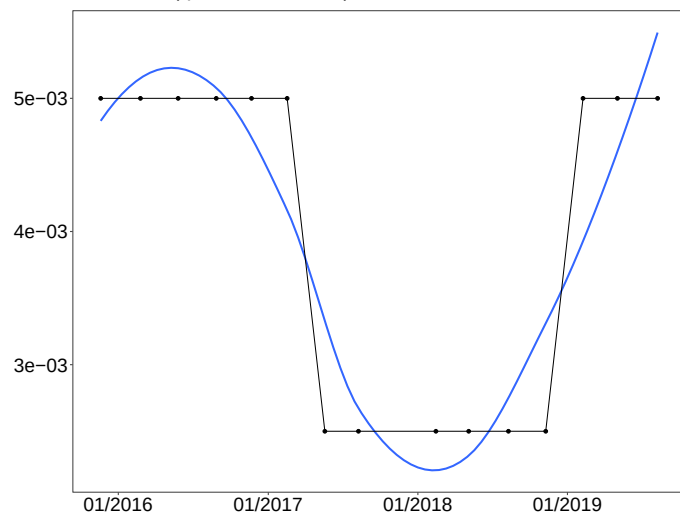
RB1 – pH
 $\tau = 0$ | p-value = 1 | No trend



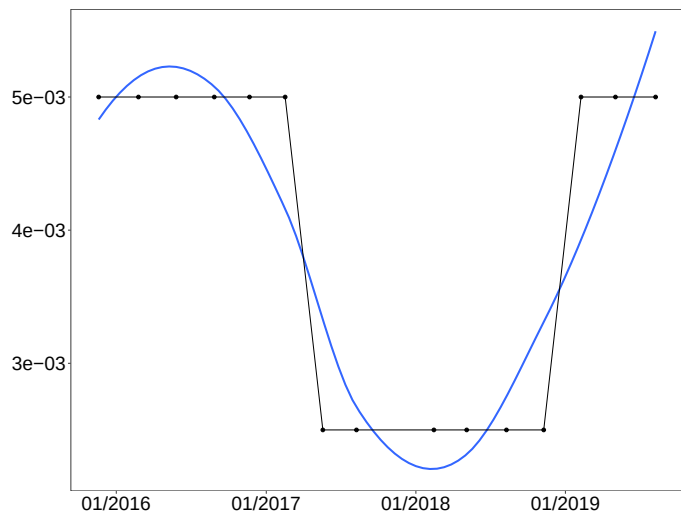
RB1 – Potassium
 $\tau = -0.443$ | p-value = 0.053 | No trend



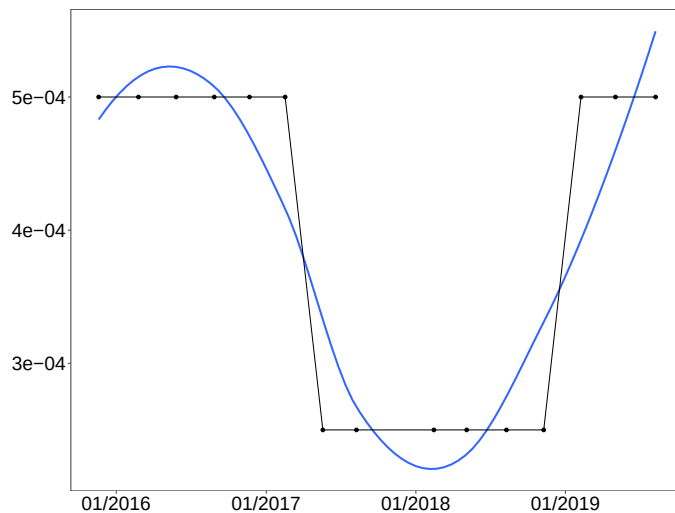
RB1 – Selenium (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



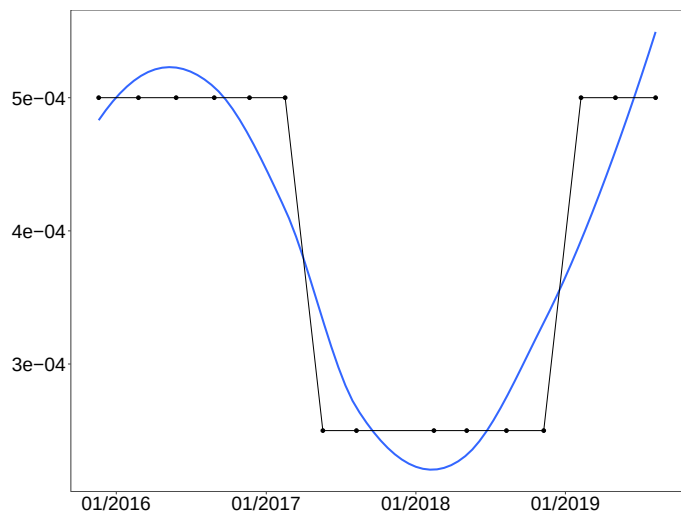
RB1 – Selenium (t.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



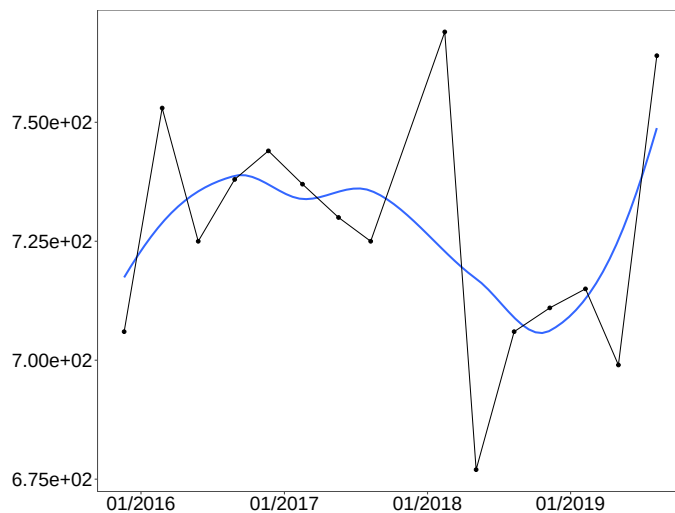
RB1 – Silver (d.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



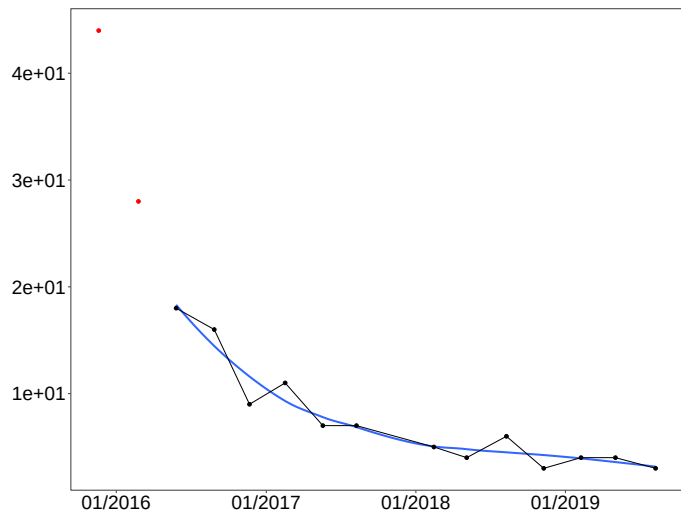
RB1 – Silver (t.)
 $\tau = -0.239$ | p-value = 0.316 | No trend



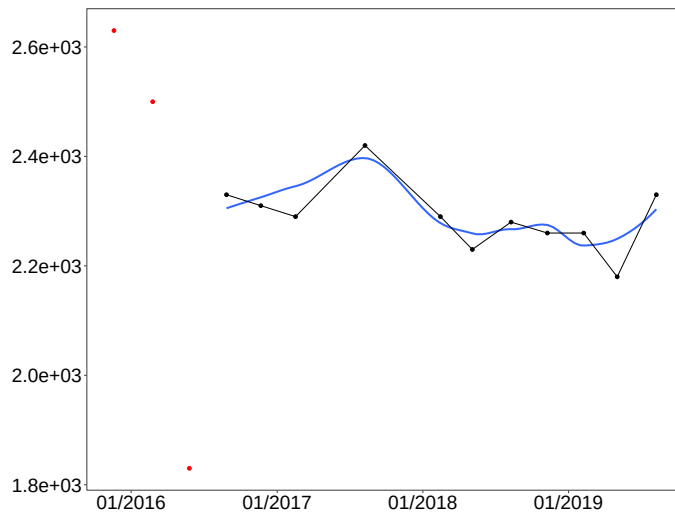
RB1 – Sodium
 $\tau = -0.183$ | p-value = 0.372 | No trend



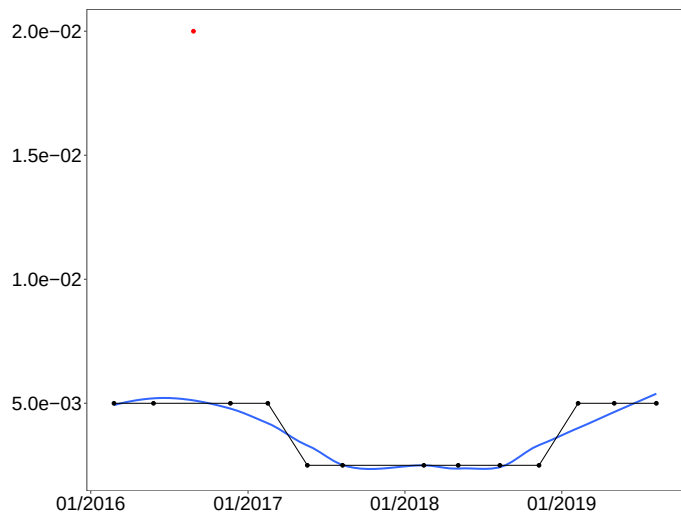
RB1 – Sulphate
 $\tau = -0.878$ | p-value = 0.0000092 | Negative trend



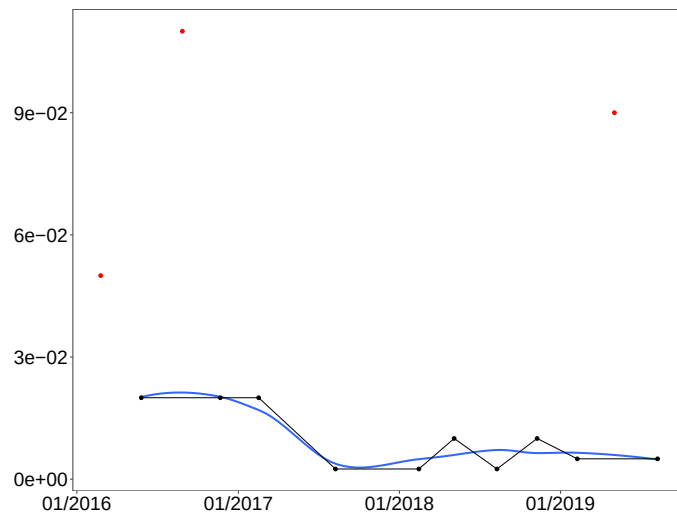
RB1 – TDS
 $\tau = -0.425$ | p-value = 0.0419 | Negative trend



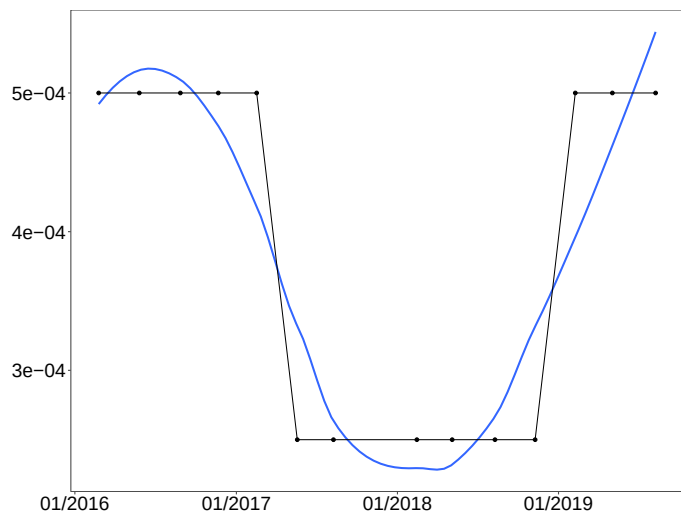
RB2 – Aluminium (d.)
 $\tau = -0.212$ | p-value = 0.386 | No trend



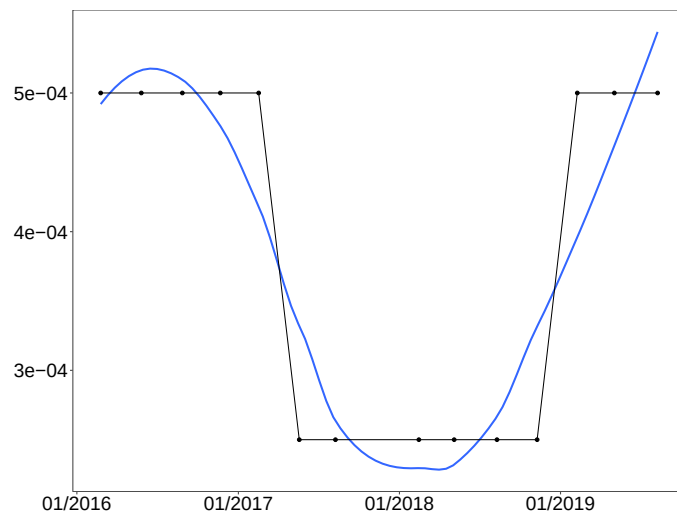
RB2 – Aluminium (t.)
 $\tau = -0.325$ | p-value = 0.153 | No trend



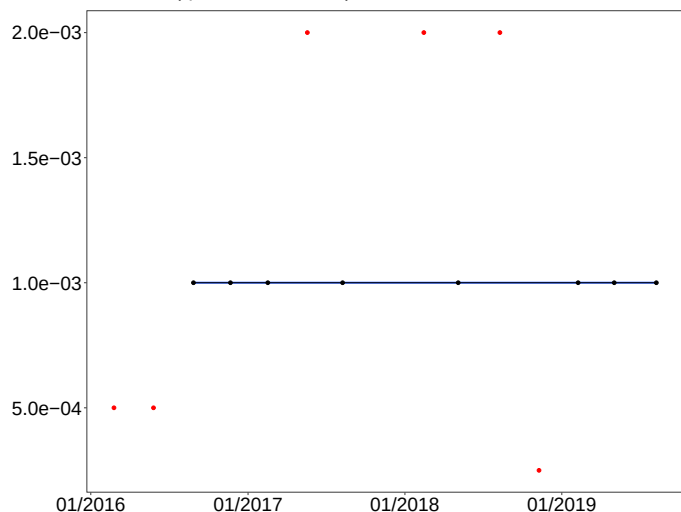
RB2 – Antimony (d.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



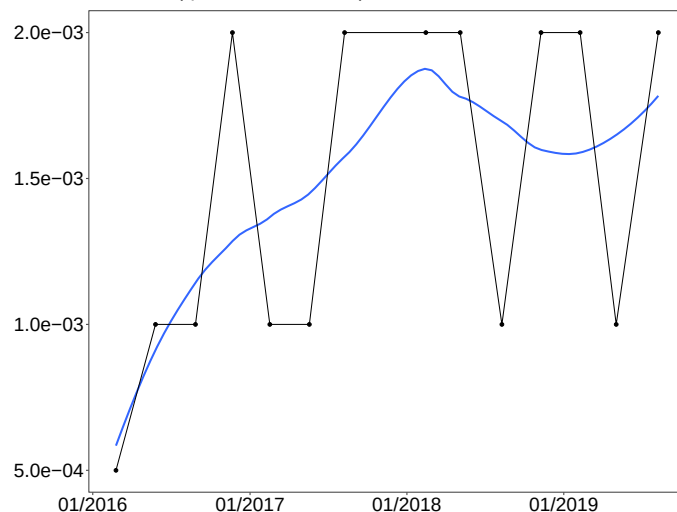
RB2 – Antimony (t.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



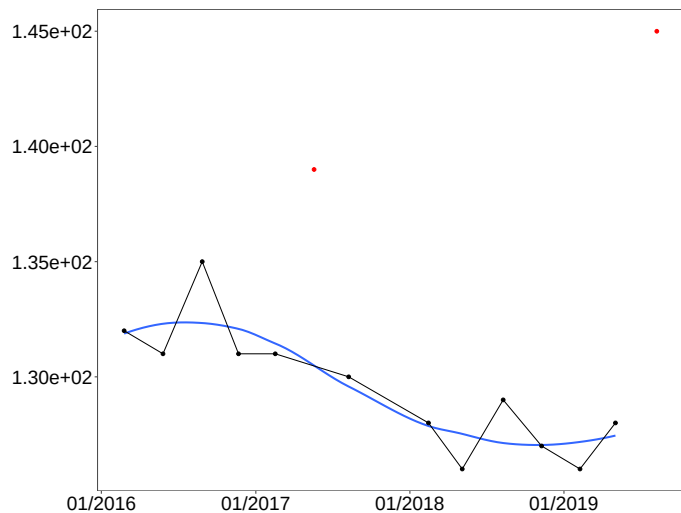
RB2 – Arsenic (d.)
 $\tau = 0.205$ | p-value = 0.389 | No trend



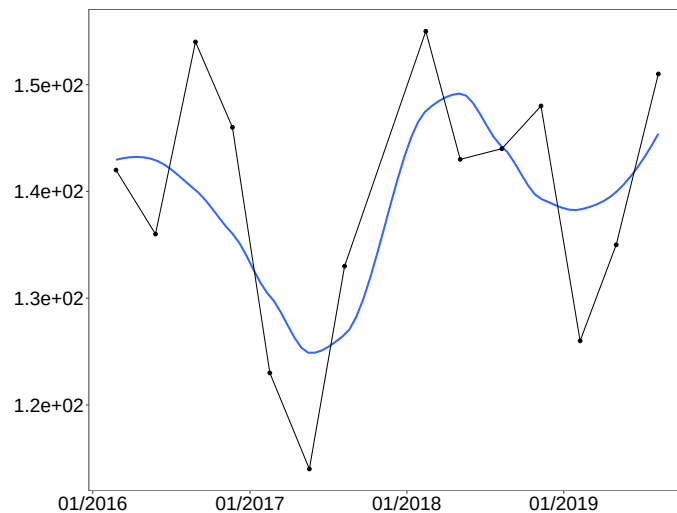
RB2 – Arsenic (t.)
 $\tau = 0.438$ | p-value = 0.0633 | No trend



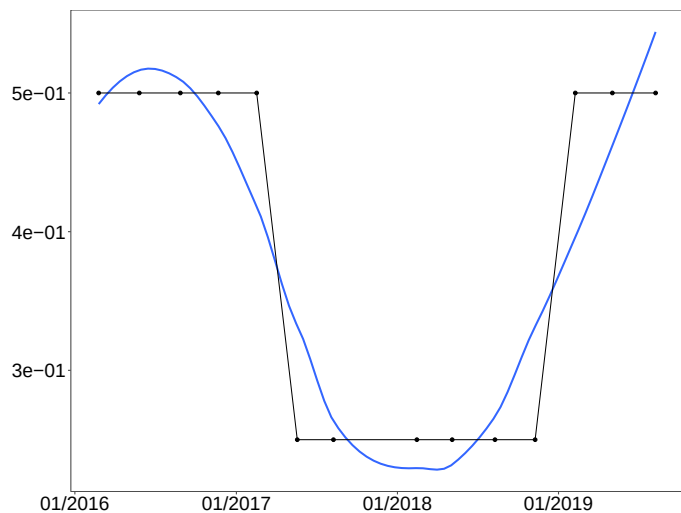
RB2 – Bicarbonate
 $\tau = -0.384$ | p-value = 0.0684 | No trend



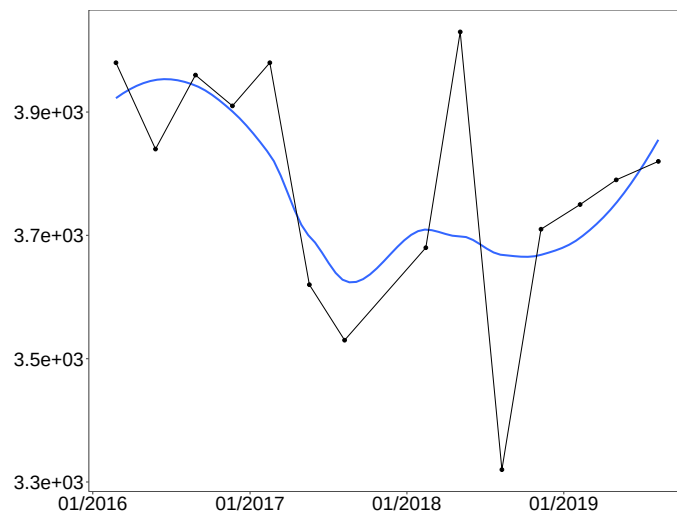
RB2 – Calcium
 $\tau = 0.0769$ | p-value = 0.743 | No trend



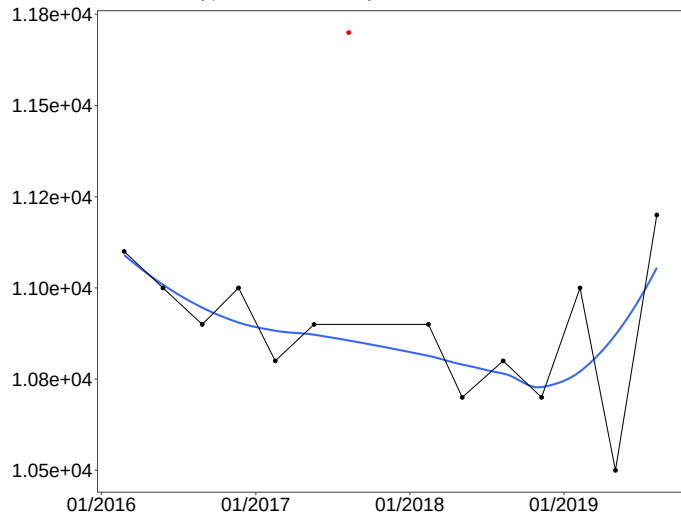
RB2 – Carbonate
 $\tau = -0.182$ | p-value = 0.478 | No trend



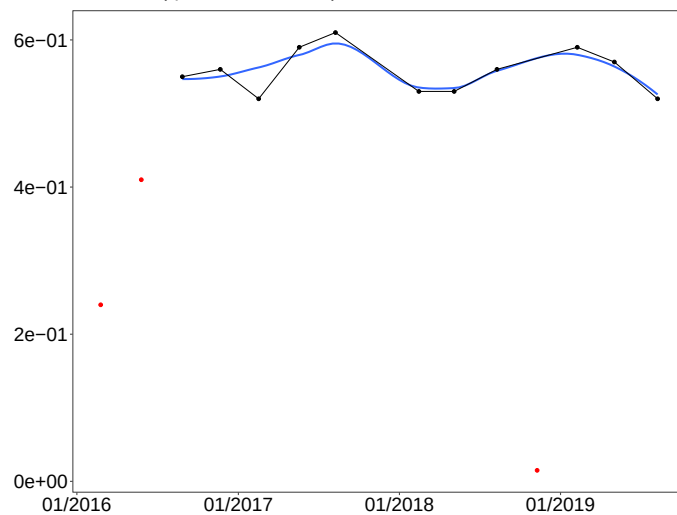
RB2 – Chloride
 $\tau = -0.177$ | p-value = 0.411 | No trend



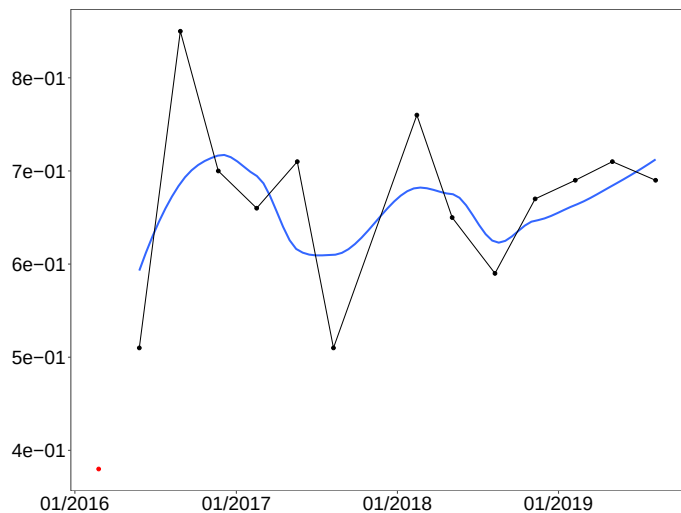
RB2 – Electrical Conductivity
 $\tau = -0.288$ | p-value = 0.183 | No trend



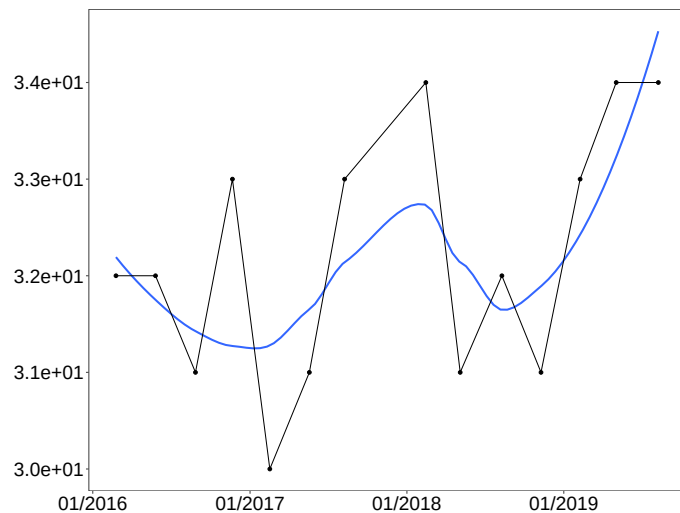
RB2 – Iron (d.)
 $\tau = 0.191$ | p-value = 0.378 | No trend



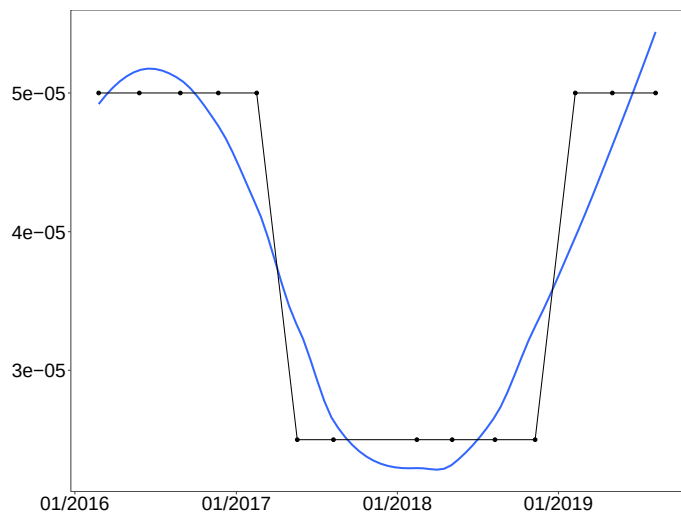
RB2 – Iron (t.)
 $\tau = 0.201$ | p-value = 0.35 | No trend



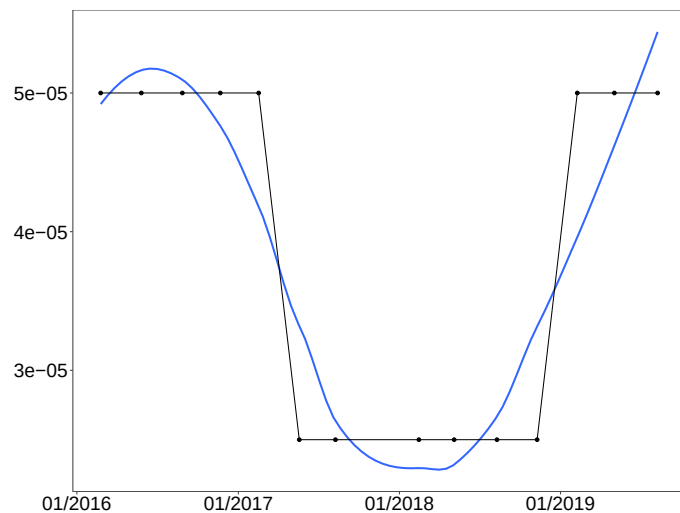
RB2 – Magnesium
 $\tau = 0.337$ | p-value = 0.128 | No trend



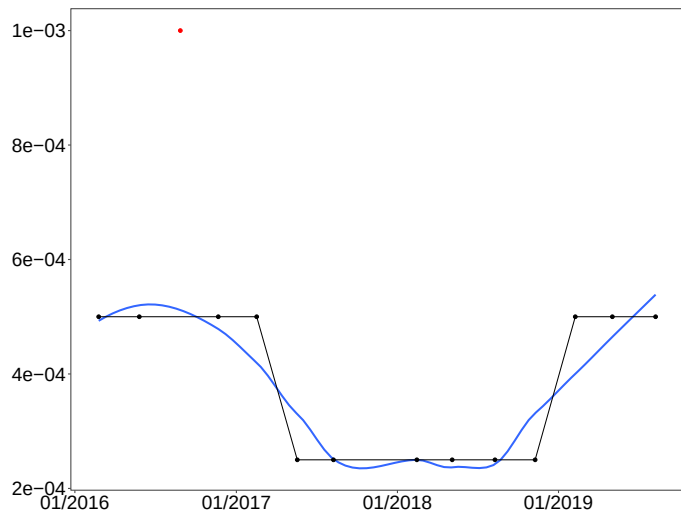
RB2 – Mercury (d.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



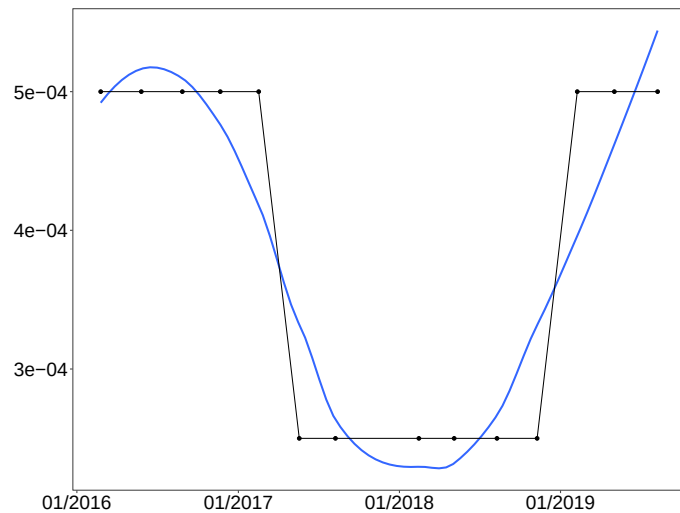
RB2 – Mercury (t.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



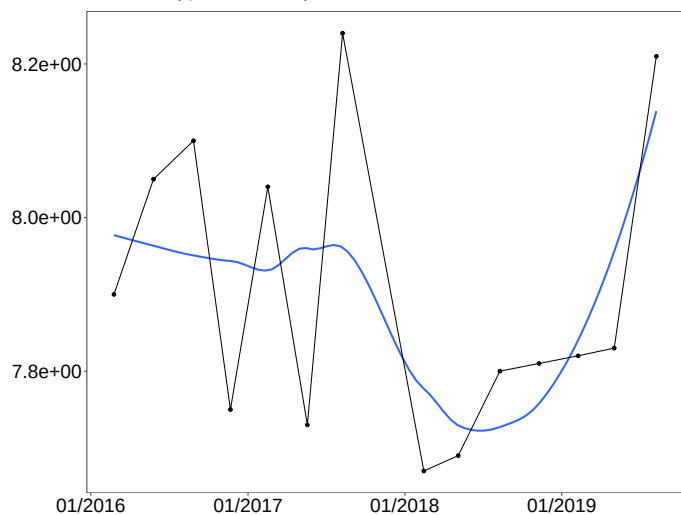
RB2 – Molybdenum (d.)
 $\tau = -0.212$ | p-value = 0.386 | No trend



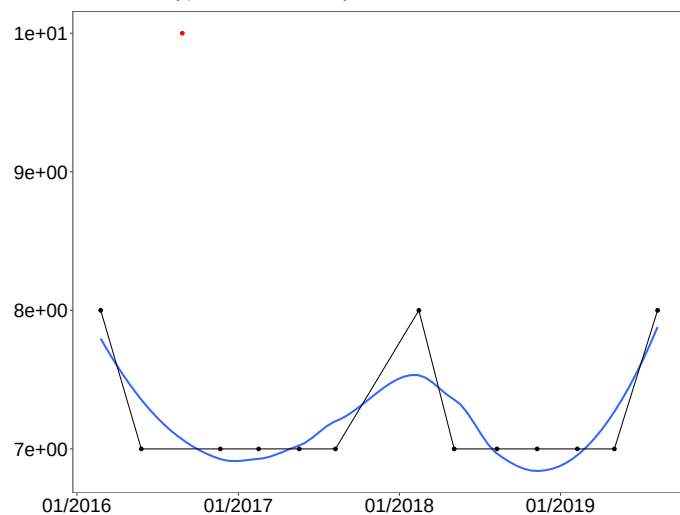
RB2 – Molybdenum (t.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



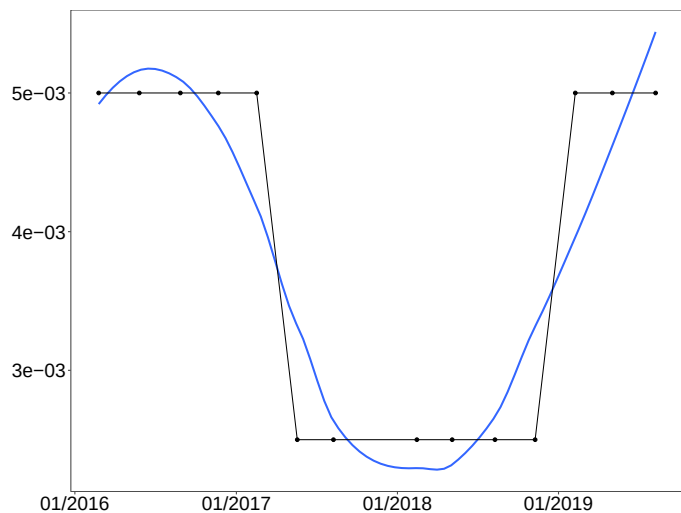
RB2 - pH
 $\tau = 0.011$ | p-value = 1 | No trend



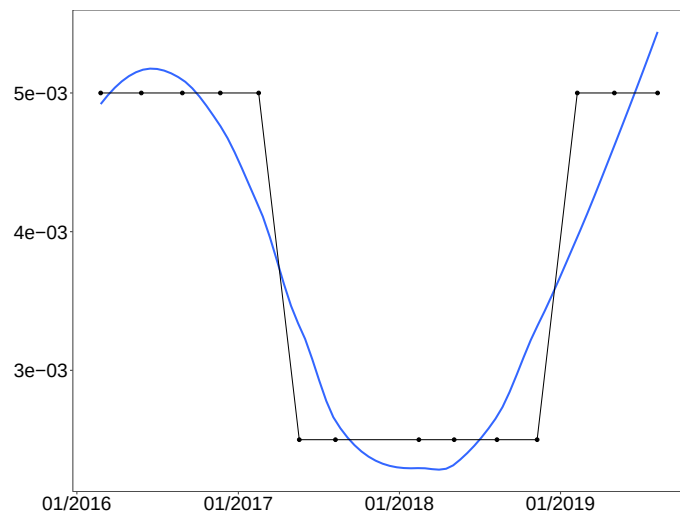
RB2 - Potassium
 $\tau = -0.144$ | p-value = 0.576 | No trend



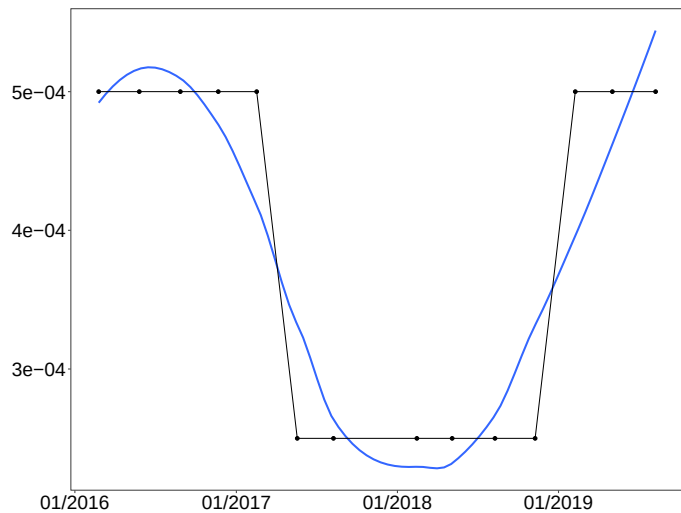
RB2 - Selenium (d.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



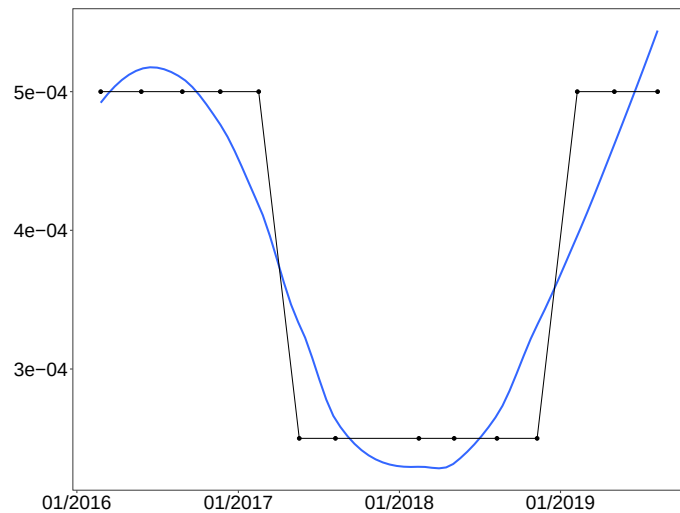
RB2 - Selenium (t.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



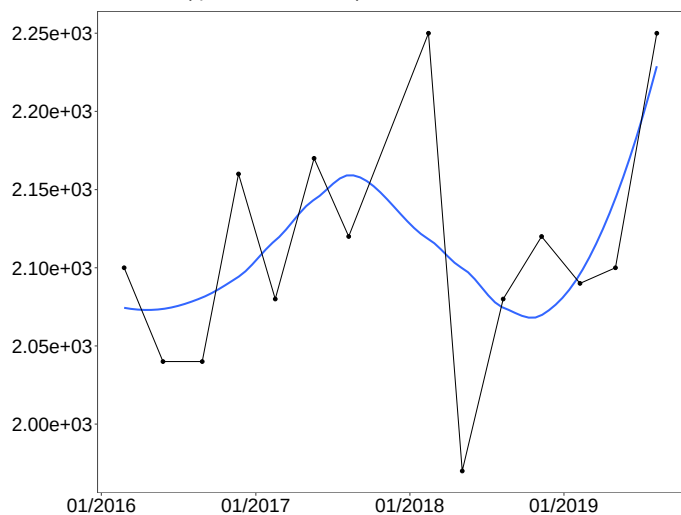
RB2 - Silver (d.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



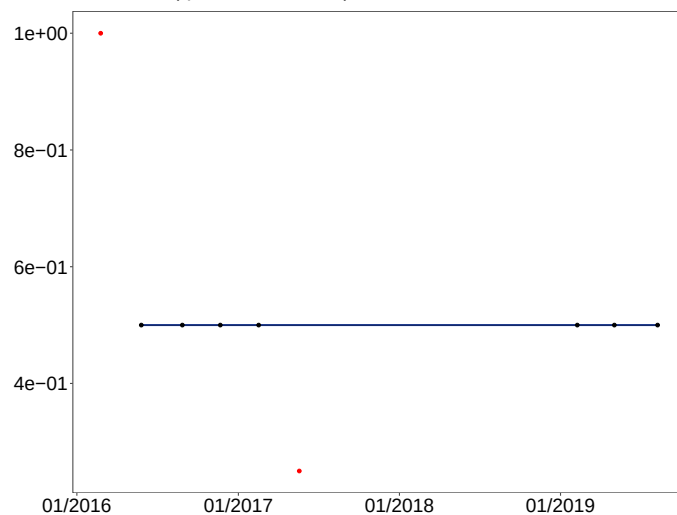
RB2 - Silver (t.)
 $\tau = -0.182$ | p-value = 0.478 | No trend



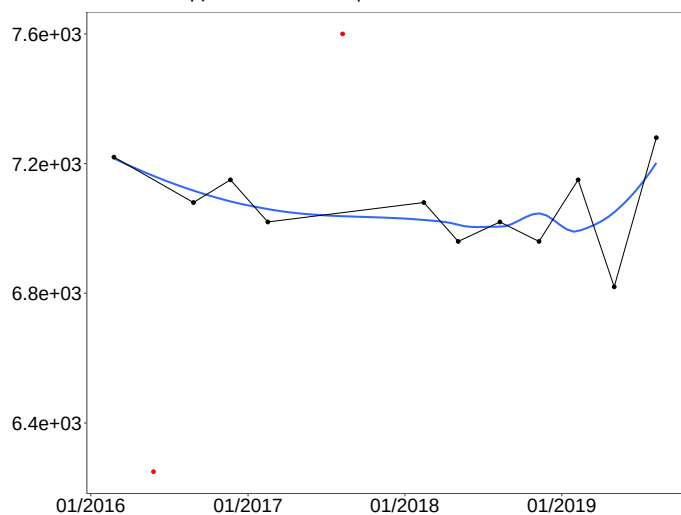
RB2 – Sodium
 $\tau = 0.226$ | p-value = 0.295 | No trend



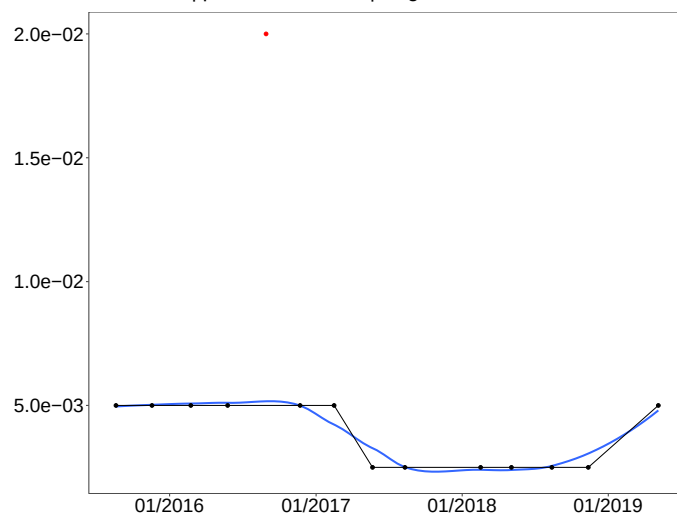
RB2 – Sulphate
 $\tau = -0.387$ | p-value = 0.247 | No trend



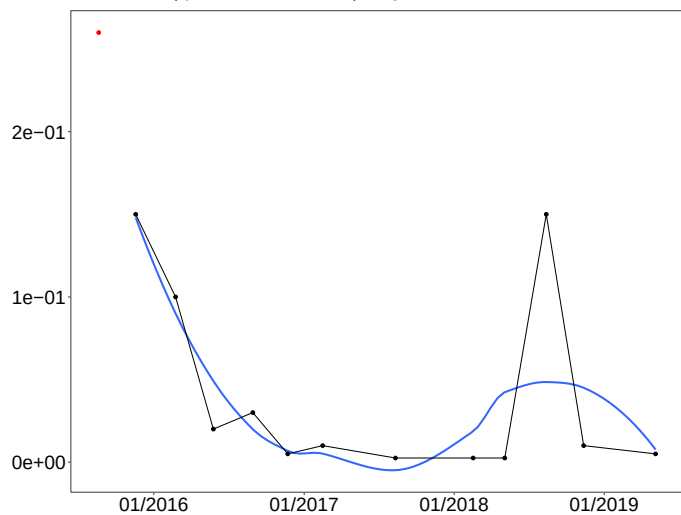
RB2 – TDS
 $\tau = -0.079$ | p-value = 0.759 | No trend



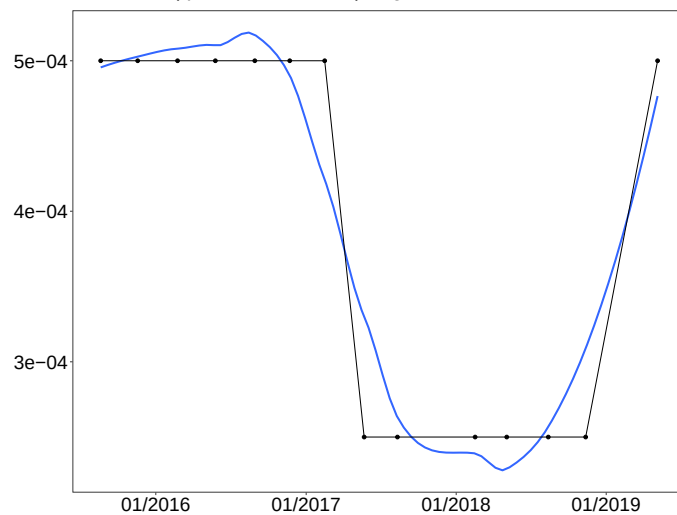
RB3 – Aluminium (d.)
 $\tau = -0.495$ | p-value = 0.0353 | Negative trend



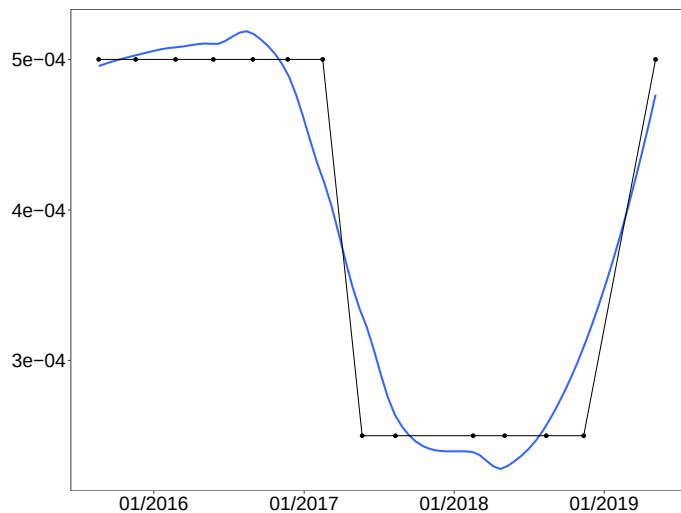
RB3 – Aluminium (t.)
 $\tau = -0.507$ | p-value = 0.0223 | Negative trend



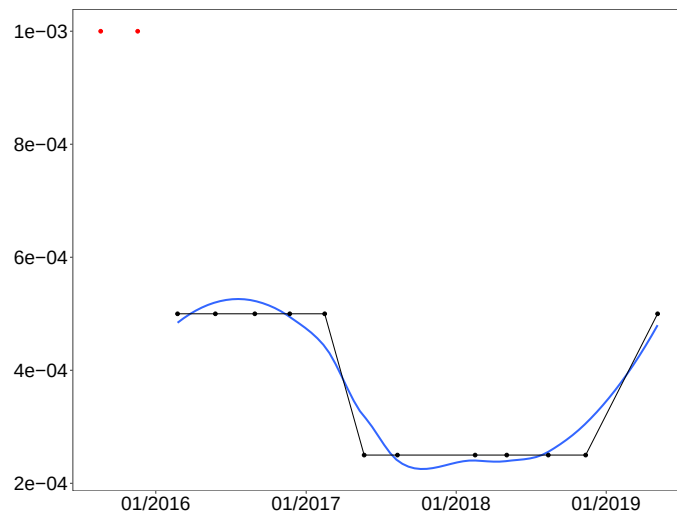
RB3 – Antimony (d.)
 $\tau = -0.545$ | p-value = 0.0239 | Negative trend



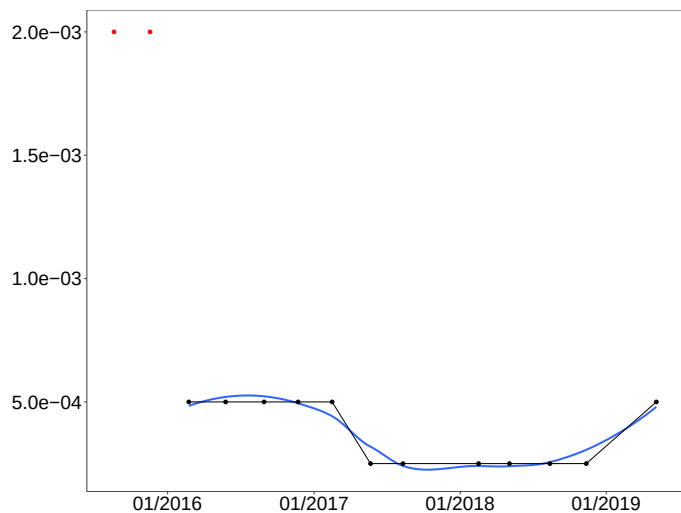
RB3 – Antimony (t.)
 $\tau = -0.545$ | p-value = 0.0239 | Negative trend



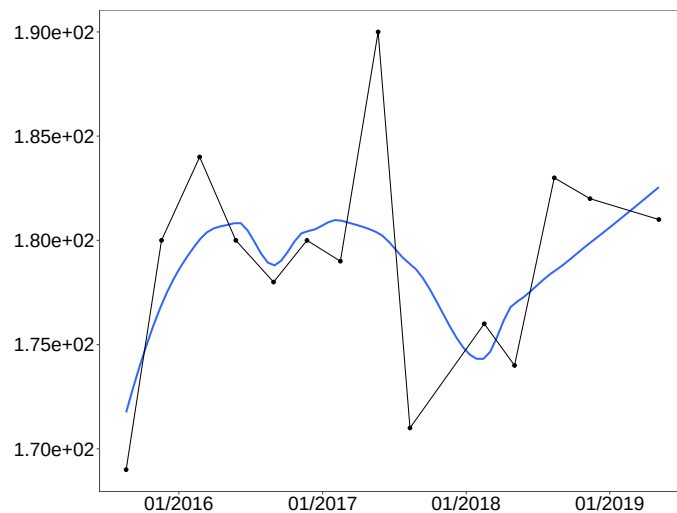
RB3 – Arsenic (d.)
 $\tau = -0.65$ | p-value = 0.00467 | Negative trend



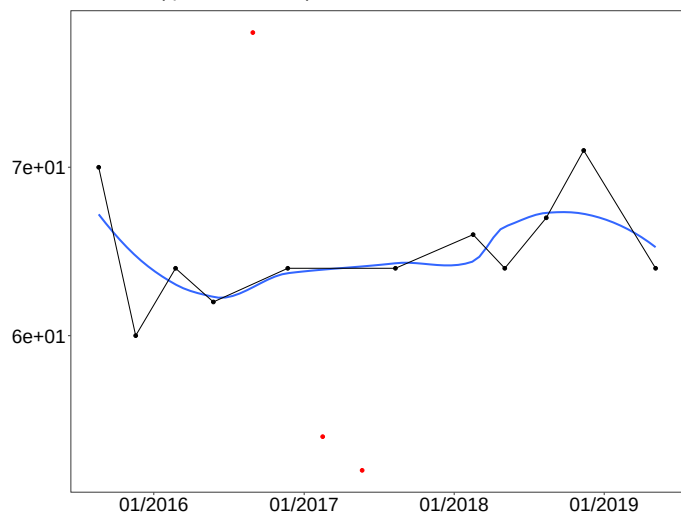
RB3 – Arsenic (t.)
 $\tau = -0.65$ | p-value = 0.00467 | Negative trend



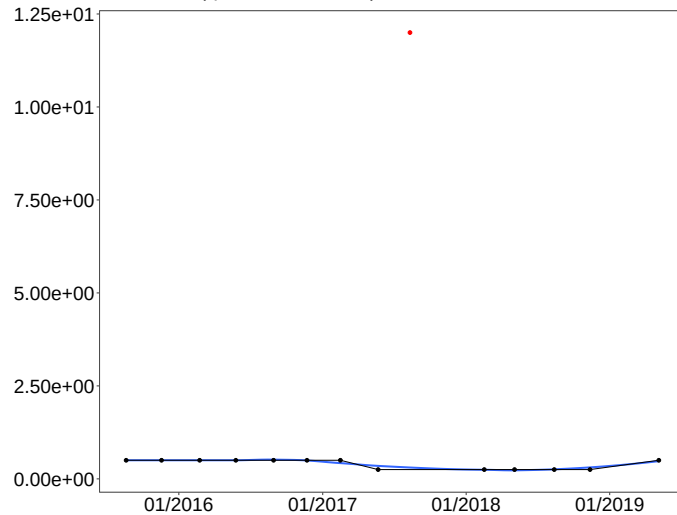
RB3 – Bicarbonate
 $\tau = 0.0894$ | p-value = 0.7 | No trend



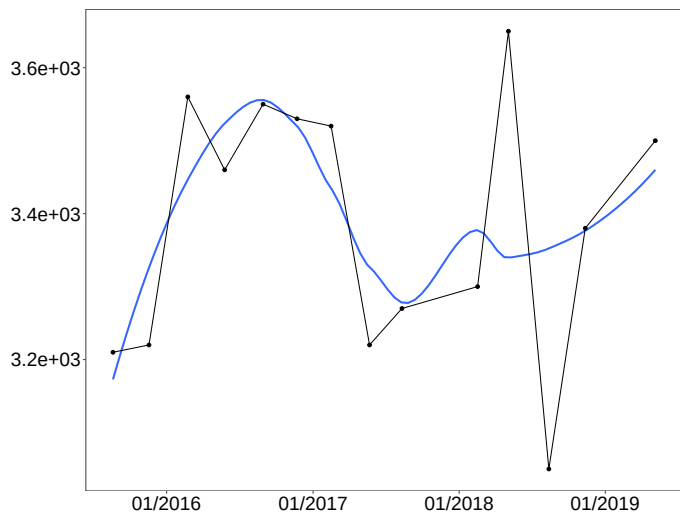
RB3 – Calcium
 $\tau = 0.151$ | p-value = 0.5 | No trend



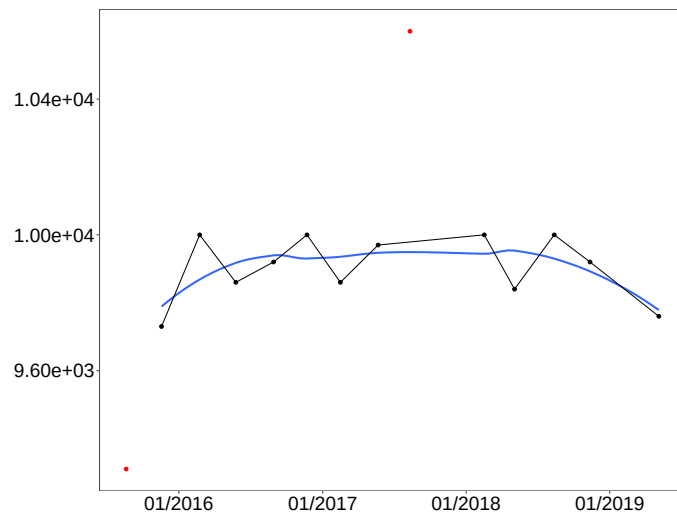
RB3 – Carbonate
 $\tau = -0.389$ | p-value = 0.101 | No trend



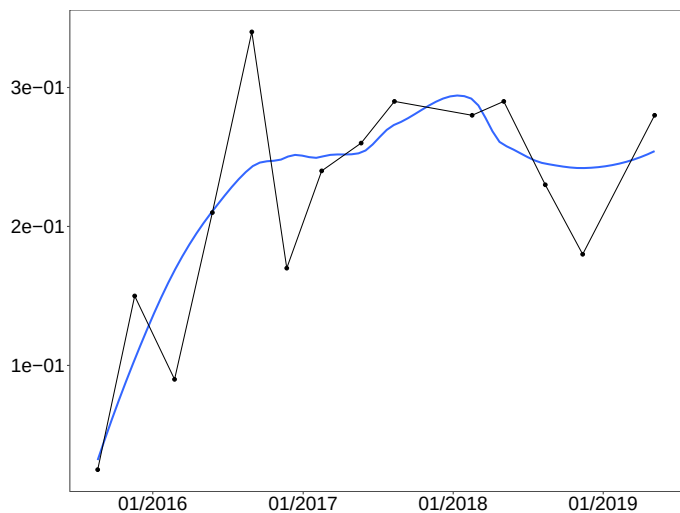
RB3 – Chloride
 $\tau = 0.0221$ | p-value = 0.956 | No trend



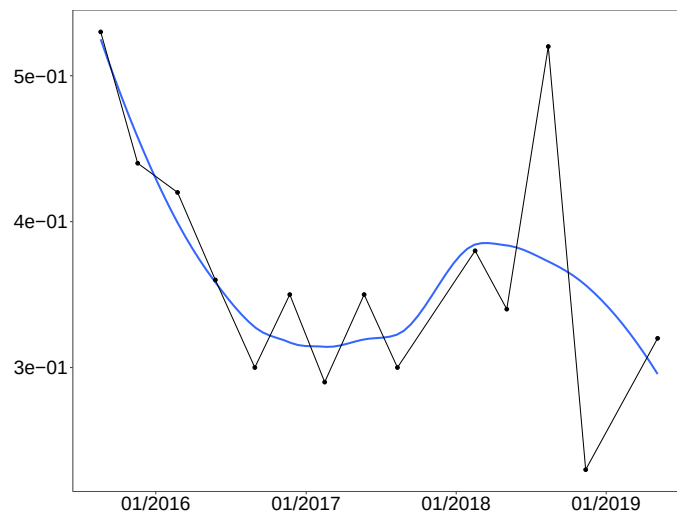
RB3 – Electrical Conductivity
 $\tau = 0.173$ | p-value = 0.436 | No trend



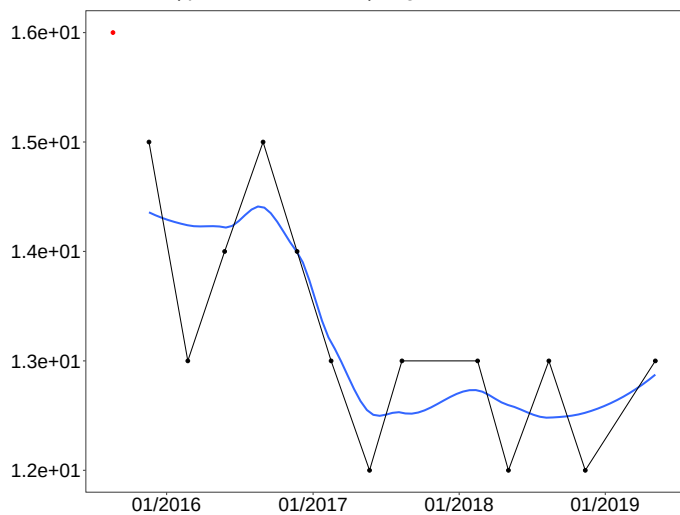
RB3 – Iron (d.)
 $\tau = 0.411$ | p-value = 0.0481 | Positive trend



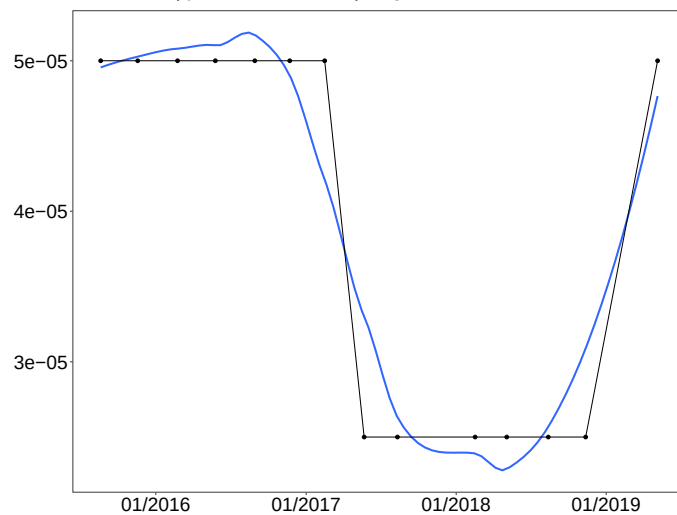
RB3 – Iron (t.)
 $\tau = -0.389$ | p-value = 0.0619 | No trend



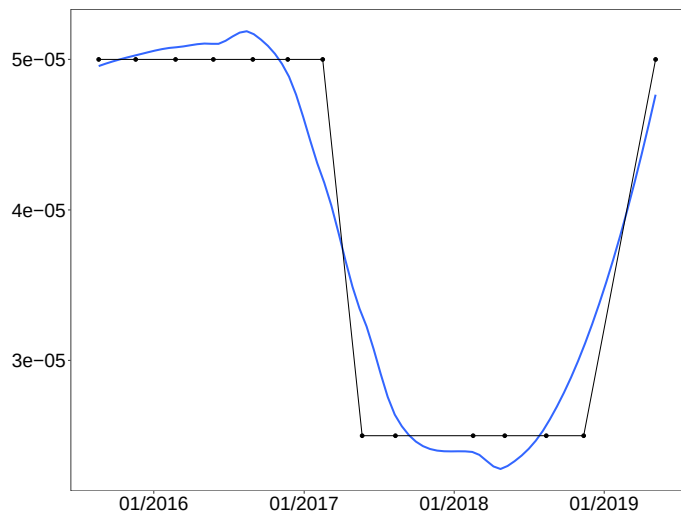
RB3 – Magnesium
 $\tau = -0.61$ | p-value = 0.00556 | Negative trend



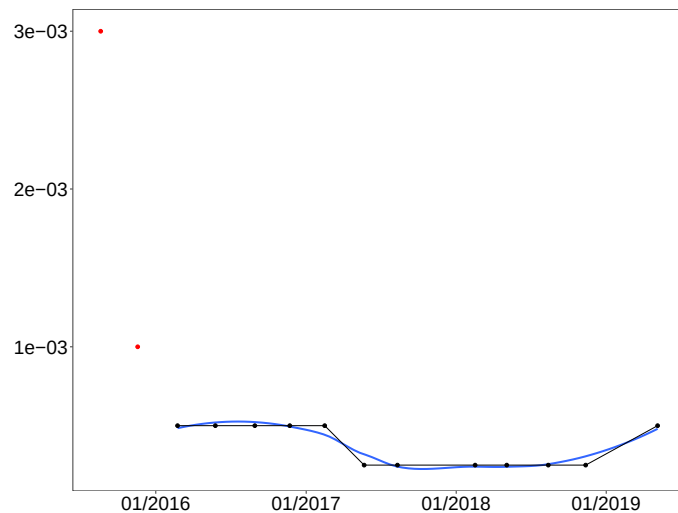
RB3 – Mercury (d.)
 $\tau = -0.545$ | p-value = 0.0239 | Negative trend



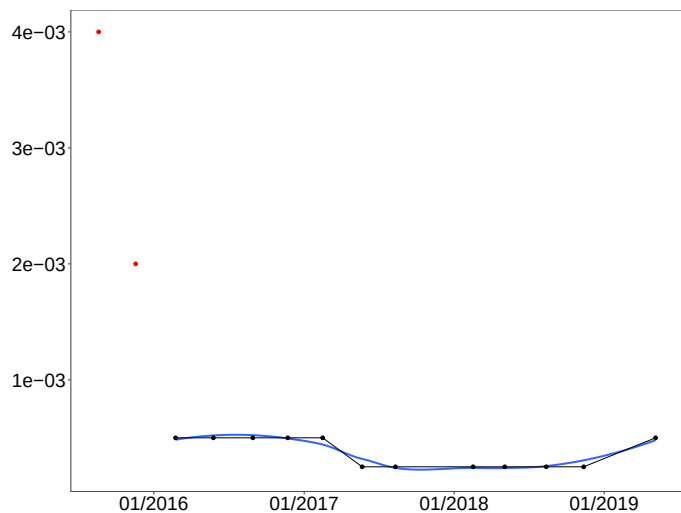
RB3 – Mercury (t.)

 $\tau = -0.545$ | p-value = 0.0239 | Negative trend

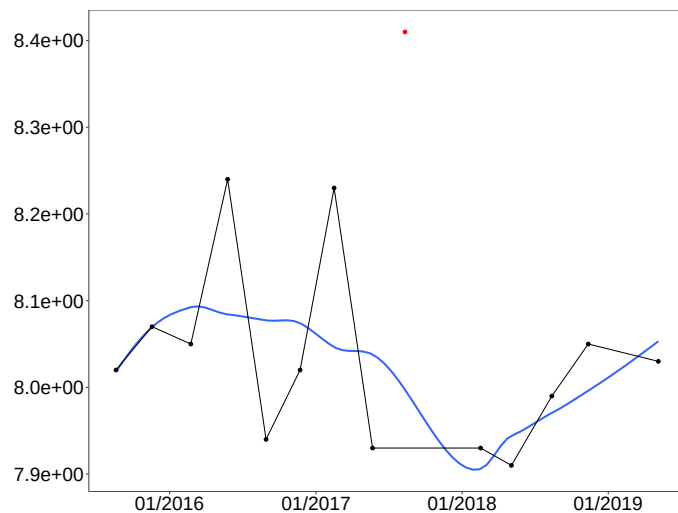
RB3 – Molybdenum (d.)

 $\tau = -0.658$ | p-value = 0.00393 | Negative trend

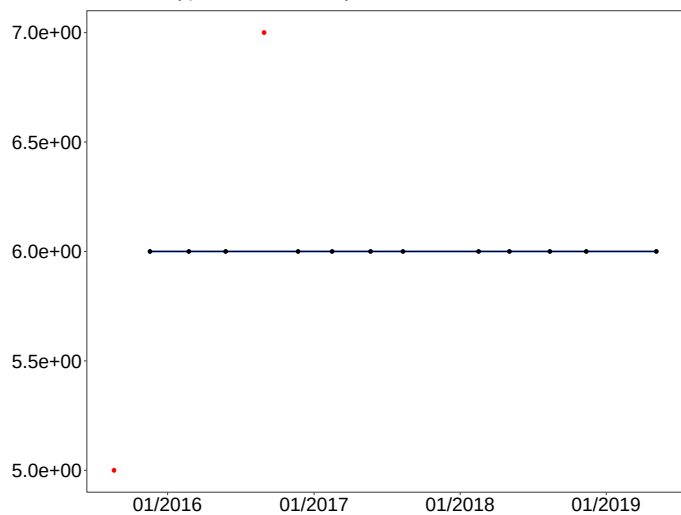
RB3 – Molybdenum (t.)

 $\tau = -0.658$ | p-value = 0.00393 | Negative trend

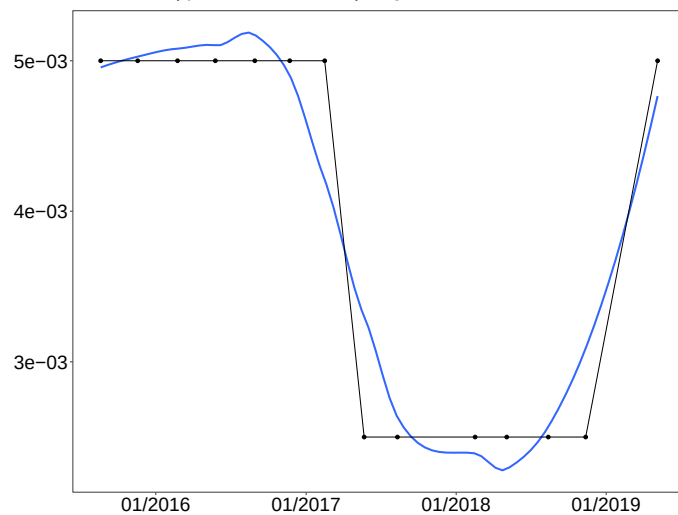
RB3 – pH

 $\tau = -0.156$ | p-value = 0.475 | No trend

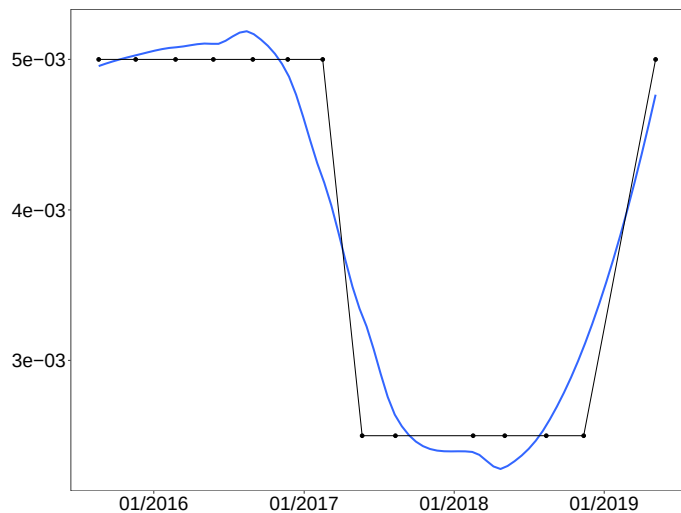
RB3 – Potassium

 $\tau = 0.147$ | p-value = 0.585 | No trend

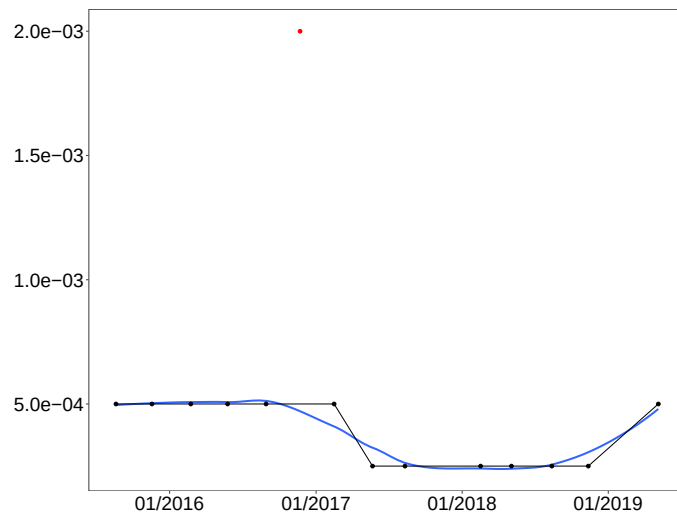
RB3 – Selenium (d.)

 $\tau = -0.545$ | p-value = 0.0239 | Negative trend

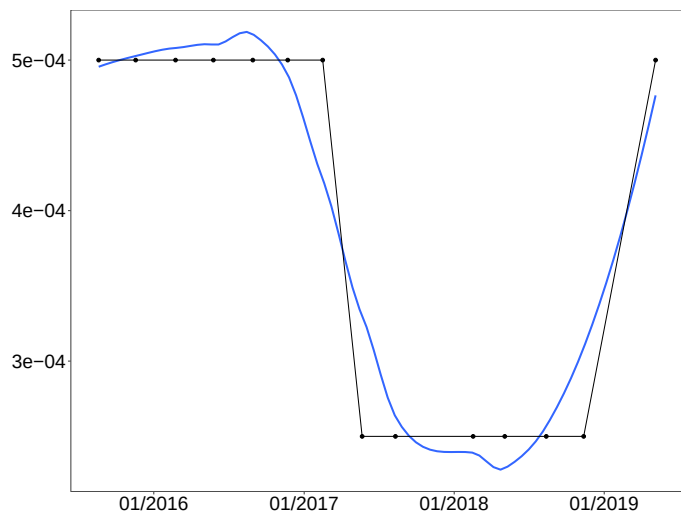
RB3 – Selenium (t.)
 $\tau = -0.545$ | p-value = 0.0239 | Negative trend



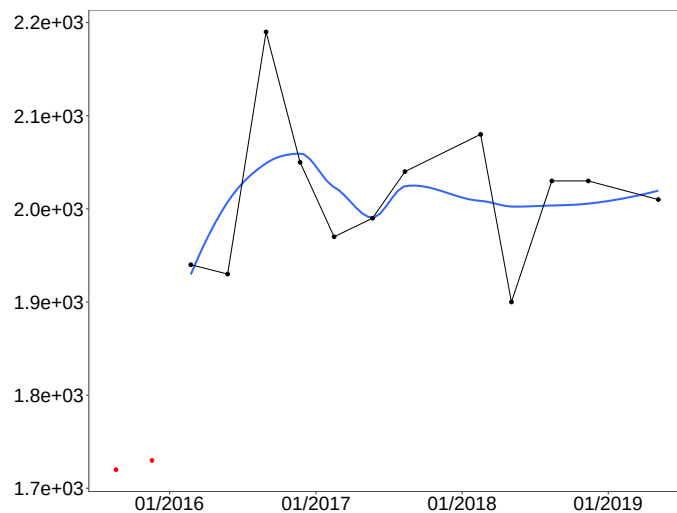
RB3 – Silver (d.)
 $\tau = -0.466$ | p-value = 0.0476 | Negative trend



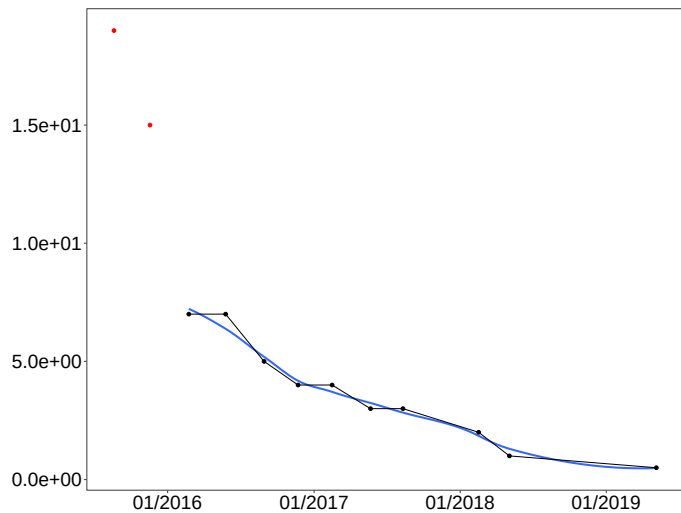
RB3 – Silver (t.)
 $\tau = -0.545$ | p-value = 0.0239 | Negative trend



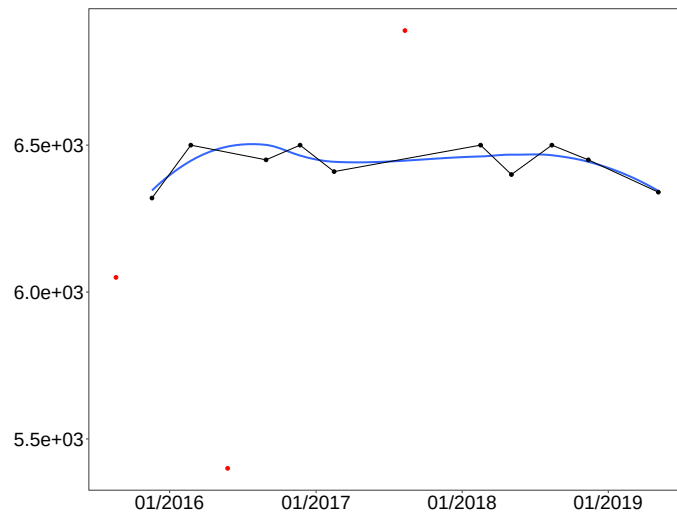
RB3 – Sodium
 $\tau = 0.309$ | p-value = 0.139 | No trend



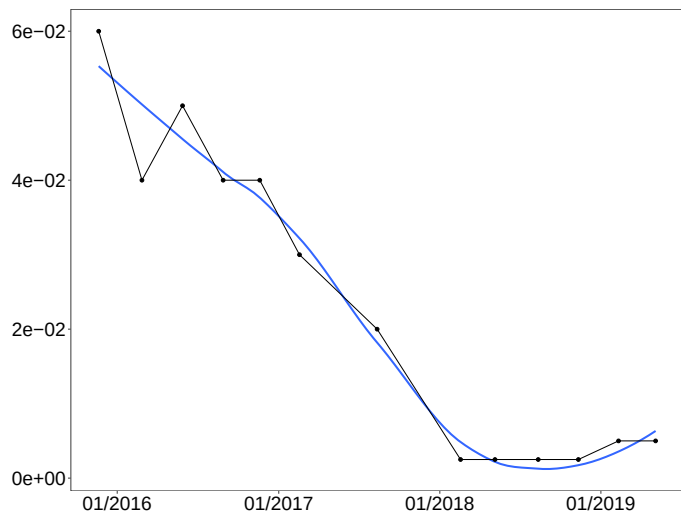
RB3 – Sulphate
 $\tau = -0.977$ | p-value = 0.0000185 | Negative trend



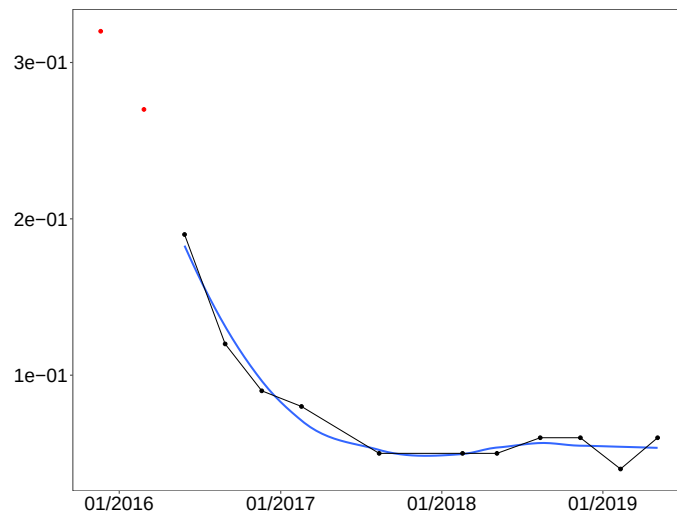
RB3 – TDS
 $\tau = 0.175$ | p-value = 0.456 | No trend



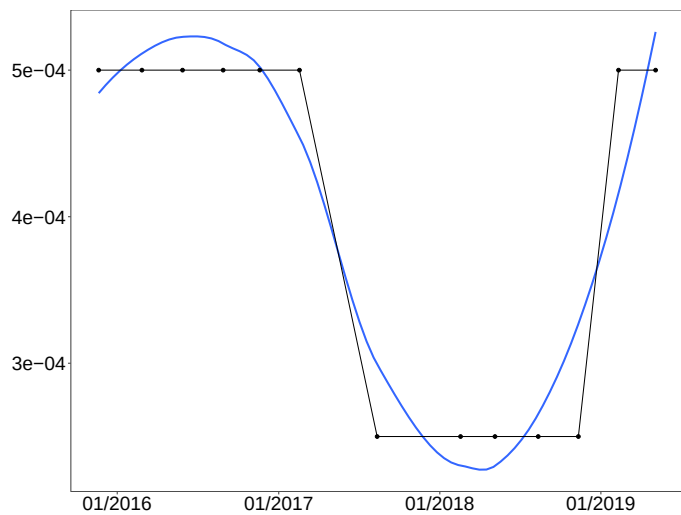
RB4 – Aluminium (d.)

 $\tau = -0.687$ | p-value = 0.00217 | Negative trend

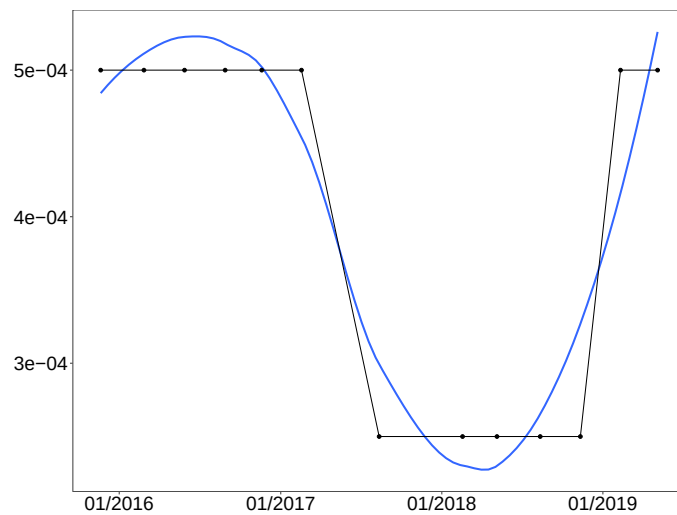
RB4 – Aluminium (t.)

 $\tau = -0.694$ | p-value = 0.00161 | Negative trend

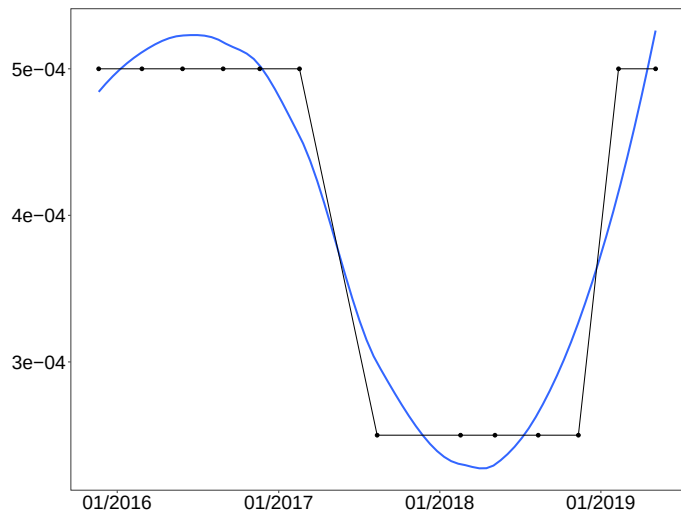
RB4 – Antimony (d.)

 $\tau = -0.358$ | p-value = 0.164 | No trend

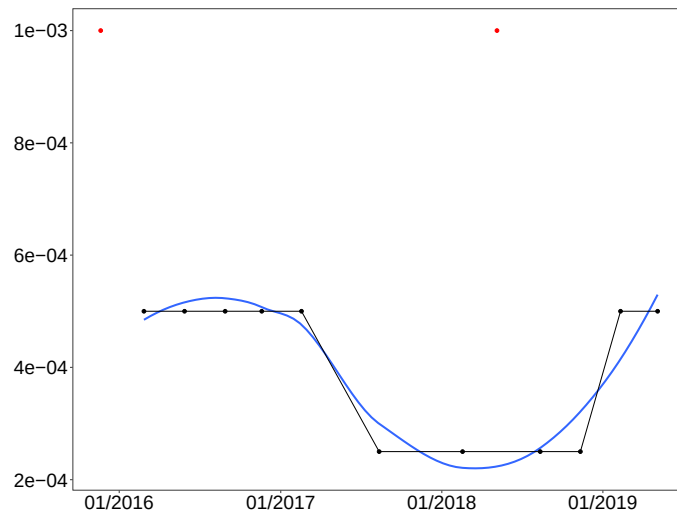
RB4 – Antimony (t.)

 $\tau = -0.358$ | p-value = 0.164 | No trend

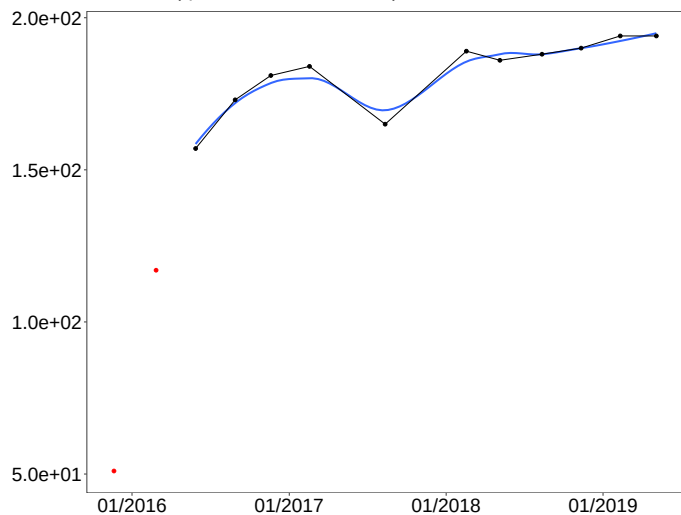
RB4 – Arsenic (d.)

 $\tau = -0.358$ | p-value = 0.164 | No trend

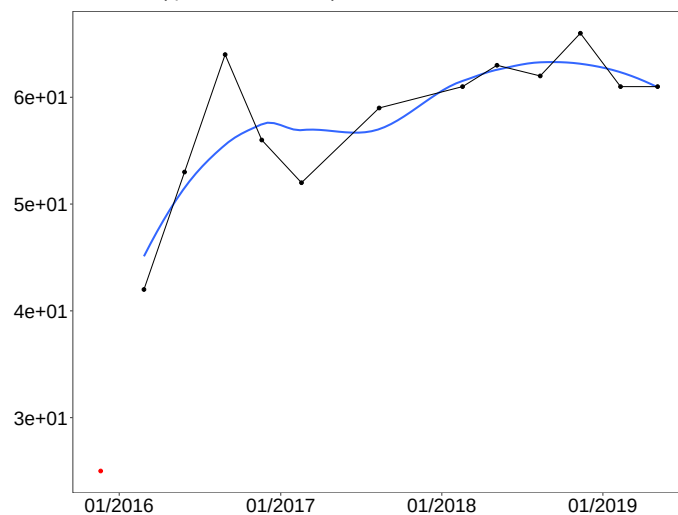
RB4 – Arsenic (t.)

 $\tau = -0.32$ | p-value = 0.195 | No trend

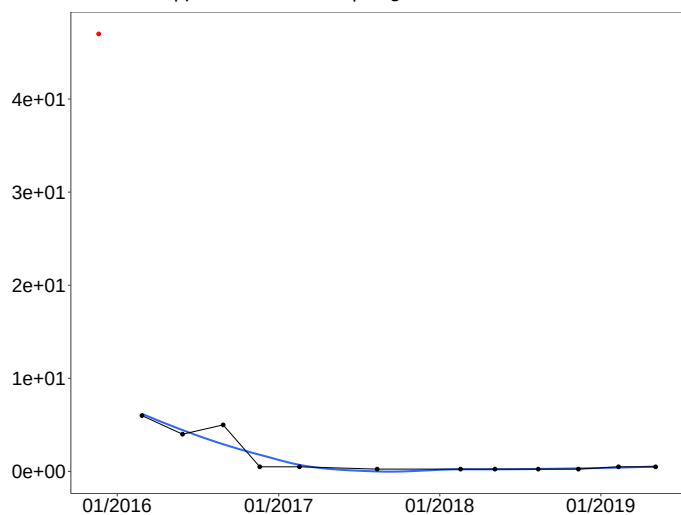
RB4 – Bicarbonate
 $\tau = 0.865$ | p-value = 0.0000548 | Positive trend



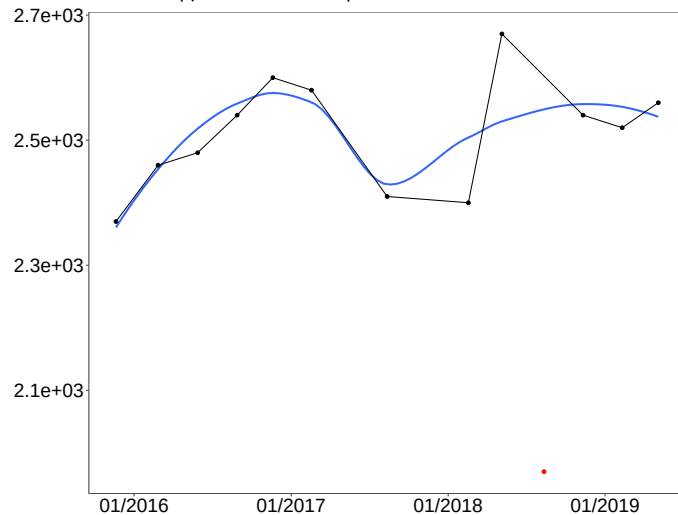
RB4 – Calcium
 $\tau = 0.536$ | p-value = 0.014 | Positive trend



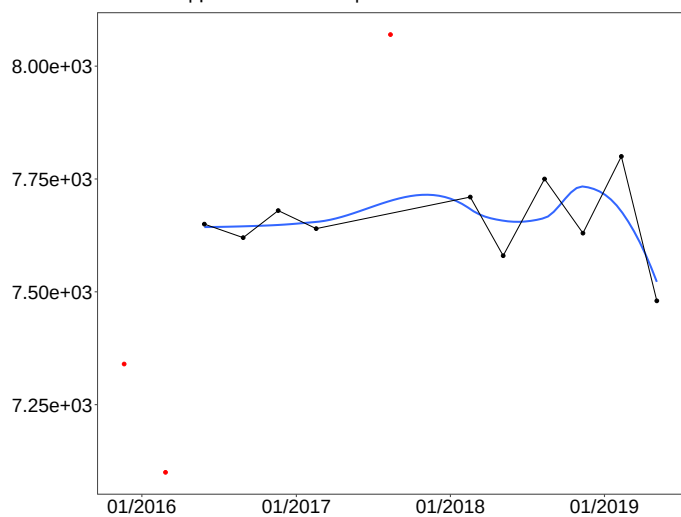
RB4 – Carbonate
 $\tau = -0.575$ | p-value = 0.0124 | Negative trend



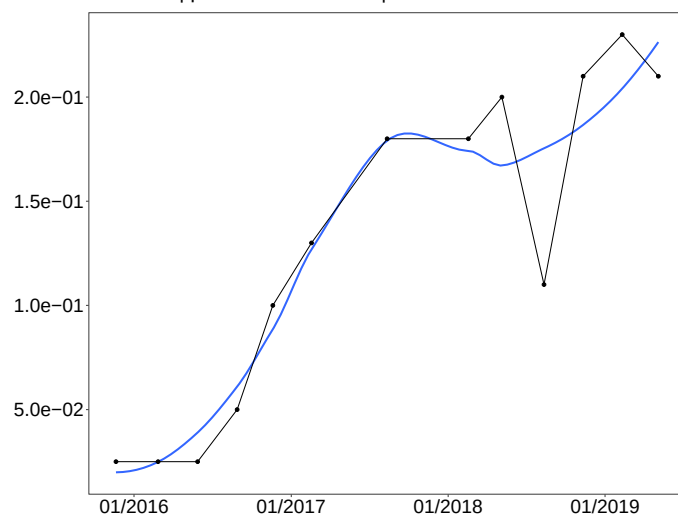
RB4 – Chloride
 $\tau = 0.168$ | p-value = 0.463 | No trend



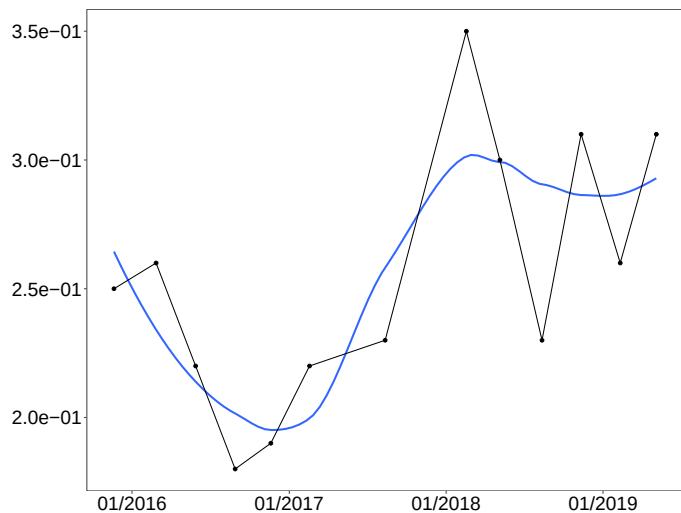
RB4 – Electrical Conductivity
 $\tau = 0.256$ | p-value = 0.246 | No trend



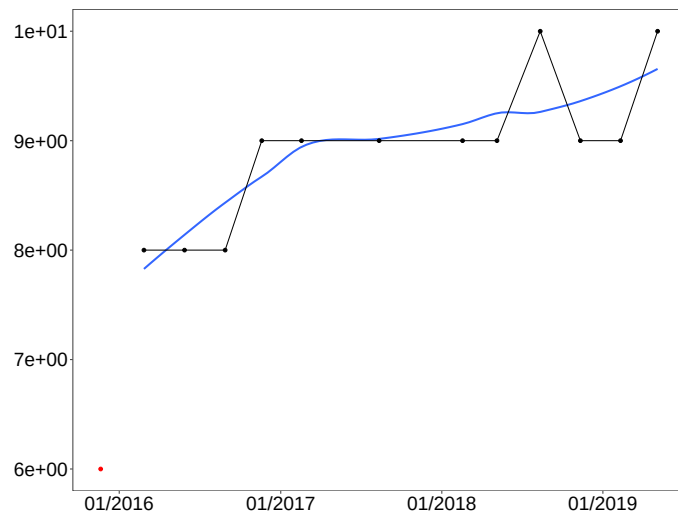
RB4 – Iron (d.)
 $\tau = 0.835$ | p-value = 0.000132 | Positive trend



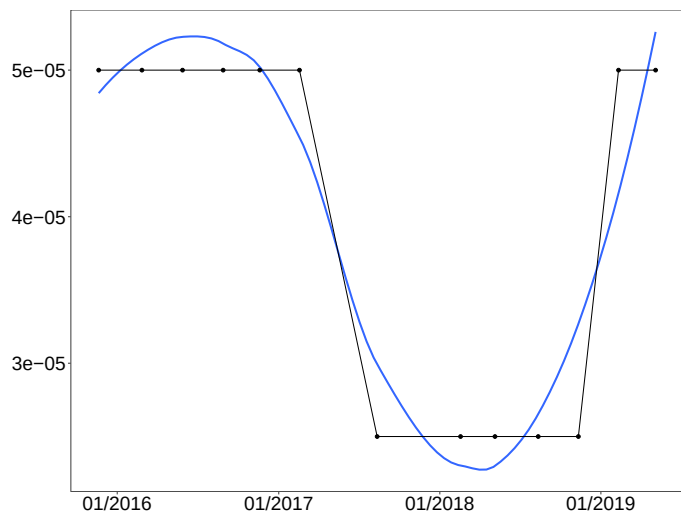
RB4 – Iron (t.)
 $\tau = 0.395$ | p-value = 0.0747 | No trend



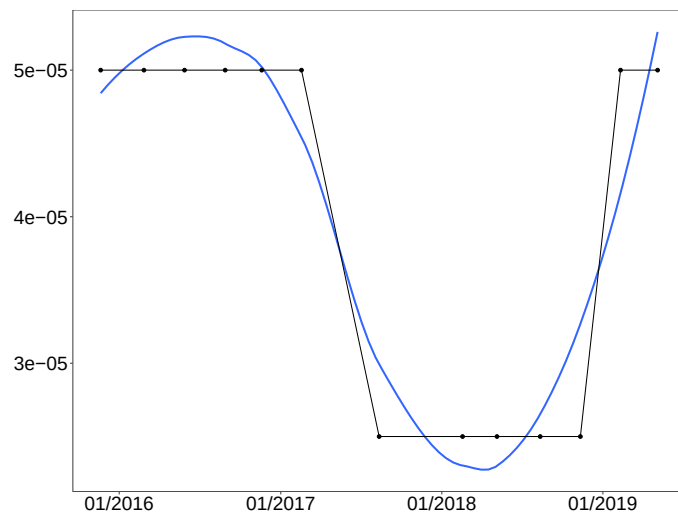
RB4 – Magnesium
 $\tau = 0.762$ | p-value = 0.0012 | Positive trend



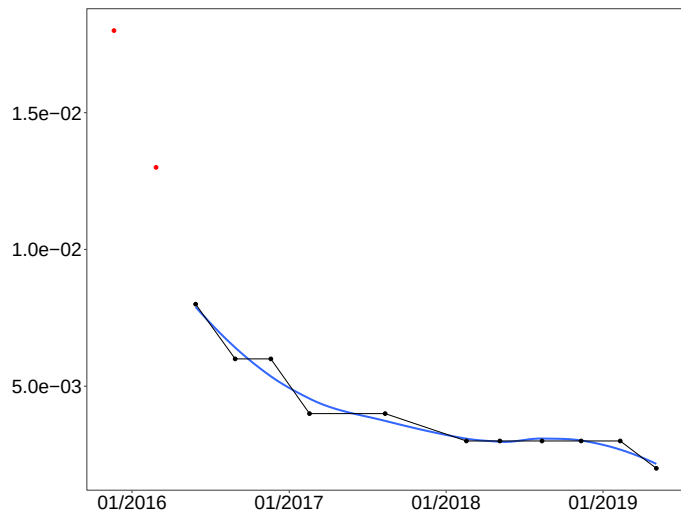
RB4 – Mercury (d.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



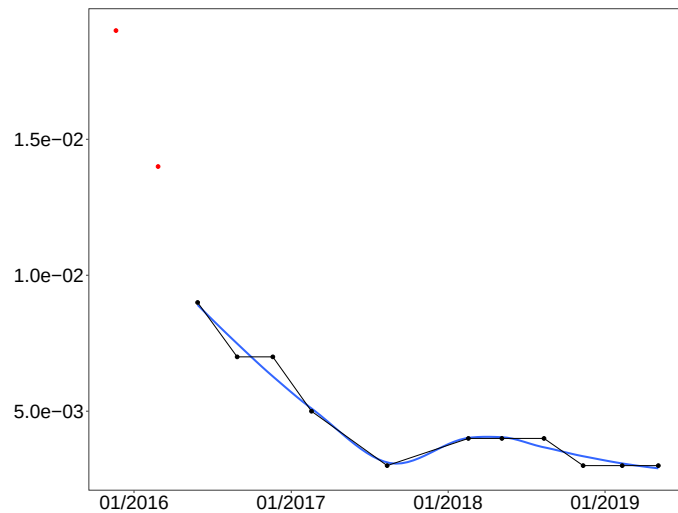
RB4 – Mercury (t.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



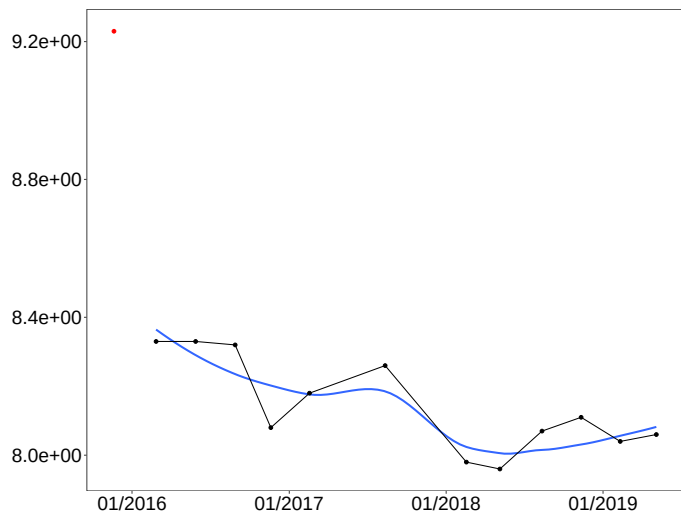
RB4 – Molybdenum (d.)
 $\tau = -0.92$ | p-value = 0.0000394 | Negative trend



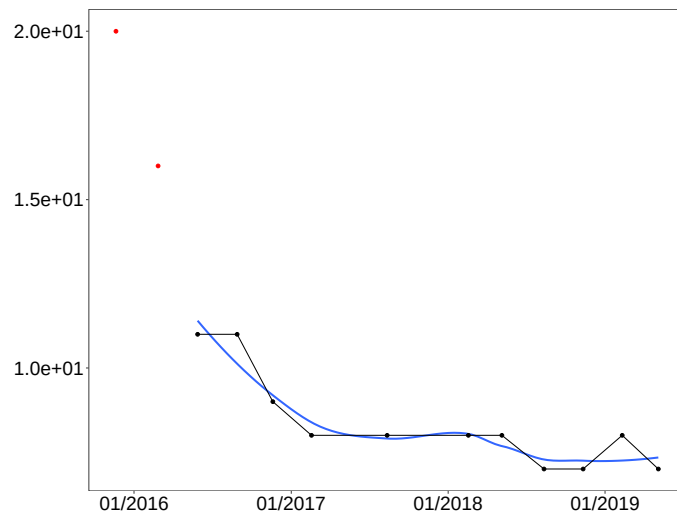
RB4 – Molybdenum (t.)
 $\tau = -0.851$ | p-value = 0.000135 | Negative trend



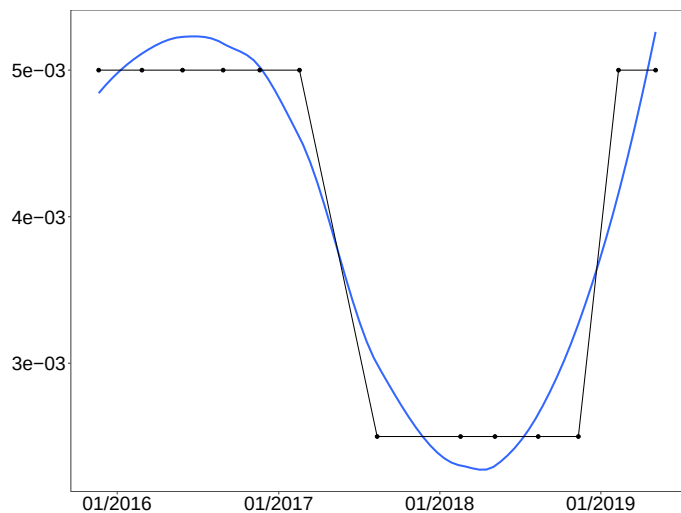
RB4 – pH
 $\tau = -0.632$ | p-value = 0.00335 | Negative trend



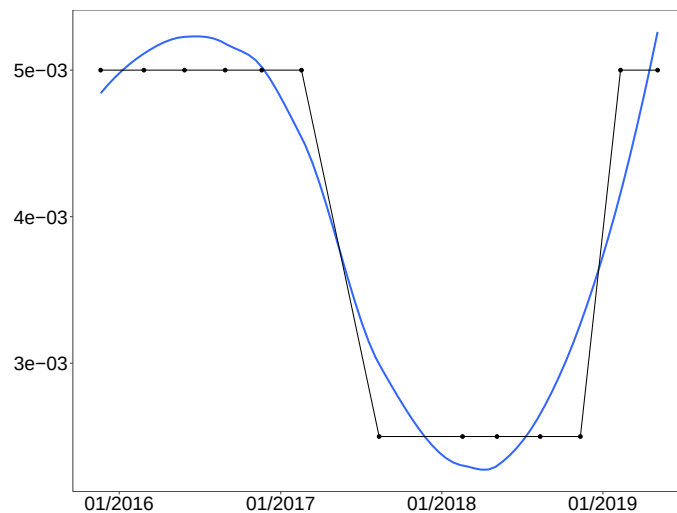
RB4 – Potassium
 $\tau = -0.849$ | p-value = 0.000176 | Negative trend



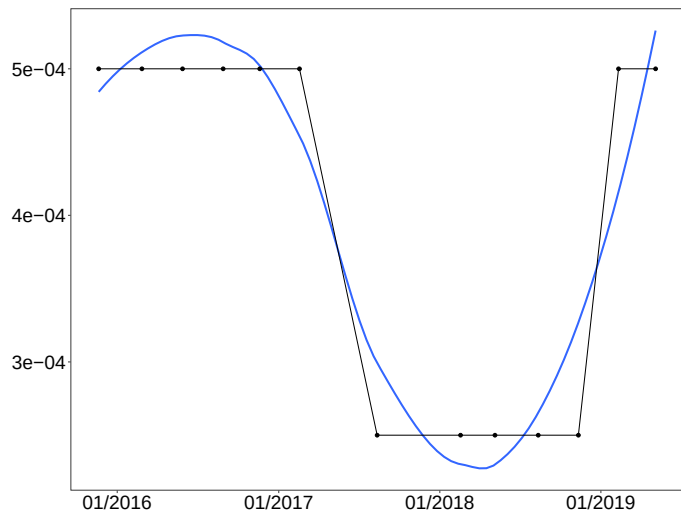
RB4 – Selenium (d.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



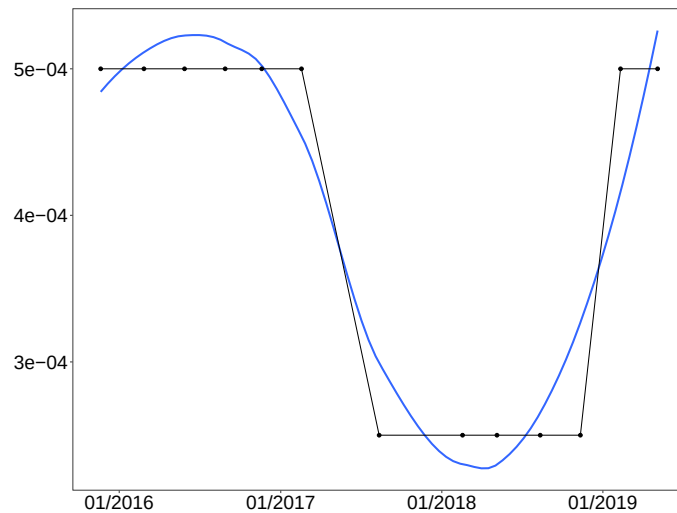
RB4 – Selenium (t.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



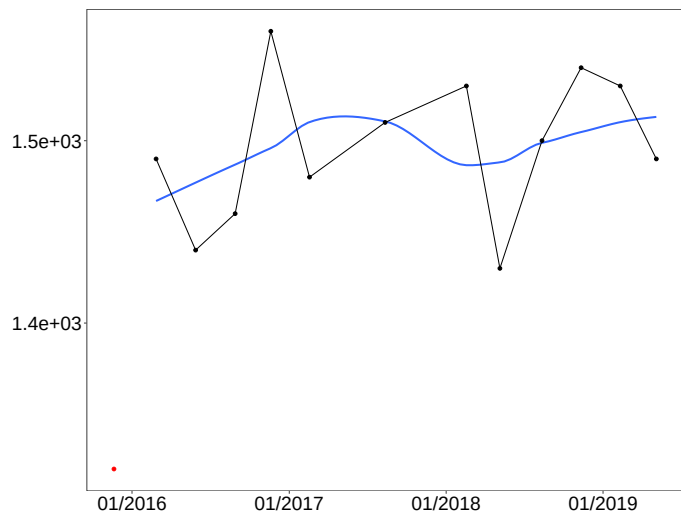
RB4 – Silver (d.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



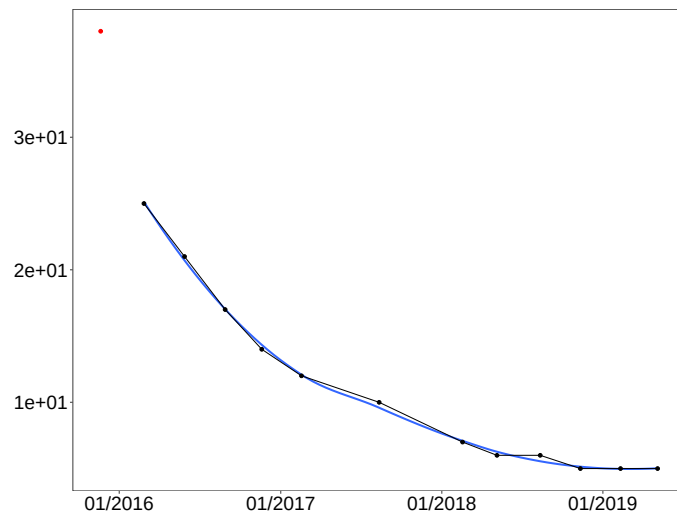
RB4 – Silver (t.)
 $\tau = -0.358$ | p-value = 0.164 | No trend



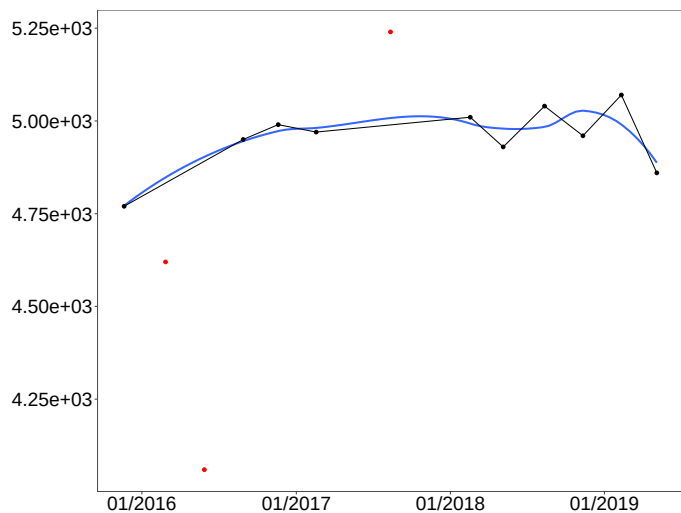
RB4 – Sodium
 $\tau = 0.338$ | p-value = 0.126 | No trend



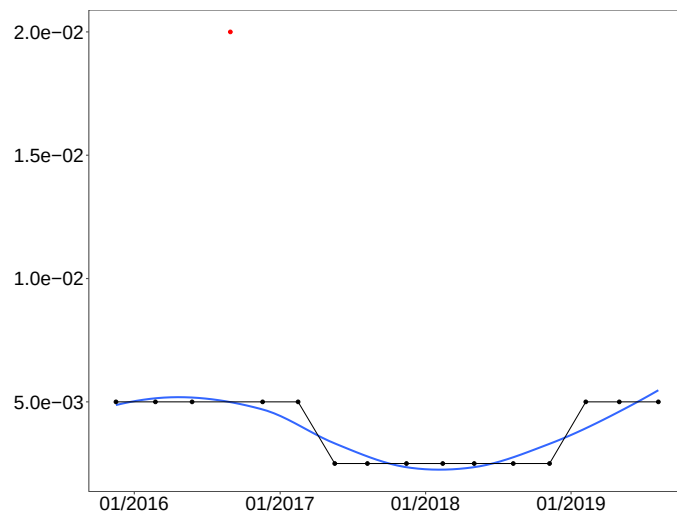
RB4 – Sulphate
 $\tau = -0.974$ | p-value = 0.00000703 | Negative trend



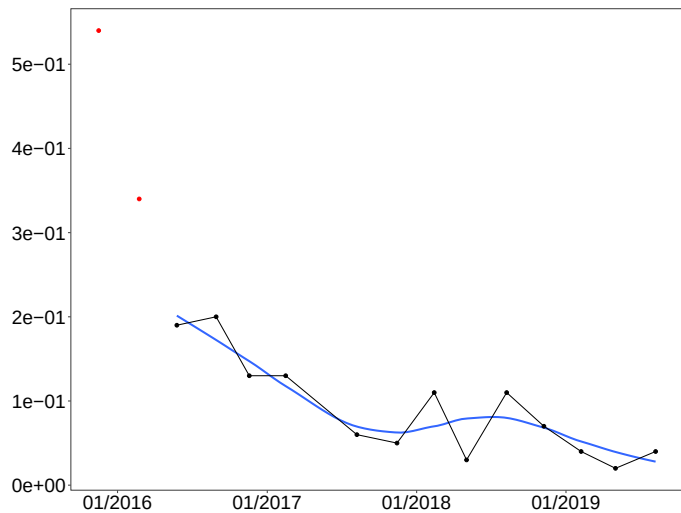
RB4 – TDS
 $\tau = 0.333$ | p-value = 0.127 | No trend



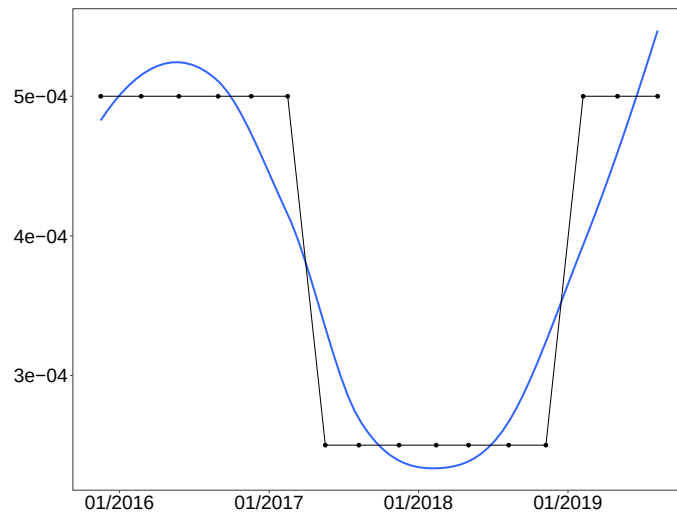
RB5 – Aluminium (d.)
 $\tau = -0.249$ | p-value = 0.261 | No trend



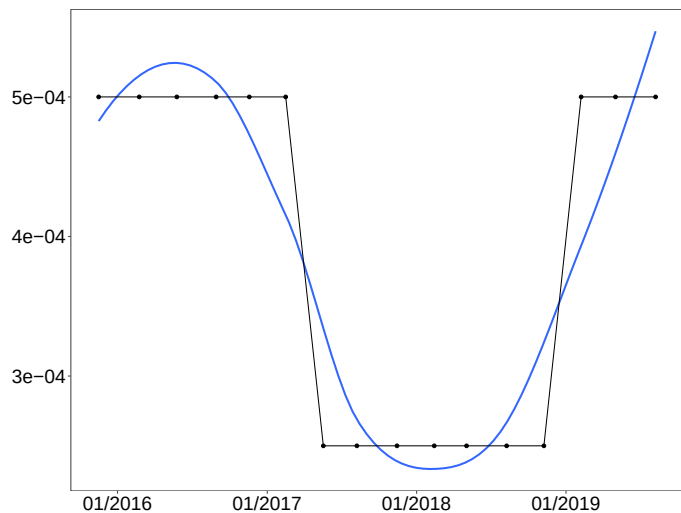
RB5 – Aluminium (t.)
 $\tau = -0.754$ | p-value = 0.000131 | Negative trend



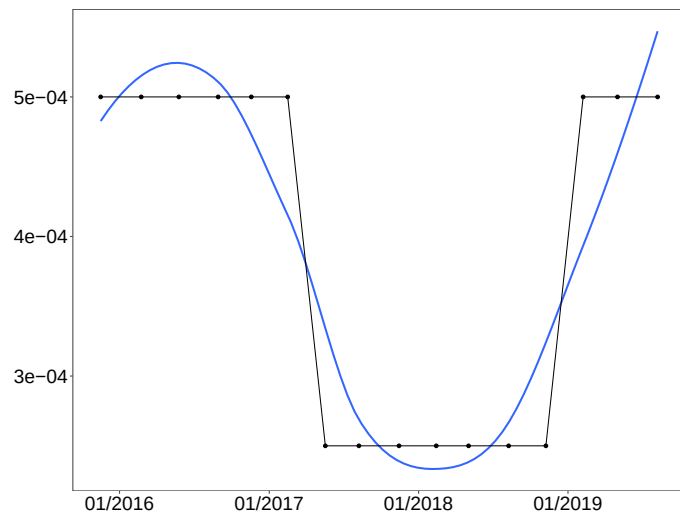
RB5 – Antimony (d.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



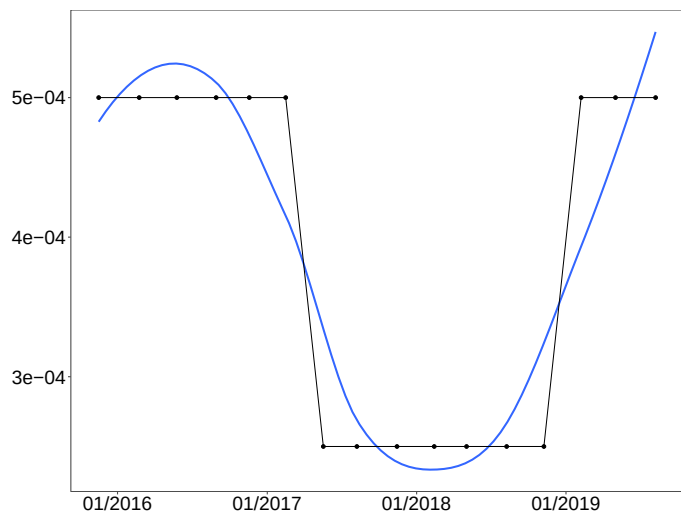
RB5 – Antimony (t.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



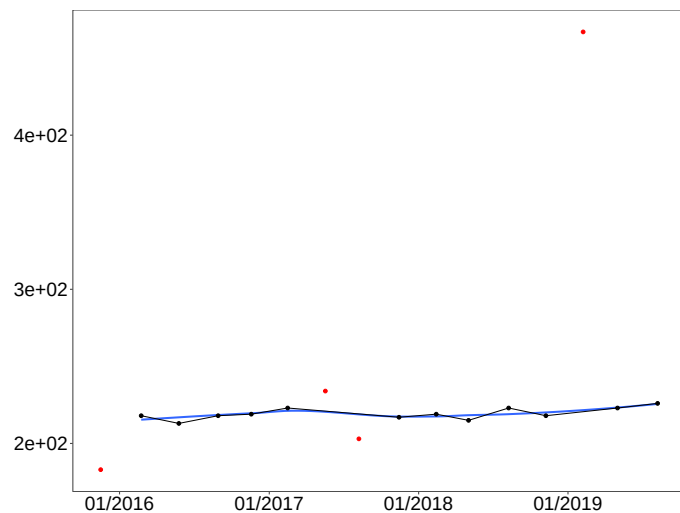
RB5 – Arsenic (d.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



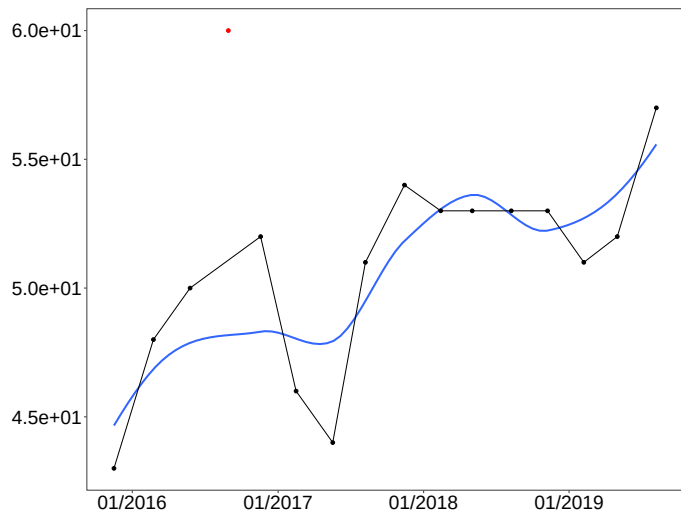
RB5 – Arsenic (t.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



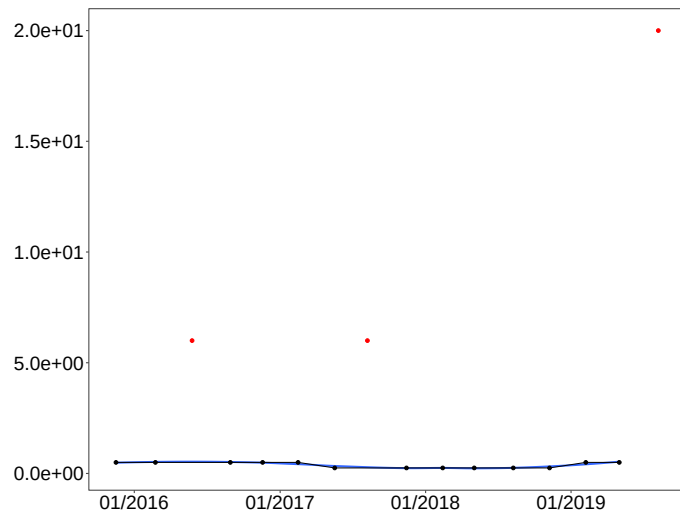
RB5 – Bicarbonate
 $\tau = 0.438$ | p-value = 0.0232 | Positive trend



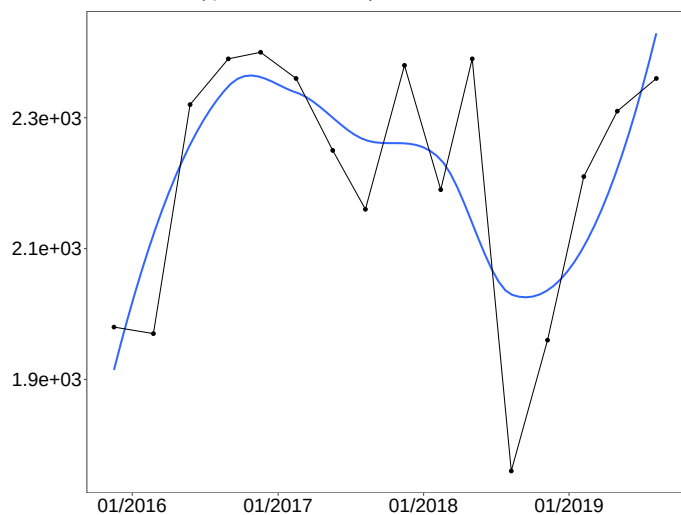
RB5 – Calcium
 $\tau = 0.362$ | p-value = 0.062 | No trend



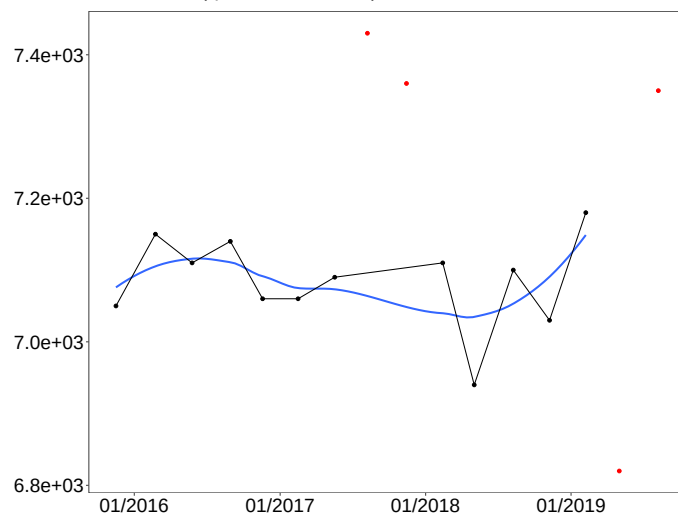
RB5 – Carbonate
 $\tau = -0.13$ | p-value = 0.558 | No trend



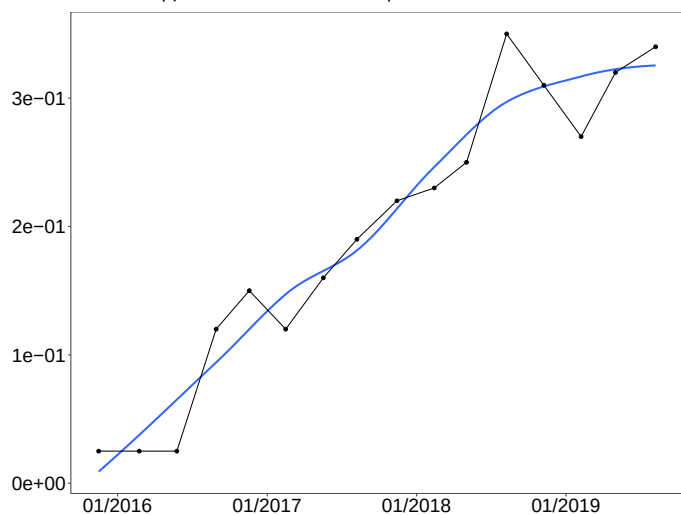
RB5 – Chloride
 $\tau = -0.0168$ | p-value = 0.964 | No trend



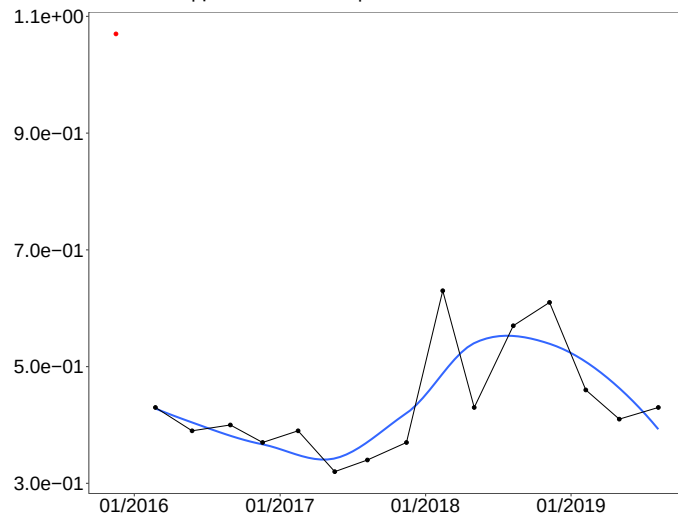
RB5 – Electrical Conductivity
 $\tau = -0.0336$ | p-value = 0.892 | No trend



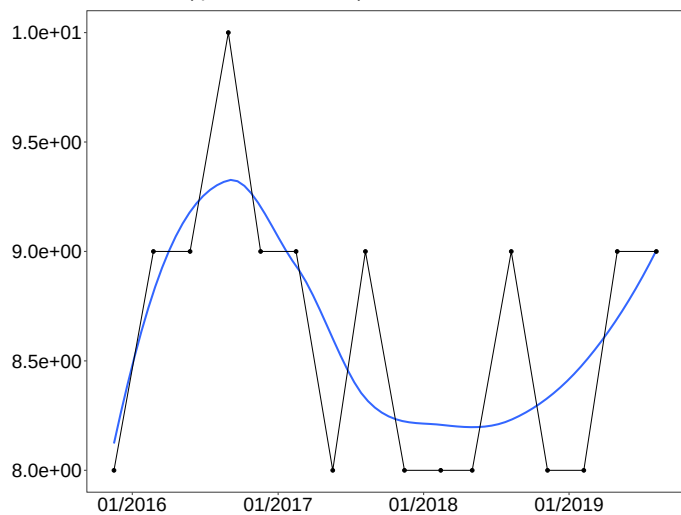
RB5 – Iron (d.)
 $\tau = 0.881$ | p-value = 0.00000322 | Positive trend



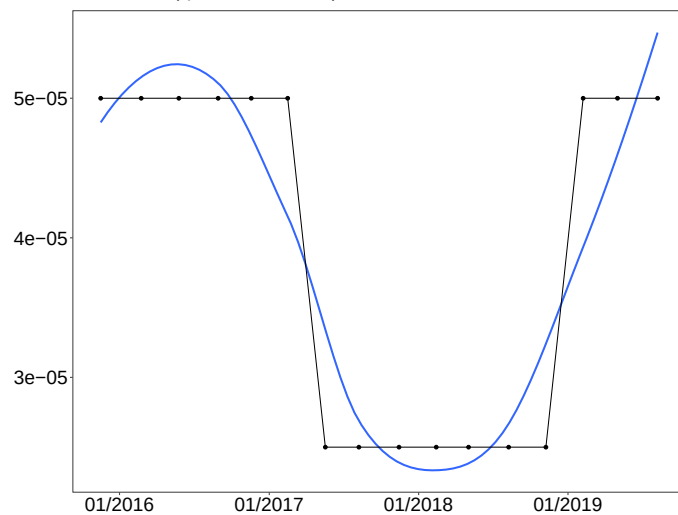
RB5 – Iron (t.)
 $\tau = 0.0936$ | p-value = 0.651 | No trend



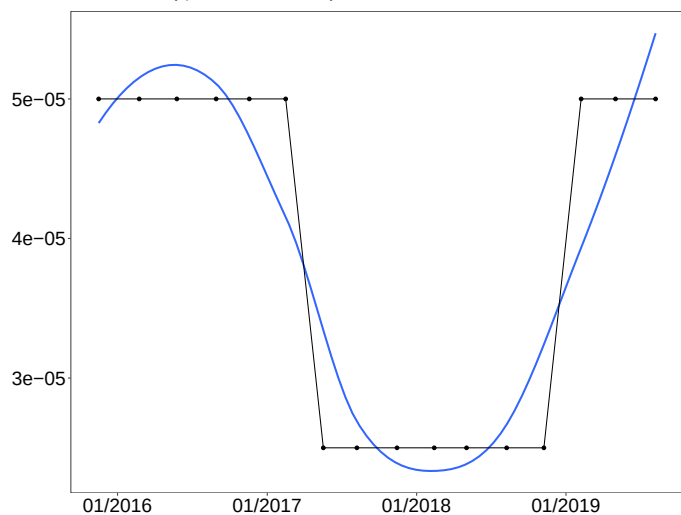
RB5 – Magnesium
 $\tau = -0.163$ | p-value = 0.475 | No trend



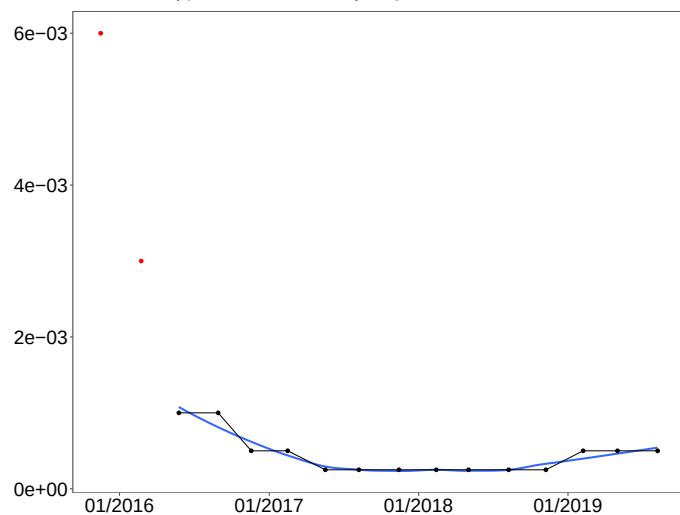
RB5 – Mercury (d.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



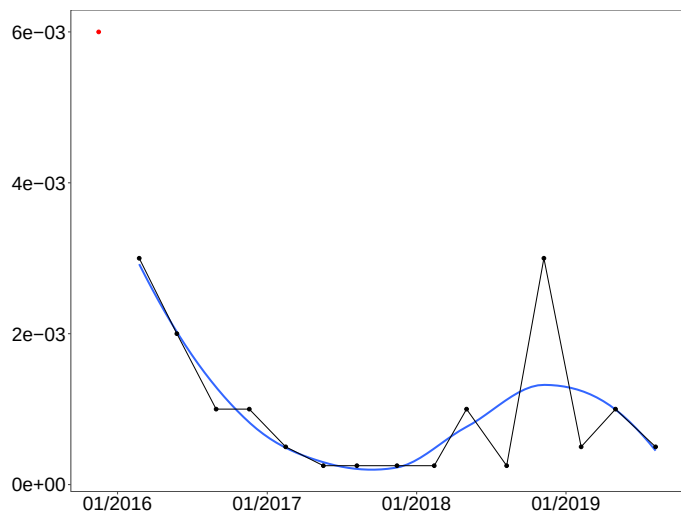
RB5 – Mercury (t.)

 $\tau = -0.242$ | p-value = 0.29 | No trend

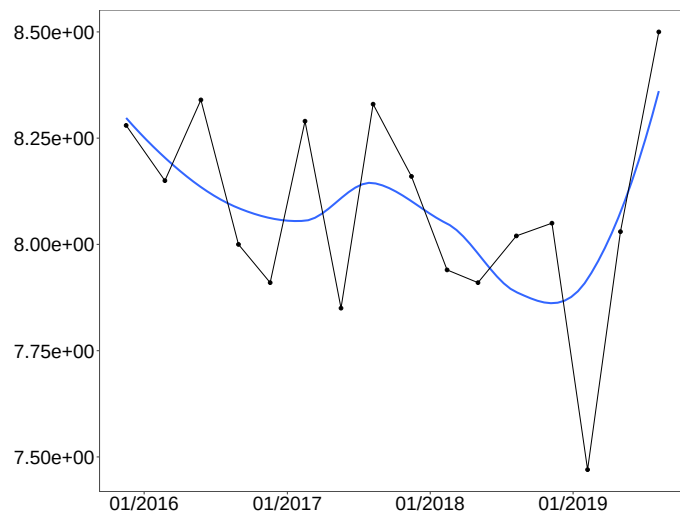
RB5 – Molybdenum (d.)

 $\tau = -0.448$ | p-value = 0.0303 | Negative trend

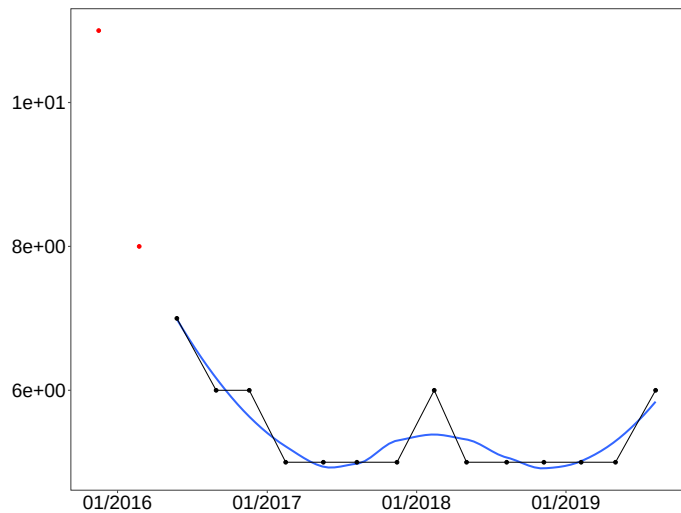
RB5 – Molybdenum (t.)

 $\tau = -0.329$ | p-value = 0.104 | No trend

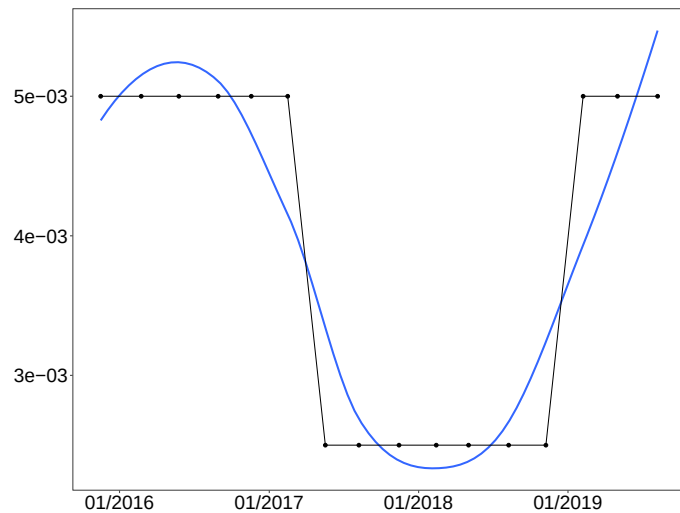
RB5 – pH

 $\tau = -0.126$ | p-value = 0.528 | No trend

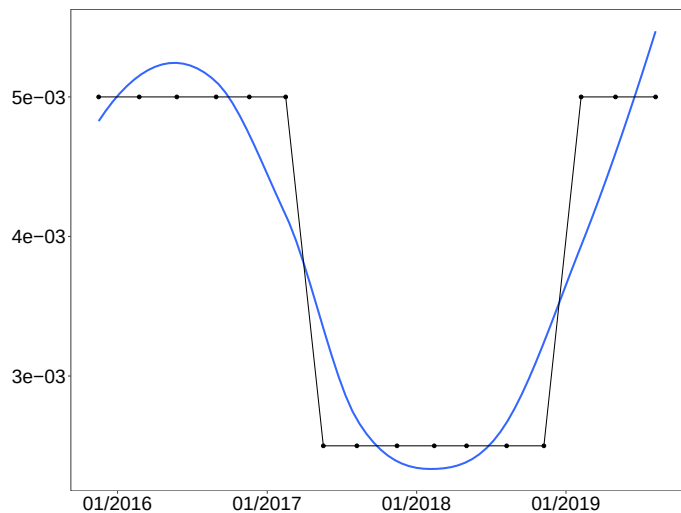
RB5 – Potassium

 $\tau = -0.537$ | p-value = 0.0101 | Negative trend

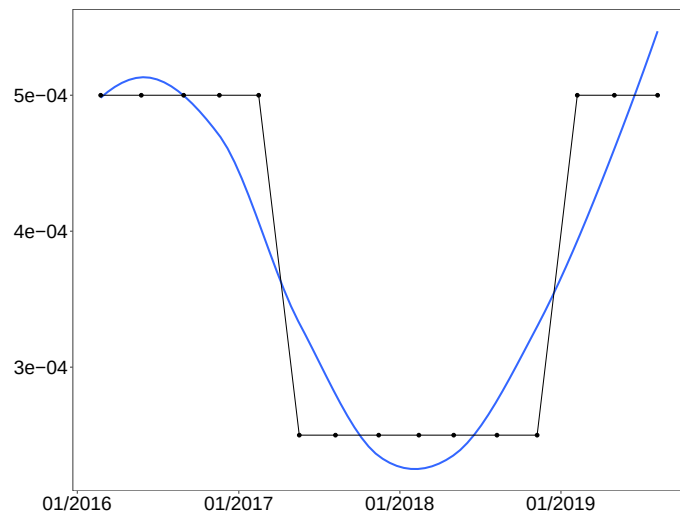
RB5 – Selenium (d.)

 $\tau = -0.242$ | p-value = 0.29 | No trend

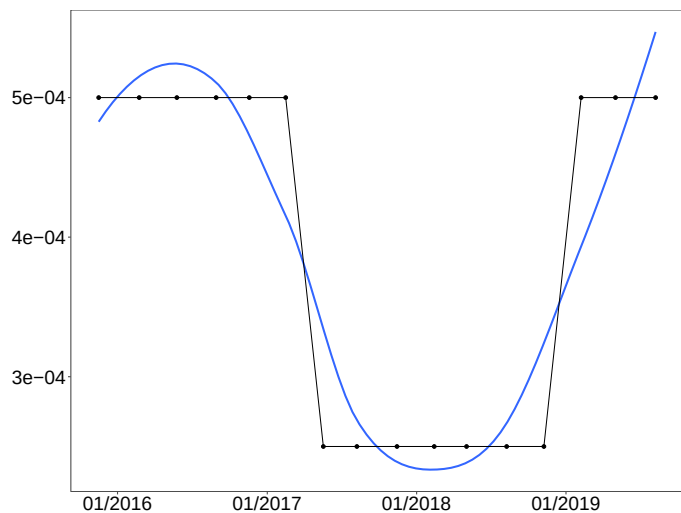
RB5 – Selenium (t.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



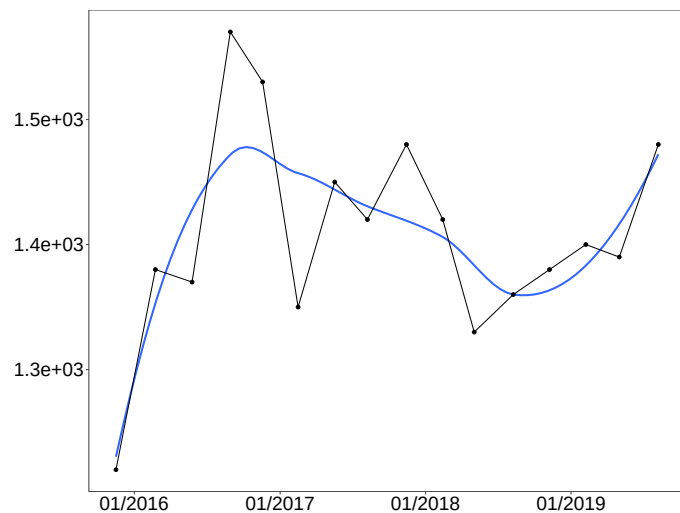
RB5 – Silver (d.)
 $\tau = -0.183$ | p-value = 0.452 | No trend



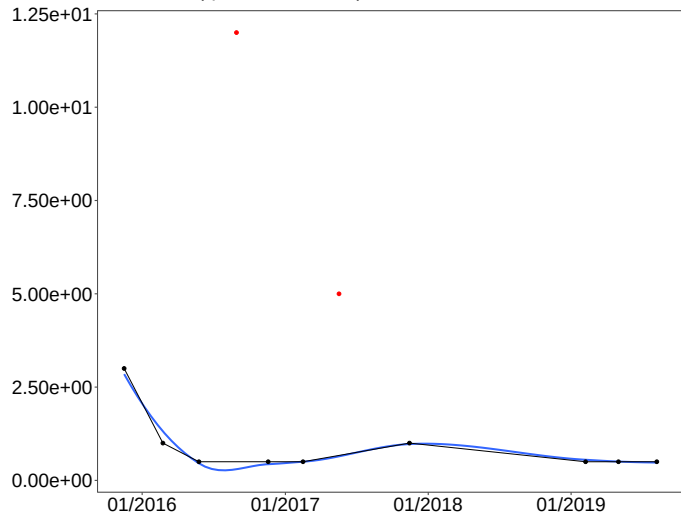
RB5 – Silver (t.)
 $\tau = -0.242$ | p-value = 0.29 | No trend



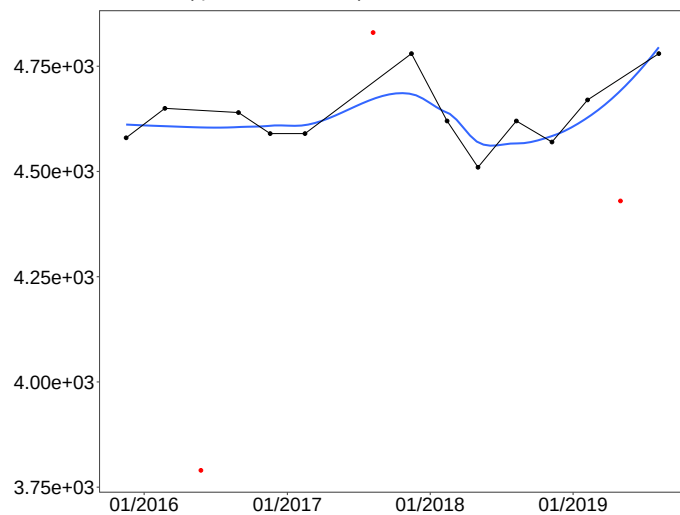
RB5 – Sodium
 $\tau = 0.0591$ | p-value = 0.786 | No trend



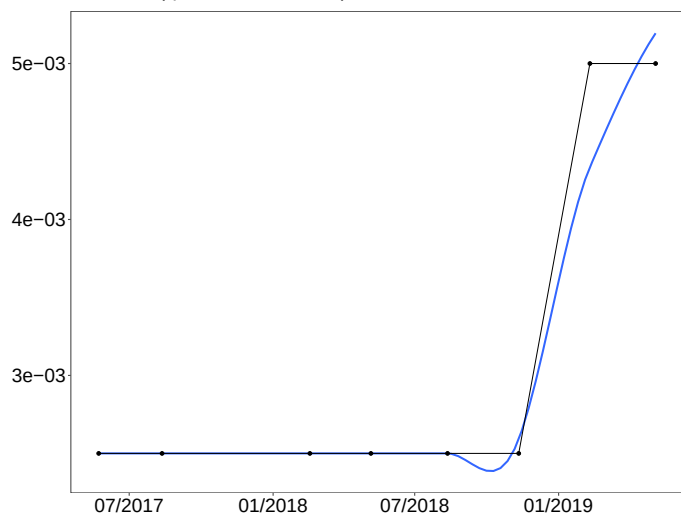
RB5 – Sulphate
 $\tau = -0.367$ | p-value = 0.17 | No trend



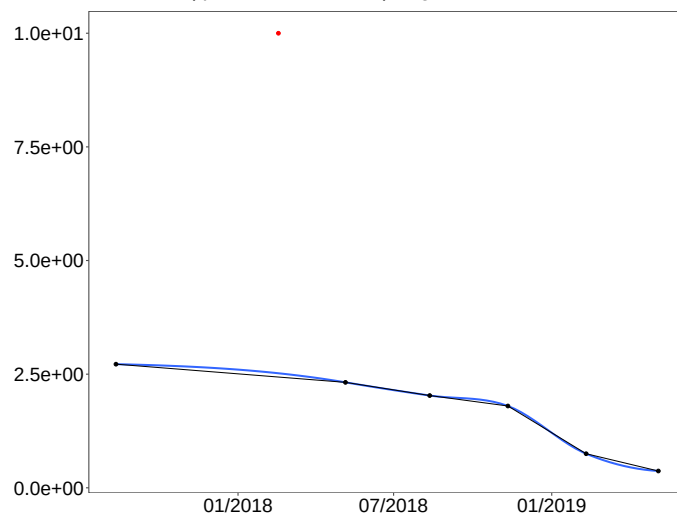
RB5 – TDS
 $\tau = 0.058$ | p-value = 0.804 | No trend



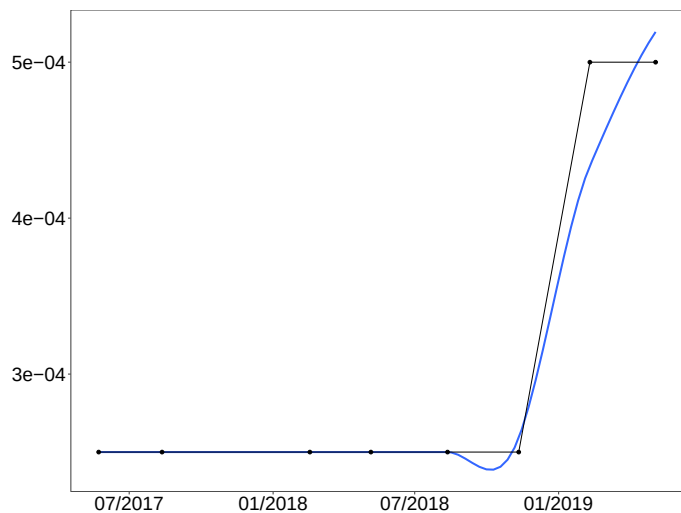
RB6 – Aluminium (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



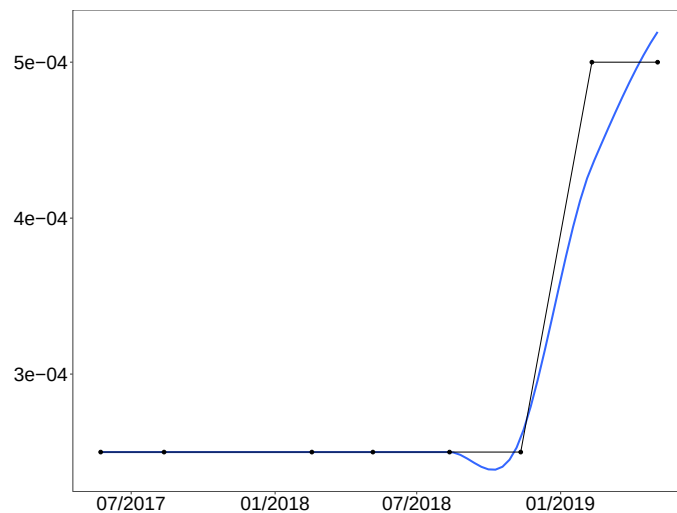
RB6 – Aluminium (t.)
 $\tau = -0.905$ | p-value = 0.00686 | Negative trend



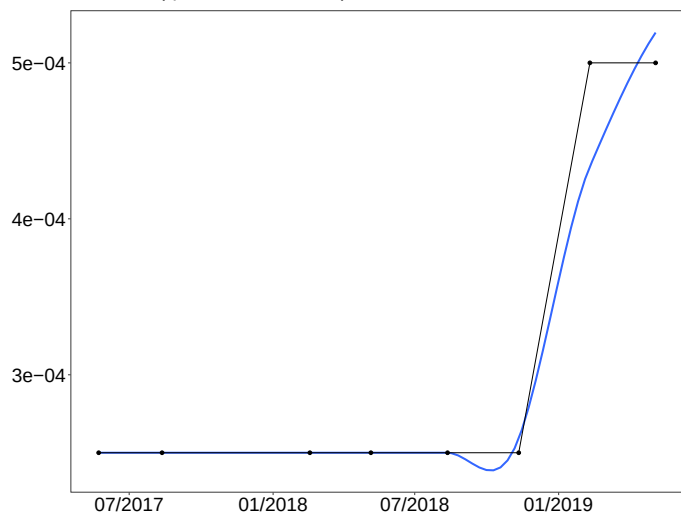
RB6 – Antimony (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



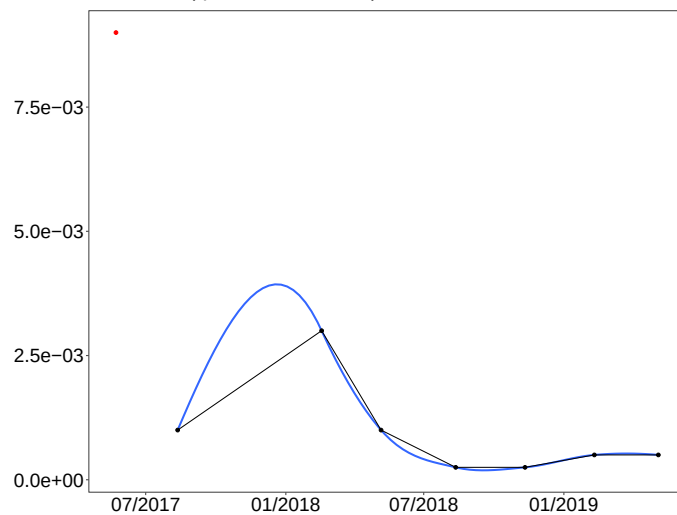
RB6 – Antimony (t.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



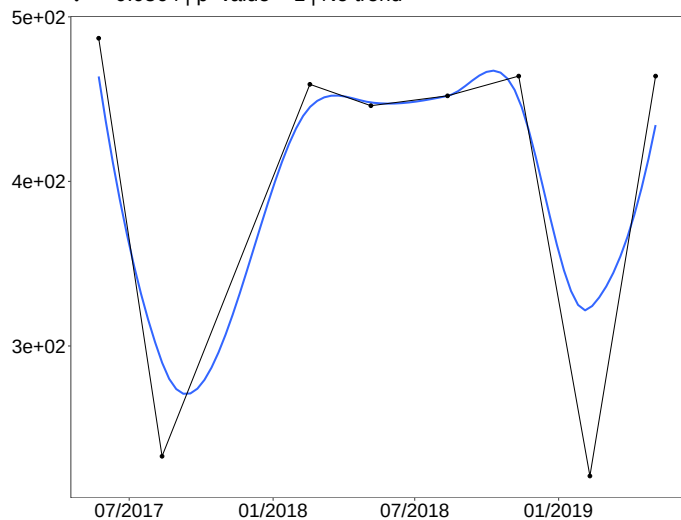
RB6 – Arsenic (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



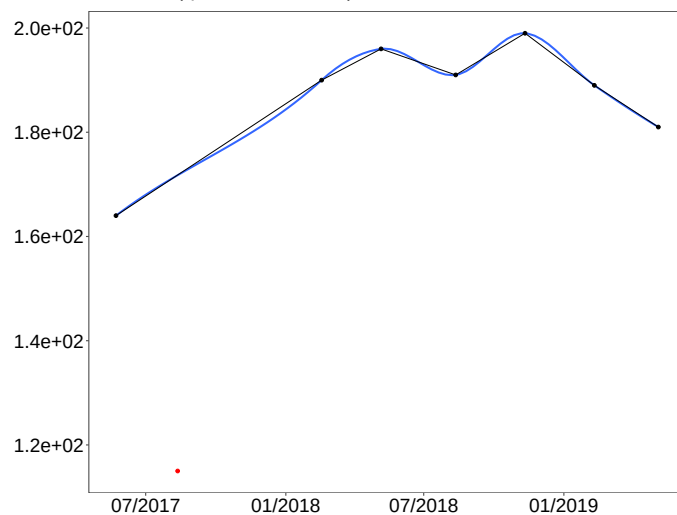
RB6 – Arsenic (t.)
 $\tau = -0.567$ | p-value = 0.0762 | No trend



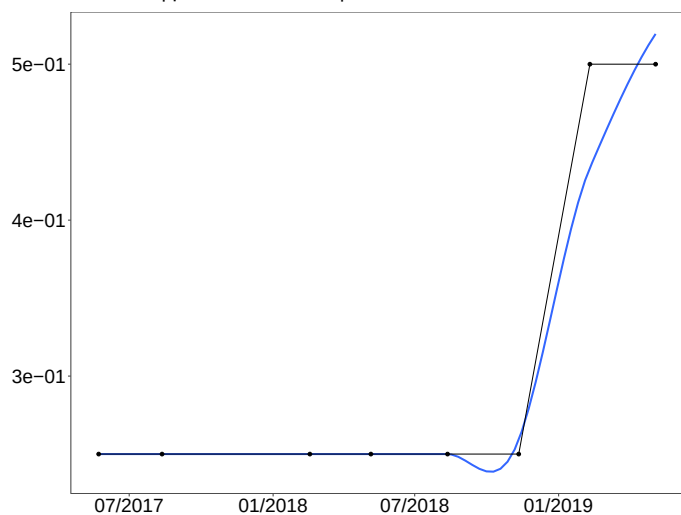
RB6 – Bicarbonate
 $\tau = -0.0364$ | $p\text{-value} = 1$ | No trend



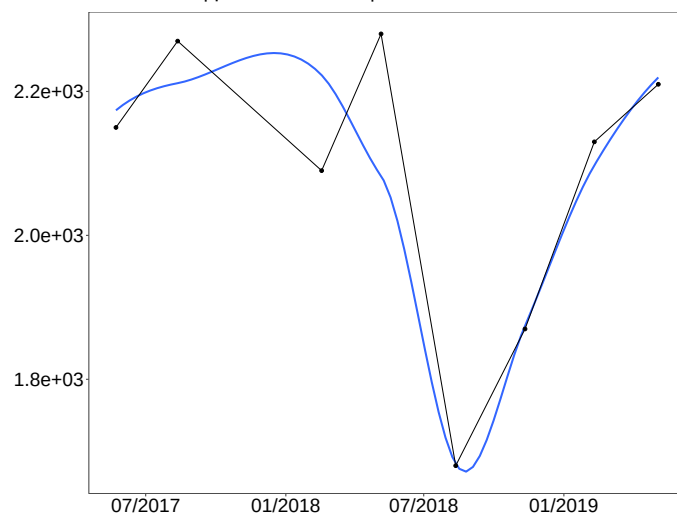
RB6 – Calcium
 $\tau = 0.214$ | $p\text{-value} = 0.536$ | No trend



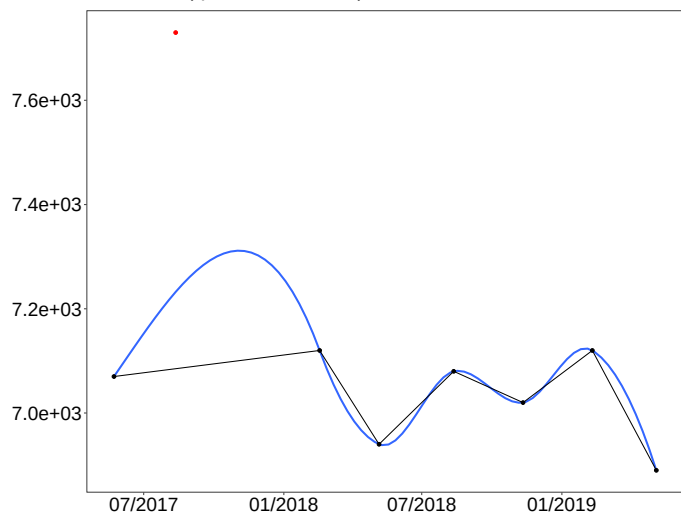
RB6 – Carbonate
 $\tau = 0.655$ | $p\text{-value} = 0.0668$ | No trend



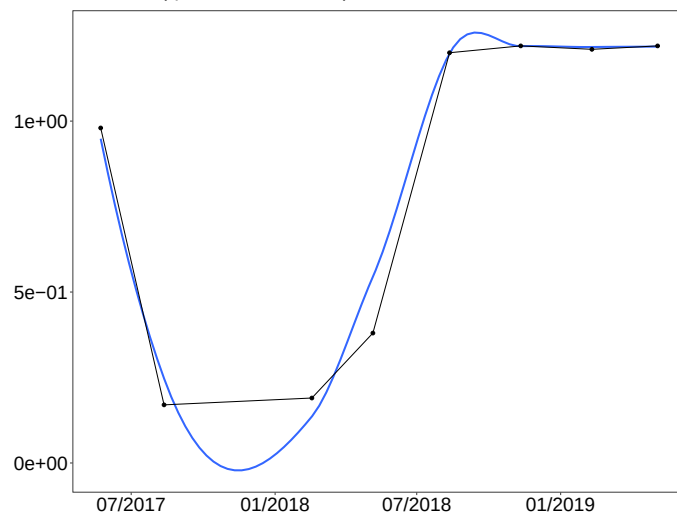
RB6 – Chloride
 $\tau = -0.0714$ | $p\text{-value} = 0.902$ | No trend



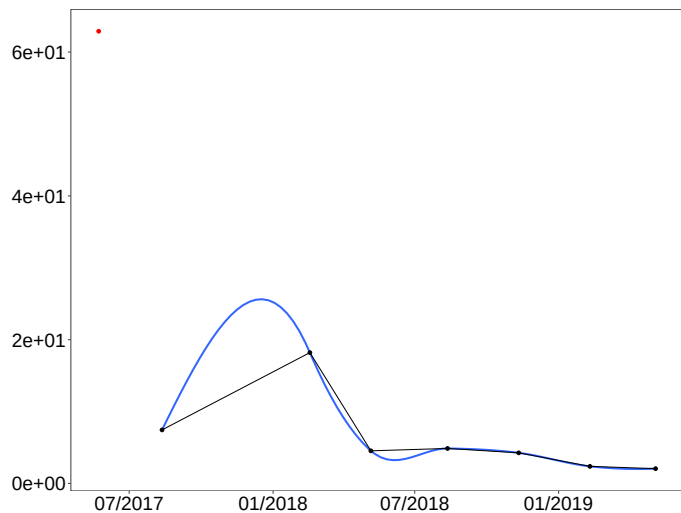
RB6 – Electrical Conductivity
 $\tau = -0.327$ | $p\text{-value} = 0.319$ | No trend



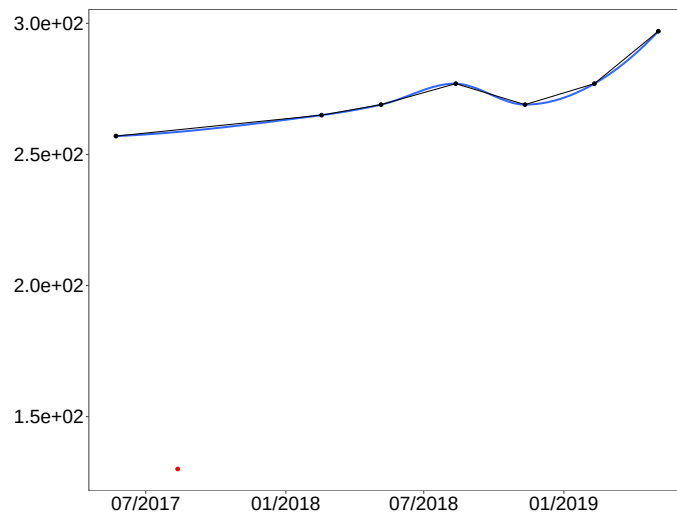
RB6 – Iron (d.)
 $\tau = 0.691$ | $p\text{-value} = 0.0248$ | Positive trend



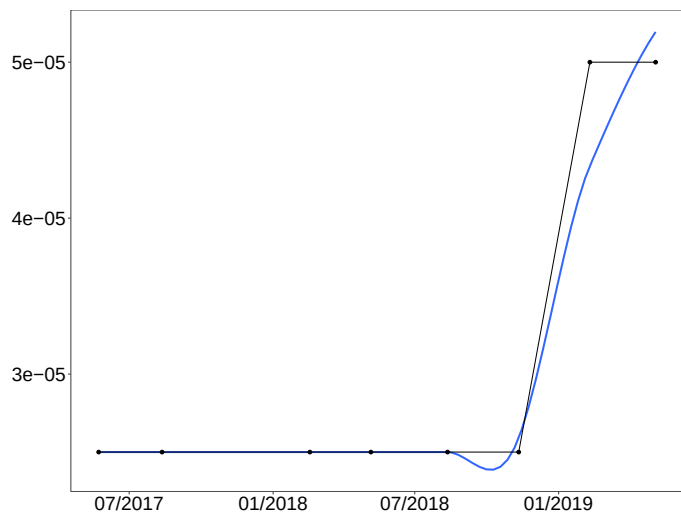
RB6 – Iron (t.)
 $\tau = -0.857$ | p-value = 0.00443 | Negative trend



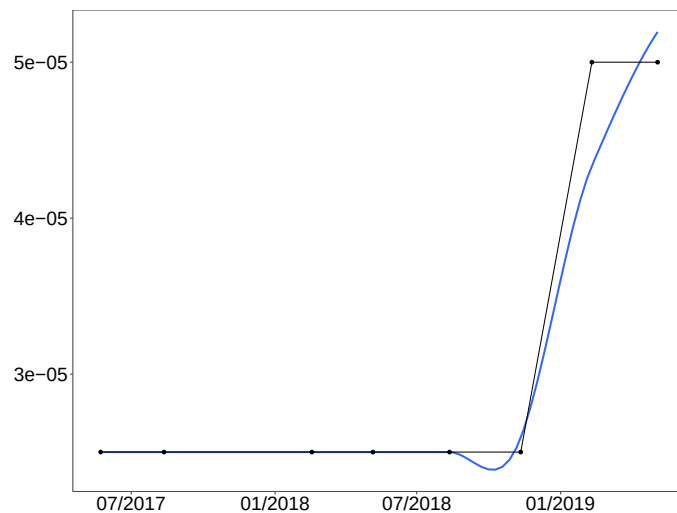
RB6 – Magnesium
 $\tau = 0.815$ | p-value = 0.00832 | Positive trend



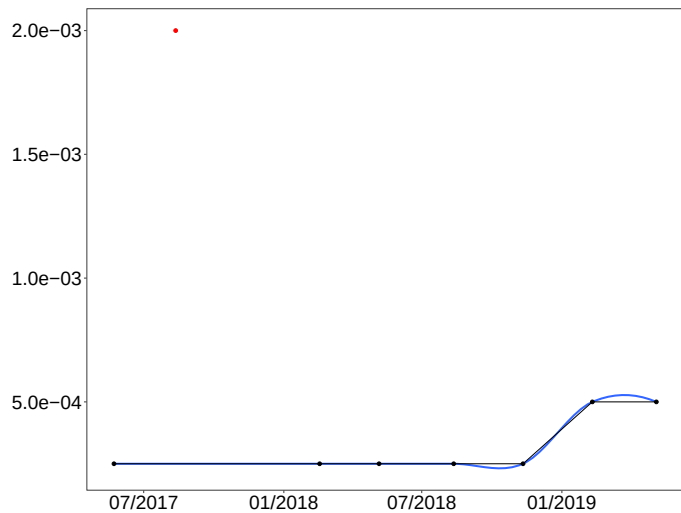
RB6 – Mercury (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



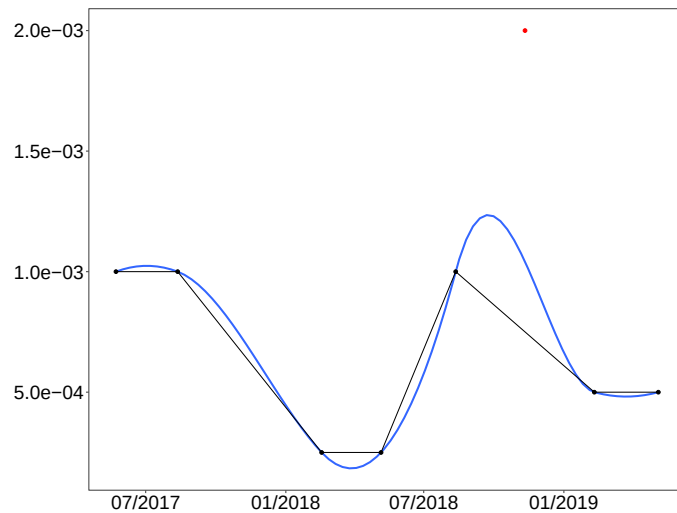
RB6 – Mercury (t.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



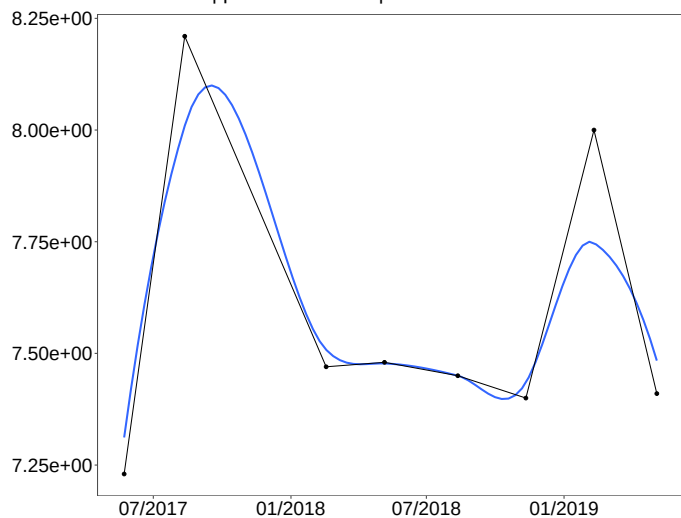
RB6 – Molybdenum (d.)
 $\tau = 0.229$ | p-value = 0.562 | No trend



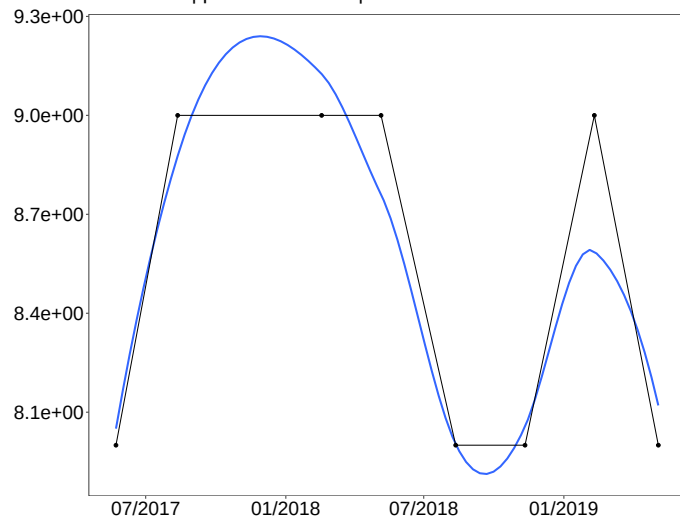
RB6 – Molybdenum (t.)
 $\tau = -0.0394$ | p-value = 1 | No trend



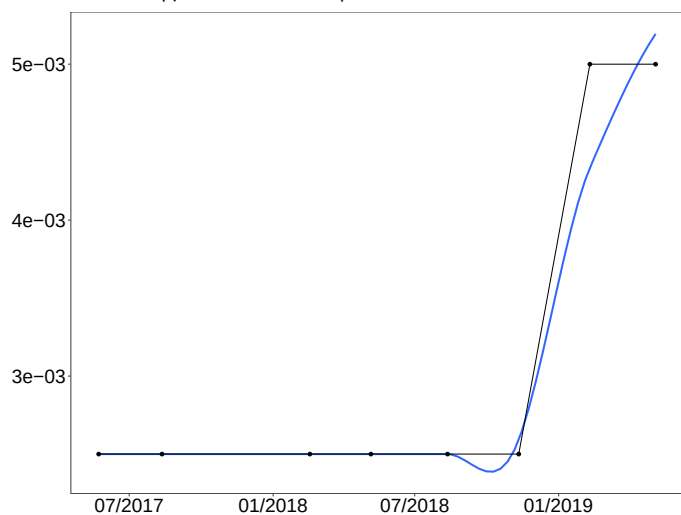
RB6 – pH
 $\tau = -0.0714$ | p-value = 0.902 | No trend



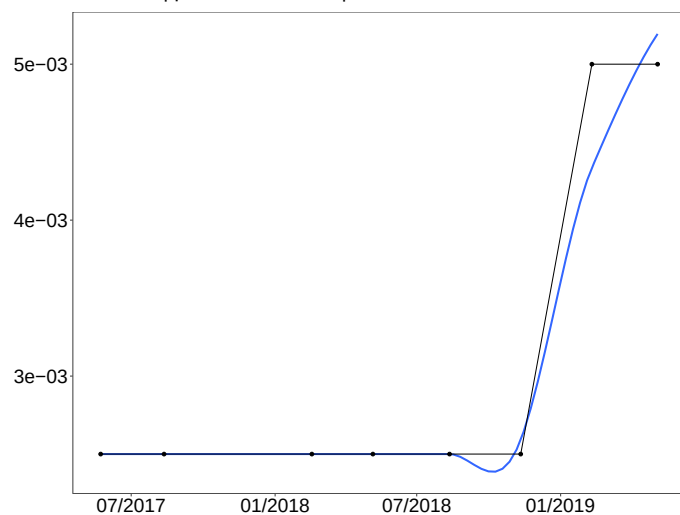
RB6 – Potassium
 $\tau = -0.189$ | p-value = 0.665 | No trend



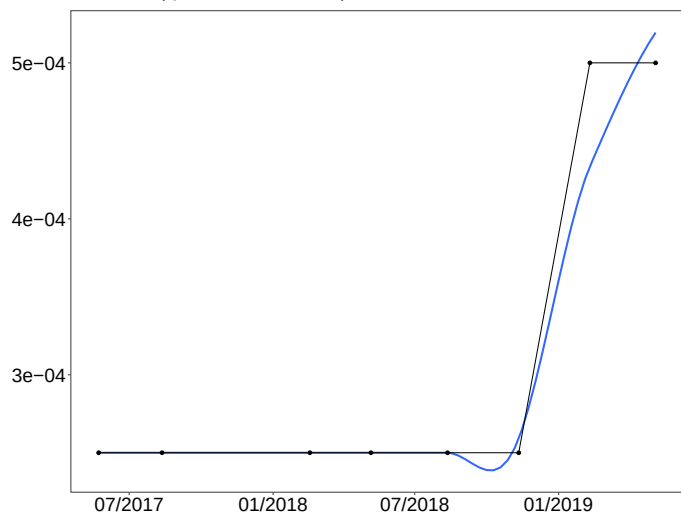
RB6 – Selenium (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



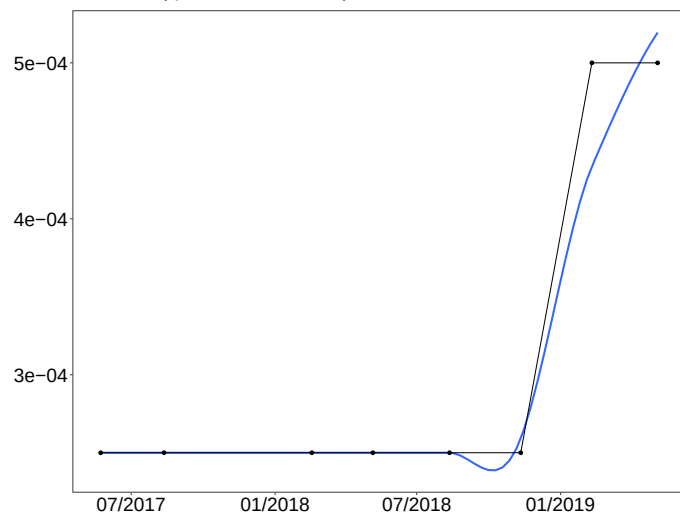
RB6 – Selenium (t.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



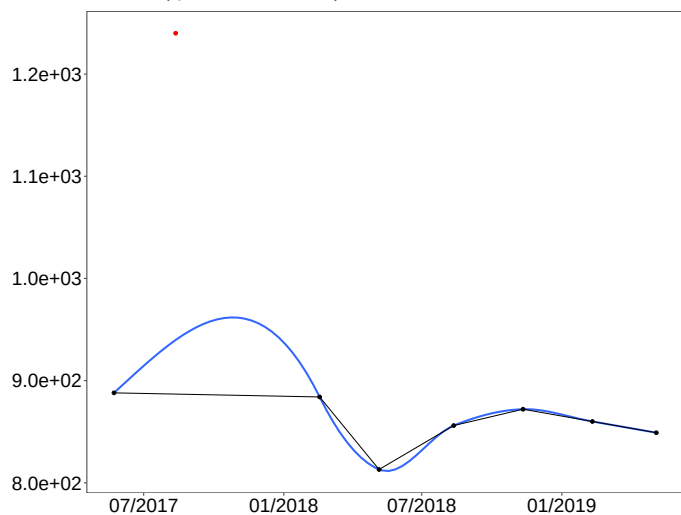
RB6 – Silver (d.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



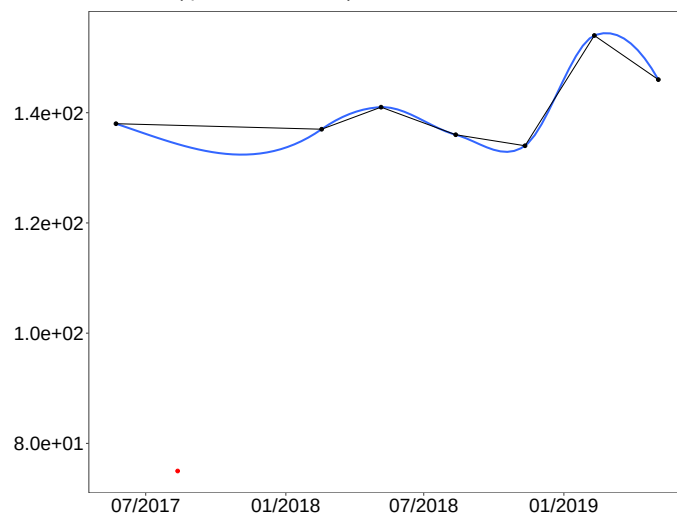
RB6 – Silver (t.)
 $\tau = 0.655$ | p-value = 0.0668 | No trend



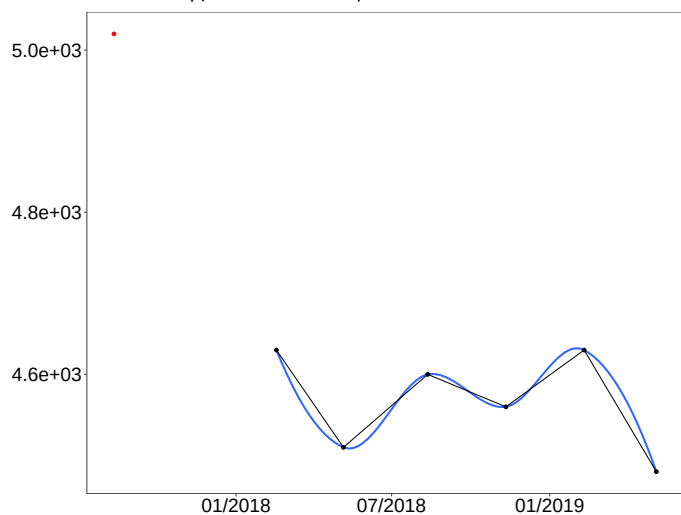
RB6 – Sodium
 $\tau = -0.5$ | p-value = 0.108 | No trend



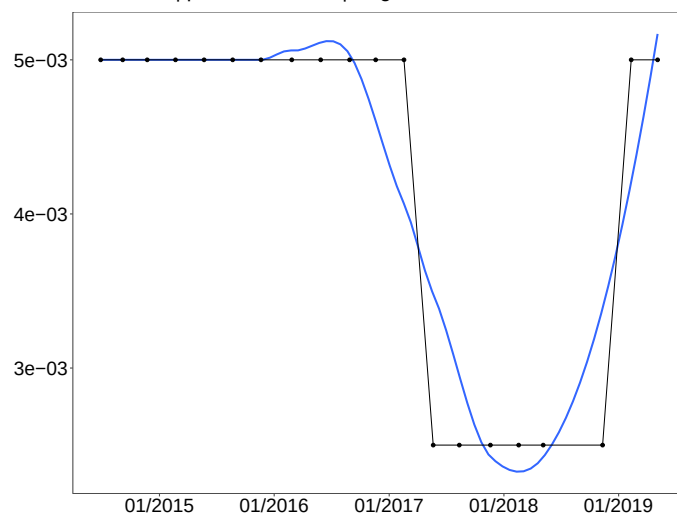
RB6 – Sulphate
 $\tau = 0.286$ | p-value = 0.386 | No trend



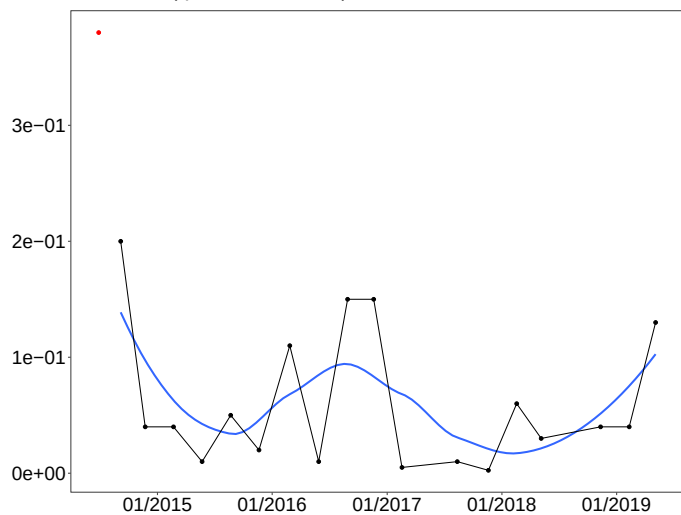
RB6 – TDS
 $\tau = -0.488$ | p-value = 0.172 | No trend



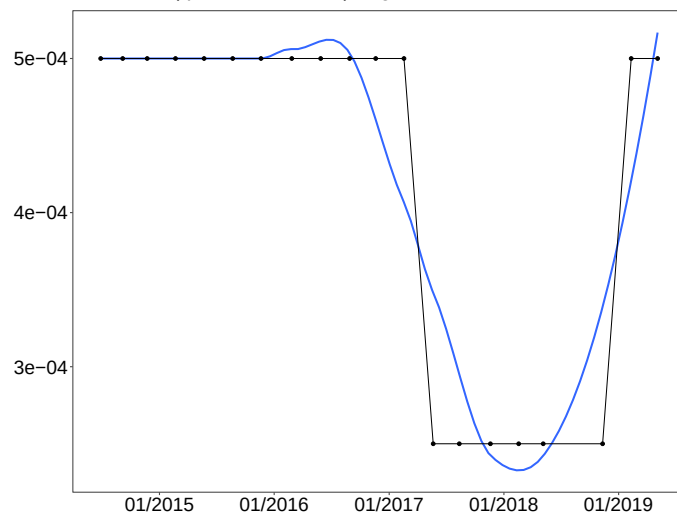
Twin Bores – Aluminium (d.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



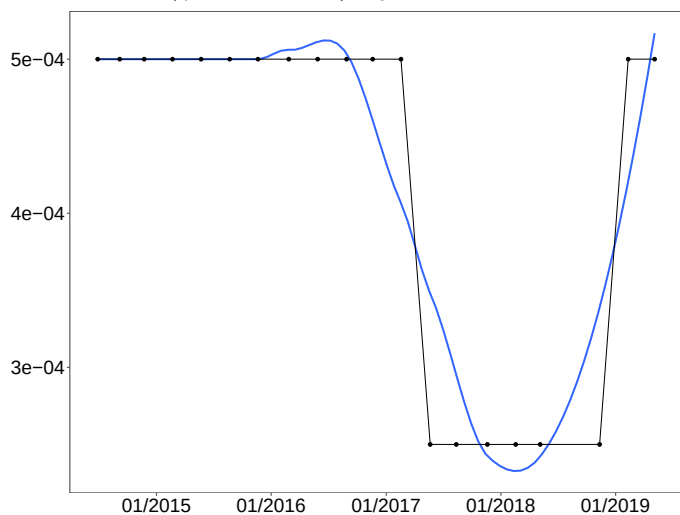
Twin Bores – Aluminium (t.)
 $\tau = -0.163$ | p-value = 0.359 | No trend



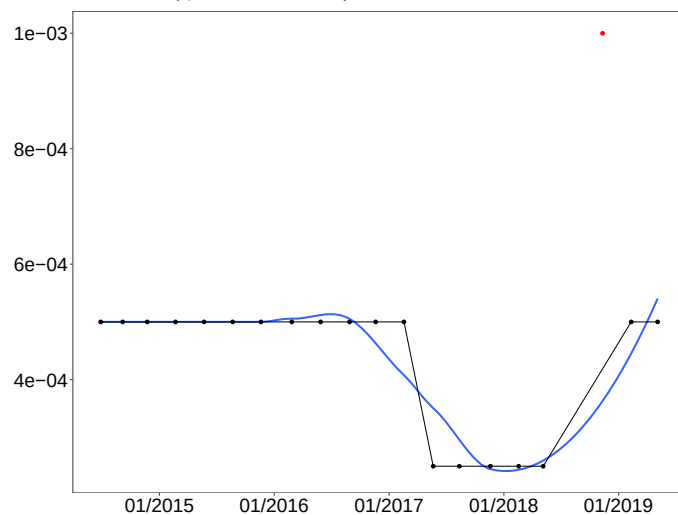
Twin Bores – Antimony (d.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



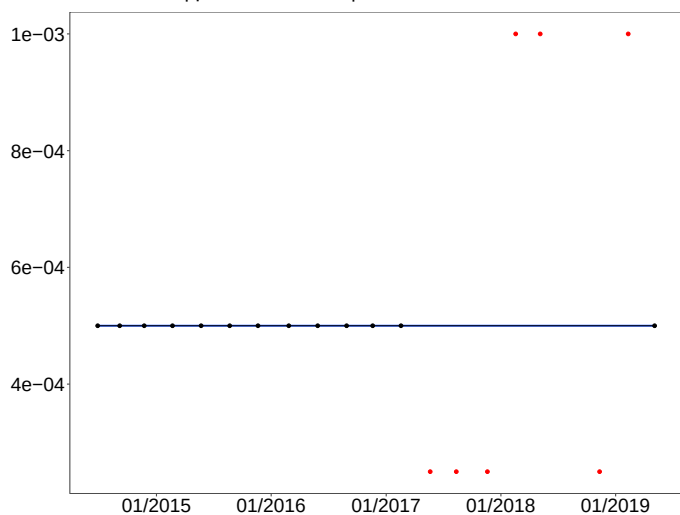
Twin Bores – Antimony (t.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



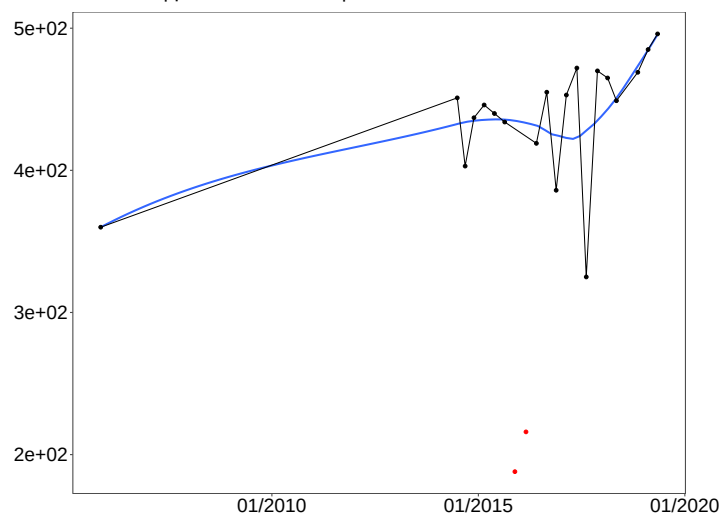
Twin Bores – Arsenic (d.)
 $\tau = -0.269$ | p-value = 0.165 | No trend



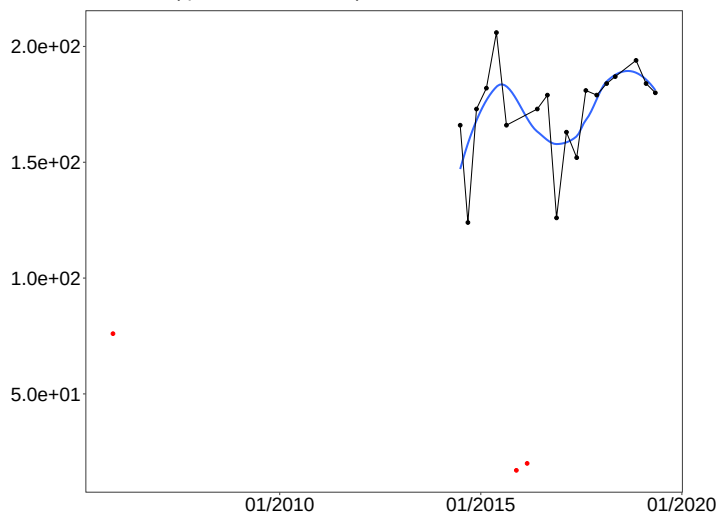
Twin Bores – Arsenic (t.)
 $\tau = -0.0214$ | p-value = 0.938 | No trend



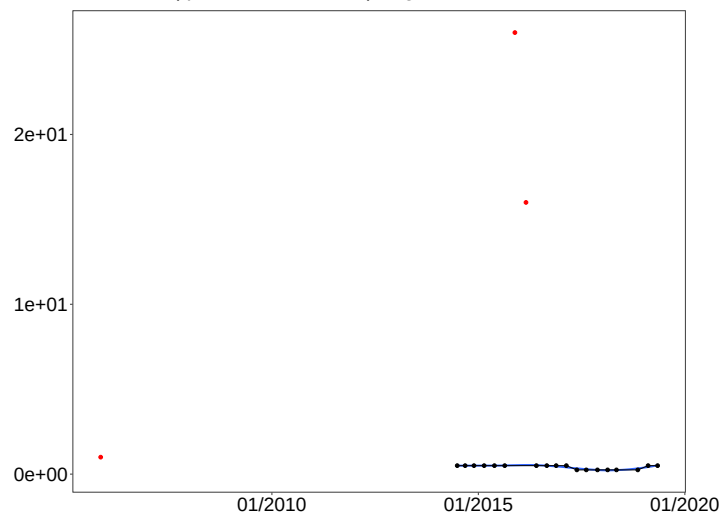
Twin Bores – Bicarbonate
 $\tau = 0.429$ | p-value = 0.0072 | Positive trend



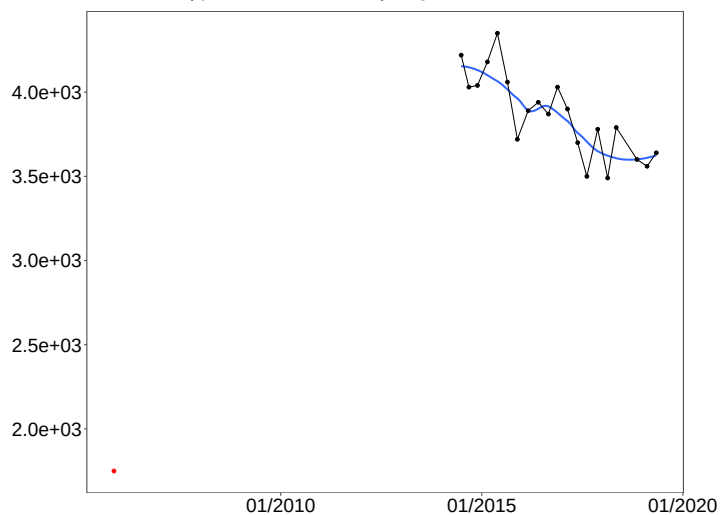
Twin Bores – Calcium
 $\tau = 0.394$ | p-value = 0.0143 | Positive trend



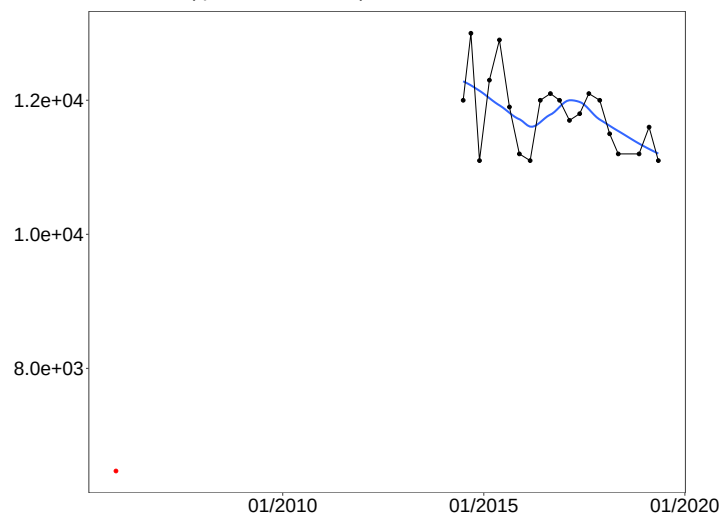
Twin Bores – Carbonate
 $\tau = -0.468$ | p-value = 0.00937 | Negative trend



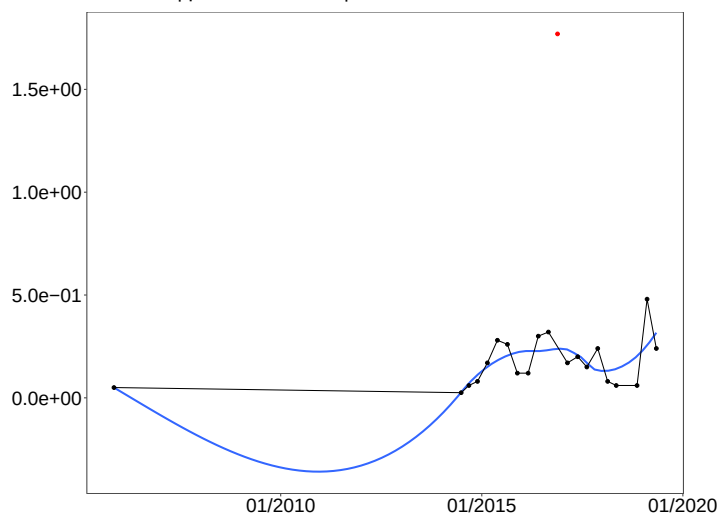
Twin Bores – Chloride
 $\tau = -0.463$ | p-value = 0.00373 | Negative trend



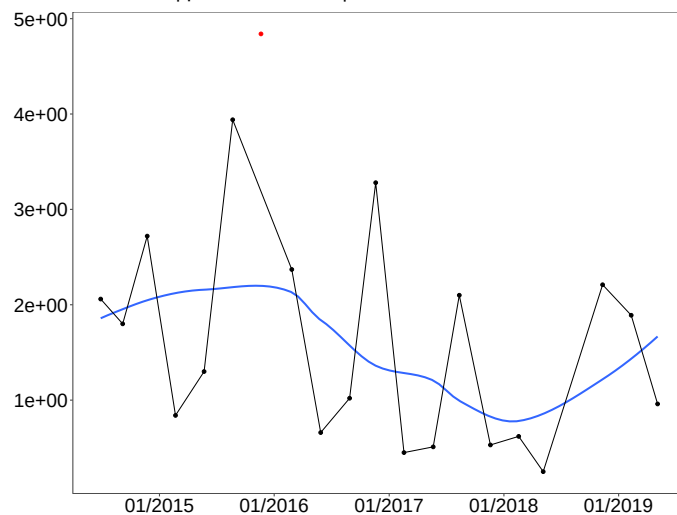
Twin Bores – Electrical Conductivity
 $\tau = -0.211$ | p-value = 0.201 | No trend



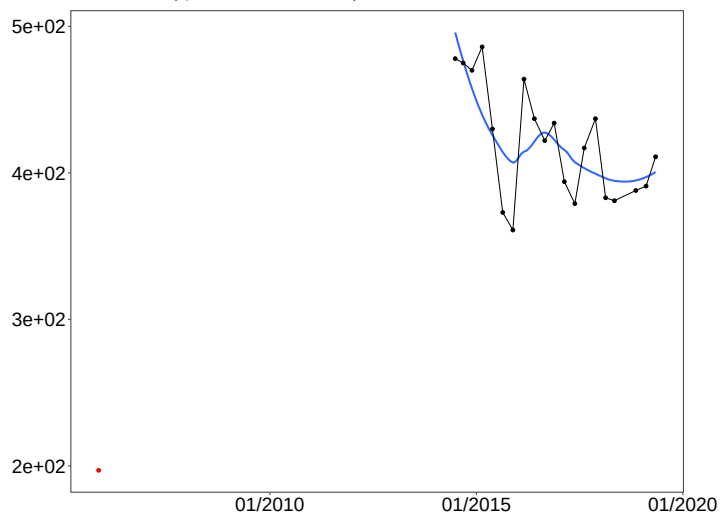
Twin Bores – Iron (d.)
 $\tau = 0.228$ | p-value = 0.163 | No trend



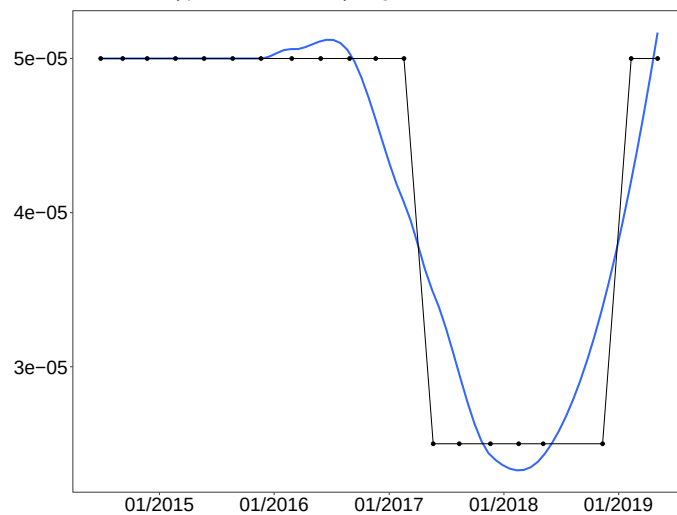
Twin Bores – Iron (t.)
 $\tau = -0.253$ | p-value = 0.127 | No trend



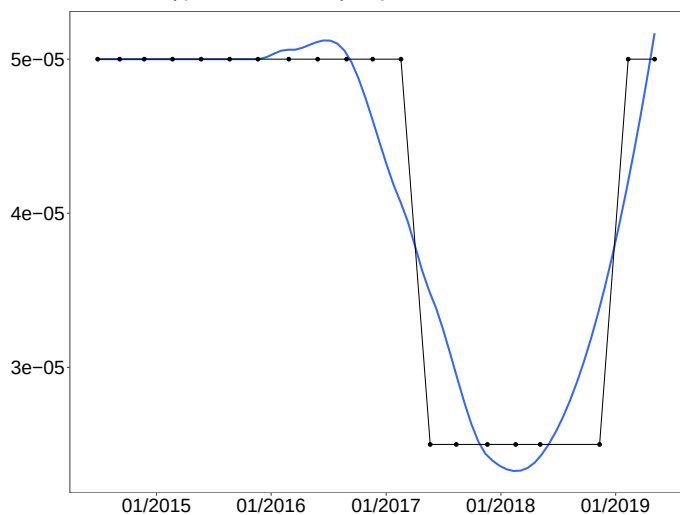
Twin Bores – Magnesium
 $\tau = -0.272$ | p-value = 0.0907 | No trend



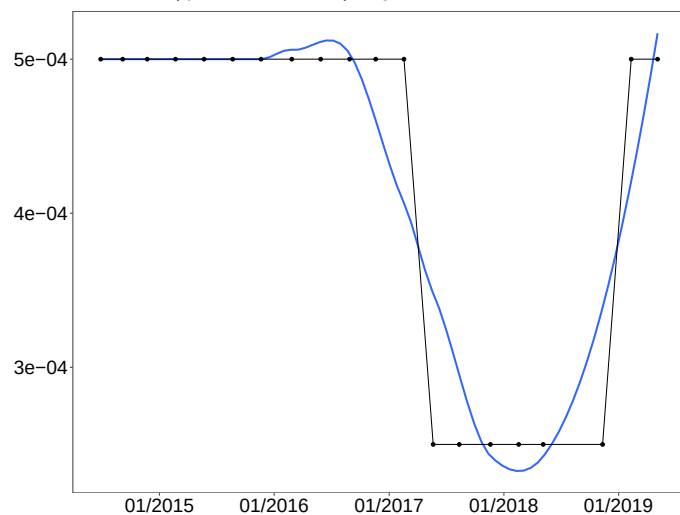
Twin Bores – Mercury (d.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



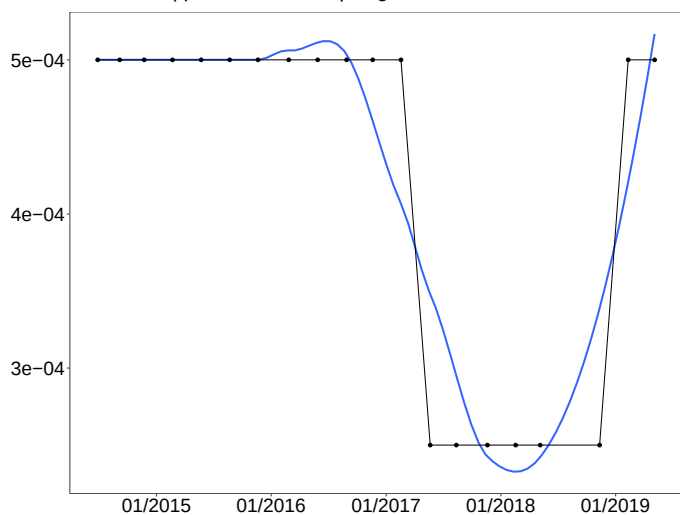
Twin Bores – Mercury (t.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



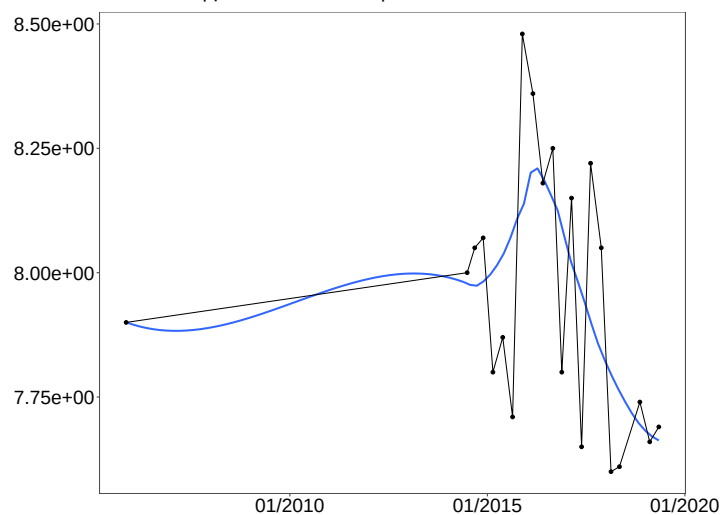
Twin Bores – Molybdenum (d.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



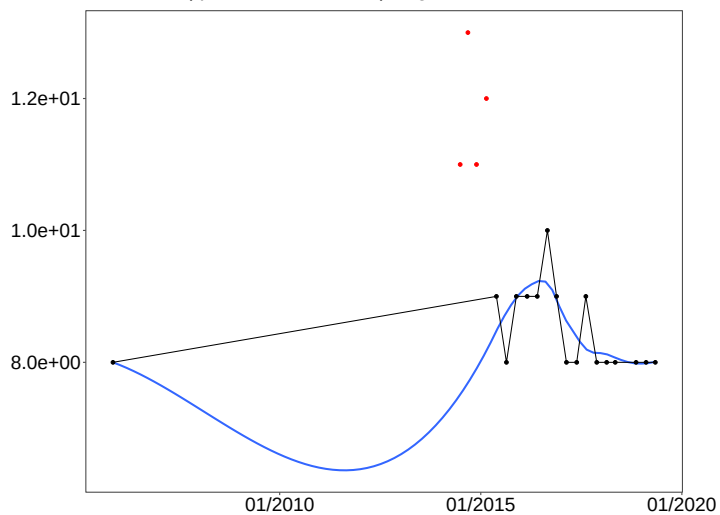
Twin Bores – Molybdenum (t.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



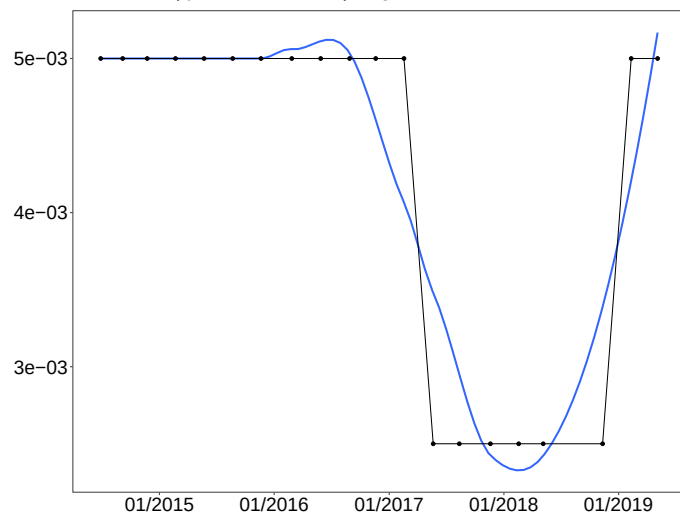
Twin Bores – pH
 $\tau = -0.278$ | p-value = 0.0849 | No trend



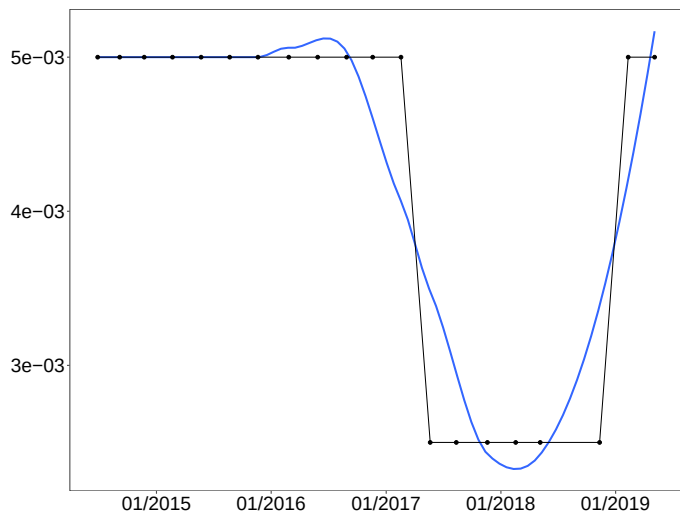
Twin Bores – Potassium
 $\tau = -0.548$ | p-value = 0.00176 | Negative trend



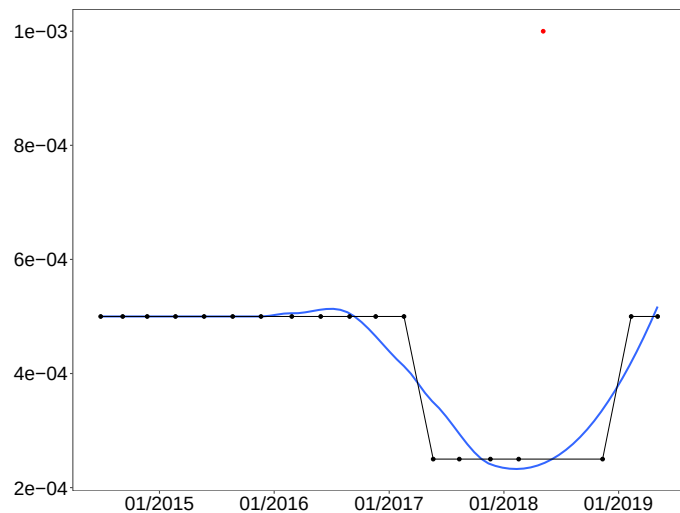
Twin Bores – Selenium (d.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



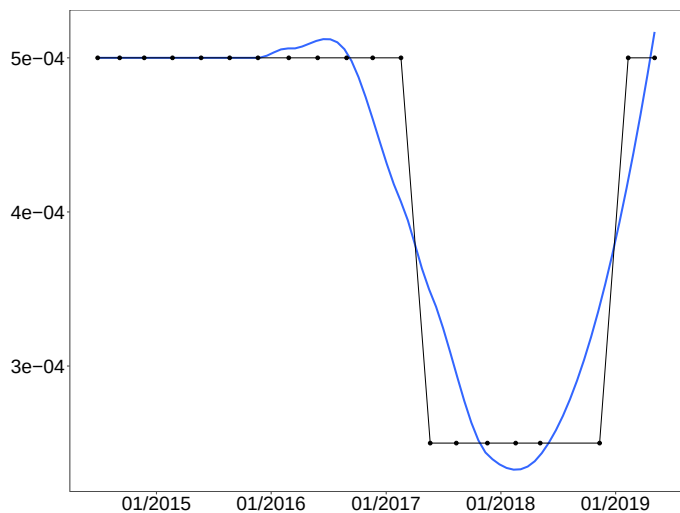
Twin Bores – Selenium (t.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



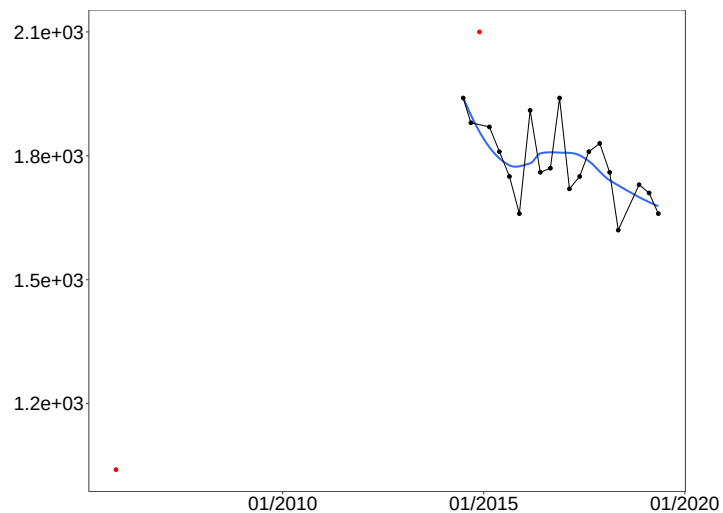
Twin Bores – Silver (d.)
 $\tau = -0.285$ | p-value = 0.142 | No trend



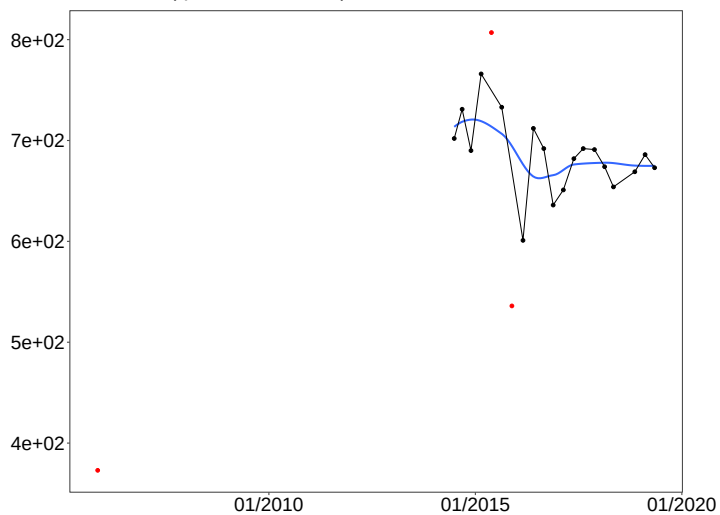
Twin Bores – Silver (t.)
 $\tau = -0.475$ | p-value = 0.015 | Negative trend



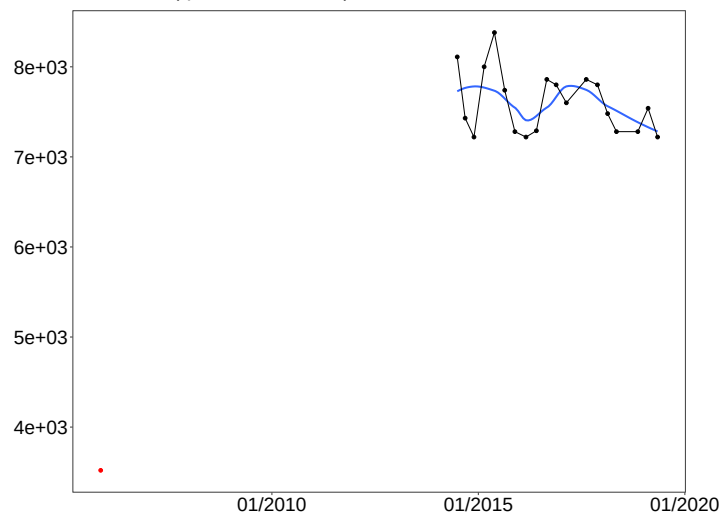
Twin Bores – Sodium
 $\tau = -0.342$ | p-value = 0.0341 | Negative trend



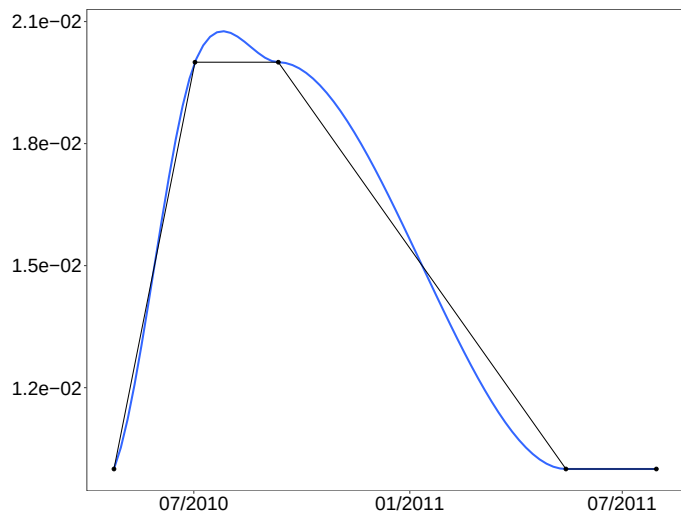
Twin Bores – Sulphate
 $\tau = -0.167$ | p-value = 0.304 | No trend



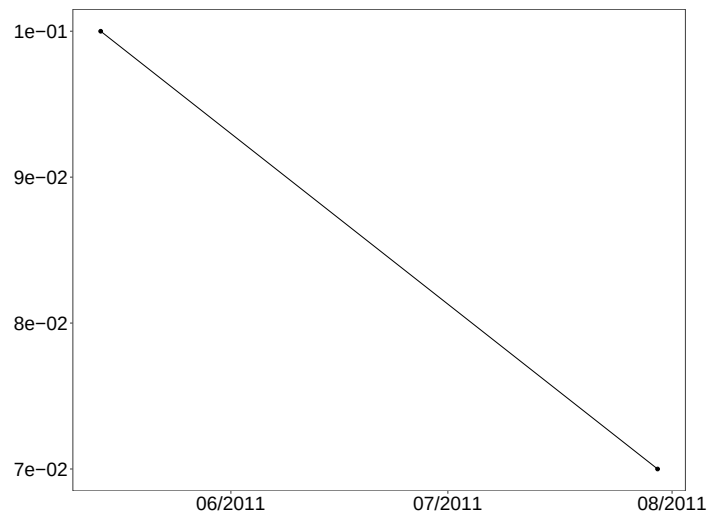
Twin Bores – TDS
 $\tau = -0.118$ | p-value = 0.494 | No trend



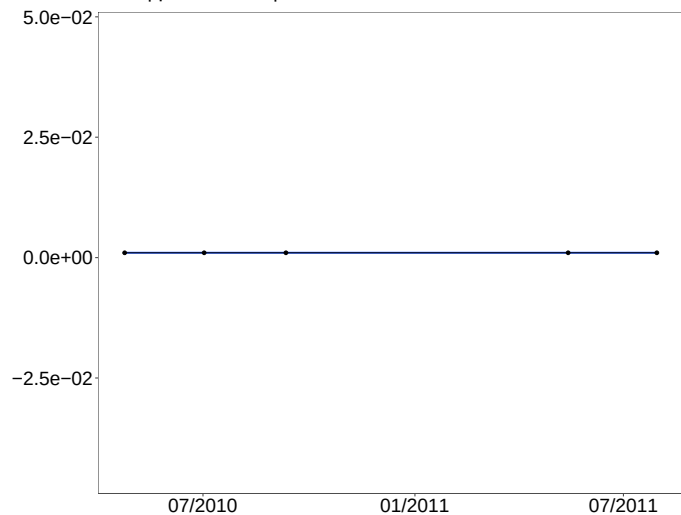
Weir Bore (2) – Aluminium (d.)
 $\tau = -0.258$ | p-value = 0.773 | No trend



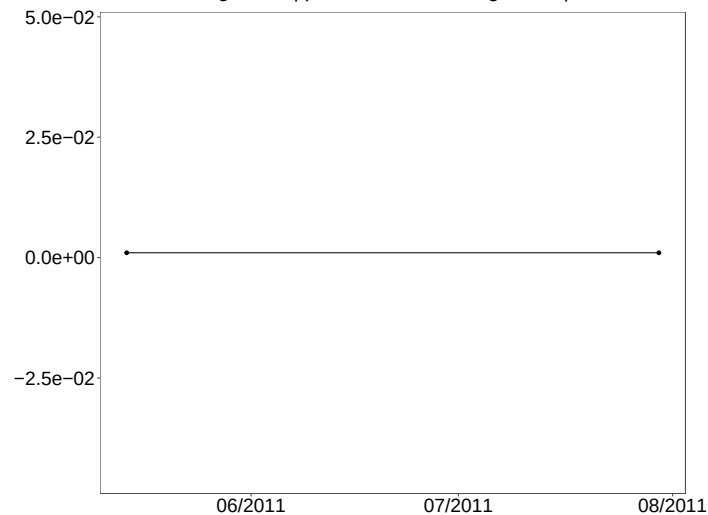
Weir Bore (2) – Aluminium (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



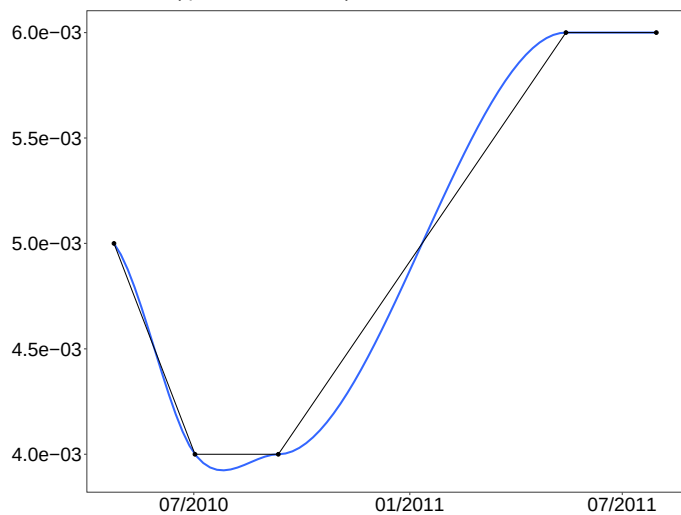
Weir Bore (2) – Antimony (d.)
 $\tau = 1$ | p-value = 1 | No trend



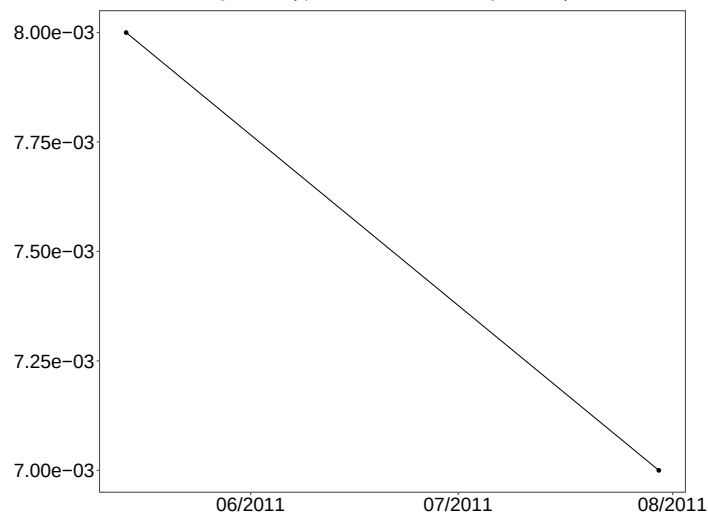
Weir Bore (2) – Antimony (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



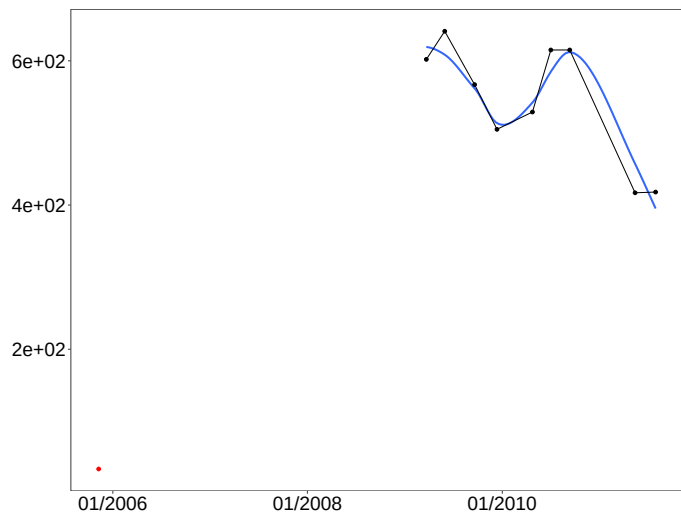
Weir Bore (2) – Arsenic (d.)
 $\tau = 0.447$ | p-value = 0.433 | No trend



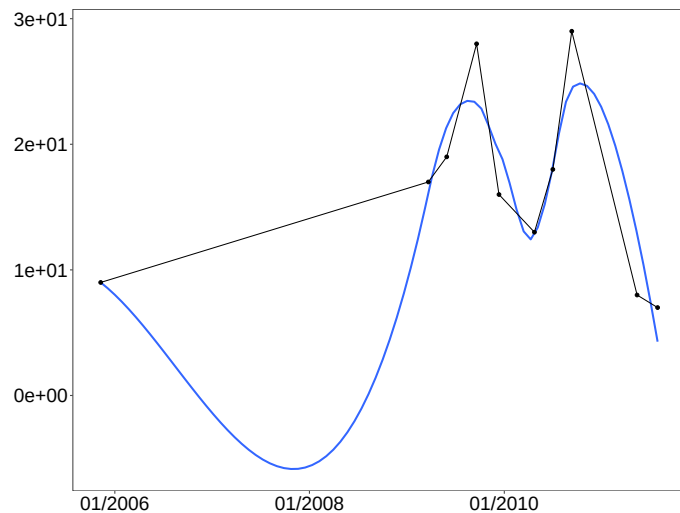
Weir Bore (2) – Arsenic (t.)
 $\tau =$ Not enough data | p-value = Not enough data | Not evaluated



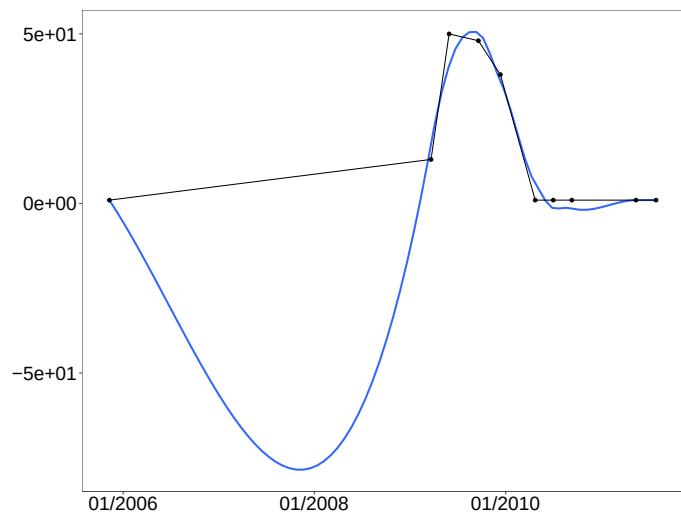
Weir Bore (2) – Bicarbonate
 $\tau = -0.0899$ | $p\text{-value} = 0.788$ | No trend



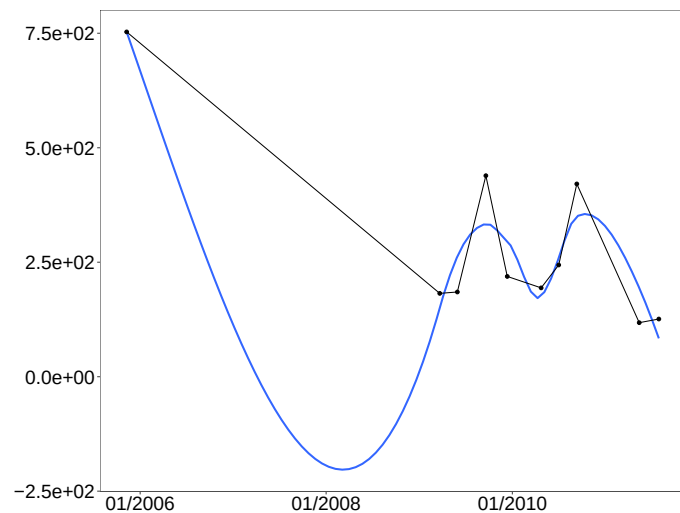
Weir Bore (2) – Calcium
 $\tau = -0.156$ | $p\text{-value} = 0.592$ | No trend



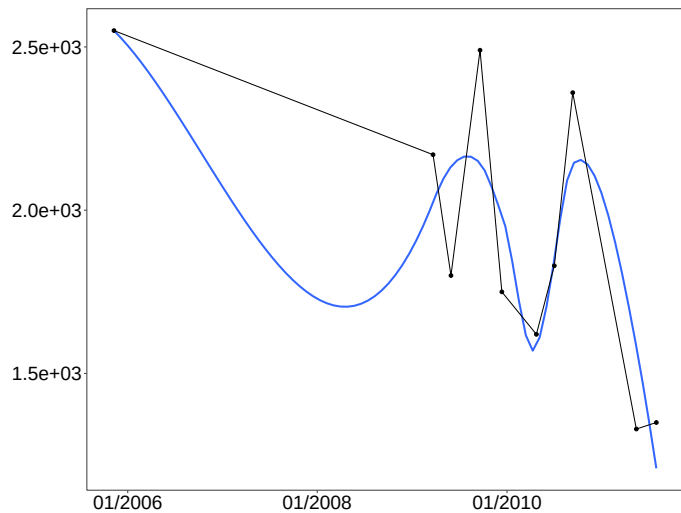
Weir Bore (2) – Carbonate
 $\tau = -0.435$ | $p\text{-value} = 0.127$ | No trend



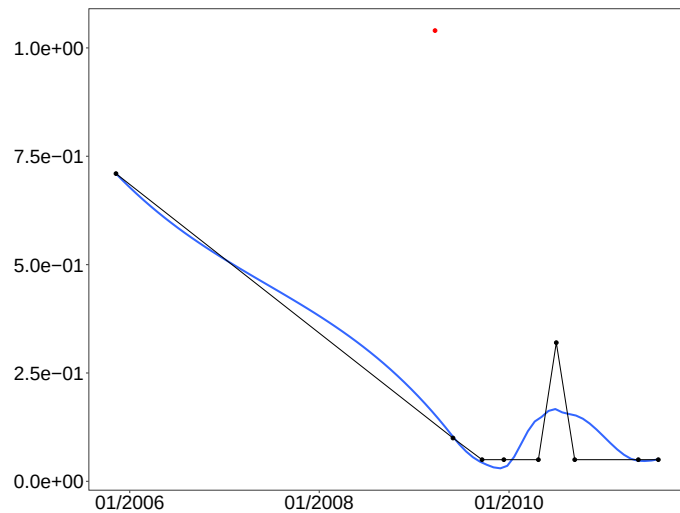
Weir Bore (2) – Chloride
 $\tau = -0.244$ | $p\text{-value} = 0.371$ | No trend



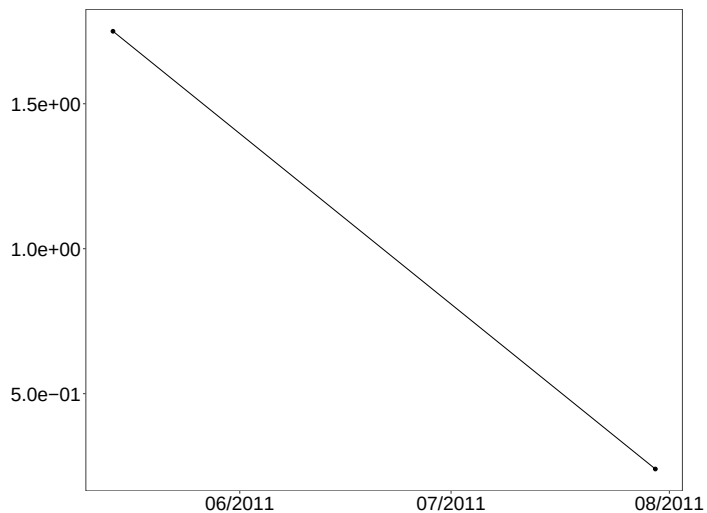
Weir Bore (2) – Electrical Conductivity
 $\tau = -0.511$ | $p\text{-value} = 0.0491$ | Negative trend



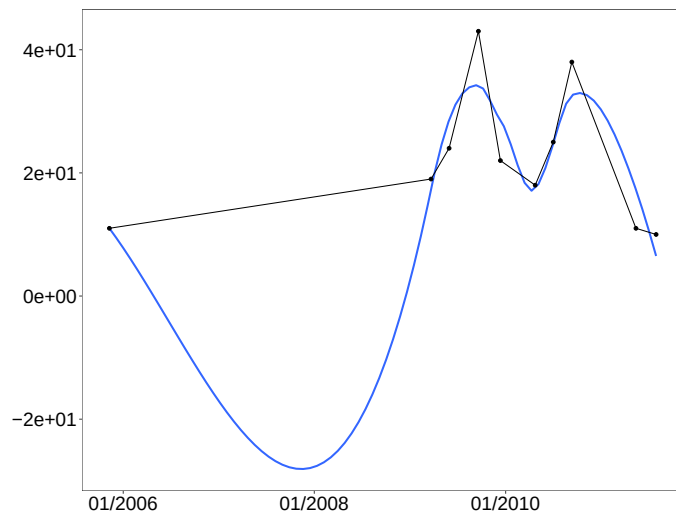
Weir Bore (2) – Iron (d.)
 $\tau = -0.544$ | $p\text{-value} = 0.0533$ | No trend



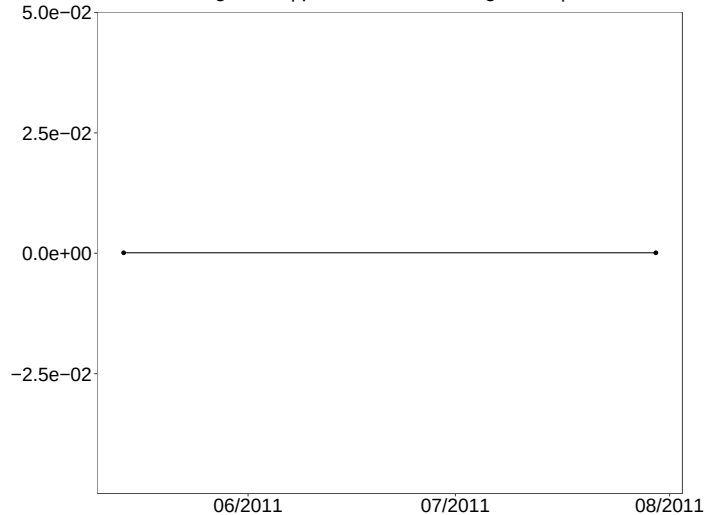
Weir Bore (2) – Iron (t.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

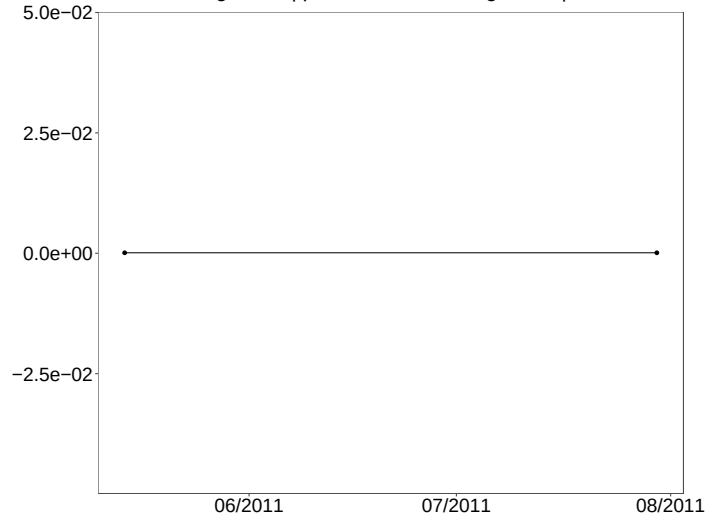
Weir Bore (2) – Magnesium

 τ = -0.0899 | p-value = 0.788 | No trend

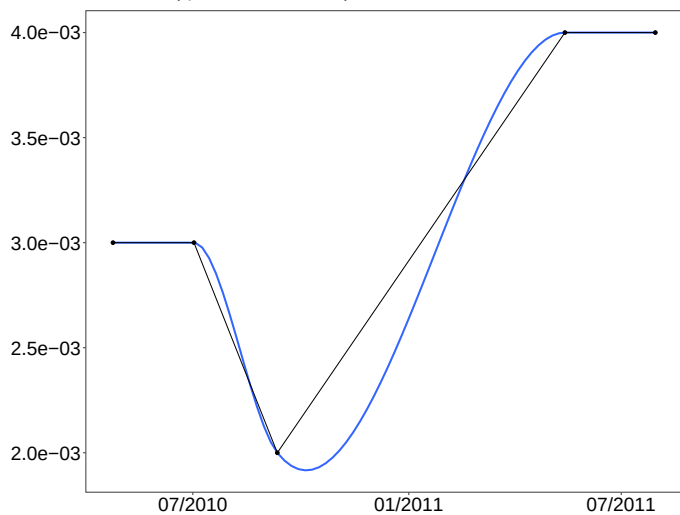
Weir Bore (2) – Mercury (d.)

 τ = Not enough data | p-value = Not enough data | Not evaluated

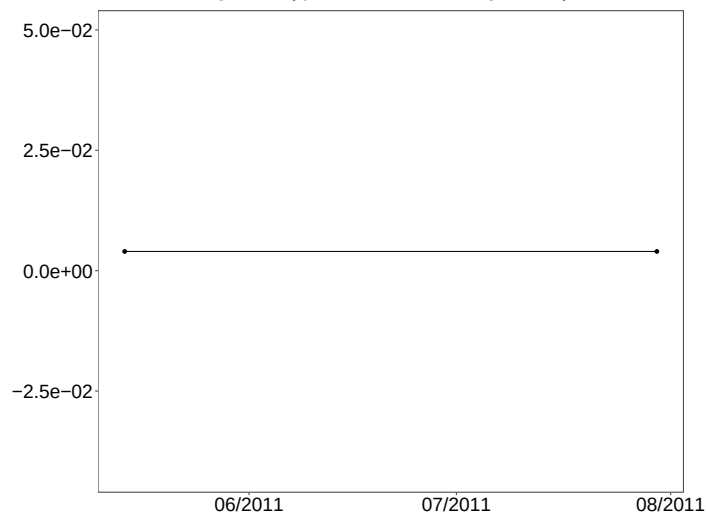
Weir Bore (2) – Mercury (t.)

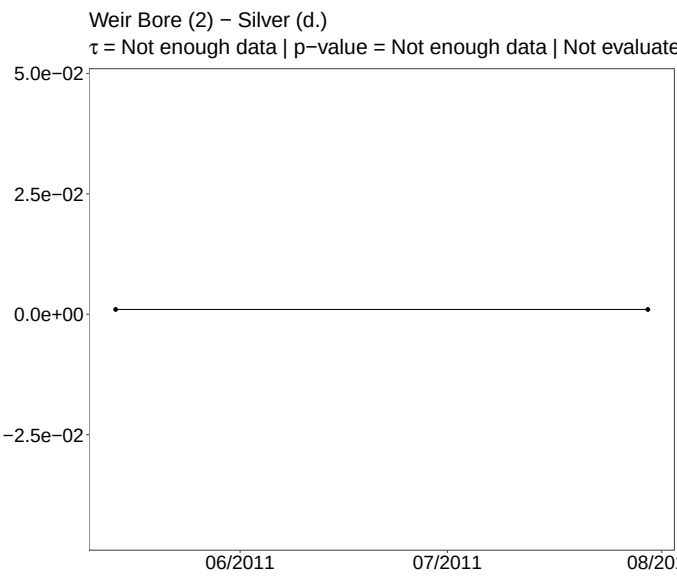
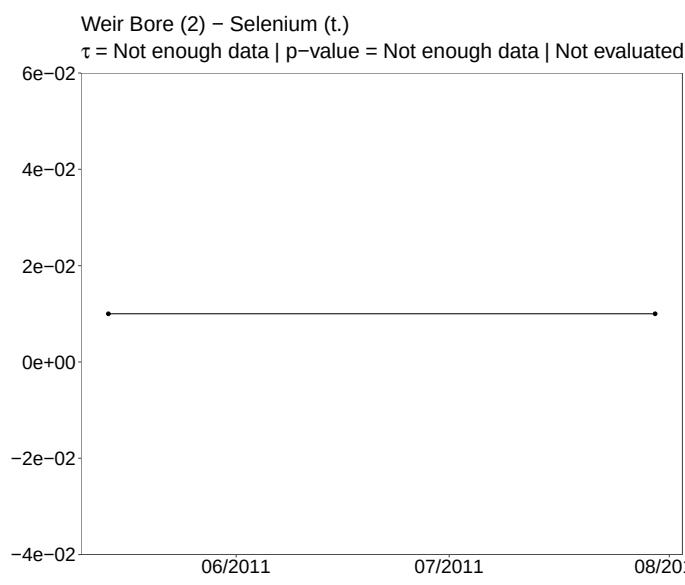
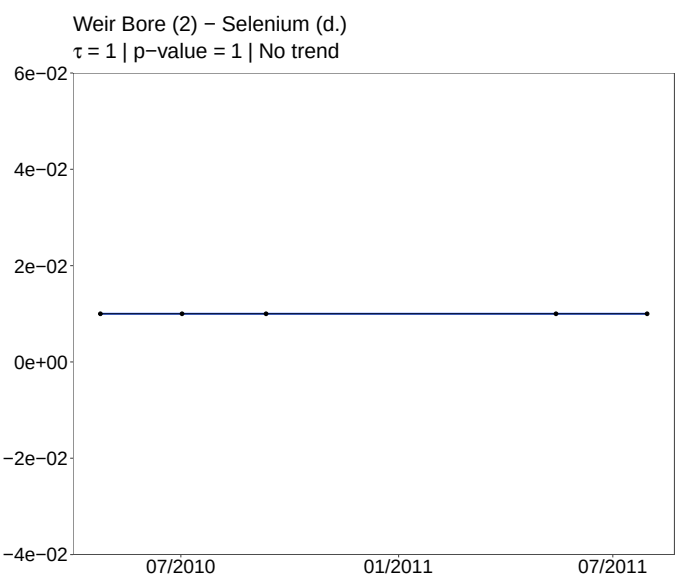
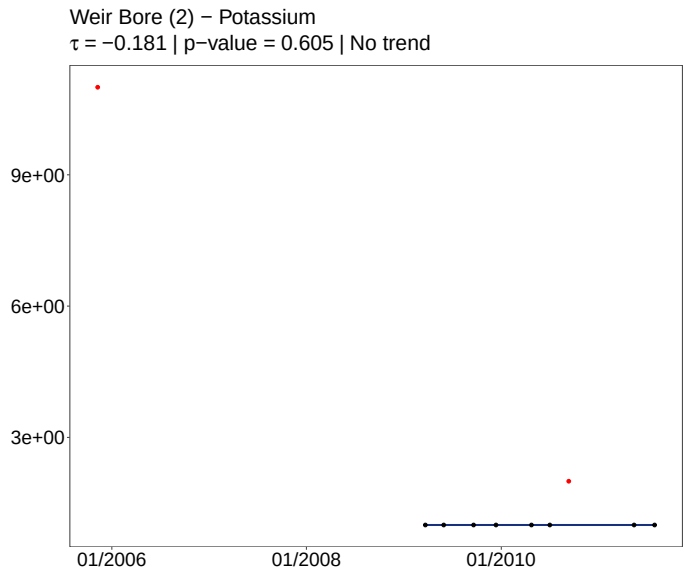
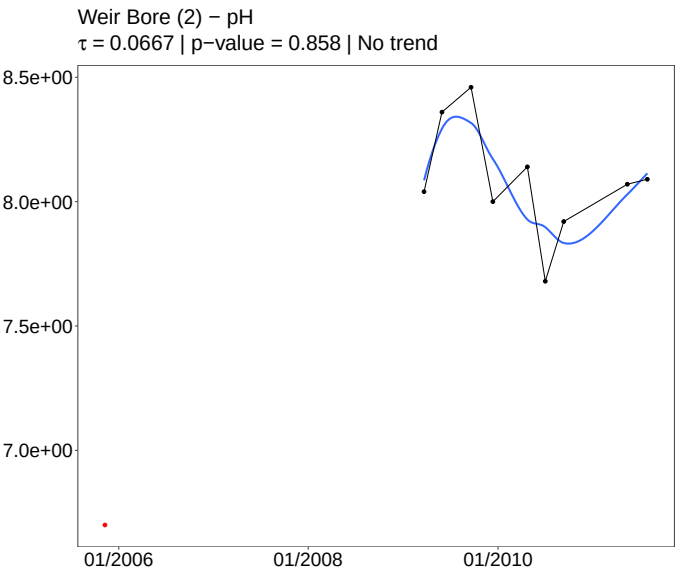
 τ = Not enough data | p-value = Not enough data | Not evaluated

Weir Bore (2) – Molybdenum (d.)

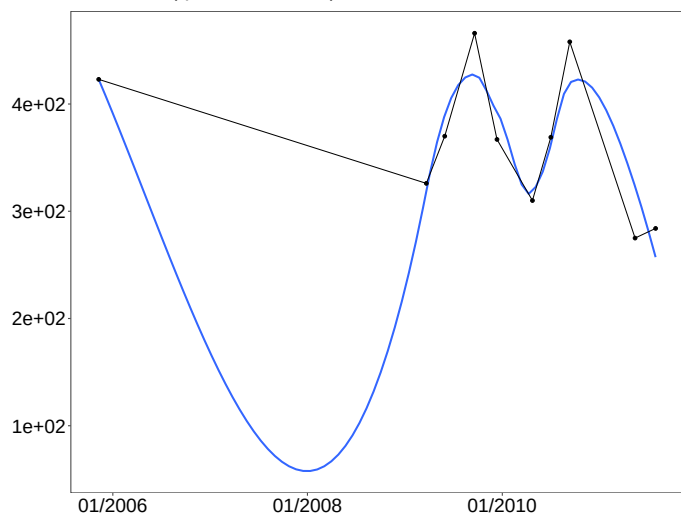
 τ = 0.447 | p-value = 0.433 | No trend

Weir Bore (2) – Molybdenum (t.)

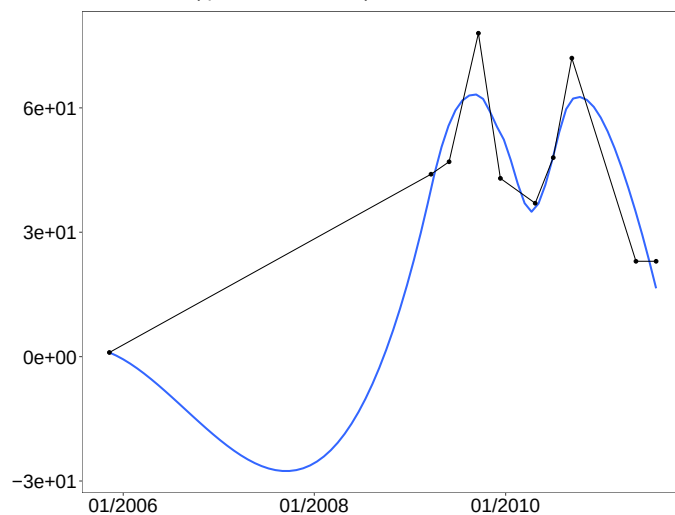
 τ = Not enough data | p-value = Not enough data | Not evaluated



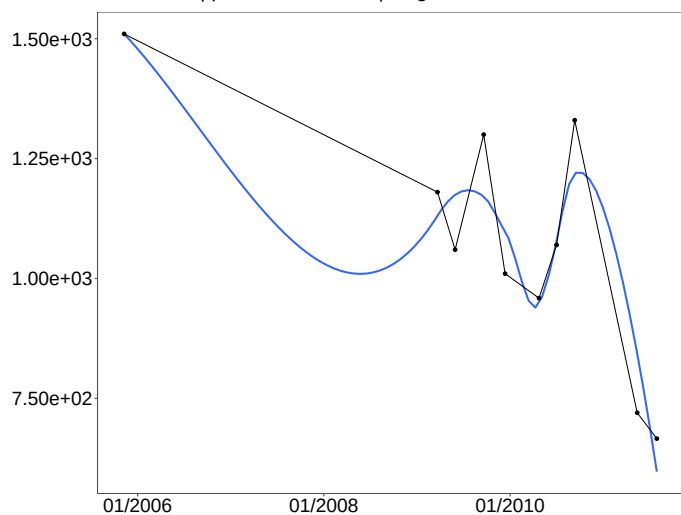
Weir Bore (2) – Sodium
 $\tau = -0.333$ | p-value = 0.21 | No trend



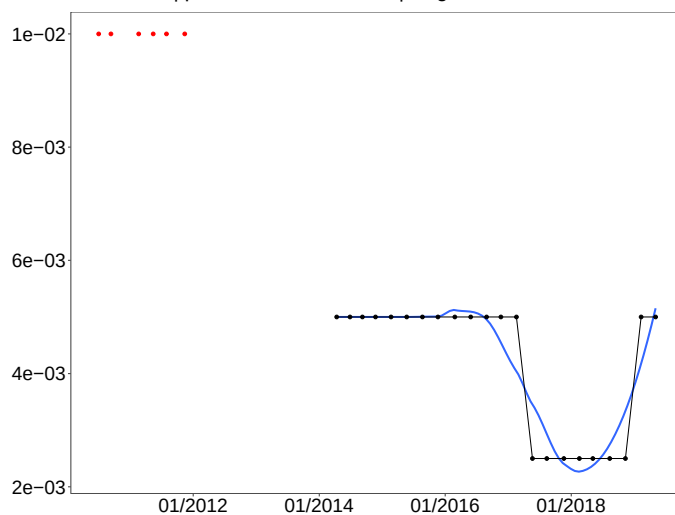
Weir Bore (2) – Sulphate
 $\tau = -0.0449$ | p-value = 0.928 | No trend



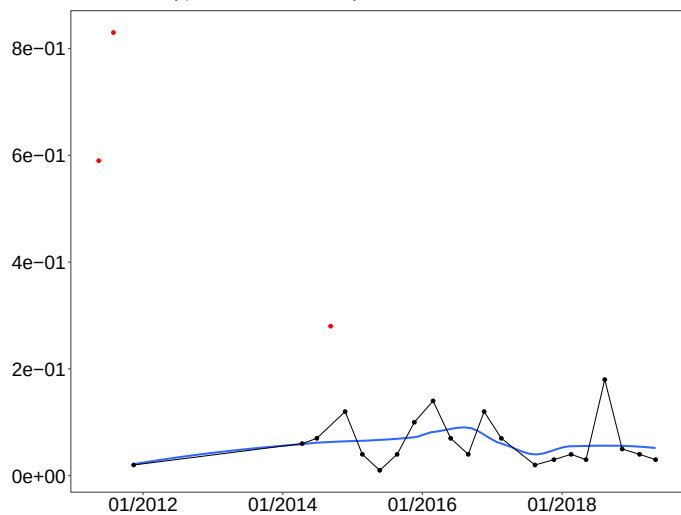
Weir Bore (2) – TDS
 $\tau = -0.511$ | p-value = 0.0491 | Negative trend



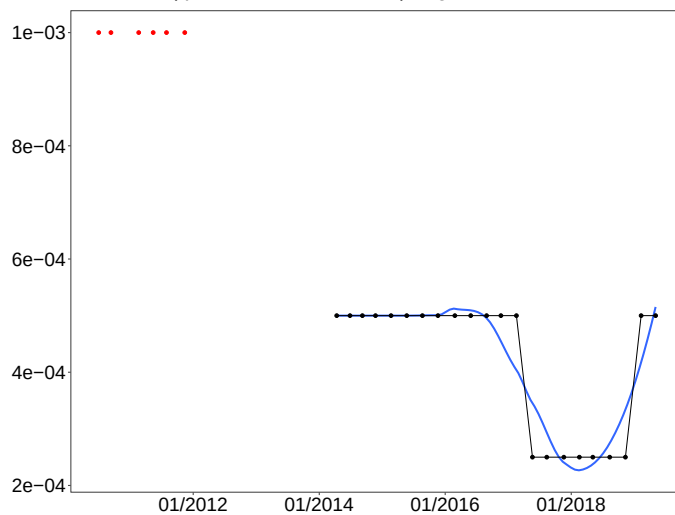
Winton Creek Bore – Aluminium (d.)
 $\tau = -0.698$ | p-value = 0.00000512 | Negative trend



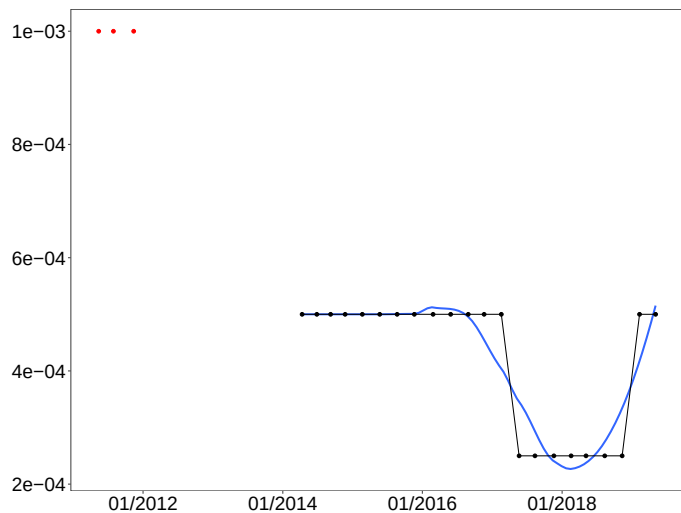
Winton Creek Bore – Aluminium (t.)
 $\tau = -0.262$ | p-value = 0.0845 | No trend



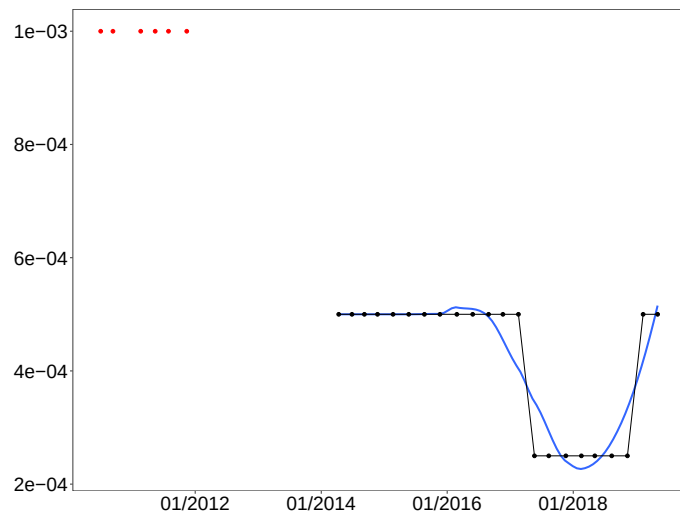
Winton Creek Bore – Antimony (d.)
 $\tau = -0.698$ | p-value = 0.00000512 | Negative trend



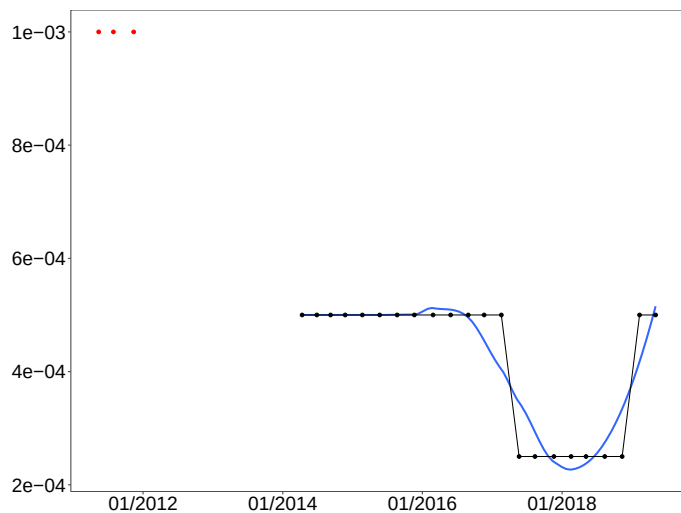
Winton Creek Bore – Antimony (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

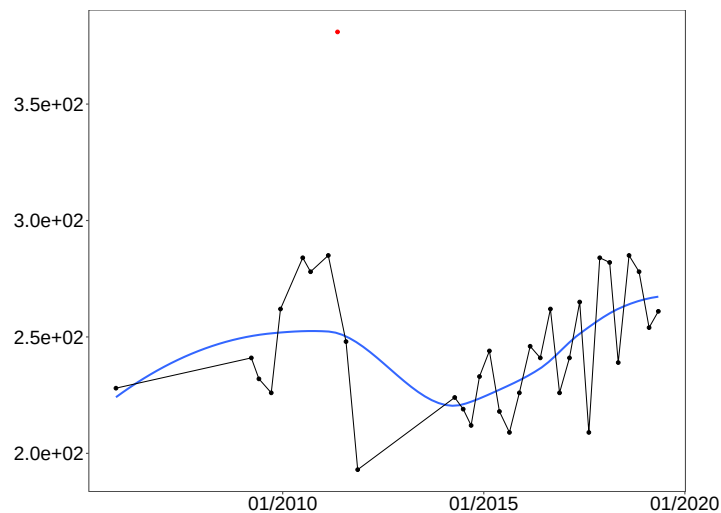
Winton Creek Bore – Arsenic (d.)

 $\tau = -0.698$ | p-value = 0.00000512 | Negative trend

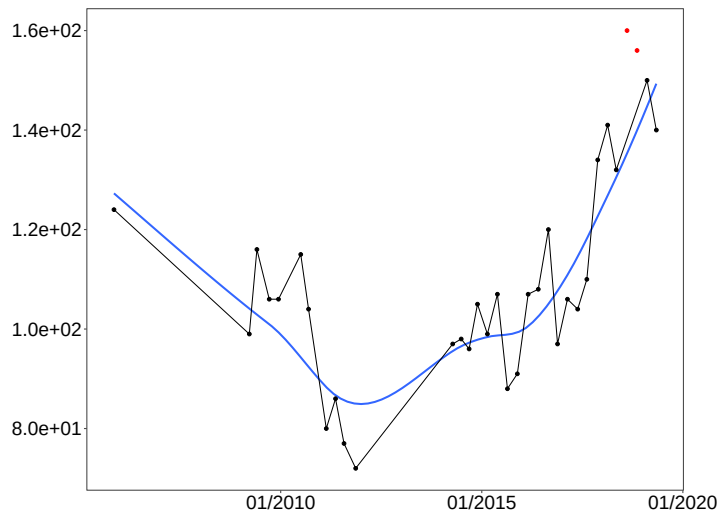
Winton Creek Bore – Arsenic (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

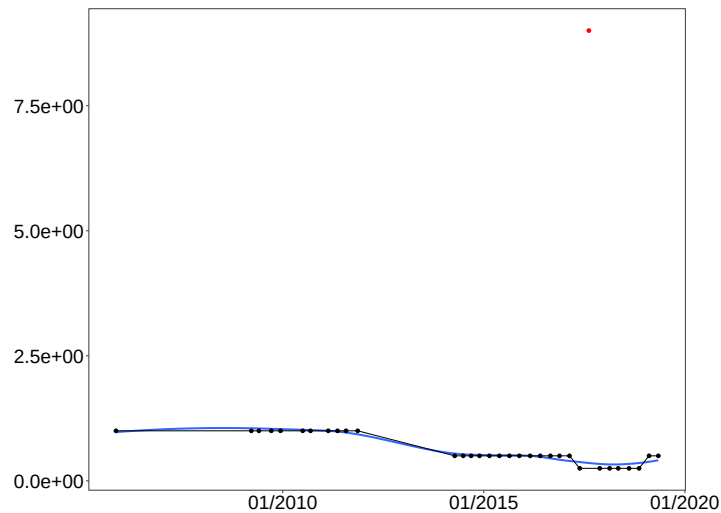
Winton Creek Bore – Bicarbonate

 $\tau = 0.128$ | p-value = 0.306 | No trend

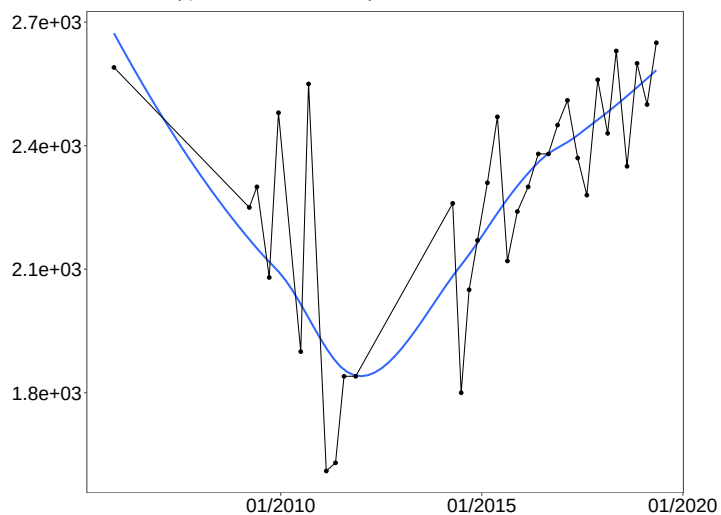
Winton Creek Bore – Calcium

 $\tau = 0.376$ | p-value = 0.00237 | Positive trend

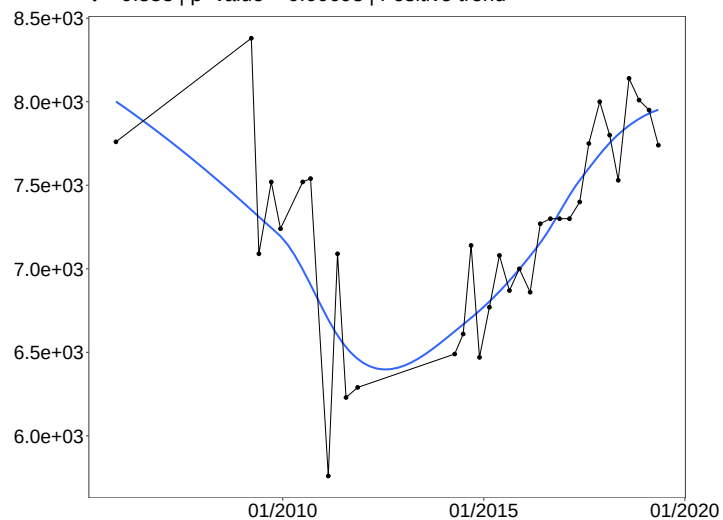
Winton Creek Bore – Carbonate

 $\tau = -0.646$ | p-value = 0.00000321 | Negative trend

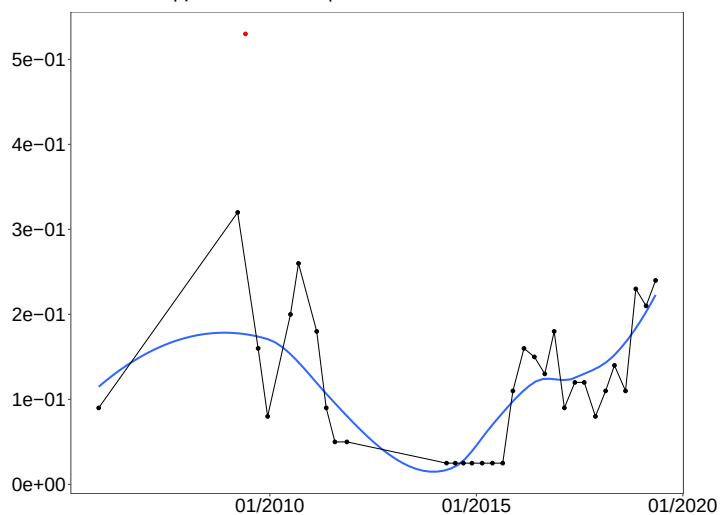
Winton Creek Bore – Chloride
 $\tau = 0.405$ | $p\text{-value} = 0.00102$ | Positive trend



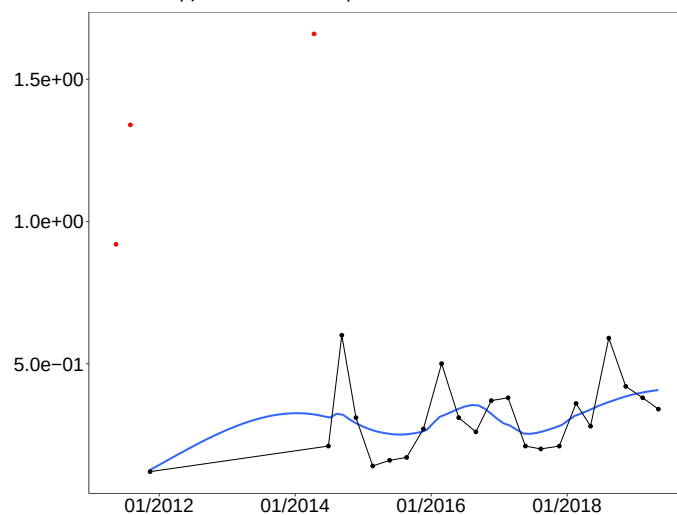
Winton Creek Bore – Electrical Conductivity
 $\tau = 0.333$ | $p\text{-value} = 0.00698$ | Positive trend



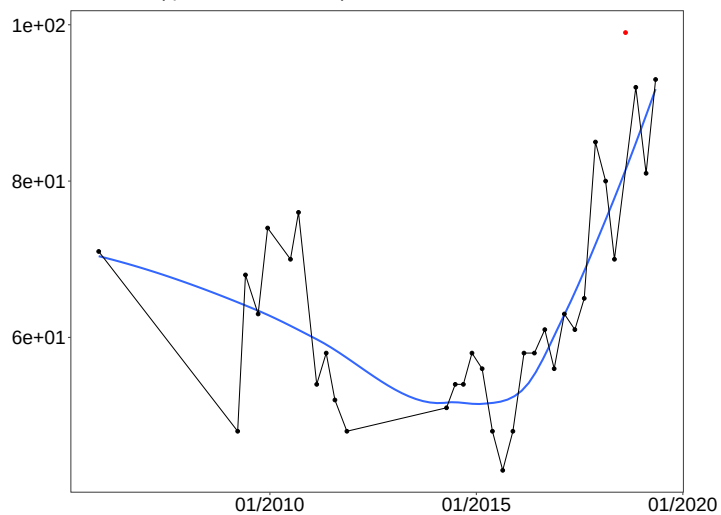
Winton Creek Bore – Iron (d.)
 $\tau = 0.0469$ | $p\text{-value} = 0.72$ | No trend



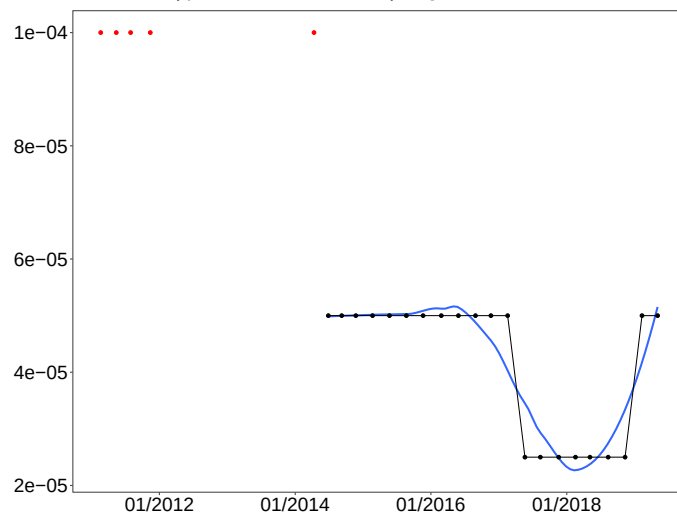
Winton Creek Bore – Iron (t.)
 $\tau = 0.037$ | $p\text{-value} = 0.815$ | No trend



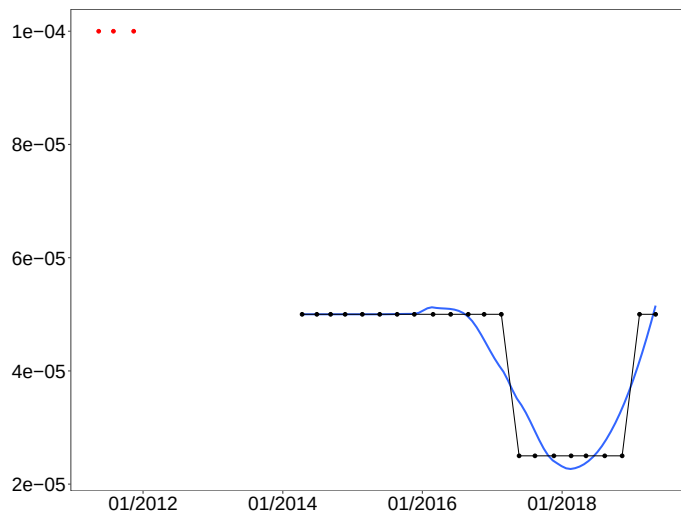
Winton Creek Bore – Magnesium
 $\tau = 0.311$ | $p\text{-value} = 0.0129$ | Positive trend



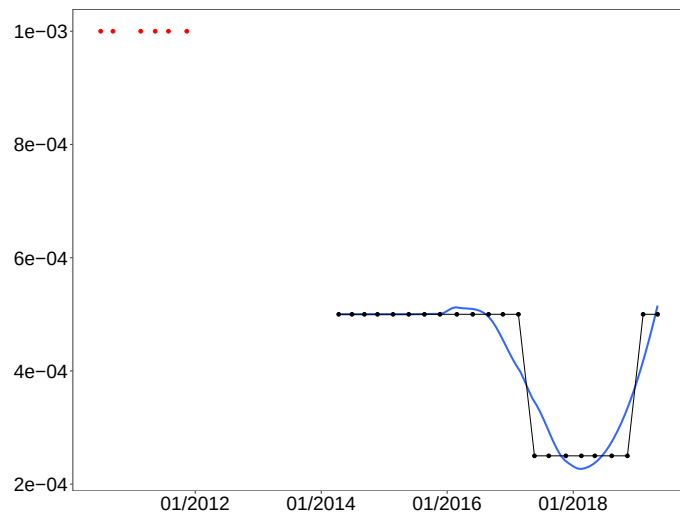
Winton Creek Bore – Mercury (d.)
 $\tau = -0.681$ | $p\text{-value} = 0.0000199$ | Negative trend



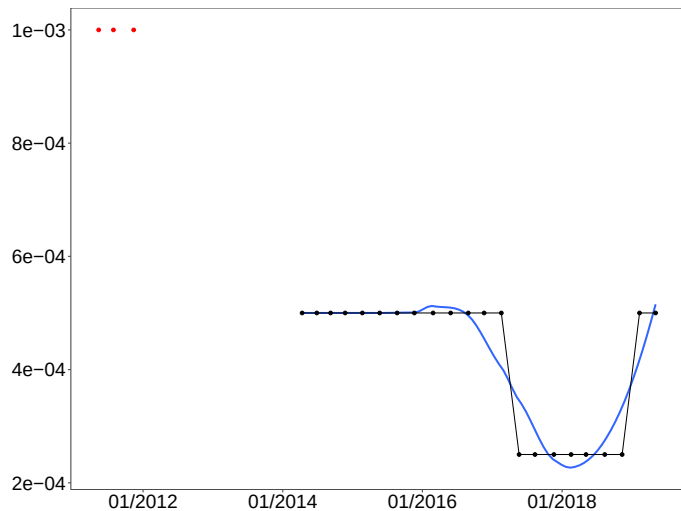
Winton Creek Bore – Mercury (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

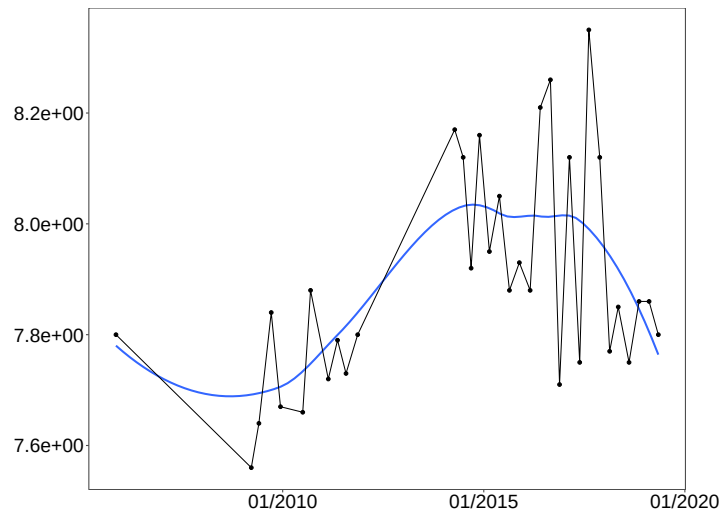
Winton Creek Bore – Molybdenum (d.)

 $\tau = -0.698$ | p-value = 0.00000512 | Negative trend

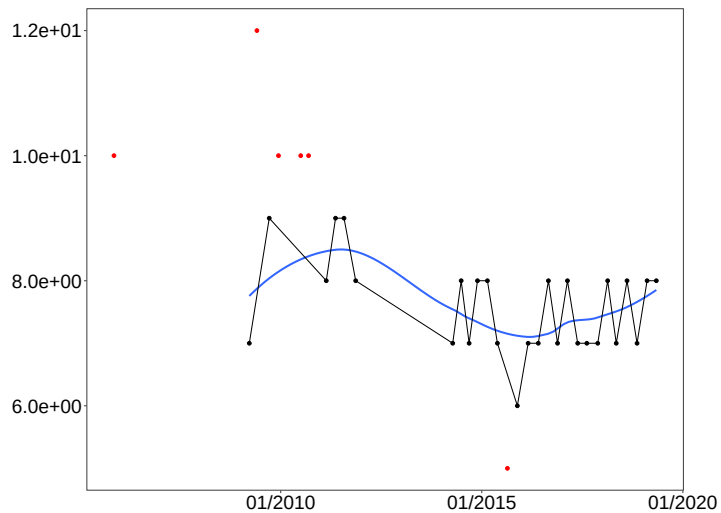
Winton Creek Bore – Molybdenum (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

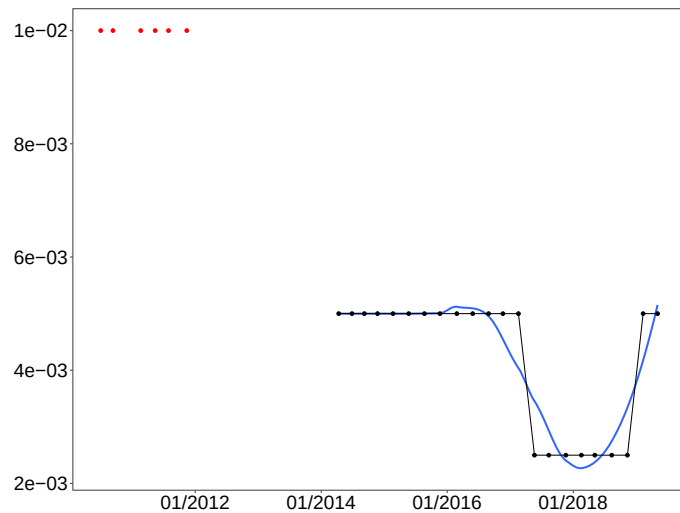
Winton Creek Bore – pH

 $\tau = 0.243$ | p-value = 0.0505 | No trend

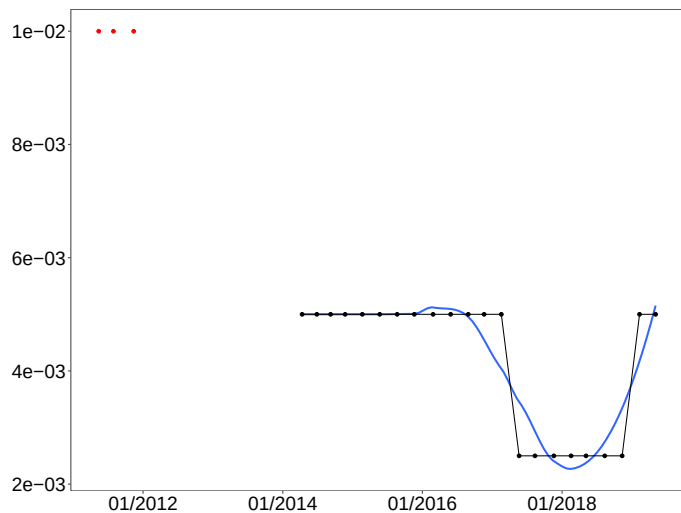
Winton Creek Bore – Potassium

 $\tau = -0.388$ | p-value = 0.00397 | Negative trend

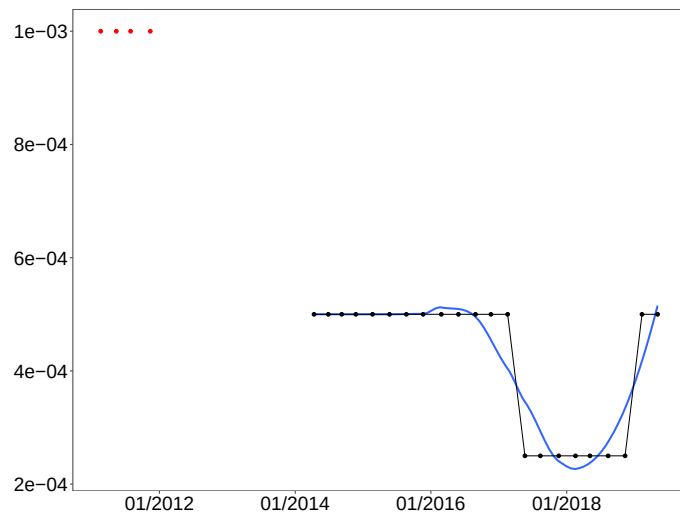
Winton Creek Bore – Selenium (d.)

 $\tau = -0.698$ | p-value = 0.00000512 | Negative trend

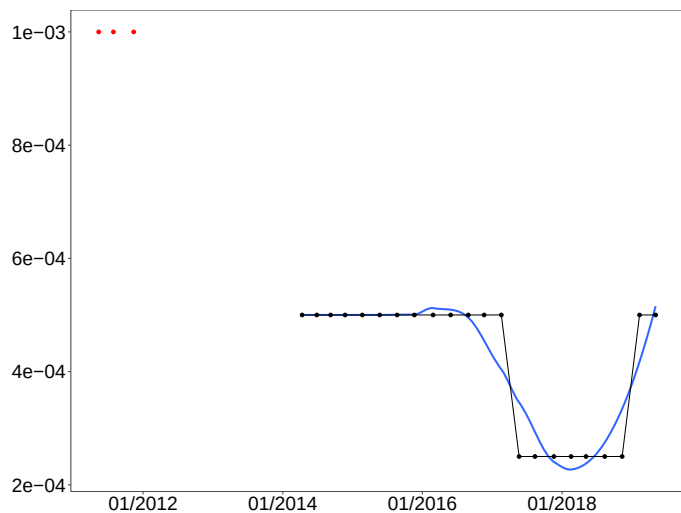
Winton Creek Bore – Selenium (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

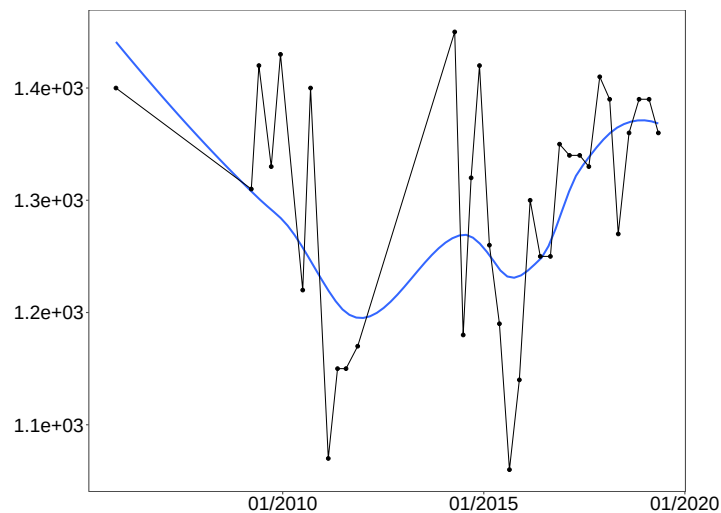
Winton Creek Bore – Silver (d.)

 $\tau = -0.659$ | p-value = 0.0000406 | Negative trend

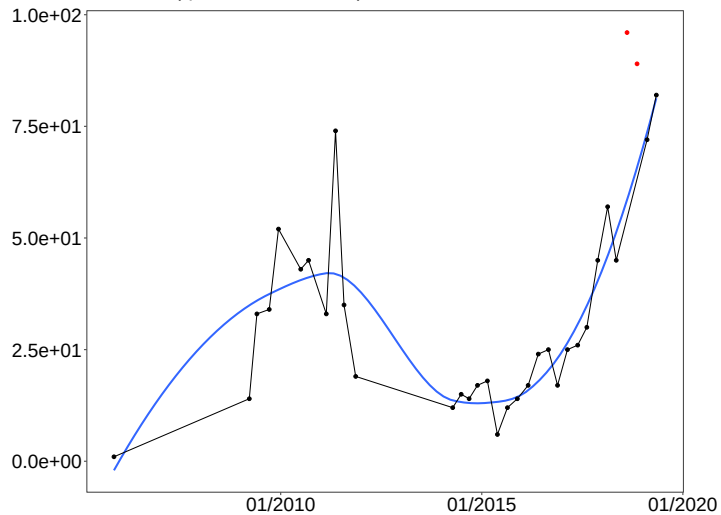
Winton Creek Bore – Silver (t.)

 $\tau = -0.631$ | p-value = 0.00013 | Negative trend

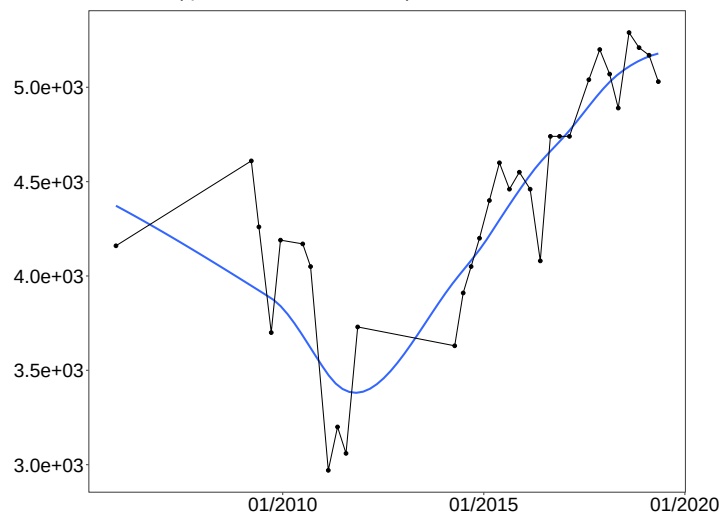
Winton Creek Bore – Sodium

 $\tau = 0.126$ | p-value = 0.313 | No trend

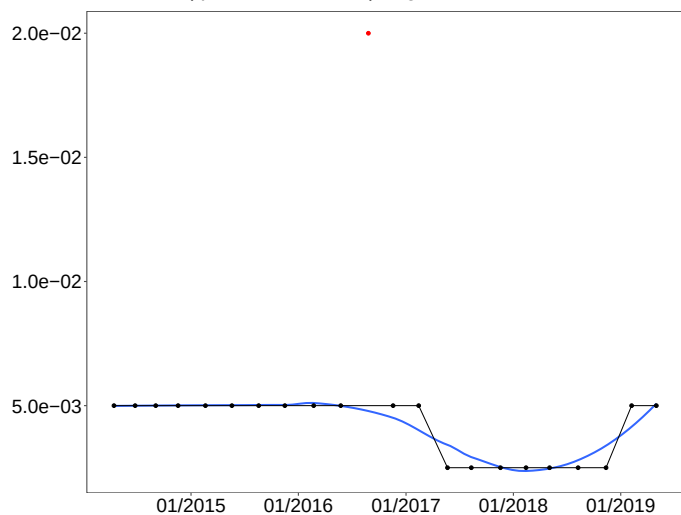
Winton Creek Bore – Sulphate

 $\tau = 0.299$ | p-value = 0.0161 | Positive trend

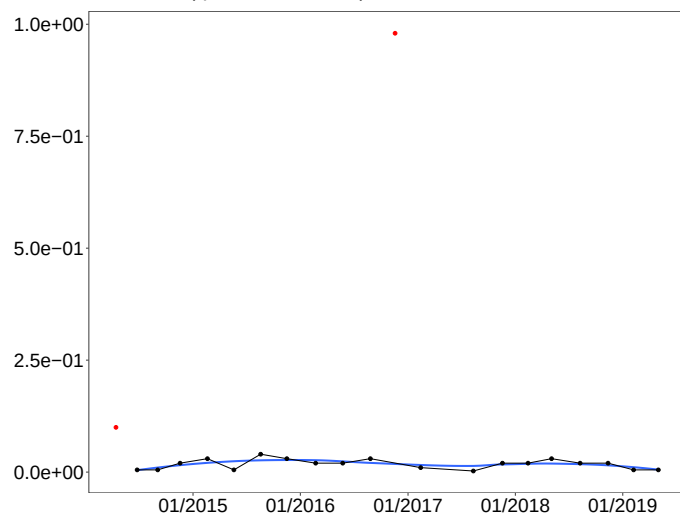
Winton Creek Bore – TDS

 $\tau = 0.602$ | p-value = 0.00000155 | Positive trend

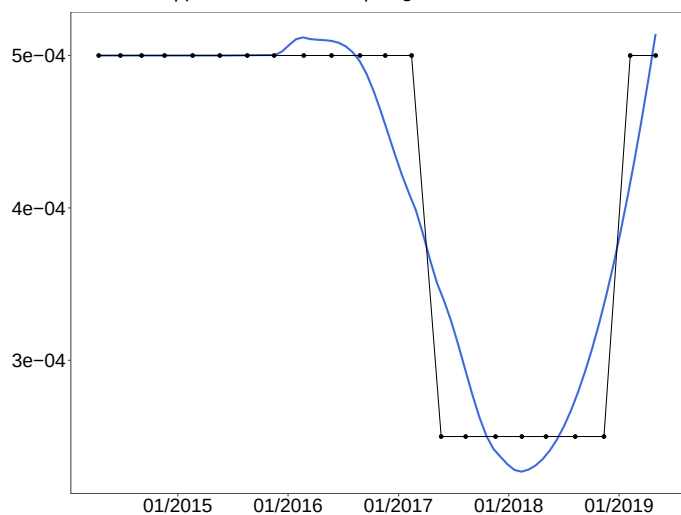
WSMB2D – Aluminium (d.)
 $\tau = -0.428$ | p-value = 0.0183 | Negative trend



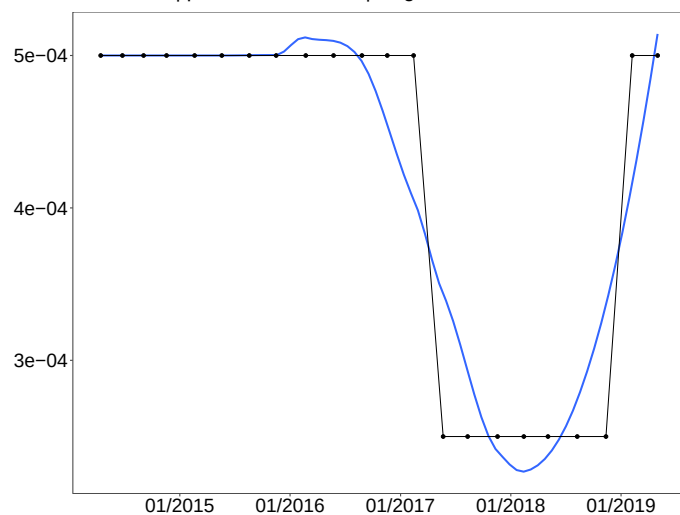
WSMB2D – Aluminium (t.)
 $\tau = -0.152$ | p-value = 0.382 | No trend



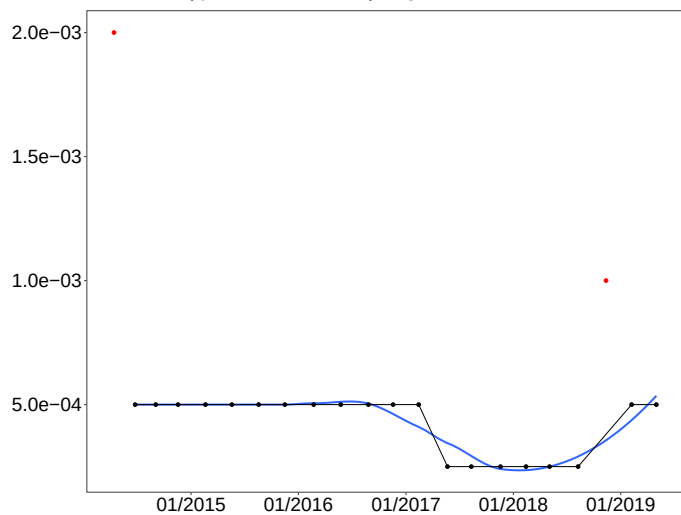
WSMB2D – Antimony (d.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



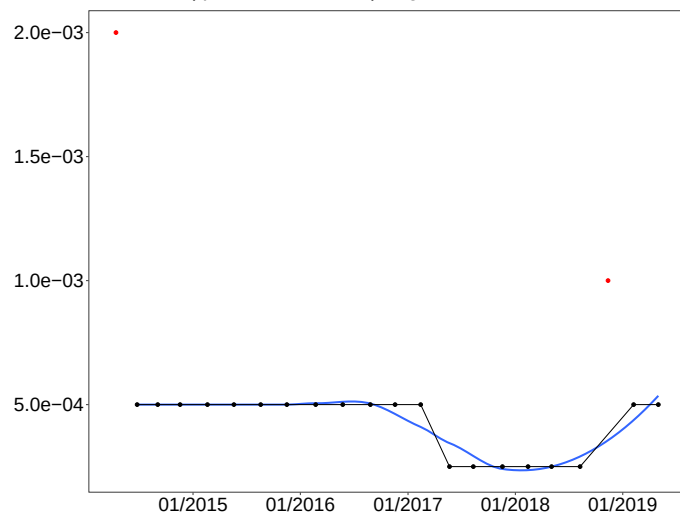
WSMB2D – Antimony (t.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



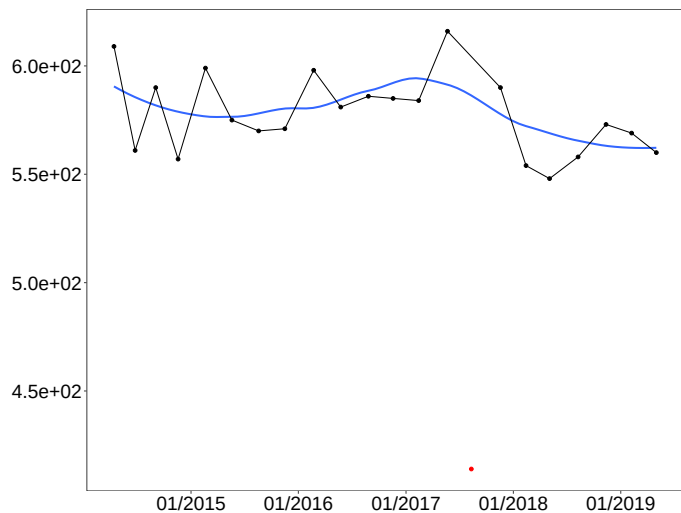
WSMB2D – Arsenic (d.)
 $\tau = -0.383$ | p-value = 0.0325 | Negative trend



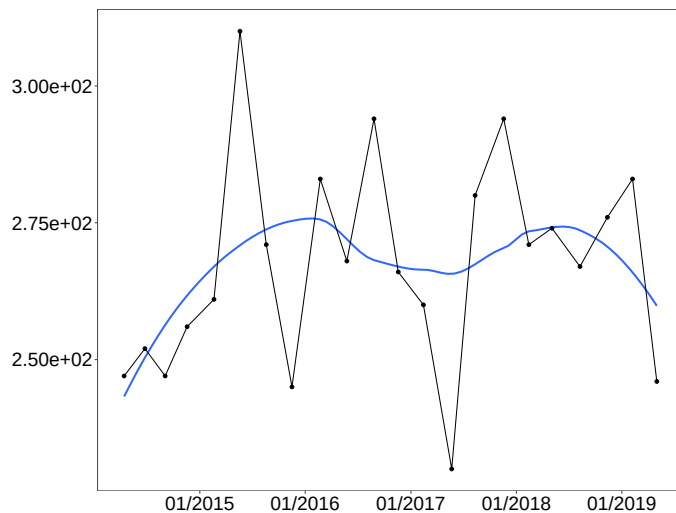
WSMB2D – Arsenic (t.)
 $\tau = -0.383$ | p-value = 0.0325 | Negative trend



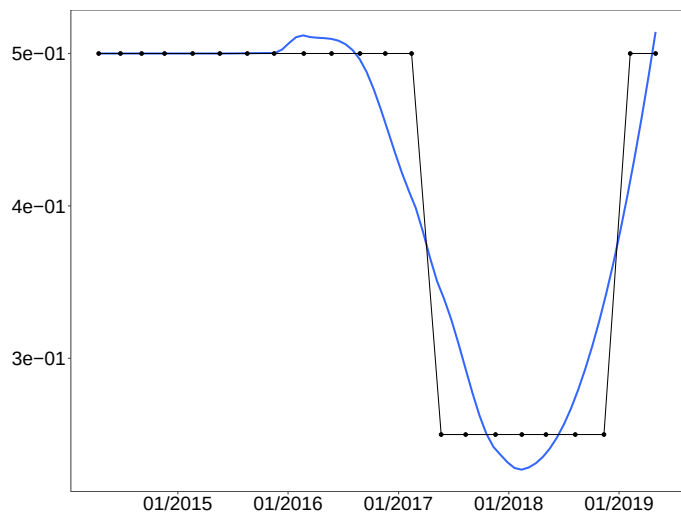
WSMB2D – Bicarbonate
 $\tau = -0.234$ | p-value = 0.135 | No trend



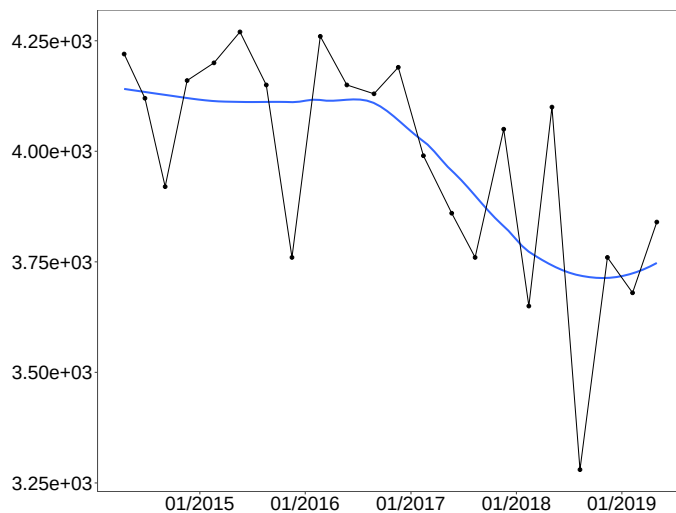
WSMB2D – Calcium
 $\tau = 0.214$ | p-value = 0.175 | No trend



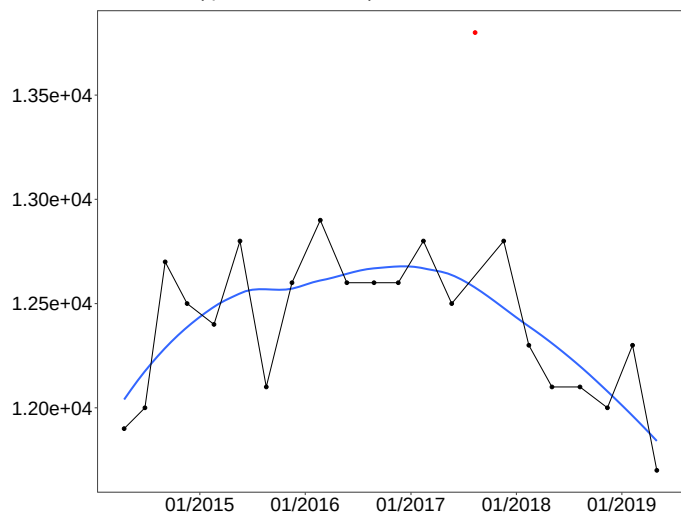
WSMB2D – Carbonate
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



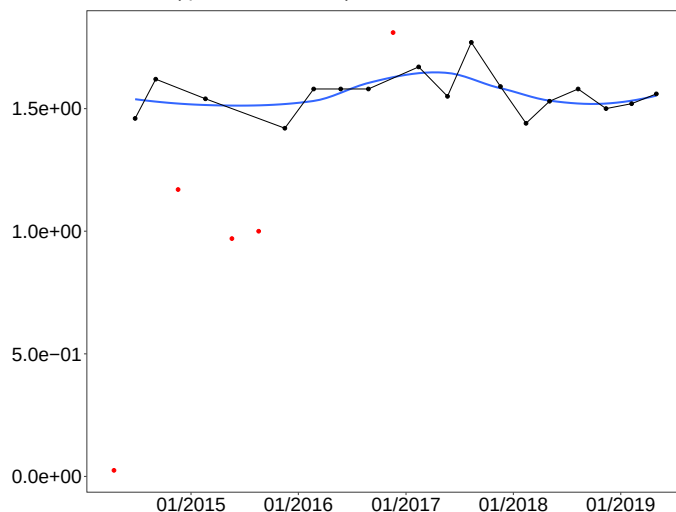
WSMB2D – Chloride
 $\tau = -0.493$ | p-value = 0.00156 | Negative trend



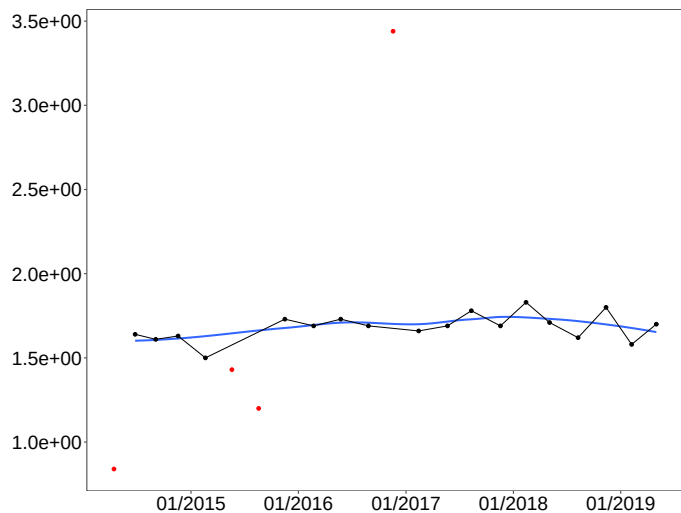
WSMB2D – Electrical Conductivity
 $\tau = -0.116$ | p-value = 0.477 | No trend



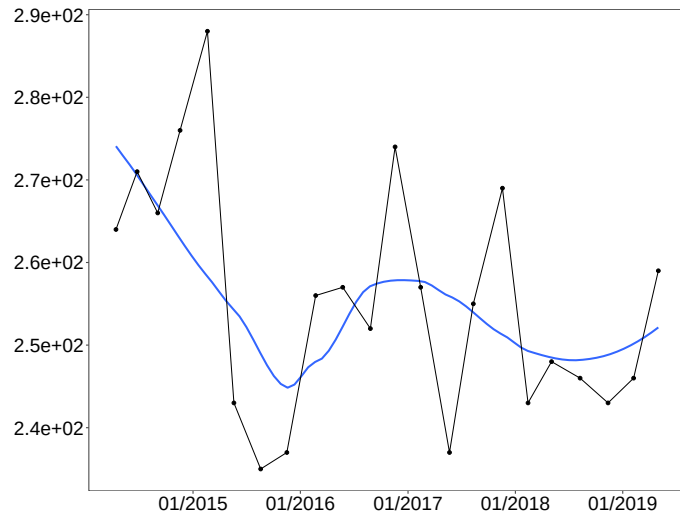
WSMB2D – Iron (d.)
 $\tau = 0.215$ | p-value = 0.174 | No trend



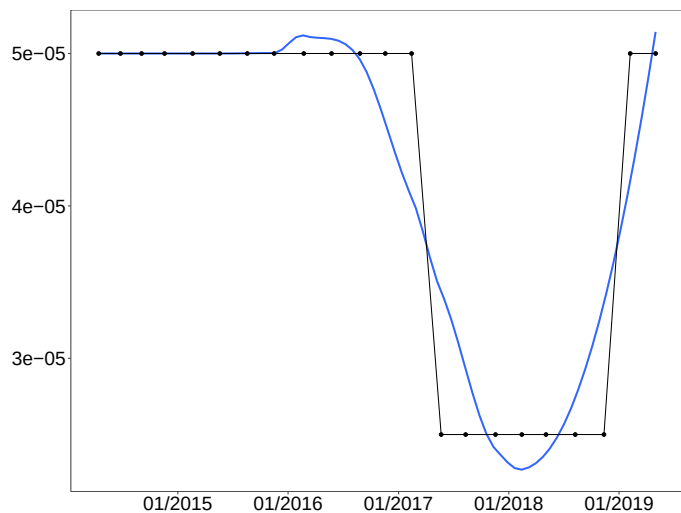
WSMB2D – Iron (t.)
 $\tau = 0.334$ | p-value = 0.0338 | Positive trend



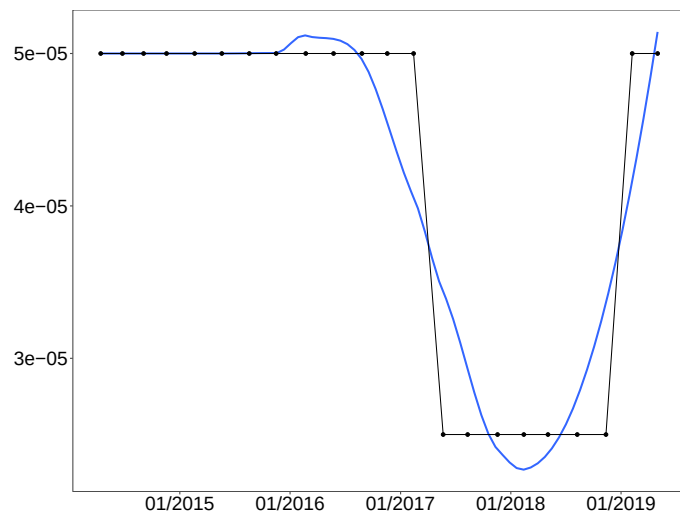
WSMB2D – Magnesium
 $\tau = -0.224$ | p-value = 0.157 | No trend



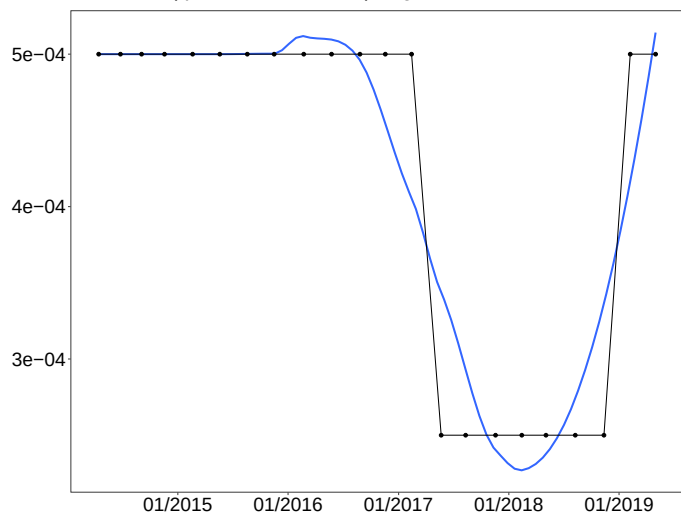
WSMB2D – Mercury (d.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



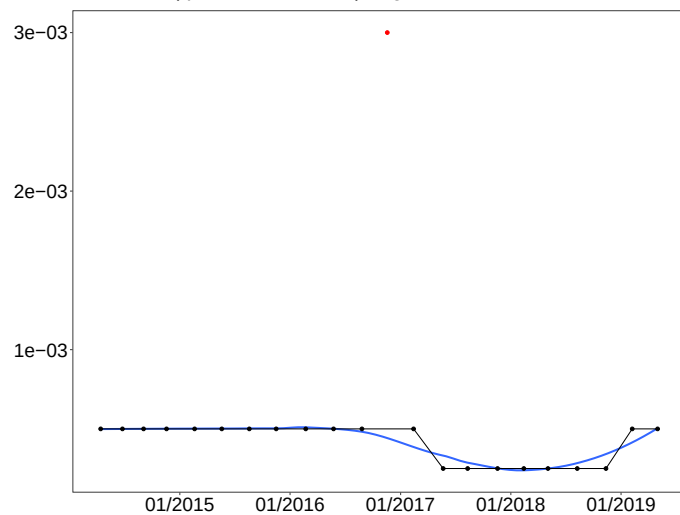
WSMB2D – Mercury (t.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



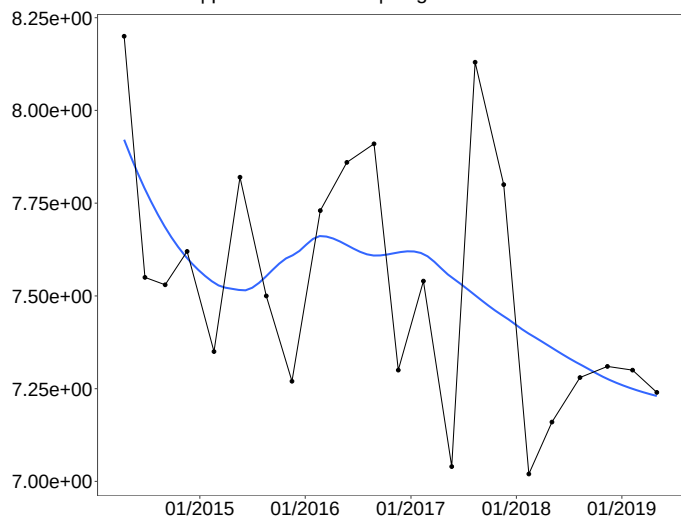
WSMB2D – Molybdenum (d.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



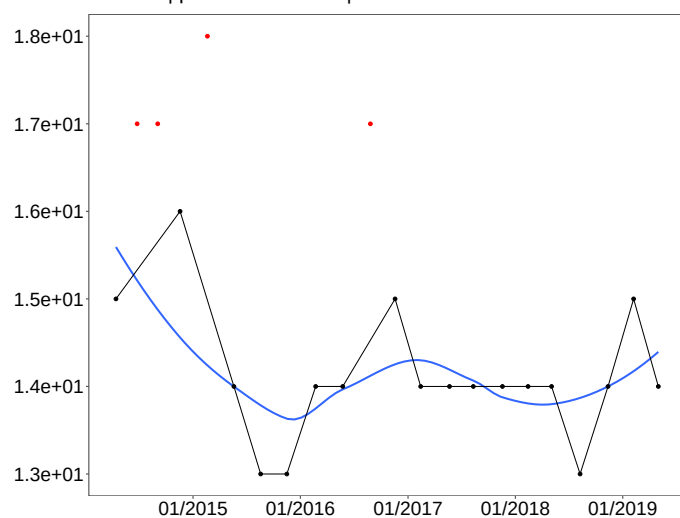
WSMB2D – Molybdenum (t.)
 $\tau = -0.416$ | p-value = 0.0219 | Negative trend



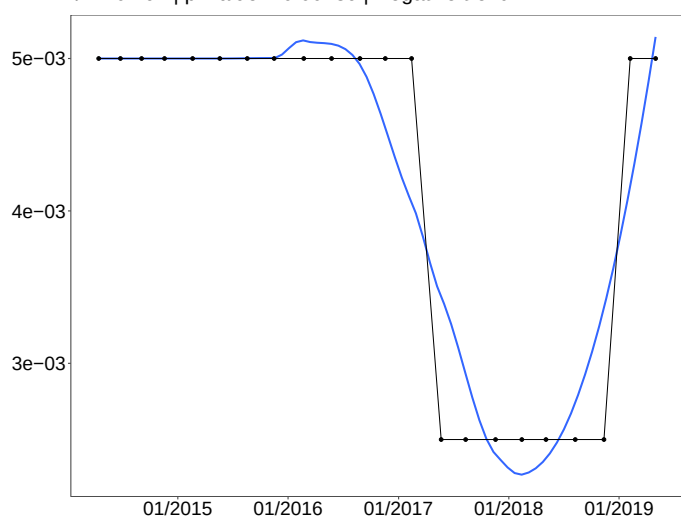
WSMB2D – pH

 $\tau = -0.312$ | p-value = 0.0452 | Negative trend

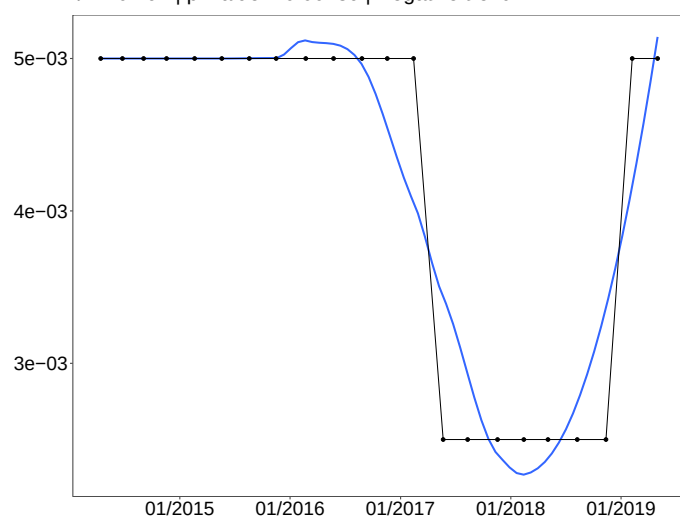
WSMB2D – Potassium

 $\tau = -0.3$ | p-value = 0.0778 | No trend

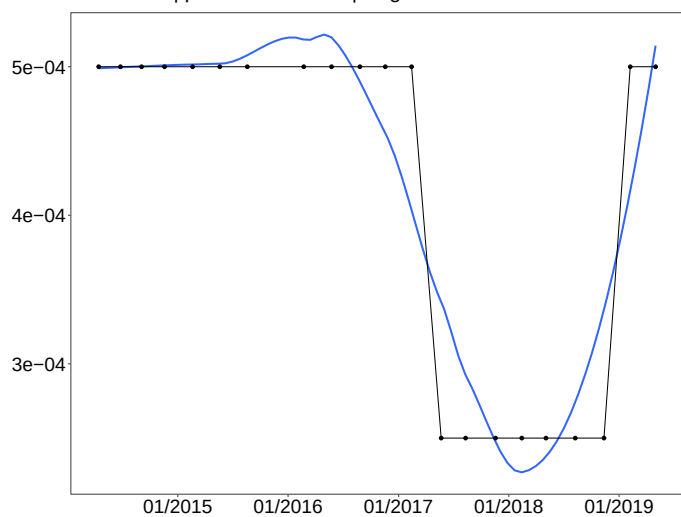
WSMB2D – Selenium (d.)

 $\tau = -0.494$ | p-value = 0.00739 | Negative trend

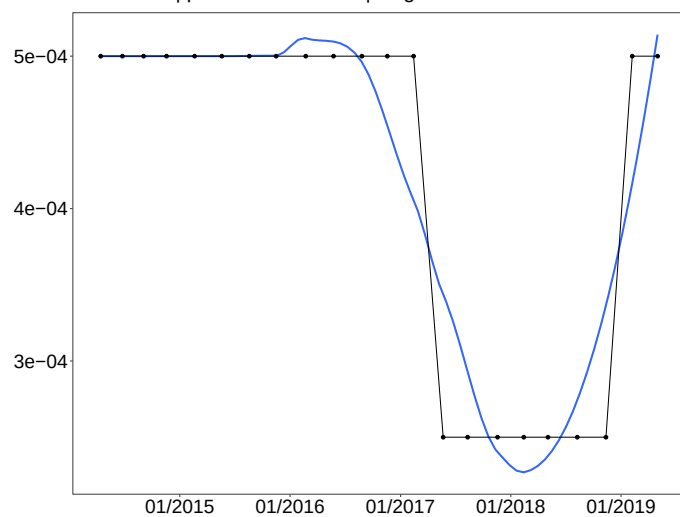
WSMB2D – Selenium (t.)

 $\tau = -0.494$ | p-value = 0.00739 | Negative trend

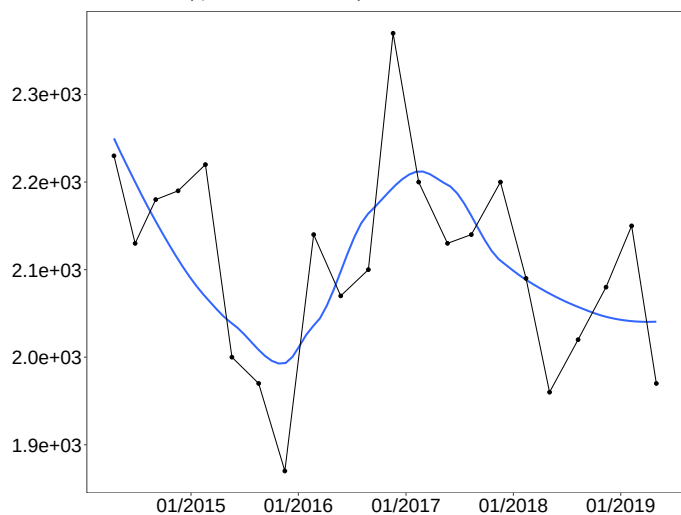
WSMB2D – Silver (d.)

 $\tau = -0.488$ | p-value = 0.0101 | Negative trend

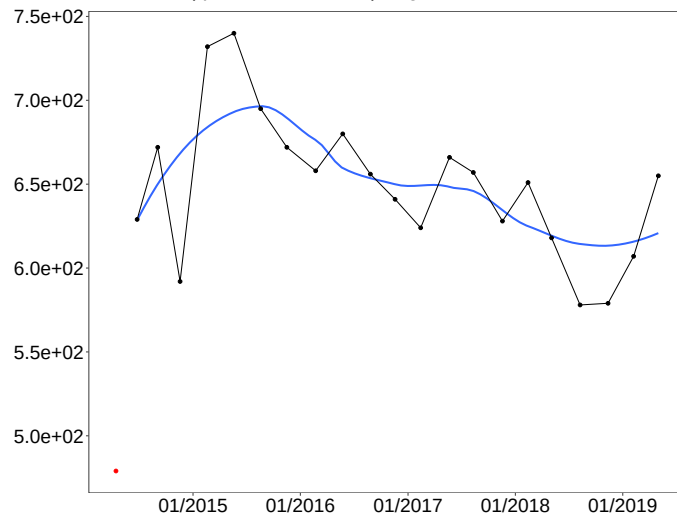
WSMB2D – Silver (t.)

 $\tau = -0.494$ | p-value = 0.00739 | Negative trend

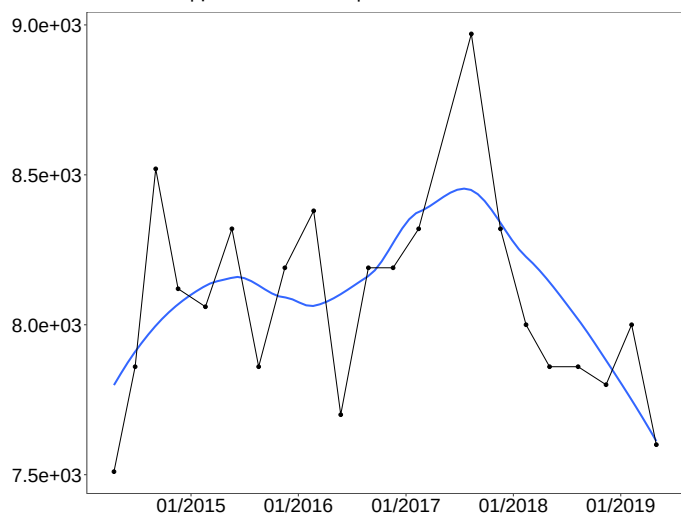
WSMB2D – Sodium
 $\tau = -0.205$ | p-value = 0.194 | No trend



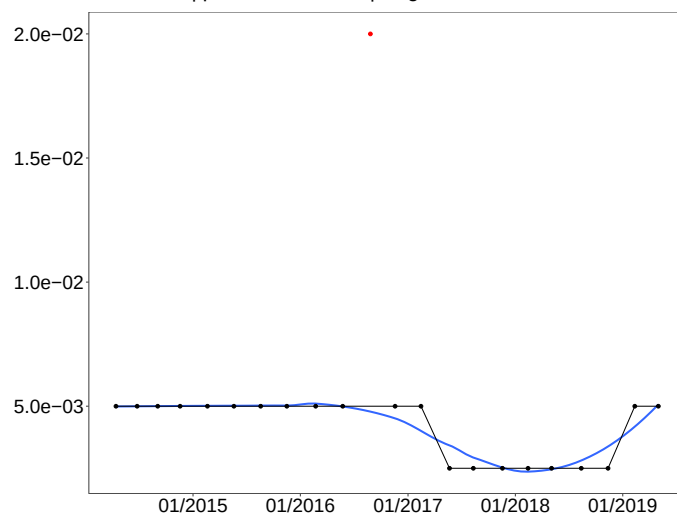
WSMB2D – Sulphate
 $\tau = -0.312$ | p-value = 0.0452 | Negative trend



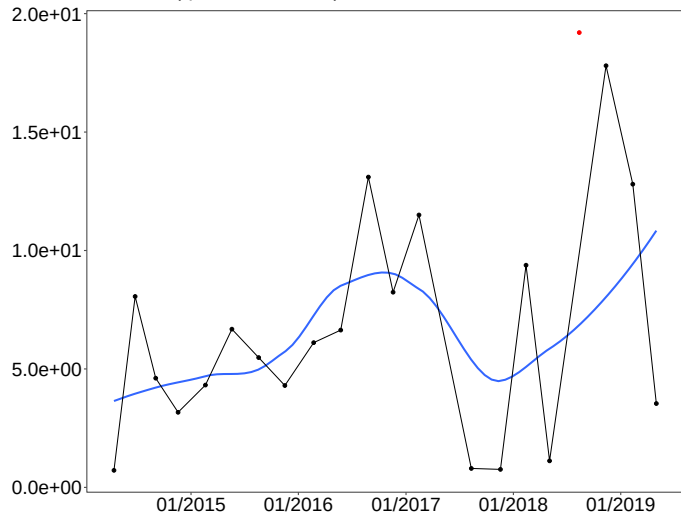
WSMB2D – TDS
 $\tau = -0.123$ | p-value = 0.465 | No trend



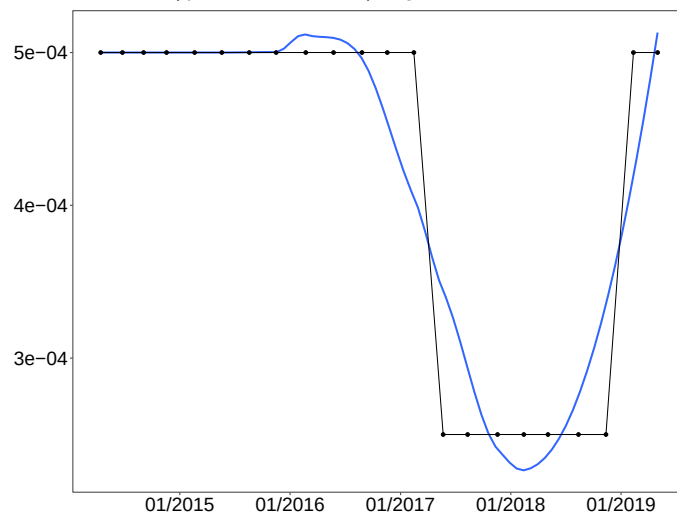
WSMB2S – Aluminium (d.)
 $\tau = -0.428$ | p-value = 0.0183 | Negative trend



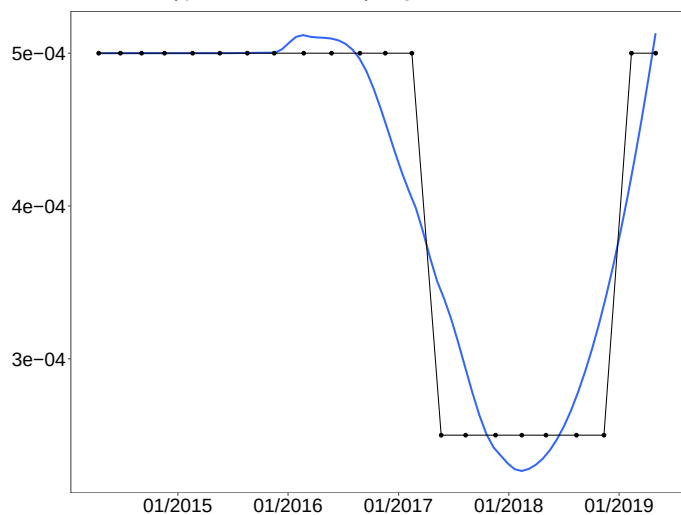
WSMB2S – Aluminium (t.)
 $\tau = 0.257$ | p-value = 0.11 | No trend



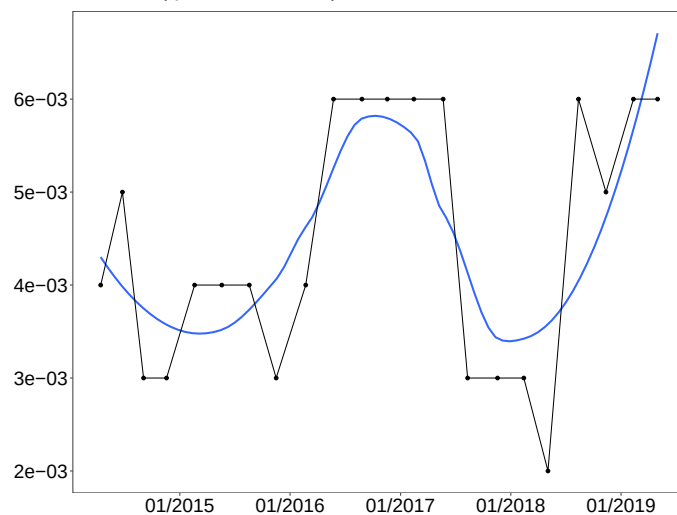
WSMB2S – Antimony (d.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



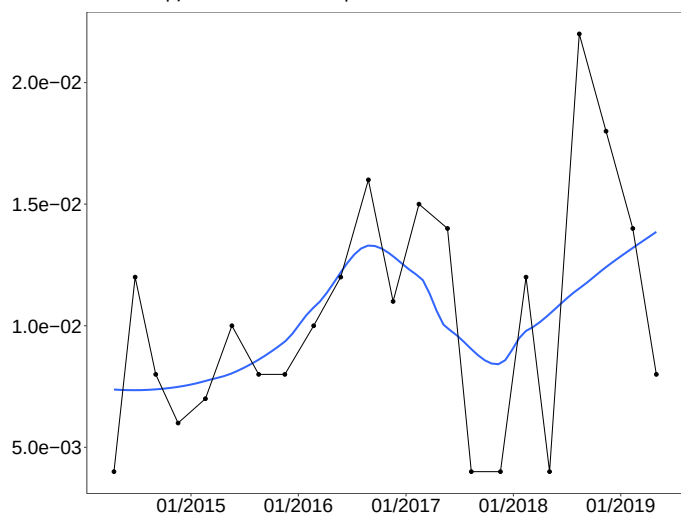
WSMB2S – Antimony (t.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



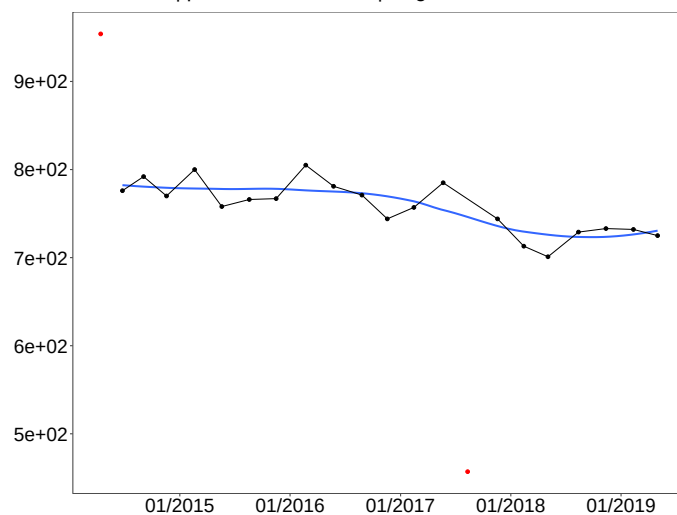
WSMB2S – Arsenic (d.)
 $\tau = 0.193$ | p-value = 0.262 | No trend



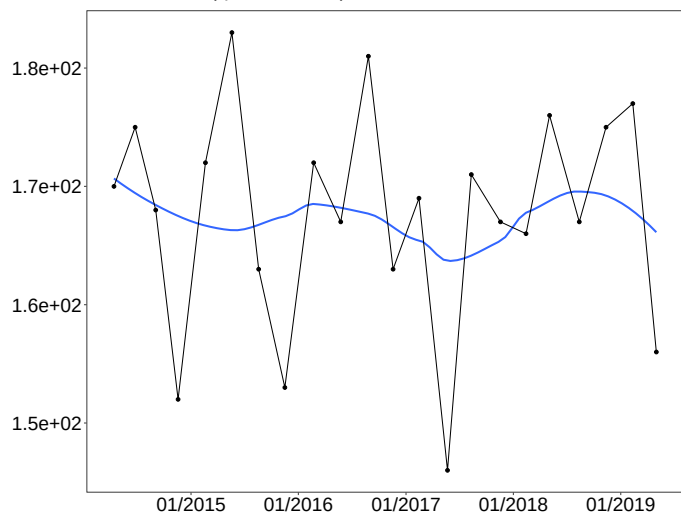
WSMB2S – Arsenic (t.)
 $\tau = 0.27$ | p-value = 0.0931 | No trend



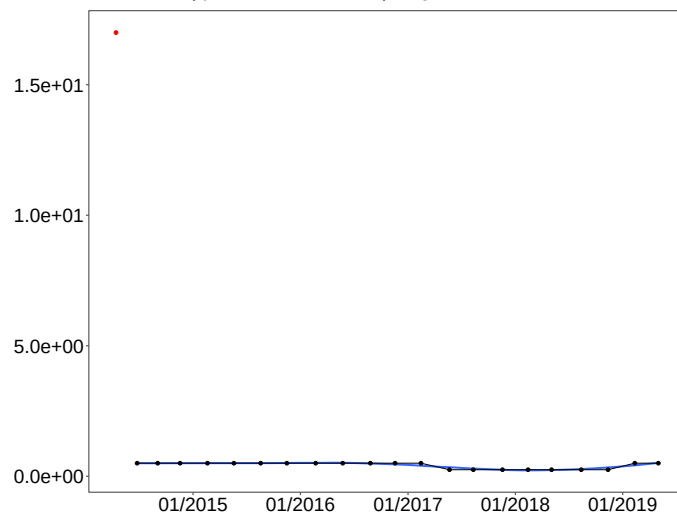
WSMB2S – Bicarbonate
 $\tau = -0.564$ | p-value = 0.000274 | Negative trend



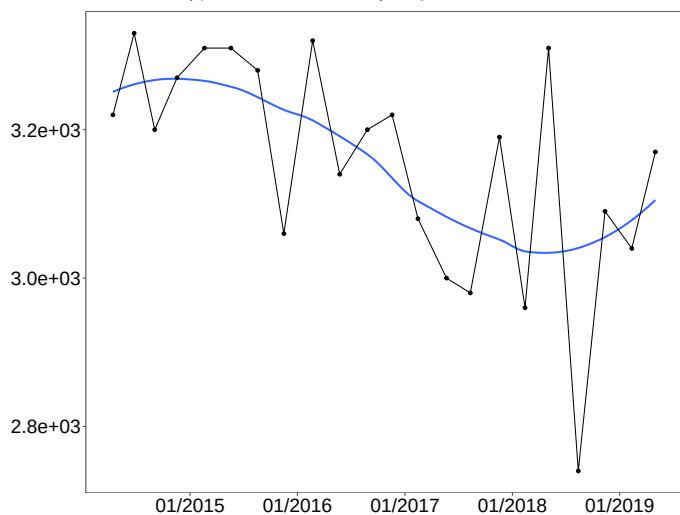
WSMB2S – Calcium
 $\tau = -0.00439$ | p-value = 1 | No trend



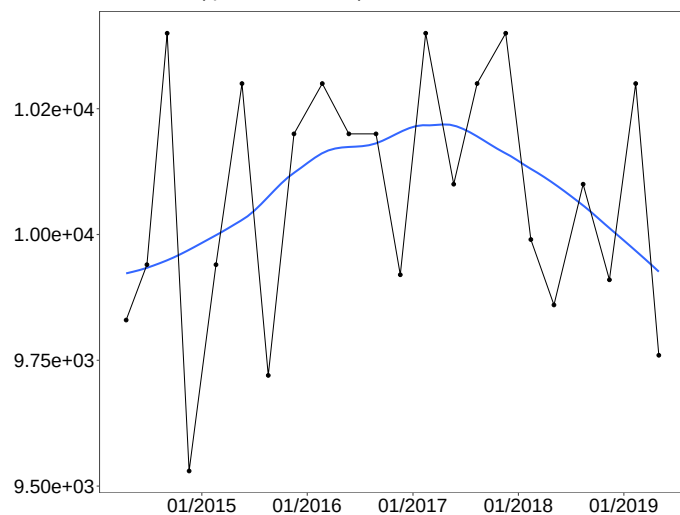
WSMB2S – Carbonate
 $\tau = -0.549$ | p-value = 0.00241 | Negative trend



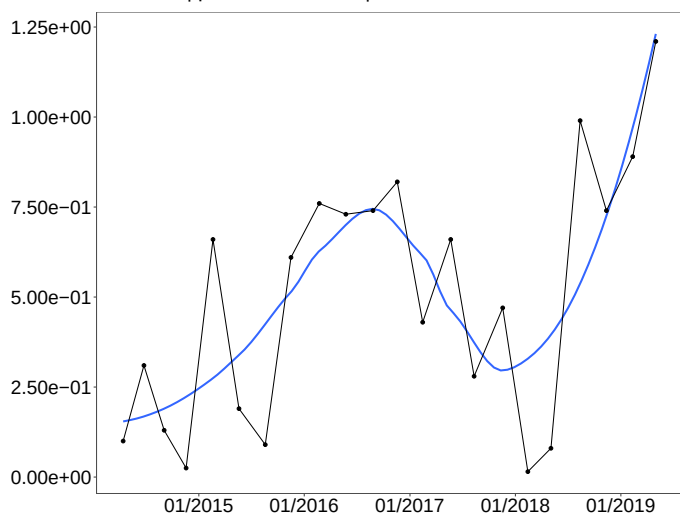
WSMB2S – Chloride
 $\tau = -0.429$ | $p\text{-value} = 0.00612$ | Negative trend



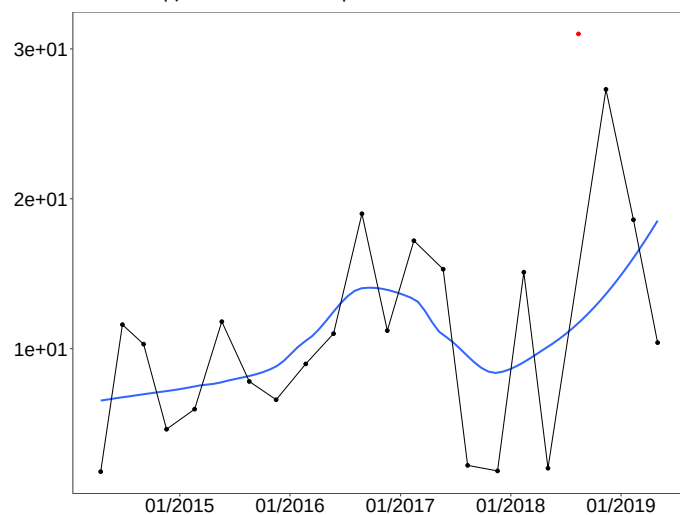
WSMB2S – Electrical Conductivity
 $\tau = 0.0223$ | $p\text{-value} = 0.91$ | No trend



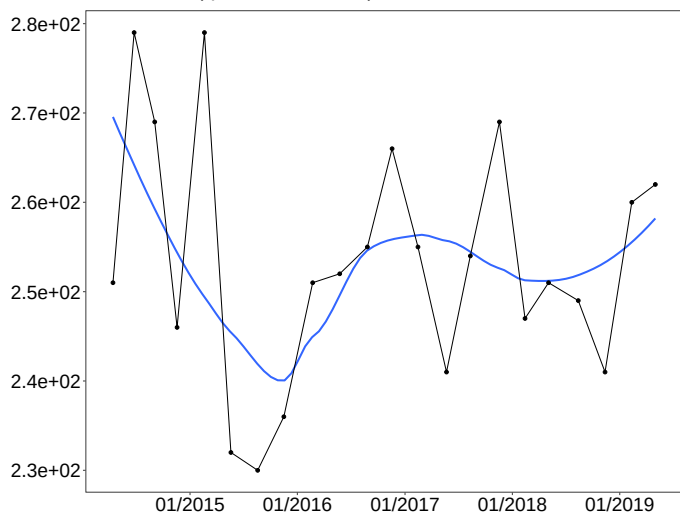
WSMB2S – Iron (d.)
 $\tau = 0.343$ | $p\text{-value} = 0.0277$ | Positive trend



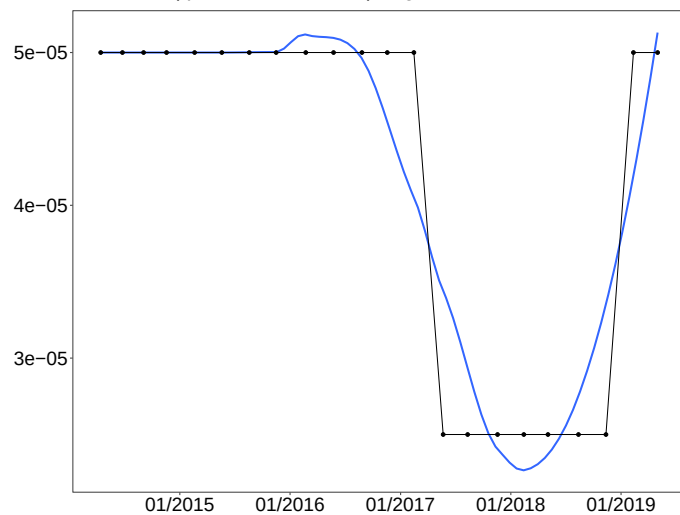
WSMB2S – Iron (t.)
 $\tau = 0.281$ | $p\text{-value} = 0.0711$ | No trend



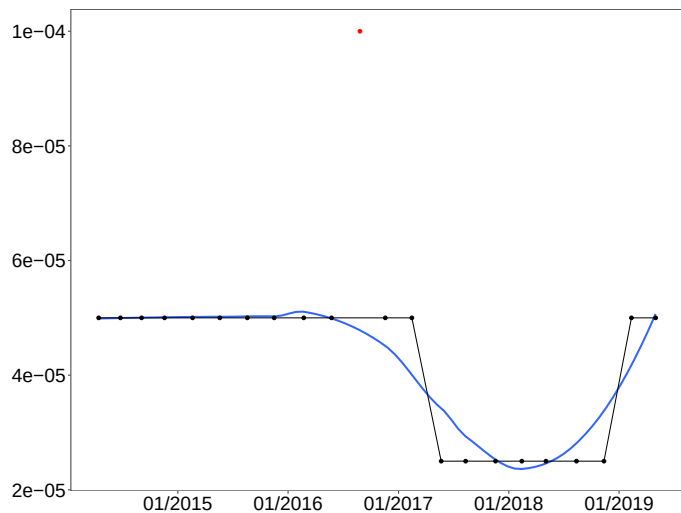
WSMB2S – Magnesium
 $\tau = 0.00879$ | $p\text{-value} = 0.977$ | No trend



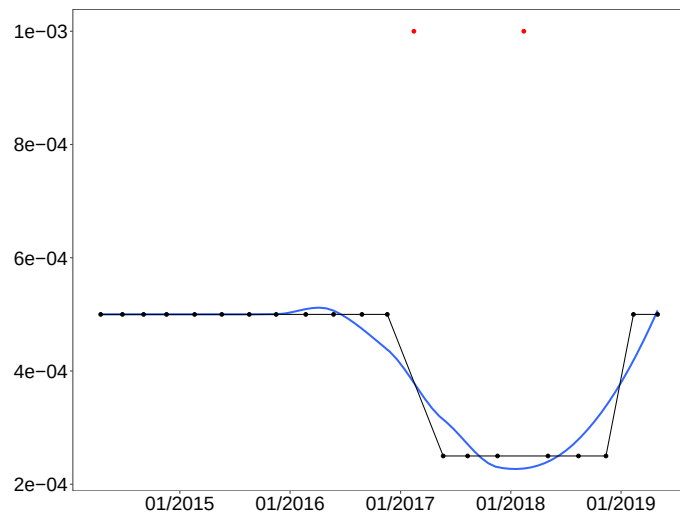
WSMB2S – Mercury (d.)
 $\tau = -0.494$ | $p\text{-value} = 0.00739$ | Negative trend



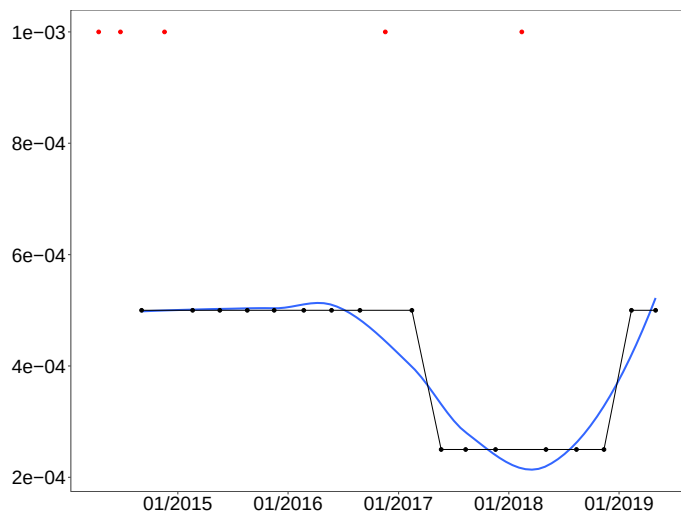
WSMB2S – Mercury (t.)
 $\tau = -0.428$ | p-value = 0.0183 | Negative trend



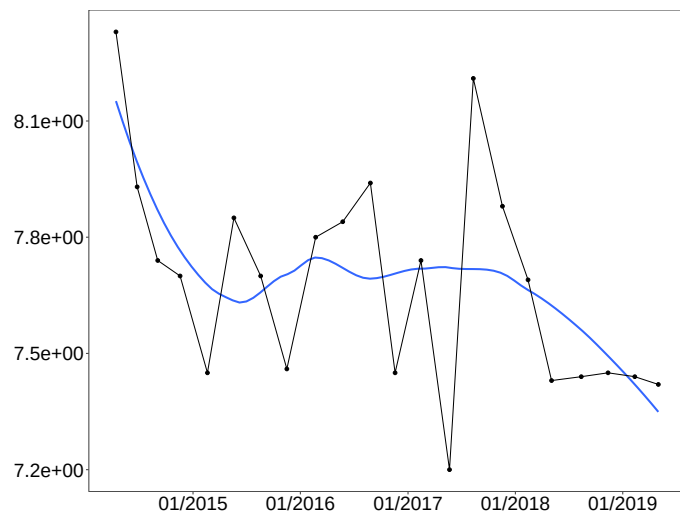
WSMB2S – Molybdenum (d.)
 $\tau = -0.272$ | p-value = 0.132 | No trend



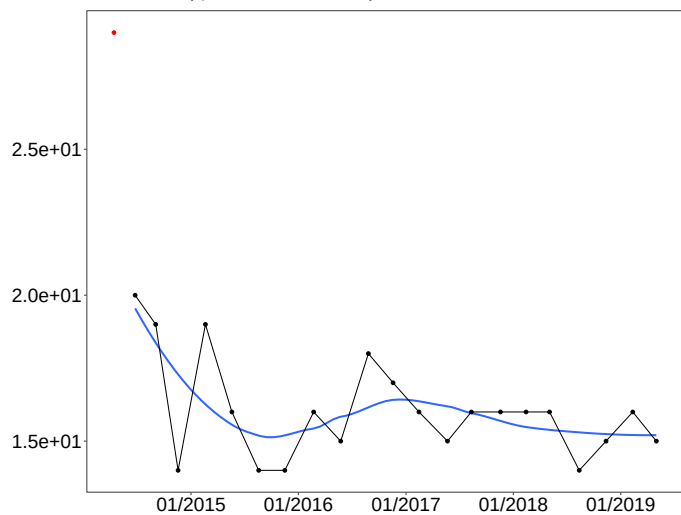
WSMB2S – Molybdenum (t.)
 $\tau = -0.455$ | p-value = 0.00945 | Negative trend



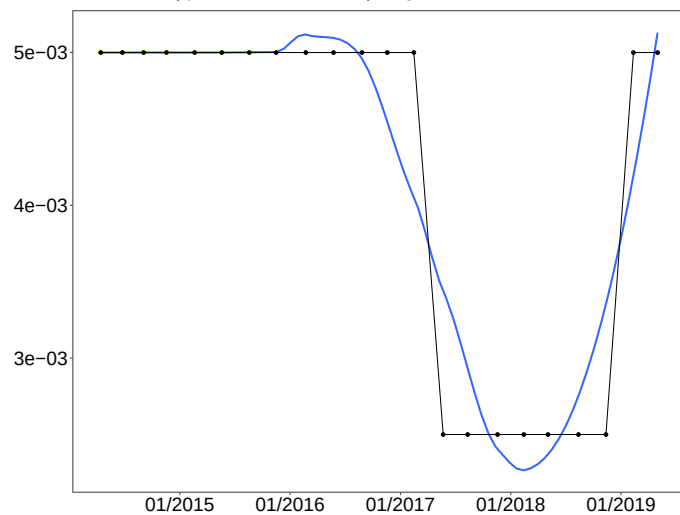
WSMB2S – pH
 $\tau = -0.399$ | p-value = 0.0109 | Negative trend



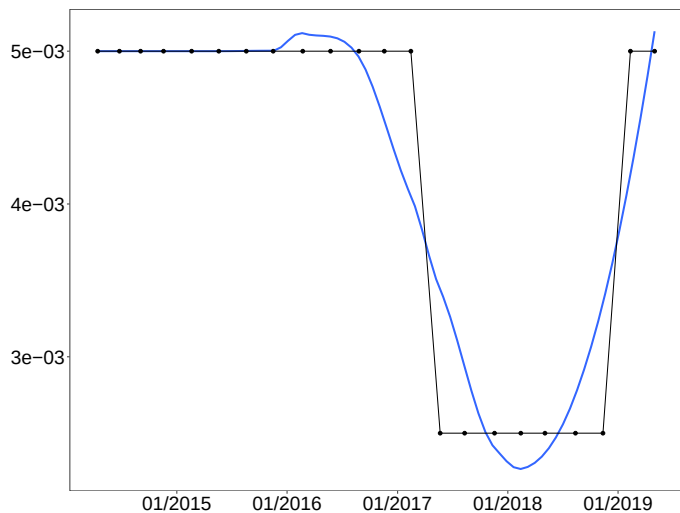
WSMB2S – Potassium
 $\tau = -0.315$ | p-value = 0.0578 | No trend



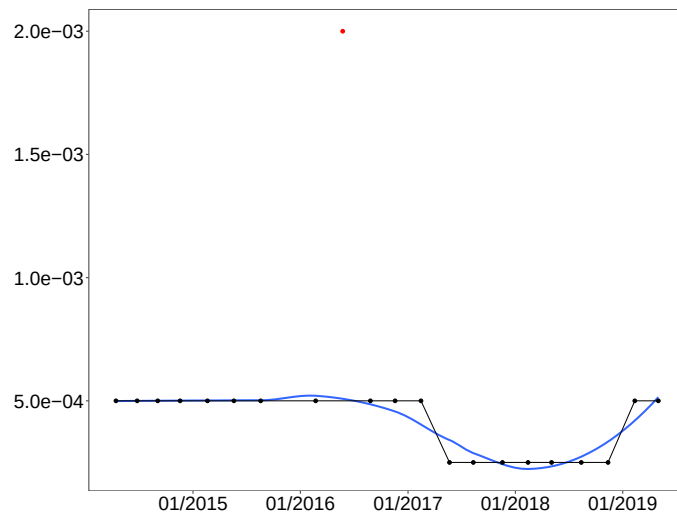
WSMB2S – Selenium (d.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



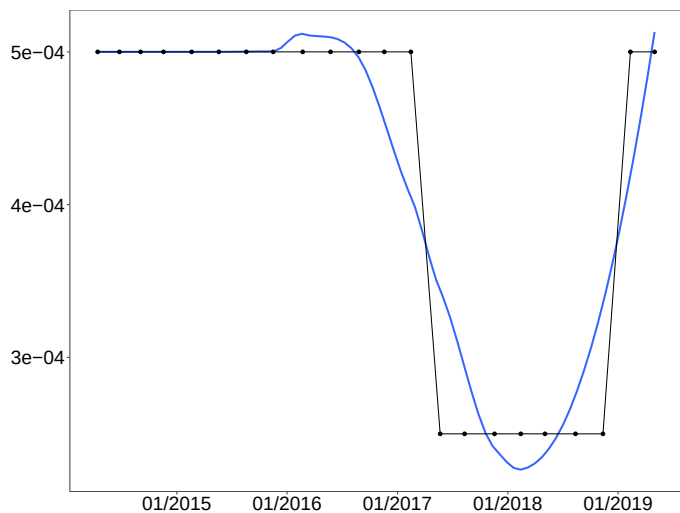
WSMB2S – Selenium (t.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



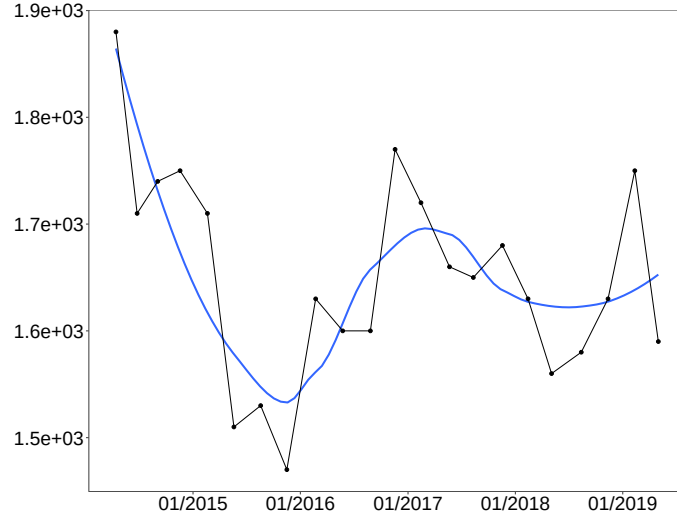
WSMB2S – Silver (d.)
 $\tau = -0.439$ | p-value = 0.0184 | Negative trend



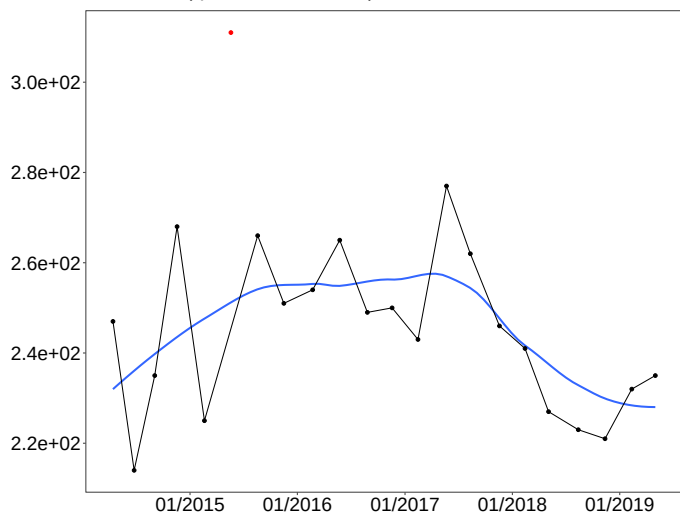
WSMB2S – Silver (t.)
 $\tau = -0.494$ | p-value = 0.00739 | Negative trend



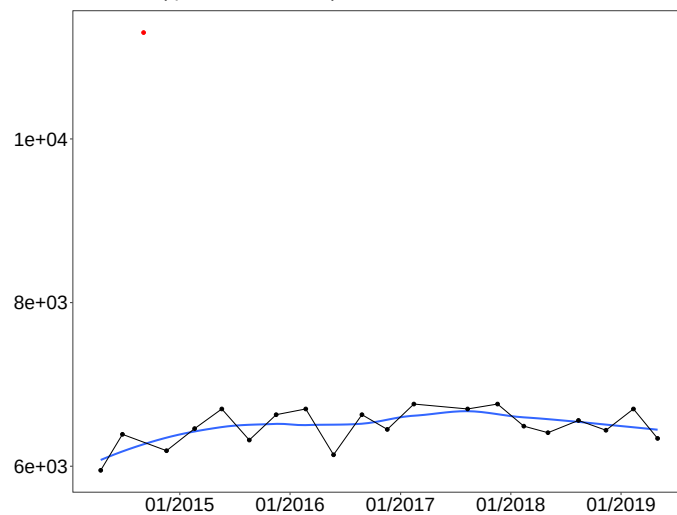
WSMB2S – Sodium
 $\tau = -0.18$ | p-value = 0.258 | No trend



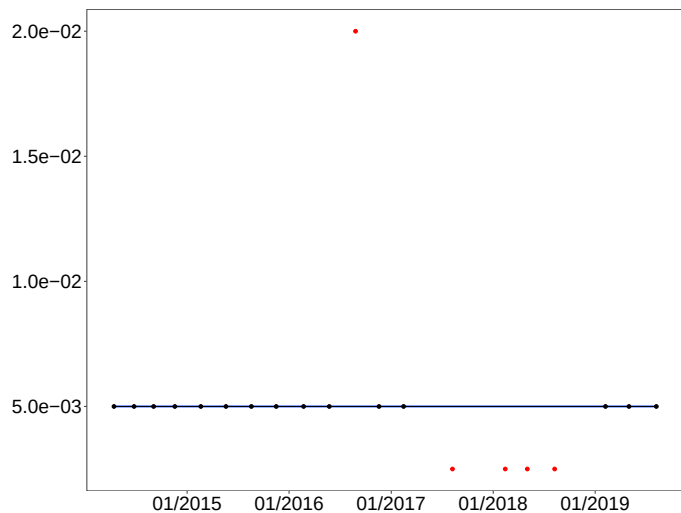
WSMB2S – Sulphate
 $\tau = -0.269$ | p-value = 0.0853 | No trend



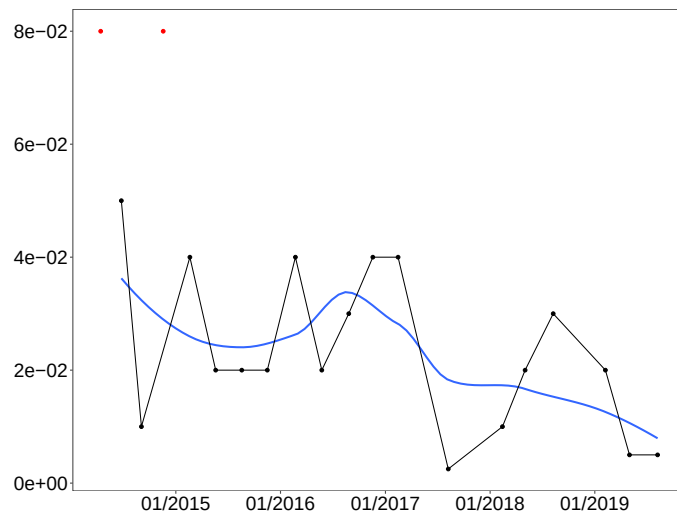
WSMB2S – TDS
 $\tau = 0.107$ | p-value = 0.524 | No trend



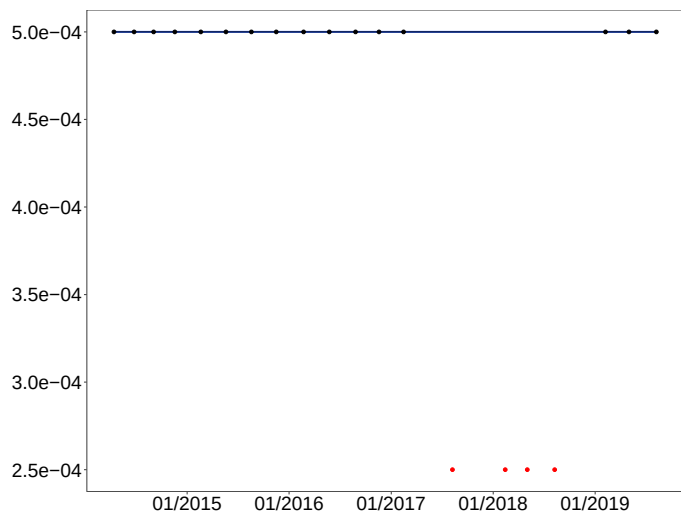
WSMB3D – Aluminium (d.)
 $\tau = -0.286$ | p-value = 0.141 | No trend



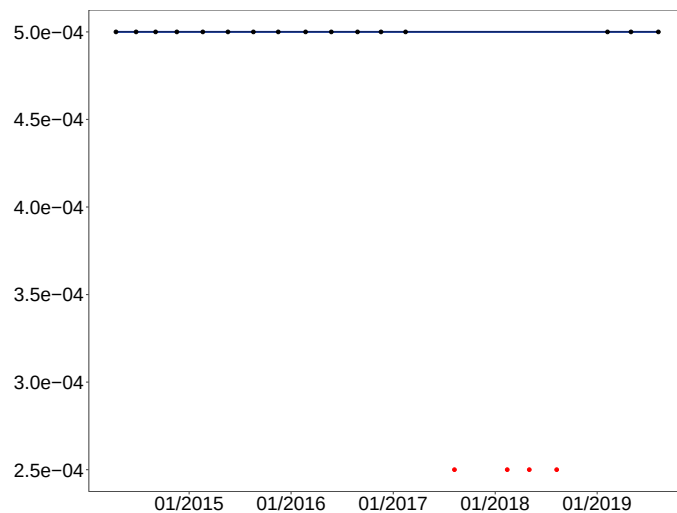
WSMB3D – Aluminium (t.)
 $\tau = -0.424$ | p-value = 0.0141 | Negative trend



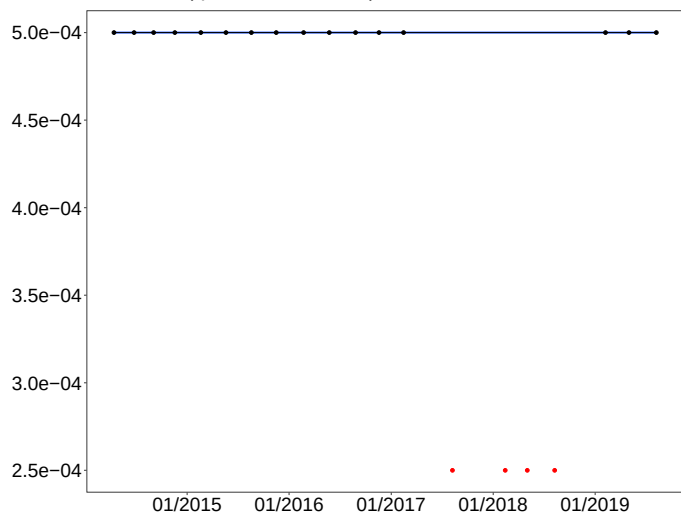
WSMB3D – Antimony (d.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



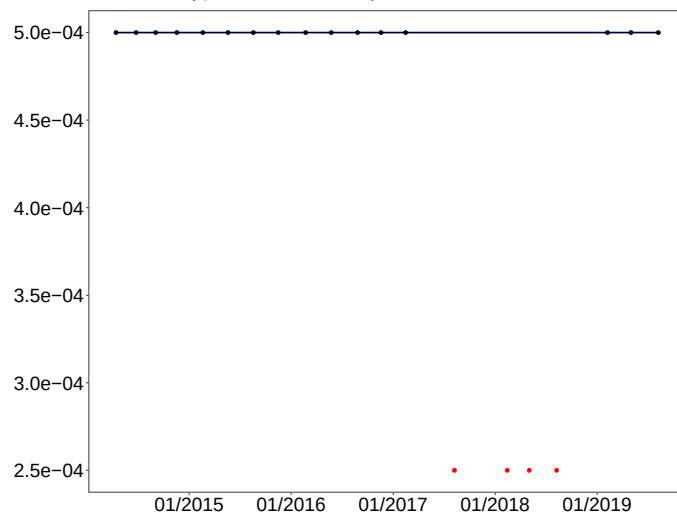
WSMB3D – Antimony (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



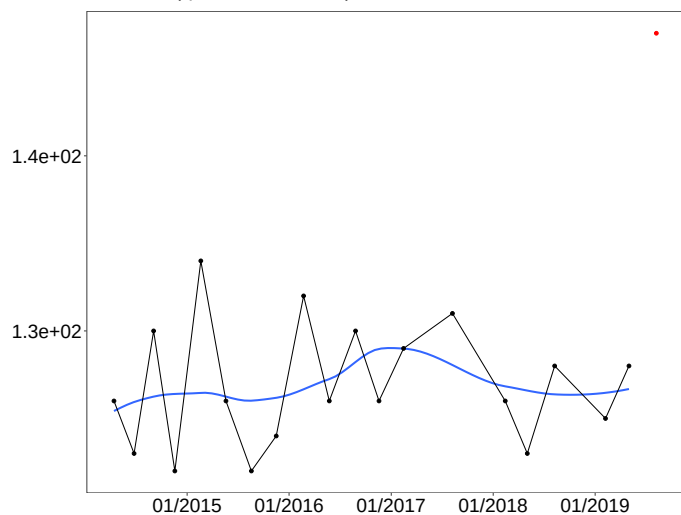
WSMB3D – Arsenic (d.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



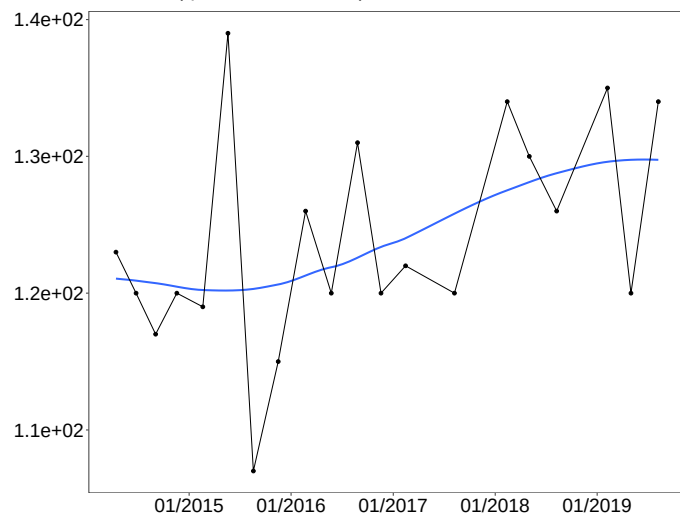
WSMB3D – Arsenic (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



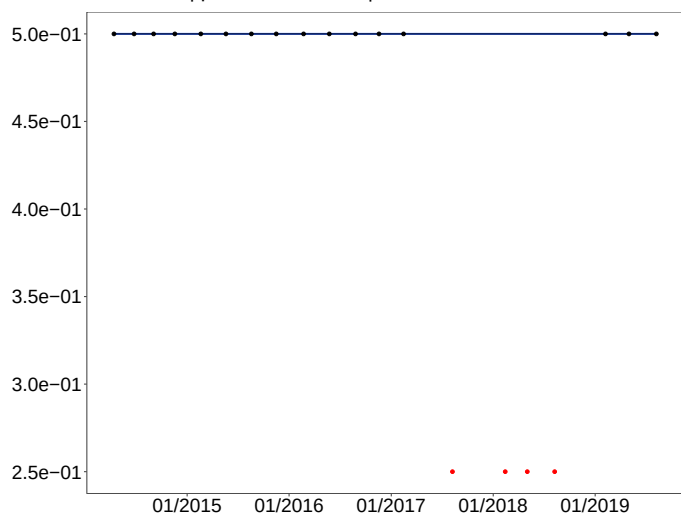
WSMB3D – Bicarbonate
 $\tau = 0.164$ | p-value = 0.341 | No trend



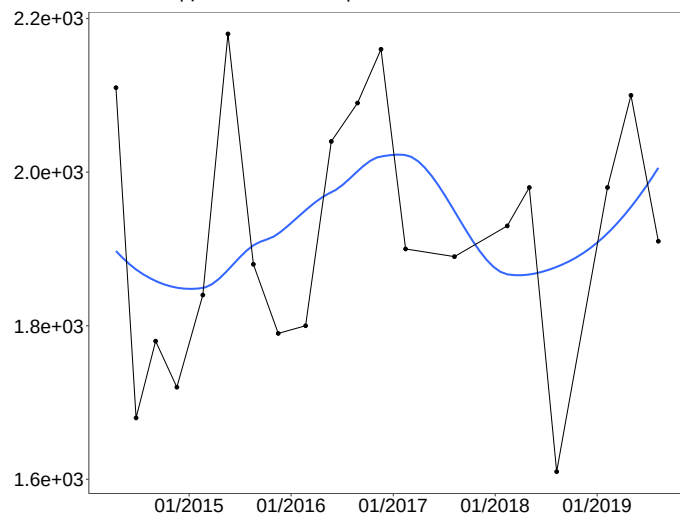
WSMB3D – Calcium
 $\tau = 0.325$ | p-value = 0.0558 | No trend



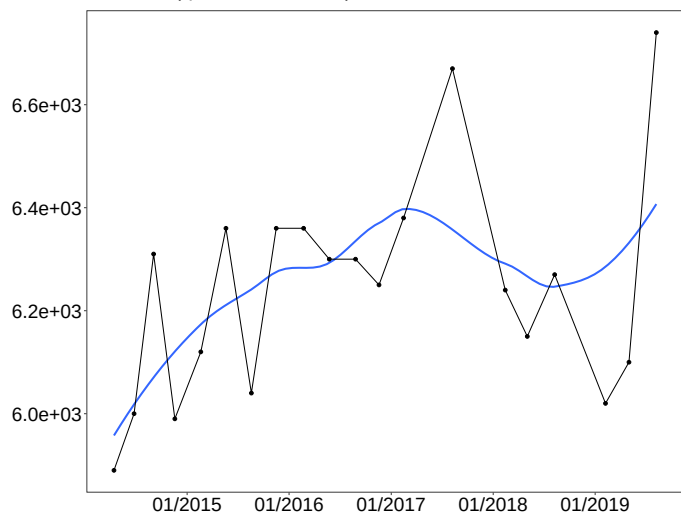
WSMB3D – Carbonate
 $\tau = -0.363$ | p-value = 0.0654 | No trend



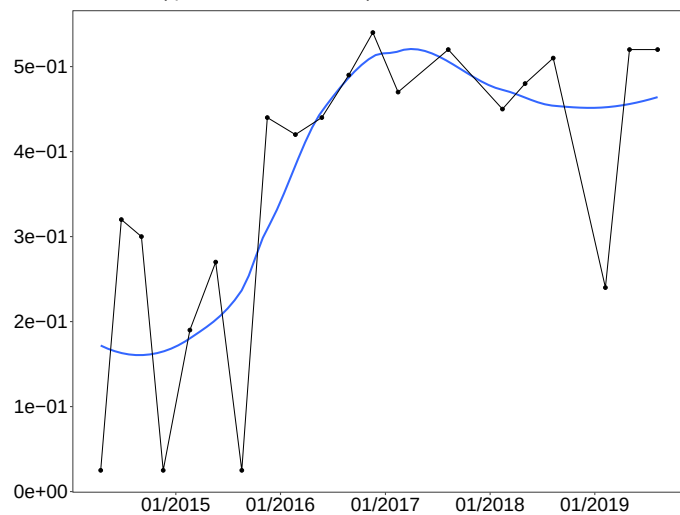
WSMB3D – Chloride
 $\tau = 0.216$ | p-value = 0.194 | No trend



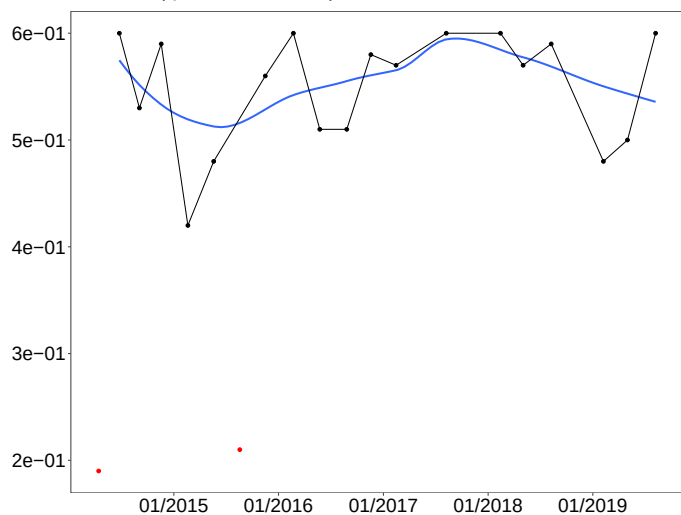
WSMB3D – Electrical Conductivity
 $\tau = 0.202$ | p-value = 0.229 | No trend



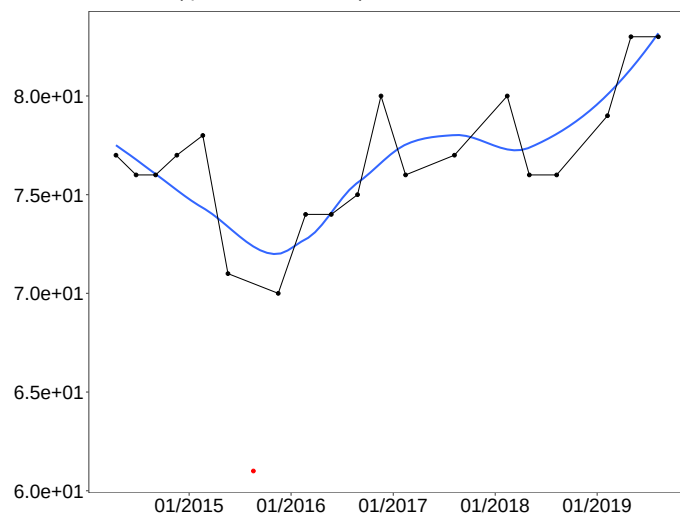
WSMB3D – Iron (d.)
 $\tau = 0.563$ | p-value = 0.000701 | Positive trend



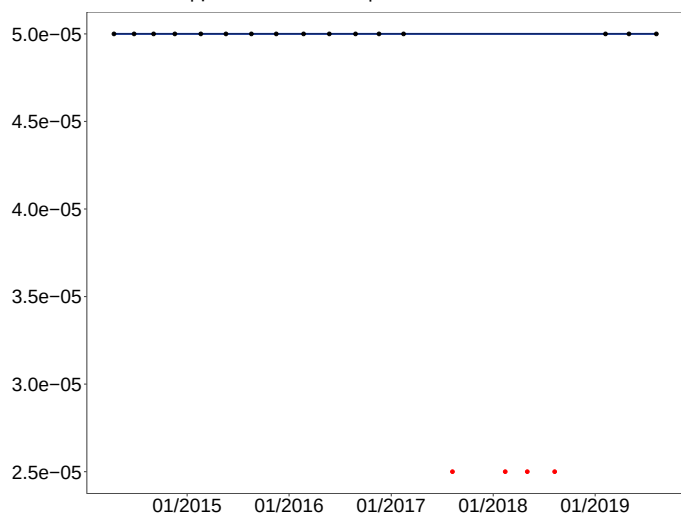
WSMB3D – Iron (t.)
 $\tau = 0.219$ | p-value = 0.201 | No trend



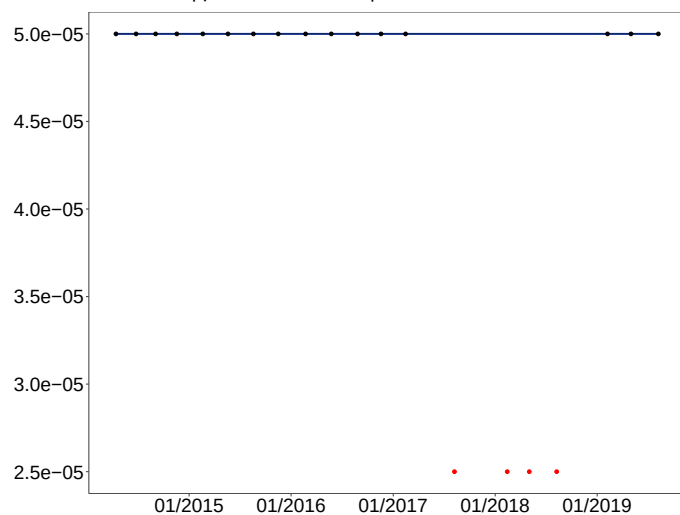
WSMB3D – Magnesium
 $\tau = 0.363$ | p-value = 0.0327 | Positive trend



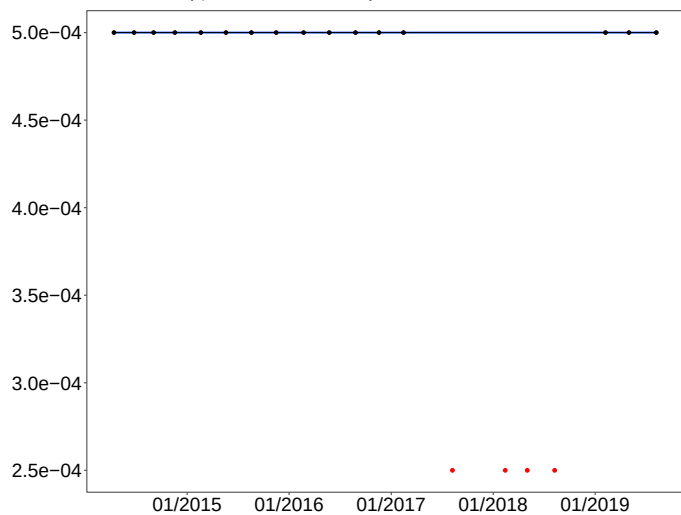
WSMB3D – Mercury (d.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



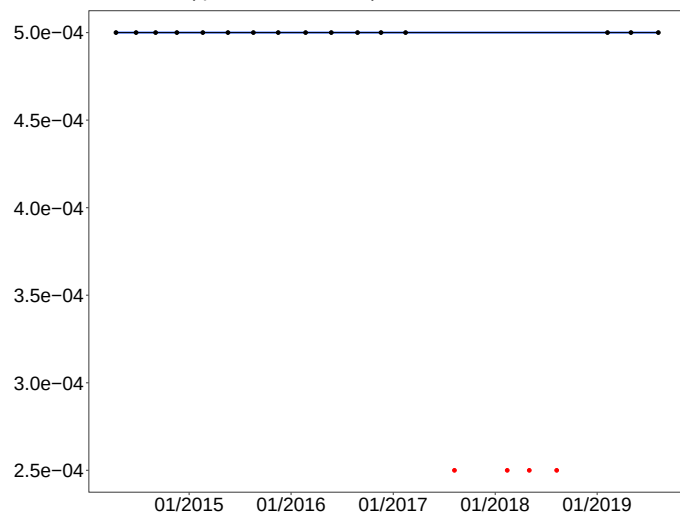
WSMB3D – Mercury (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



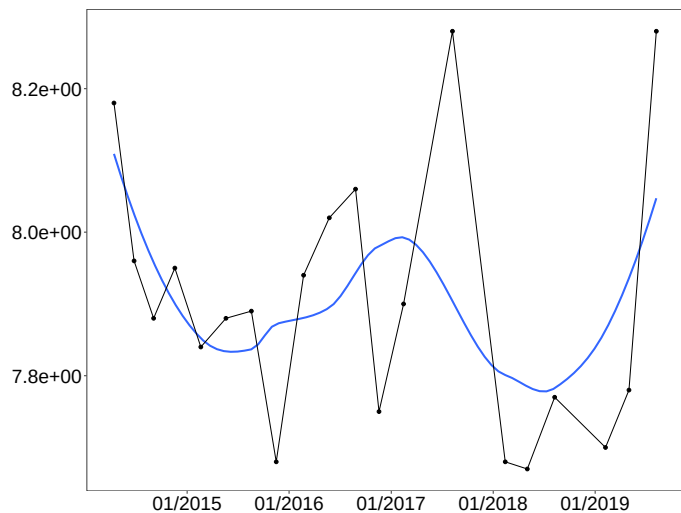
WSMB3D – Molybdenum (d.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



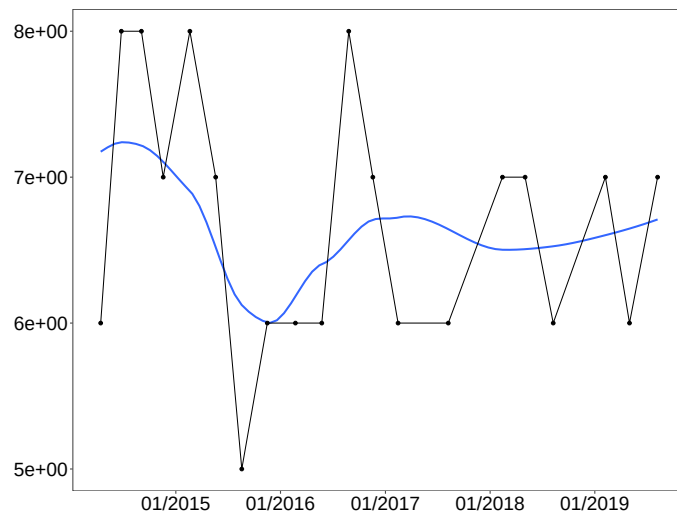
WSMB3D – Molybdenum (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



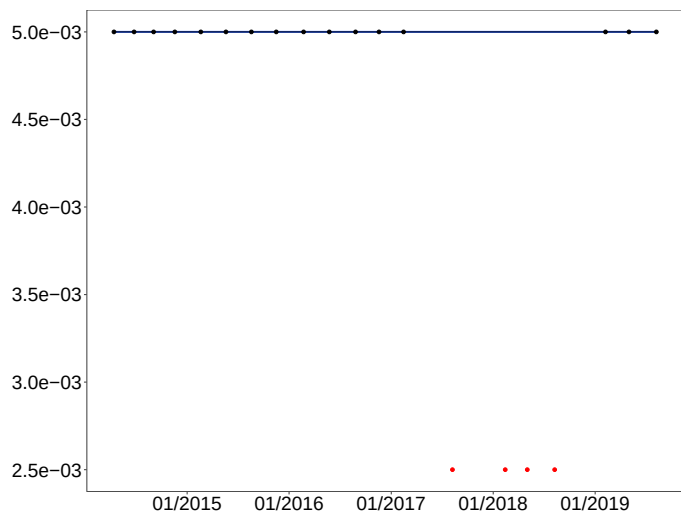
WSMB3D – pH
 $\tau = -0.164$ | p-value = 0.33 | No trend



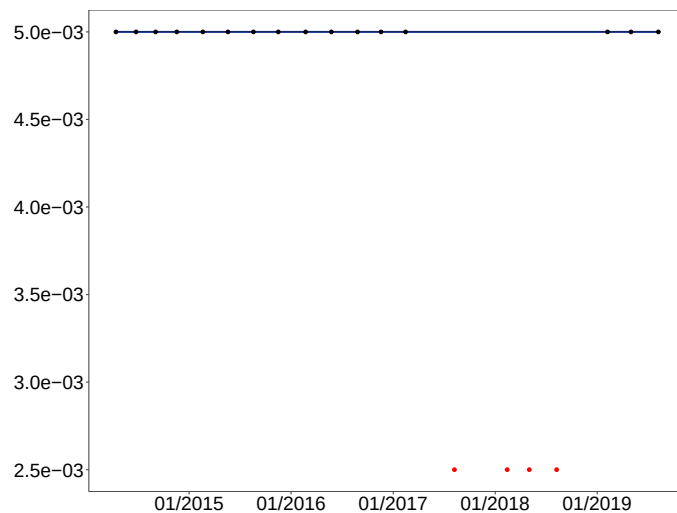
WSMB3D – Potassium
 $\tau = -0.144$ | p-value = 0.446 | No trend



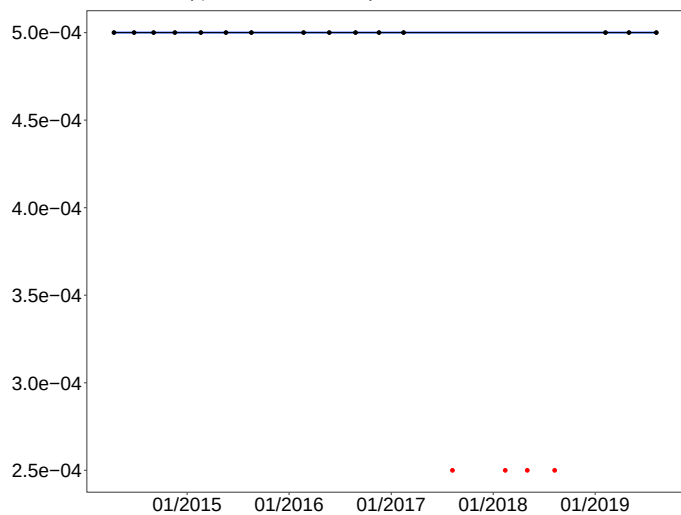
WSMB3D – Selenium (d.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



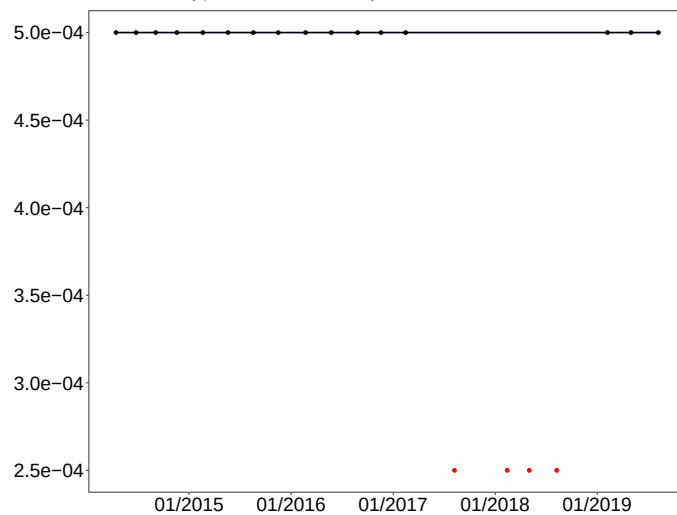
WSMB3D – Selenium (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



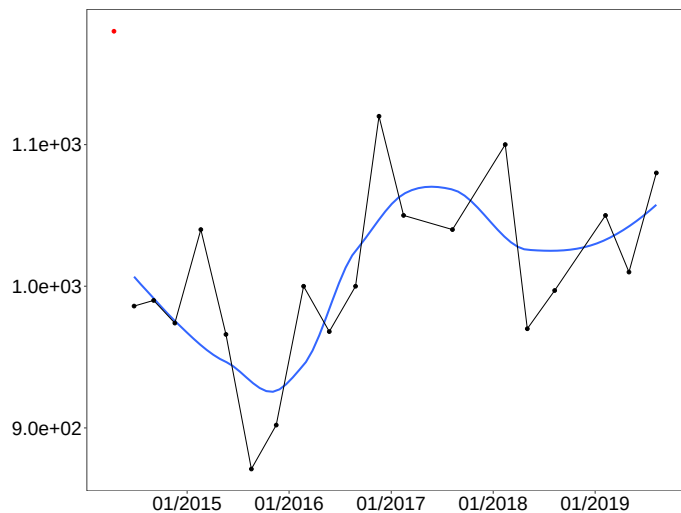
WSMB3D – Silver (d.)
 $\tau = -0.355$ | p-value = 0.0801 | No trend



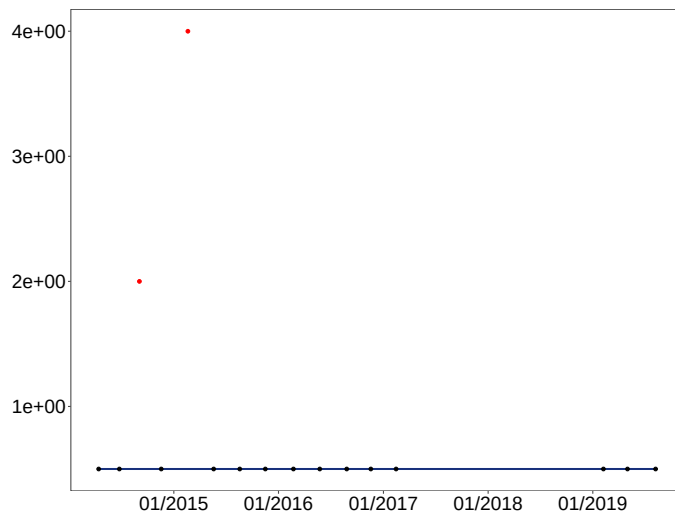
WSMB3D – Silver (t.)
 $\tau = -0.363$ | p-value = 0.0654 | No trend



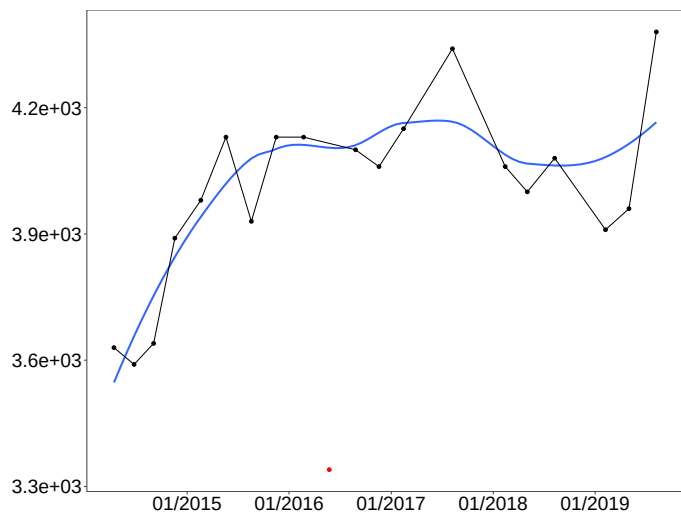
WSMB3D – Sodium
 $\tau = 0.218$ | p-value = 0.194 | No trend



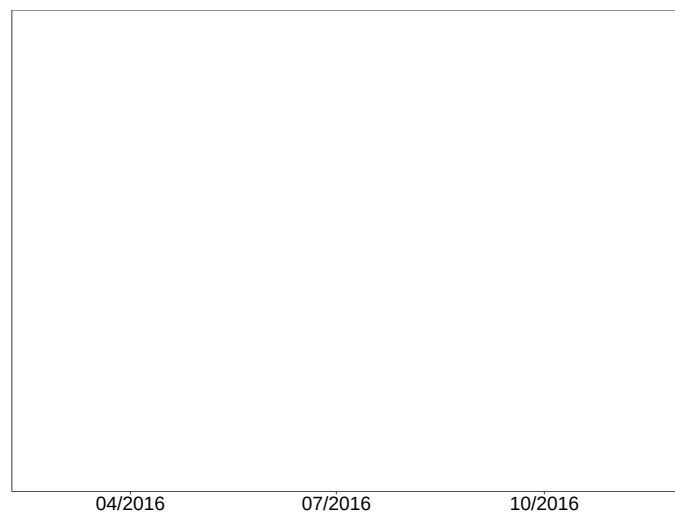
WSMB3D – Sulphate
 $\tau = -0.288$ | p-value = 0.205 | No trend



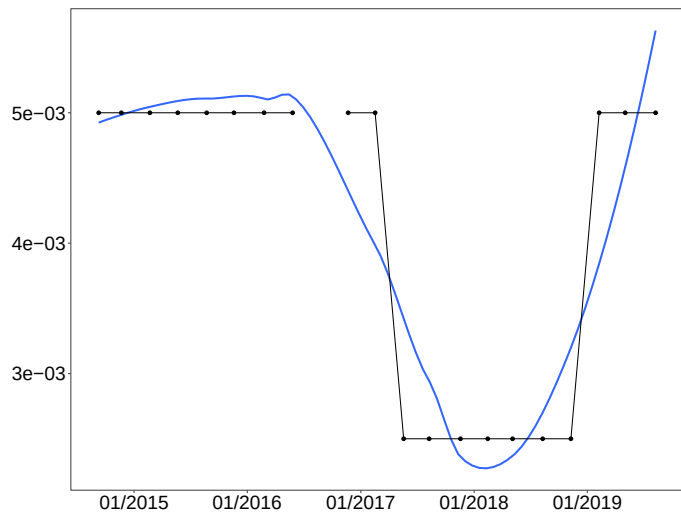
WSMB3D – TDS
 $\tau = 0.33$ | p-value = 0.0473 | Positive trend



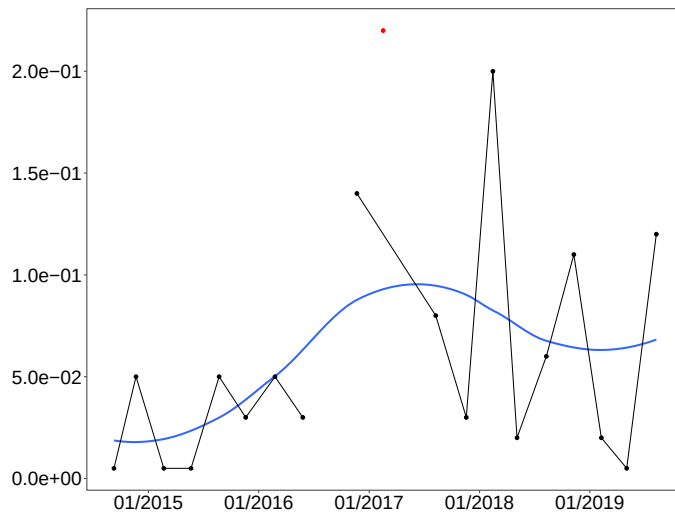
WSMB3S – Silver (d.)
 τ = Not enough data | p-value = Not enough data | Not evaluated



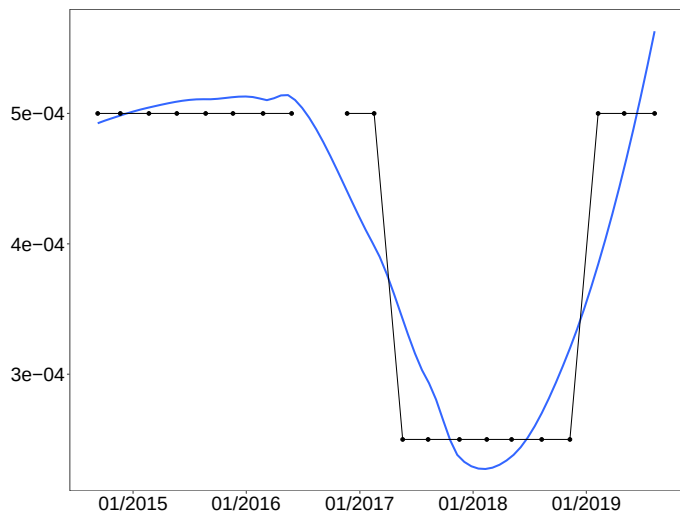
Yongala Bore – Aluminium (d.)
 $\tau = -0.373$ | p-value = 0.0572 | No trend



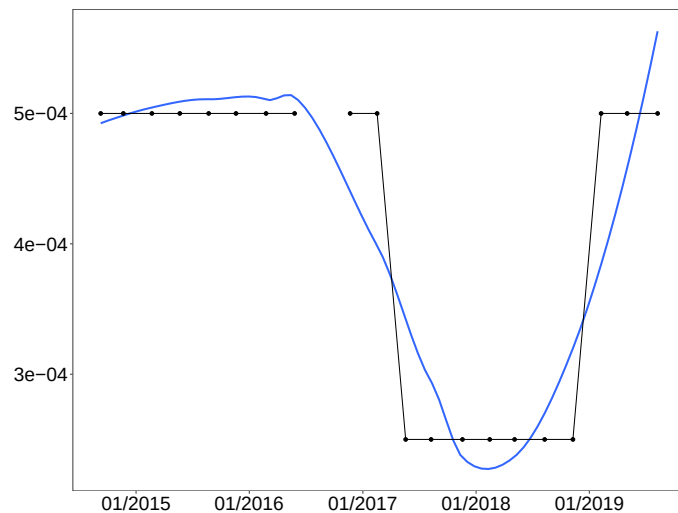
Yongala Bore – Aluminium (t.)
 $\tau = 0.207$ | p-value = 0.243 | No trend



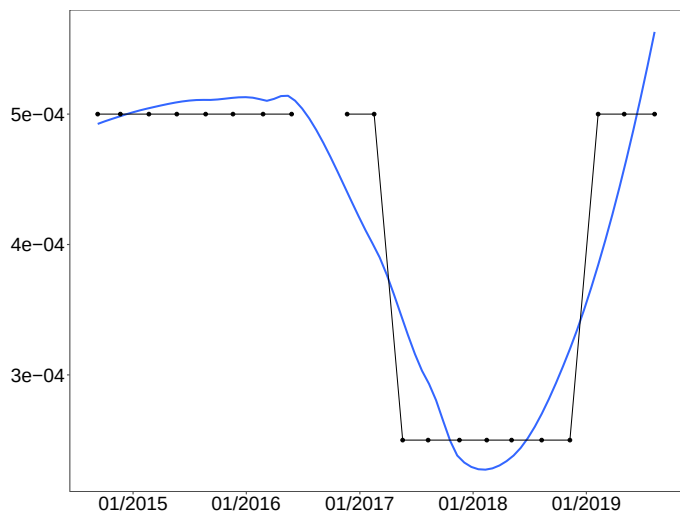
Yongala Bore – Antimony (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

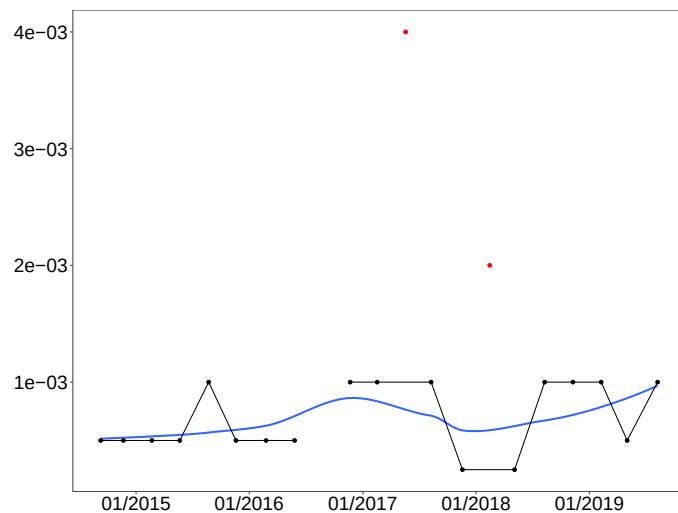
Yongala Bore – Antimony (t.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

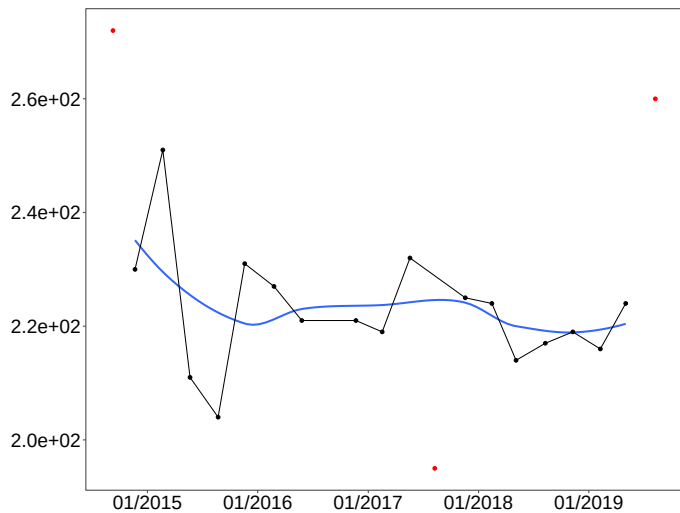
Yongala Bore – Arsenic (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

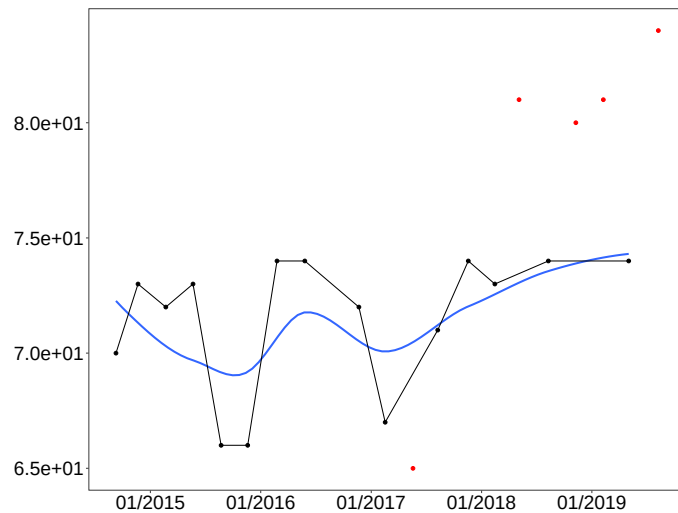
Yongala Bore – Arsenic (t.)

 $\tau = 0.245$ | p-value = 0.184 | No trend

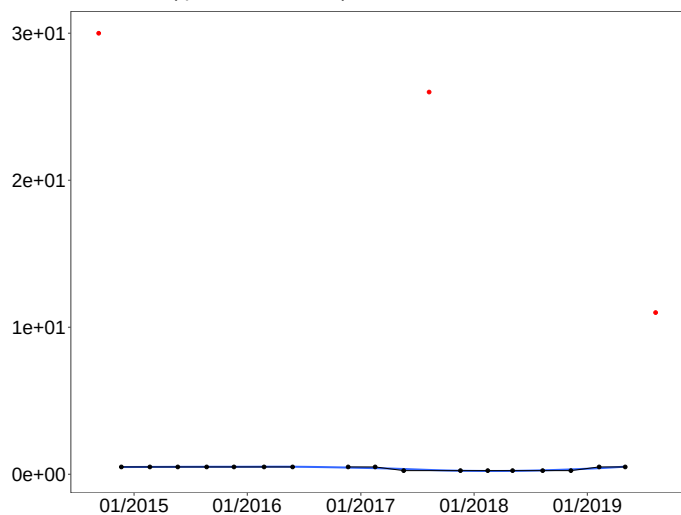
Yongala Bore – Bicarbonate

 $\tau = -0.186$ | p-value = 0.269 | No trend

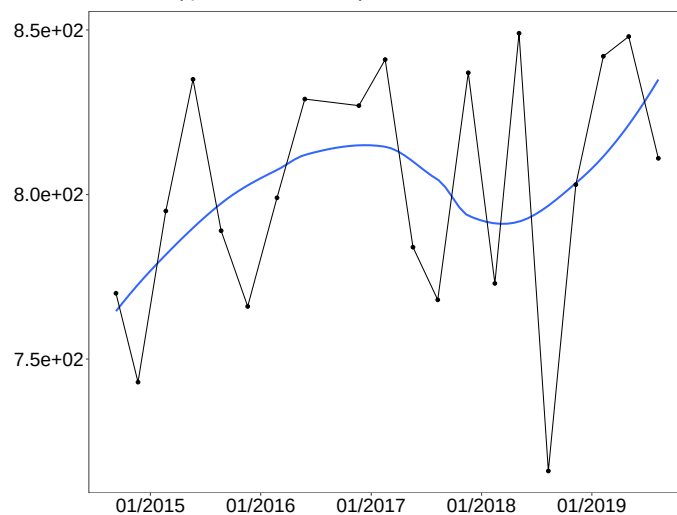
Yongala Bore – Calcium

 $\tau = 0.473$ | p-value = 0.00523 | Positive trend

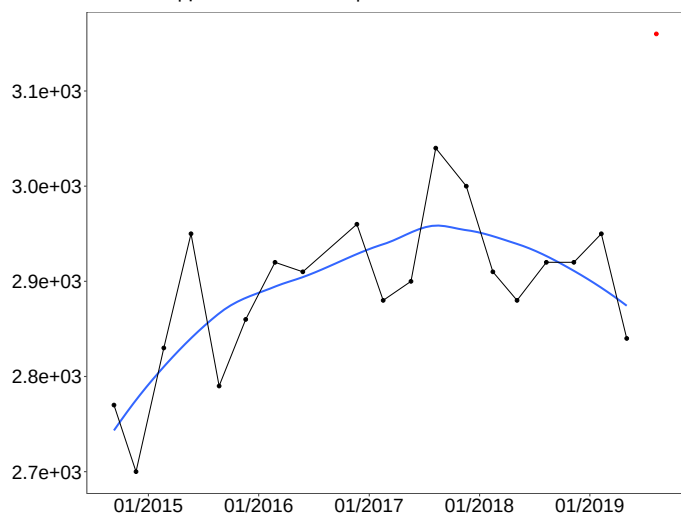
Yongala Bore – Carbonate
 $\tau = -0.278$ | p-value = 0.136 | No trend



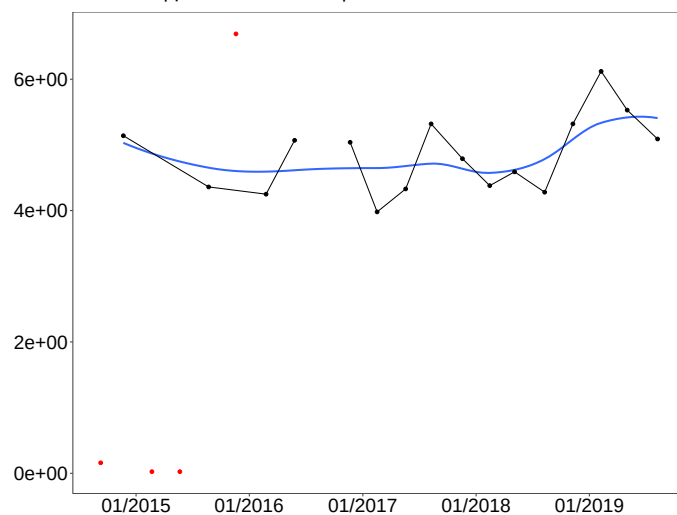
Yongala Bore – Chloride
 $\tau = 0.284$ | p-value = 0.0855 | No trend



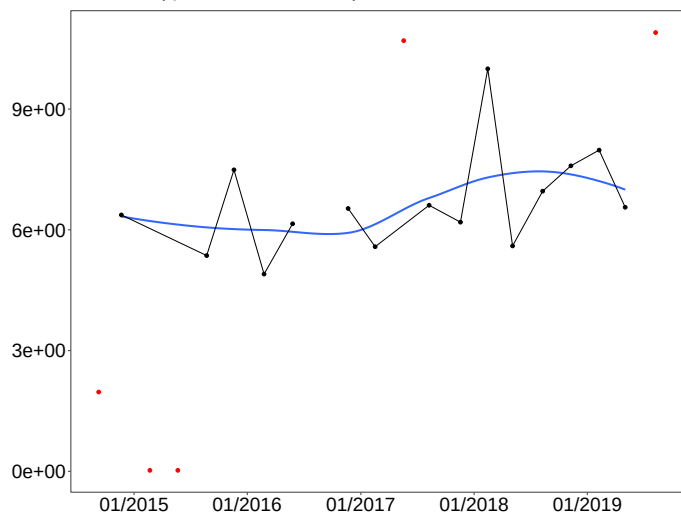
Yongala Bore – Electrical Conductivity
 $\tau = 0.406$ | p-value = 0.0146 | Positive trend



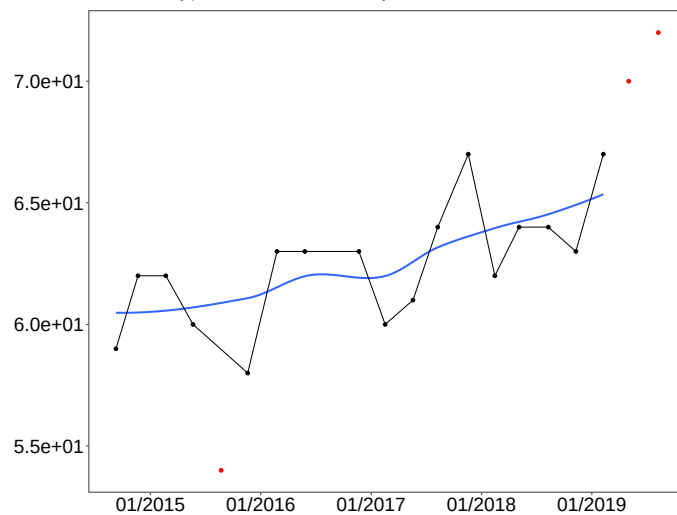
Yongala Bore – Iron (d.)
 $\tau = 0.339$ | p-value = 0.0407 | Positive trend



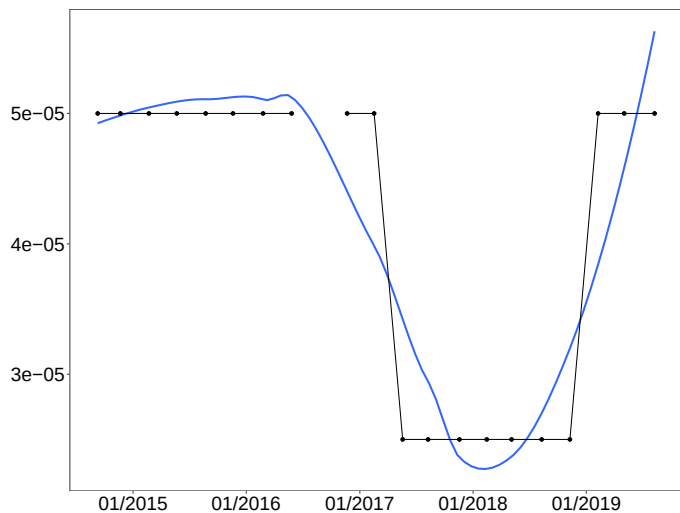
Yongala Bore – Iron (t.)
 $\tau = 0.522$ | p-value = 0.00147 | Positive trend



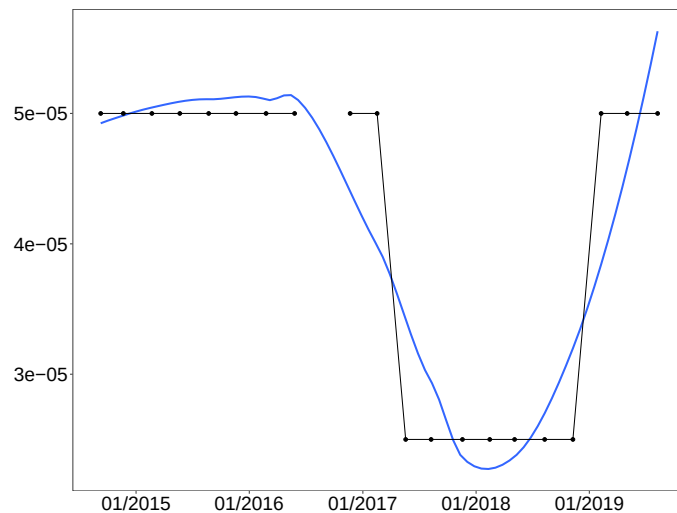
Yongala Bore – Magnesium
 $\tau = 0.623$ | p-value = 0.000214 | Positive trend



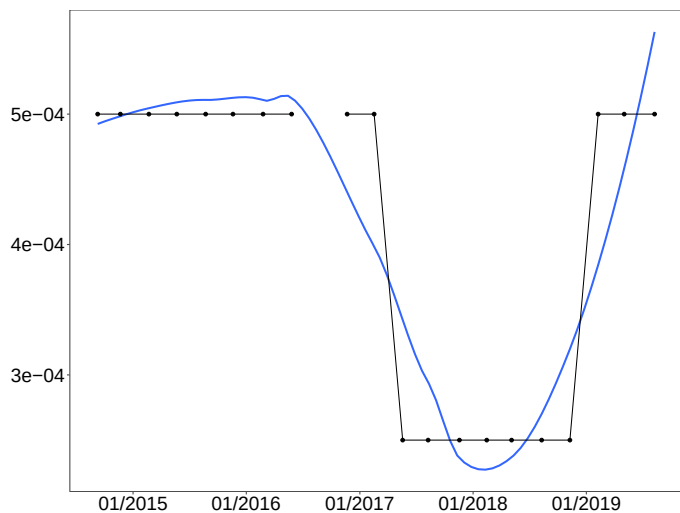
Yongala Bore – Mercury (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

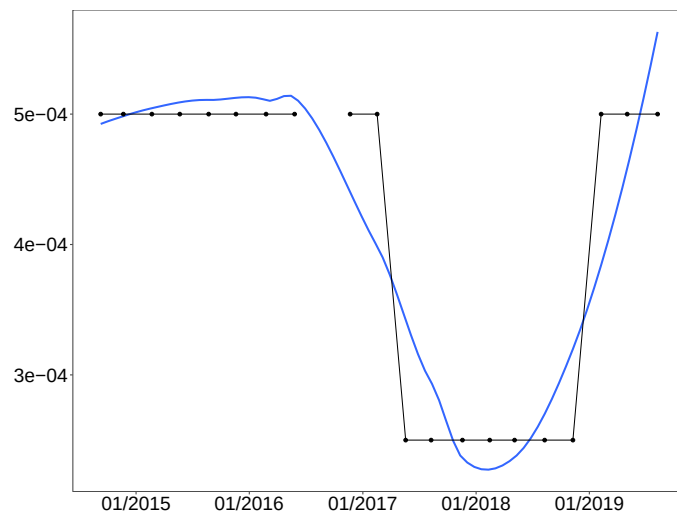
Yongala Bore – Mercury (t.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

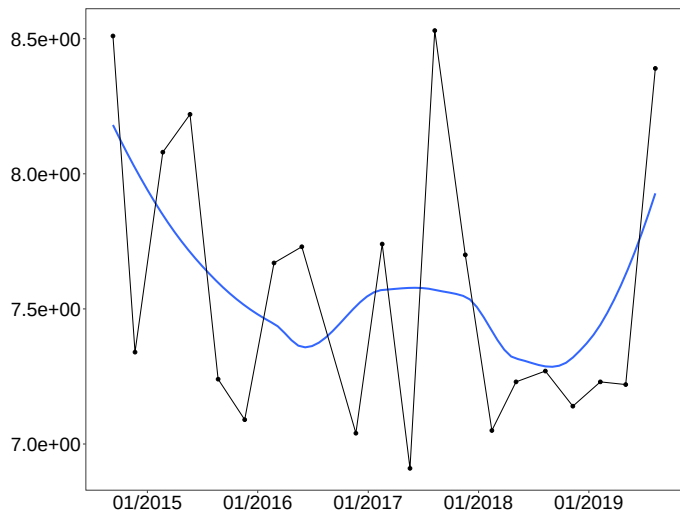
Yongala Bore – Molybdenum (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

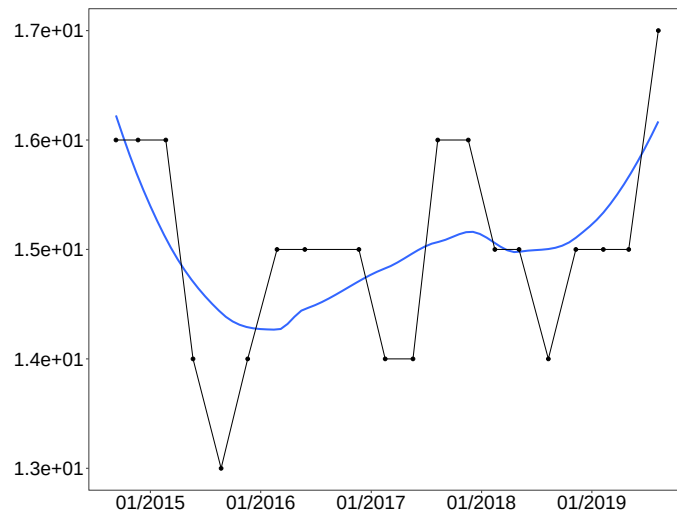
Yongala Bore – Molybdenum (t.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

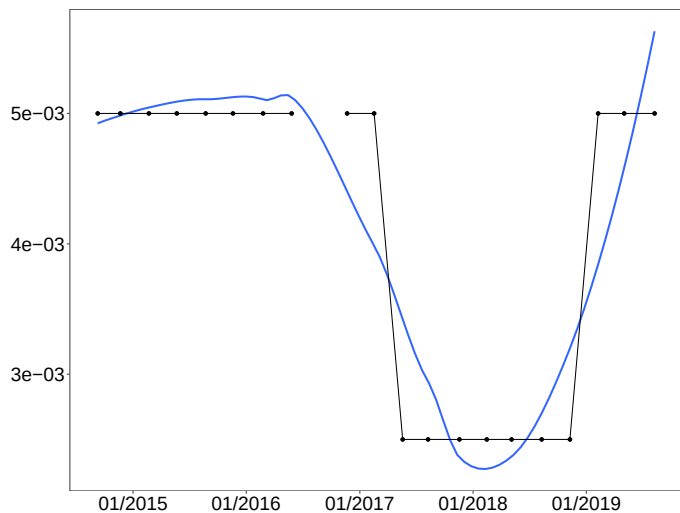
Yongala Bore – pH

 $\tau = -0.195$ | p-value = 0.243 | No trend

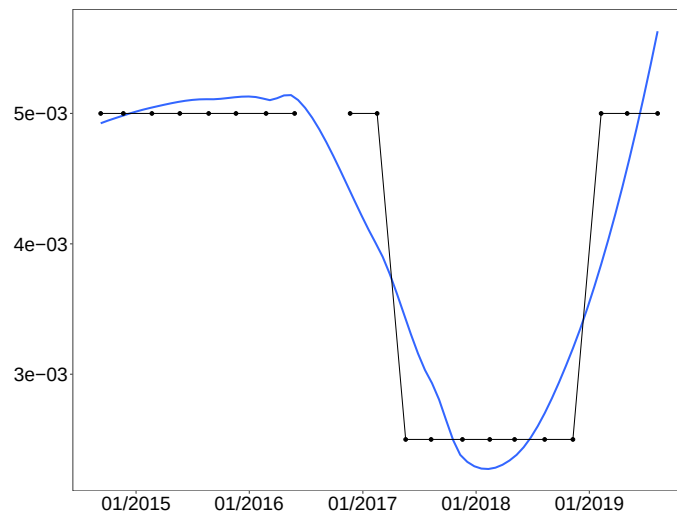
Yongala Bore – Potassium

 $\tau = 0.0609$ | p-value = 0.758 | No trend

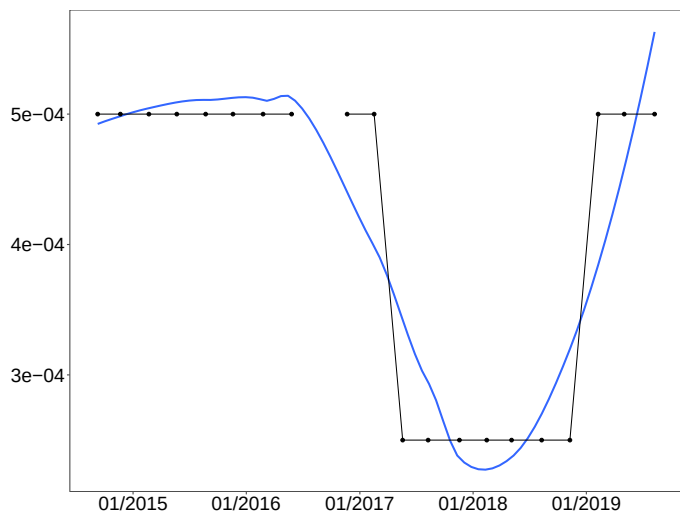
Yongala Bore – Selenium (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

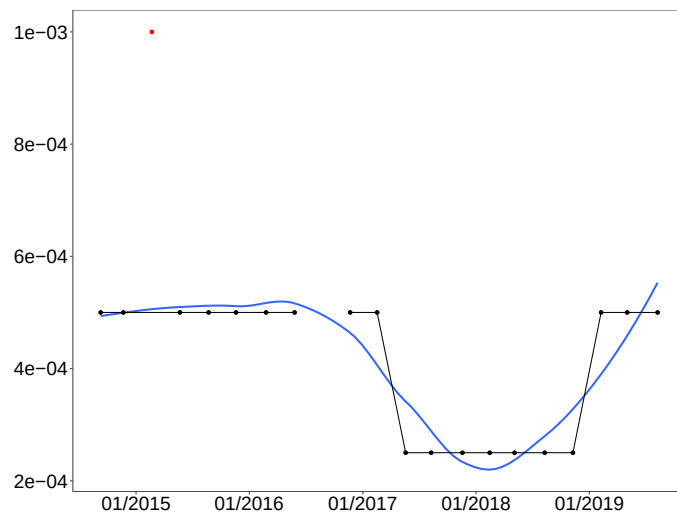
Yongala Bore – Selenium (t.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

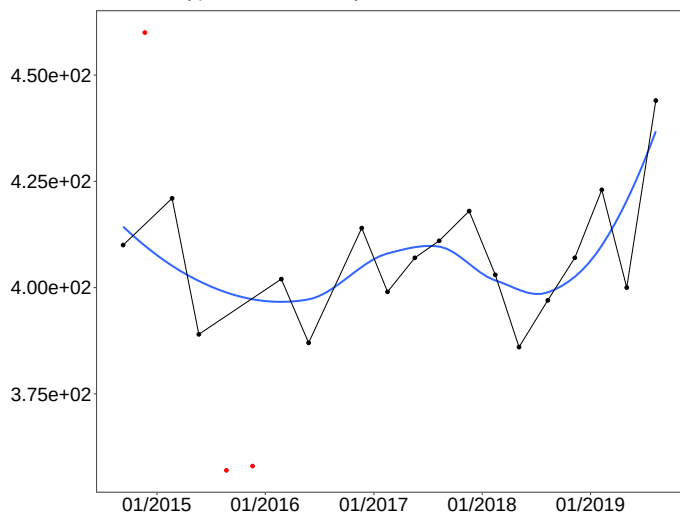
Yongala Bore – Silver (d.)

 $\tau = -0.373$ | p-value = 0.0572 | No trend

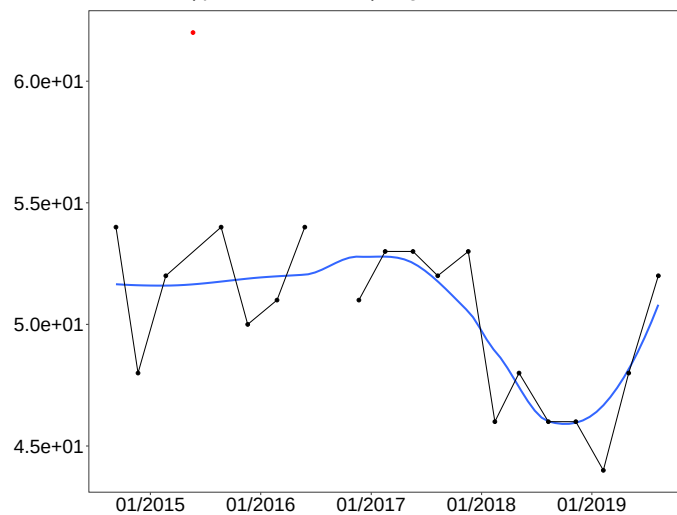
Yongala Bore – Silver (t.)

 $\tau = -0.407$ | p-value = 0.0334 | Negative trend

Yongala Bore – Sodium

 $\tau = 0.111$ | p-value = 0.516 | No trend

Yongala Bore – Sulphate

 $\tau = -0.407$ | p-value = 0.0167 | Negative trend

APPENDIX F

Hydrographs

Figure F-1 Hydrograph for EC01 and EC03 showing baseline water levels and CRD

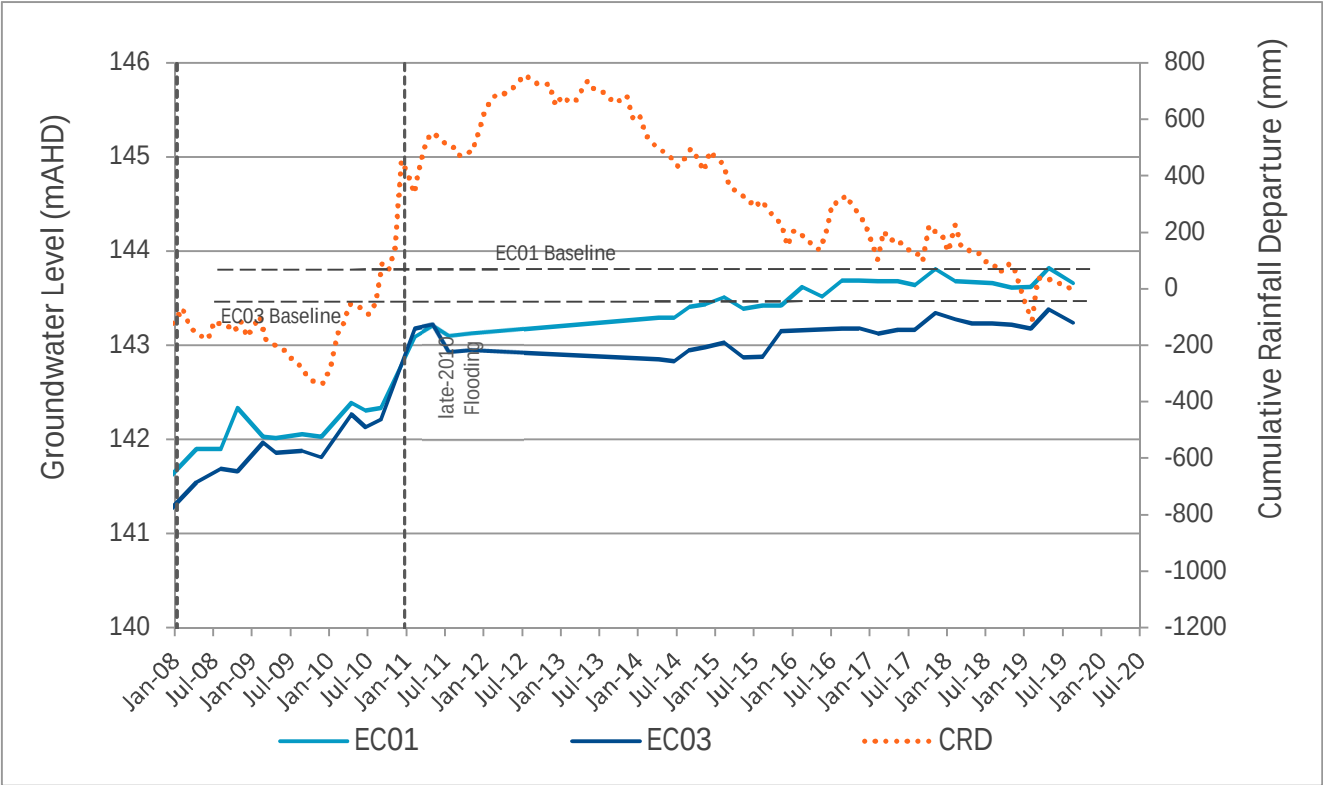


Figure F-2 Hydrograph for EC07, EC09A and EC11 showing baseline water levels and CRD

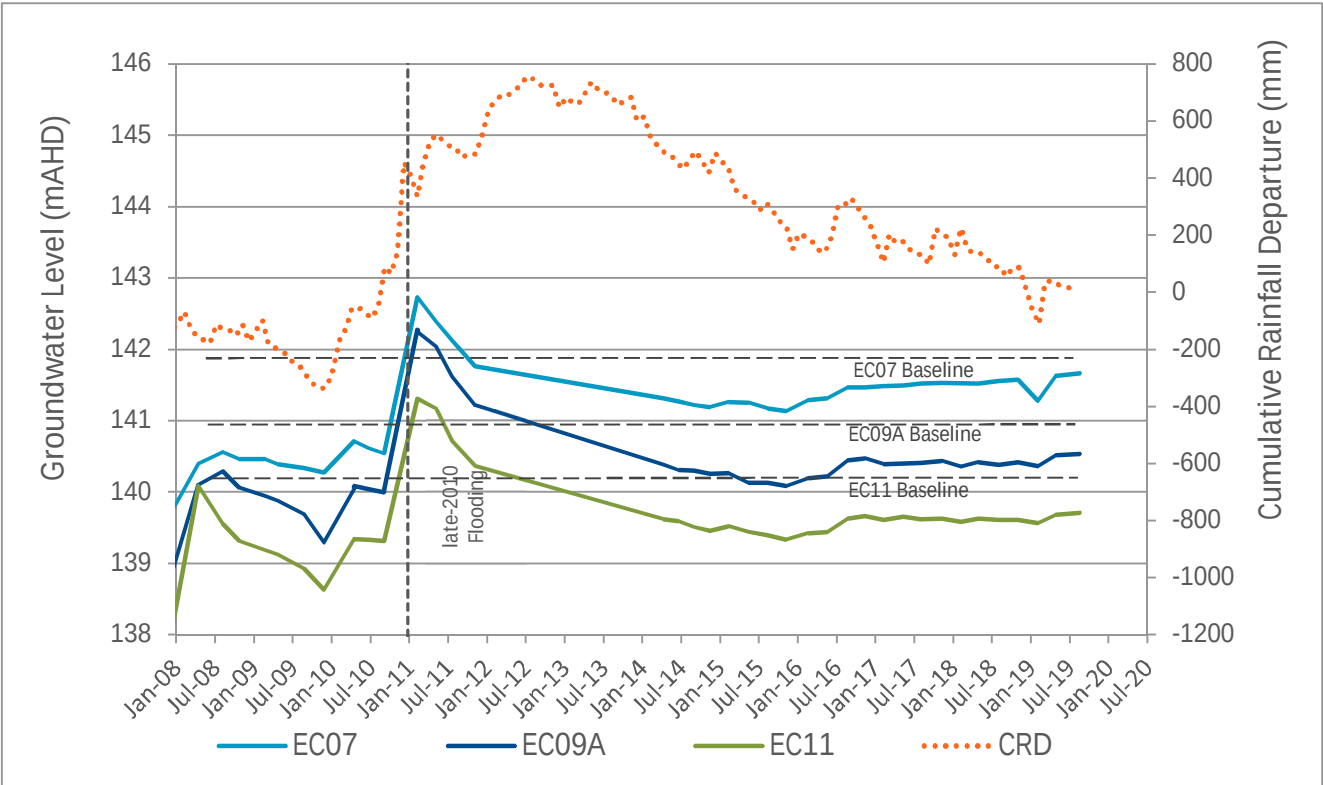


Figure F-3 Hydrograph for EC13 showing baseline water levels and CRD

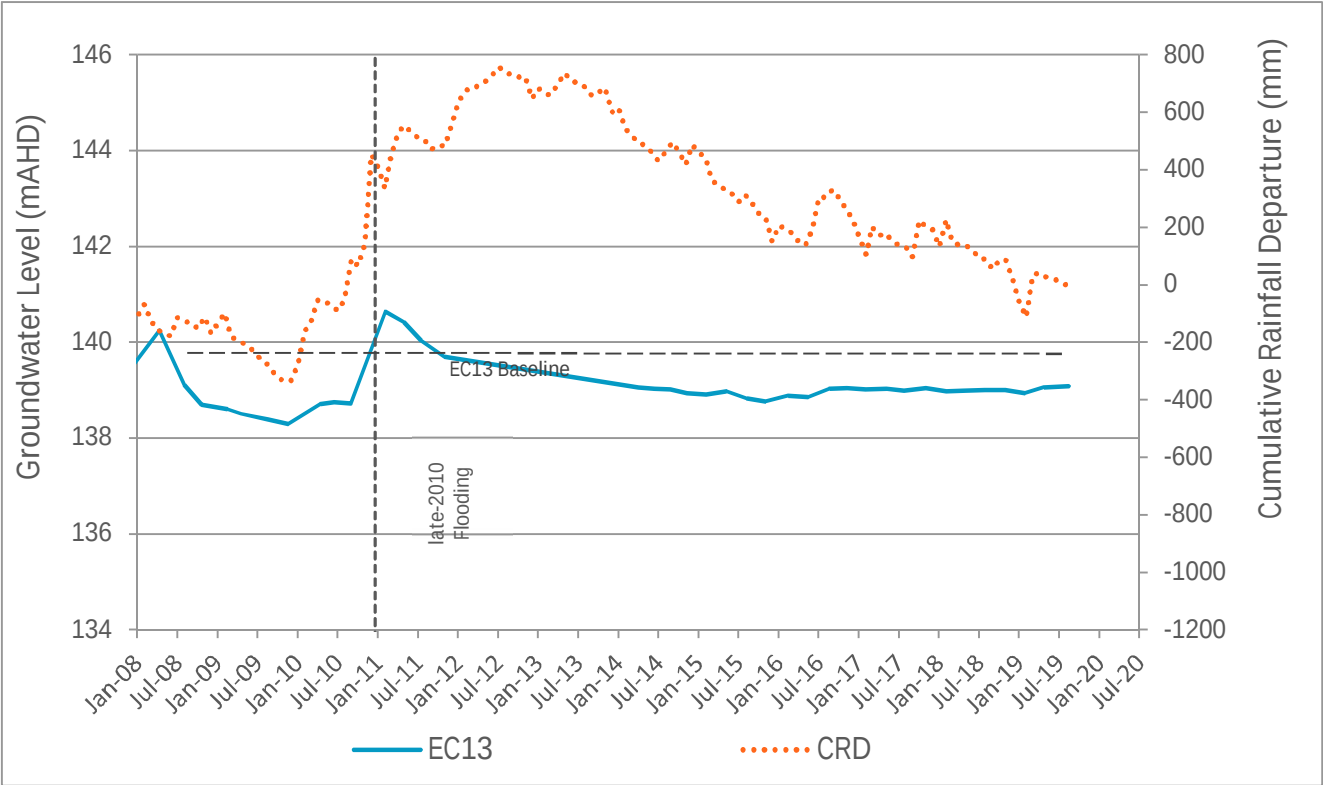


Figure F- 4 Hydrograph for GW01 and EC14 showing baseline water levels and CR

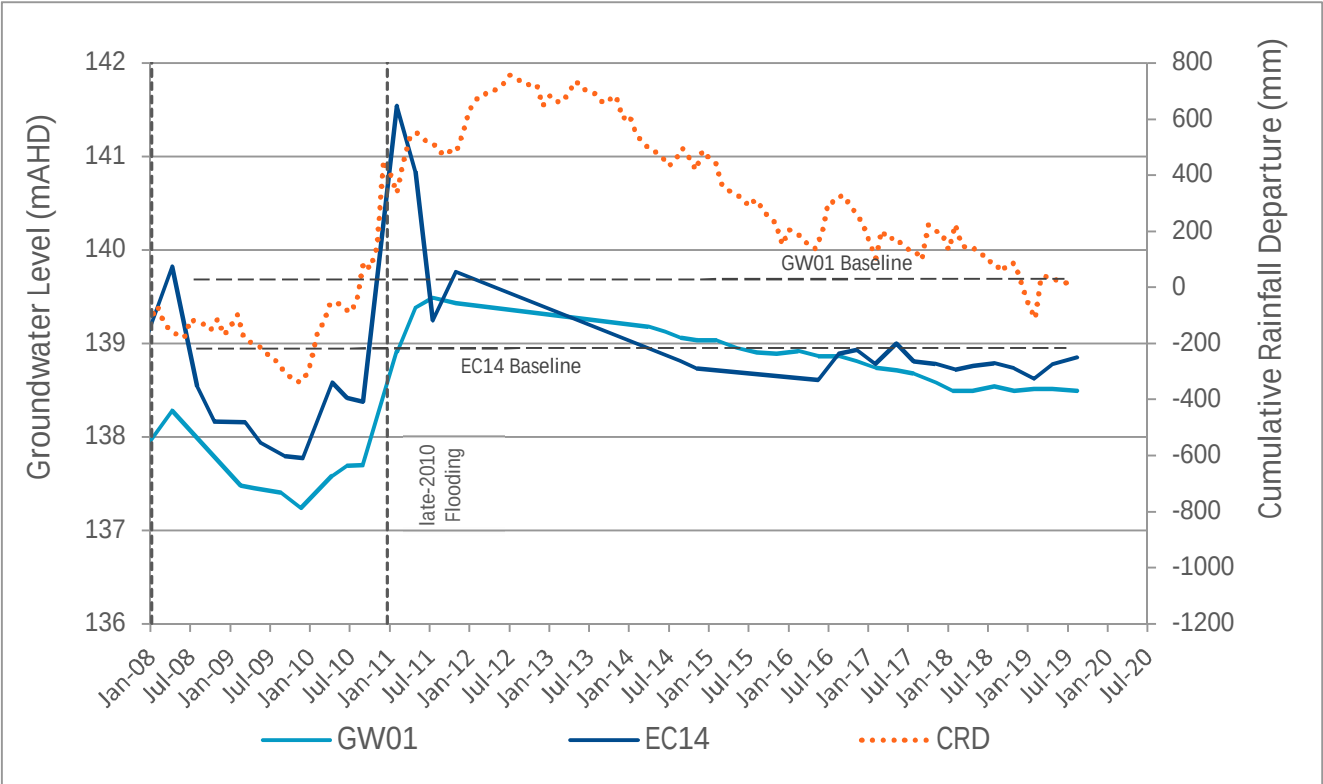


Figure F-5 Hydrograph for Twin Bore showing baseline water levels and CRD

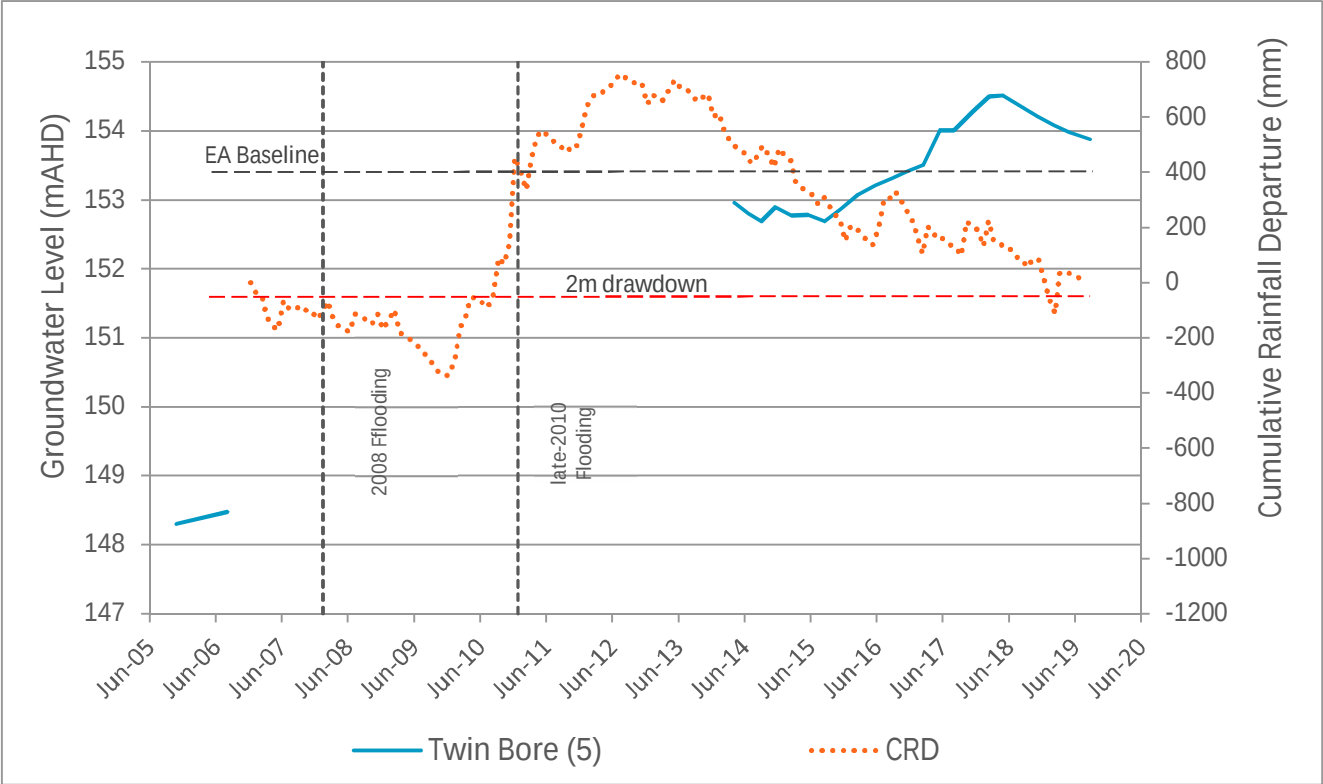


Figure F-6 Hydrograph for WSMB2D, WSMB2S and WSMB3D showing baseline water levels and CRD

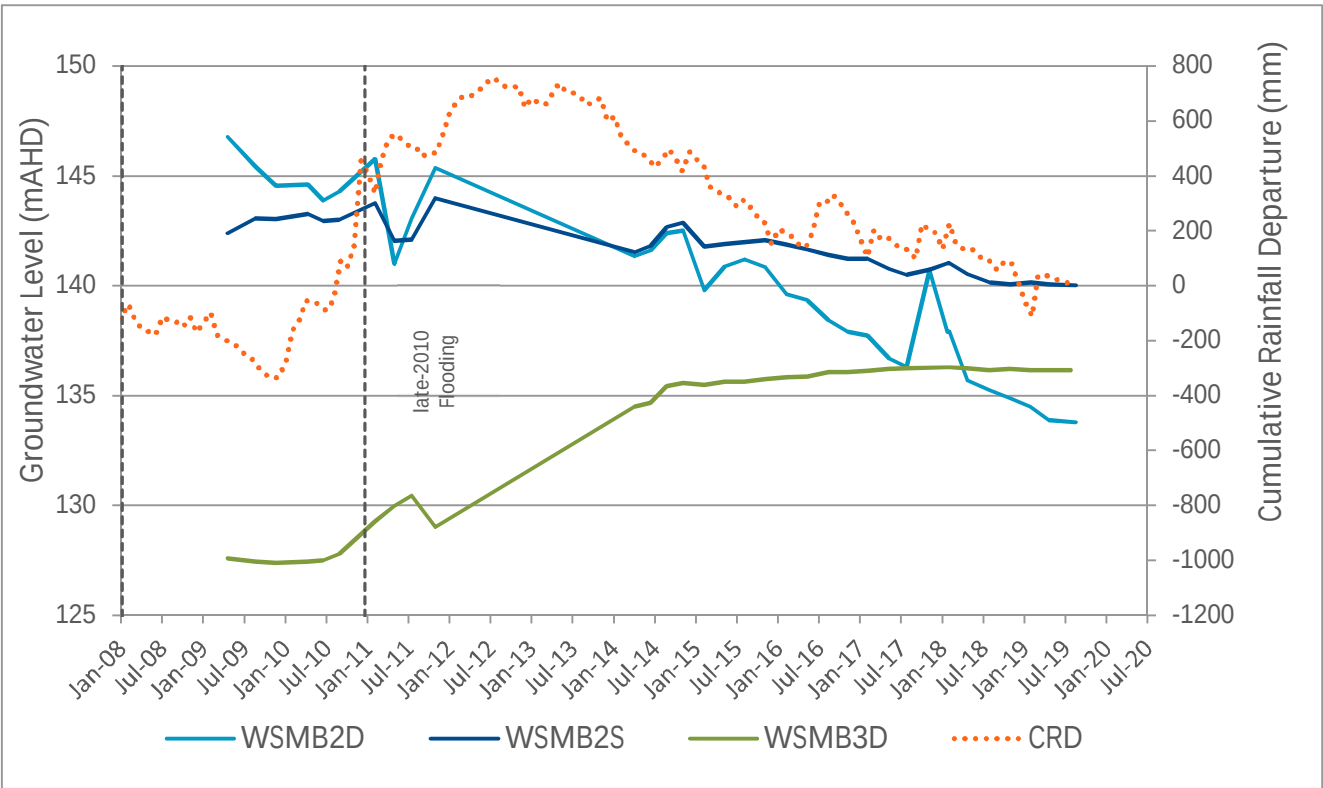


Figure F-7 Hydrograph for Winton Creek bore showing baseline water levels and CRD

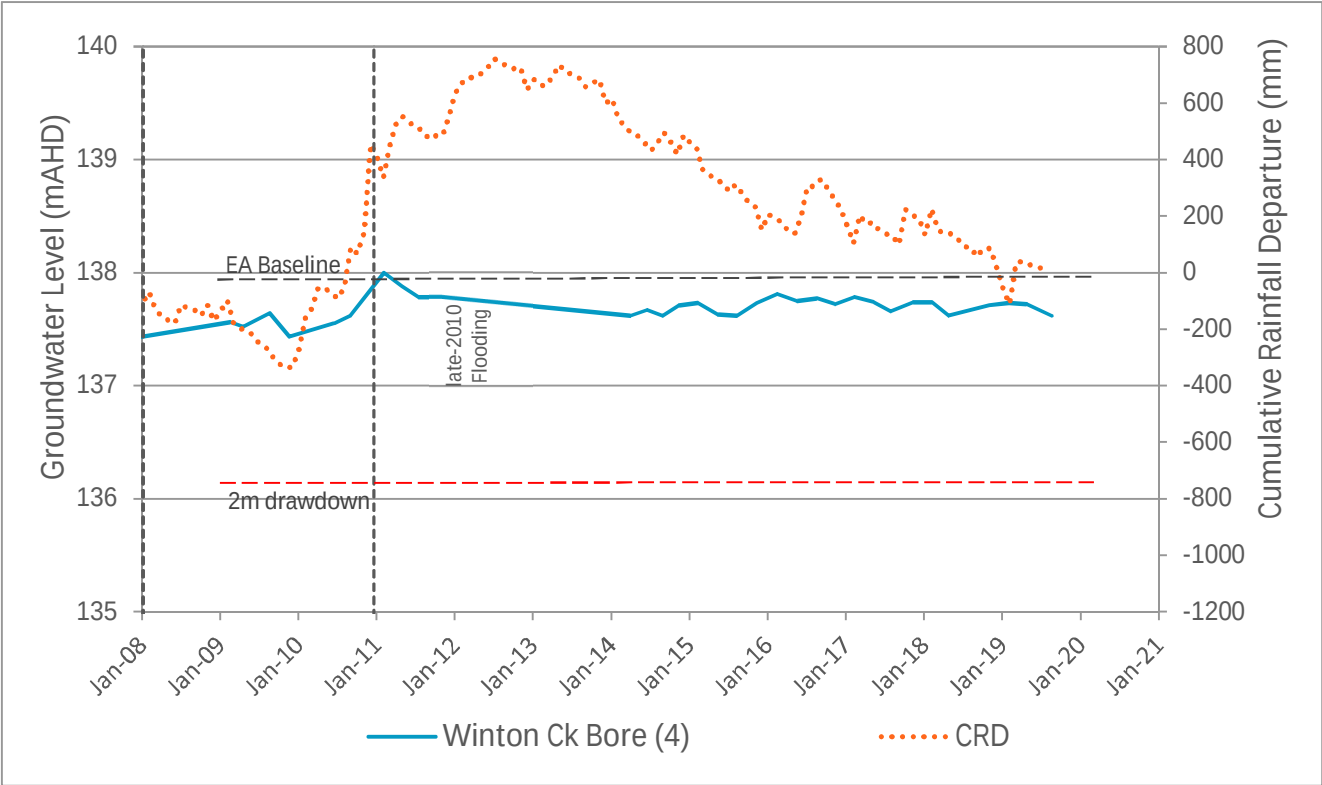


Figure F-8 Hydrograph for Jamar Bore showing baseline water levels and CRD

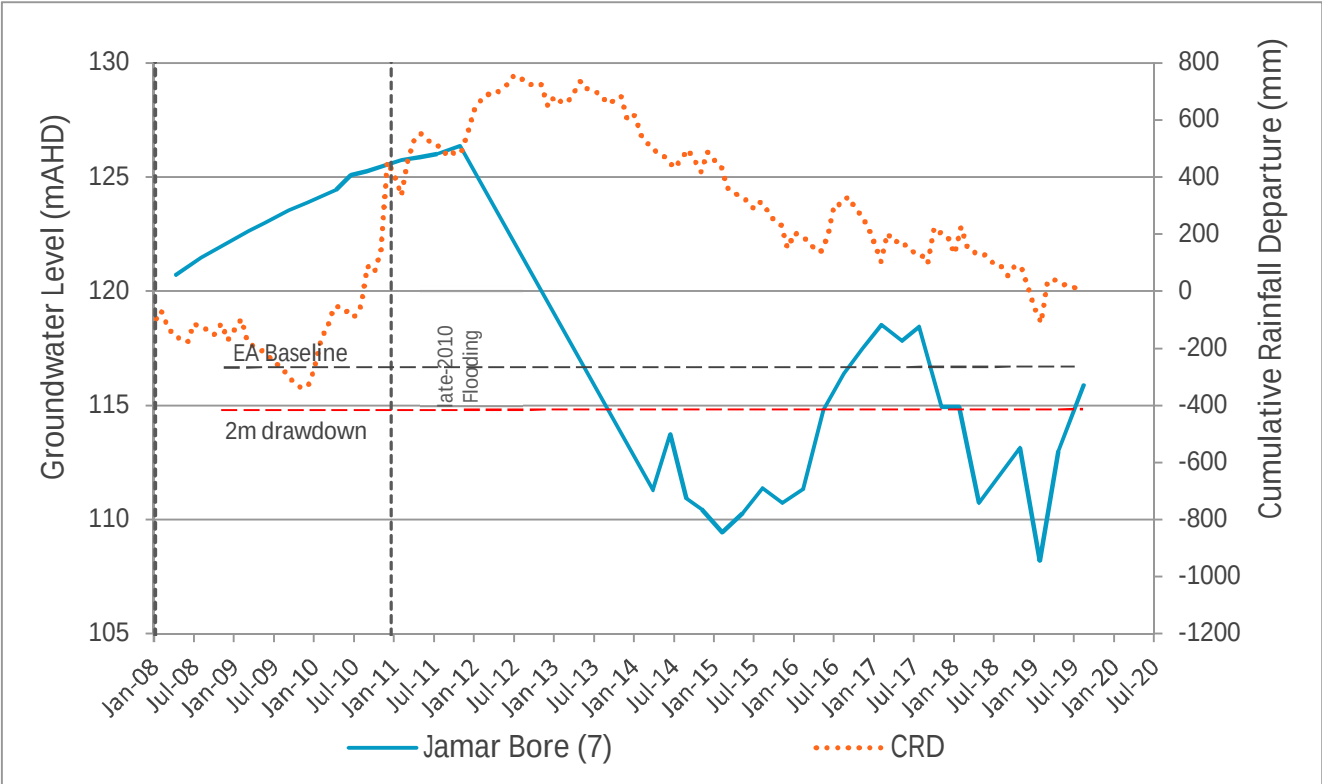


Figure F-9 Hydrograph for Karanga Bore showing baseline water levels and CRD

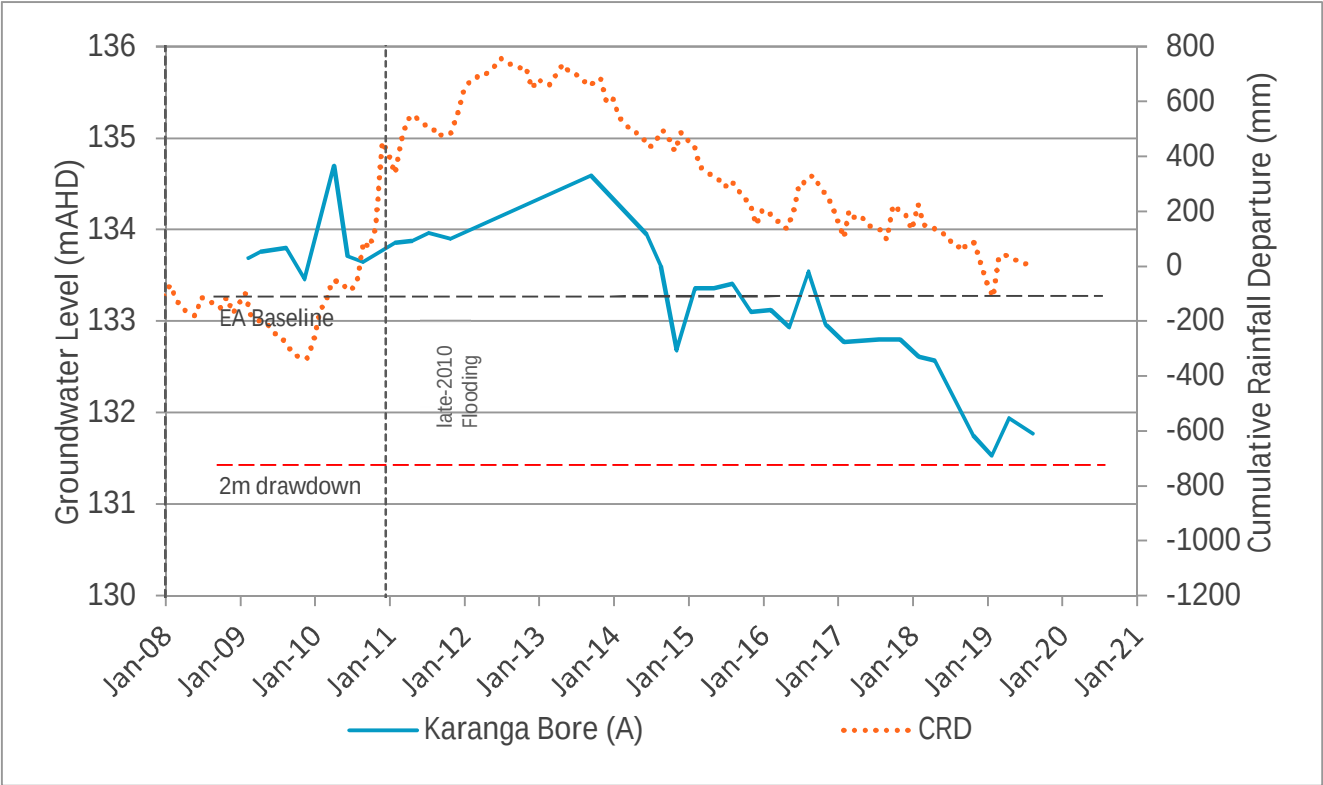


Figure F-10 Hydrograph for Conmurra bore showing baseline water levels and CRD

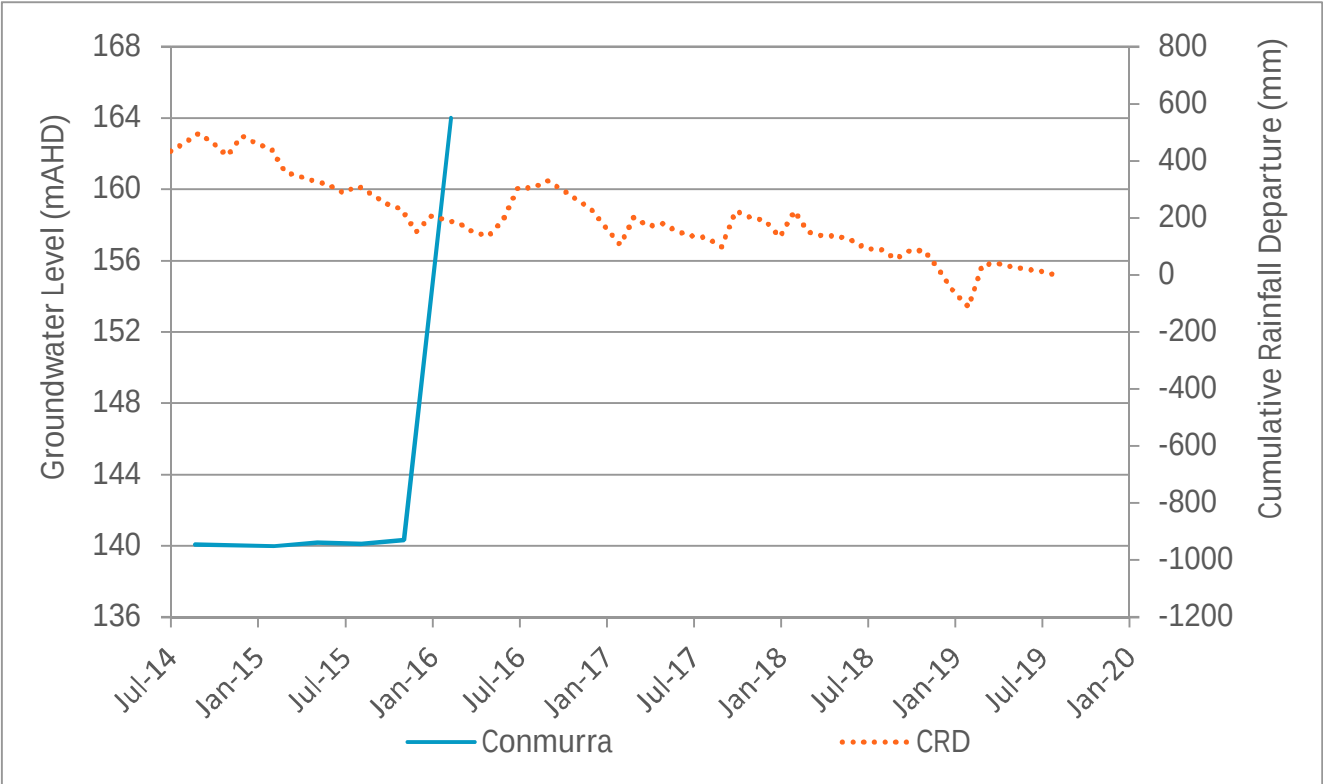


Figure F-11 Hydrograph for Fairhills bore showing baseline water levels and CRD

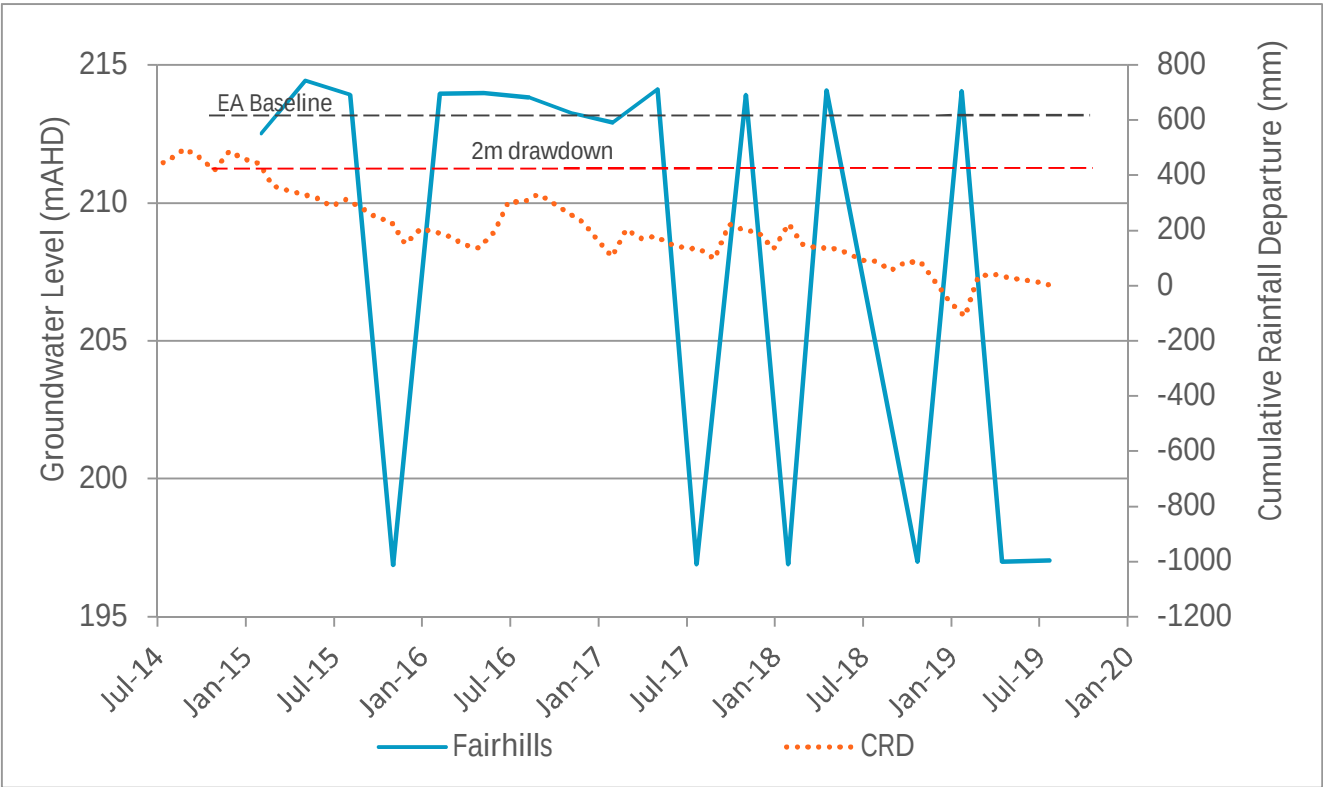


Figure F-12 Hydrograph for Railway bore showing baseline water levels and CRD

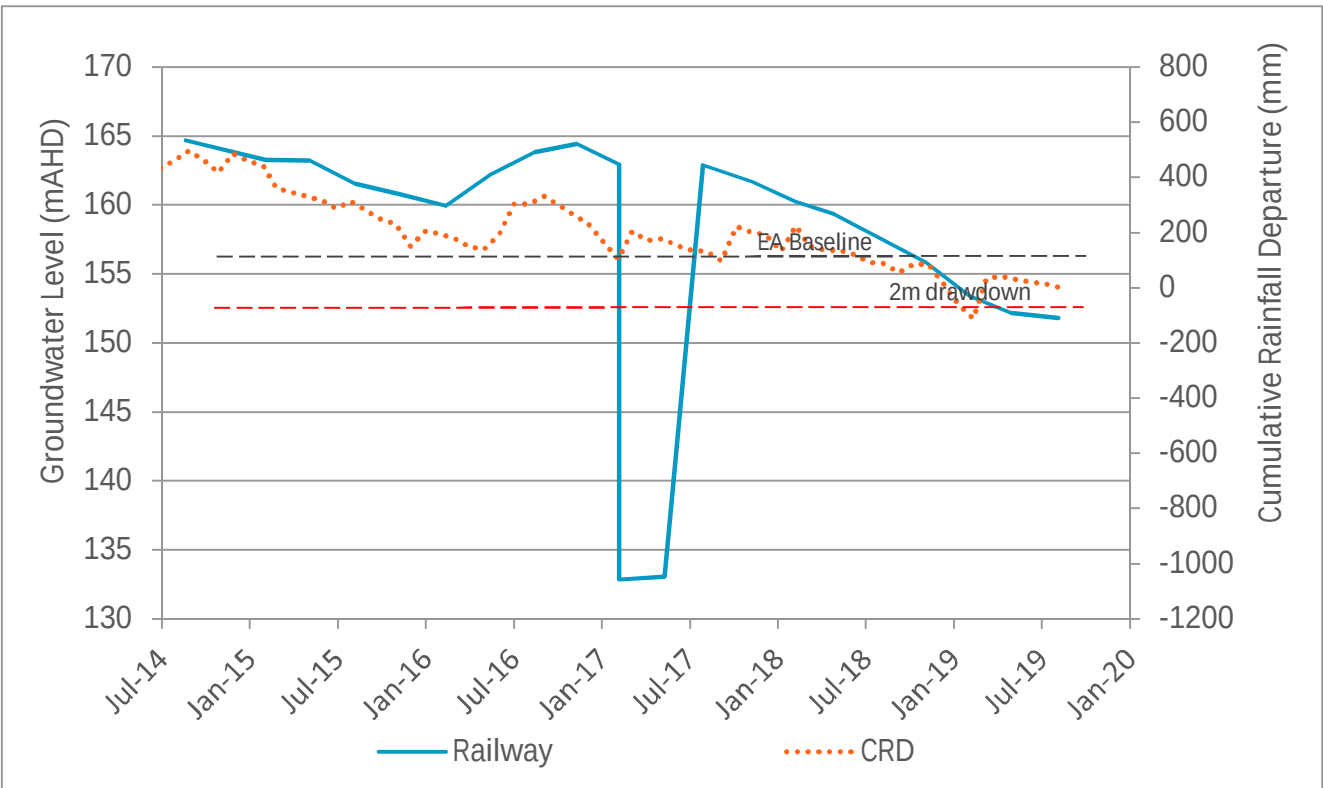


Figure F-13 Hydrograph for Yongalla Bore showing baseline water levels and CRD

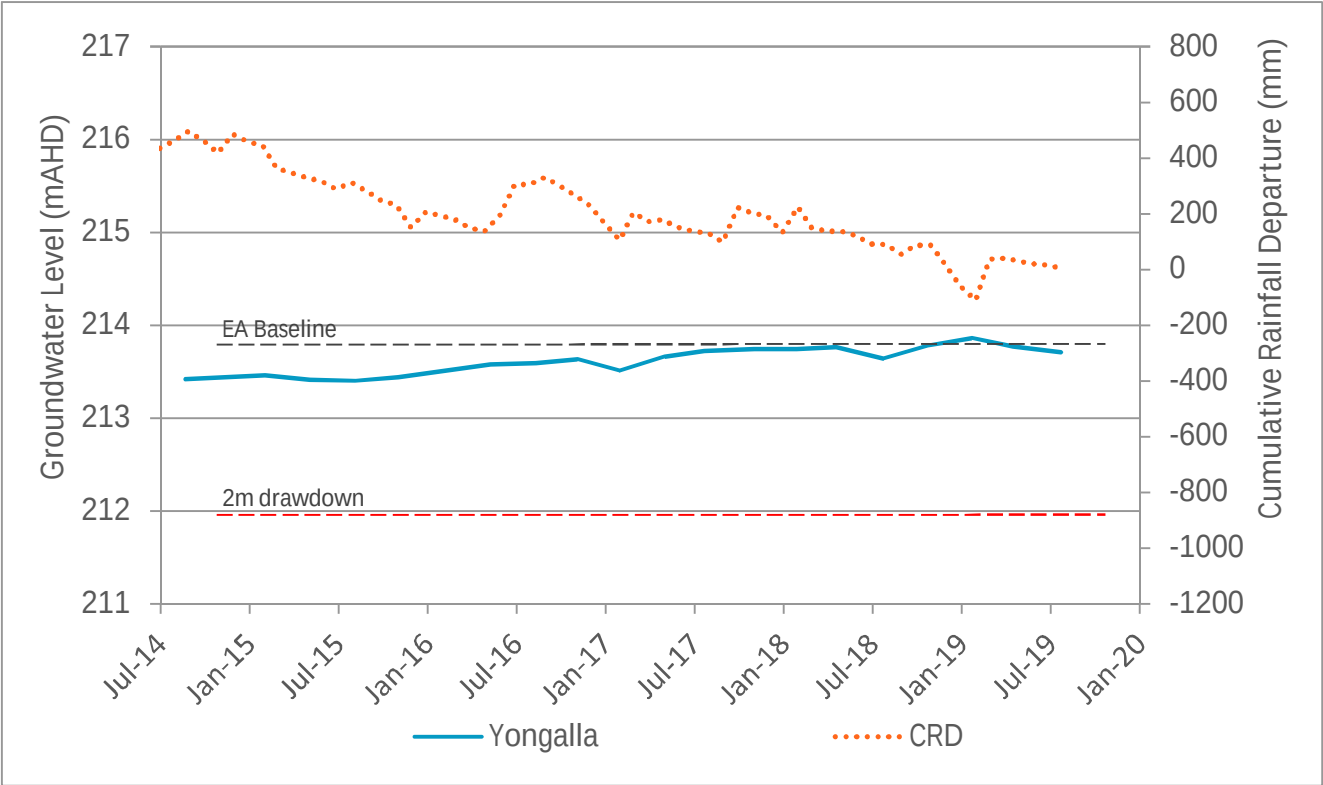


Figure F-14 Hydrograph for RB01 showing baseline water levels and CRD

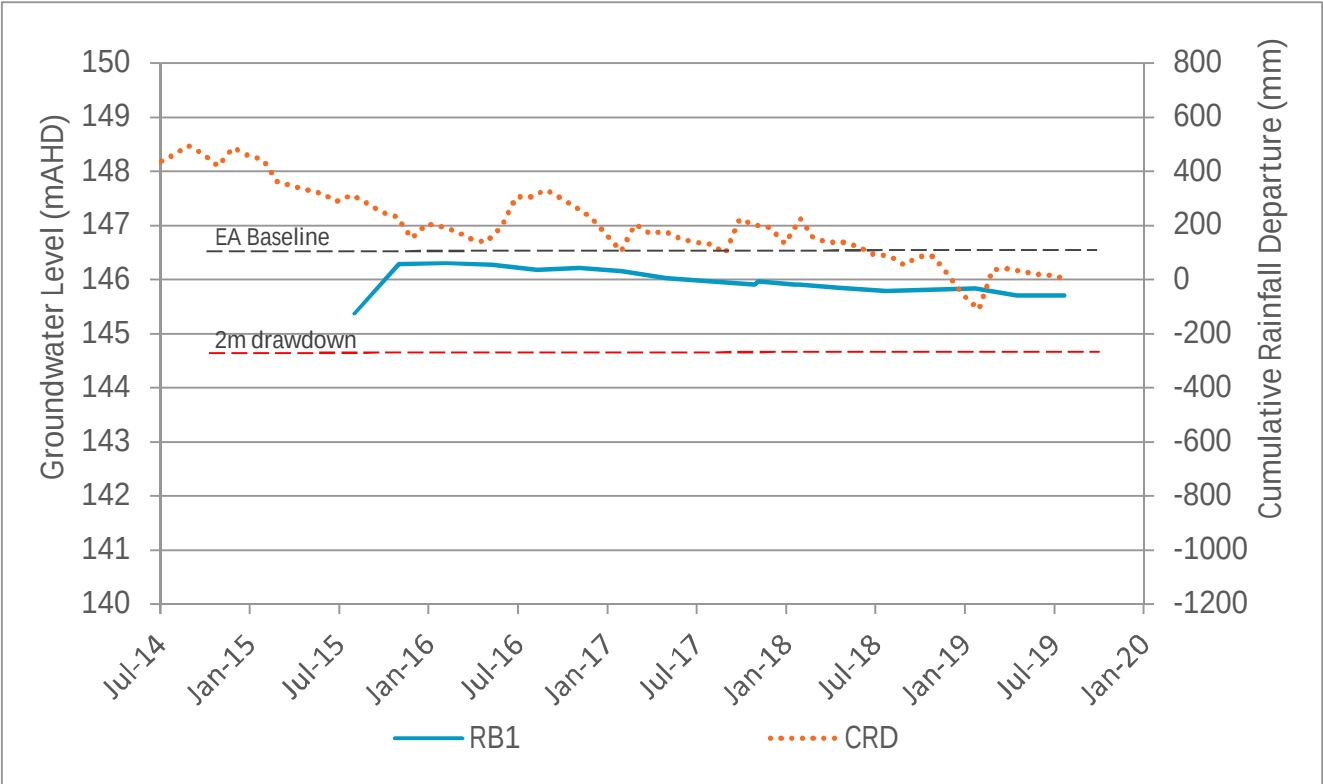


Figure F-15 Hydrograph for RB02 showing baseline water levels and CRD

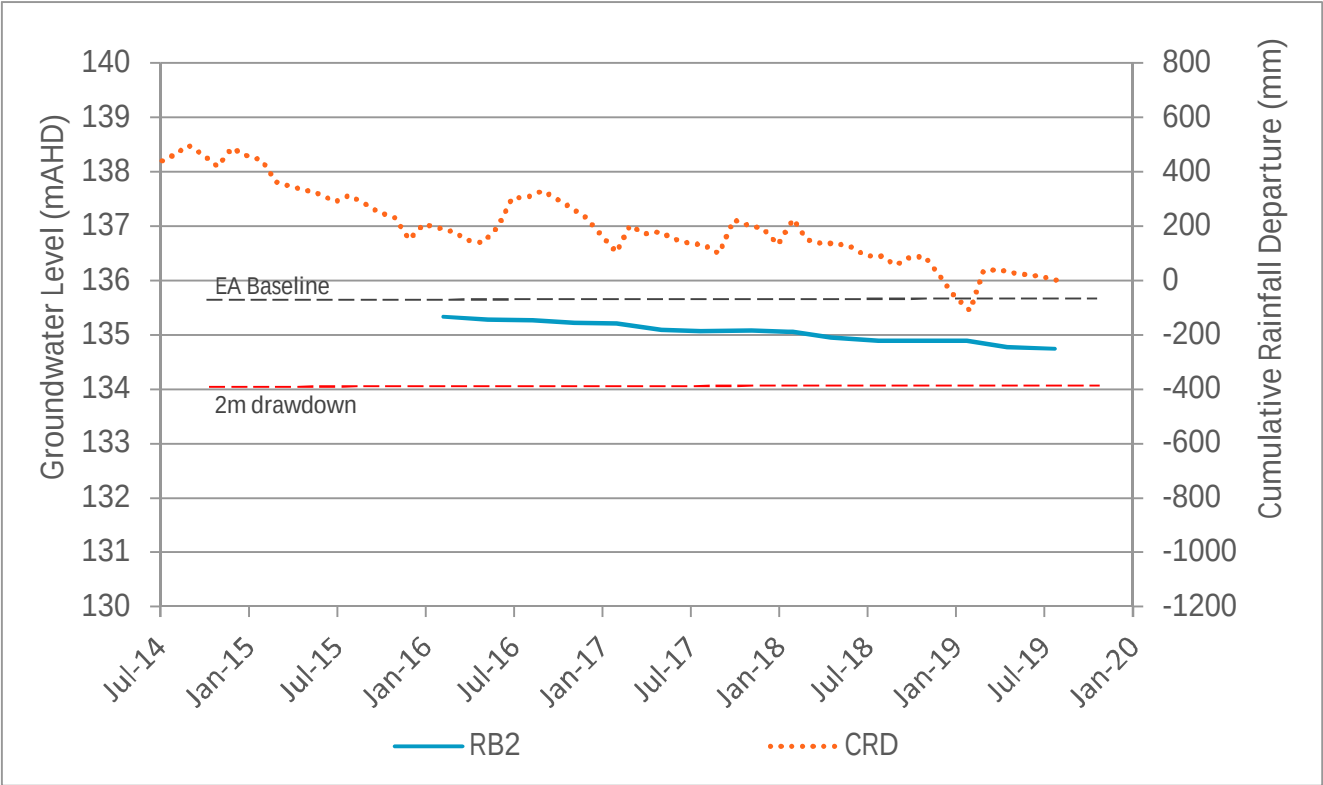


Figure F-16 Hydrograph for RB03 showing baseline water levels and CRD

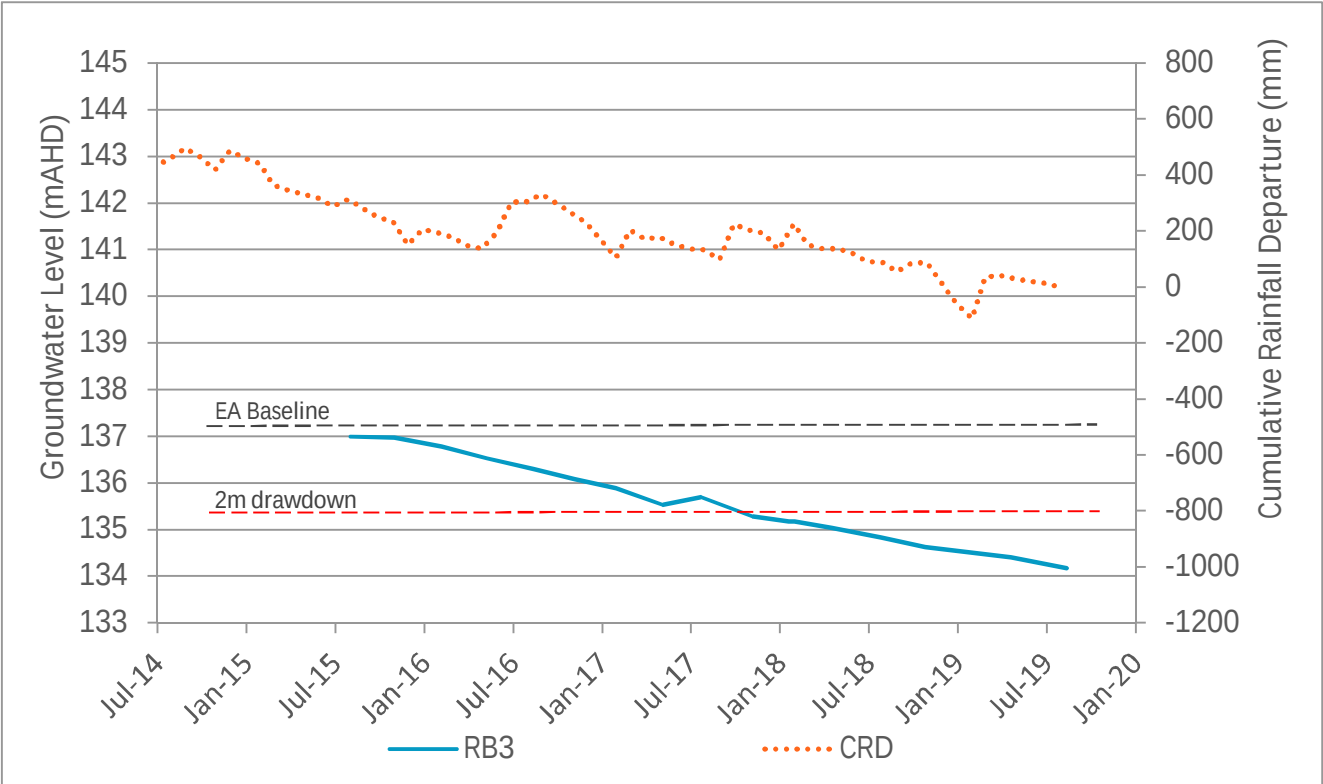


Figure F-17 Hydrograph for RB04 showing baseline water levels and CRD

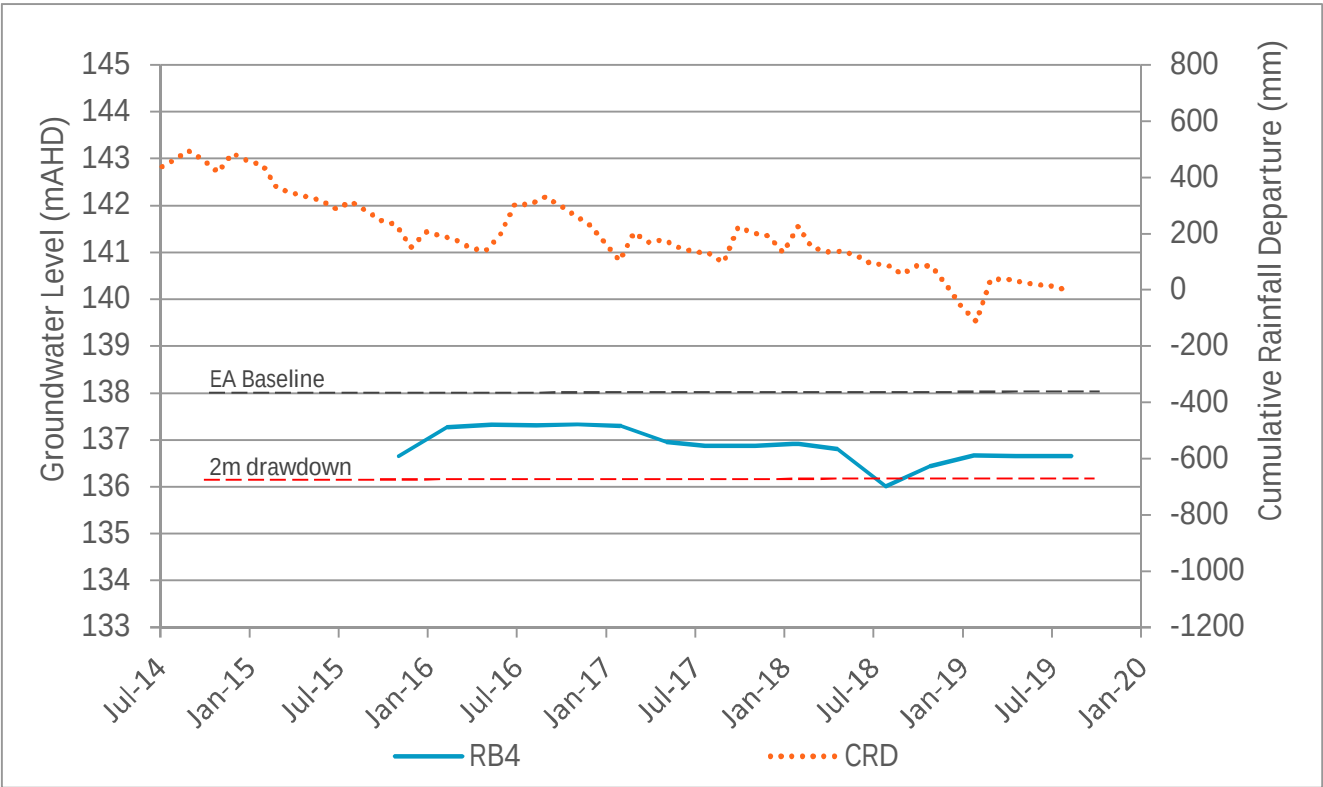


Figure F-18 Hydrograph for RB05 showing baseline water levels and CRD

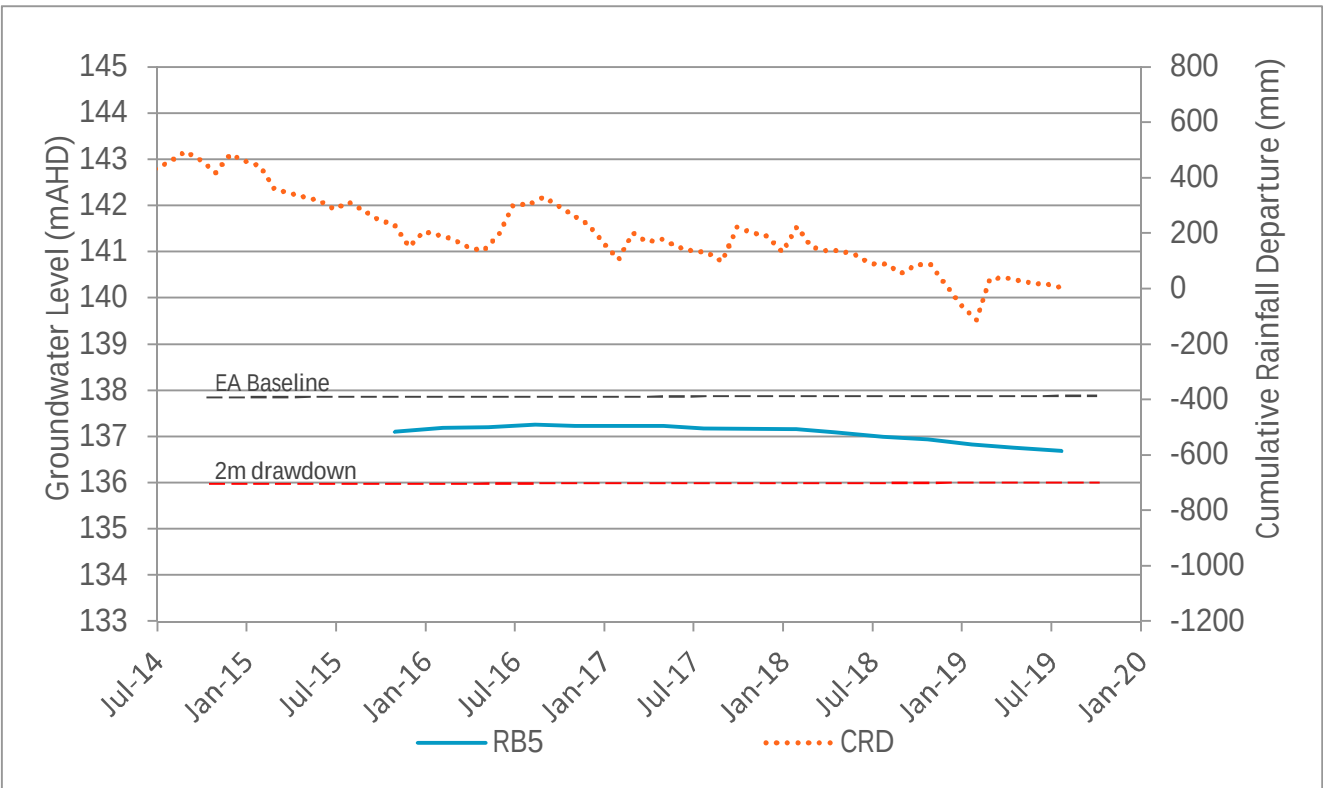
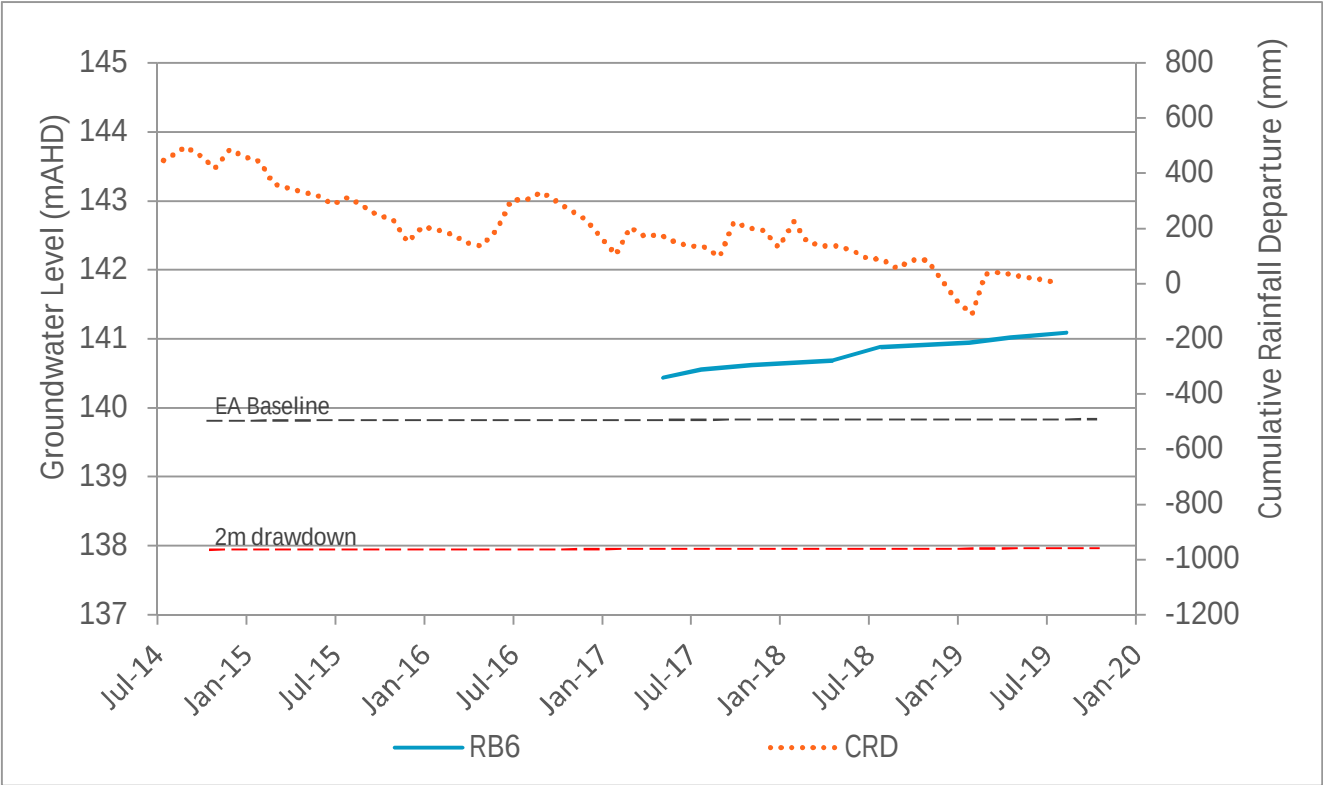
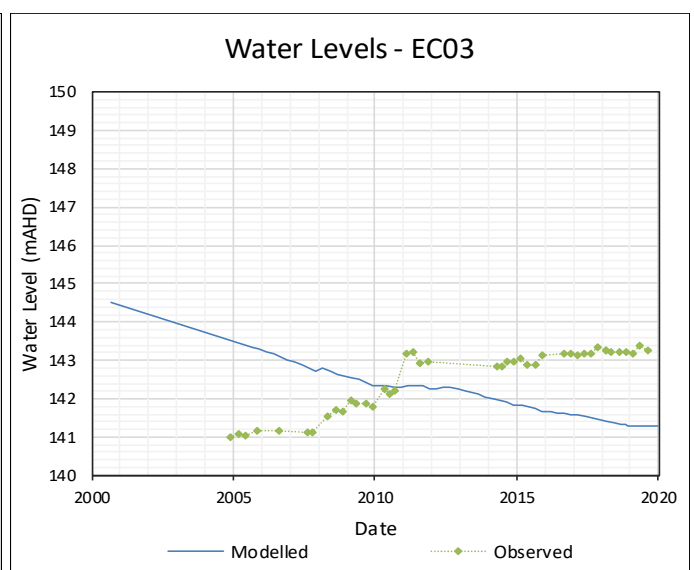
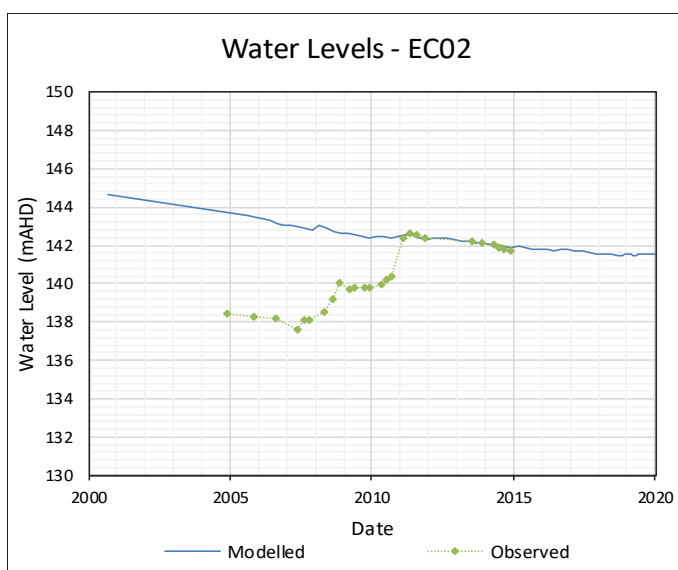
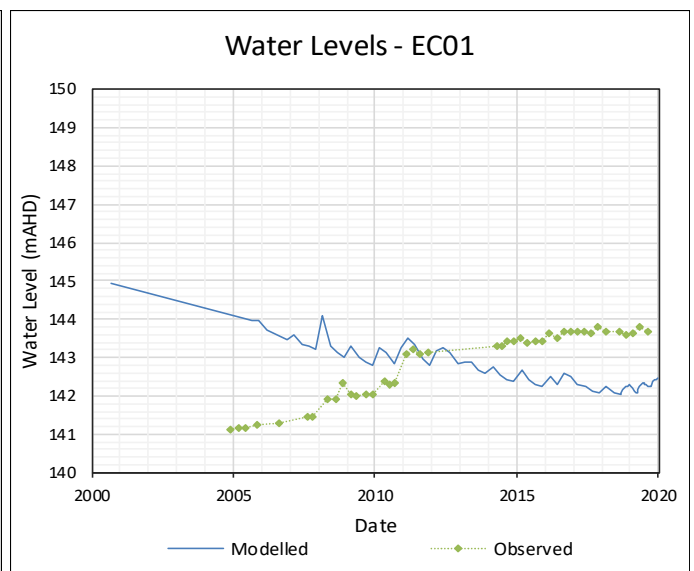
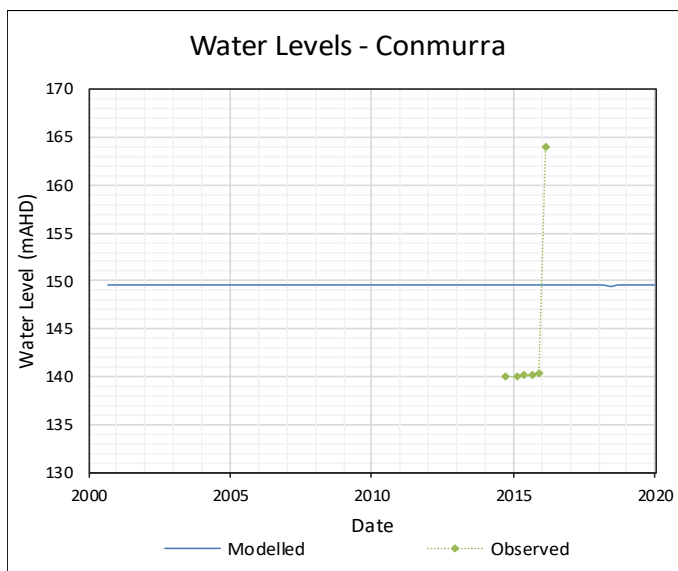
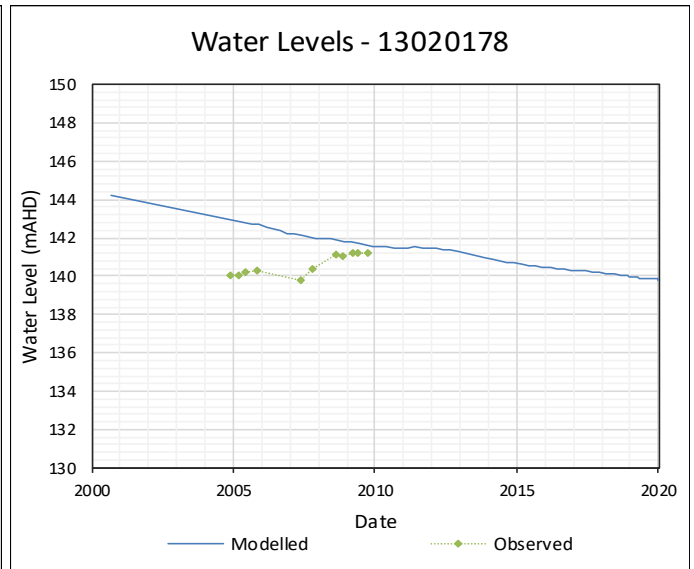
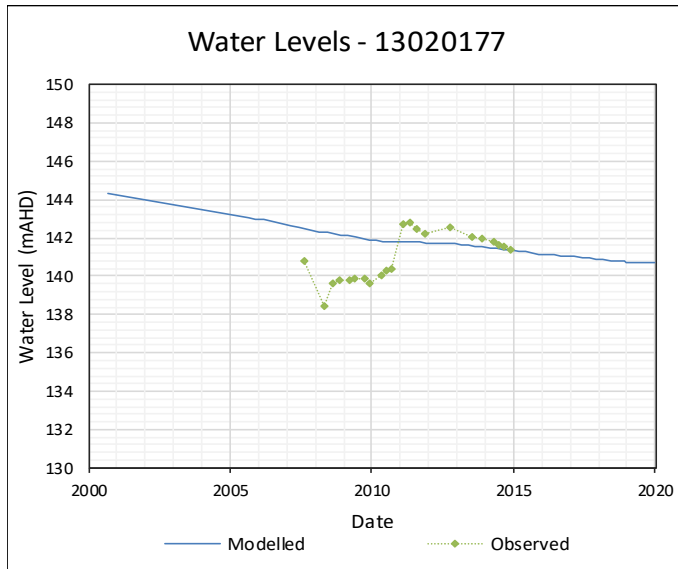


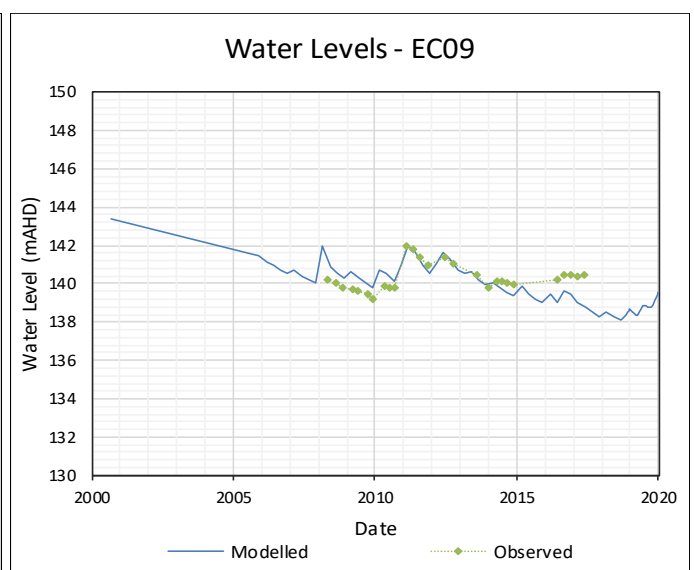
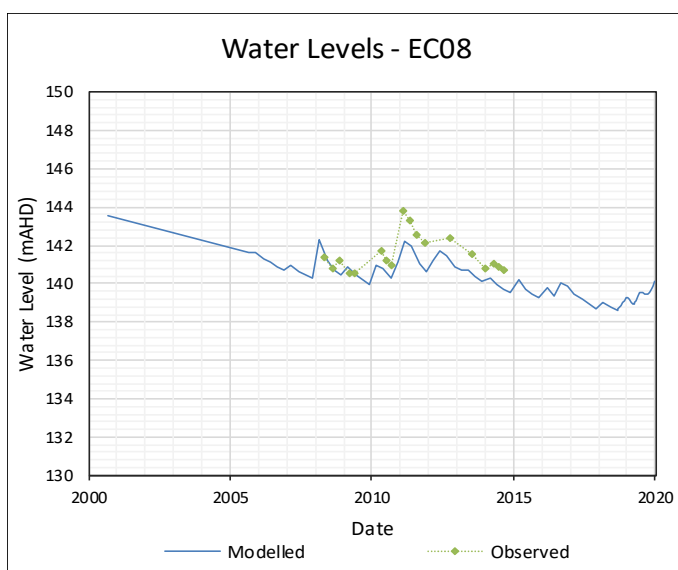
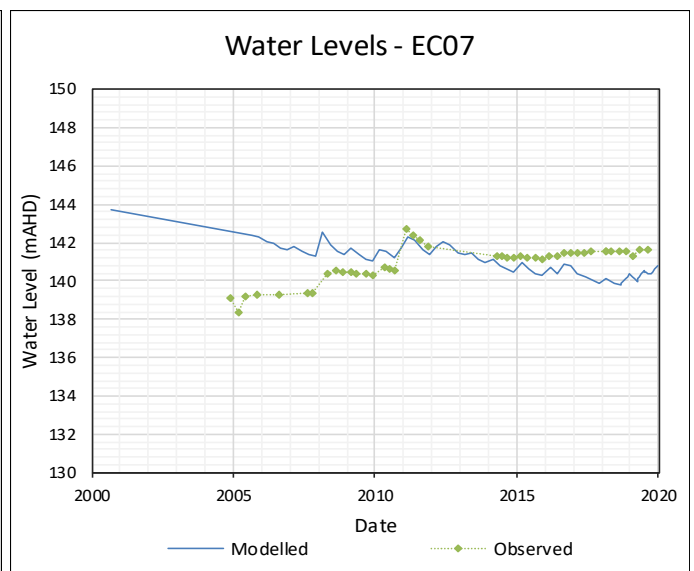
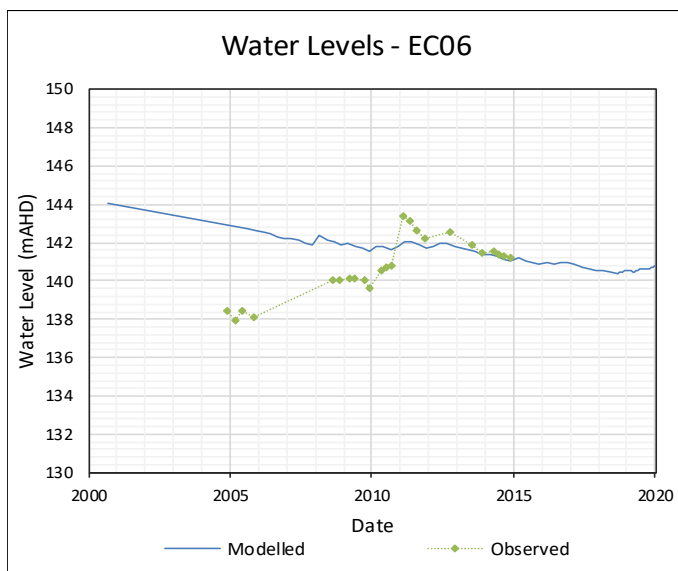
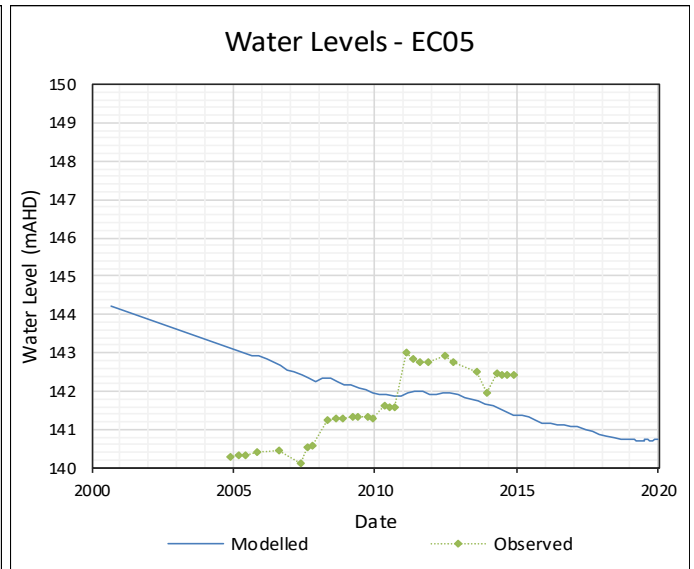
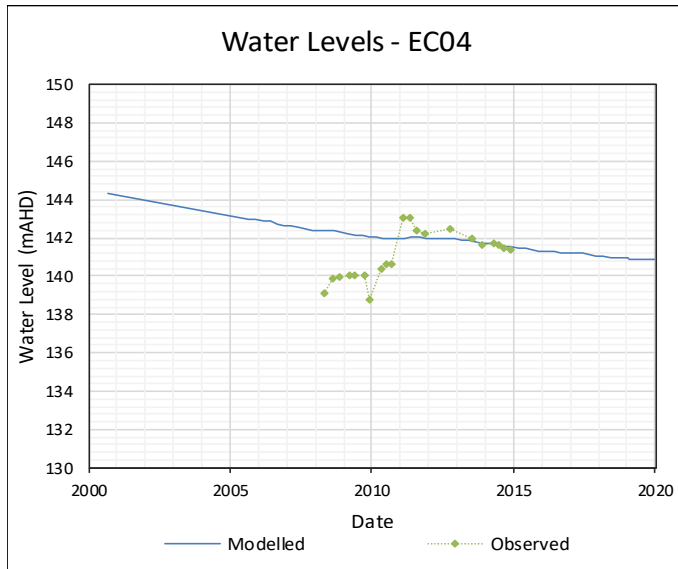
Figure F-19 Hydrograph for RB06 showing baseline water levels and CRD

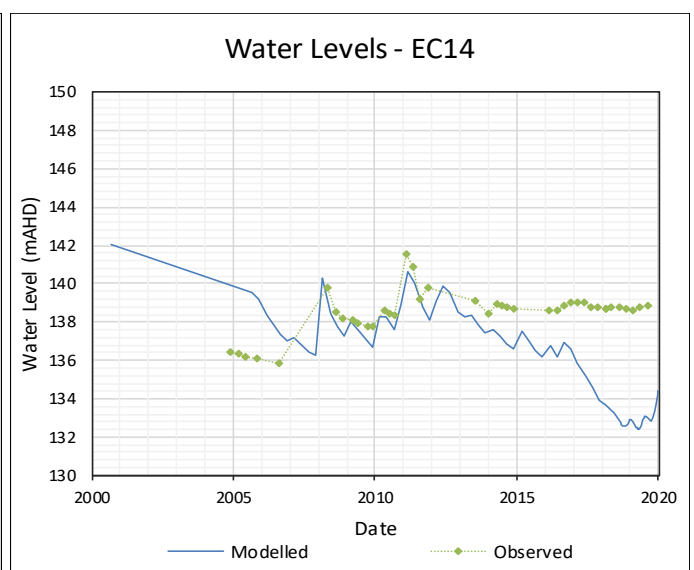
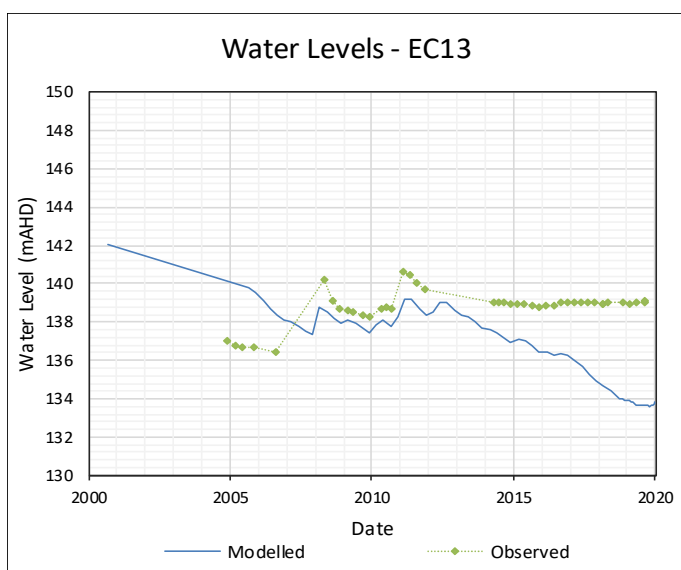
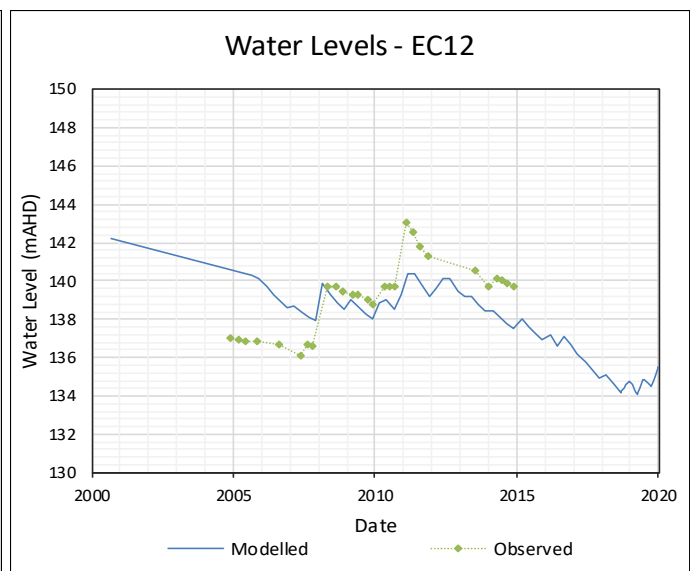
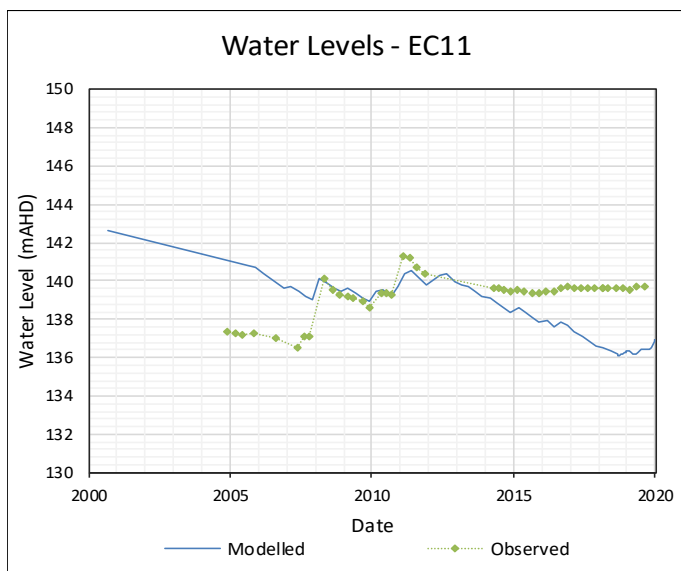
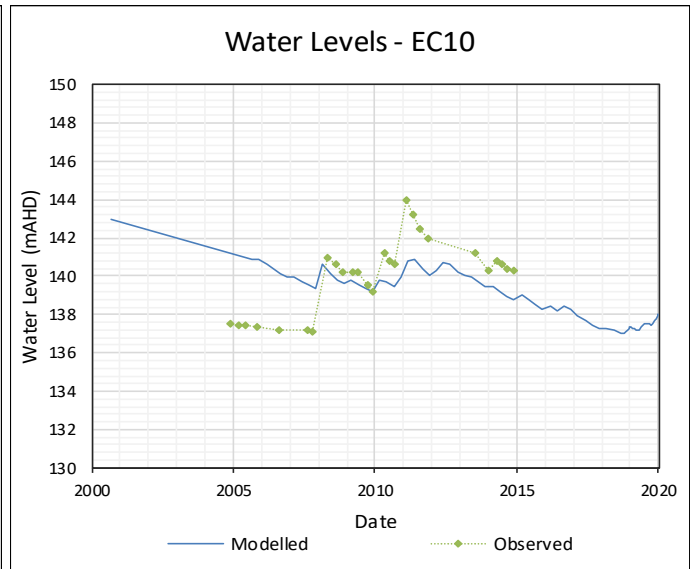
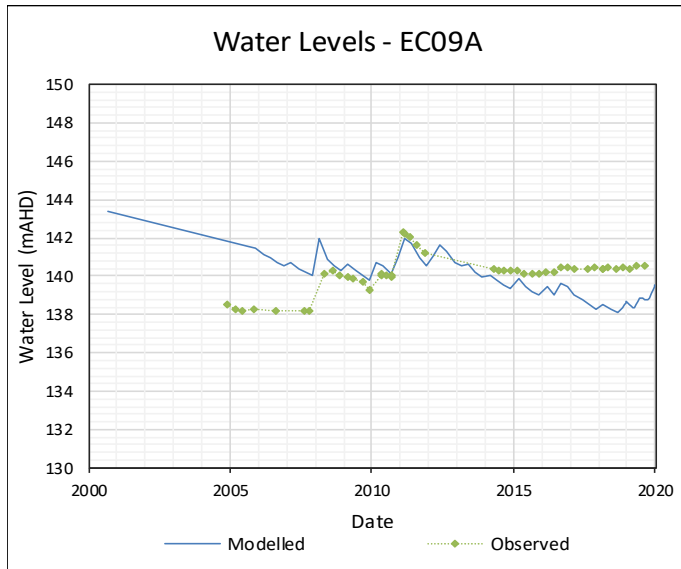


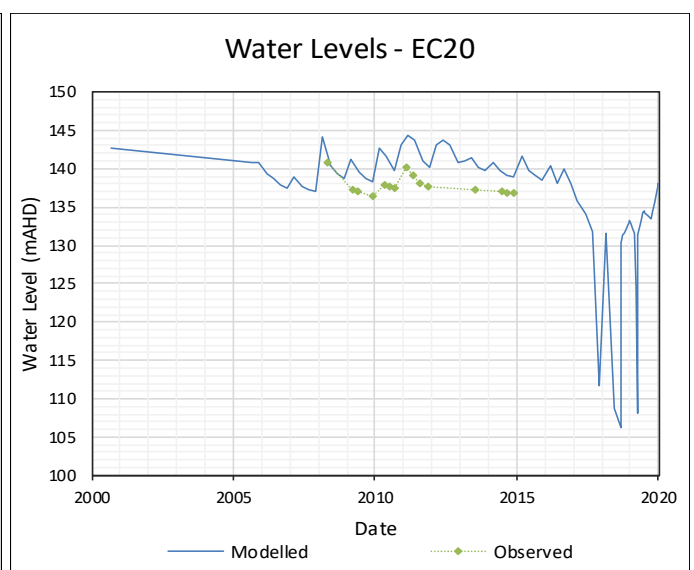
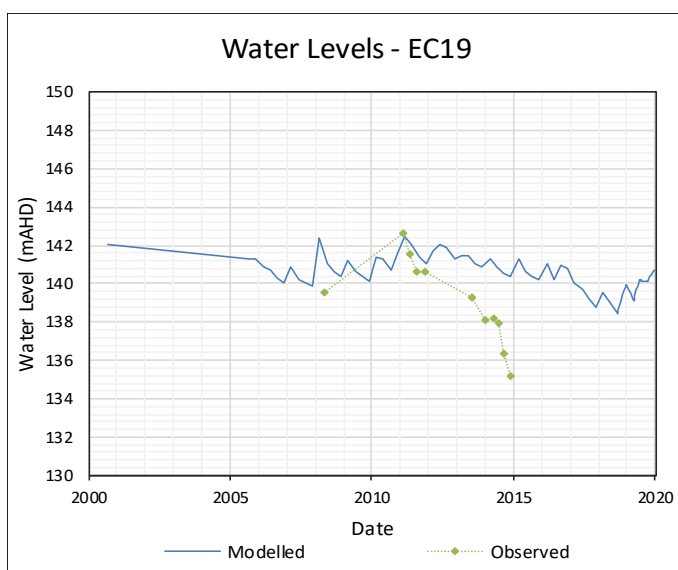
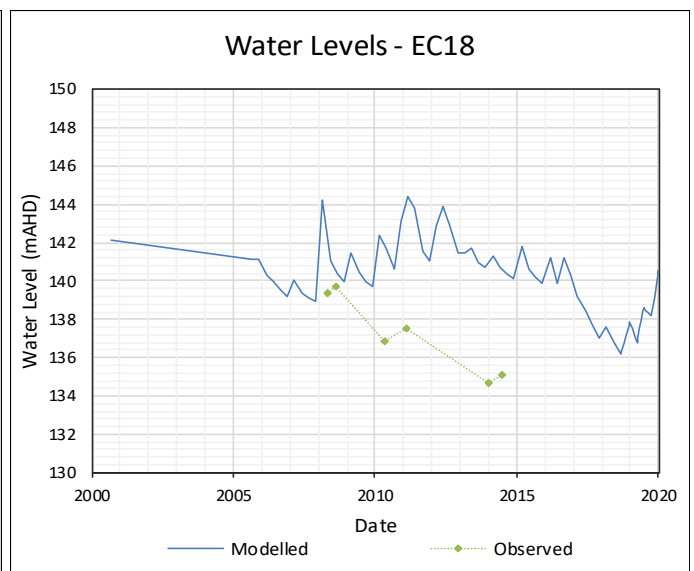
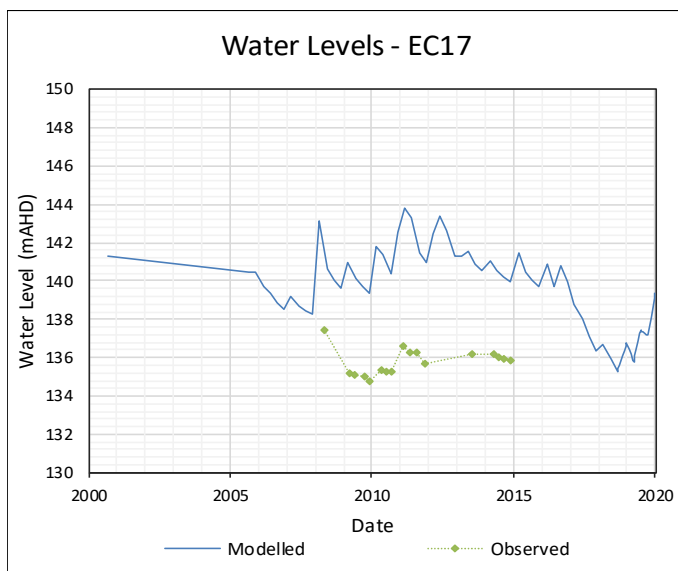
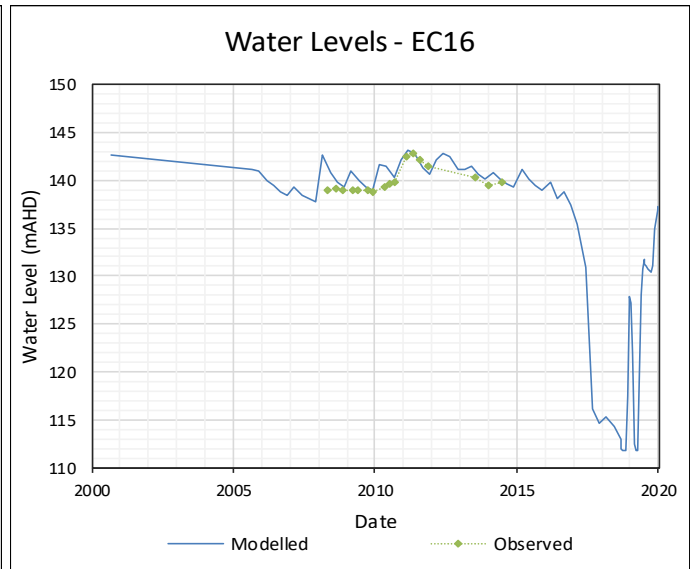
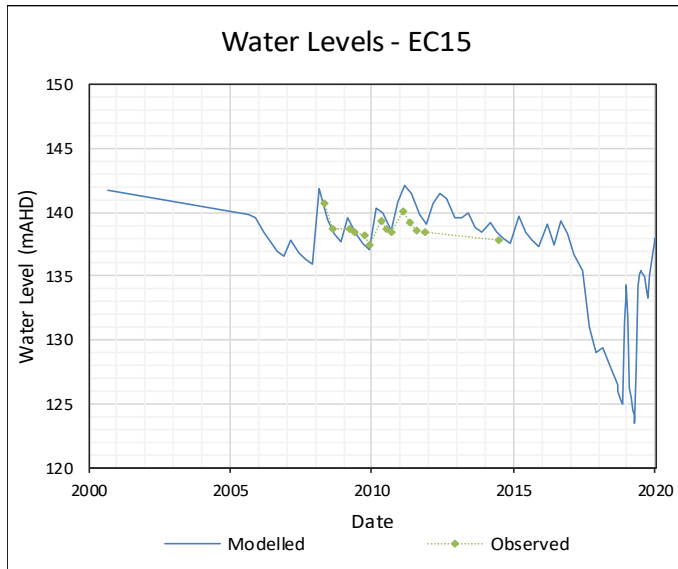
APPENDIX G

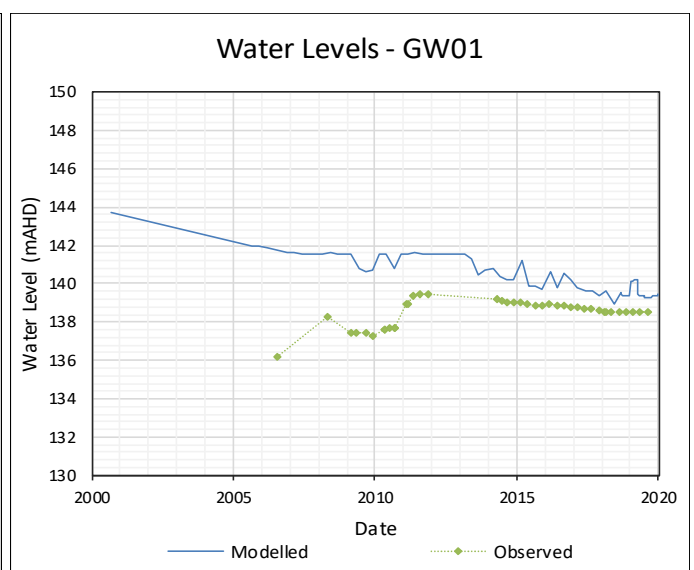
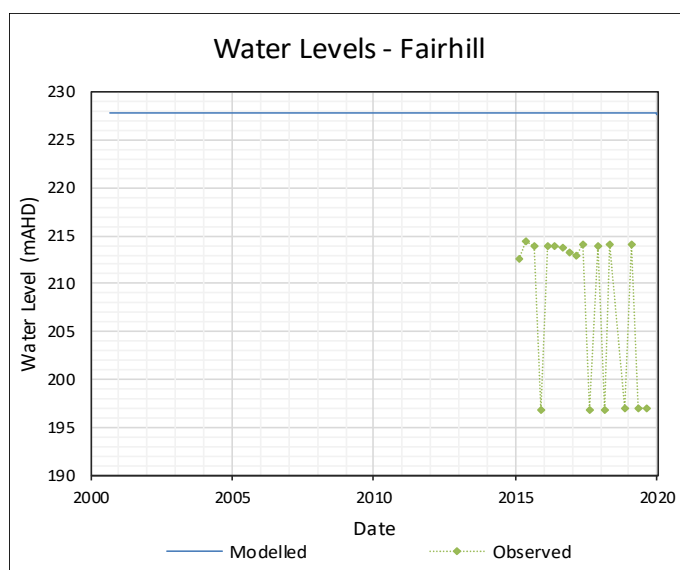
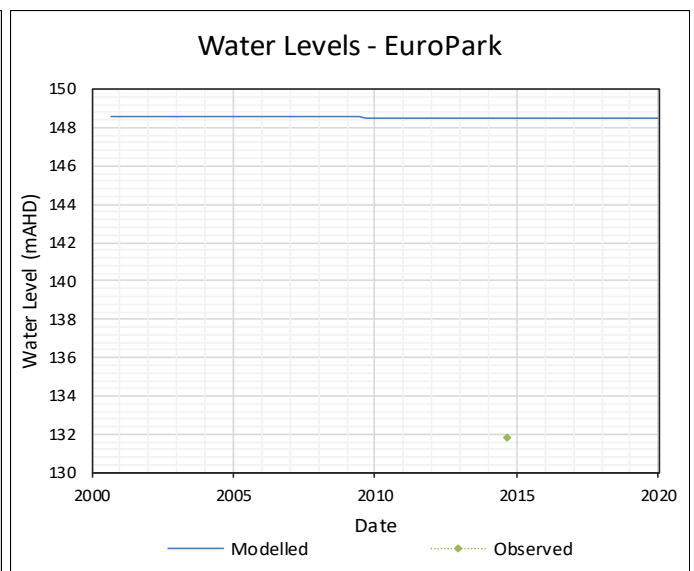
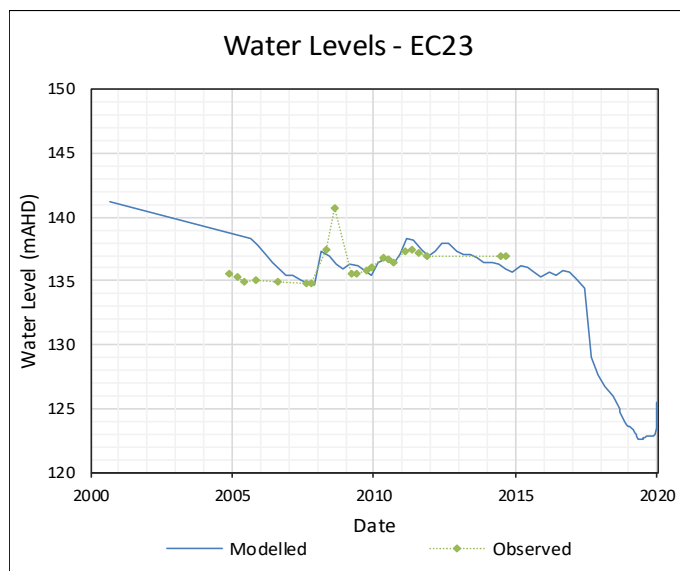
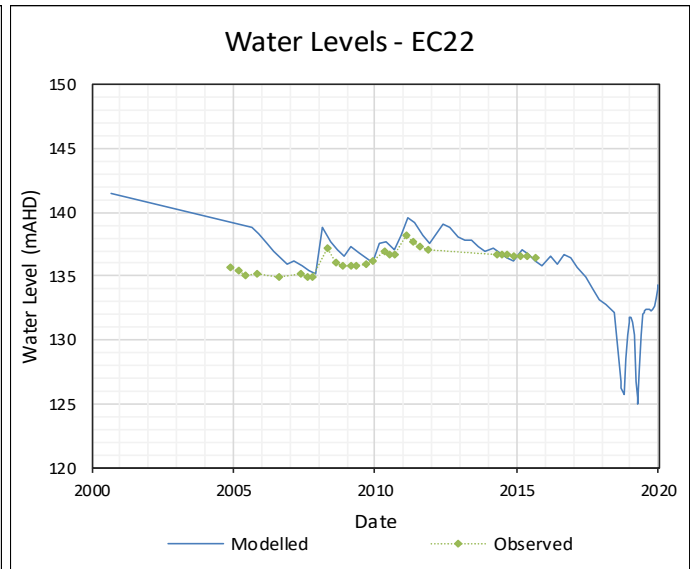
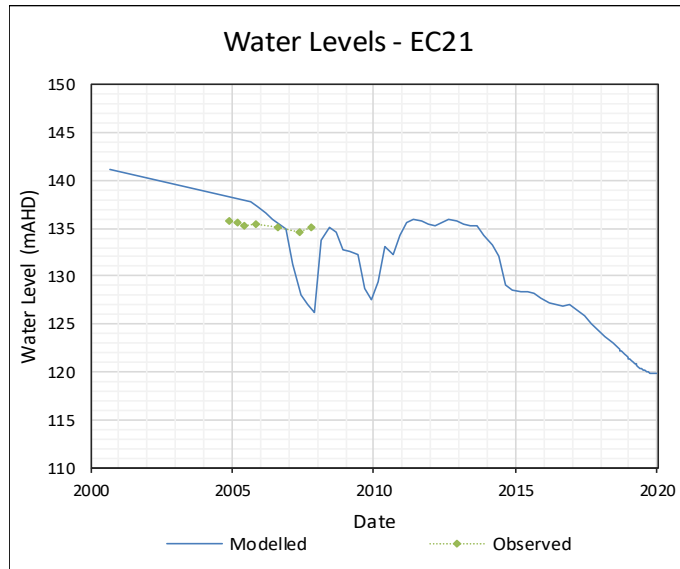
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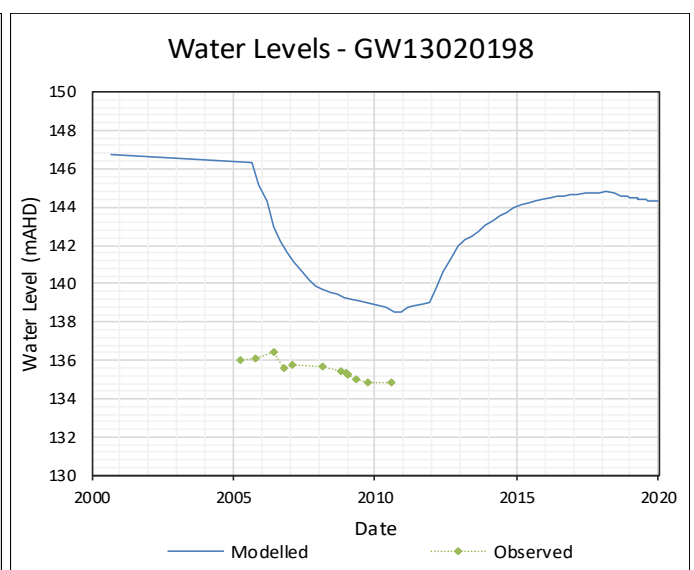
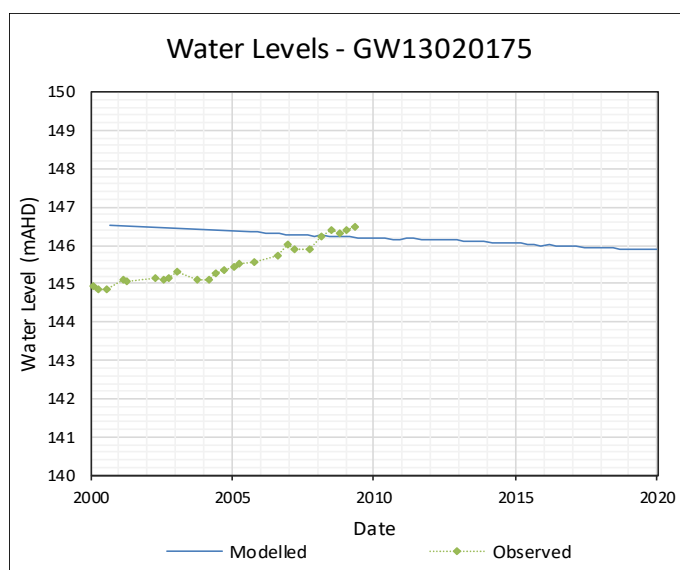
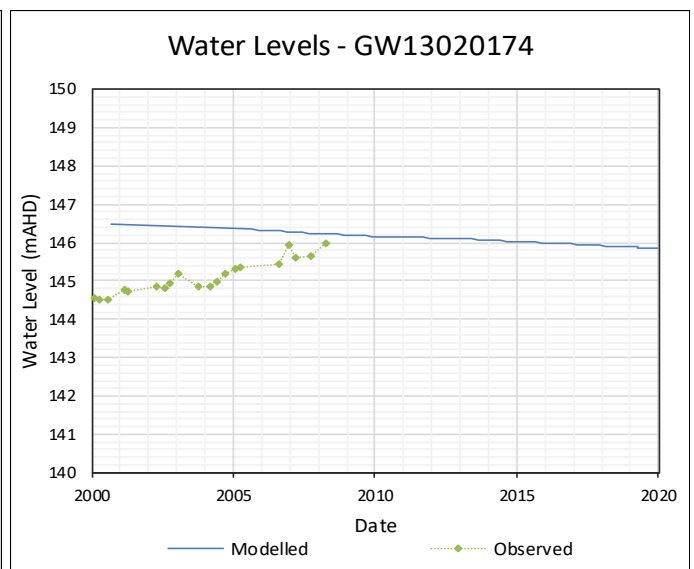
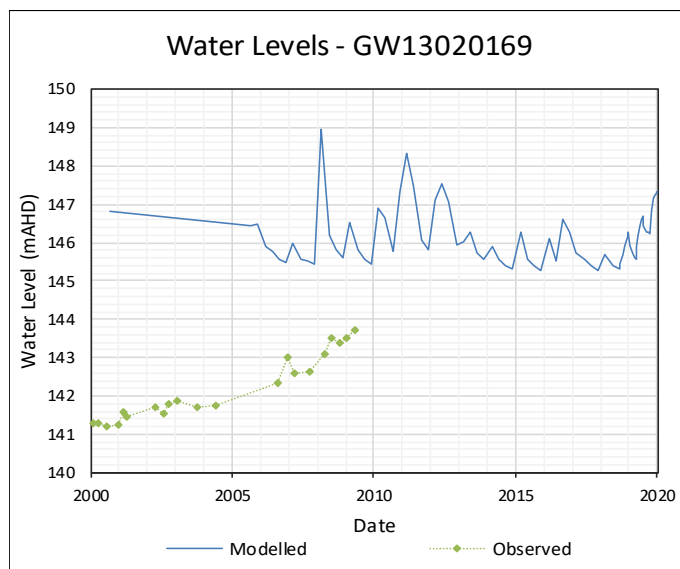
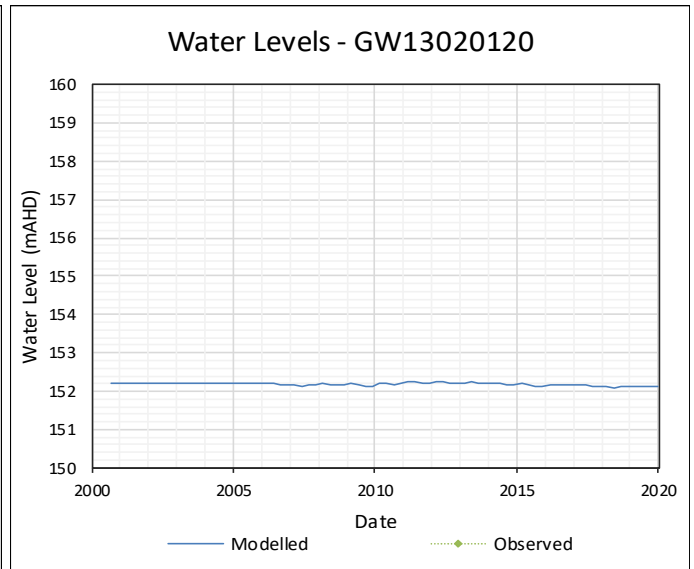
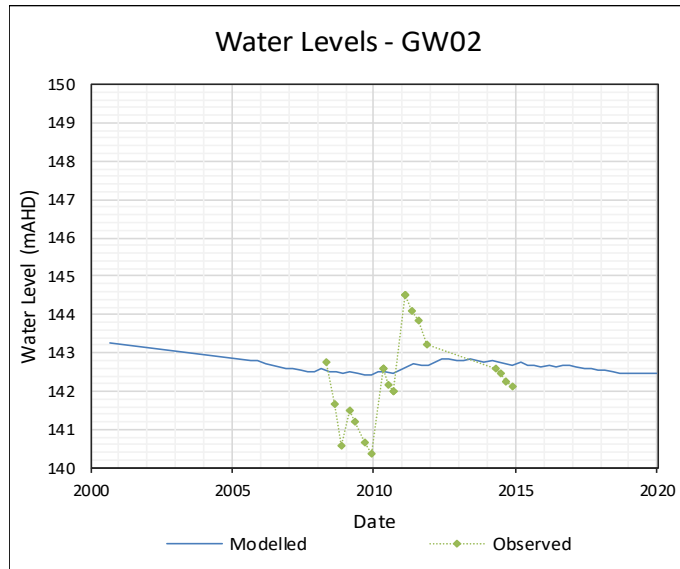


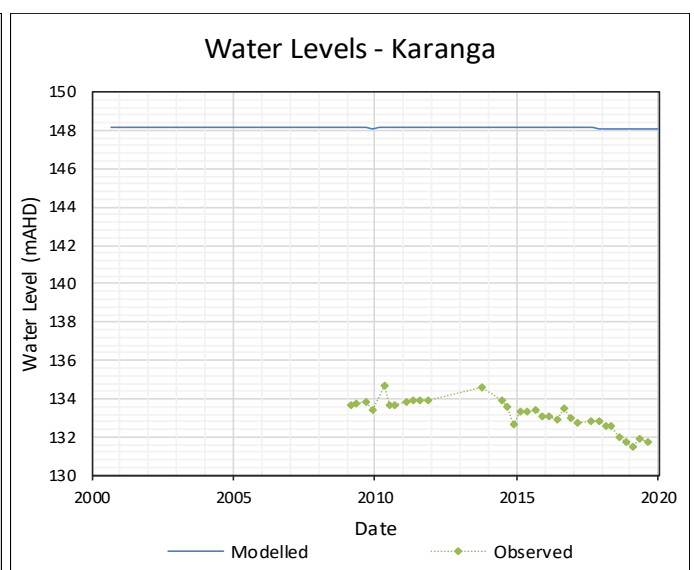
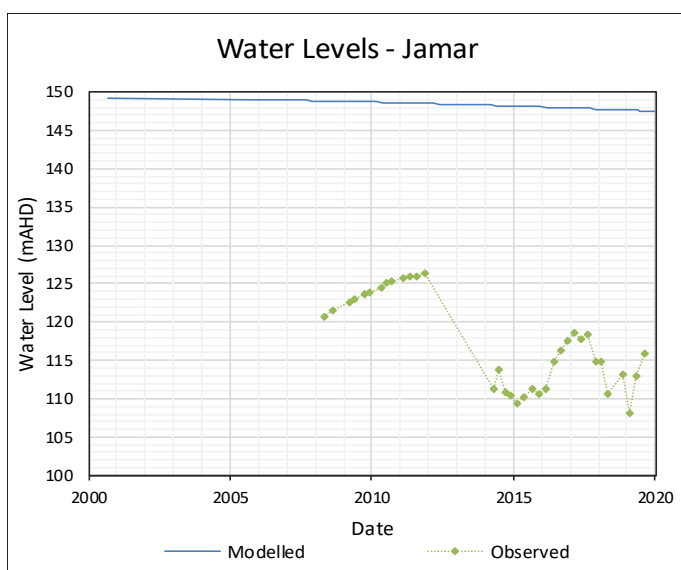
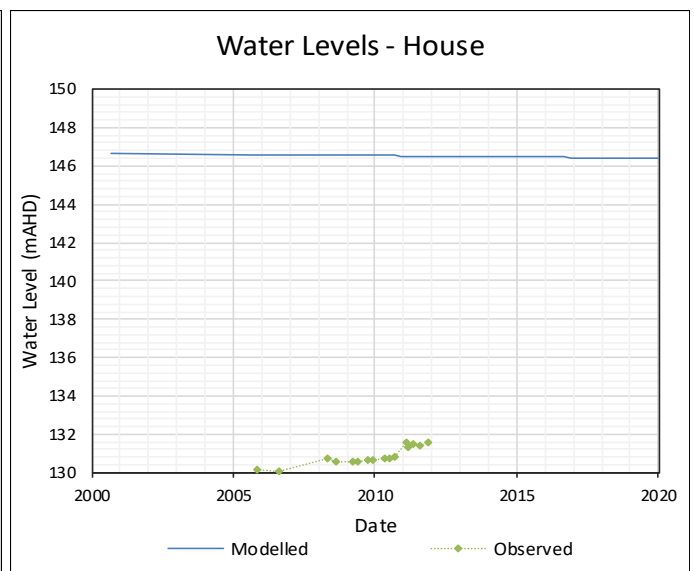
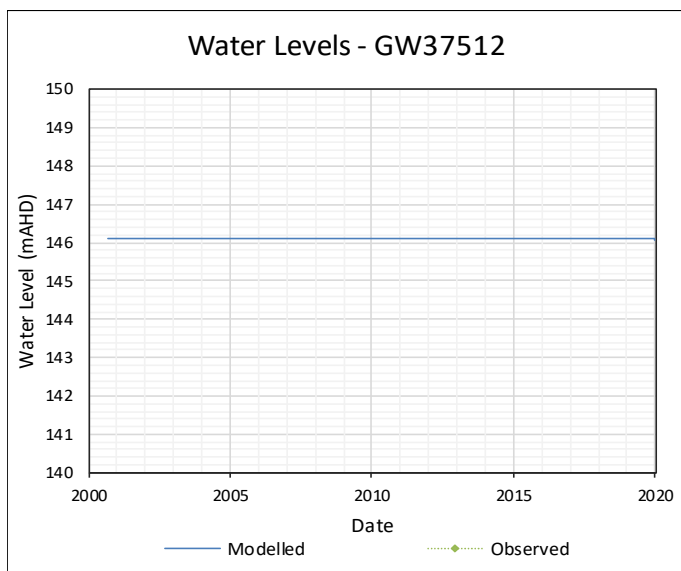
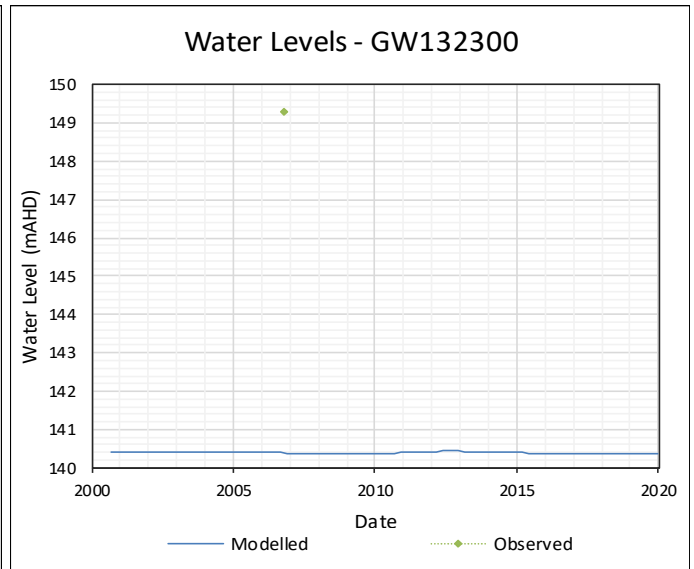
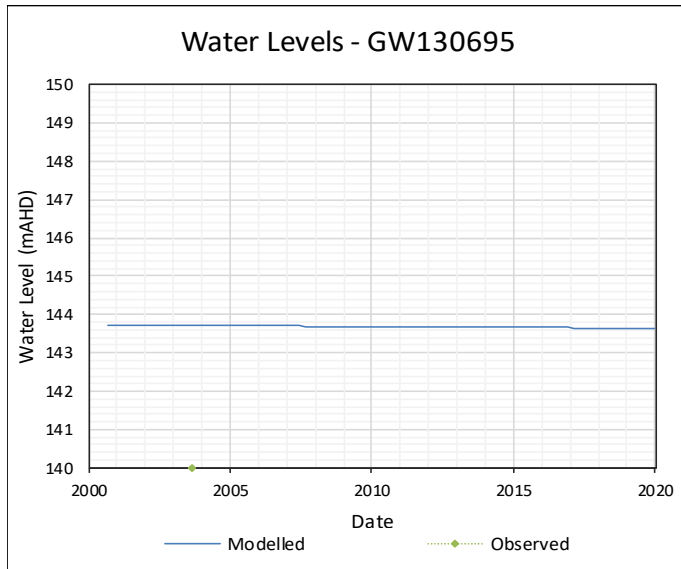


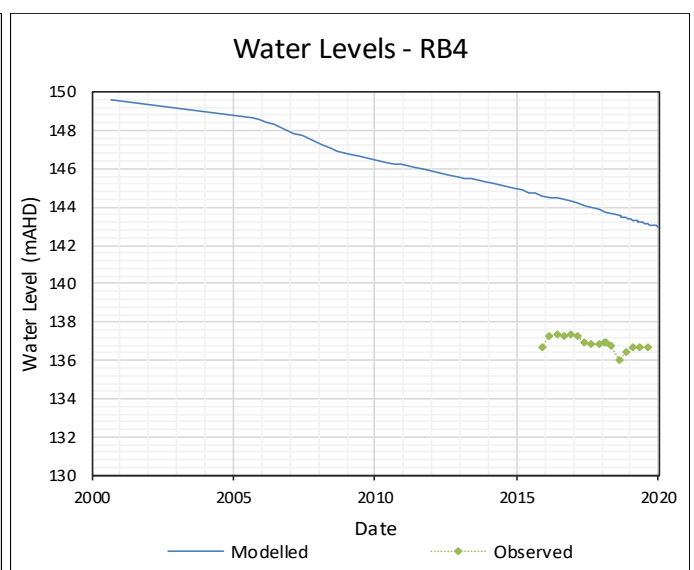
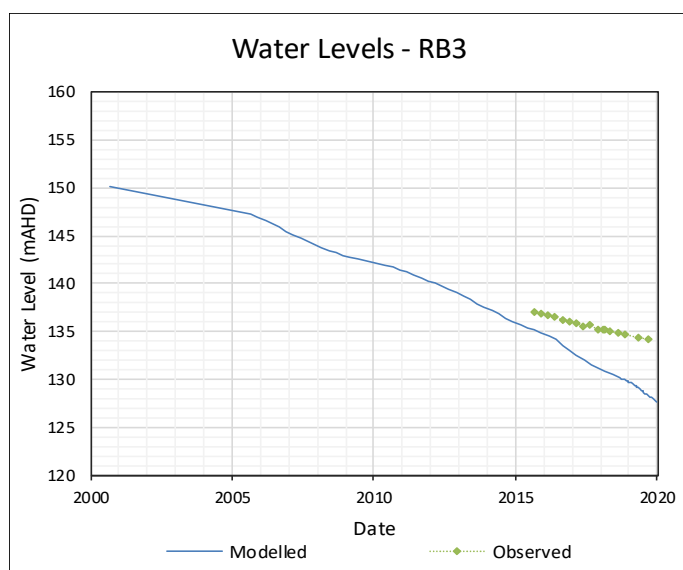
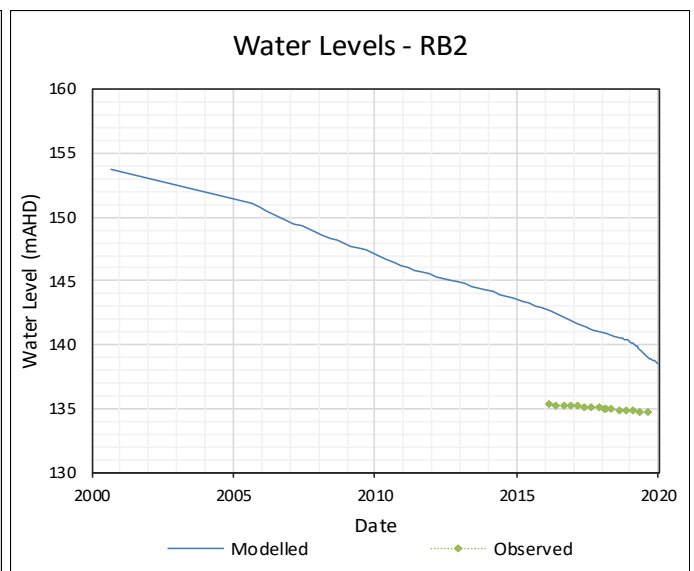
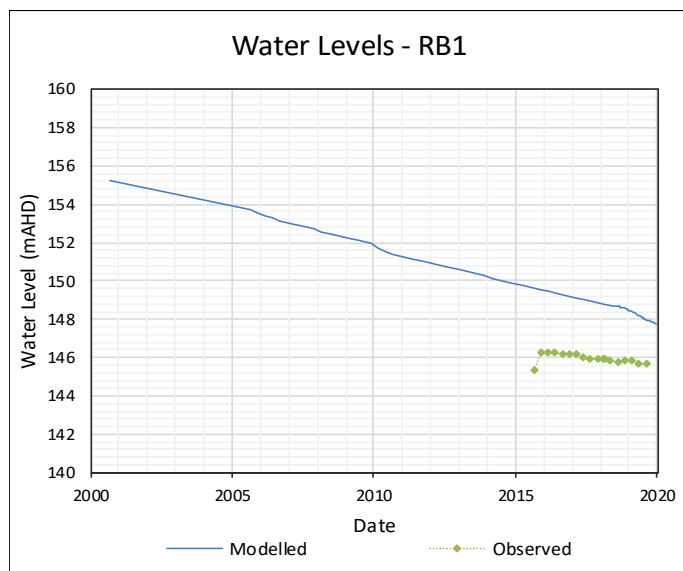
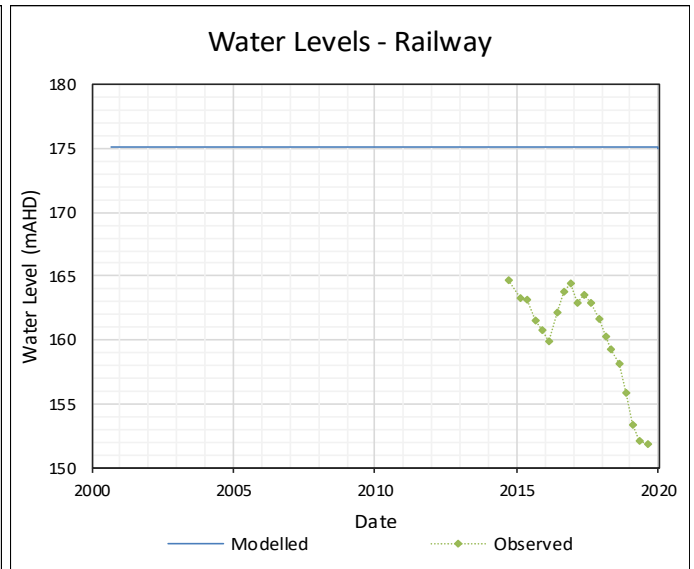
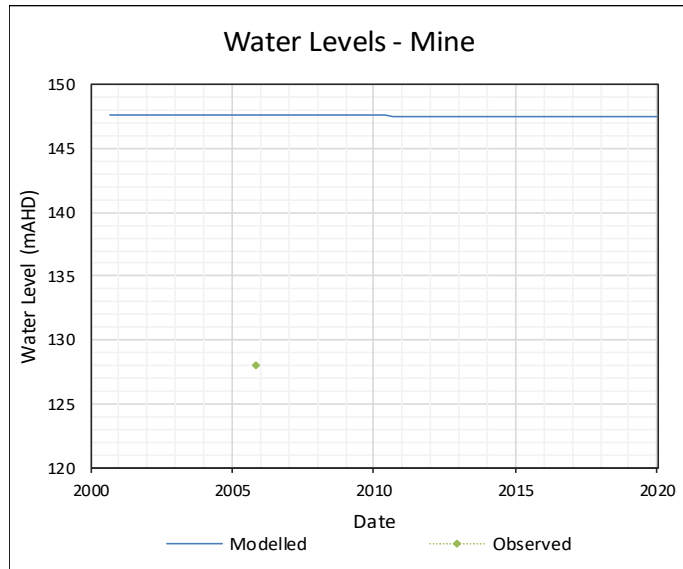


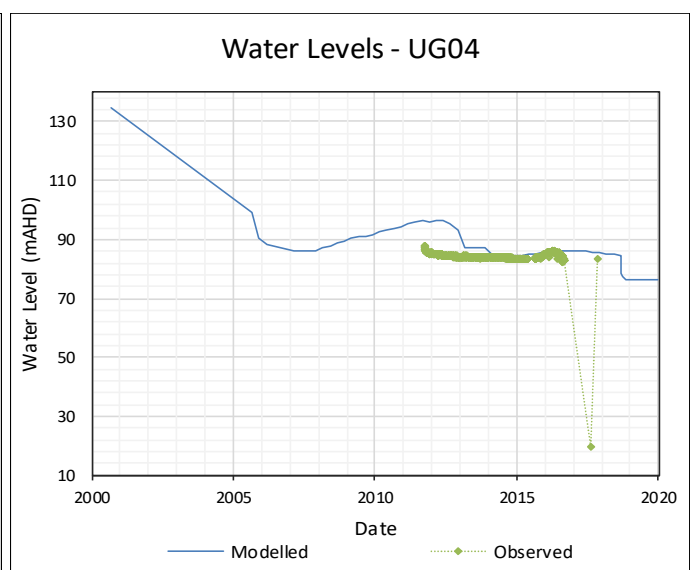
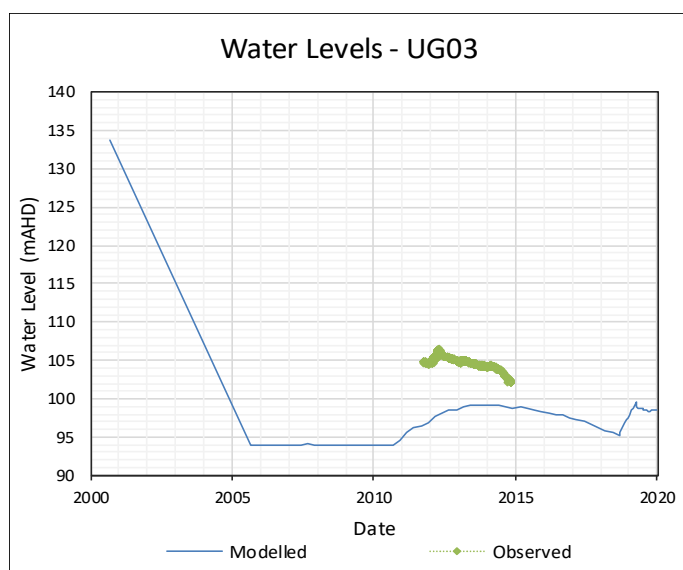
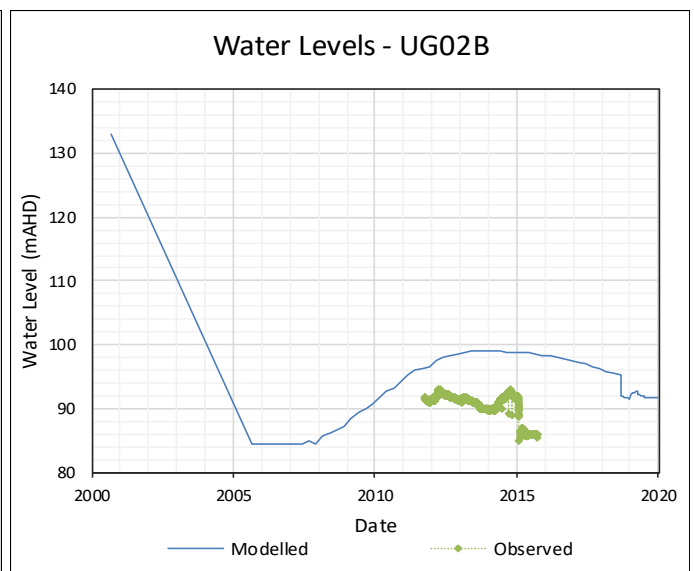
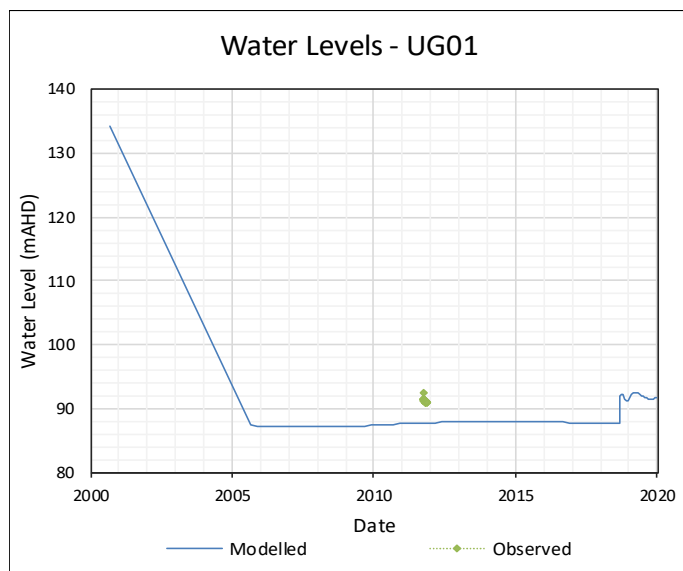
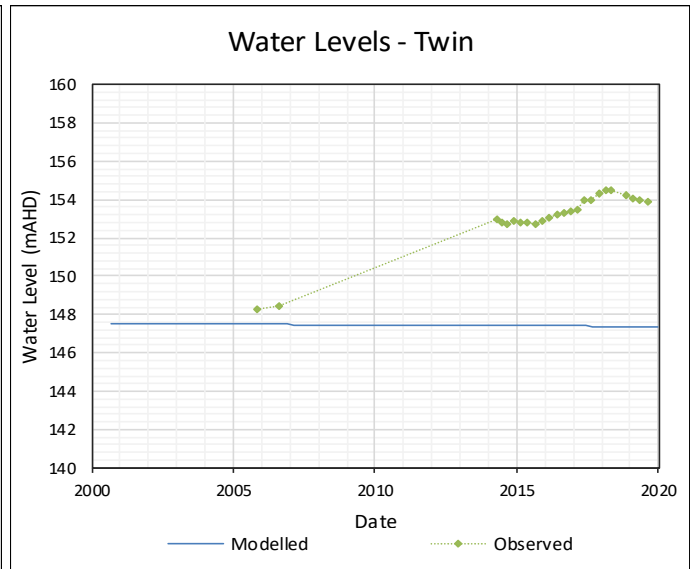
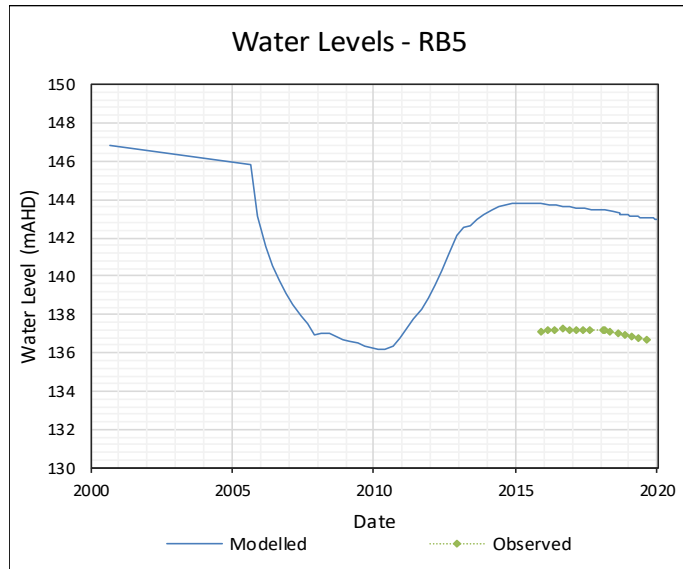


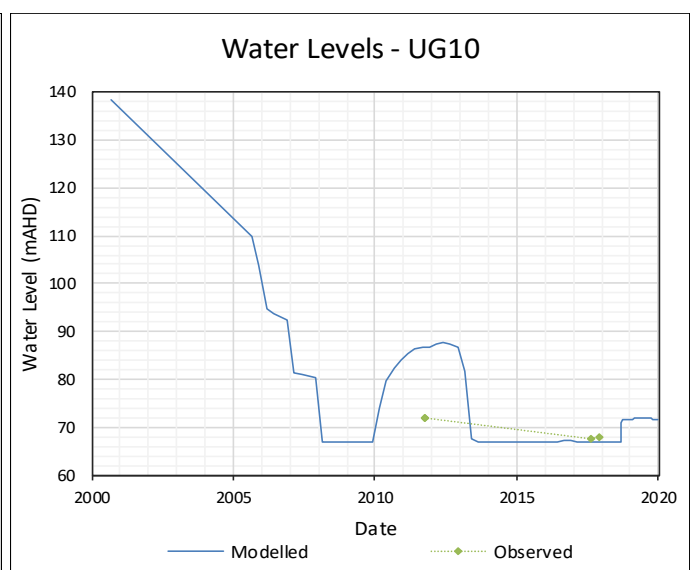
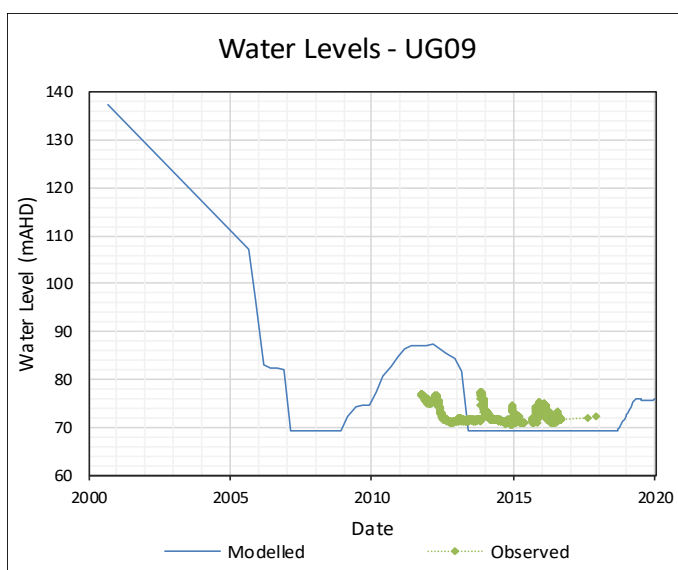
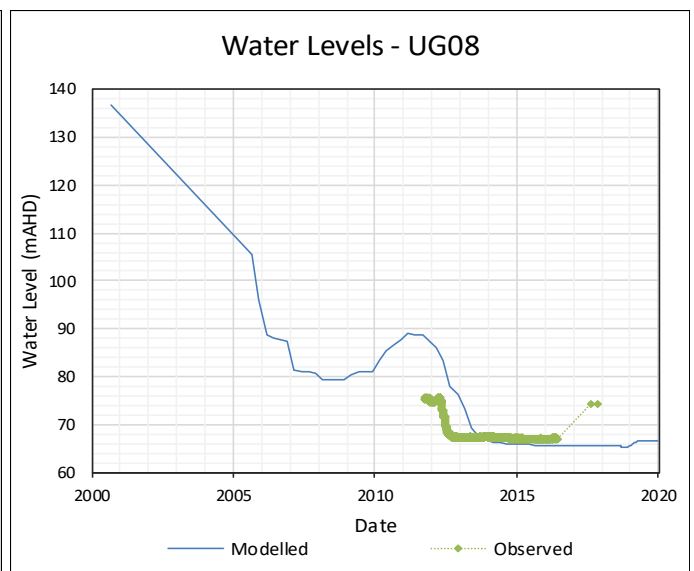
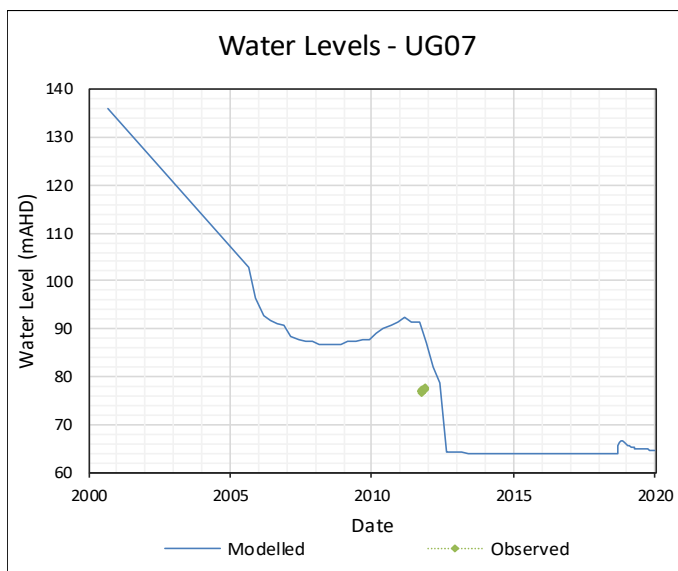
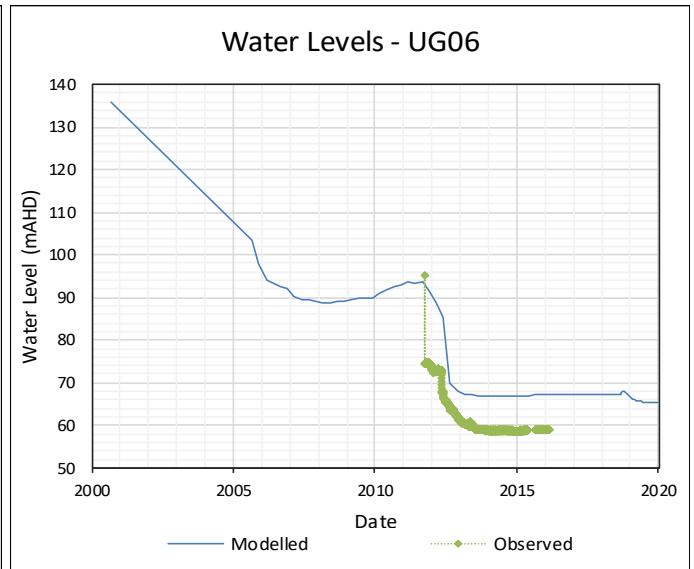
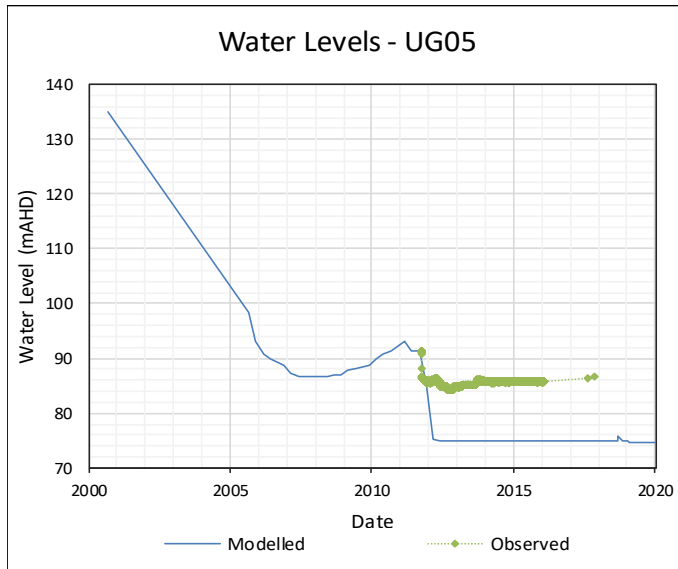


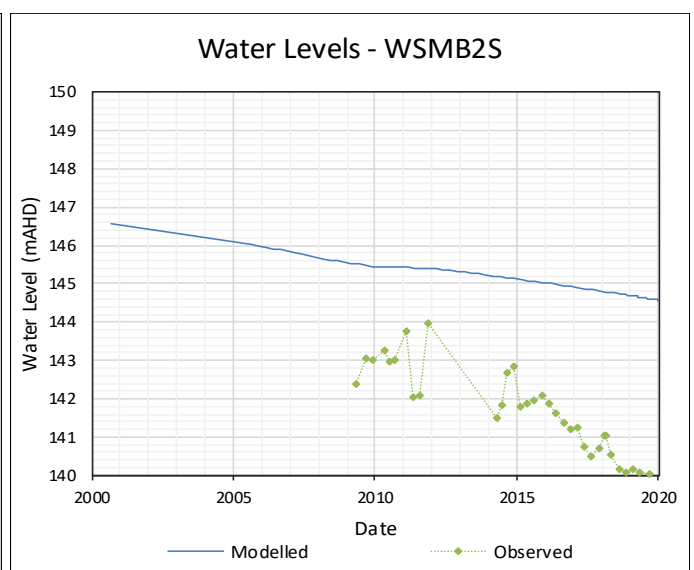
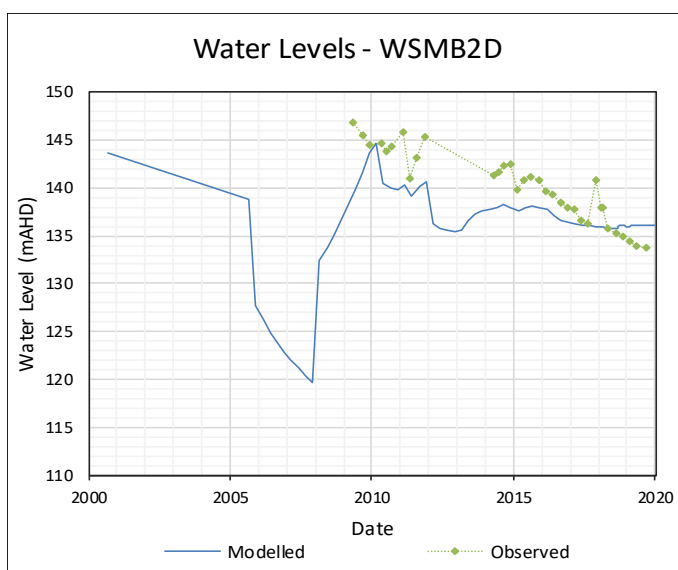
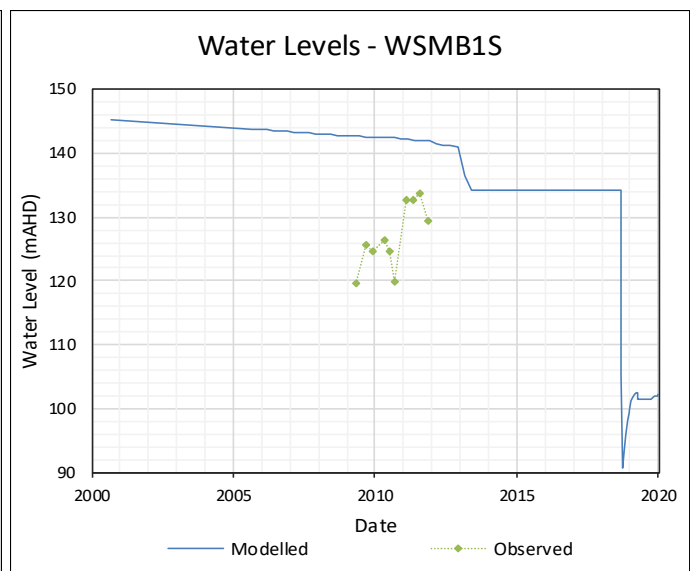
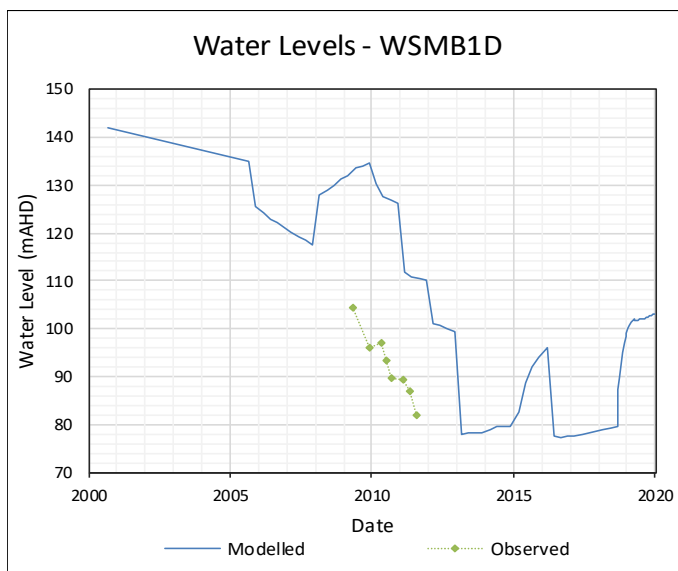
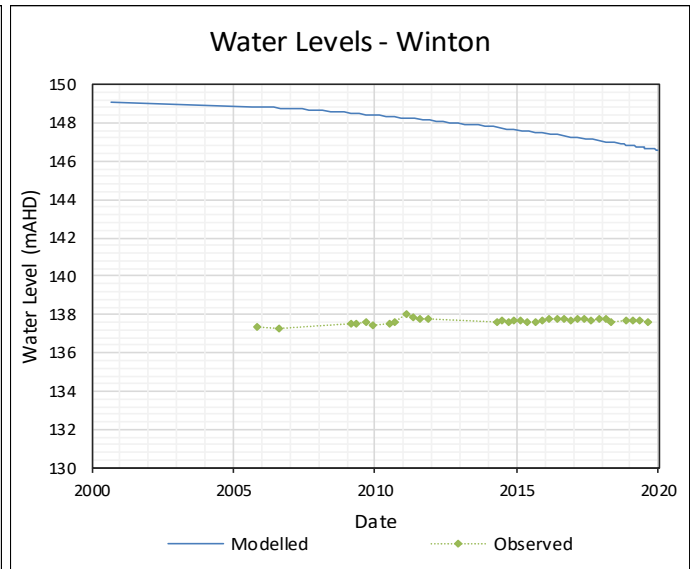
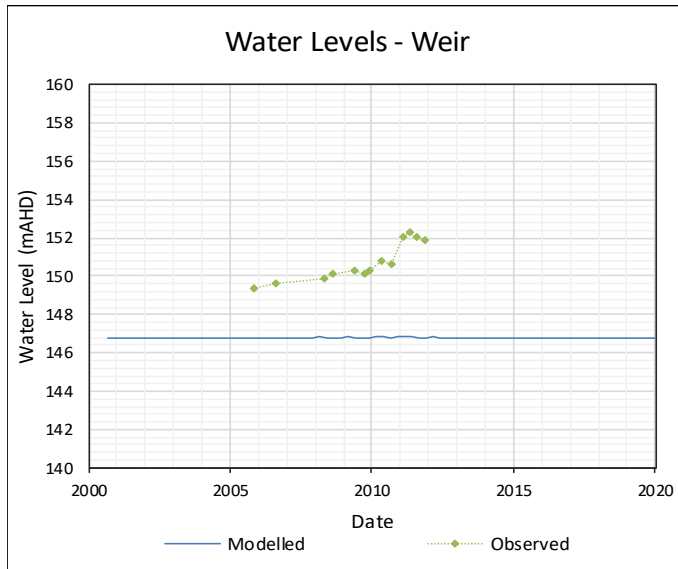


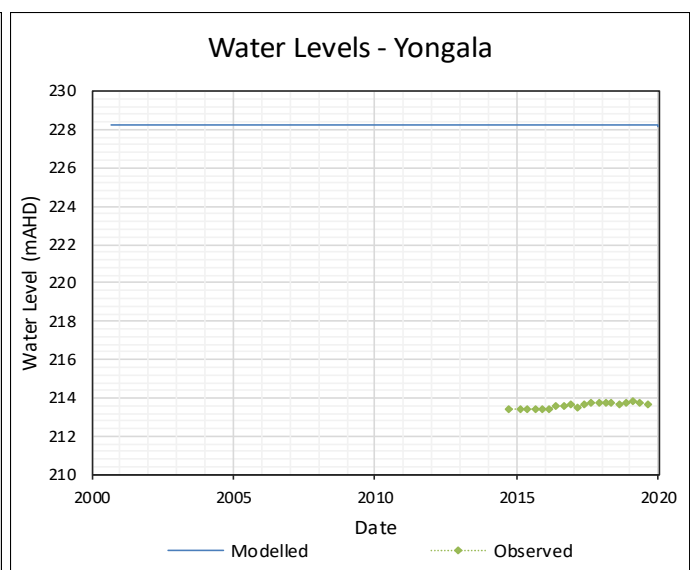
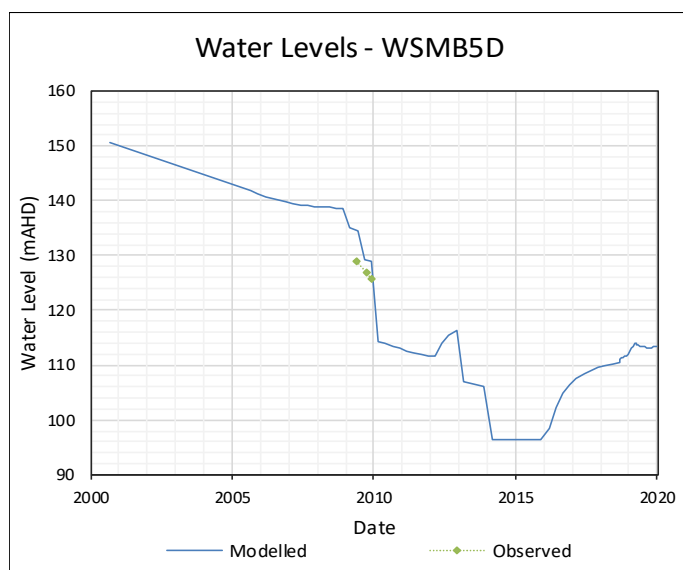
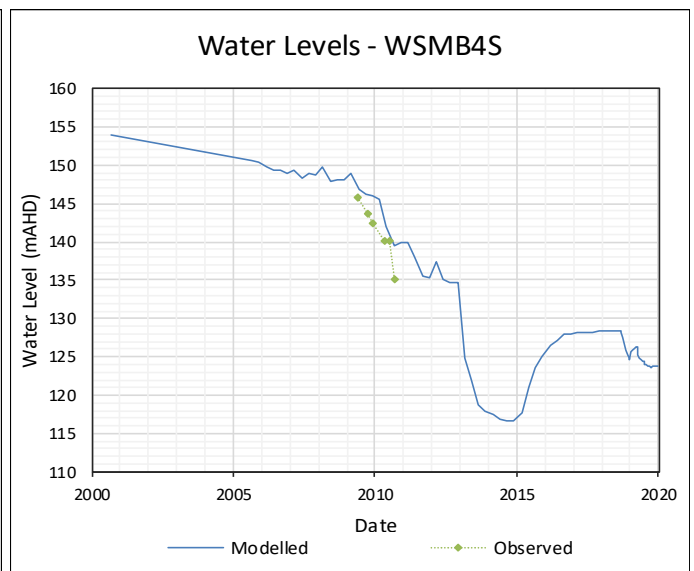
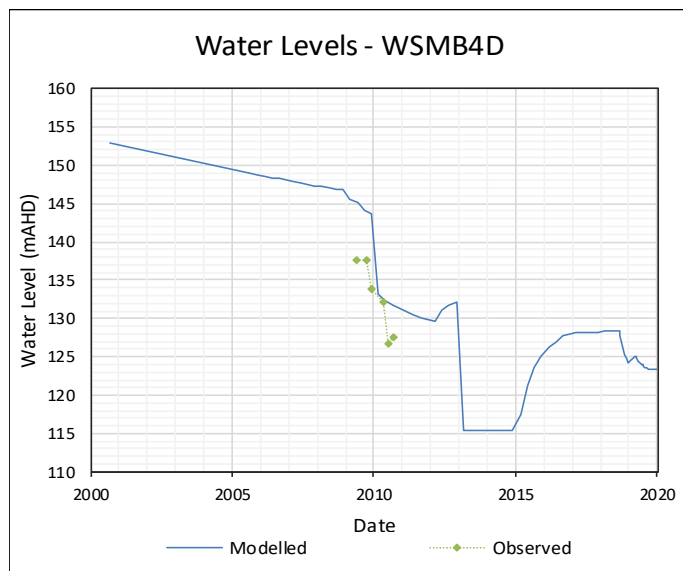
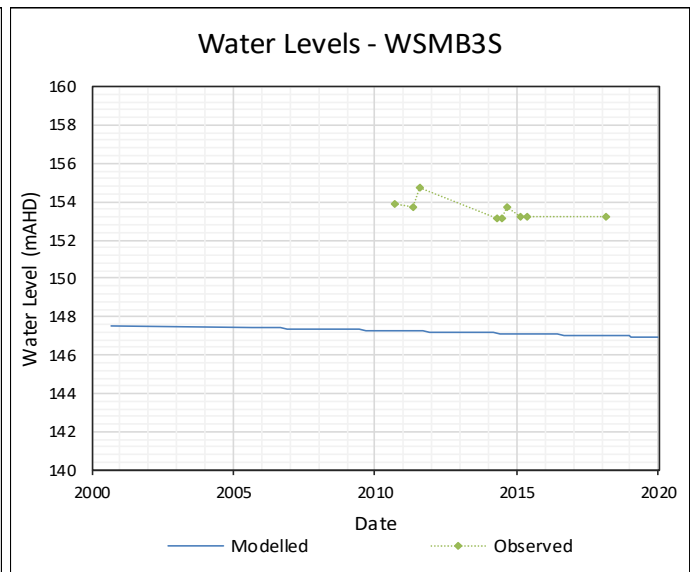
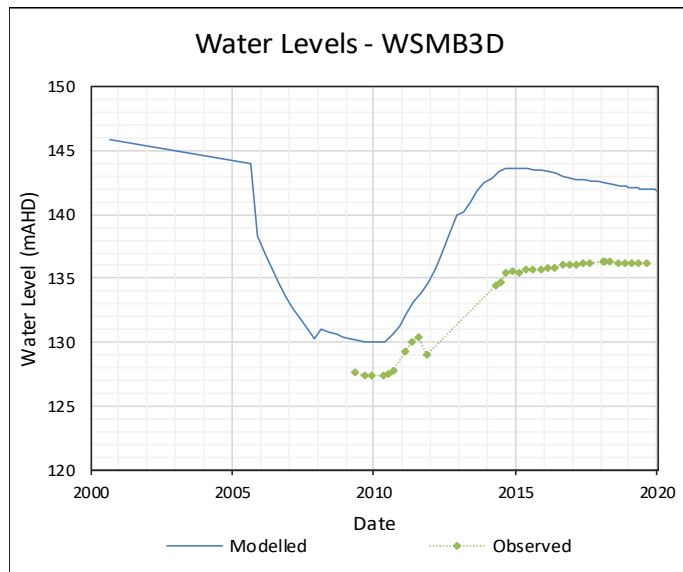








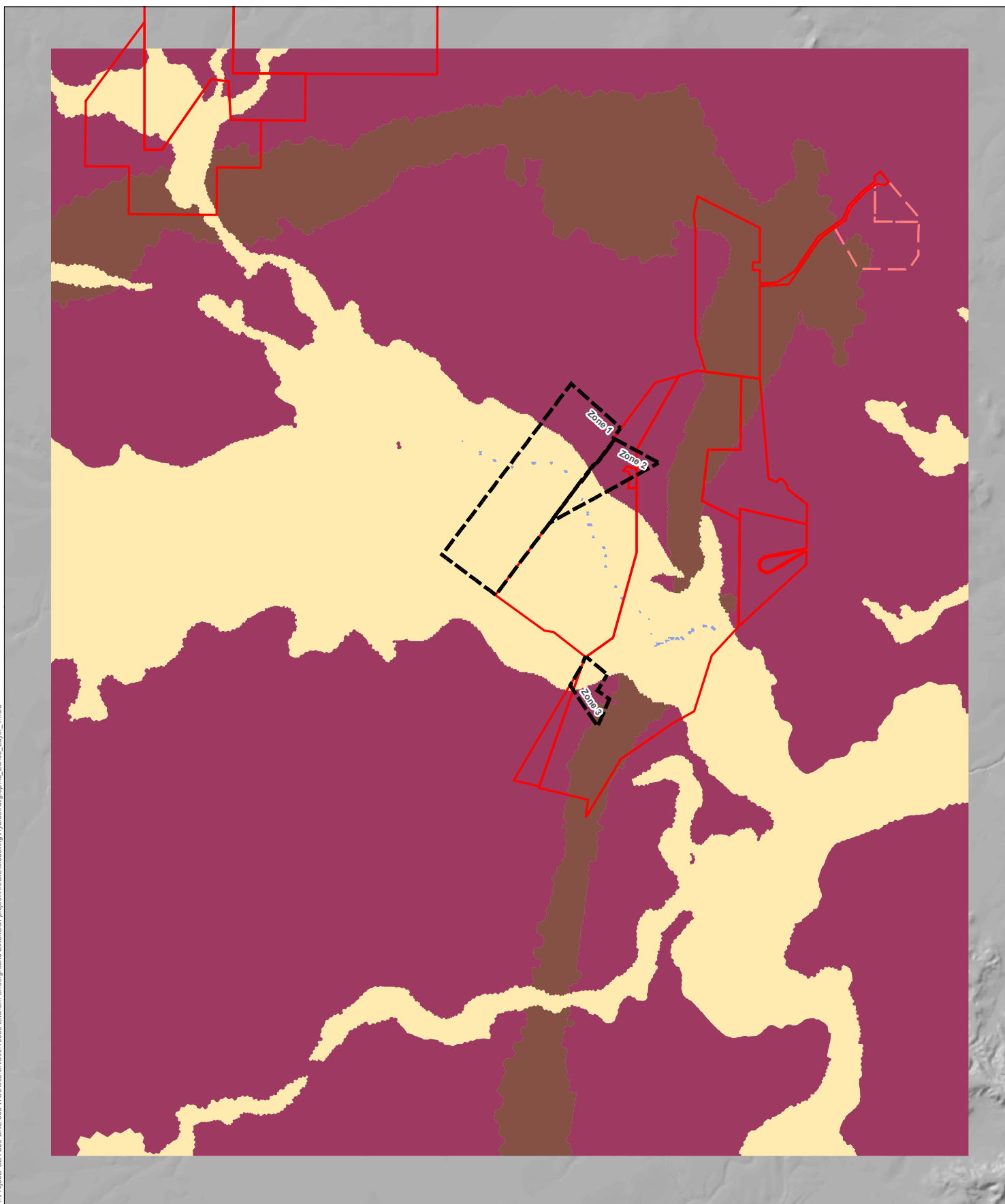




APPENDIX H

Hydraulic property zones

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

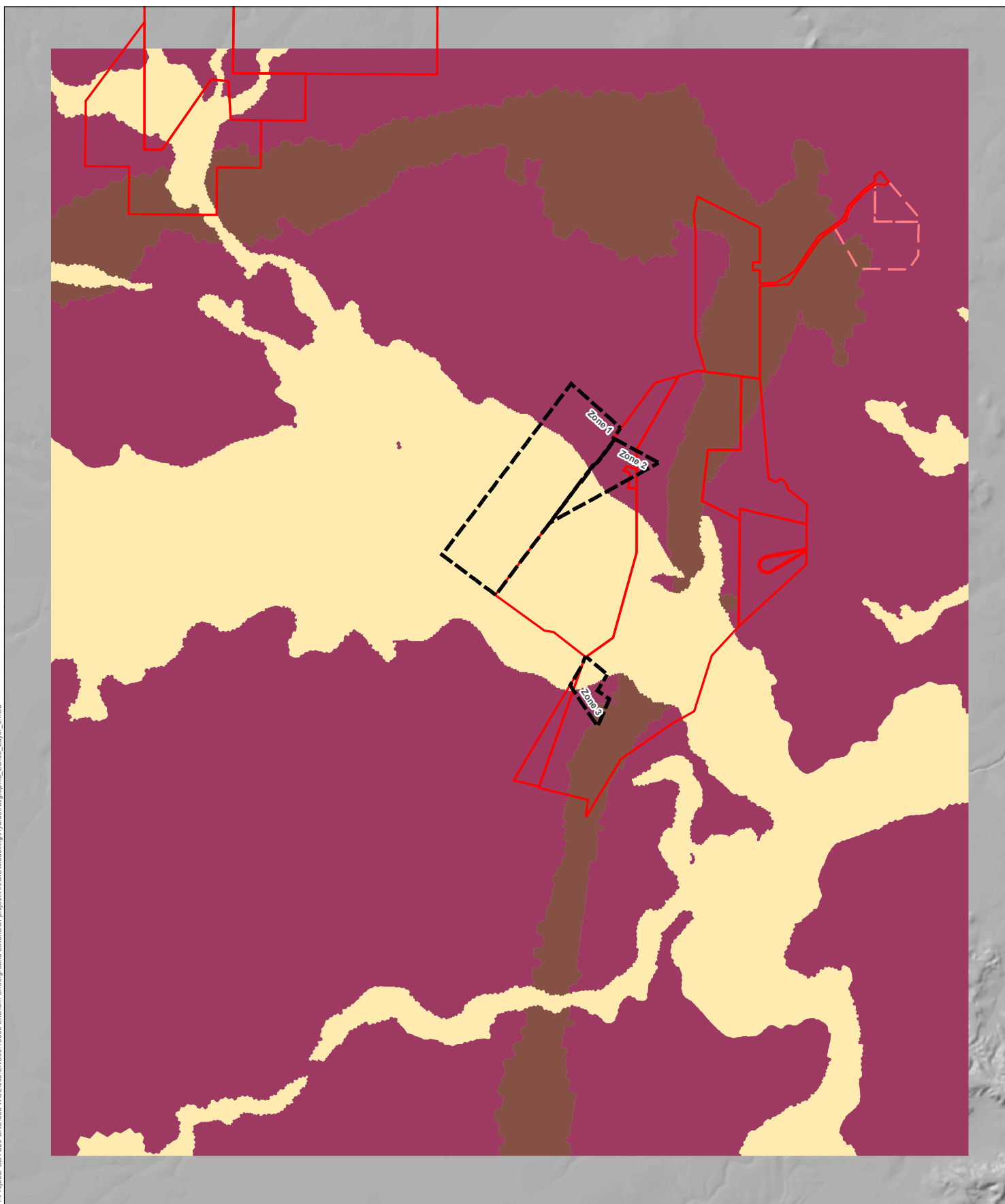
L1 K Zones

- Alluvium
- Nagoa River
- Regolith
- Shallow CM

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 1

H1-1



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L2 K Zones

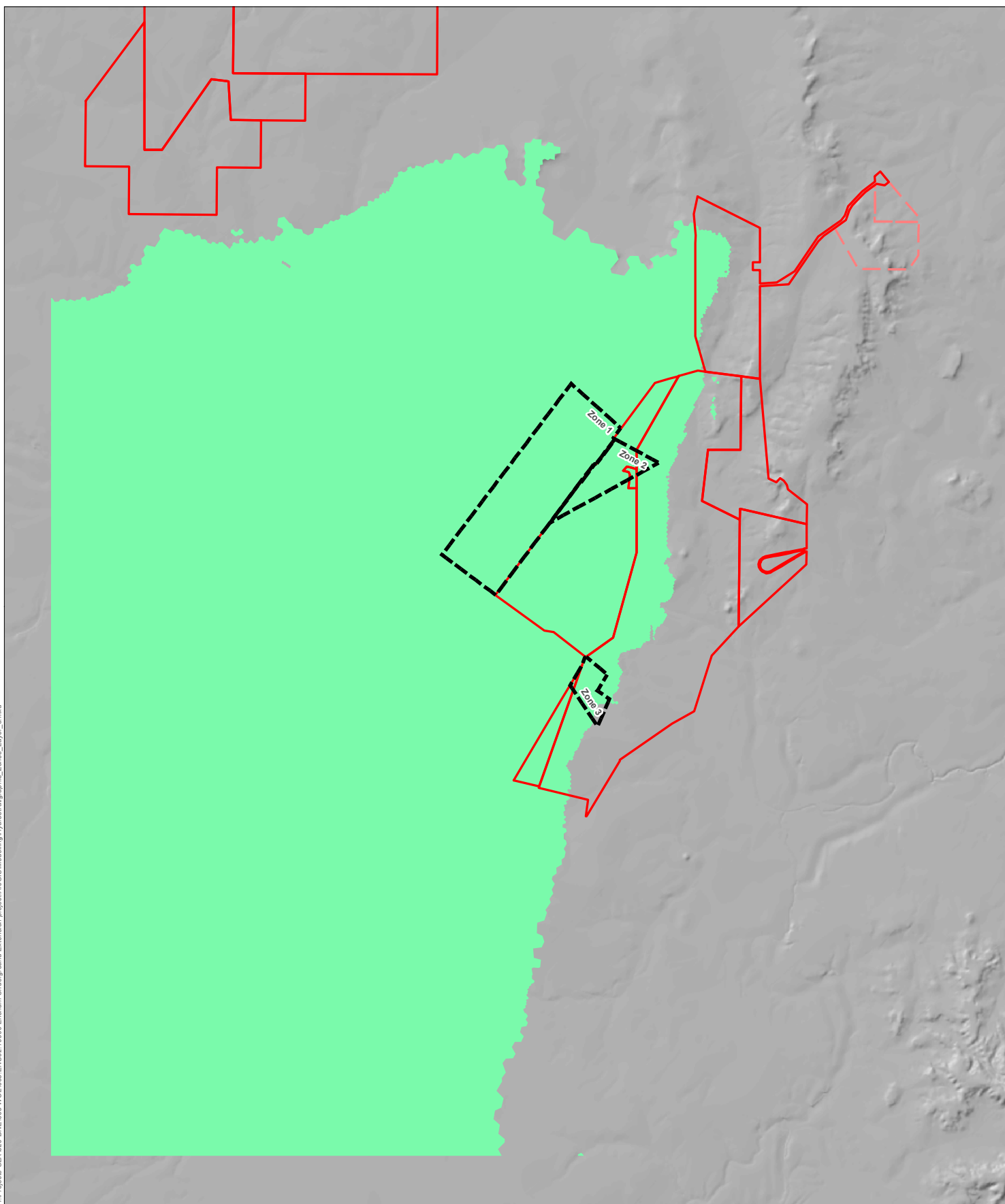
- Alluvium
- Regolith
- Shallow CM

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 2

H1-2

H:\Projects-SLR\620-6NE665-VOL166-ENS02-10000-Enham-Underground-Extension-project-ArcGISModelingHydrostratigraphic_Zones_Layer_3.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L3 K Zones

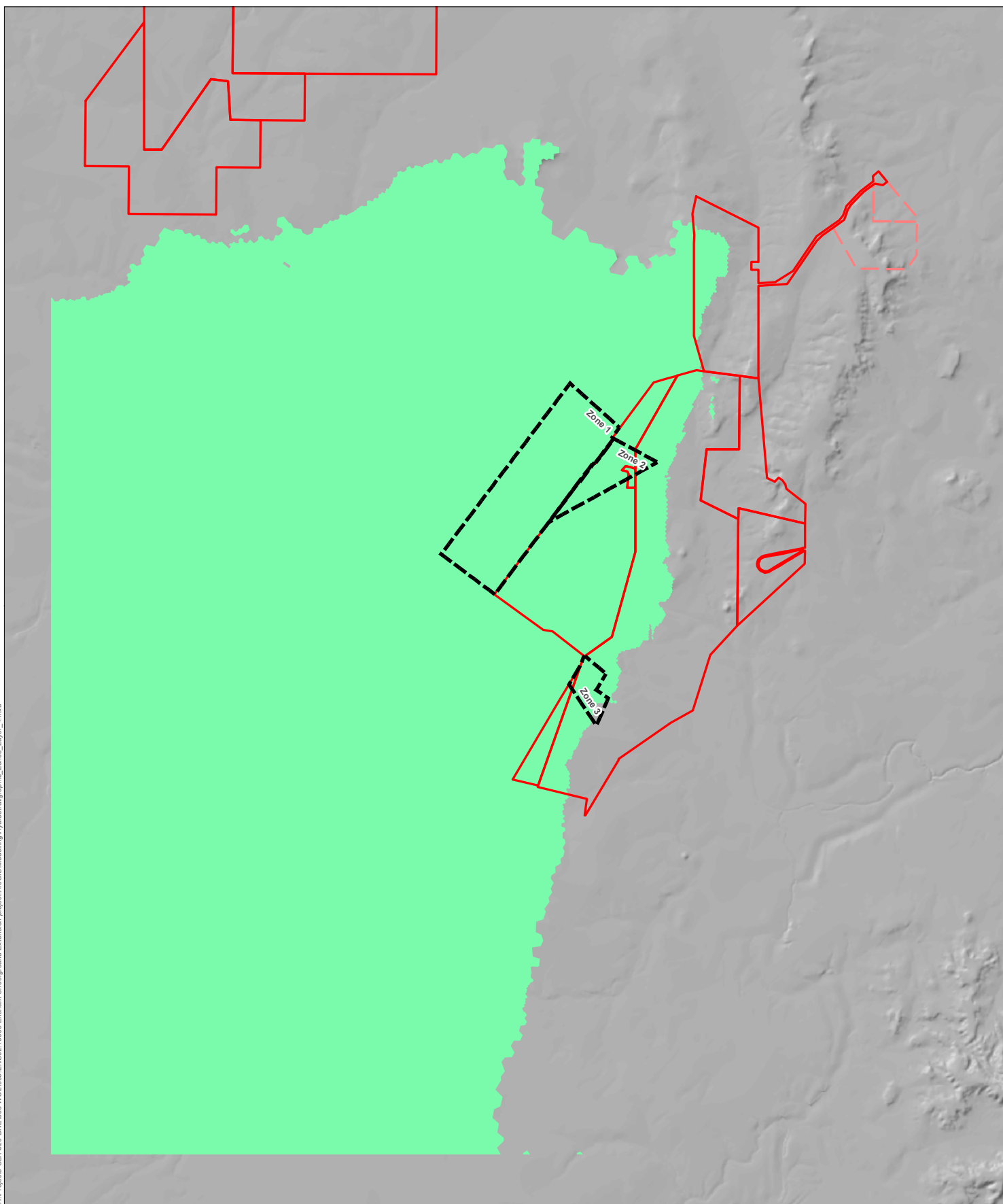
Rewan

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 3

H1-3

H:\Projects-SLR\620-6NE665-VOL1665-ENS02-10000-Ennham-Underground-Extension-project-ArcGISModelingHydrostratigraphic_Zones_Layer_4.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L4 K Zones

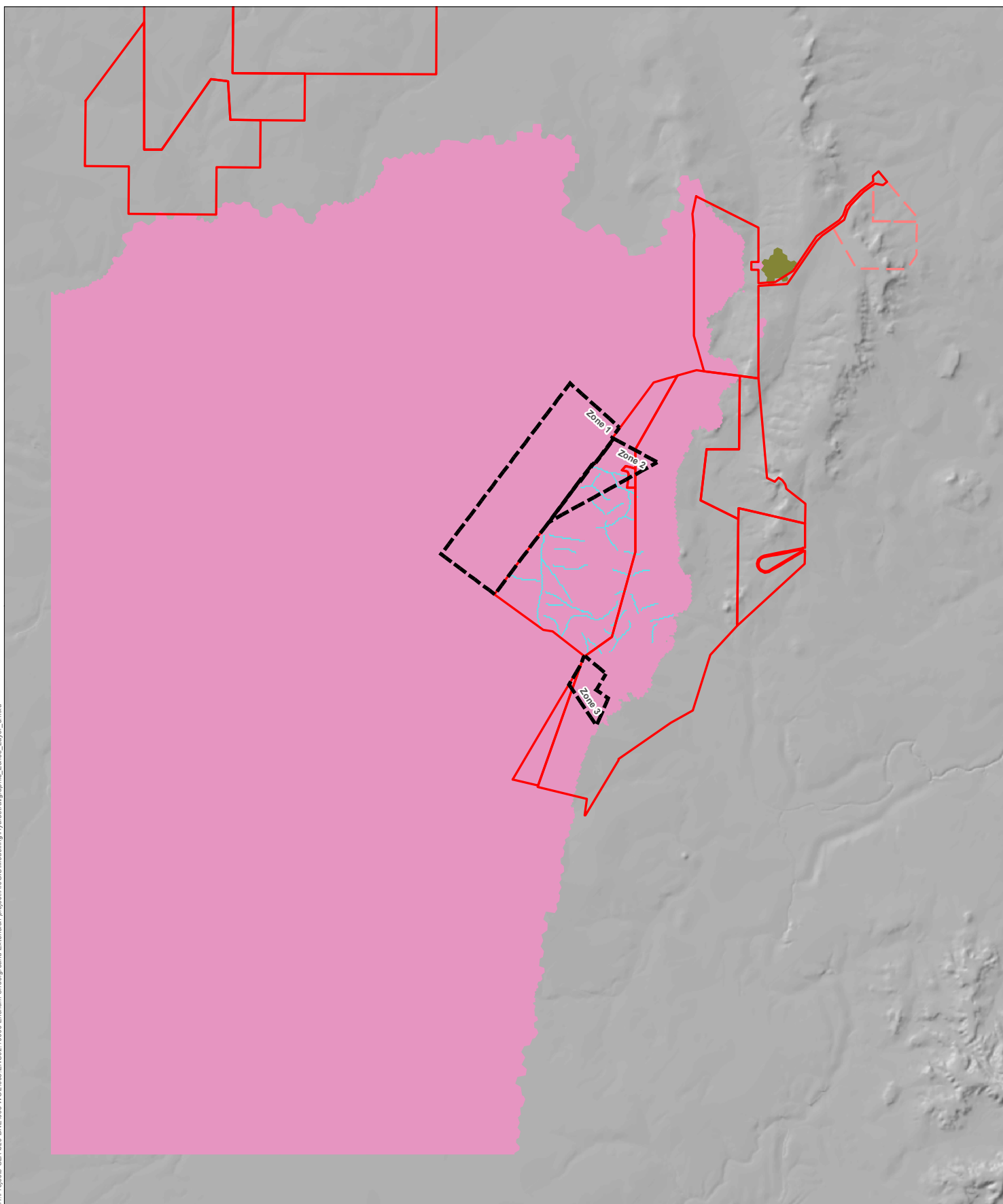
Rewan

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 4

H1-4

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L5 K Zones

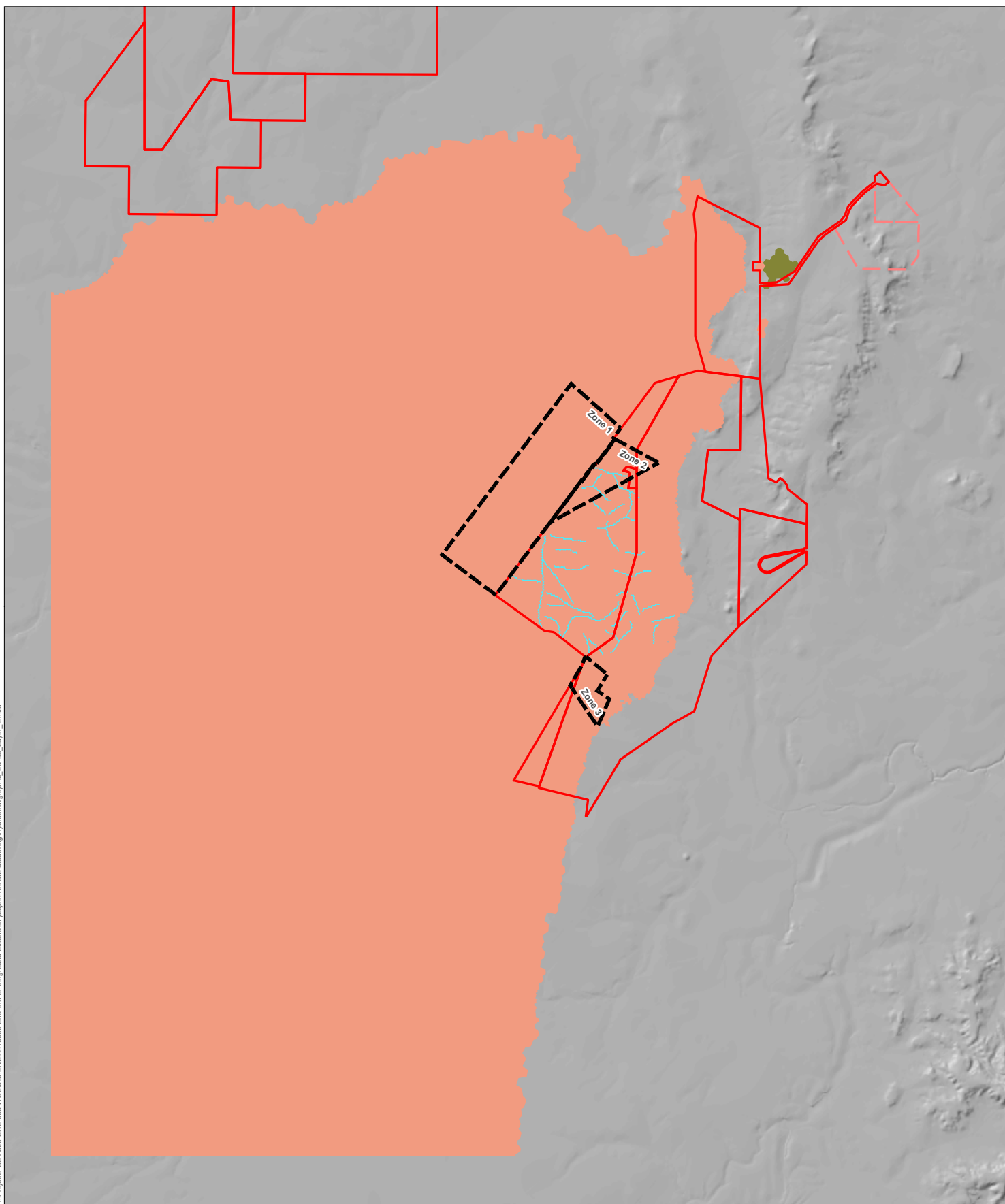
- Basement
- Fault
- Inter1

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 5

H1-5

H:\Projects-SLR\620-ENE\665-VOL\665-ENS02-10000-Enham-Underground-Extension-project\ArcGIS\Modelling\Hydrostratigraphic_Zones_Layer_6.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L6 K Zones

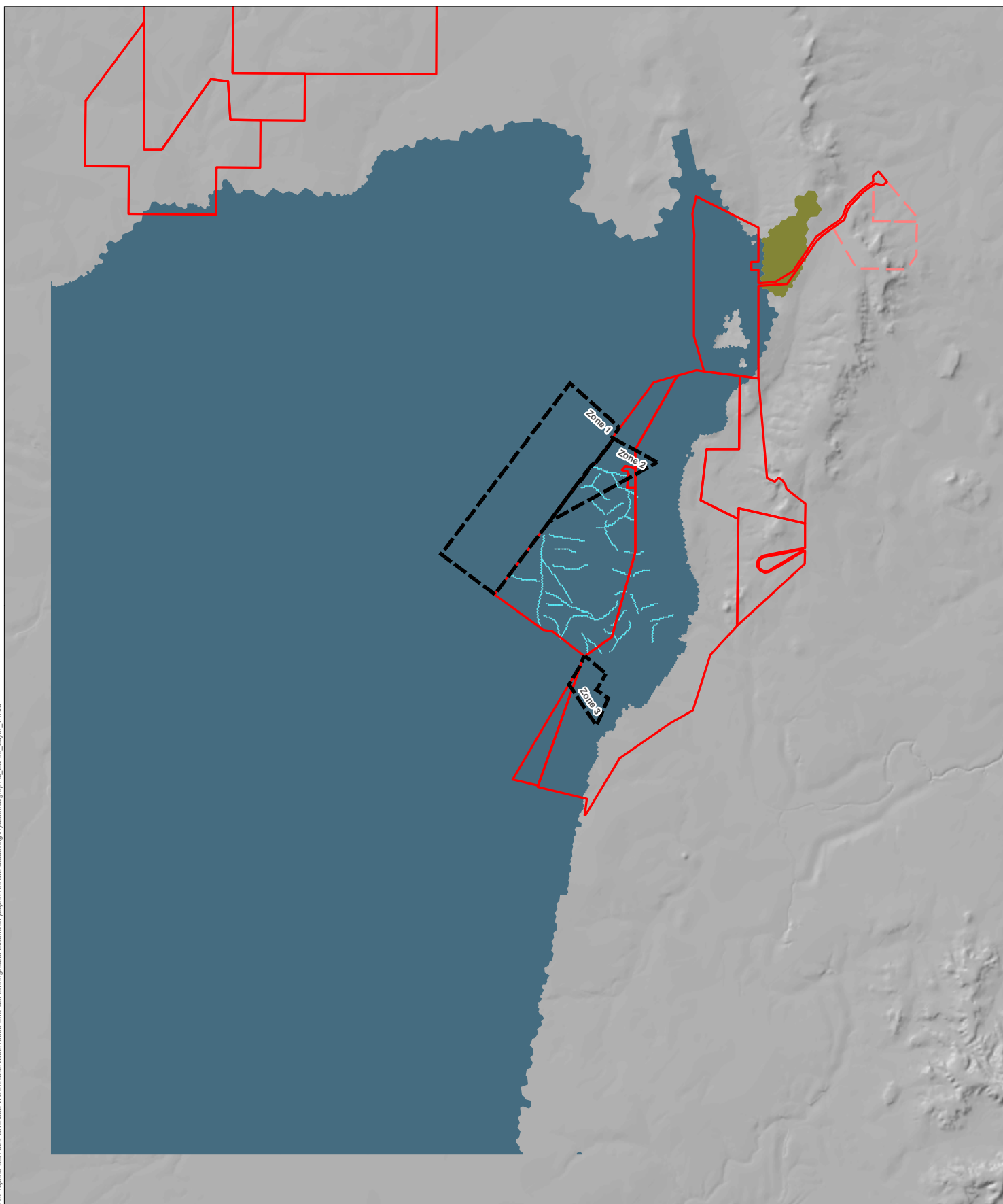
- Aries Seam
- Basement
- Fault

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 6

H1-6

H:\Projects-SLR\620-6NE665-VOL665-ENS02-10000-Enham-Underground-Extension-Project-ArcGISModelingHydrostratigraphic_Zones_Layer_7.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L7 K Zones

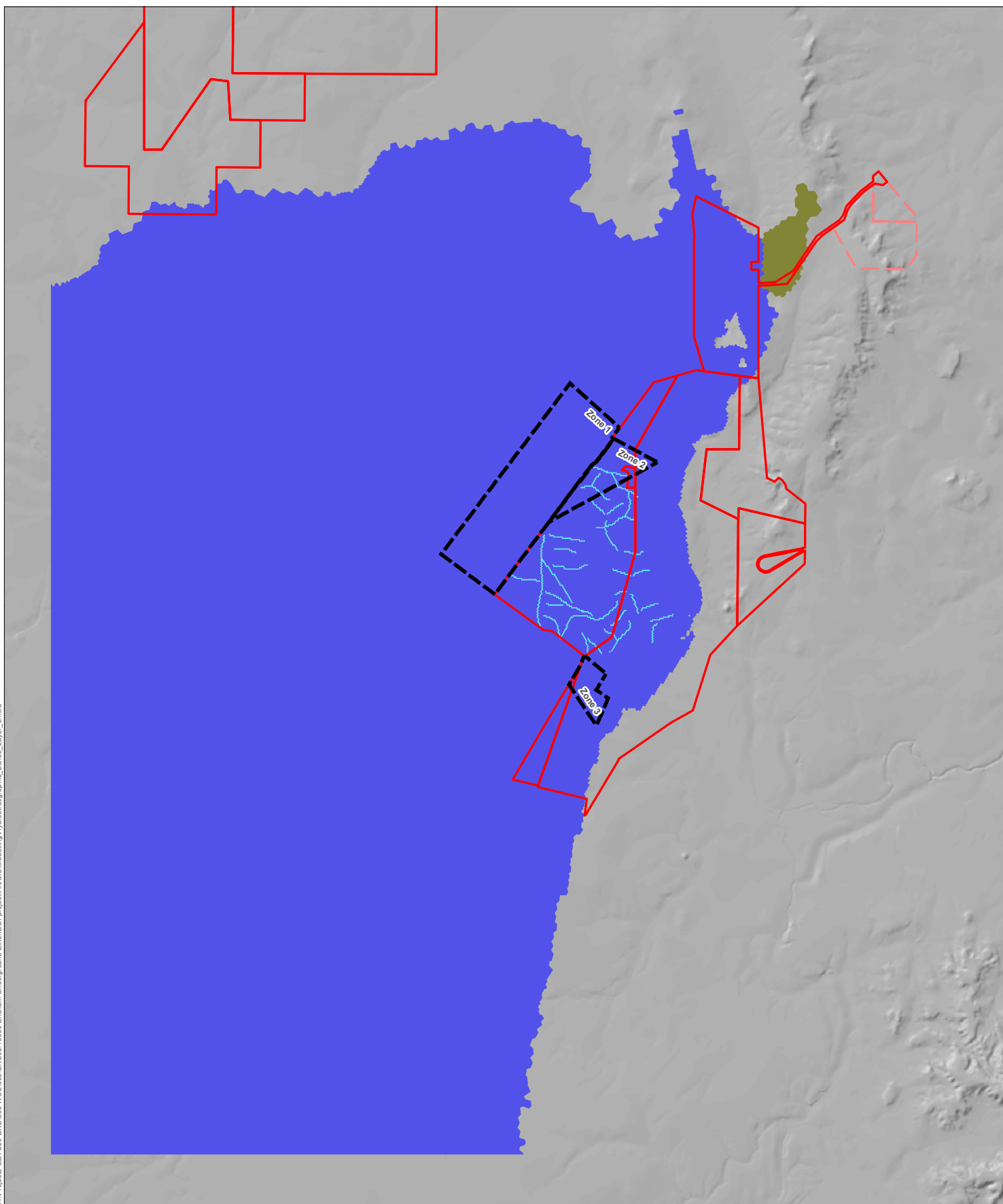
- Basement
- Fault
- Inter2

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 7

H1-7

H:\Projects-SLR\620-6NE\665-VOL\665-ENS02-10000-Enham-Underground-Extension-Project-ArcGISModelingHydrostratigraphic_Zones_Layer_8.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L8 K Zones

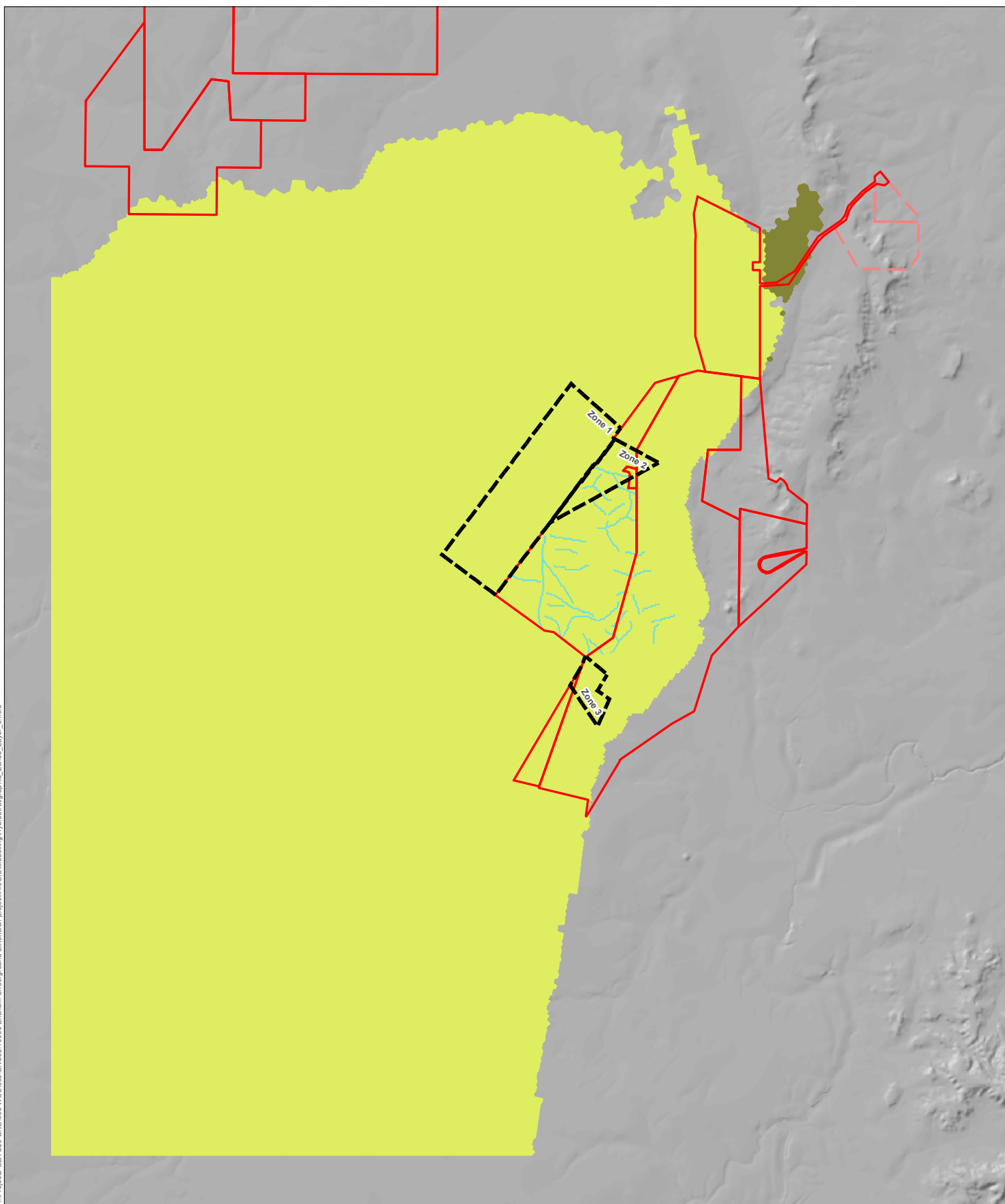
- Aries 2 and Castor
- Basement
- Fault

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 8

H1-8

H:\Projects-SLR\620-ENE\665-VOL\665_ENS02_10000_Eneham_Underground_Extension_project\ArcGISModeling\Hydrostratigraphic_Zones_Layer_9.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L9 K Zones

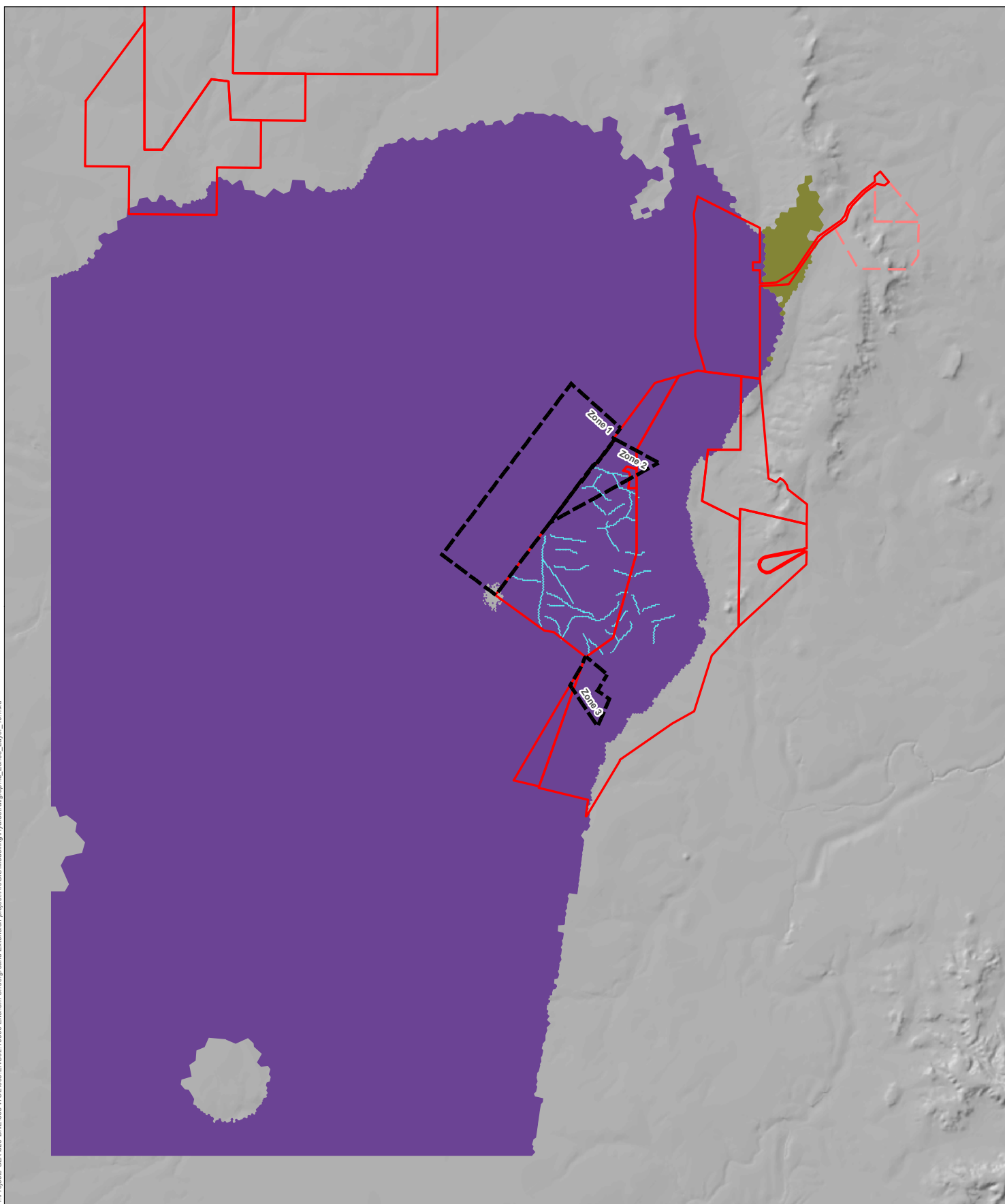
- Basement
- Fault
- Inter3

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 9

H1-9

H:\Projects-SLR\620-ENE\665-WOL\665-ENS02-10000-Ennham-Underground-Extension-project\ArcGIS\Modelling\Hydrostratigraphic_Zones_Layer_10.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L10 K Zones

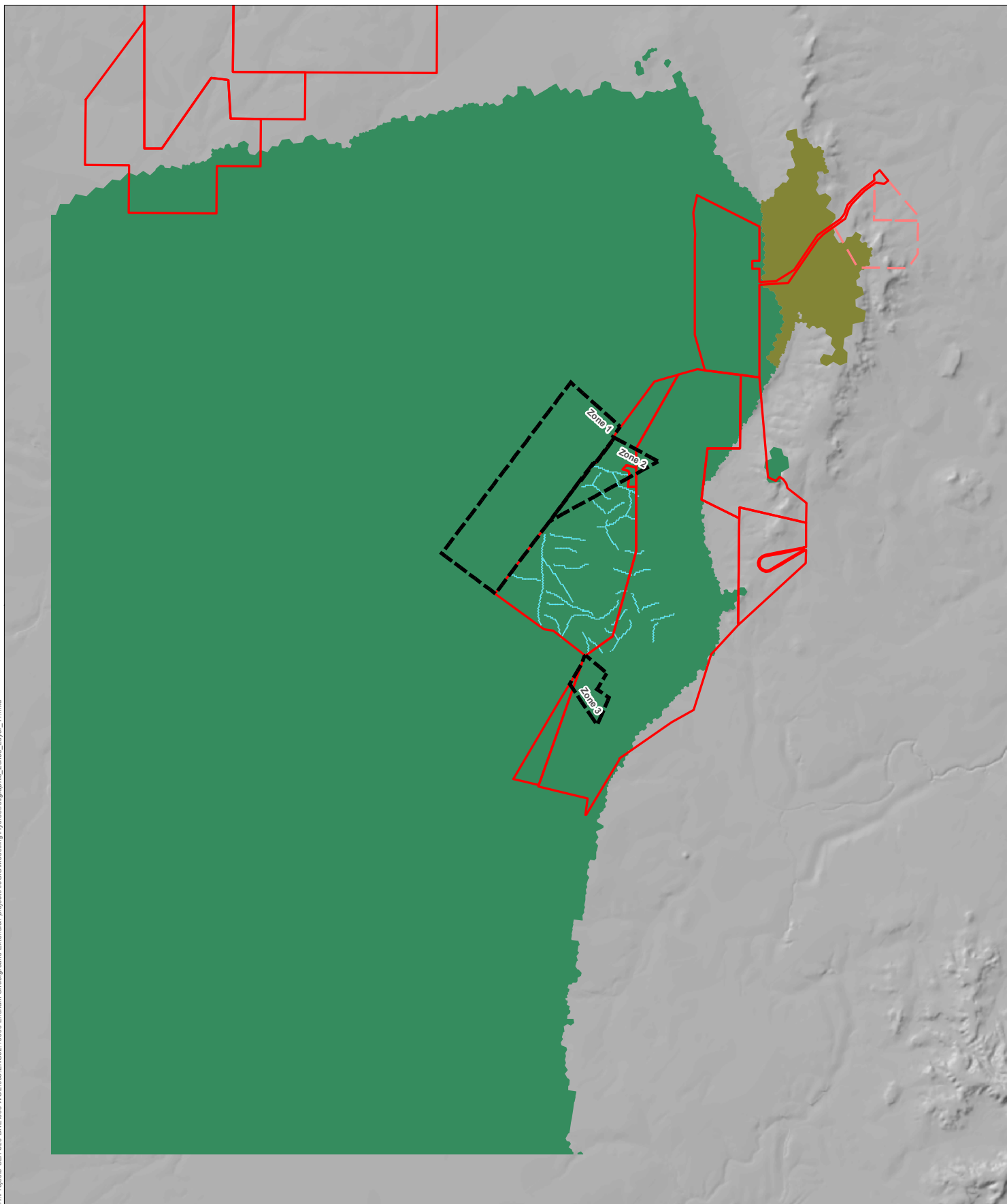
- Basement
- Fault
- Pollux Seam

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 10

H1-10

H:\Projects-SLR\620-6NE665-VOL1665-ENS02-10000-Enham-Underground-Extension-Project-ArcGISModelingHydrostratigraphic_Zones_Layer_11.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▬ Mining Lease (Granted)
- - - Mining Lease (Application)
- Project Area

L11 K Zones

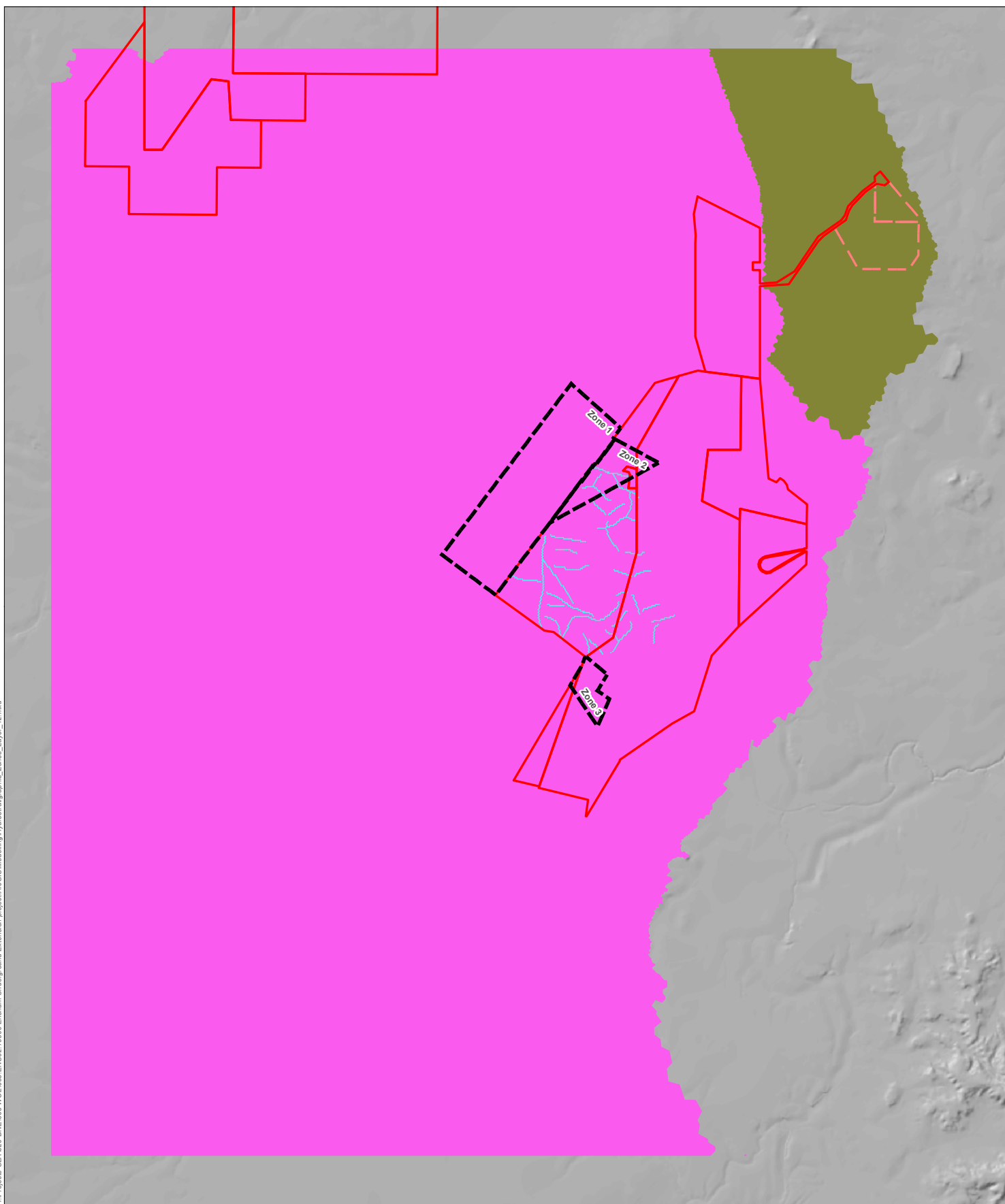
- Basement
- Fault
- Inter4

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 11

H1-11

H:\Projects-SLR\620-ENE665-VOL066-ENS02-10000-Ennham-Underground-Extension-Project\ArcGIS\Modelling\Hydrostratigraphic_Zones_Layer_12.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

L12 K Zones

- Basement
- Burngrove
- Fault

GROUNDWATER IMPACT ASSESSMENT

Hydrostratigraphic Zones - Layer 12

H1-12

H:\Projects-SLR\620-ENE\665-WOL\665-ENS02-10000-Ensham-Underground-Extension-Project-ArcGIS\Modelling\Recharge_Zones.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 07-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

RechZones

- Alluvium
- Regolith
- Shallow CM

GROUNDWATER IMPACT ASSESSMENT

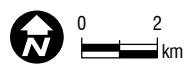
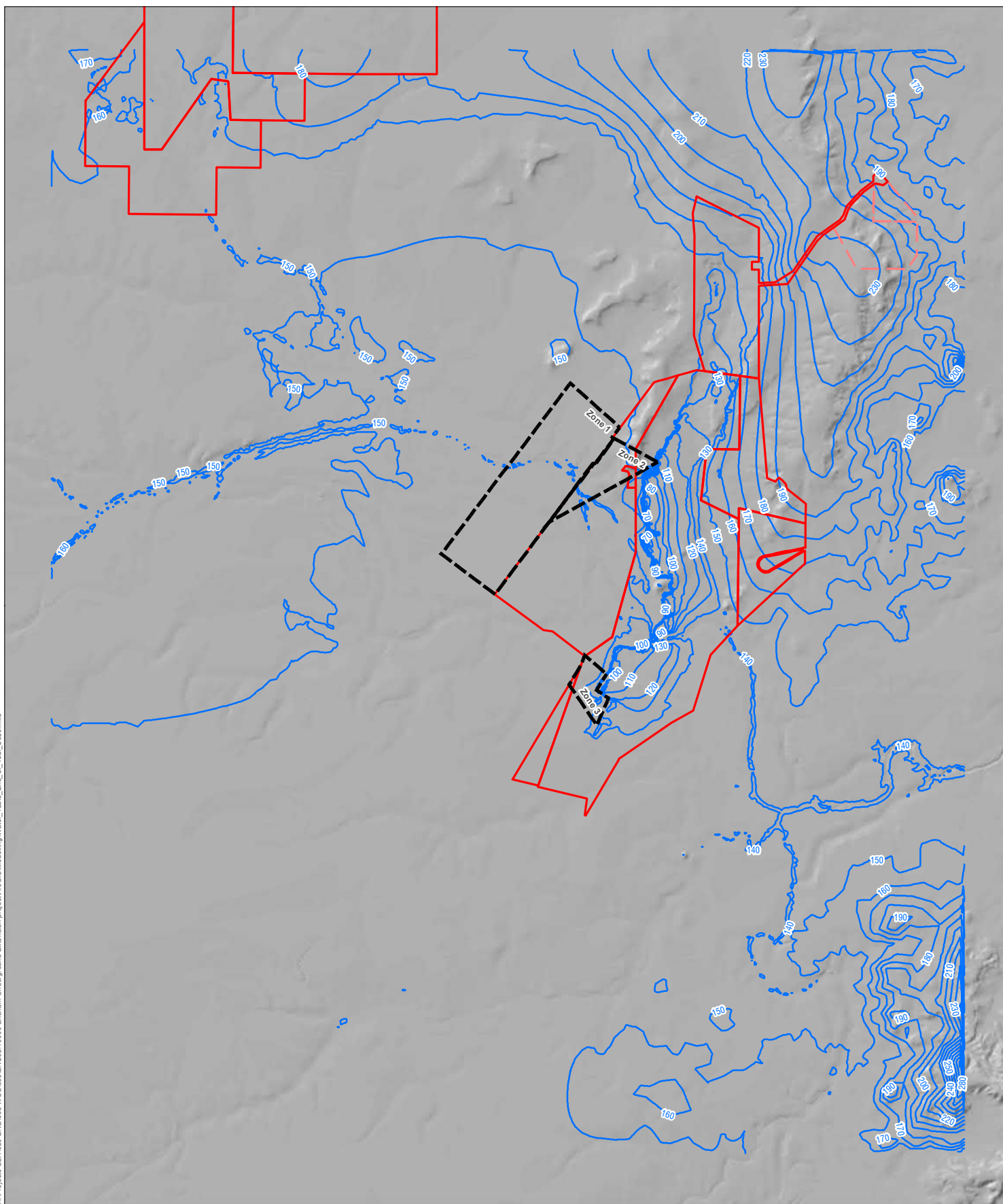
Recharge Zones

H2-1

APPENDIX I

Maps of water levels

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Water_Table_End_of_Year_2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

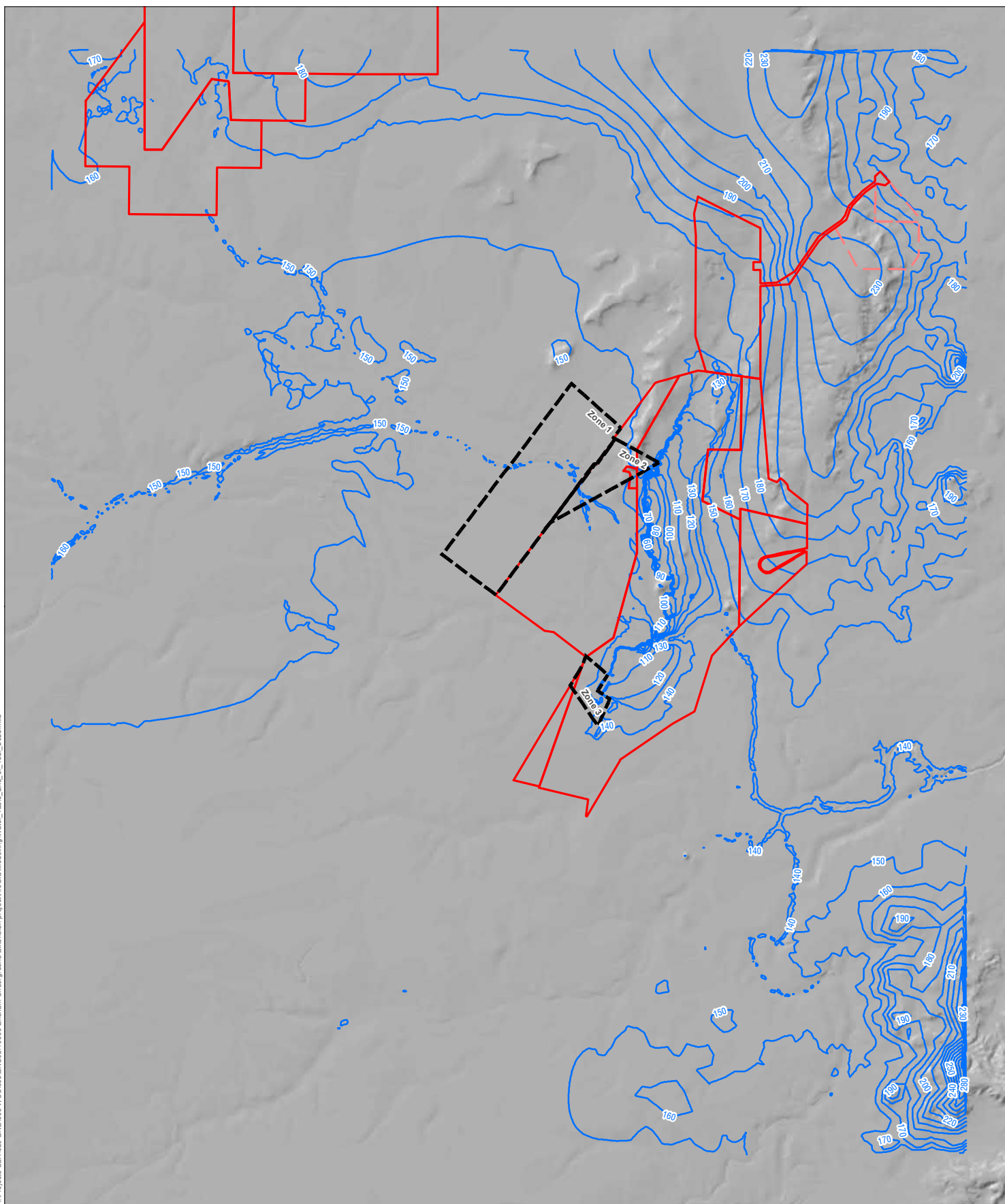
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2020

I-1

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\AcGIS\Modelling\Water_Table_End_of_Year_2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

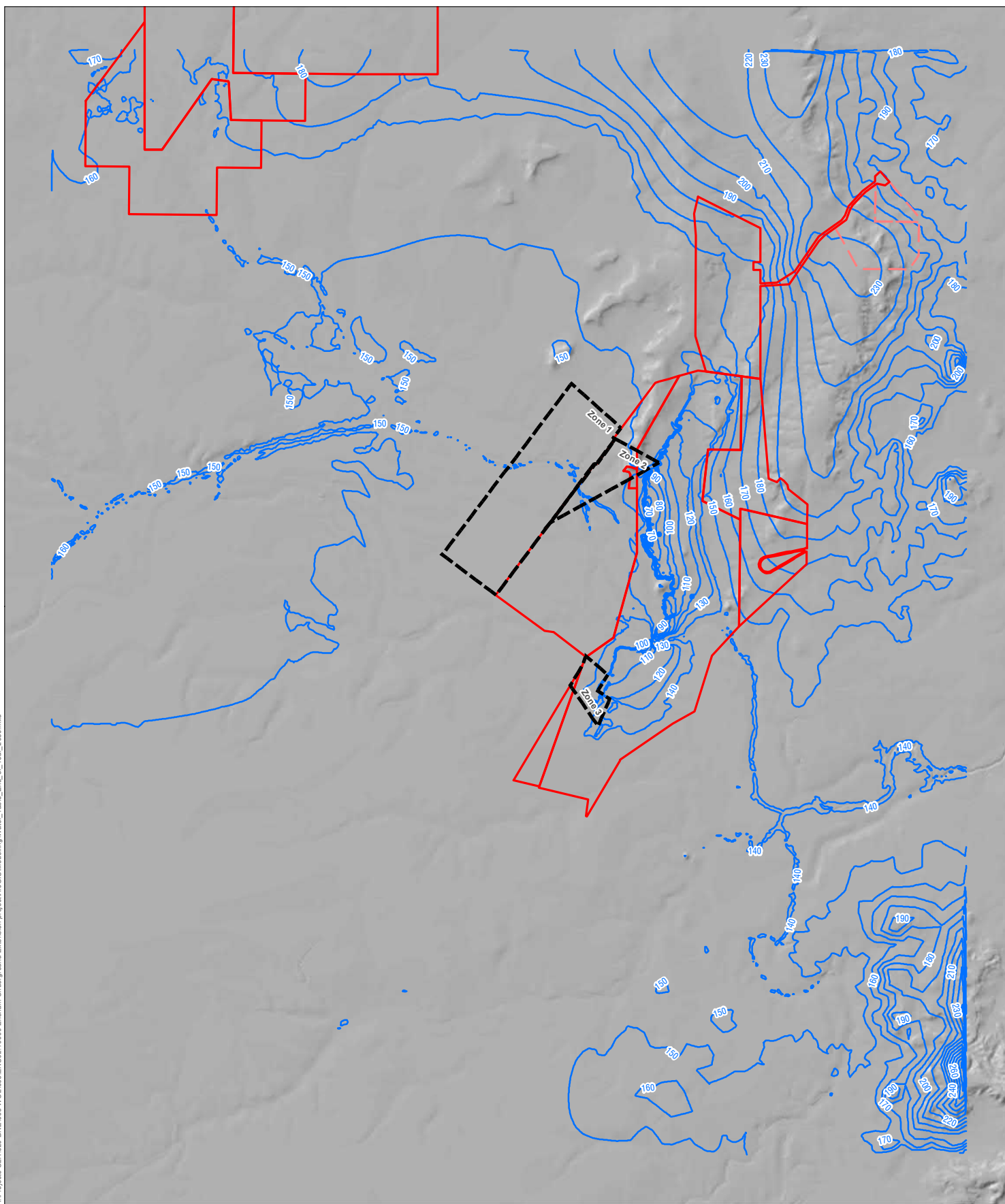
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2025

I-2

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Water_Table_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

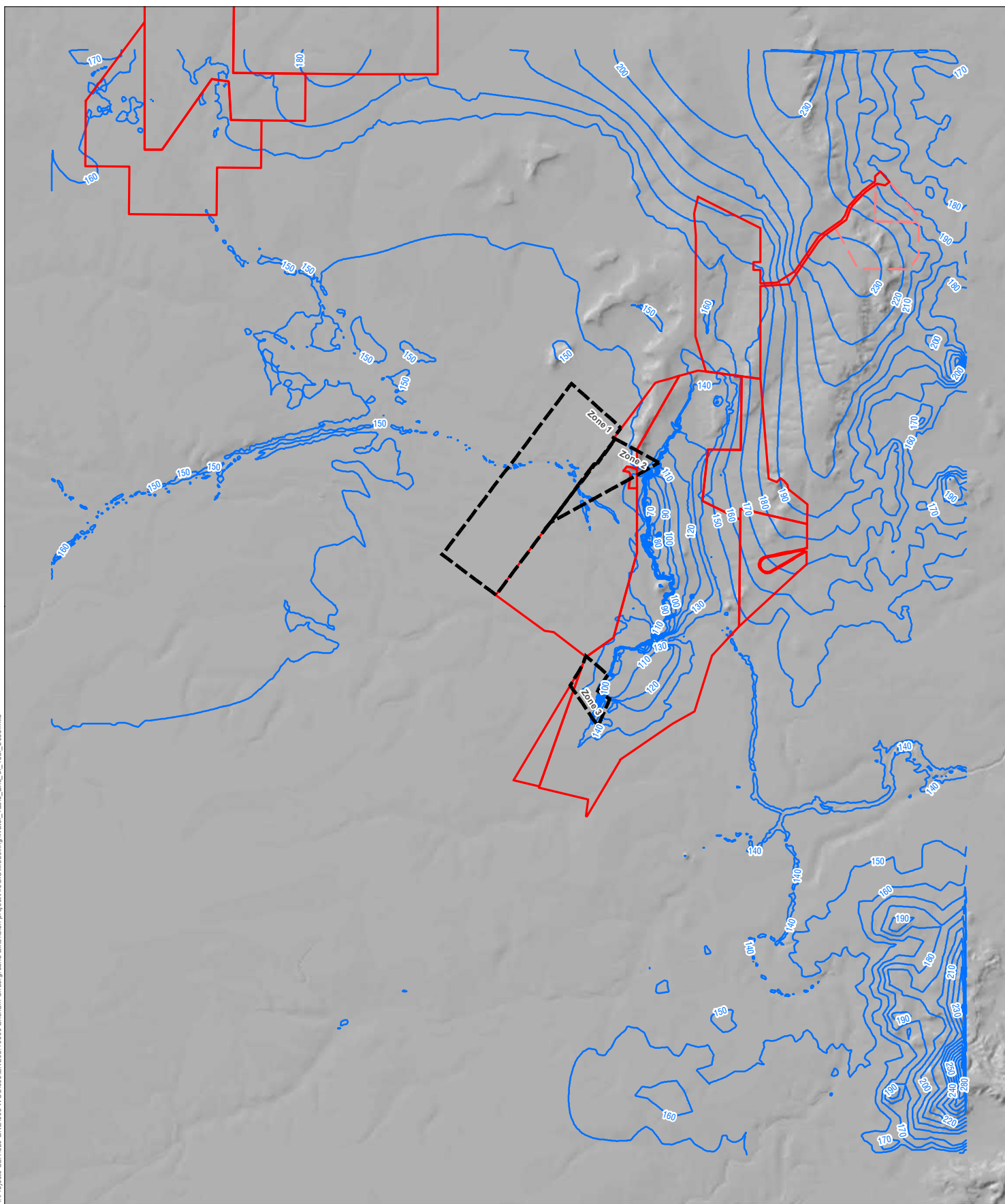
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2030

I-3

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Water_Table_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

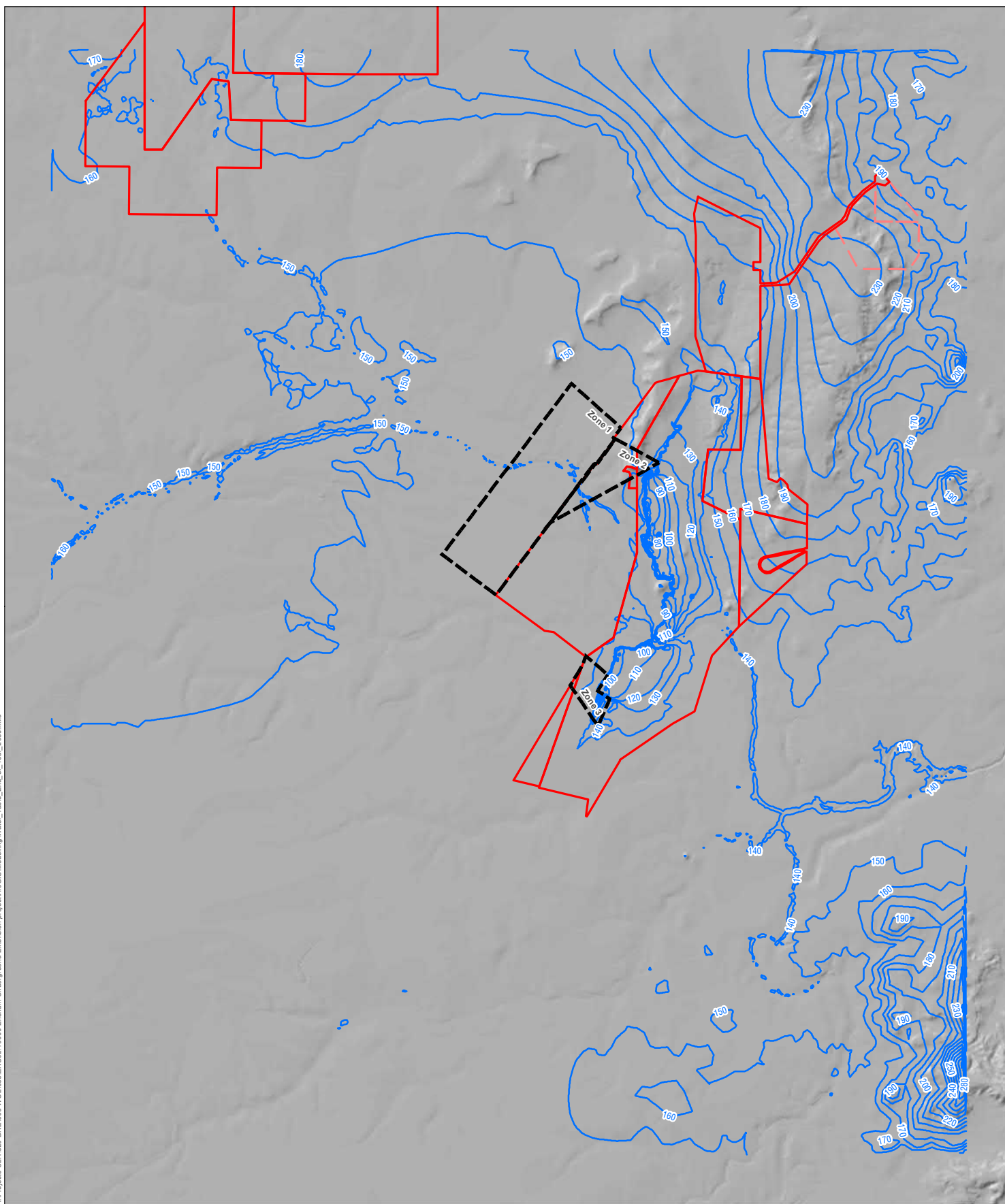
Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2035

I-4

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Water_Table_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

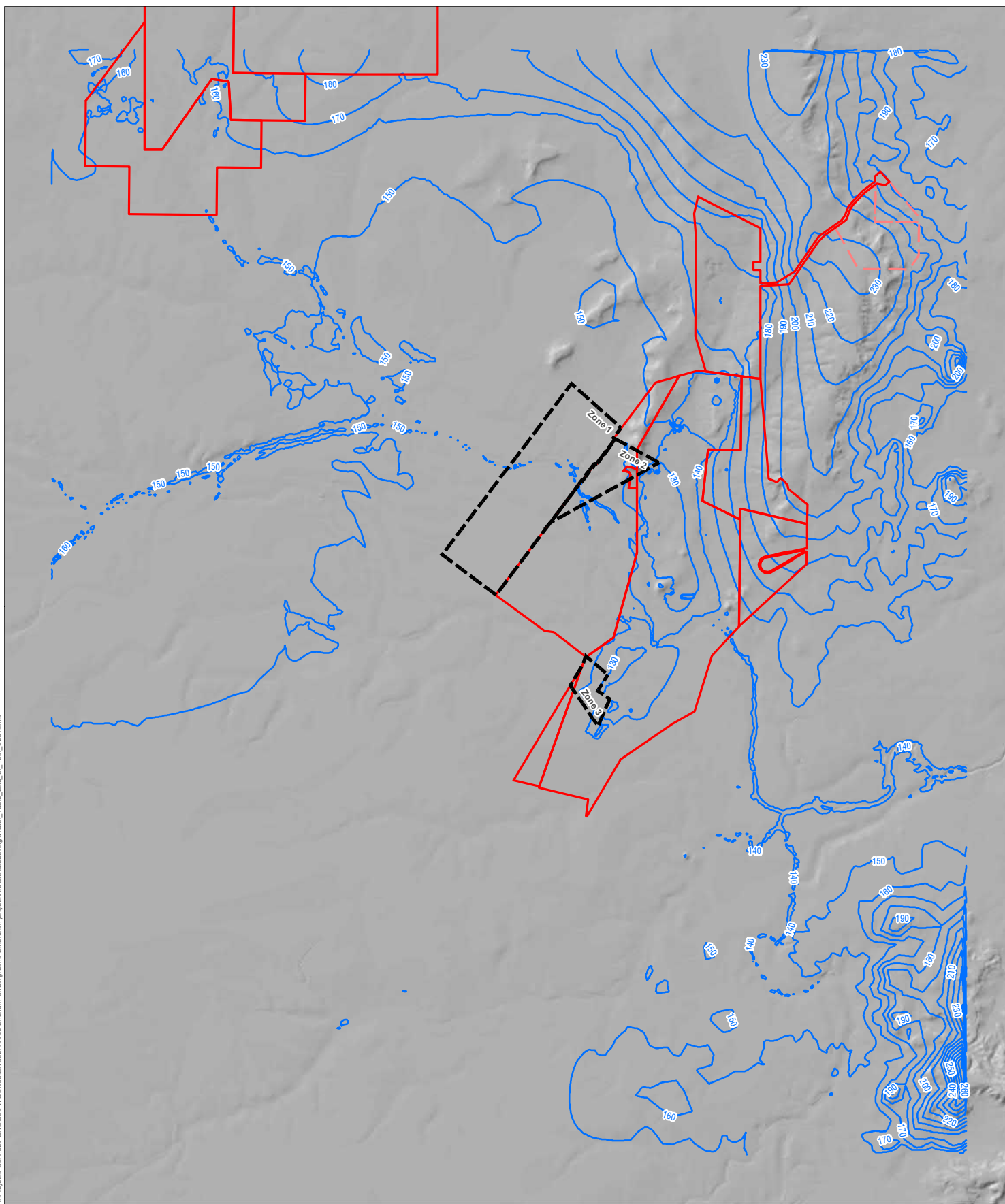
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2039

I-5

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Water_Table_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

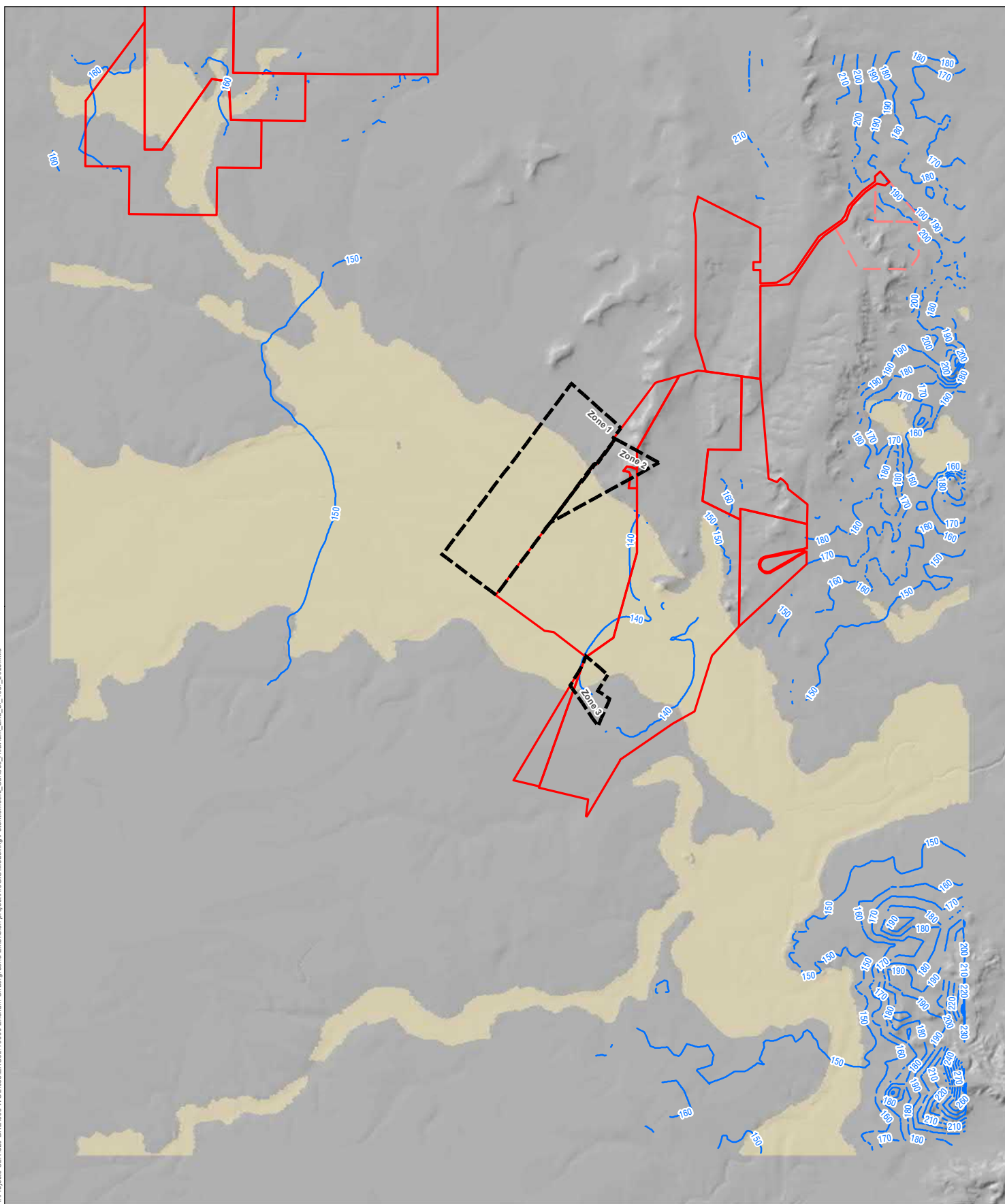
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Water Table - End of Year 2261

I-6

H:\Projects-SLR\620-BNE-665-WOL\065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- ▭ Project Area

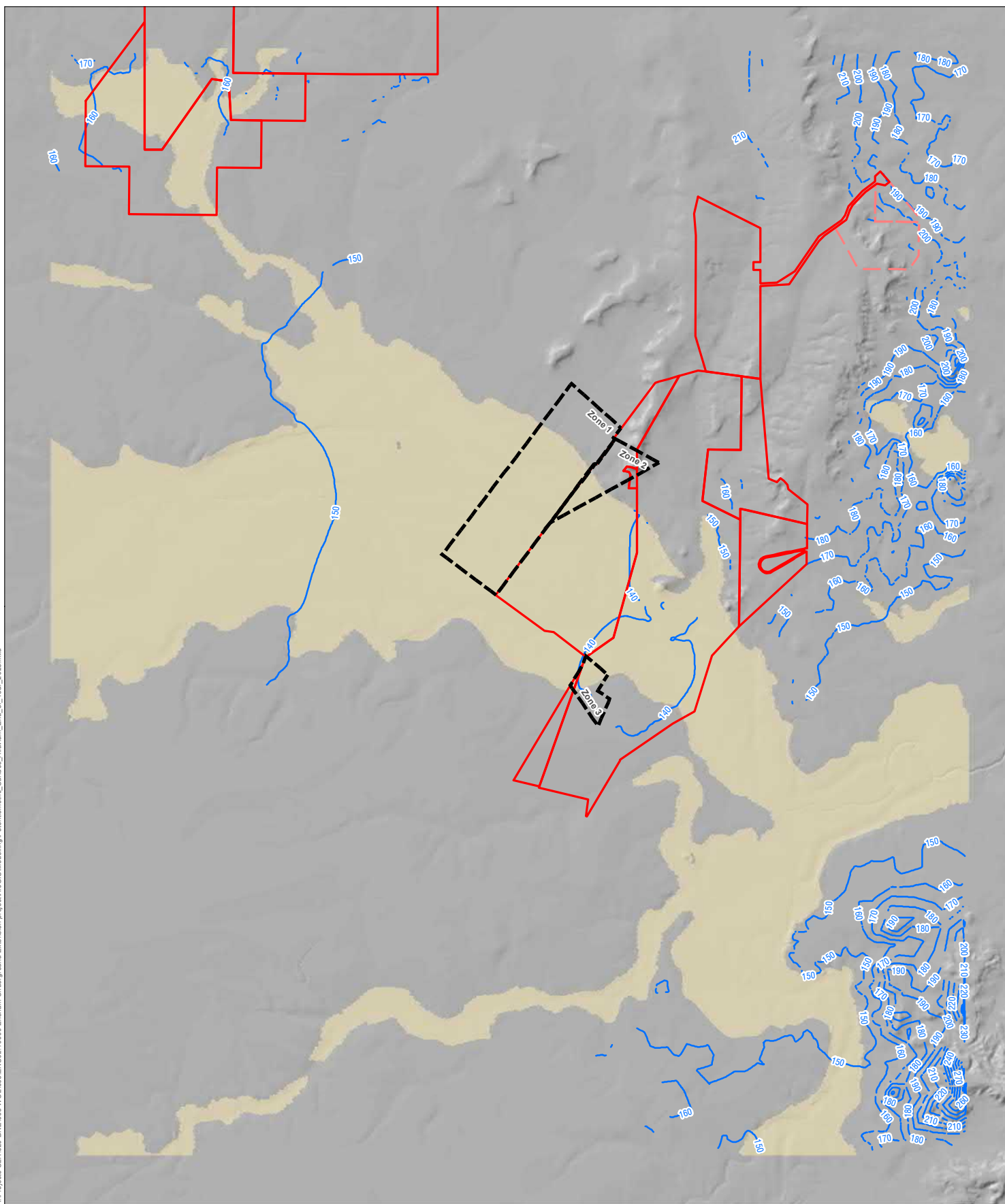
- Potentiometric Surface
- ▭ Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2020

I-7

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2025.mxd



0 2
km

Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▬ Mining Lease (Granted)
- - - Mining Lease (Application)
- Project Area

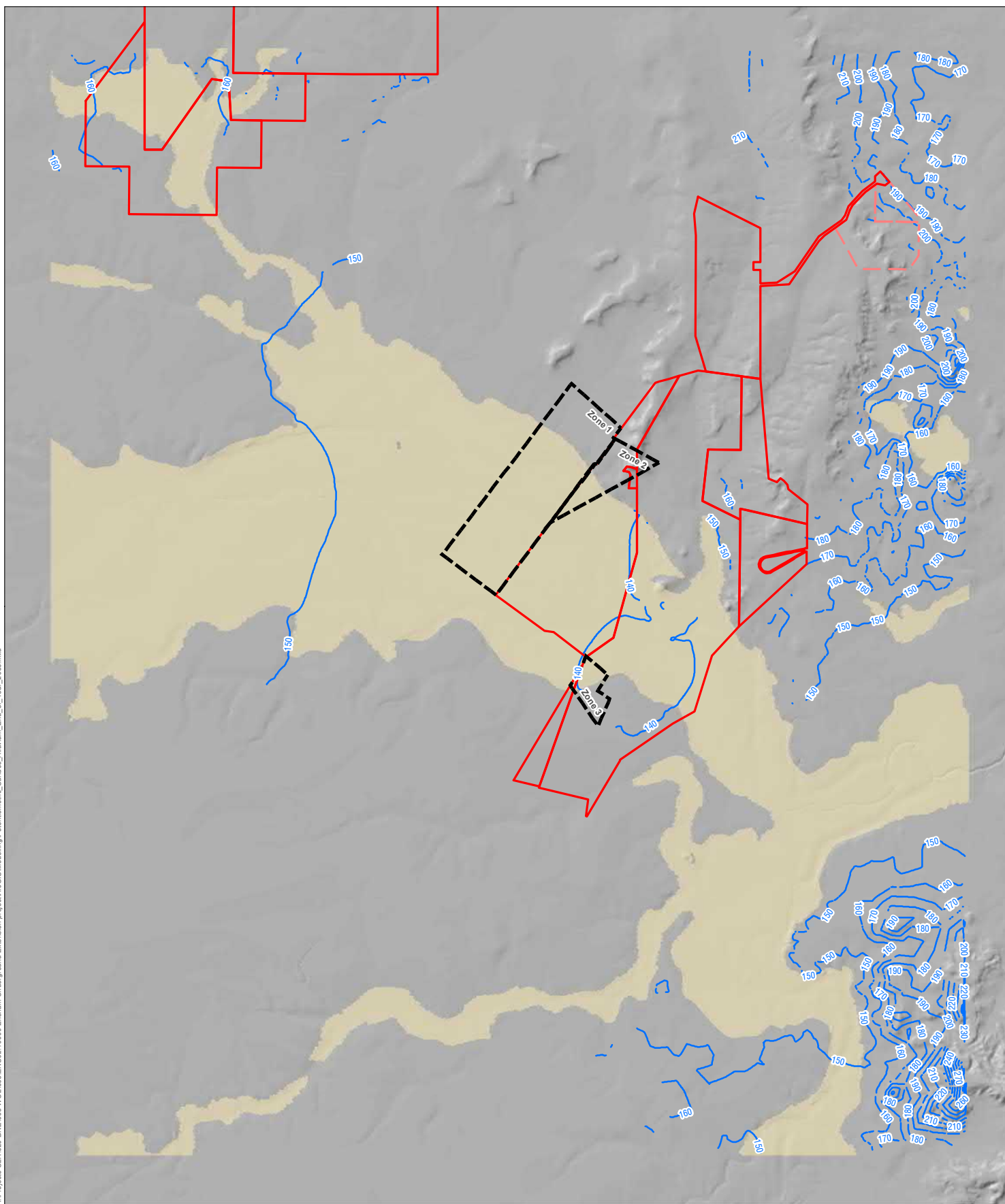
- Potentiometric Surface
- Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2025

I-8

H:\Projects-SLR\620-BNE-665-WOL\065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2030.mxd



0 2
km

Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- ▭ Project Area

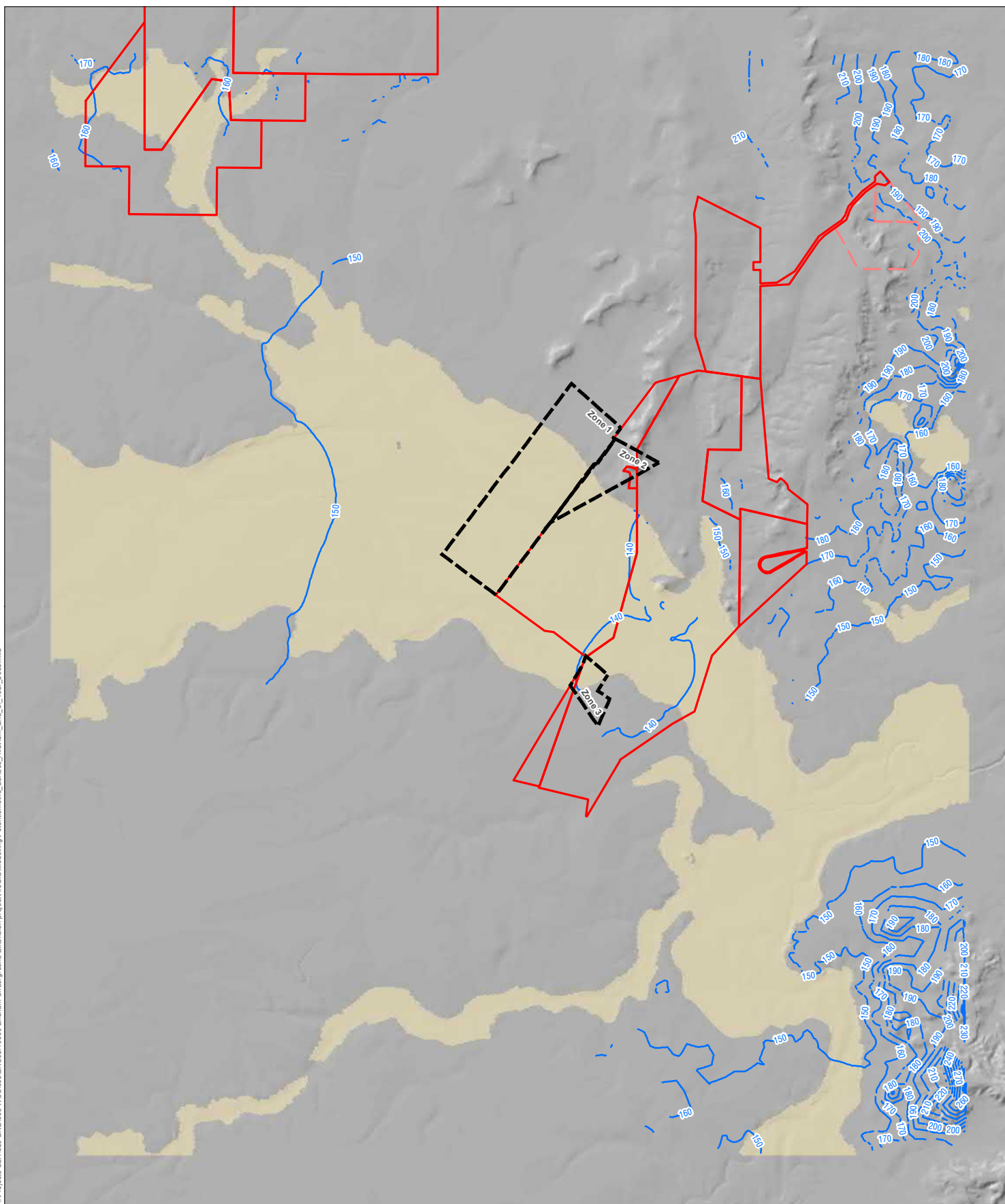
- Potentiometric Surface
- ▭ Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2030

I-9

H:\Projects-SLR\620-BNE-665-VOL066-ENS02.10000-Ensham Underground Extension project\acGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

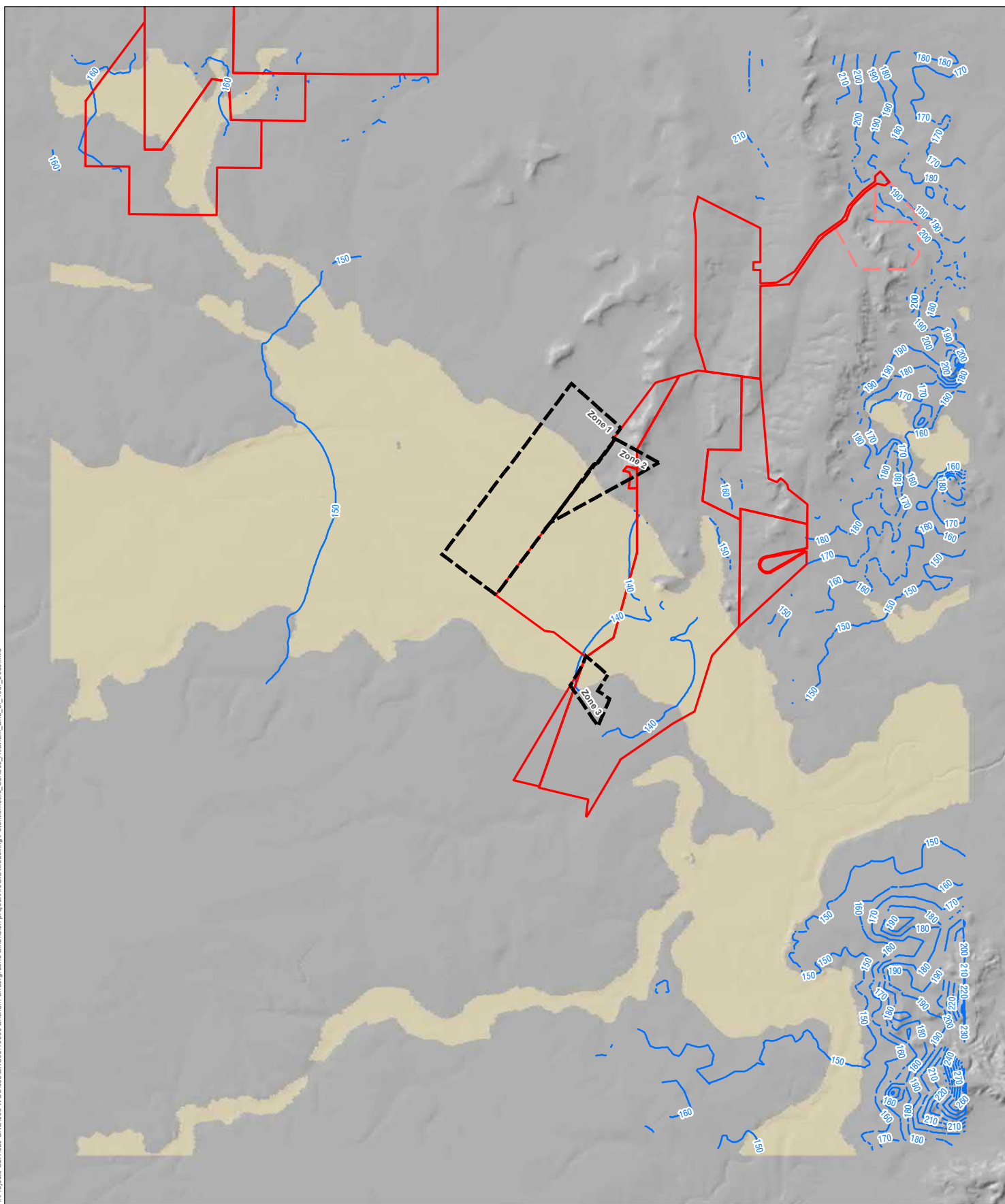
- Potentiometric Surface
- Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2035

I-10

H:\Projects-SLR\620-BNE-665-WOL\065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▬ Mining Lease (Granted)
- ▬ Mining Lease (Application)
- Project Area

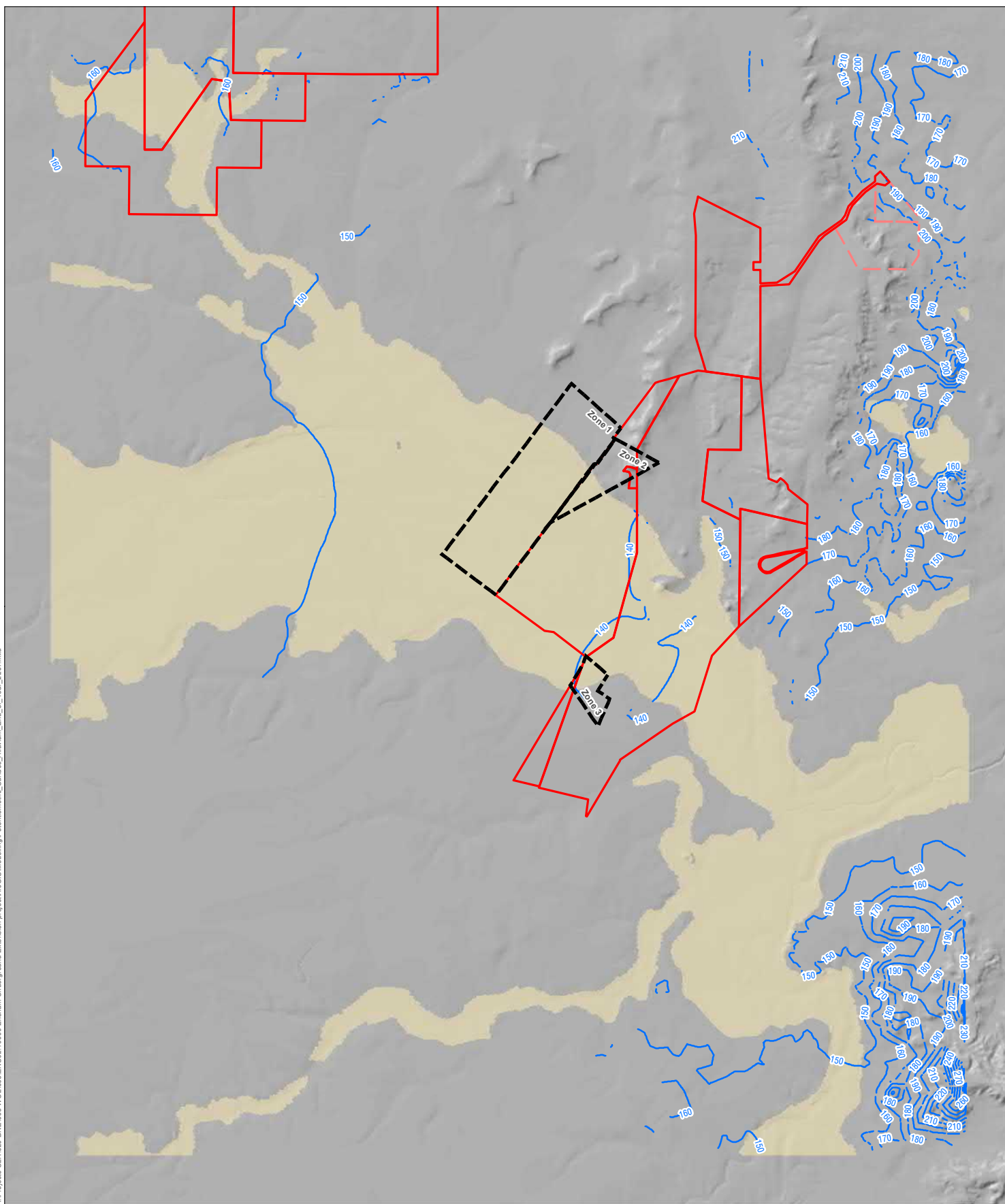
- Potentiometric Surface
- Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2039

I-11

H:\Projects-SLR\620-BNE-665-WOL\065-ENS02.10000-Ensham Underground Extension project\acGIS\Modelling\Potentiometric_Surface_Alluvium_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

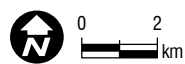
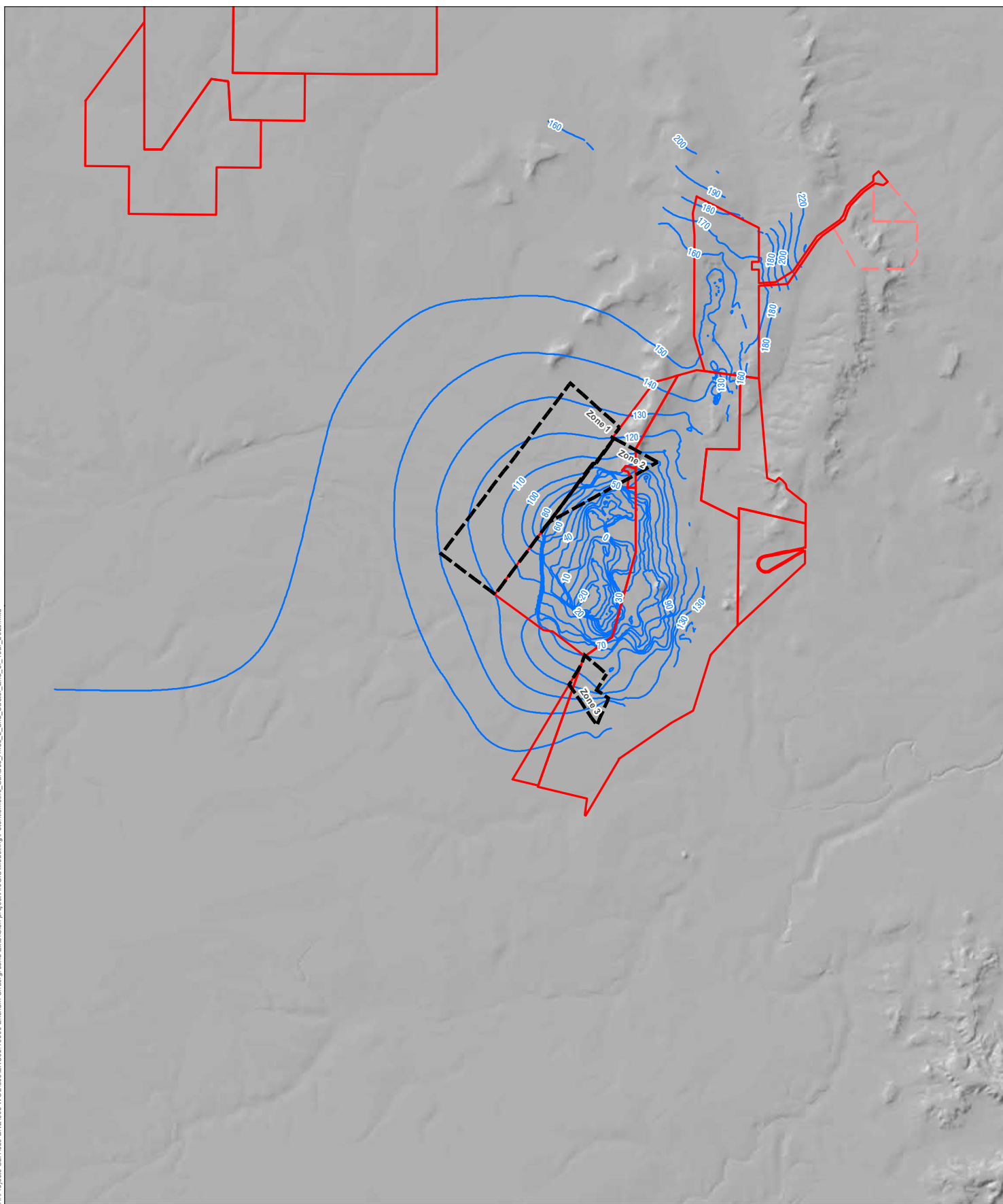
- Potentiometric Surface
- Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Alluvium - End of Year 2261

I-12

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

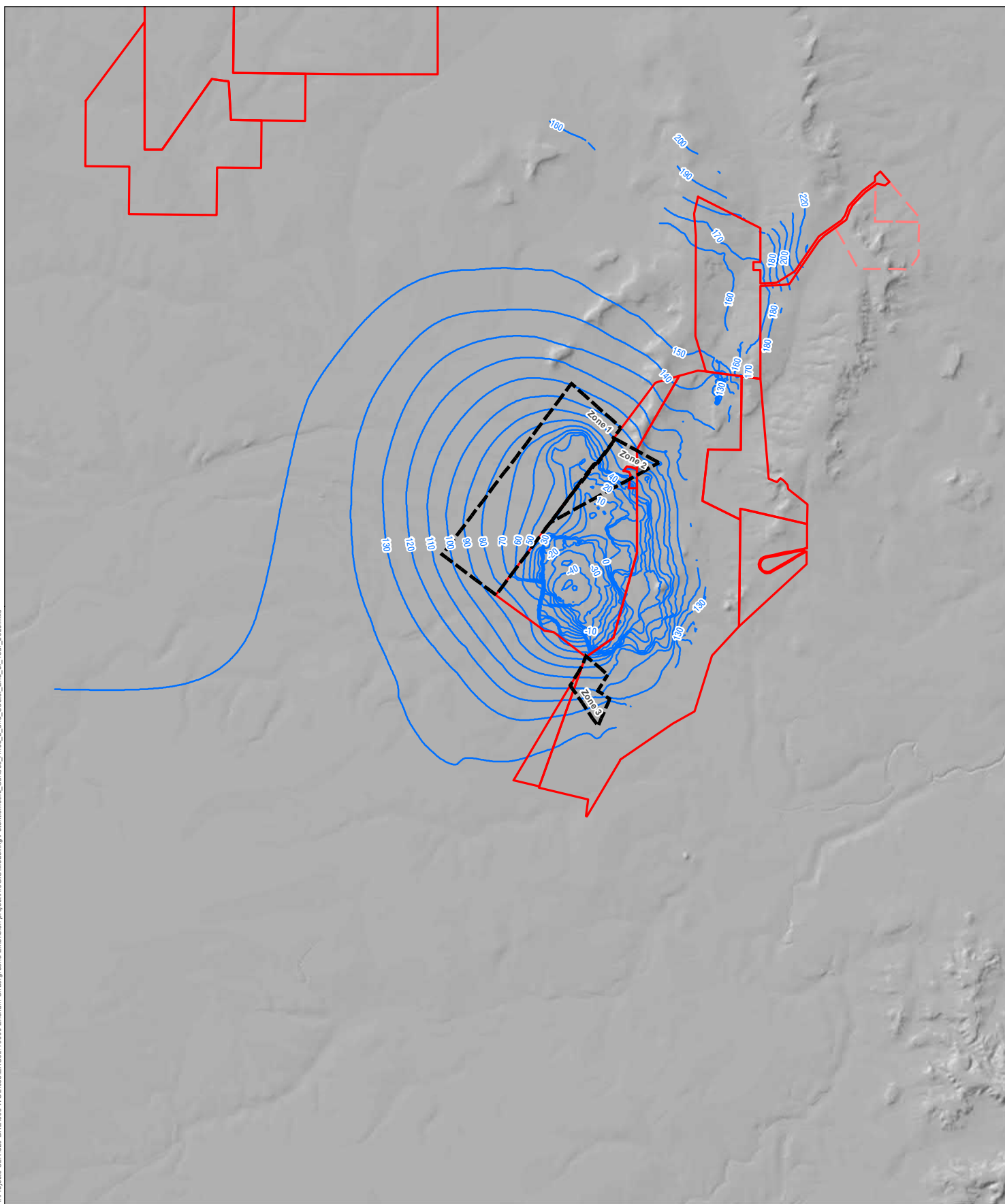
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Aries 2 and Castor - End of Year 2020

I-13

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\acGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

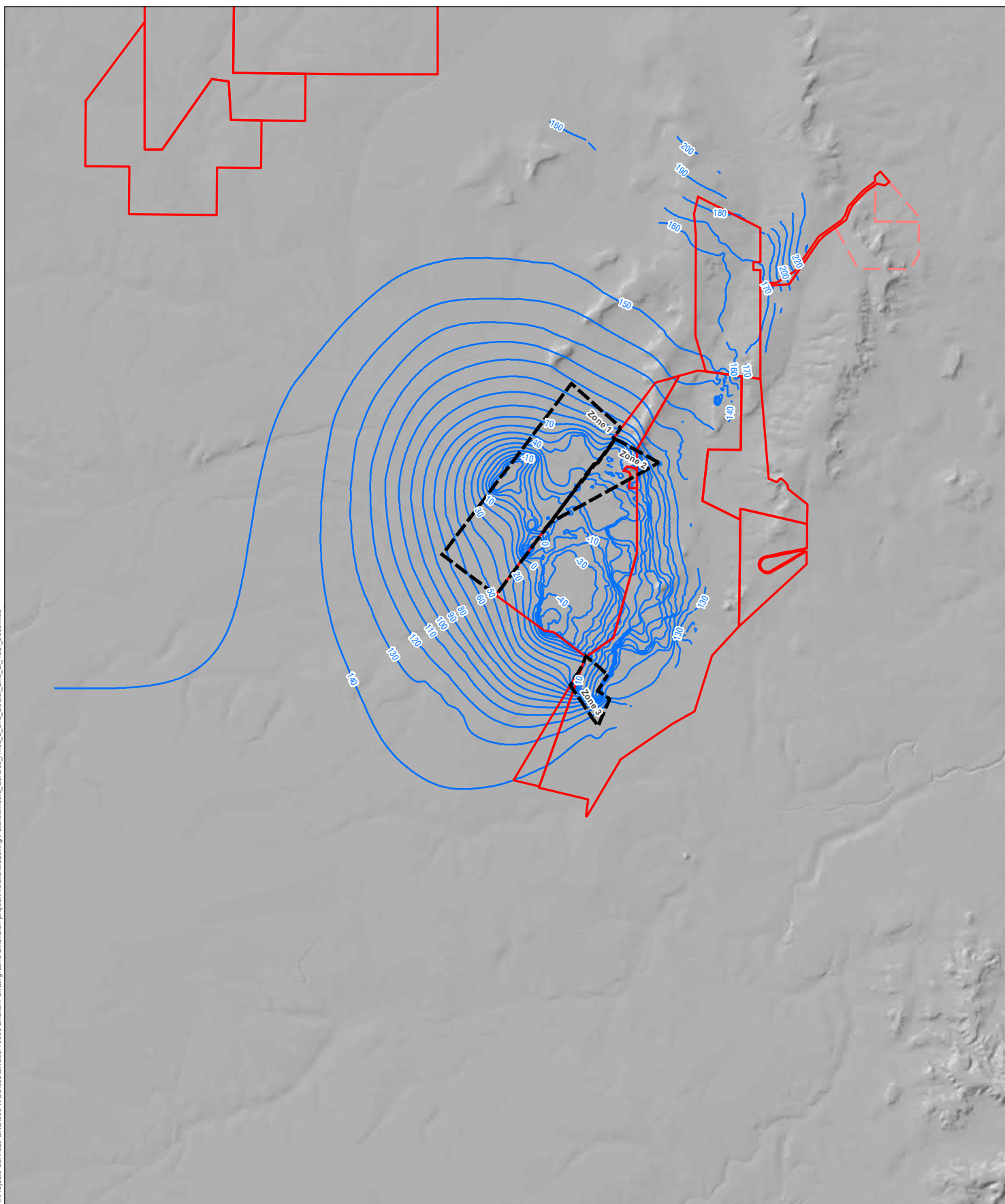
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Aries 2 and Castor - End of Year 2025

I-14

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▬ Mining Lease (Granted)
- ▬ Mining Lease (Application)
- Project Area

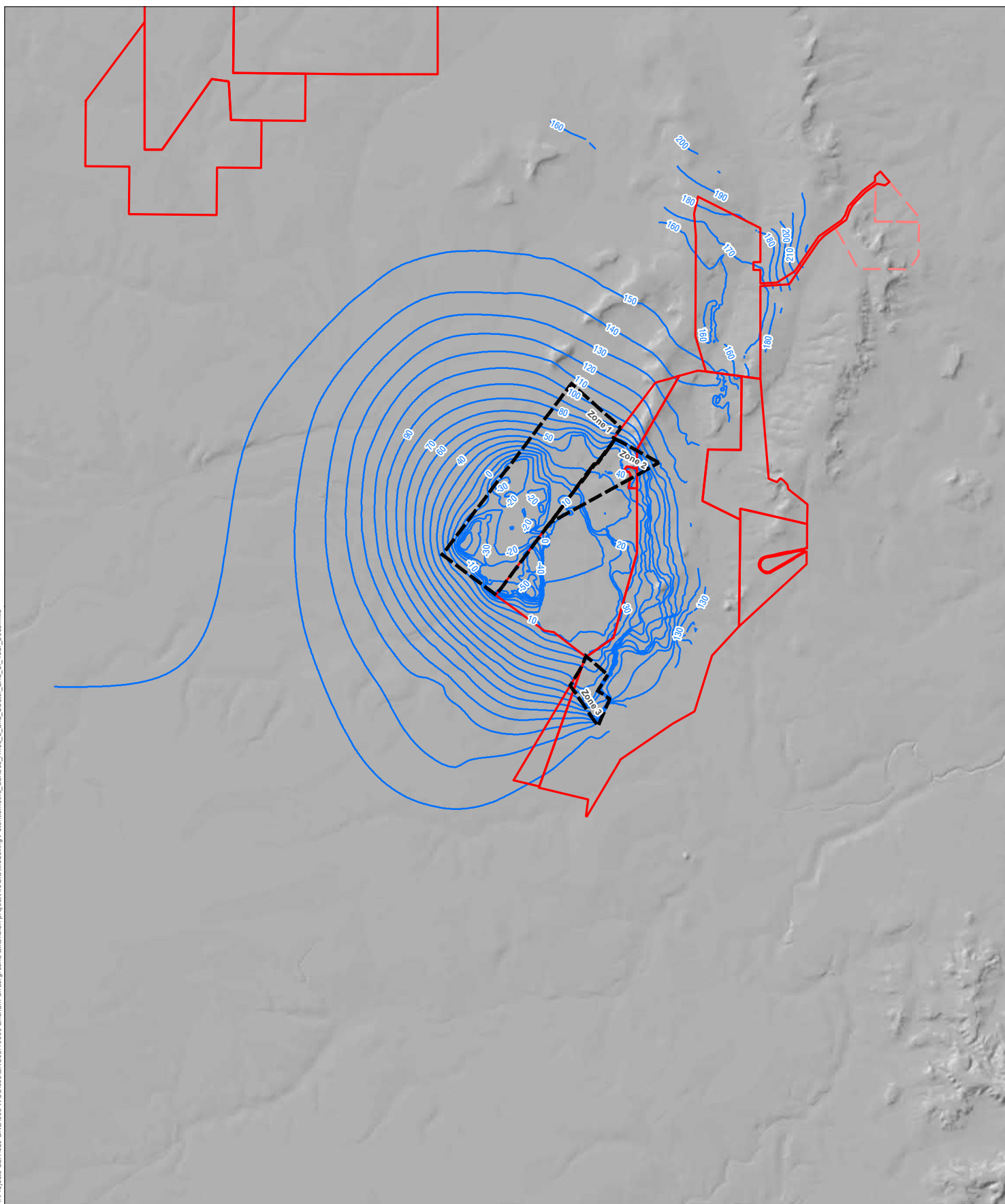
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Aries 2 and Castor - End of Year 2030

I-15

H:\Projects-SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\AcGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

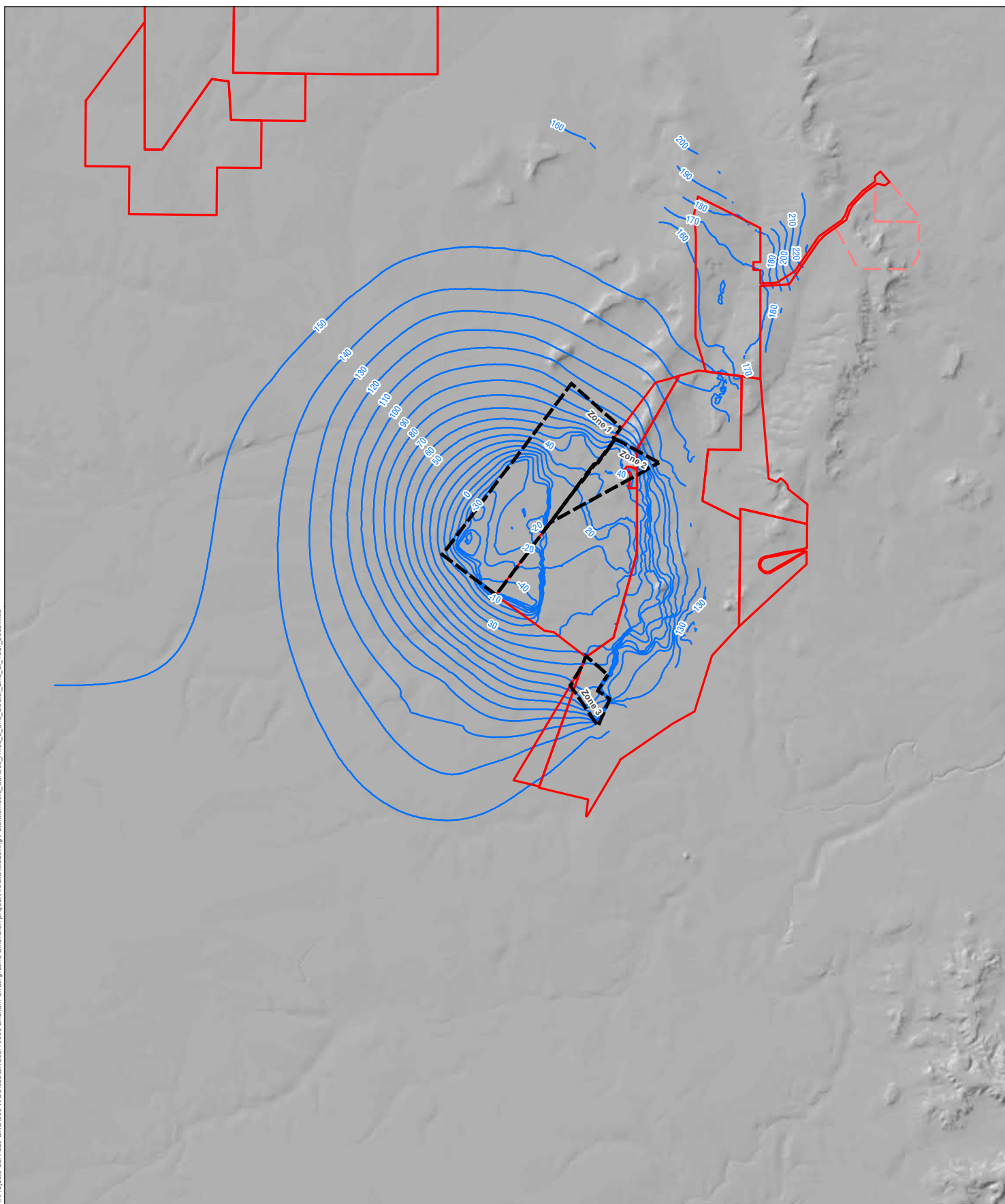
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Aries 2 and Castor - End of Year 2035

I-16

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

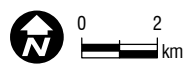
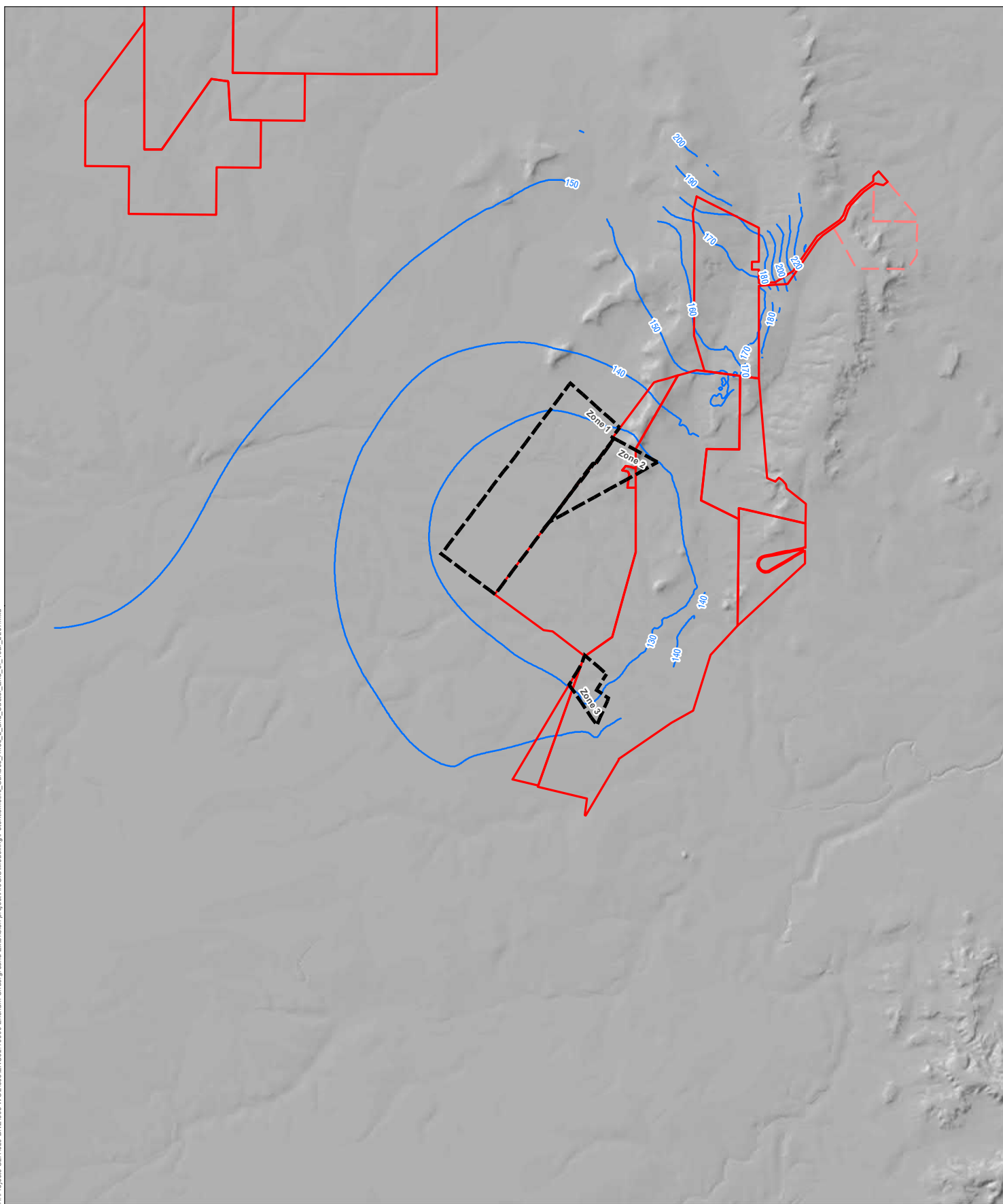
— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

Potentiometric Surface - Aries 2 and Castor - End of Year 2039

I-17

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\ArcGIS\Modelling\Potentiometric_Surface_Aries_2_and_Castor_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 7/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

— Potentiometric Surface

GROUNDWATER IMPACT ASSESSMENT

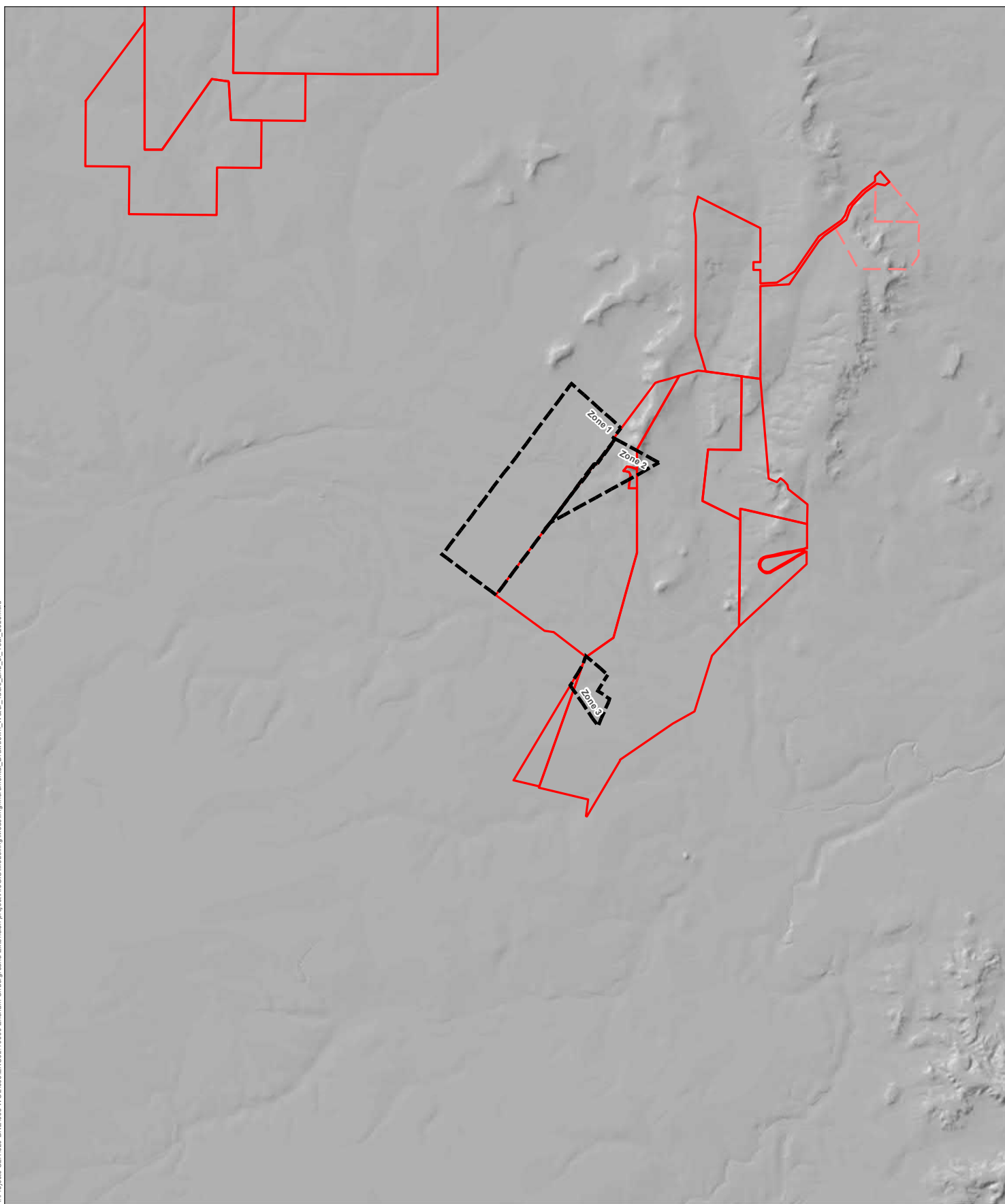
Potentiometric Surface - Aries 2 and Castor - End of Year 2261

I-18

APPENDIX J

Maps of Drawdowns

H:\Projects-SLR\620-ENE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\AcGIS\Modelling\Incremental_Drawdown_Water_Table_End_of_Year_2020.mxd



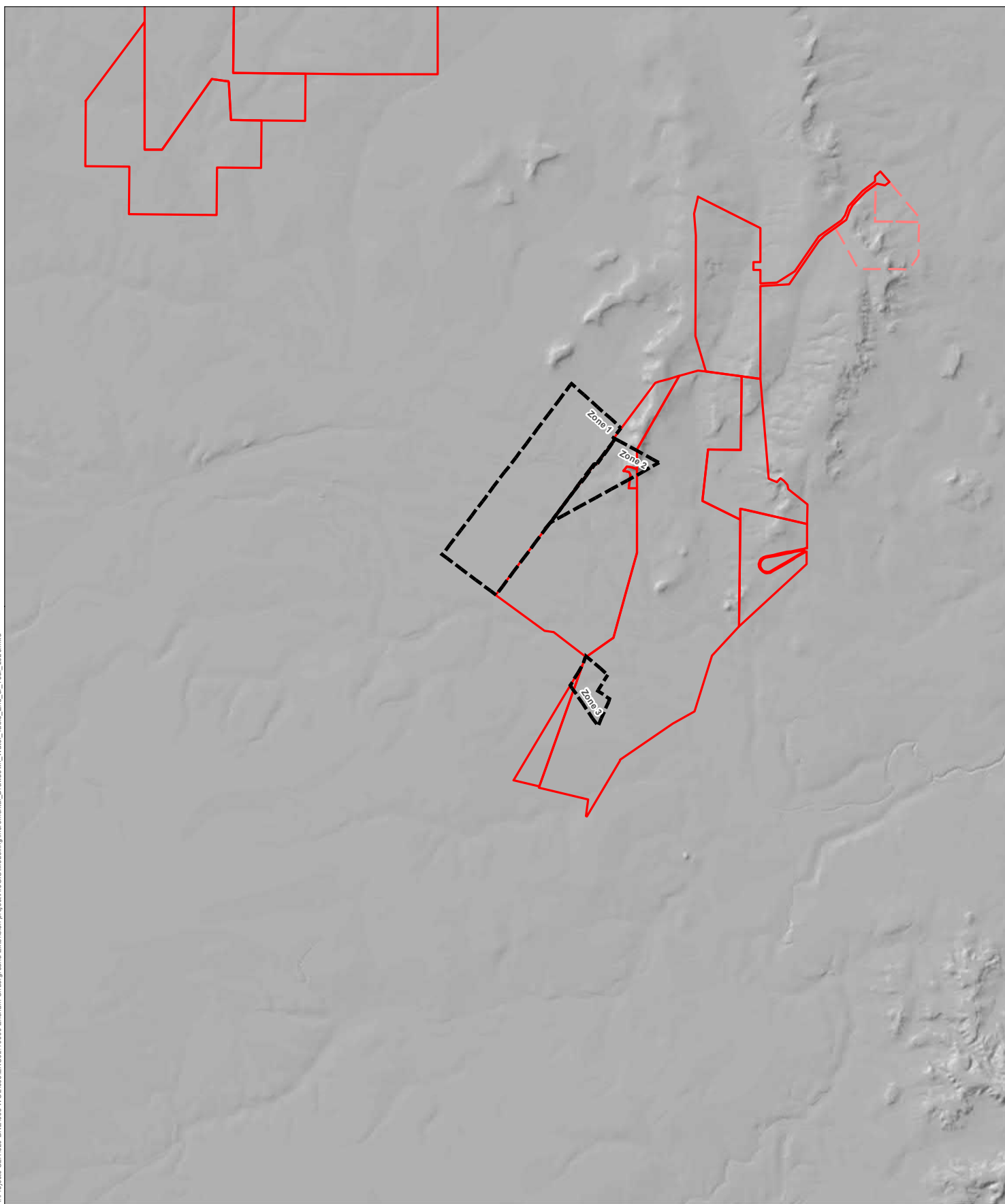
Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

H:\Projects-SLR\620-BNE-665-WOL\665-ENS02_10000 Ensham Underground Extension project\AcGIS\Modelling\Incremental Drawdown_Water_Table_End_of_Year_2025.mxd



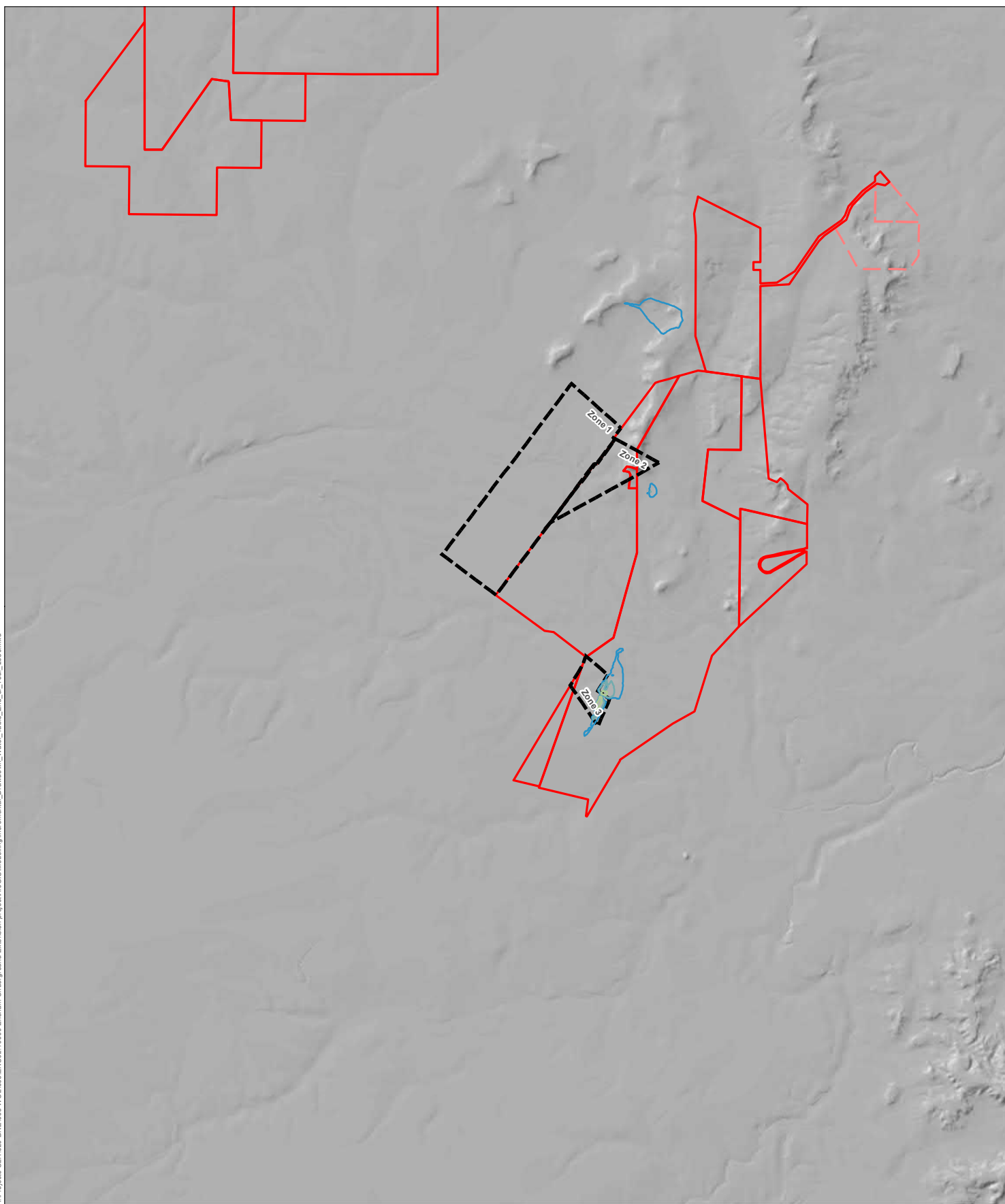
Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02-10000-Ensham Underground Extension project\ArcGIS\Modelling\Incremental_Drawdown_Water_Table_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

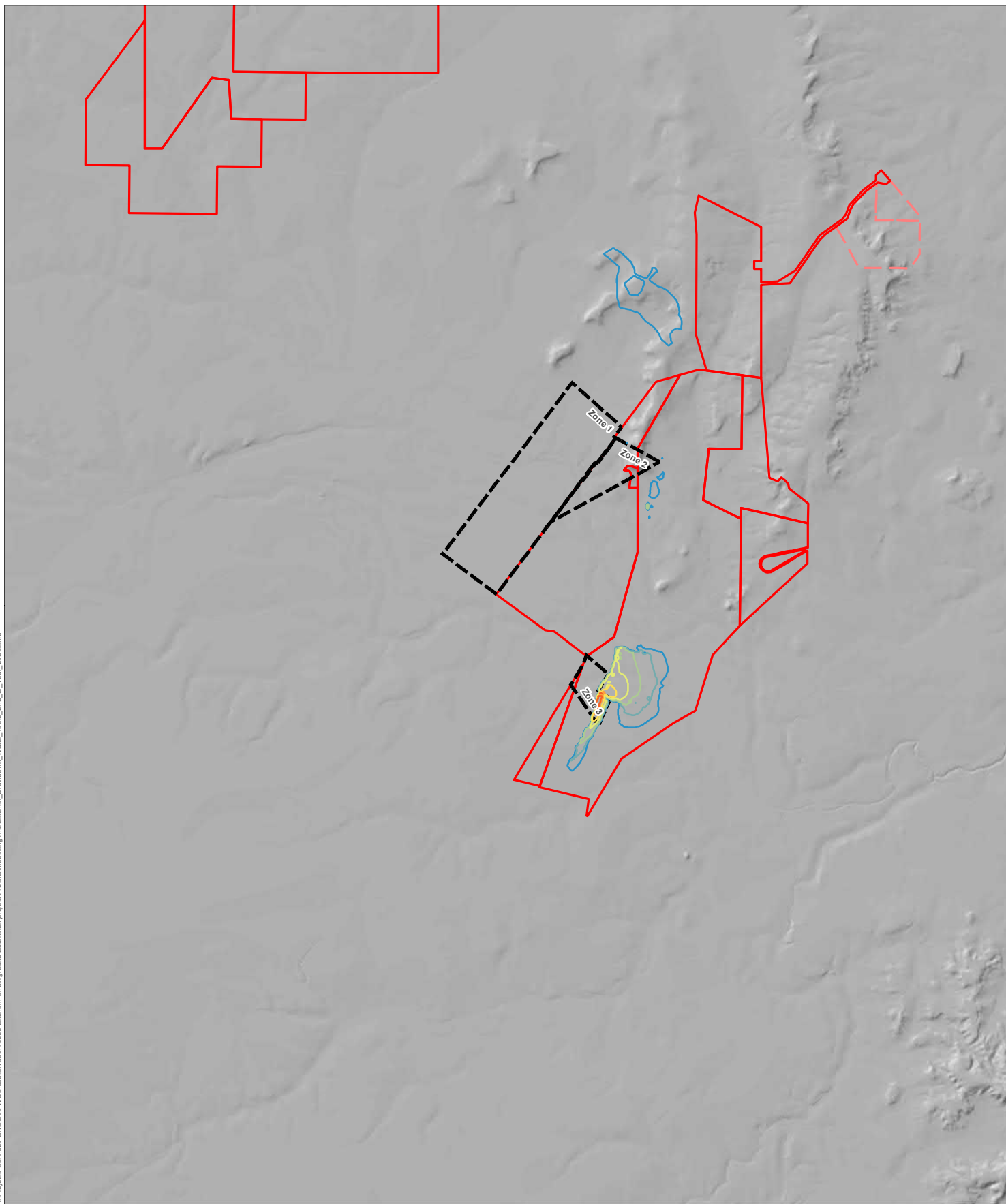
Drawdown (m) 1
 0.5 2

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Water Table - End of Year 2030

J-3

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Modelling\Incremental_Drawdown_Water_Table_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

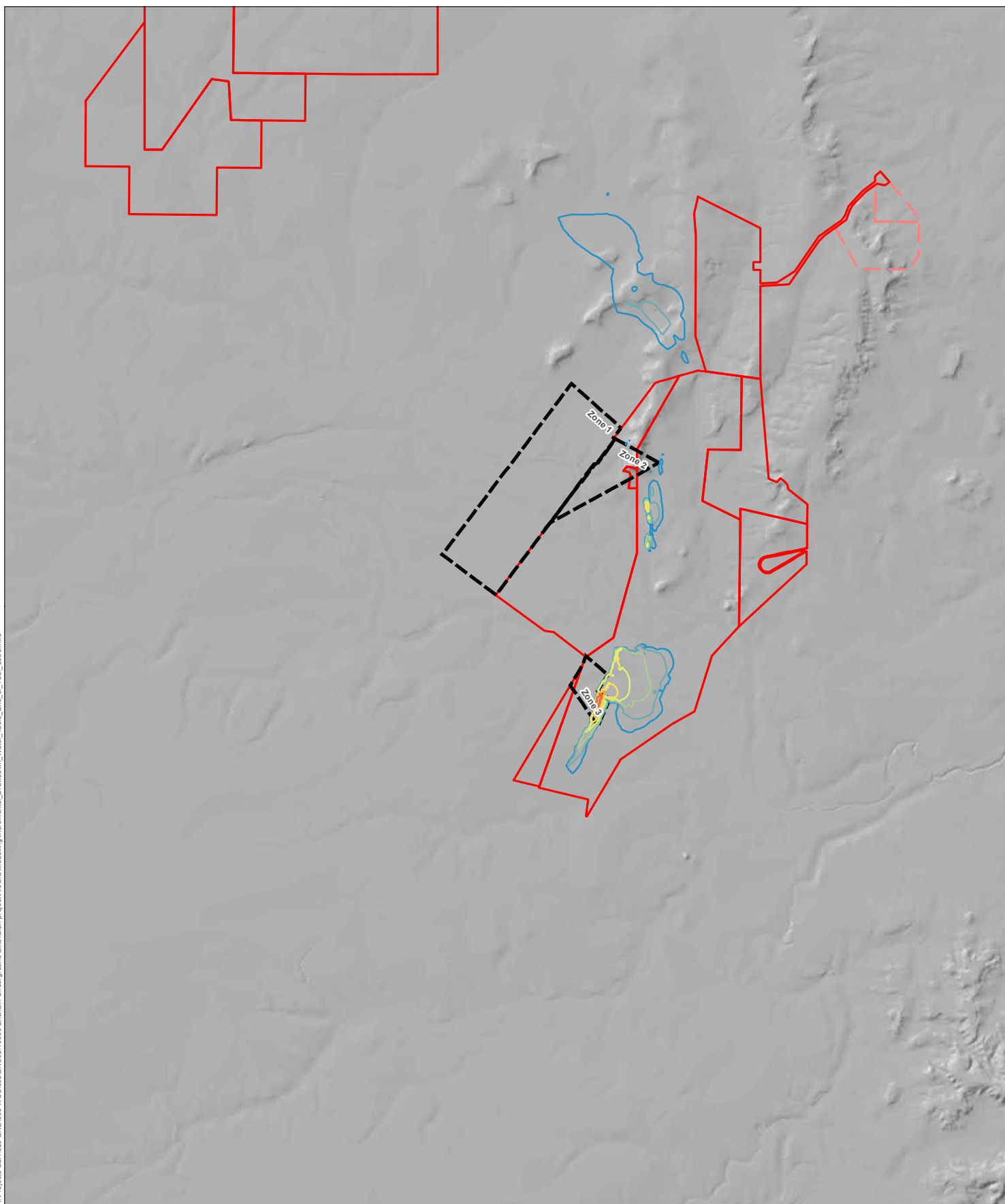
Drawdown (m)	
0.5	—
1	—
2	—
5	—
10	—
20	—
30	—

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Water Table - End of Year 2035

J-4

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02-10000-Ensham Underground Extension project\ArcGIS\Modelling\Incremental_Drawdown_Water_Table_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

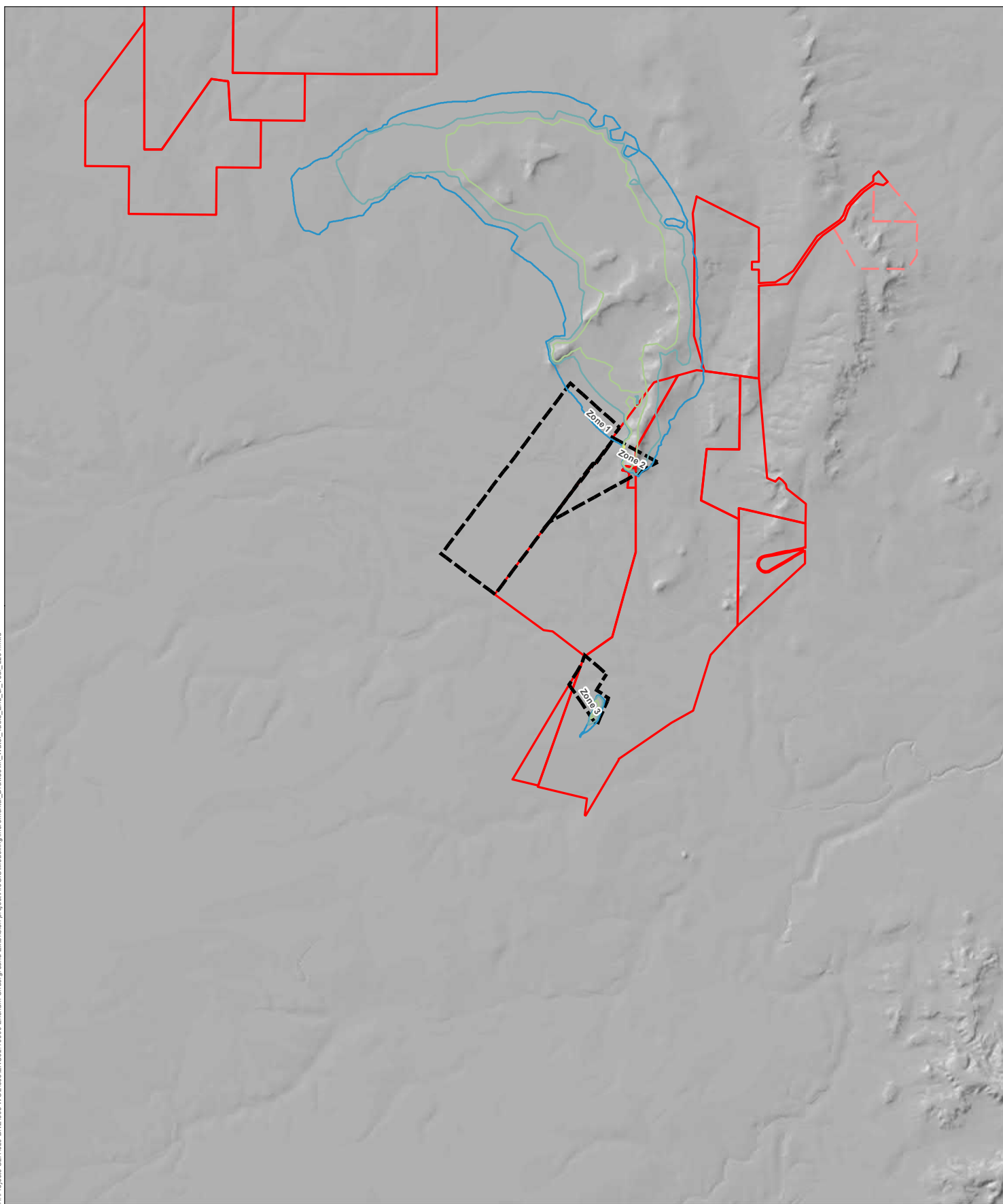
Drawdown (m)	
0.5	
1	
2	
5	
10	
20	
30	

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Water Table - End of Year 2039

J-5

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Modelling\Incremental_Drawdown_Water_Table_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m)

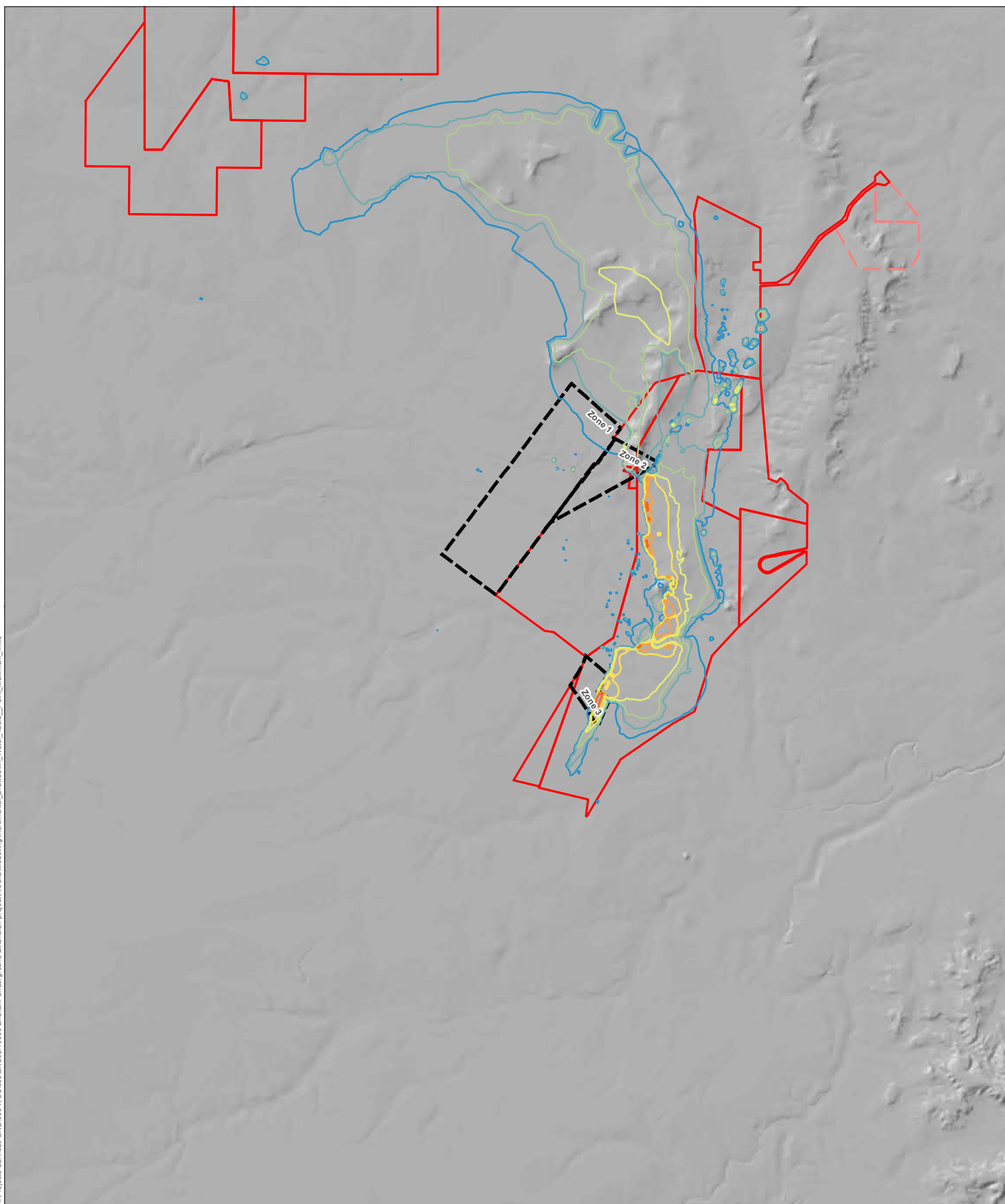
	0.5
	2
	5
	1

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Water Table - End of Year 2261

J-6

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02-10000-Ensham Underground Extension project\ArcGIS\Modelling\Incremental_Drawdown_Water_Table_Point_Maximum.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

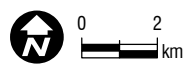
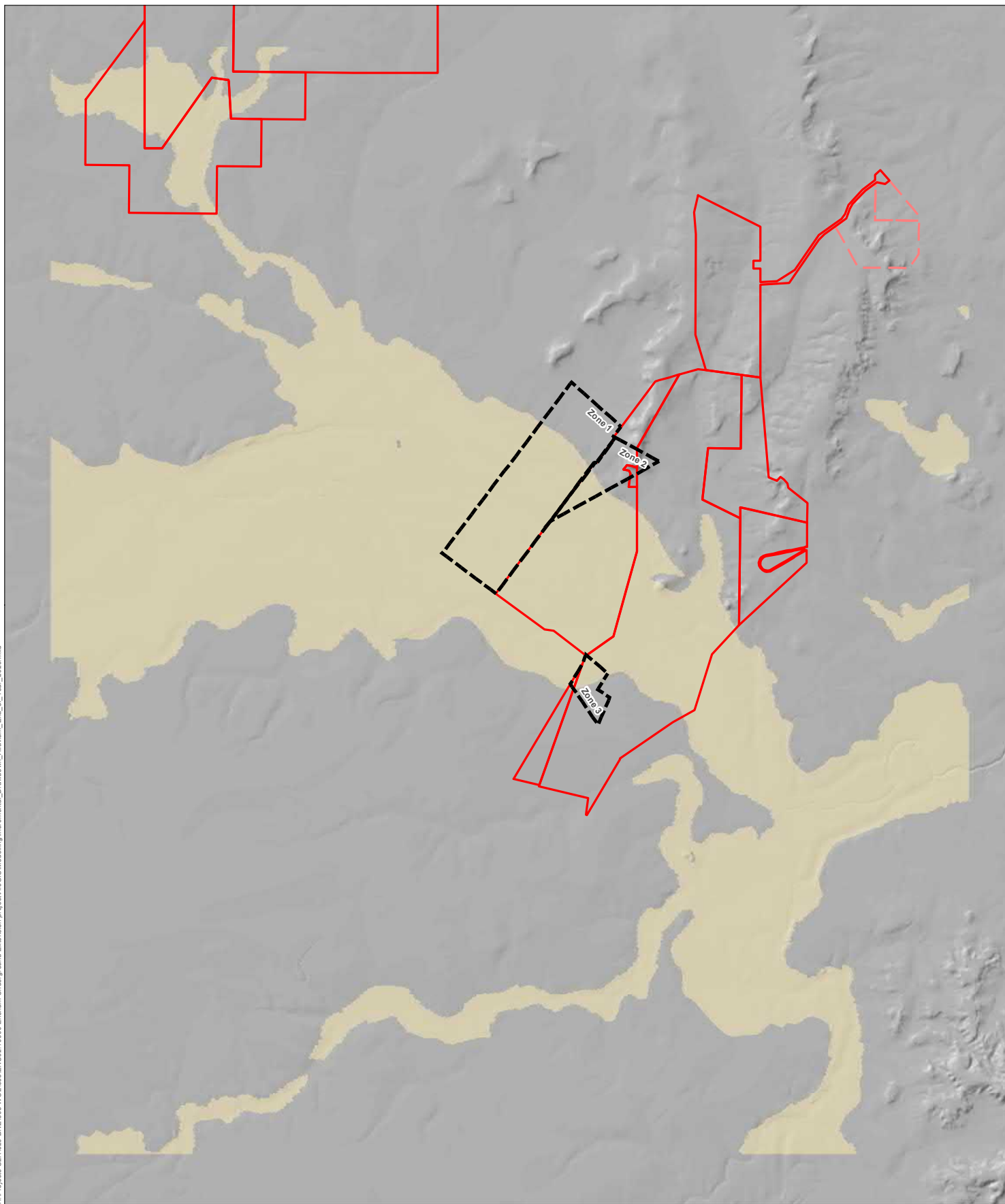
Drawdown (m)	
0.5	—
1	—
2	—
5	—
10	—
20	—
30	—

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Water Table - Point Maximum

J-7

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000_Ersham Underground Extension project\ArcGIS\Modelling\Incremental Drawdown_Alluvium_End_of_Year_2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

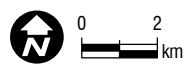
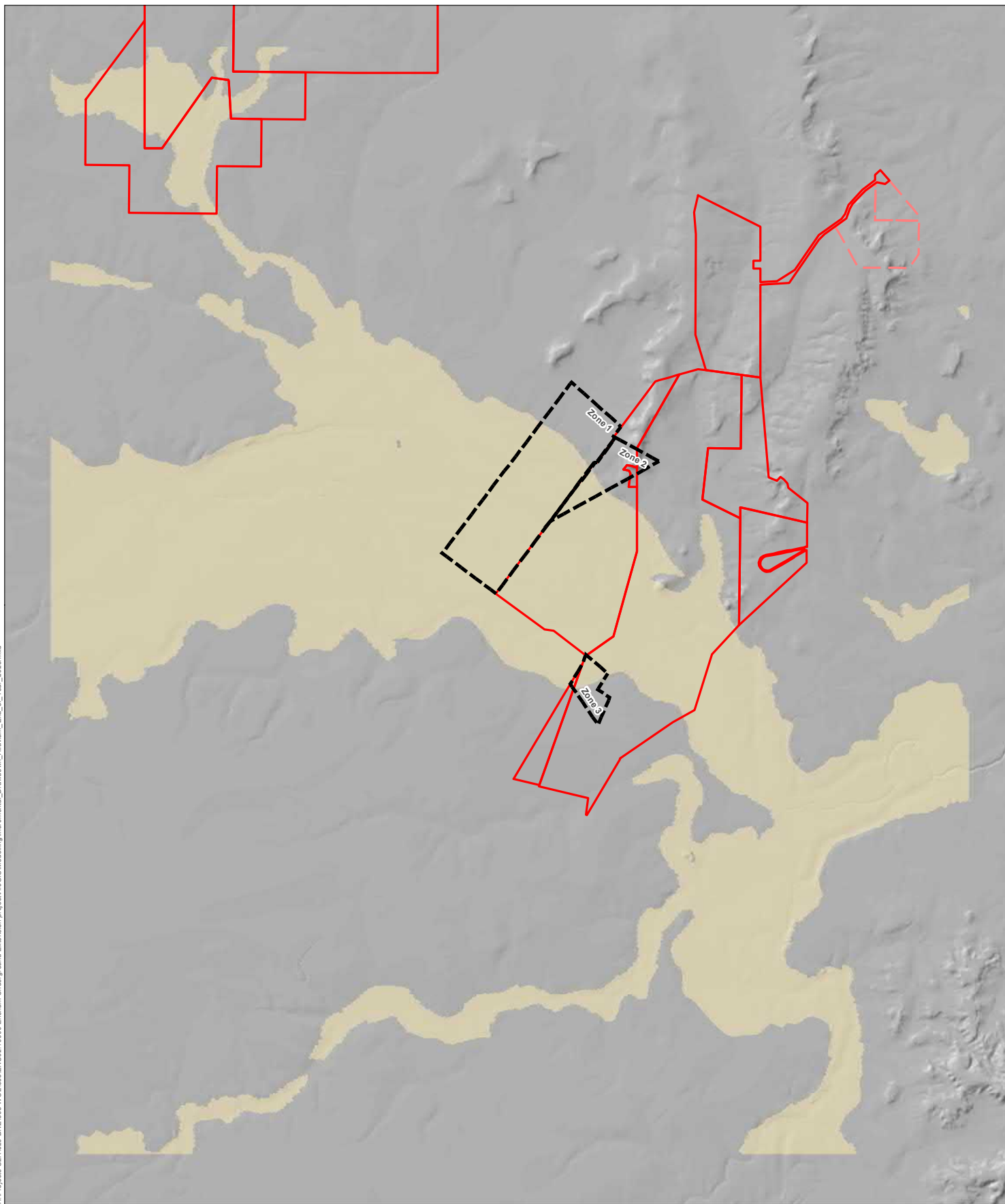
Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2020

J-8

H:\Projects\SLR\620-BNE-665-WOL\665-ENS02_10000_Ersham Underground Extension project\acGIS\Modelling\Incremental Drawdown_Alluvium_End_of_Year_2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

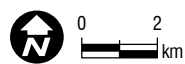
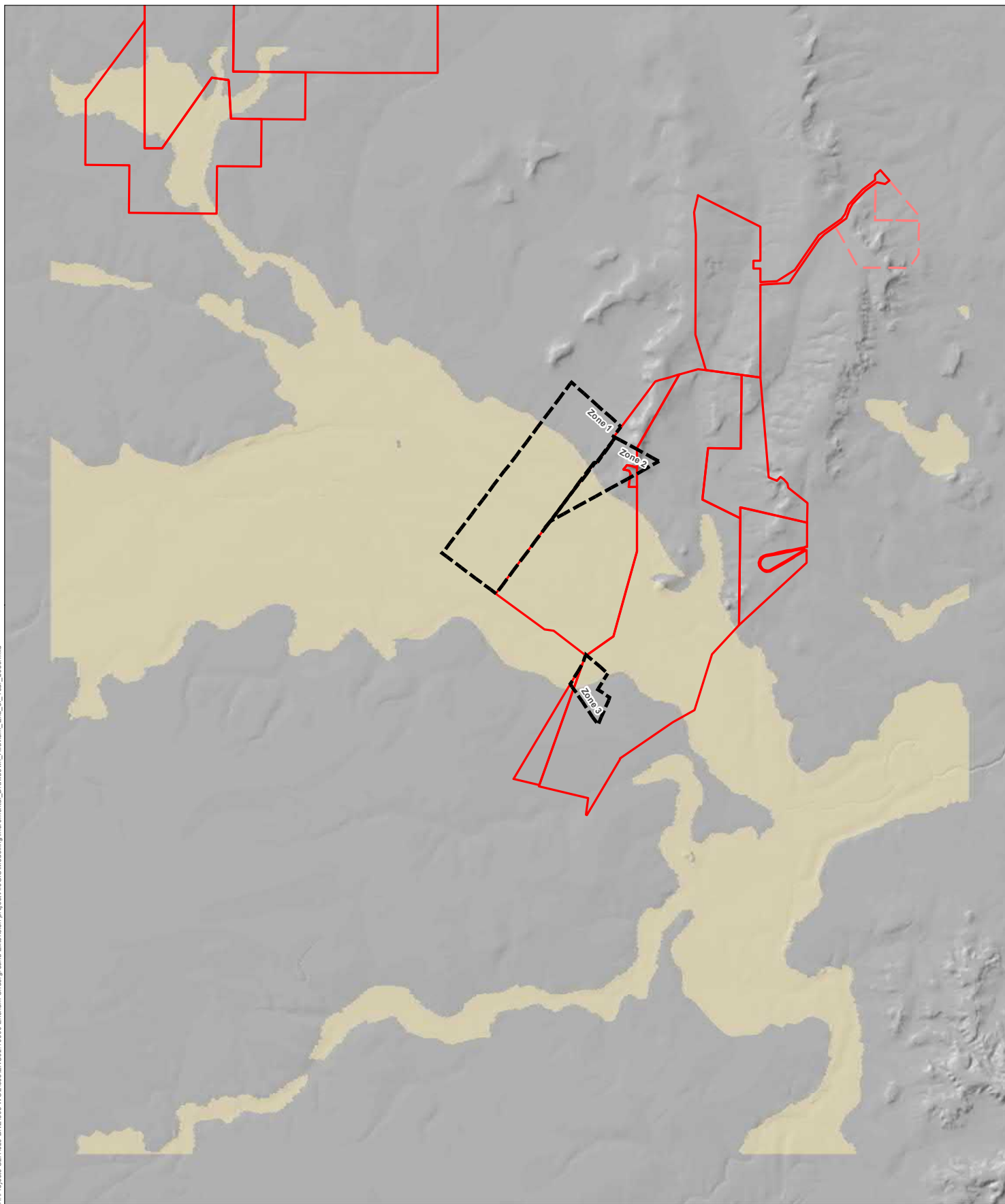
 Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2025

J-9

H:\Projects\SLR\620-BNE-665-WOL\665-ENS02_10000_Ersham Underground Extension project\acis\GIS\Modelling\Incremental Drawdown_Alluvium_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

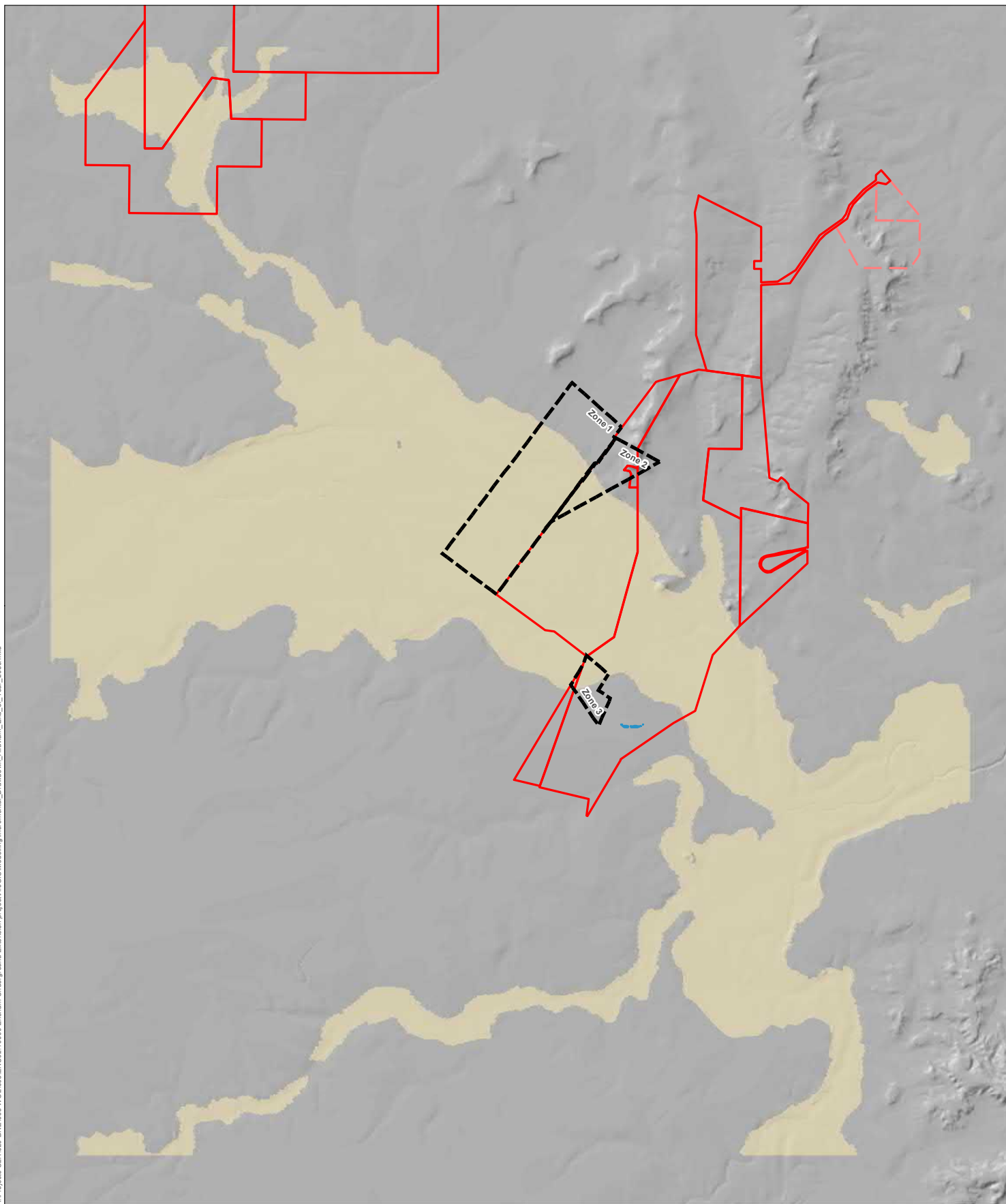
 Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2030

J-10

H:\Projects\SLR\620-BNE-665-WOL\665-ENS02_10000 Ensham Underground Extension project\acGIS\Modelling\Incremental Drawdown_Alluvium_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m) 0.5

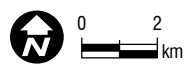
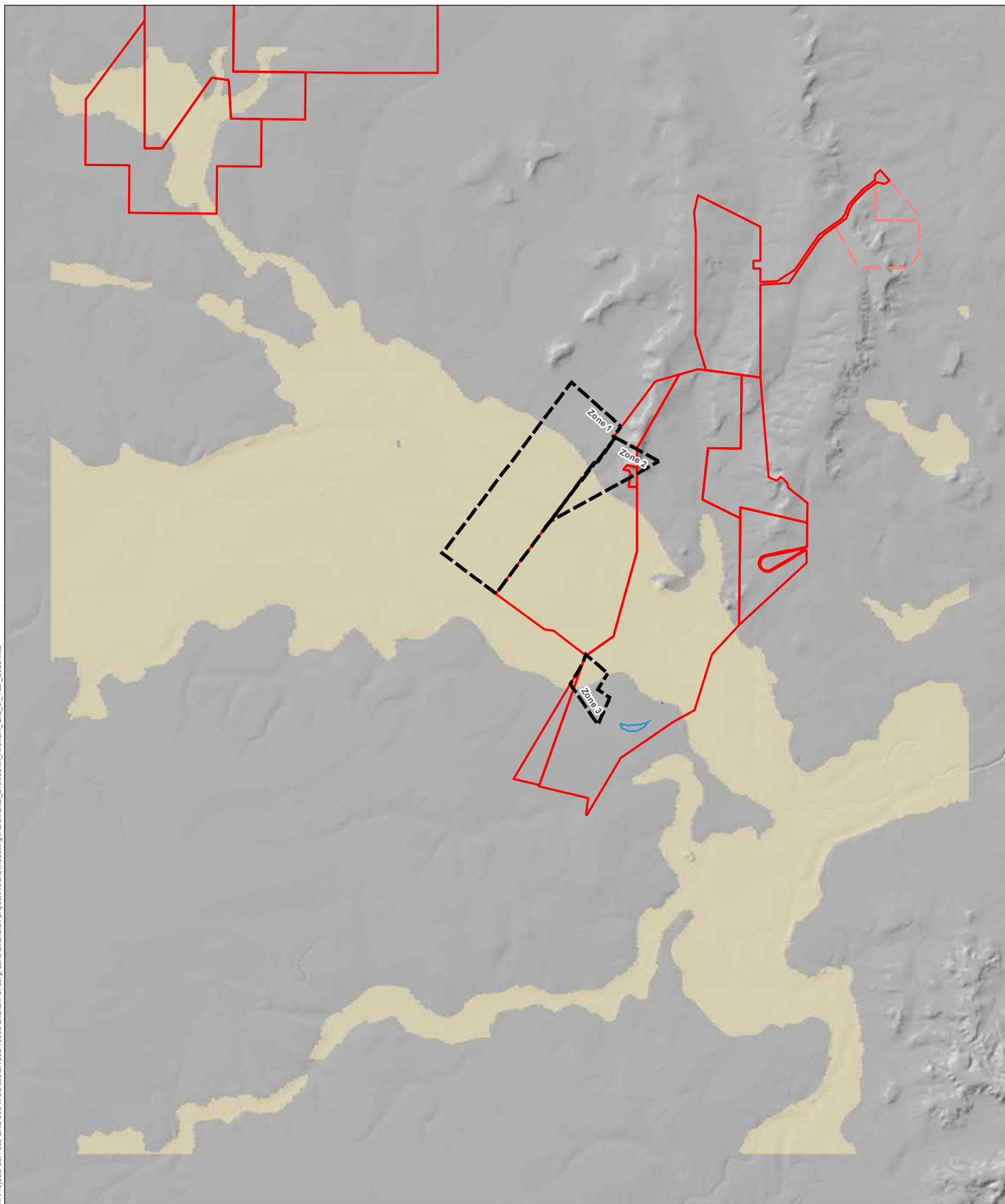
Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2035

J-11

H:\Projects-SLR\620-BNE-665-WOL\665-ENS02_10000-Ensham Underground Extension project\acis\GIS\Modelling\Incremental_Drawdown_Alluvium_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m) 0.5

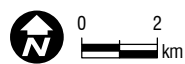
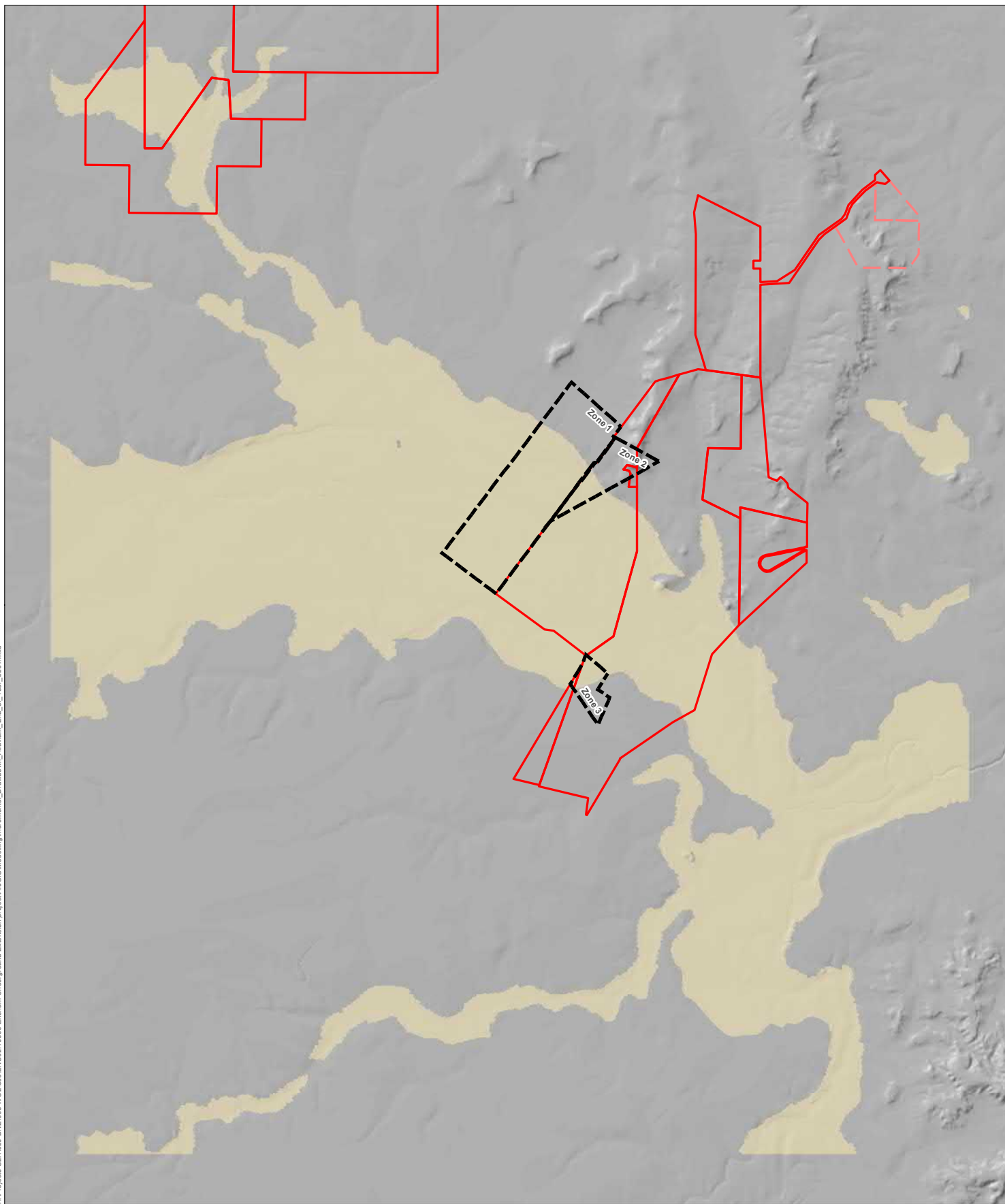
Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2039

J-12

H:\Projects\SLR\620-BNE-665-WOL\665-ENS02_10000_Ersham Underground Extension project\ArcGIS\Modelling\Incremental Drawdown_Alluvium_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

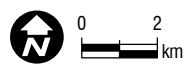
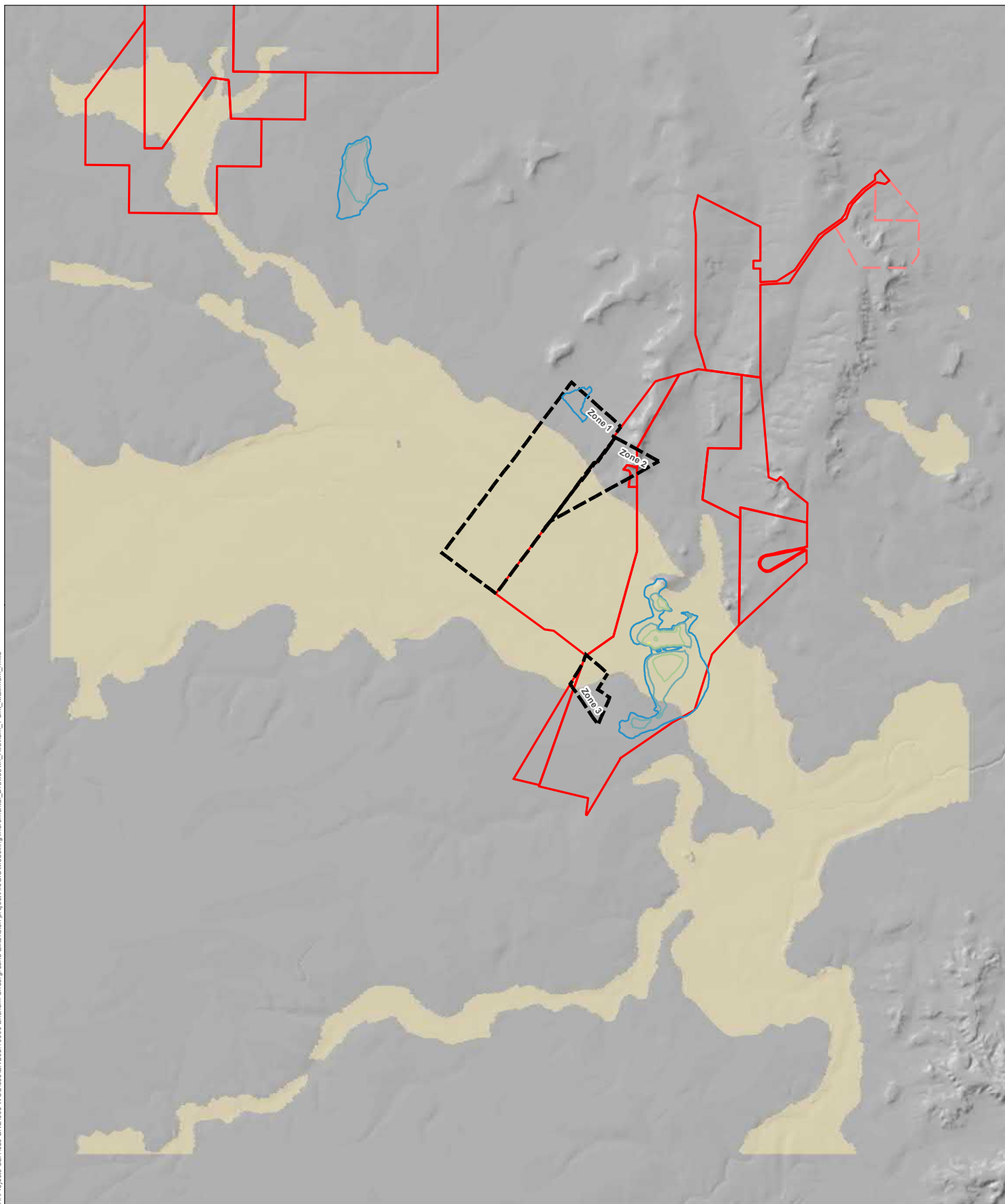
Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - End of Year 2261

J-13

H:\Projects-SLR\620-BNE-665-WOL-065-ENS02.10000-Ensham Underground Extension project\acis\GIS\Modelling\Incremental_Drawdown_Alluvium_Point_Maximum_.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

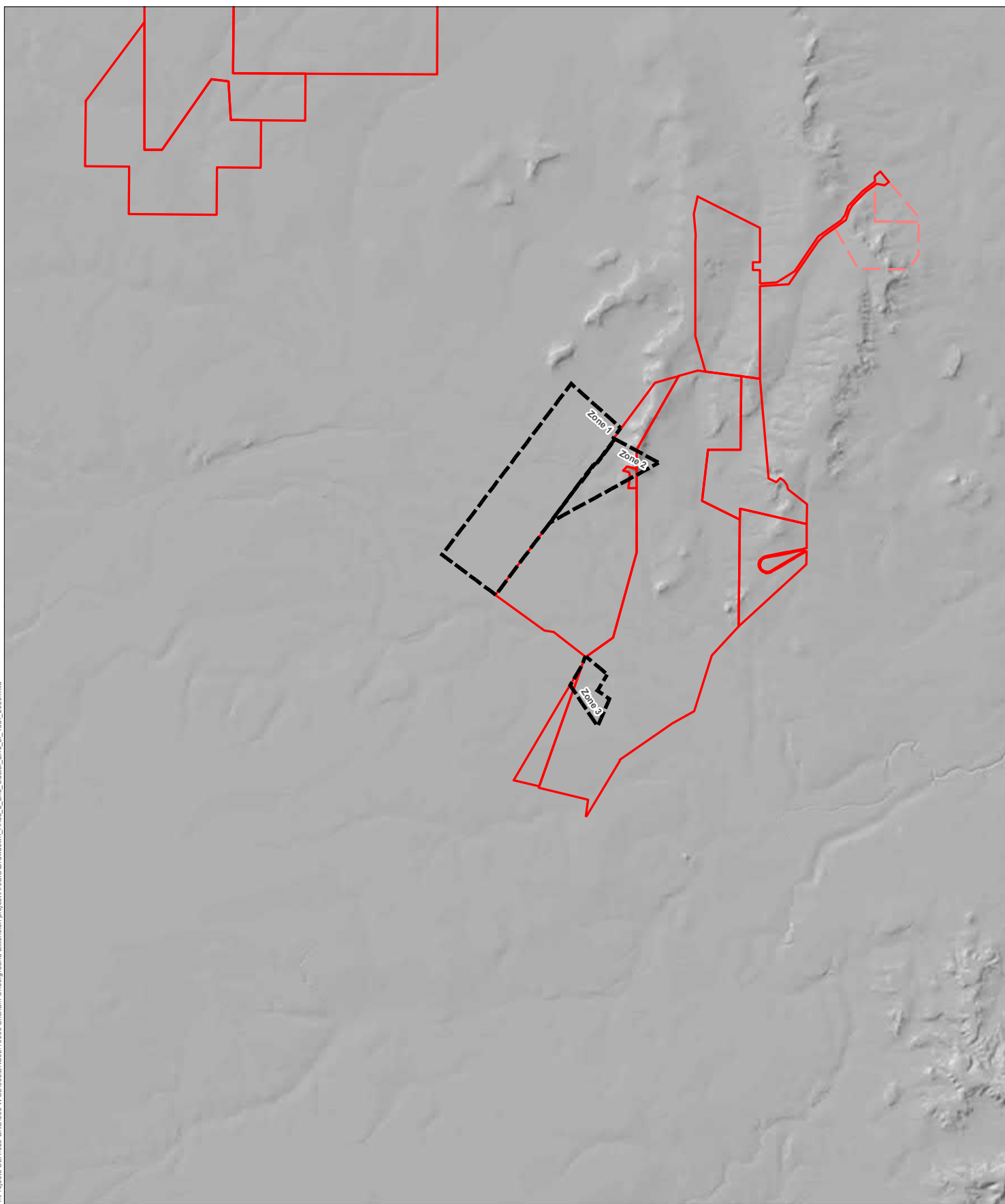
- Drawdown (m)
- 2
 - 0.5
 - 5
 - Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Incremental Drawdown - Alluvium - Point Maximum

J-14

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2020.mxd



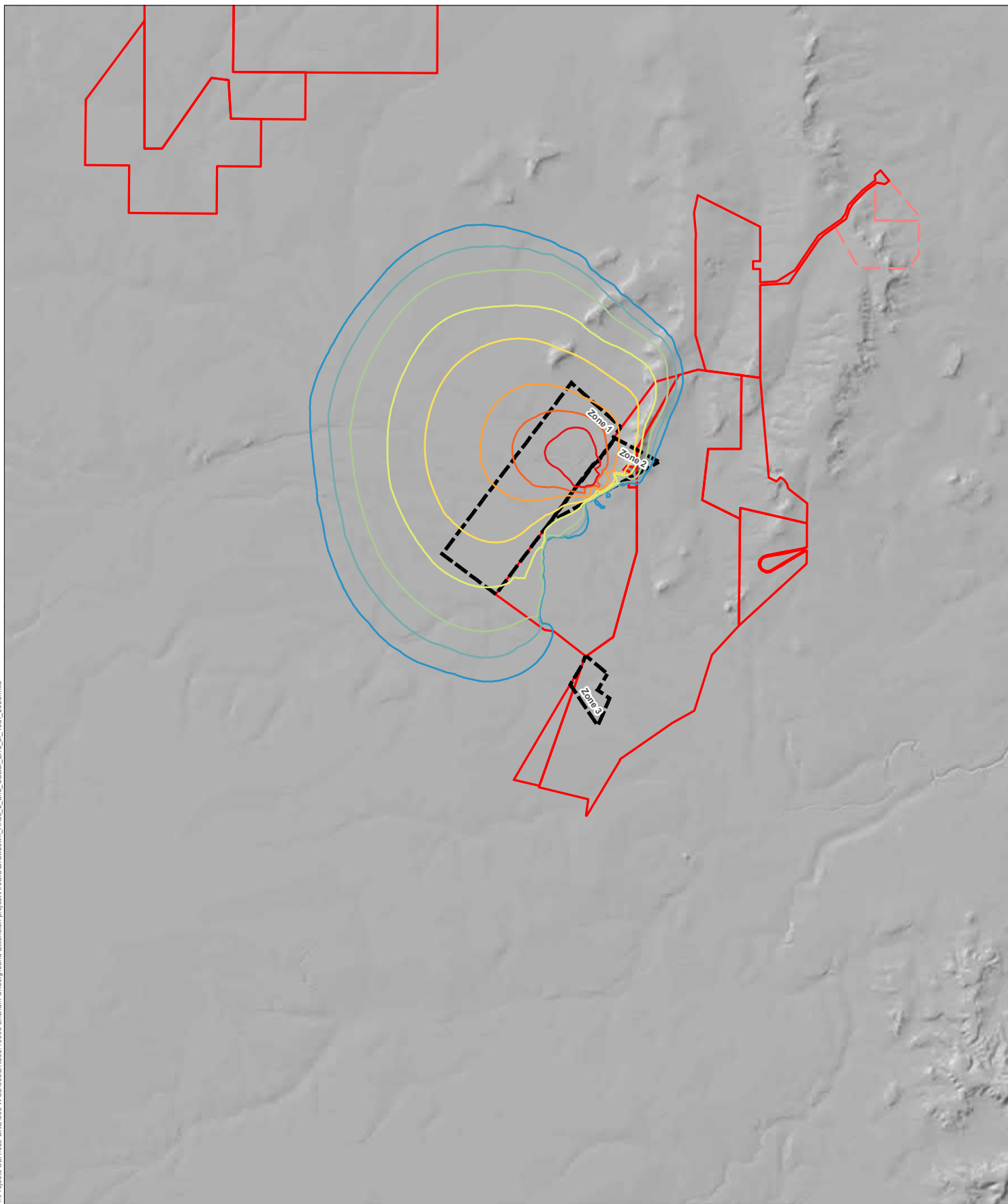
Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

H:\Projects\SLR\620-BNE\665-VOL\665-ENS02-10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

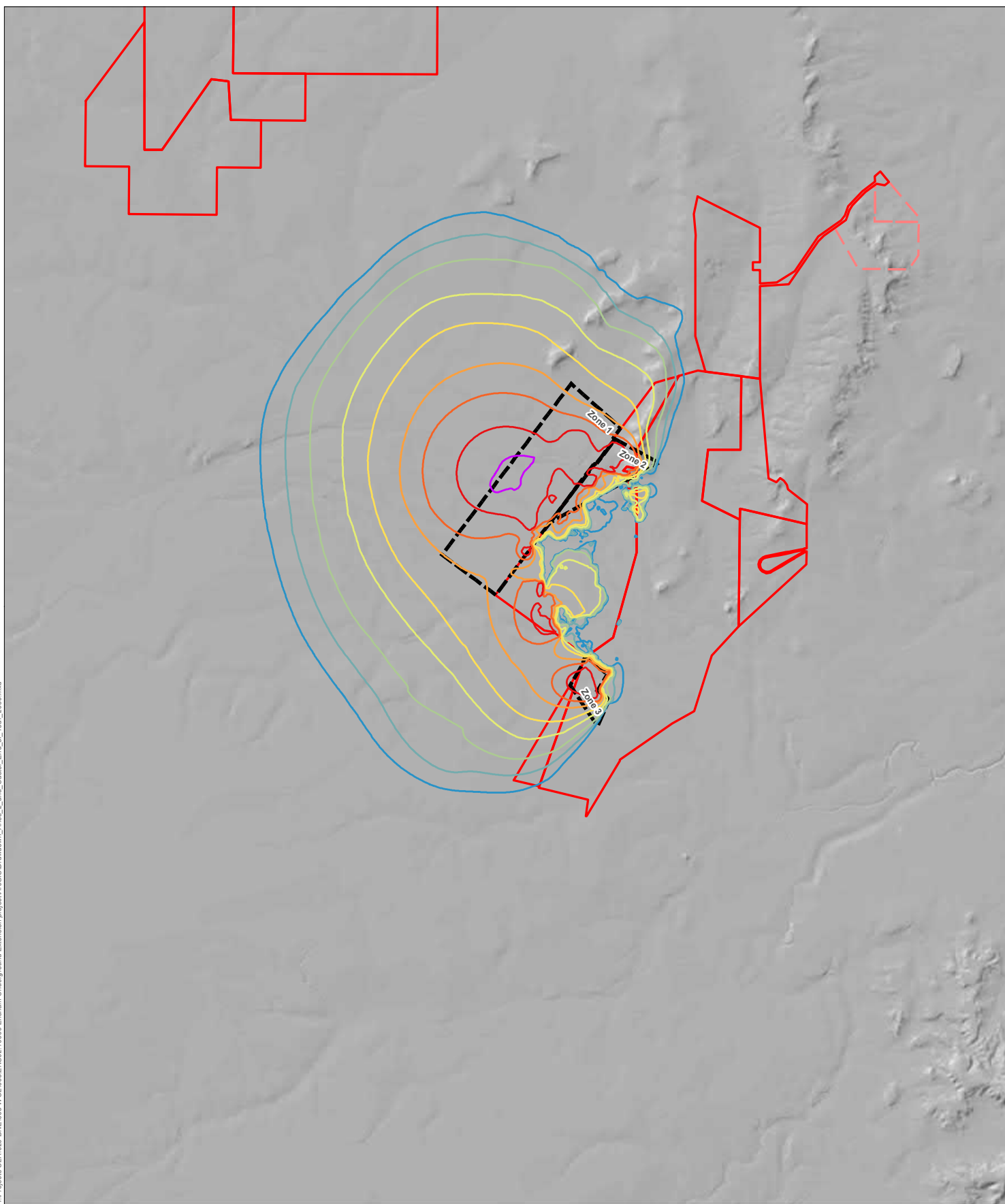
Drawdown (m)	
0.5	—
1	—
2	—
5	—
10	—
20	—
30	—
50	—

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - End of Year 2025

J-16

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- ▭ Project Area

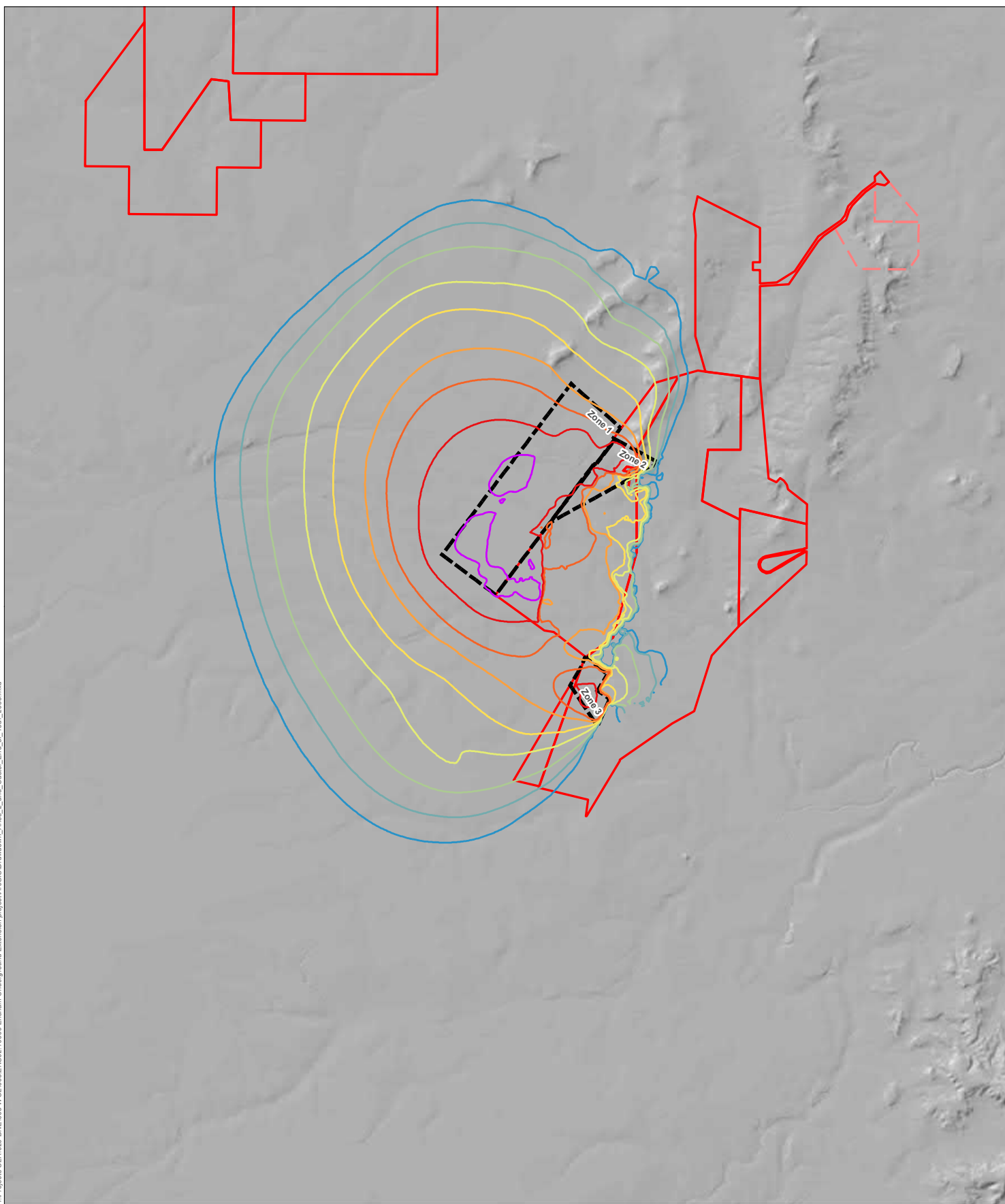
Drawdown (m)	
—	0.5
—	1
—	2
—	5
—	10
—	20
—	30
—	50
—	100

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - End of Year 2030

J-17

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

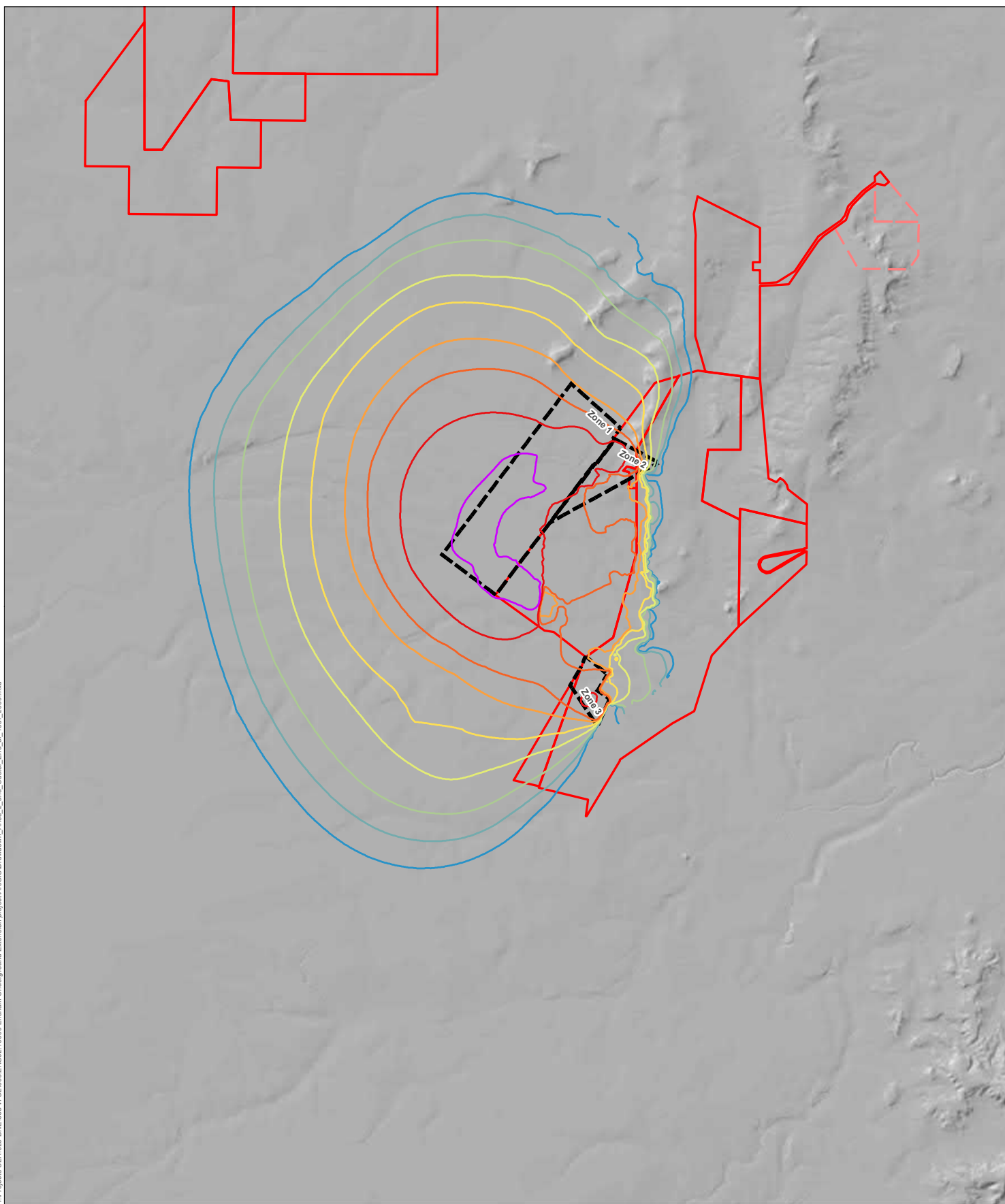
Drawdown (m)	
—	0.5
—	1
—	2
—	5
—	10
—	20
—	30
—	50
—	100

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - End of Year 2035

J-18

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

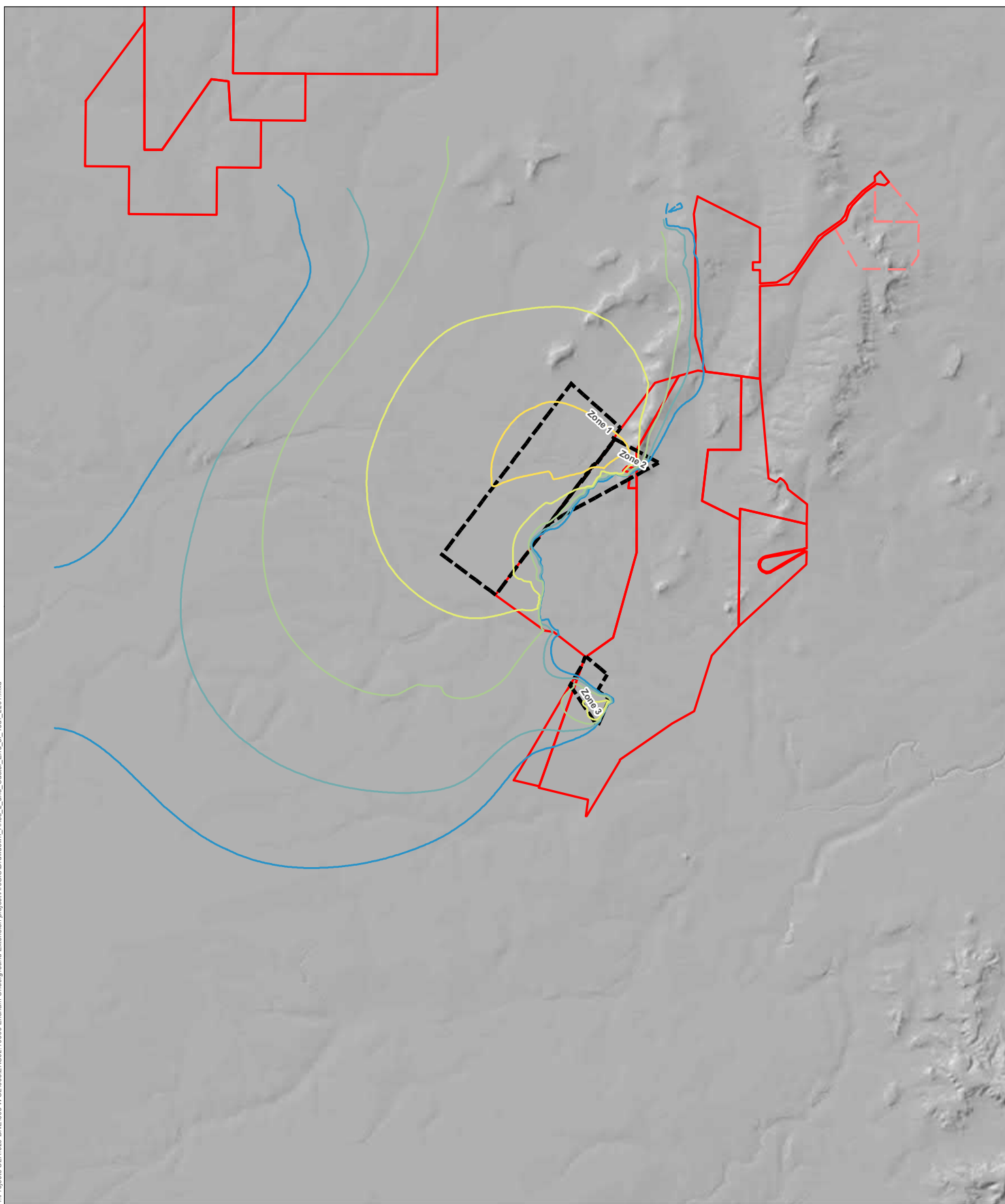
Drawdown (m)	
—	0.5
—	1
—	2
—	5
—	10
—	20
—	30
—	50
—	100

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - End of Year 2039

J-19

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m)

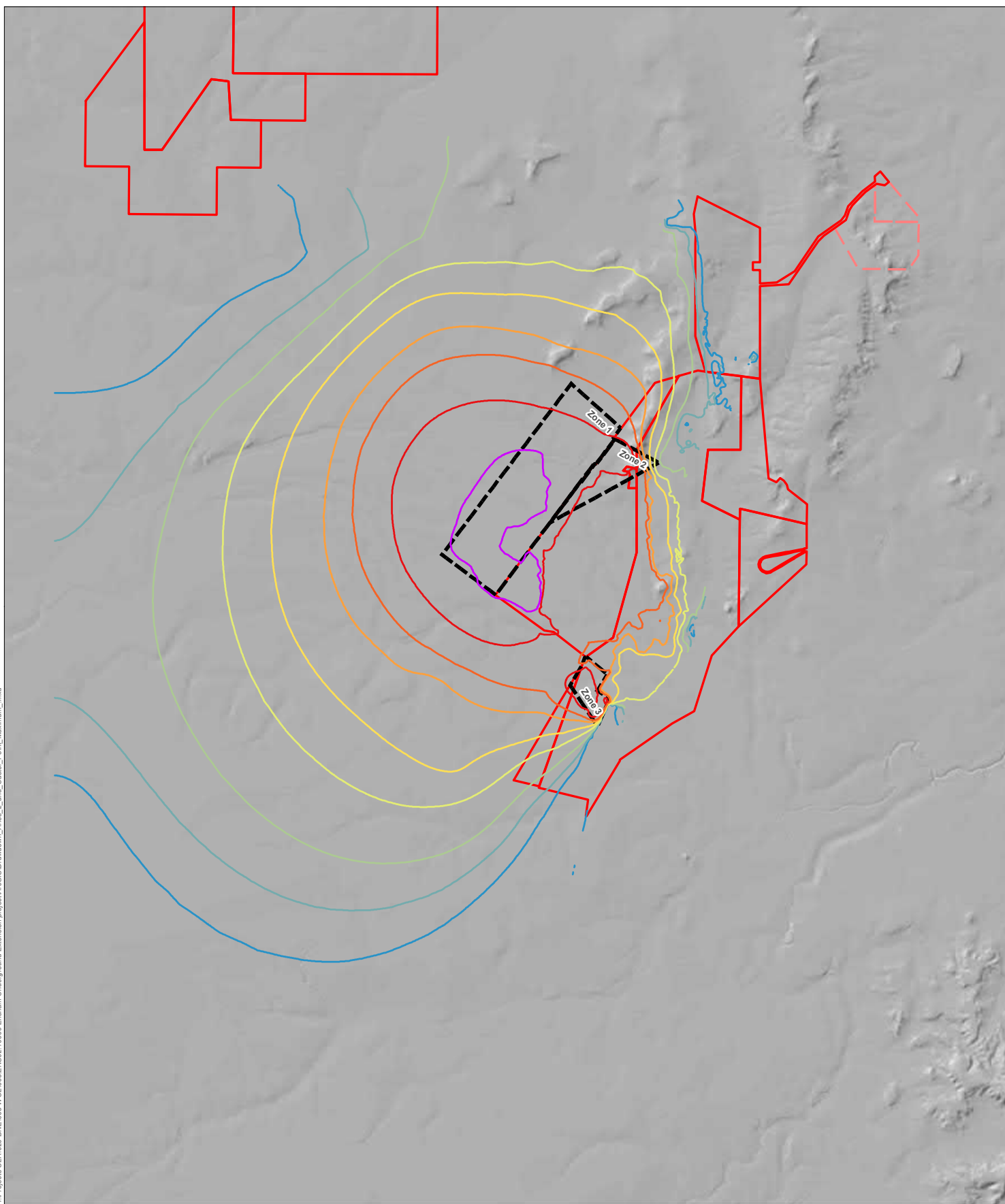
2	5
0.5	10
1	

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - End of Year 2261

J-20

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Drawdown_Aries_2_and_Castor_Point_Maximum.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

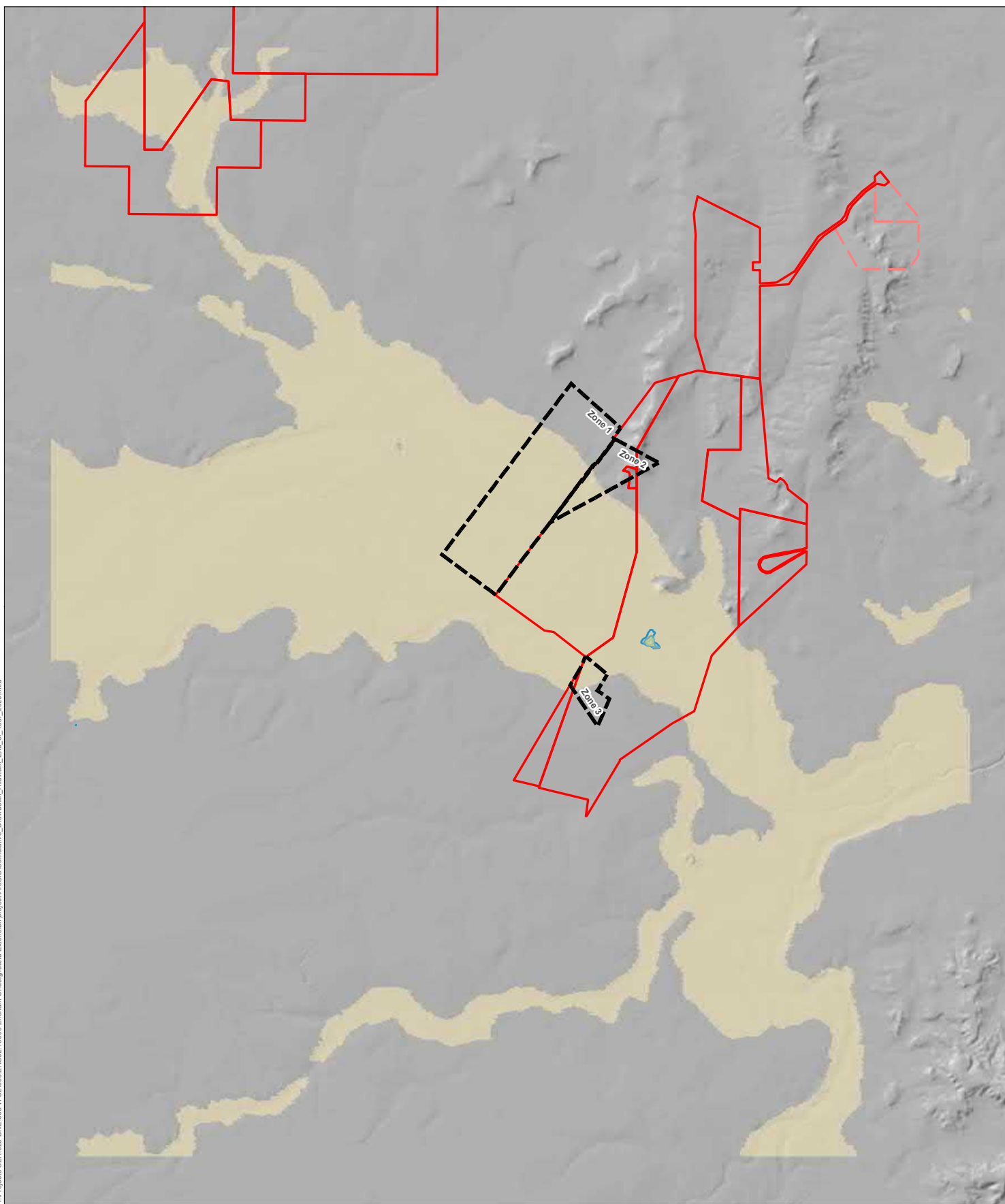
Drawdown (m)	
	0.5
	1
	2
	5
	10
	20
	30
	50
	100

GROUNDWATER IMPACT ASSESSMENT

Drawdown - Aries 2 and Castor - Point Maximum

J-21

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown Alluvium End of Year 2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

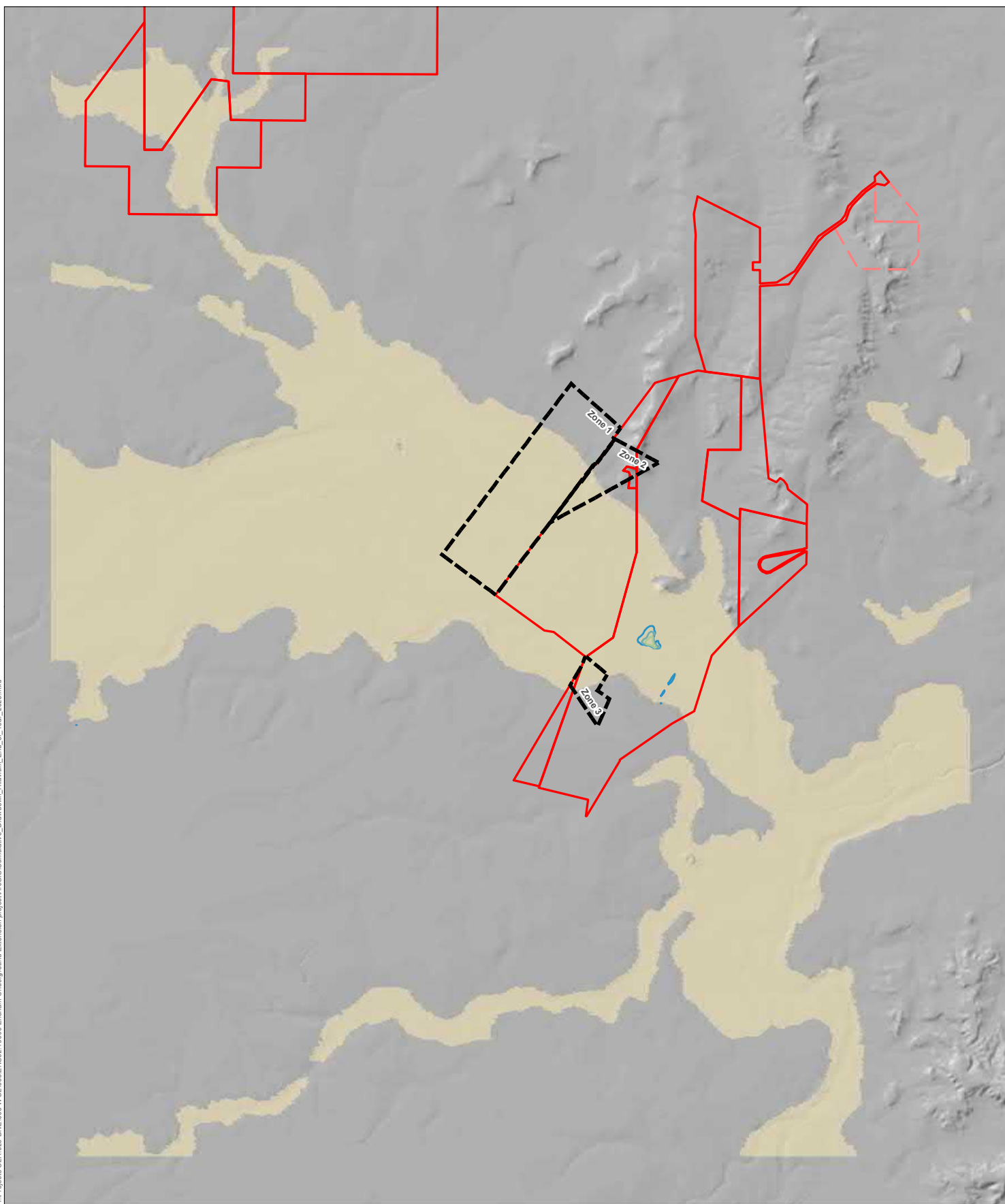
- Drawdown (m)
- 0.5
 - 1
 - 2
 - Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Alluvium - End of Year 2020

J-22

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown Alluvium End of Year 2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

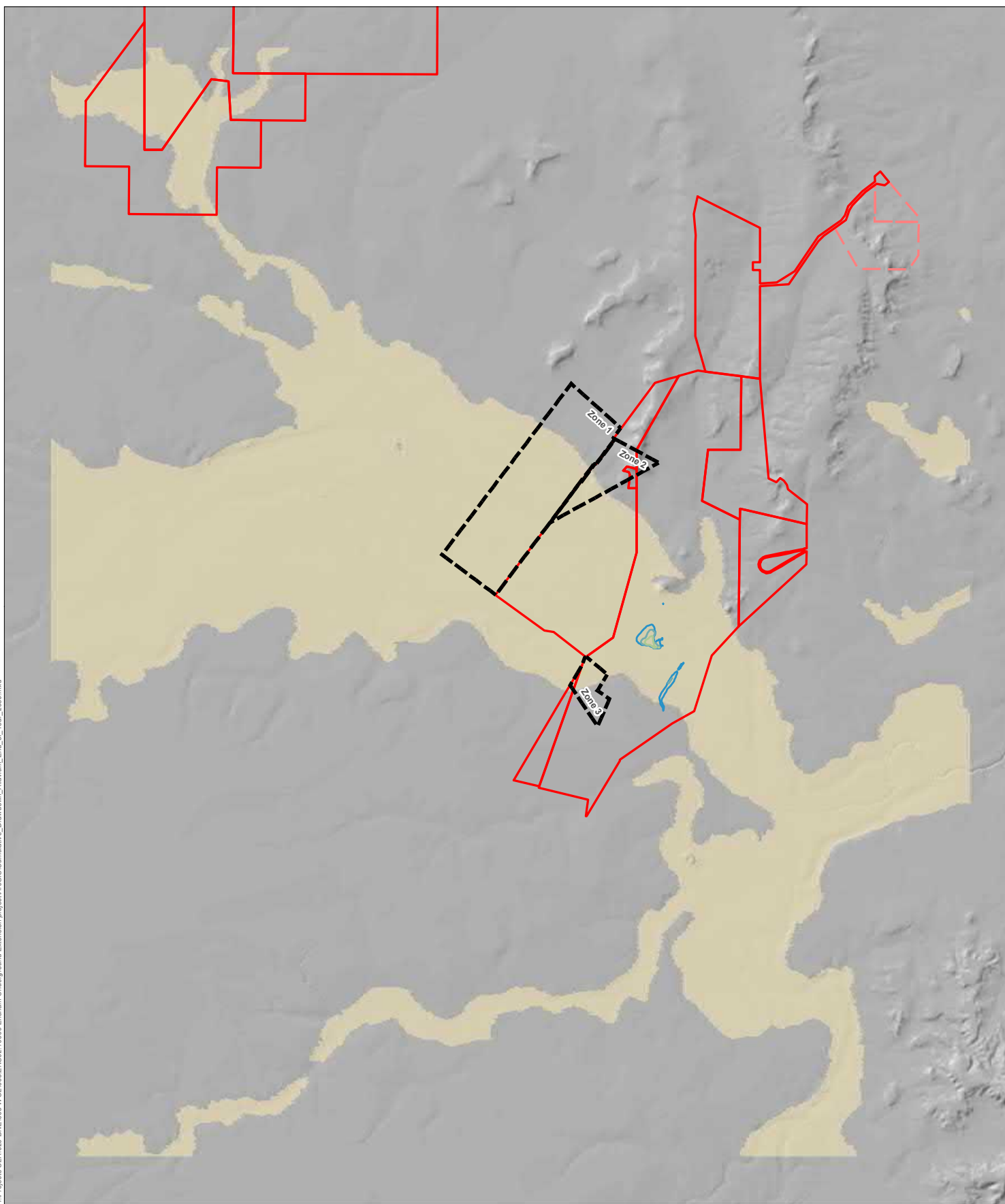
- Drawdown (m)
- 0.5
 - 1
 - 2
 - Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Alluvium - End of Year 2025

J-23

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative_Draindown_Alluvium_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

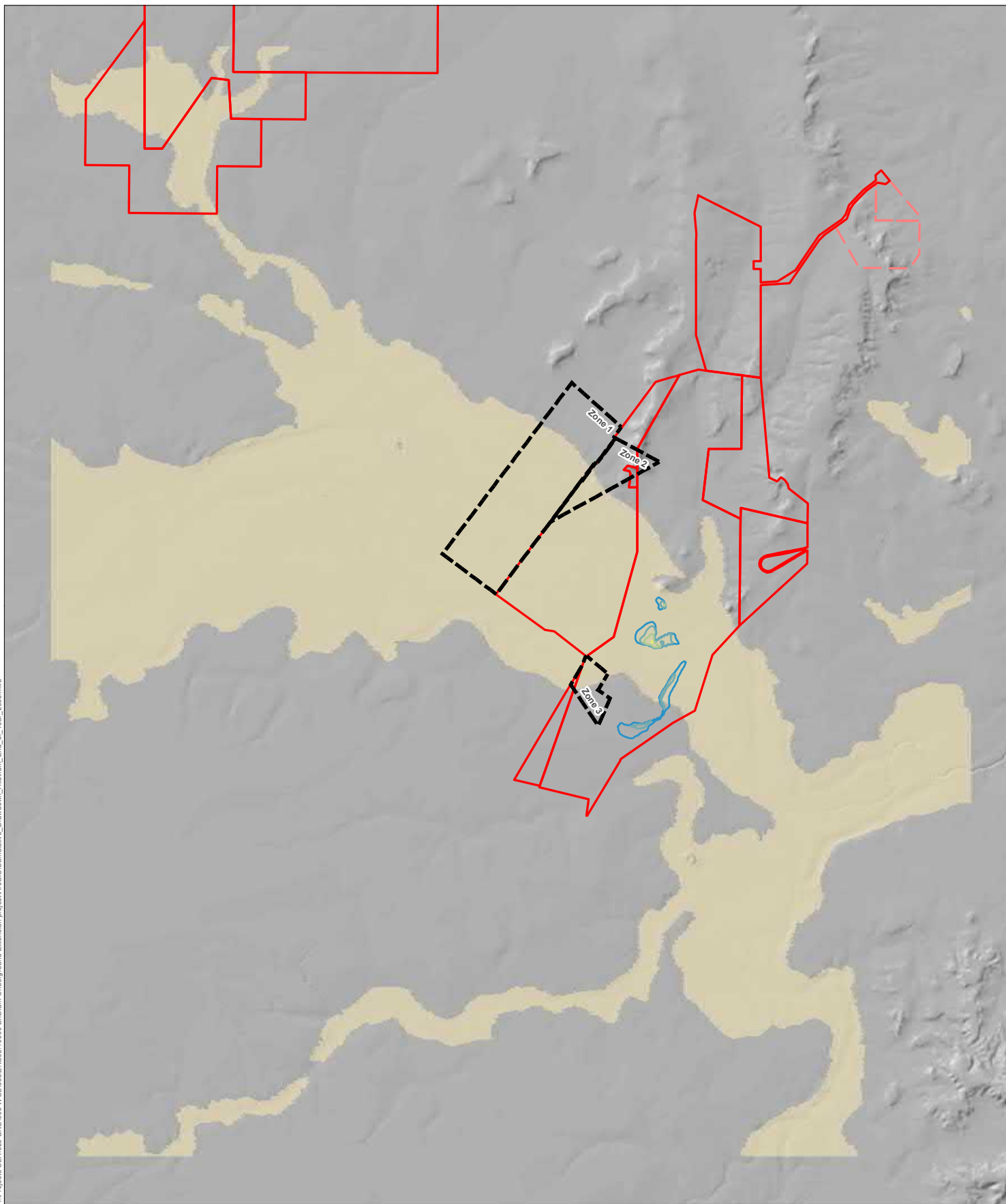
- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m) — 1 — 2
— 0.5 — 2
 Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT Cumulative Drawdown - Alluvium - End of Year 2030

J-24

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown Alluvium End of Year 2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 24-Apr-2020

Drawn by: PM

Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

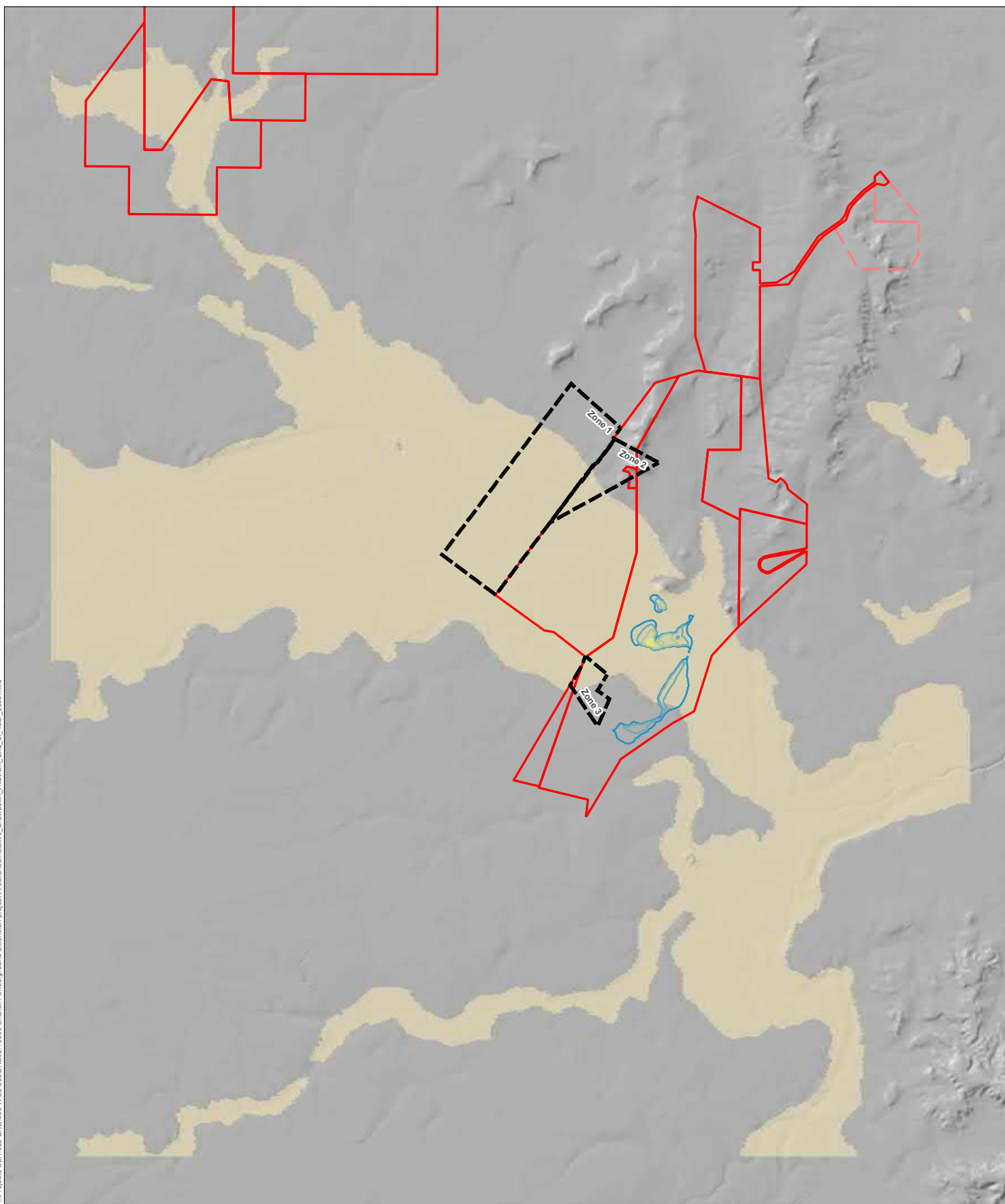
- | | | |
|--------------|-----|---|
| Drawdown (m) | 2 | 5 |
| | 0.5 | |
| | 1 | |

Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT Cumulative Drawdown - Alluvium - End of Year 2035

J-25

F:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown Alluvium End of Year 2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m)

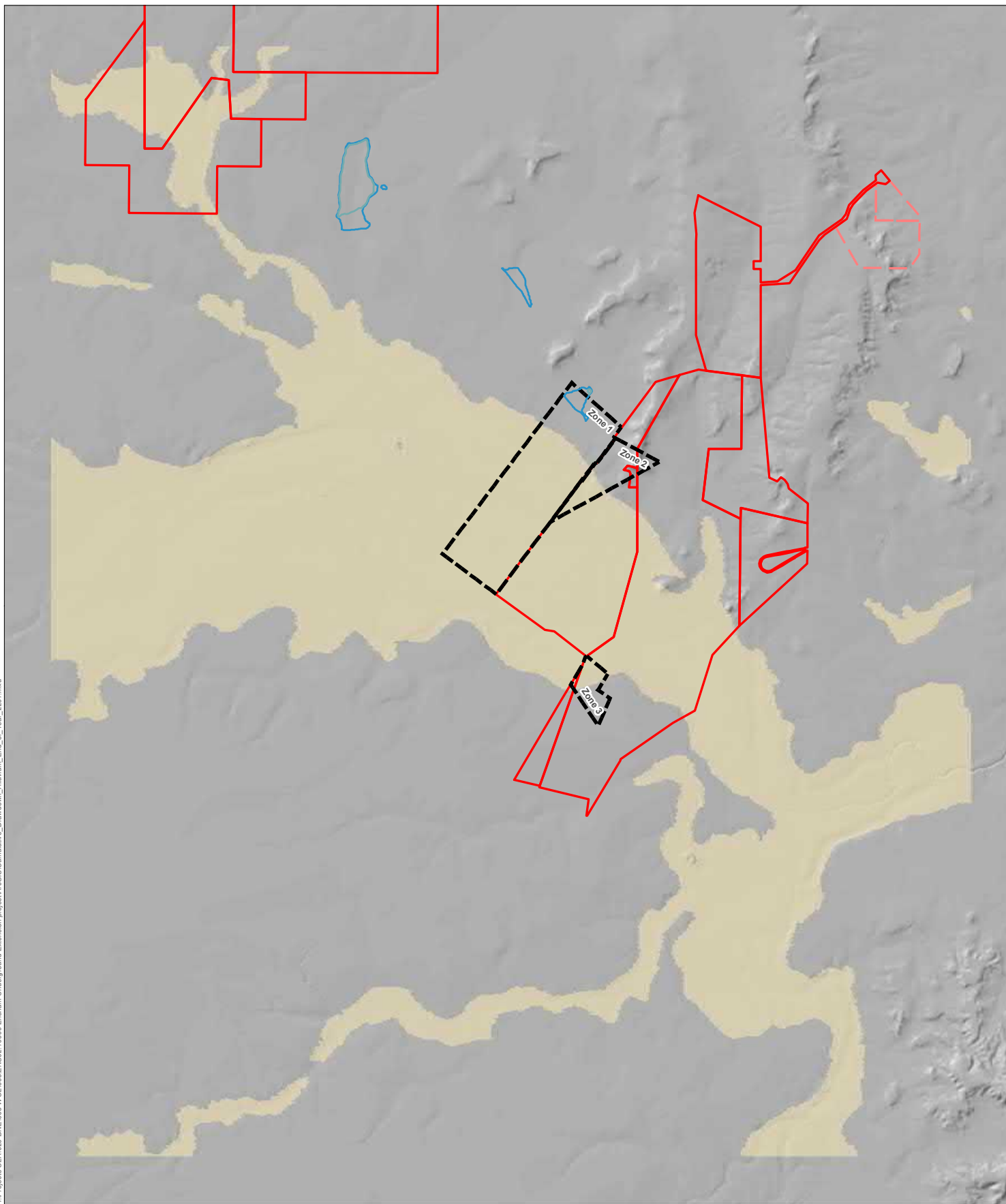
- 0.5
- 1
- 2
- 5
- Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Alluvium - End of Year 2039

J-26

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02_10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown Alluvium End of Year 2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m) — 1

— 0.5

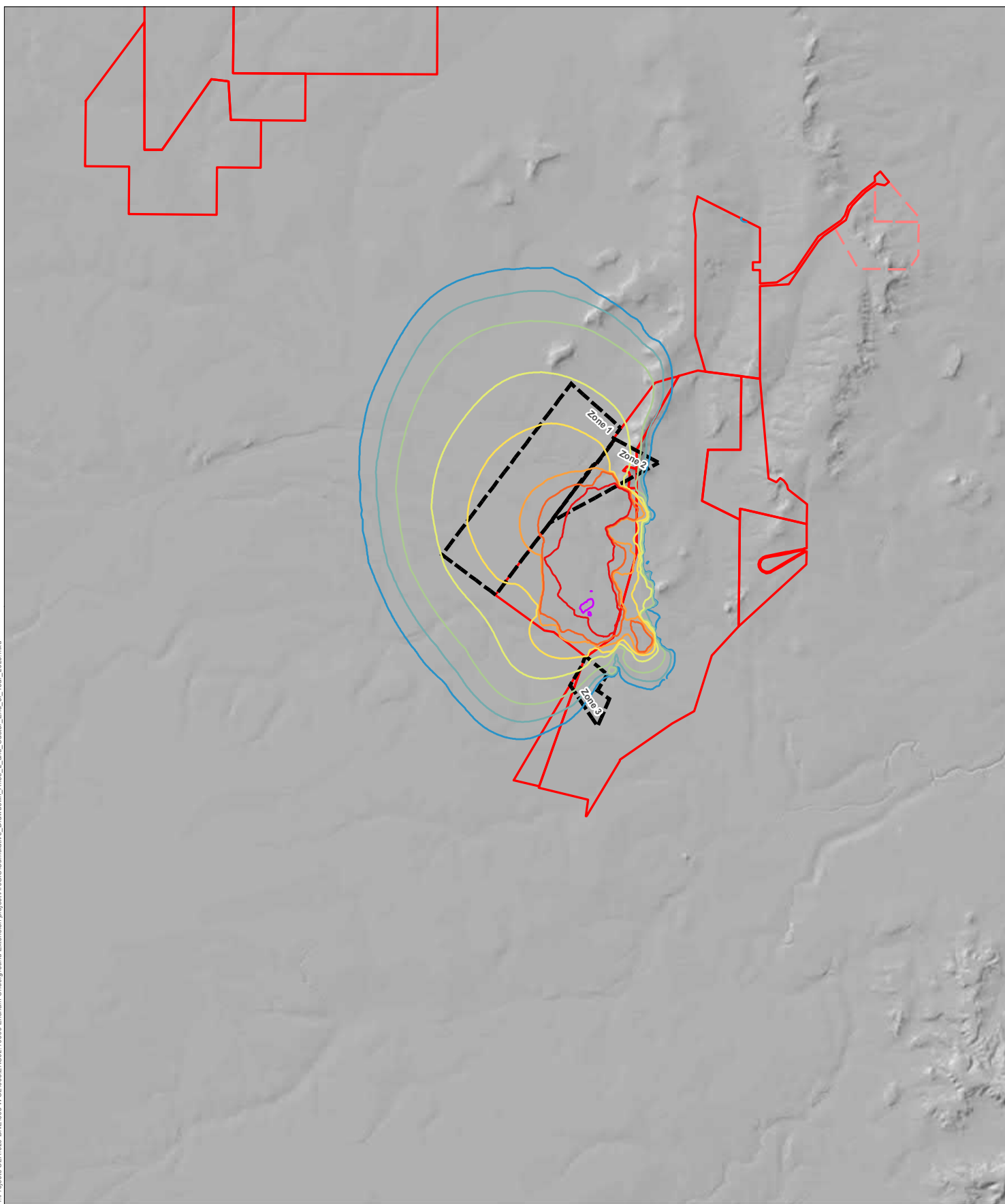
Modelled Alluvial Extents

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Alluvium - End of Year 2261

J-27

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2020.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

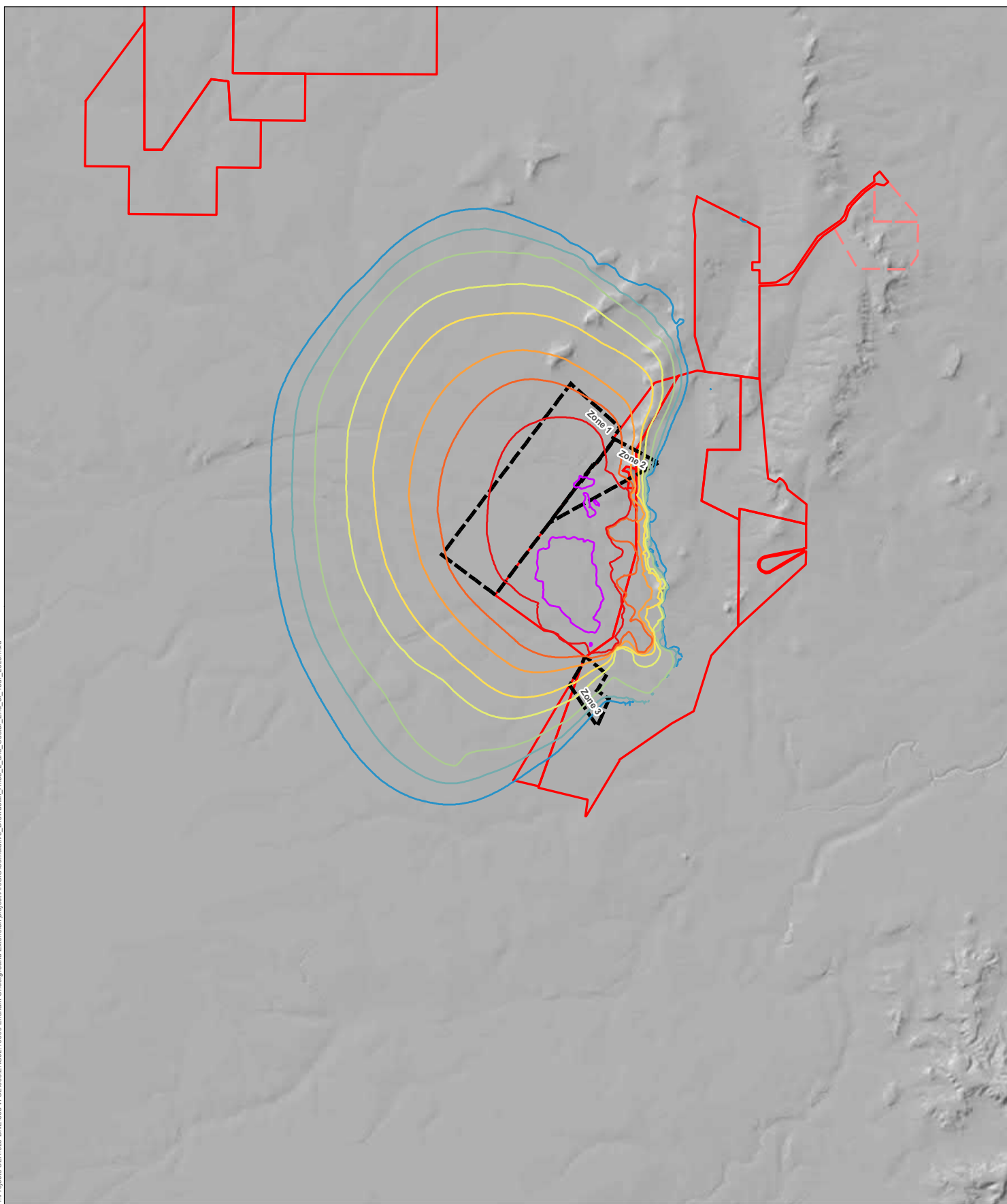
Drawdown (m)	
—	0.5
—	1
—	2
—	5
—	10
—	20
—	30
—	50
—	100

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Aries 2 and Castor - End of Year 2020

J-28

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2025.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

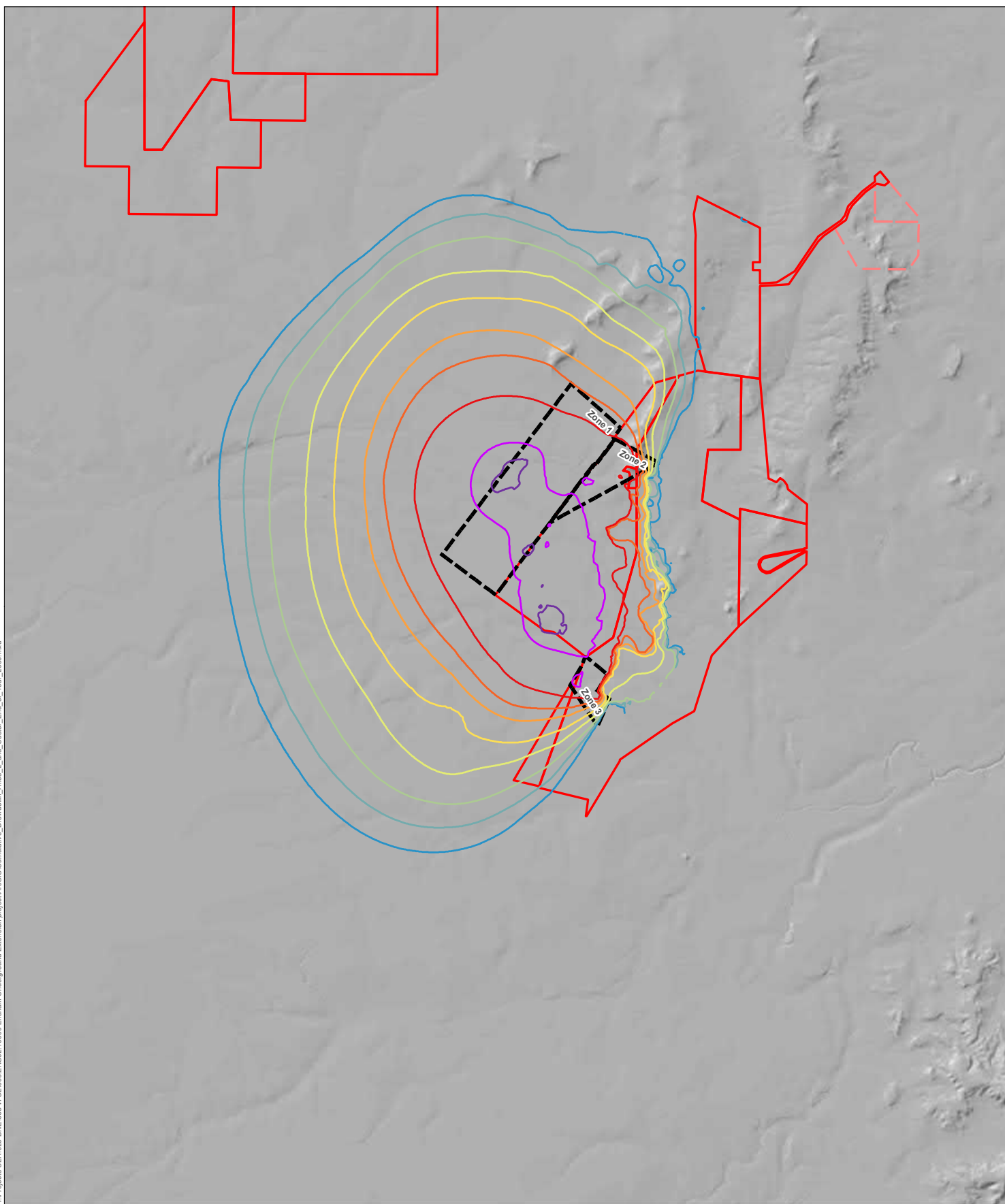
- ▭ Mining Lease (Granted)
- ▭ Mining Lease (Application)
- Project Area

Drawdown (m)	
—	0.5
—	1
—	2
—	5
—	10
—	20
—	30
—	50
—	100

GROUNDWATER IMPACT ASSESSMENT
Cumulative Drawdown - Aries 2 and Castor - End of Year 2025

J-29

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2030.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

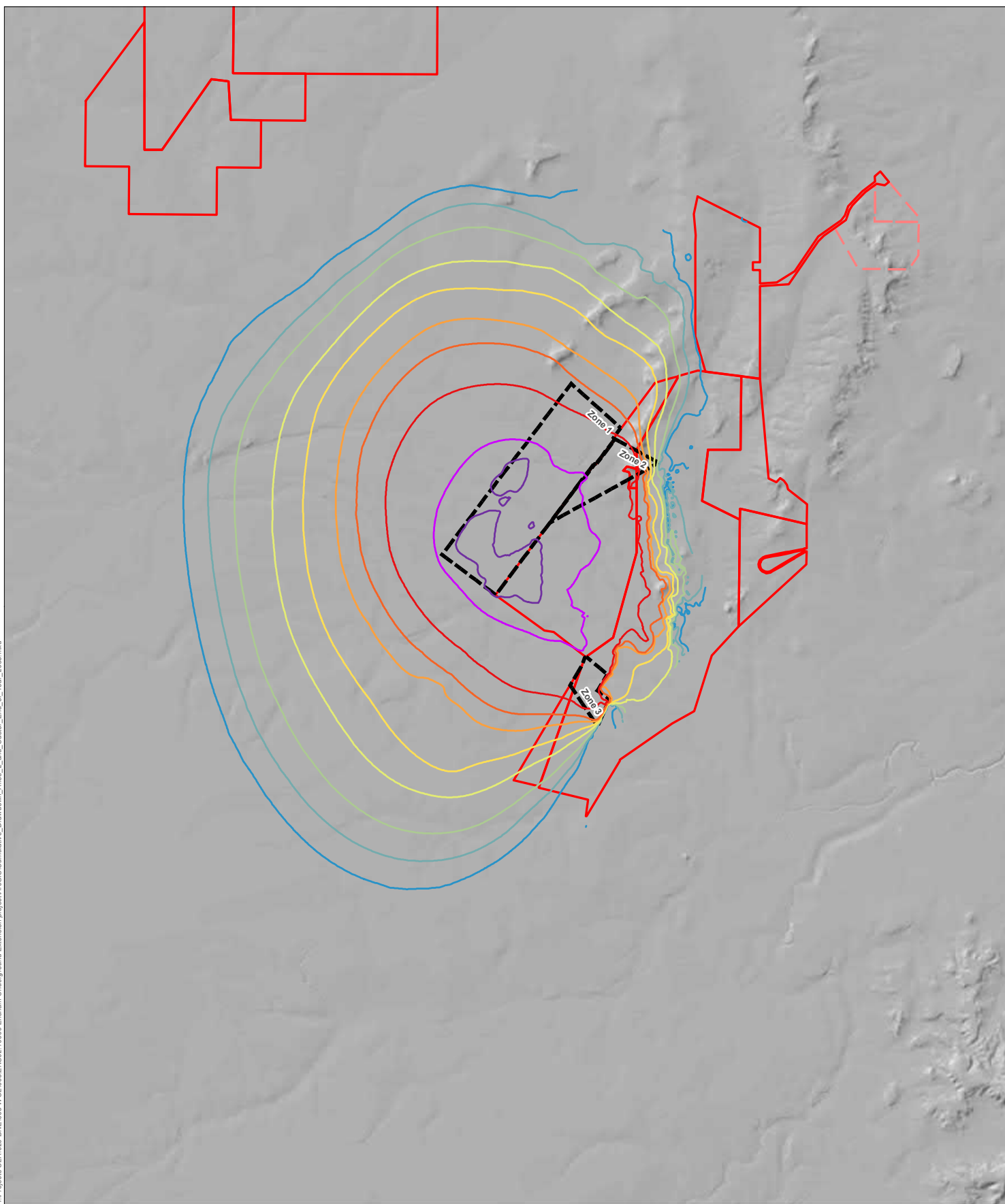
Drawdown (m)	
0.5	20
1	30
2	50
5	100
10	150

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Aries 2 and Castor - End of Year 2030

J-30

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2035.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

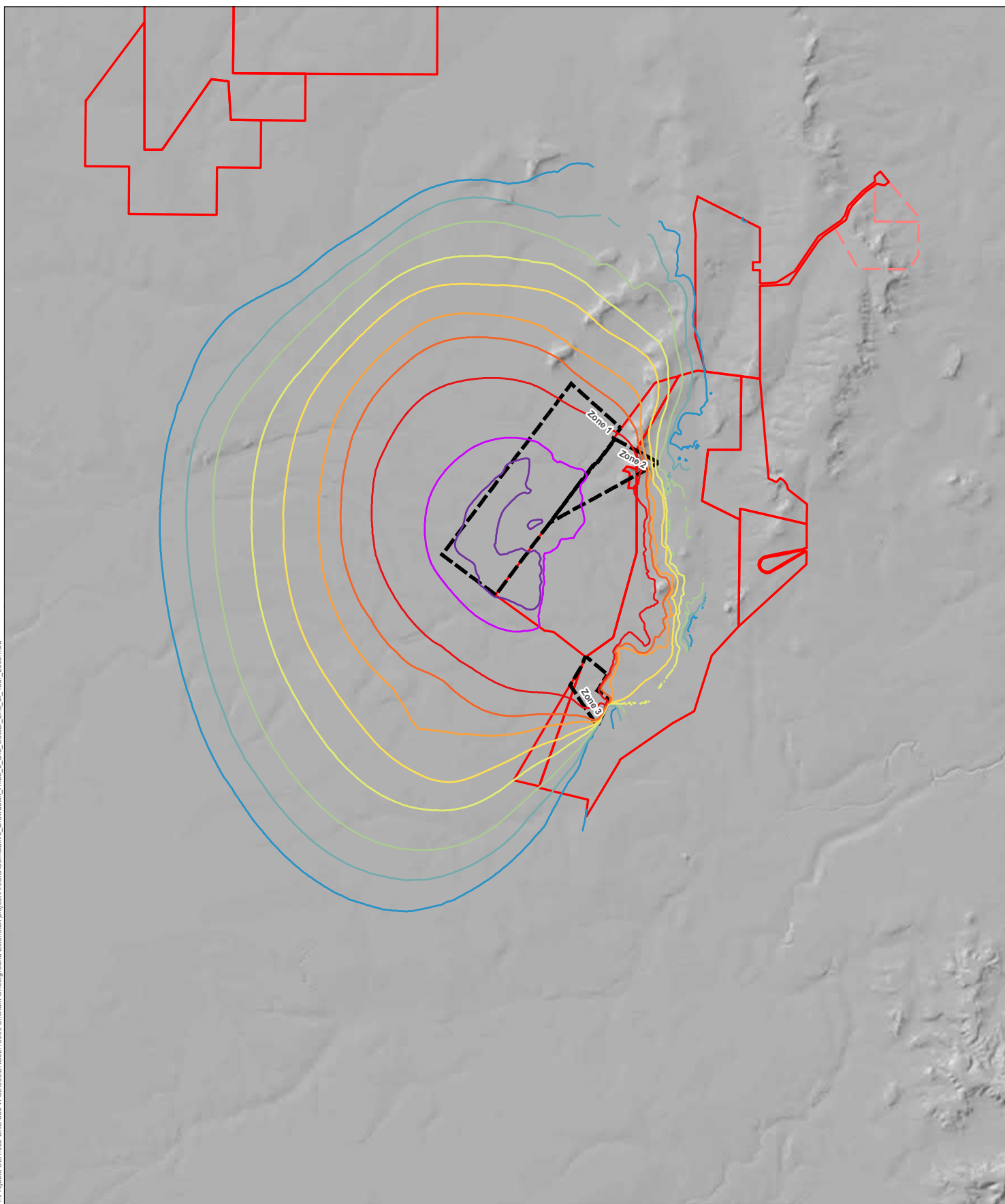
Drawdown (m)	
0.5	20
1	30
2	50
5	100
10	150

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Aries 2 and Castor - End of Year 2035

J-31

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2039.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

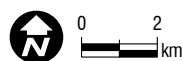
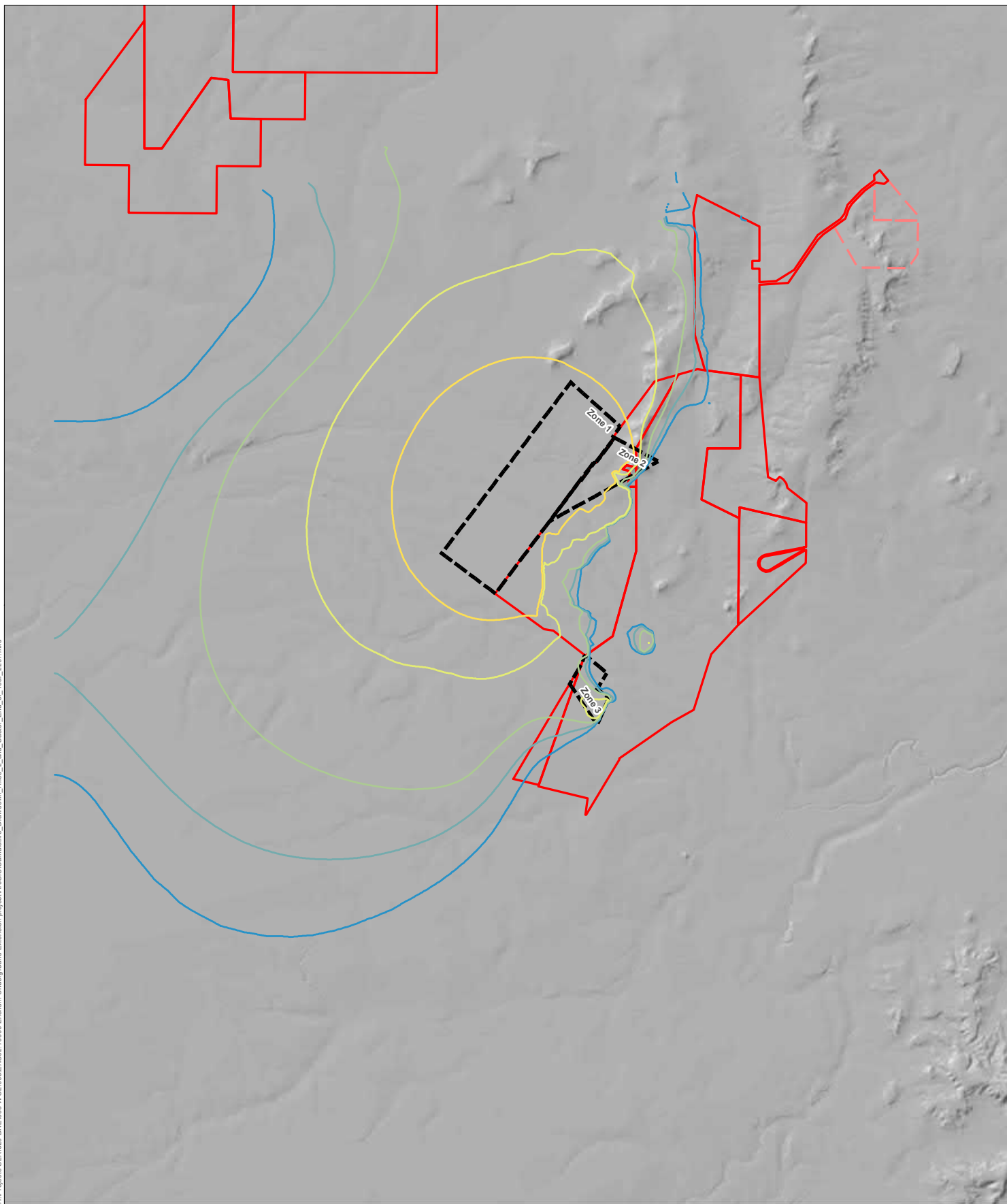
Drawdown (m)	
0.5	20
1	30
2	50
5	100
10	150

GROUNDWATER IMPACT ASSESSMENT

Cumulative Drawdown - Aries 2 and Castor - End of Year 2039

J-32

H:\Projects\SLR\620-BNE\665-WOL\665-ENS02.10000 Ensham Underground Extension project\ArcGIS\Cumulative Drawdown_Aries_2_and_Castor_End_of_Year_2261.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 24-Apr-2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

Drawdown (m)

— 0.5	— 2
— 1	— 5
	— 10

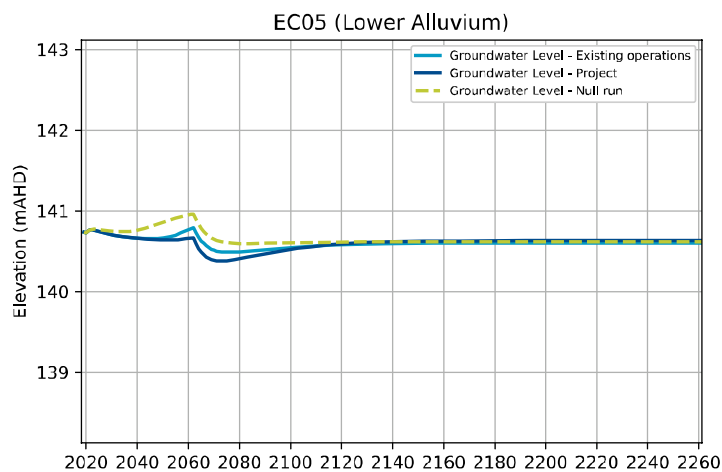
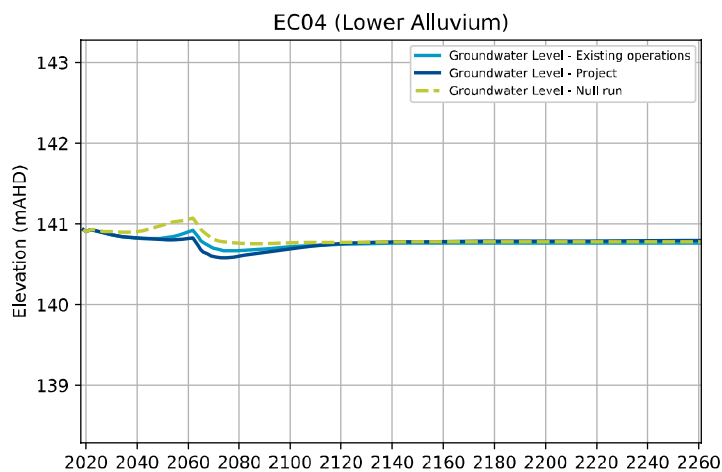
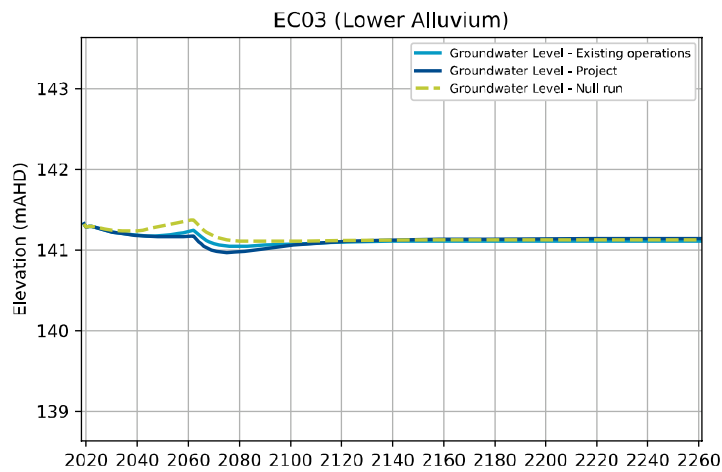
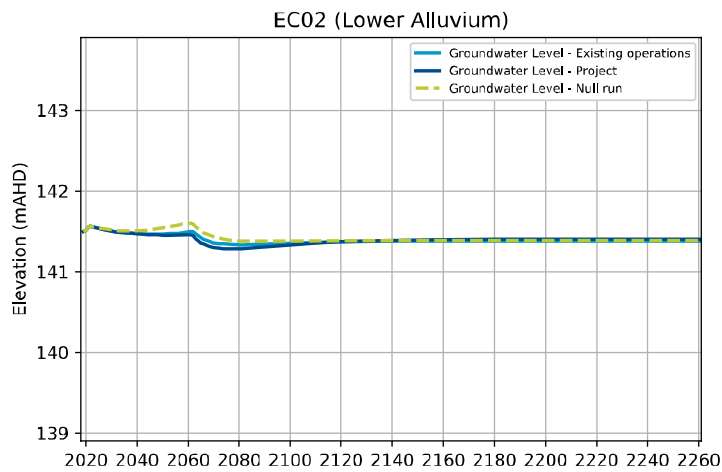
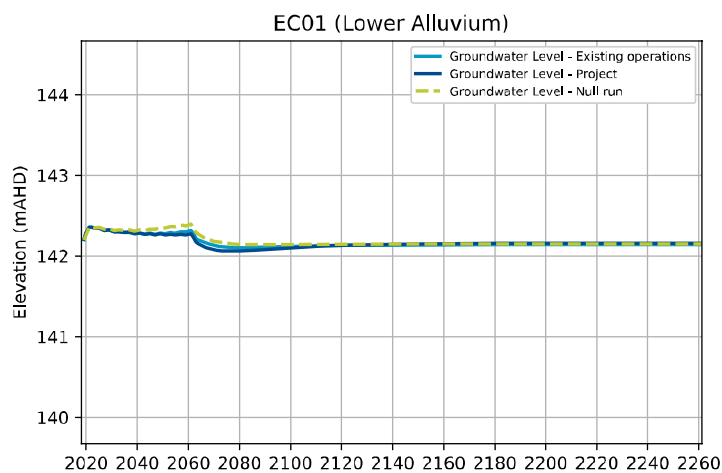
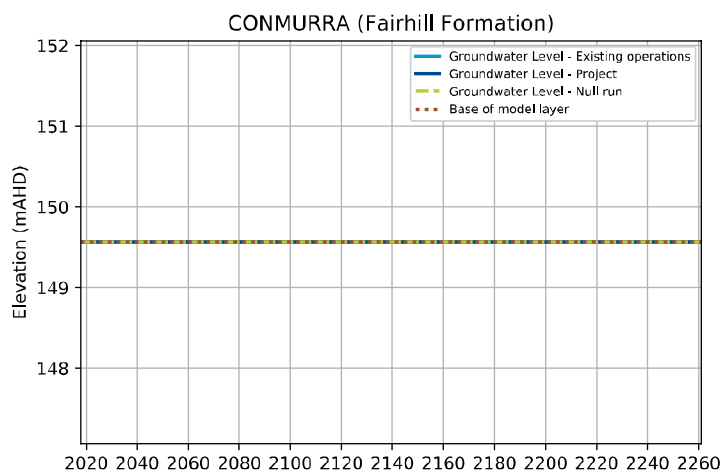
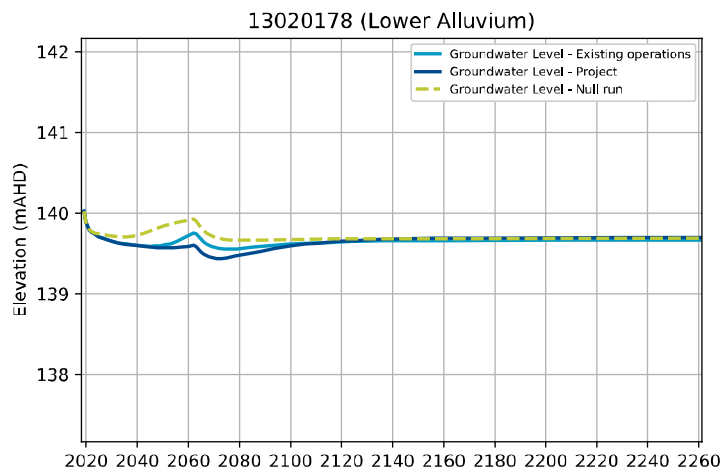
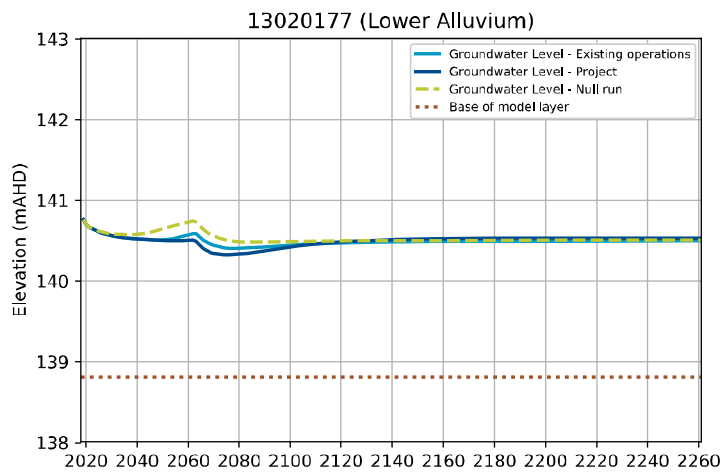
GROUNDWATER IMPACT ASSESSMENT

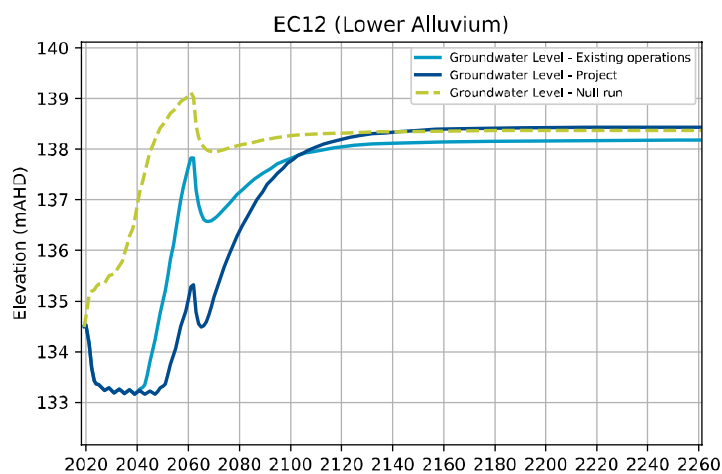
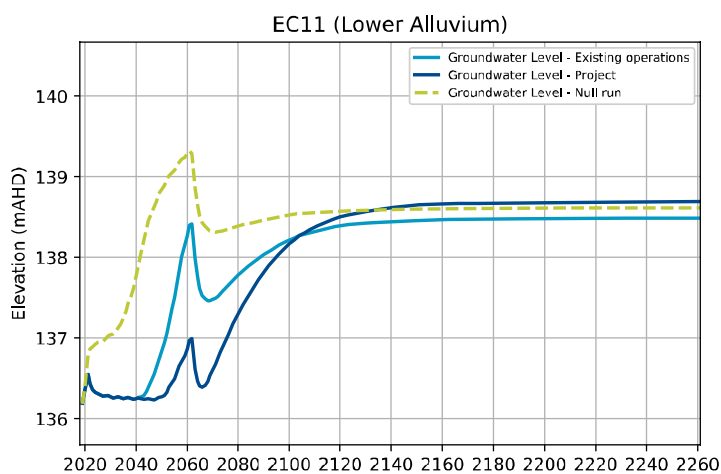
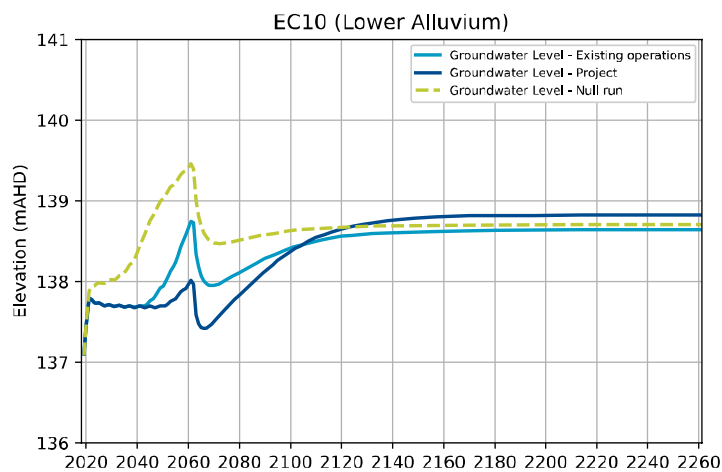
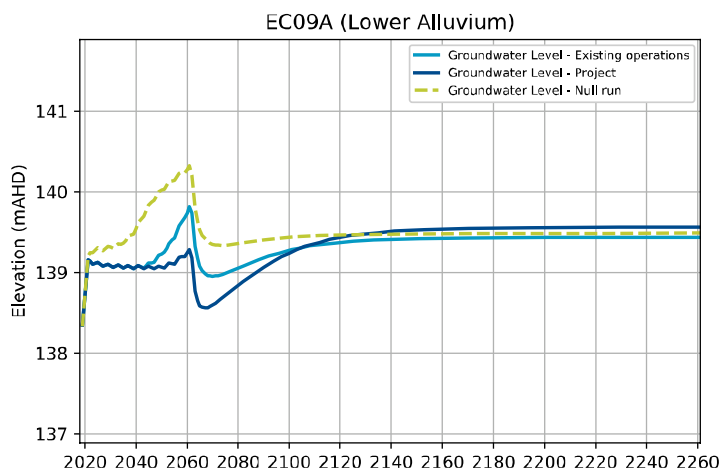
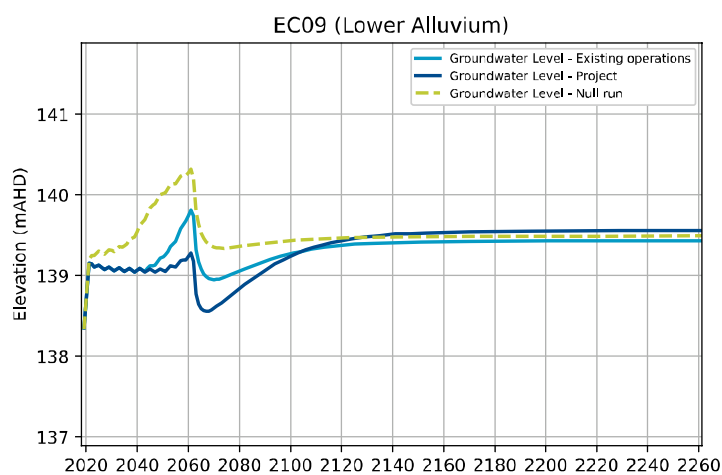
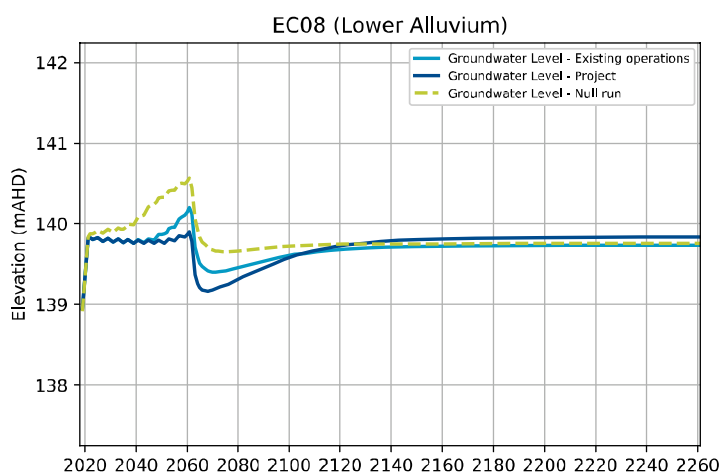
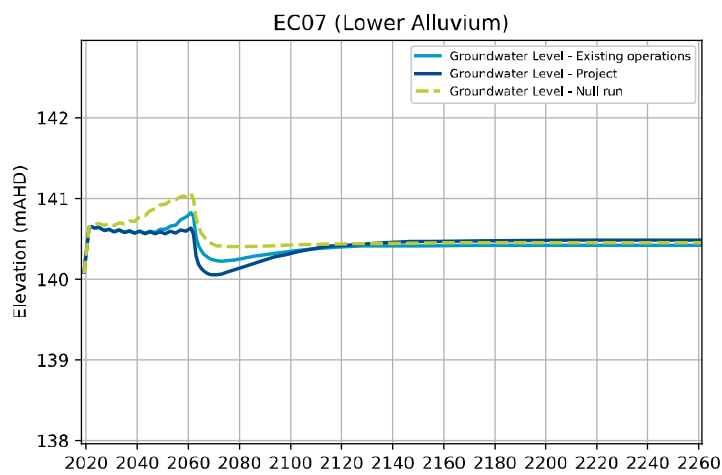
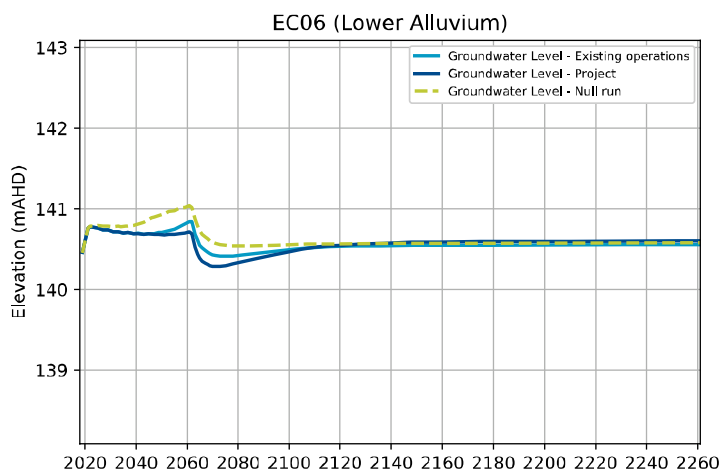
Cumulative Drawdown - Aries 2 and Castor - End of Year 2261

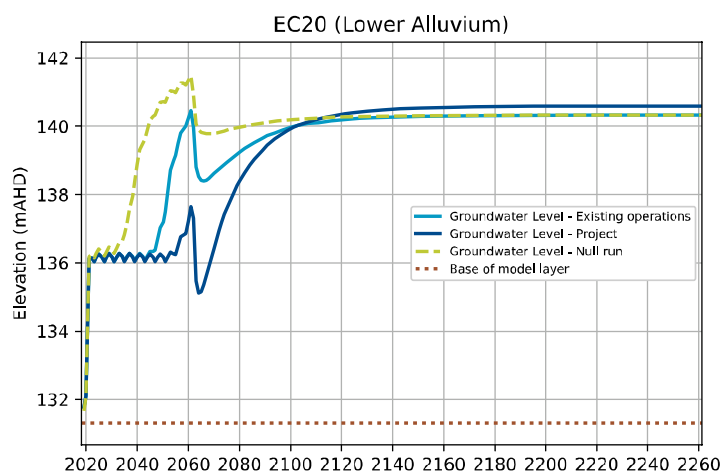
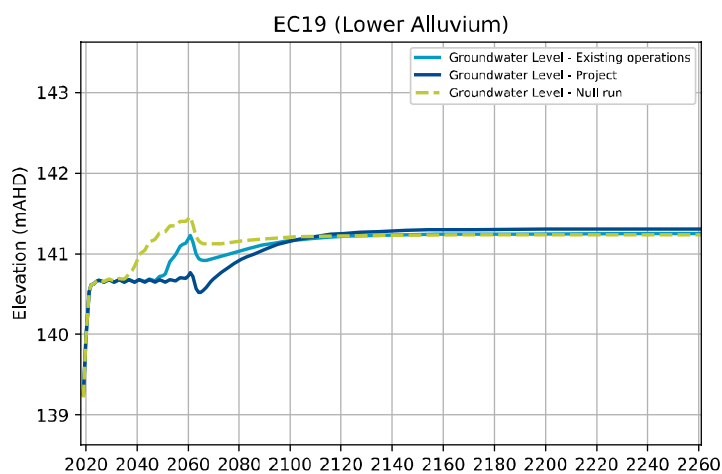
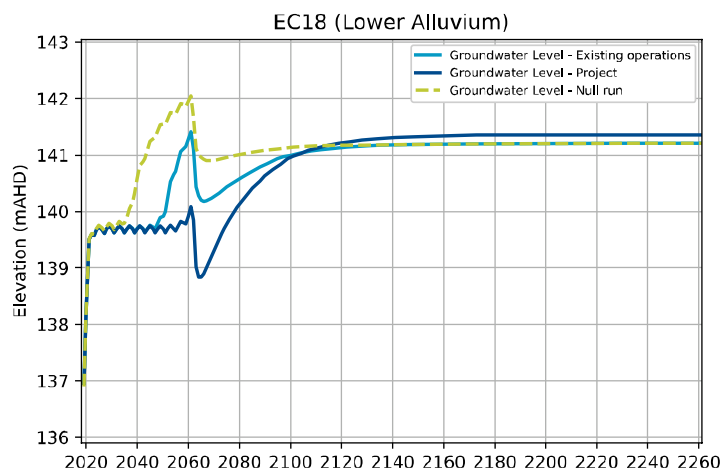
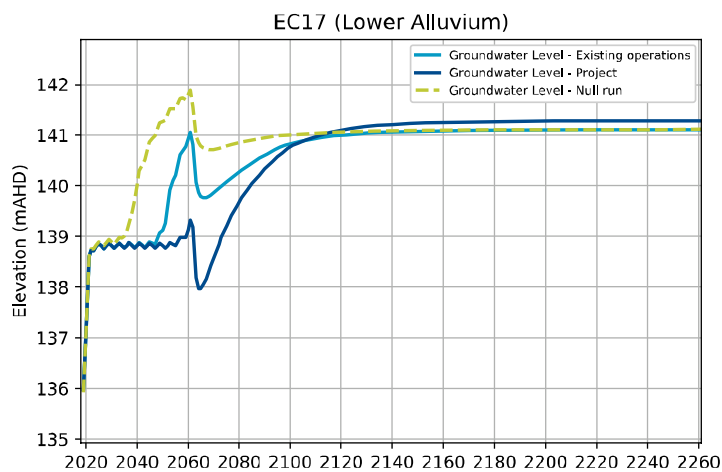
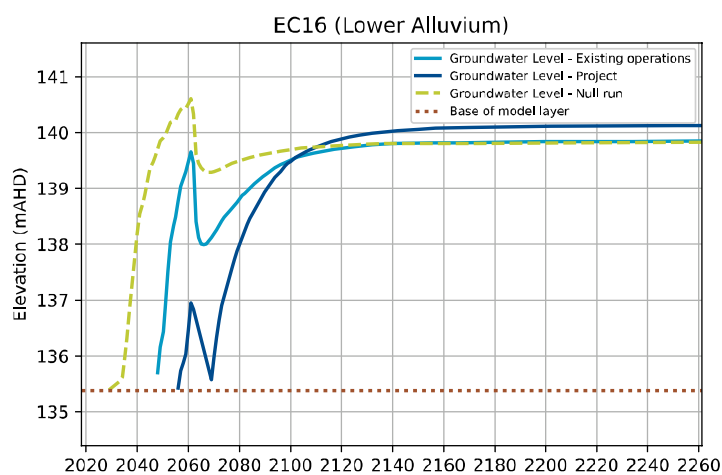
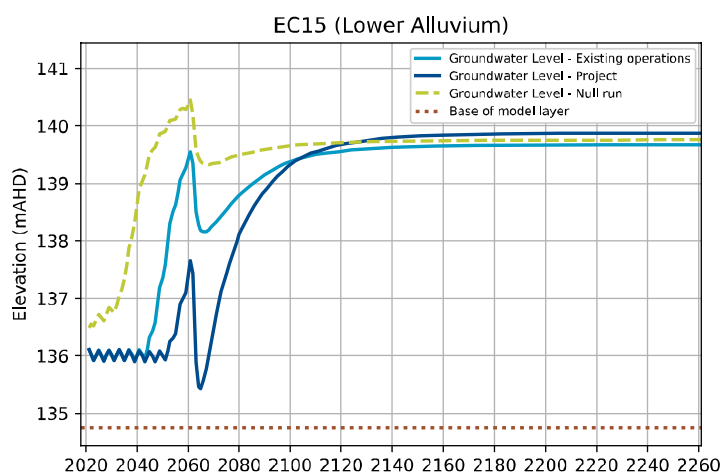
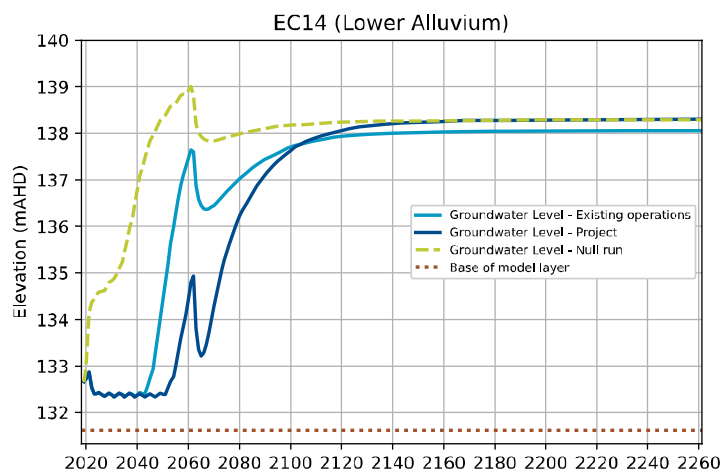
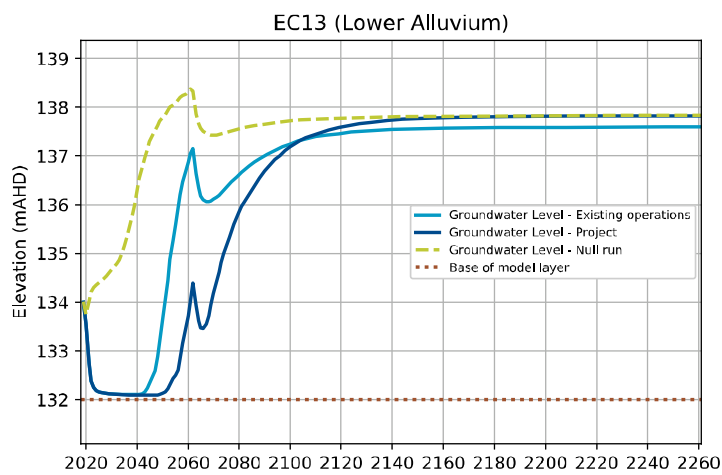
J-33

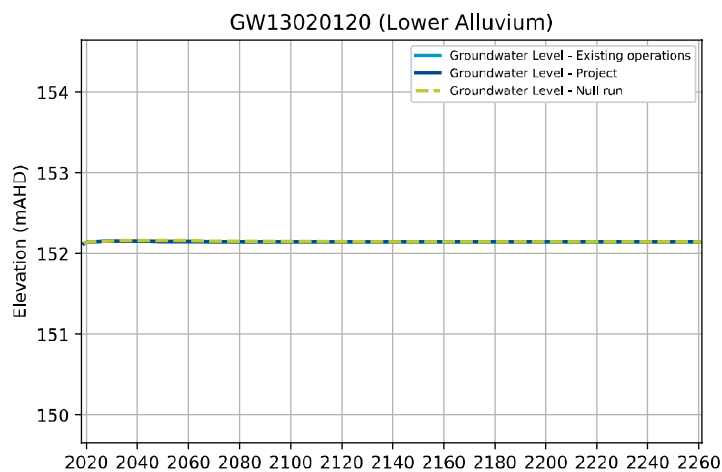
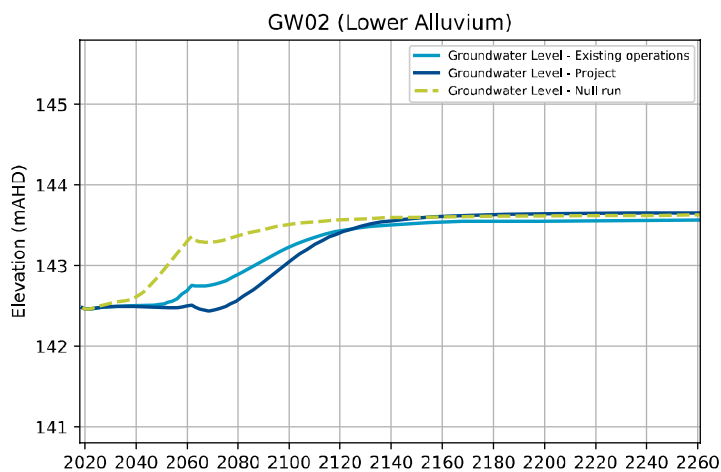
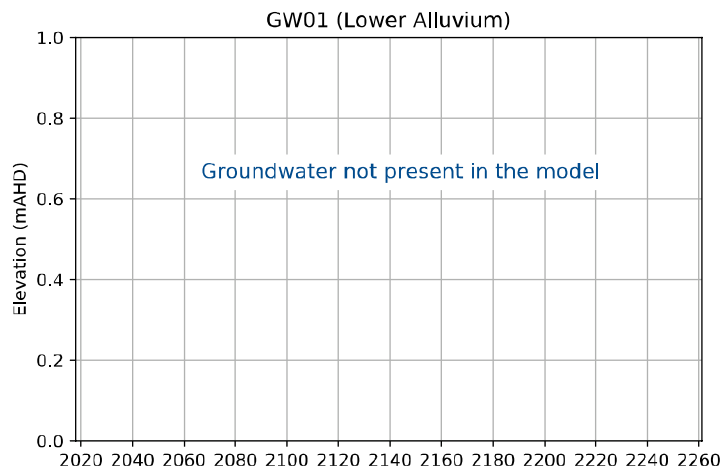
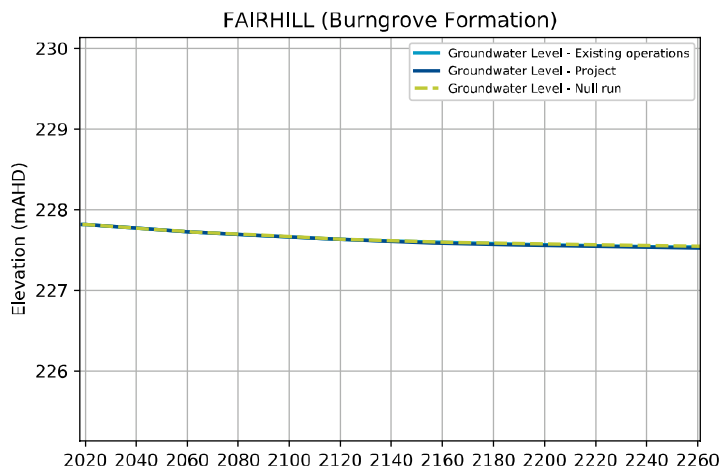
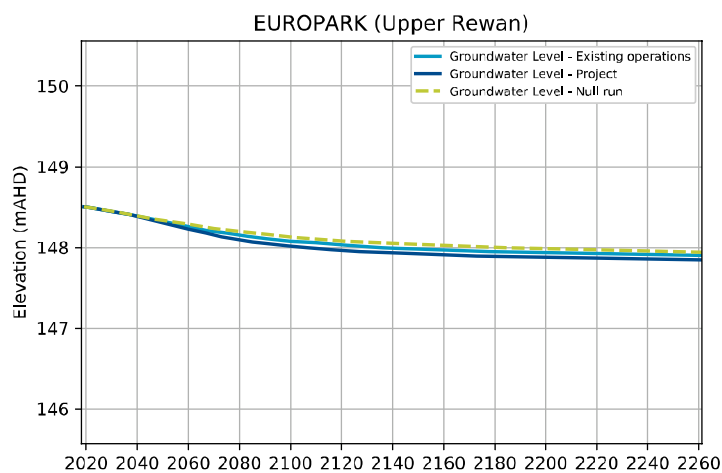
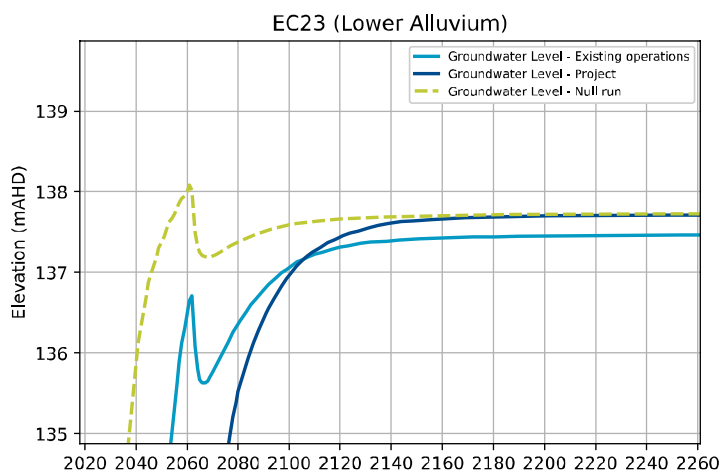
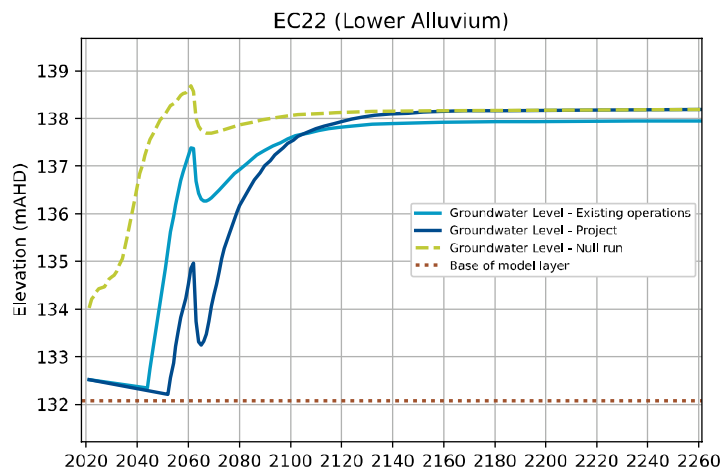
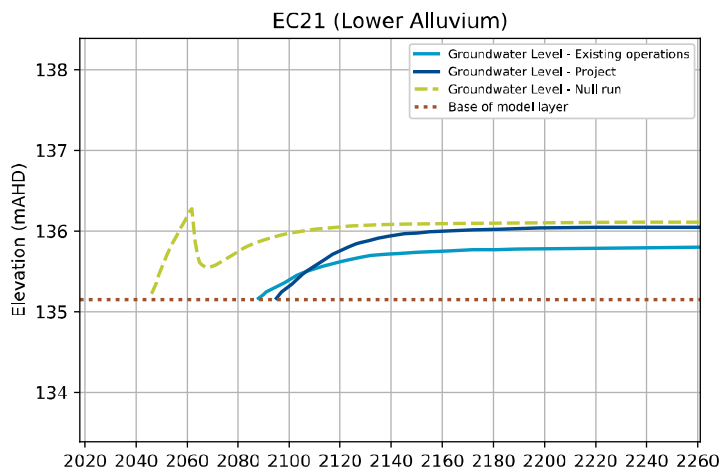
APPENDIX K

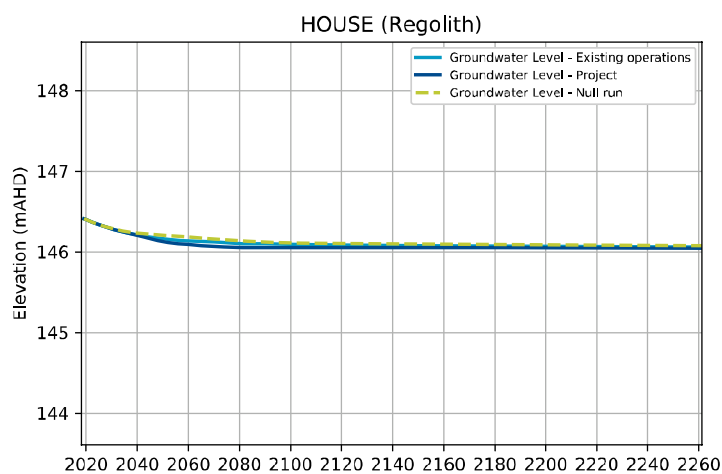
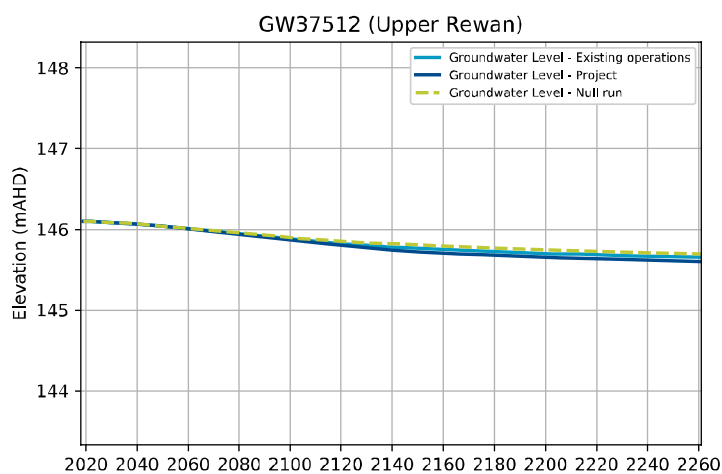
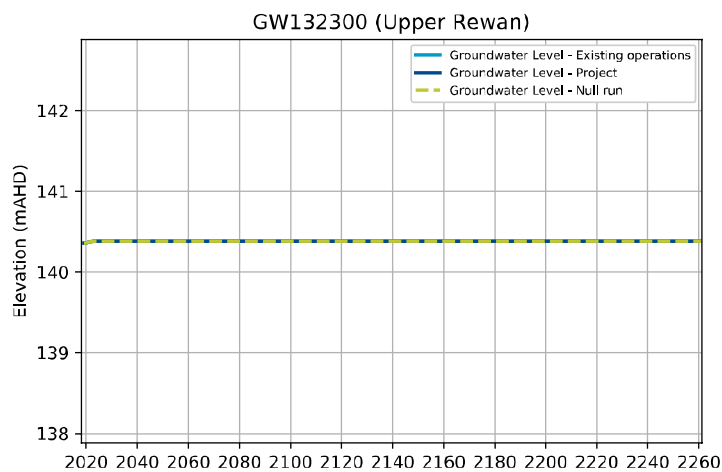
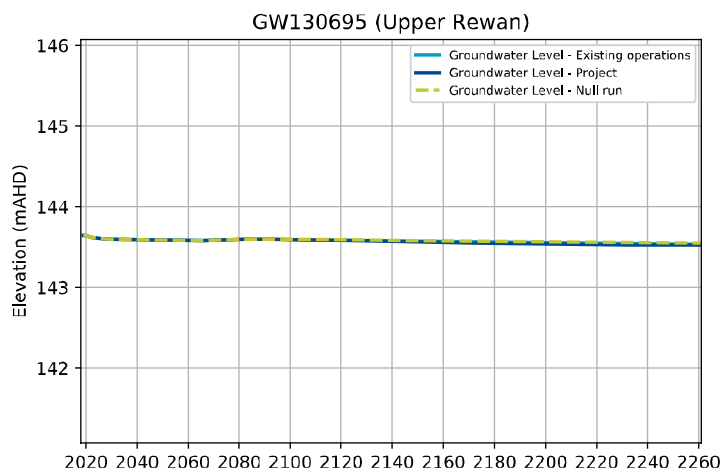
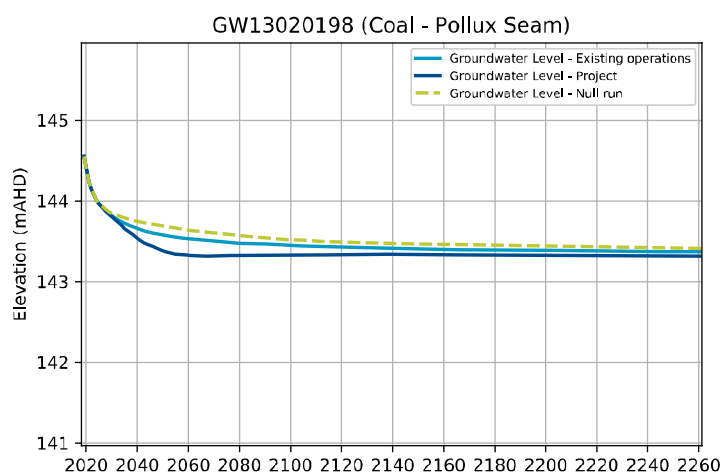
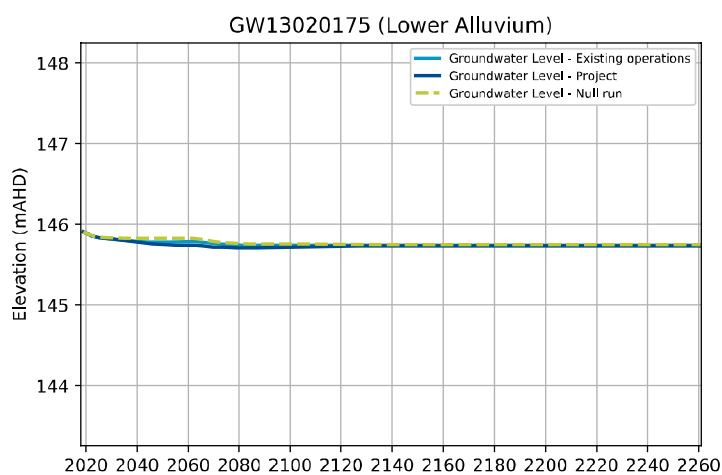
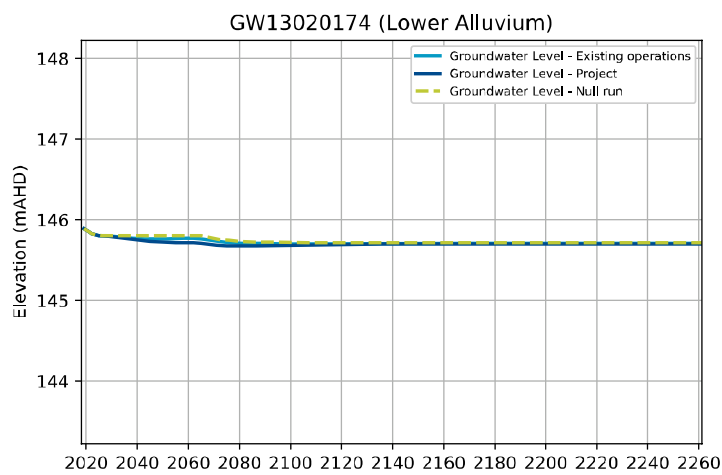
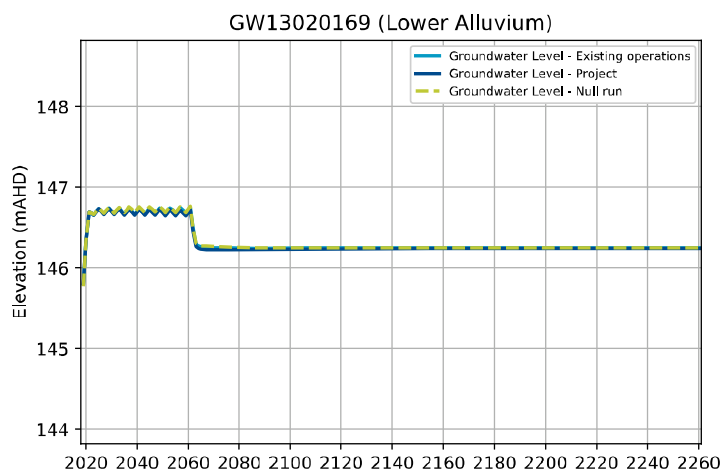
Prediction Hydrographs

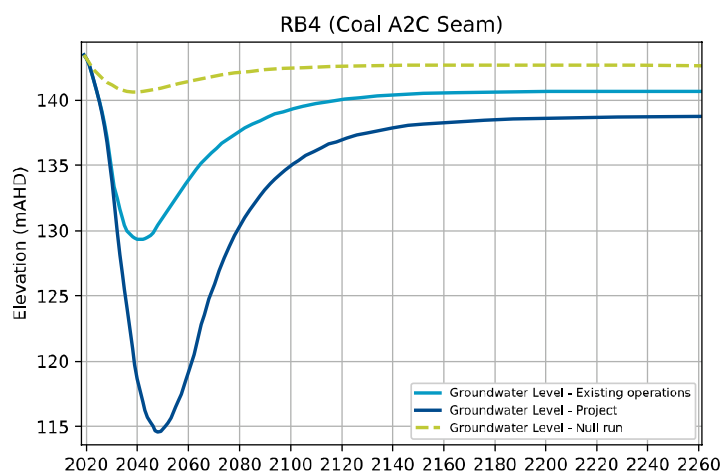
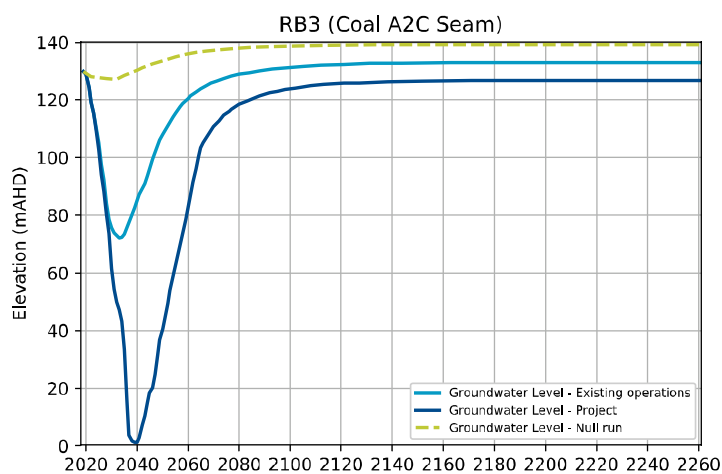
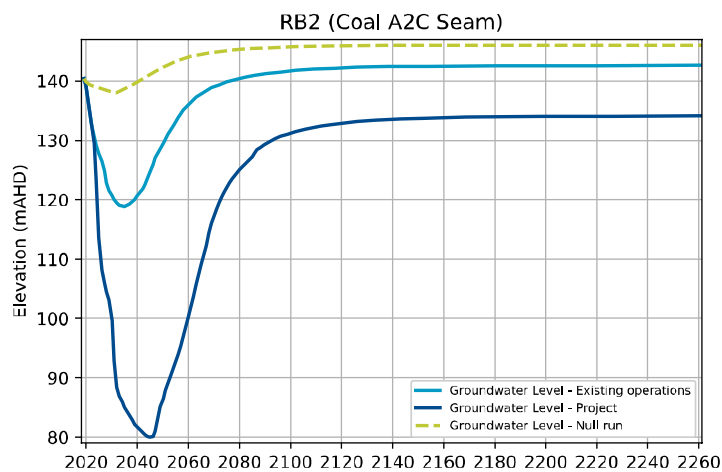
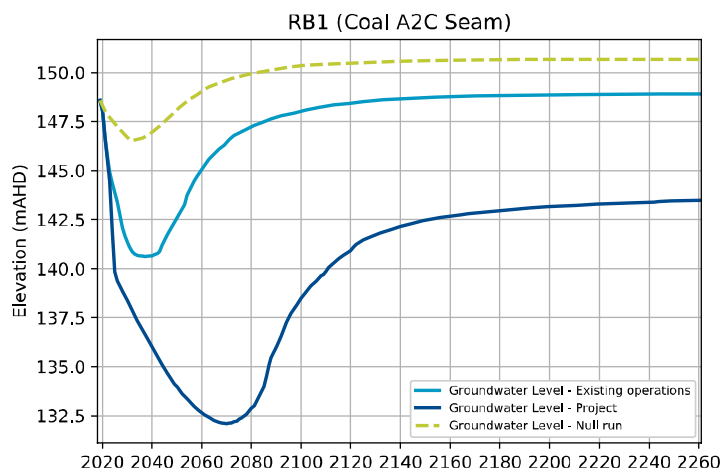
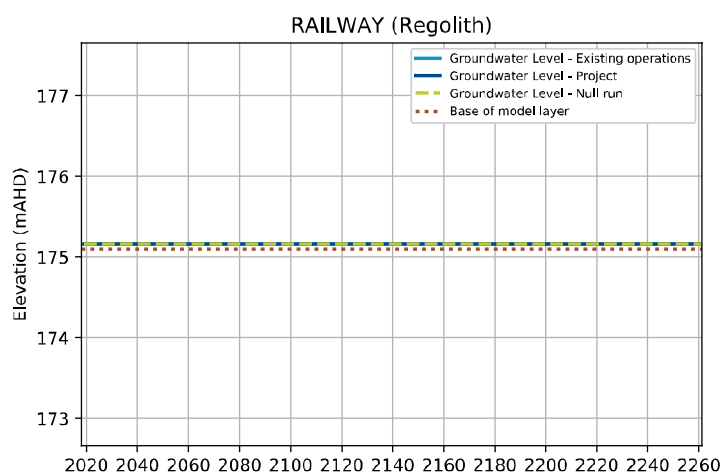
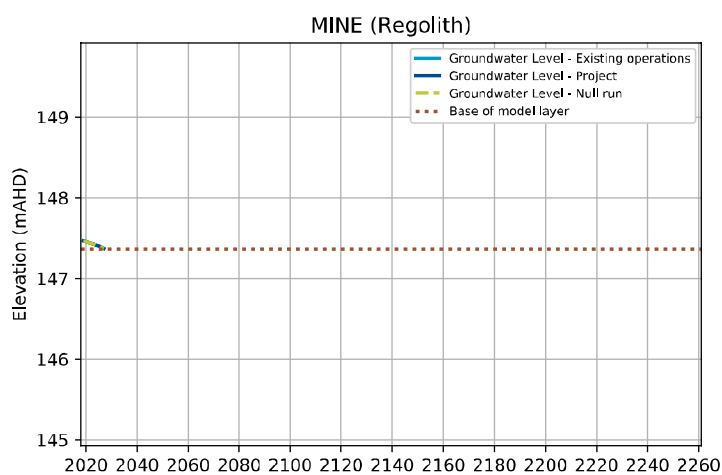
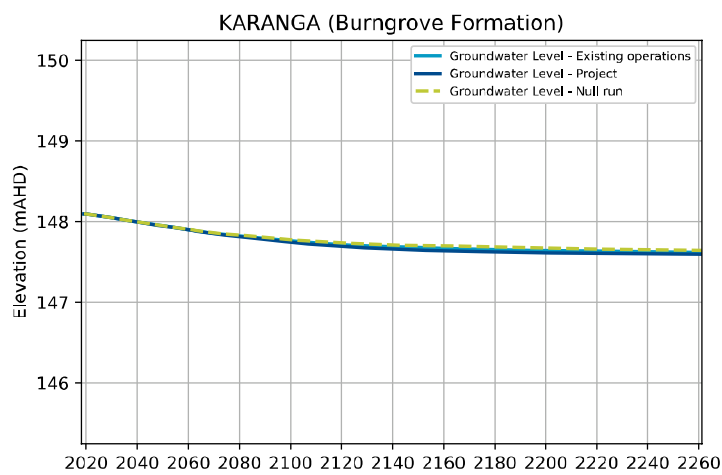
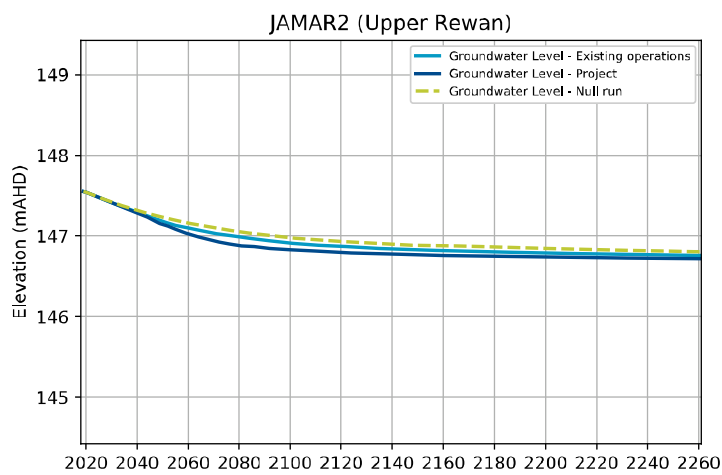


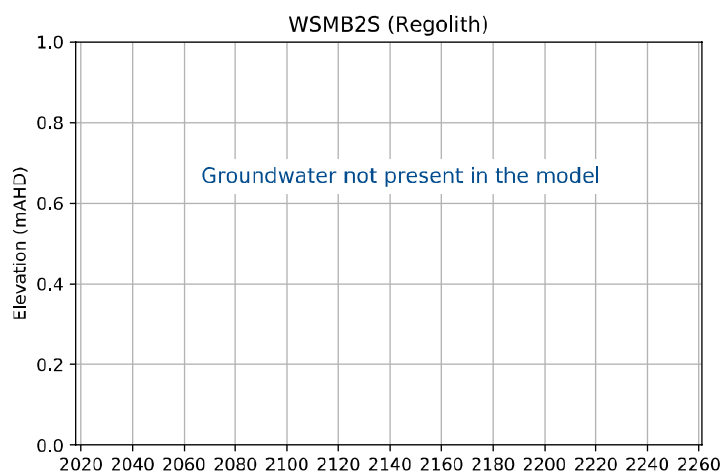
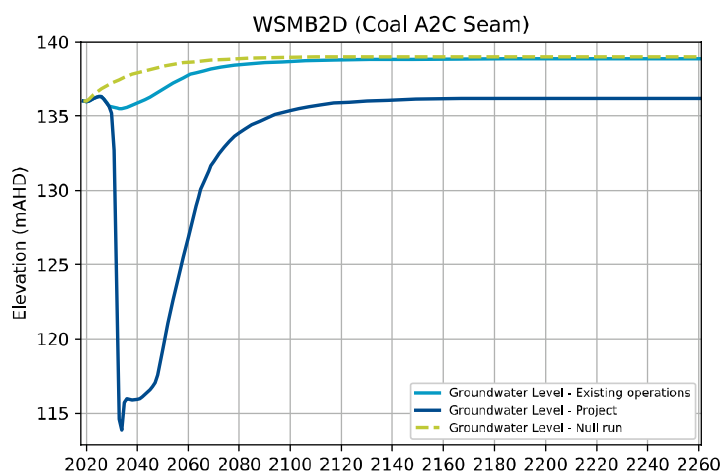
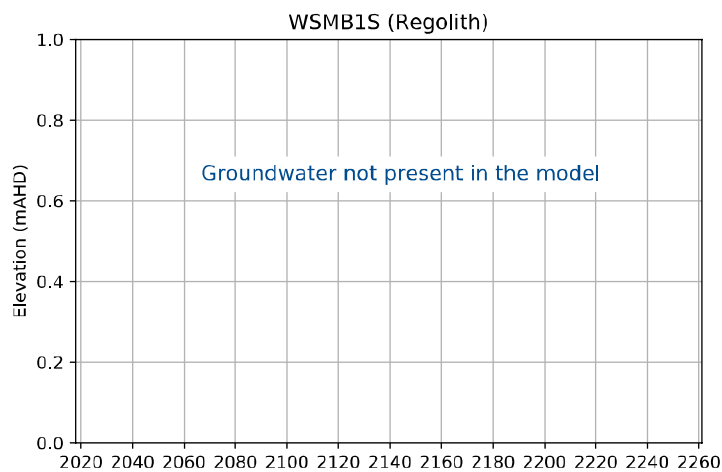
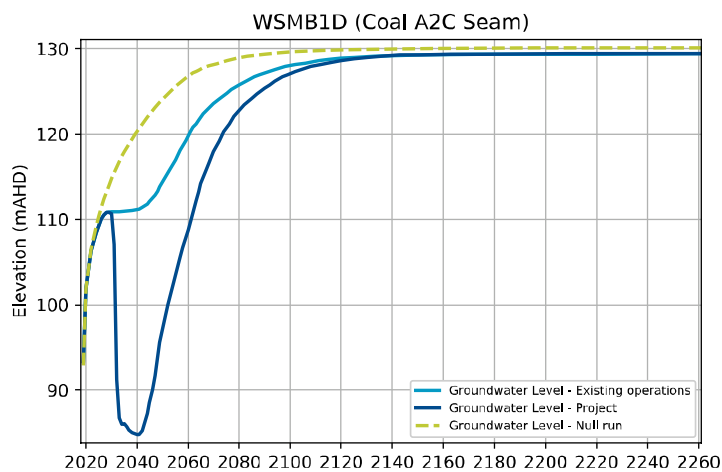
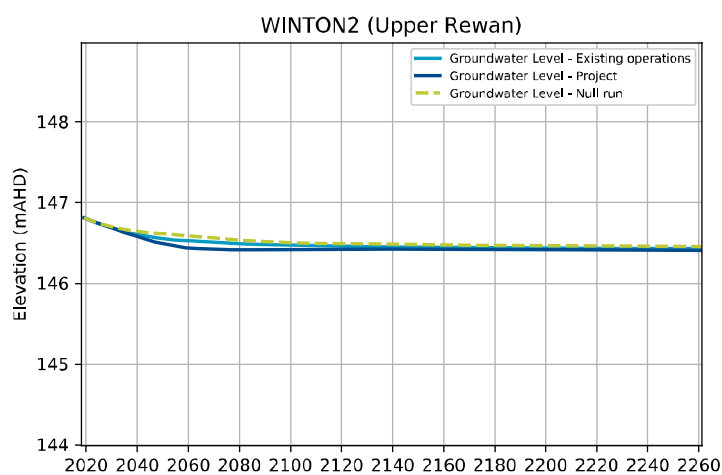
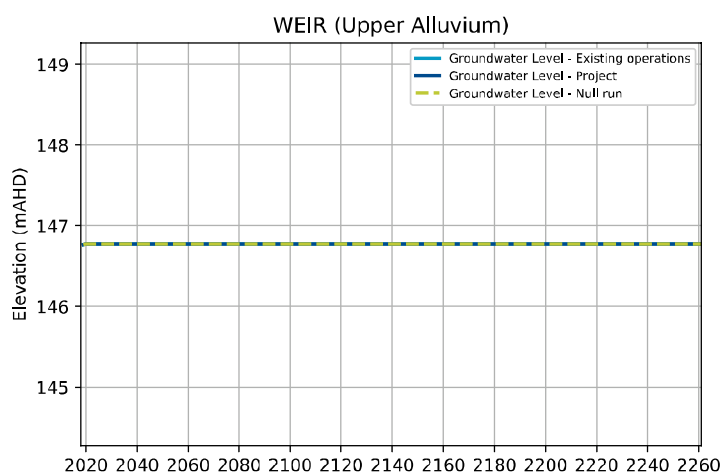
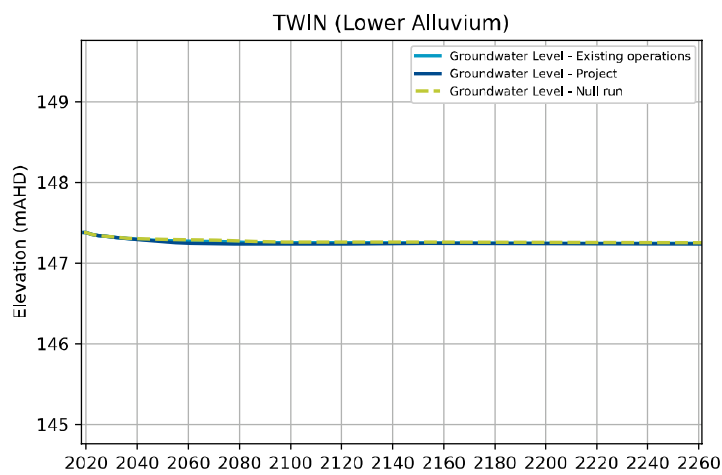
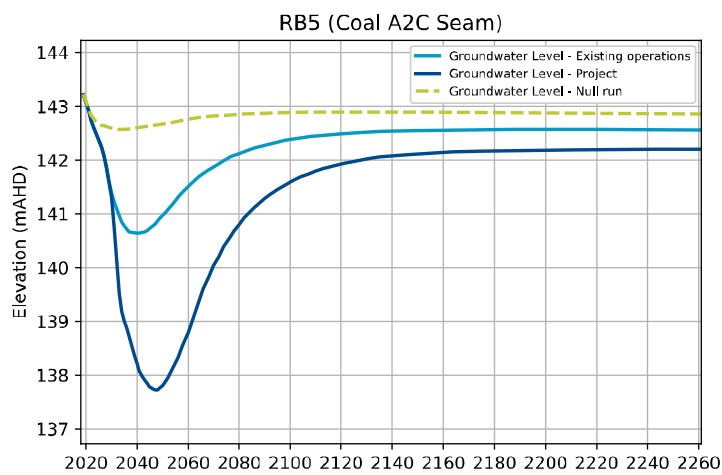


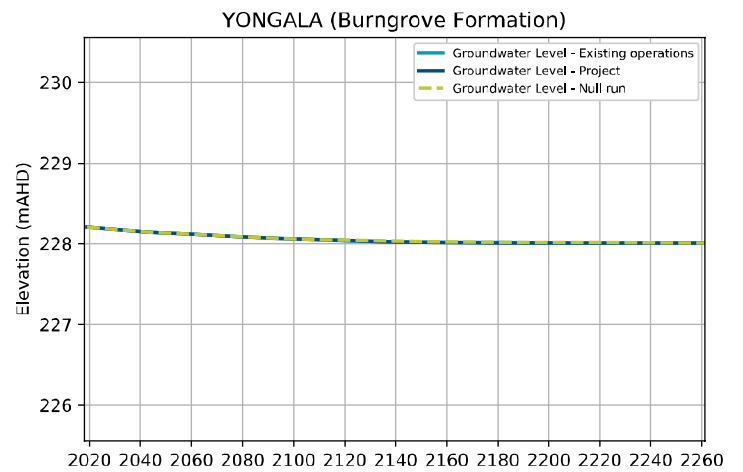
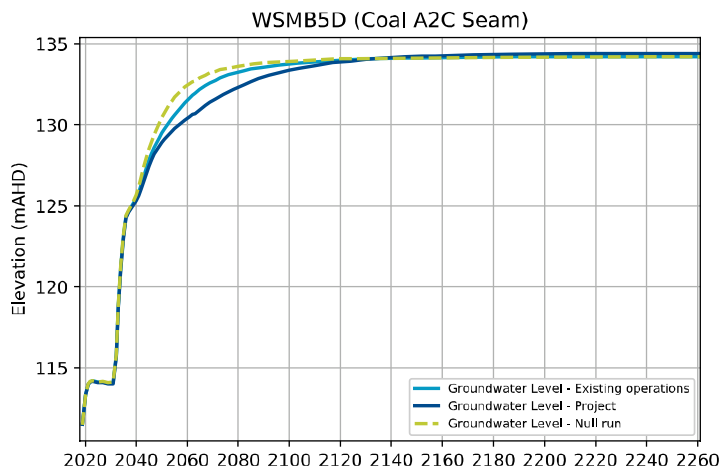
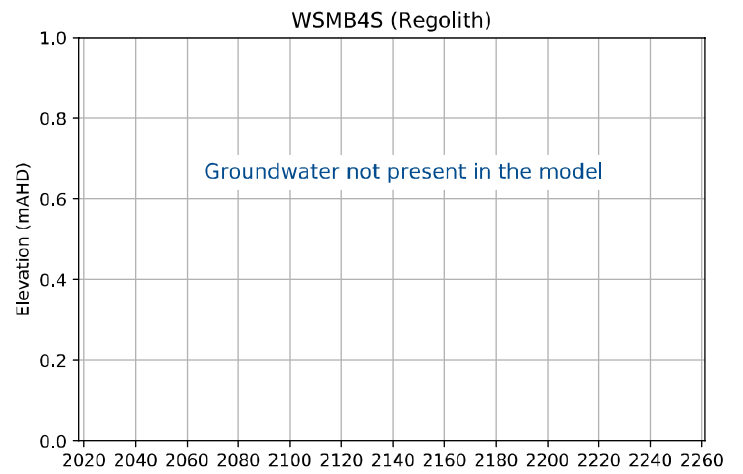
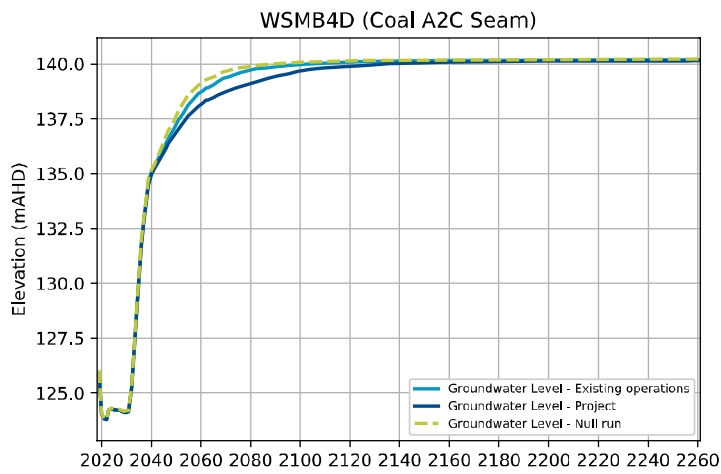
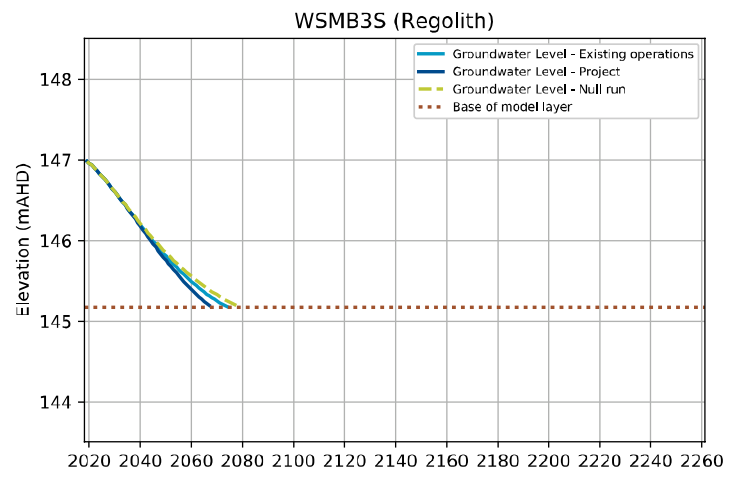
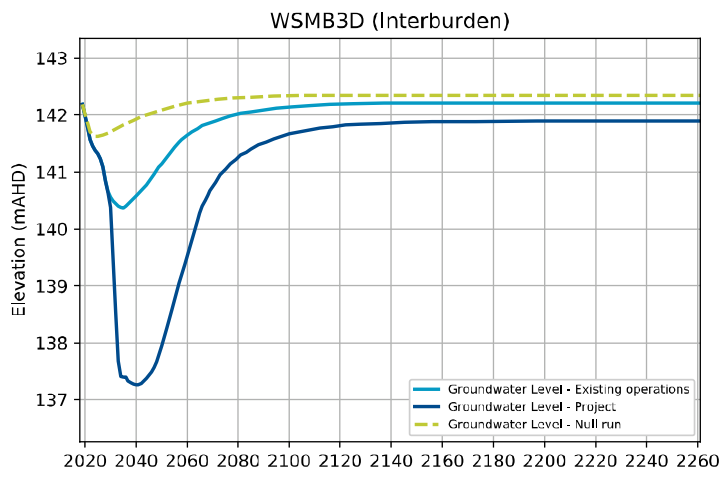








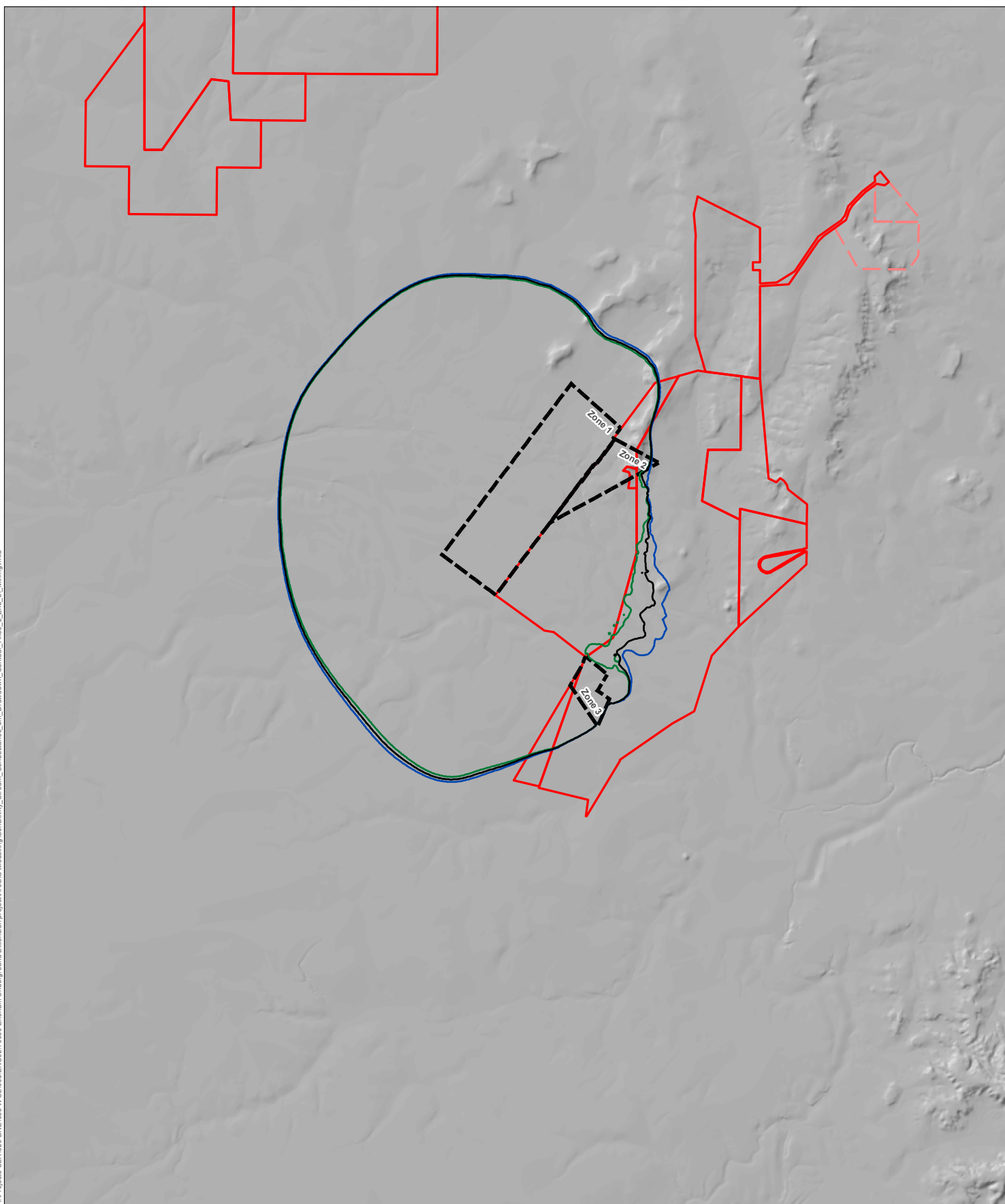




APPENDIX L

Sensitivity Analysis Maps

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Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 11/02/2020

Drawn by: PM

Sheet Size: A4

Legend

Project Area

Mining Lease (Granted)

Mining Lease (Application)

Proposed Case

Stream conductance (lower)

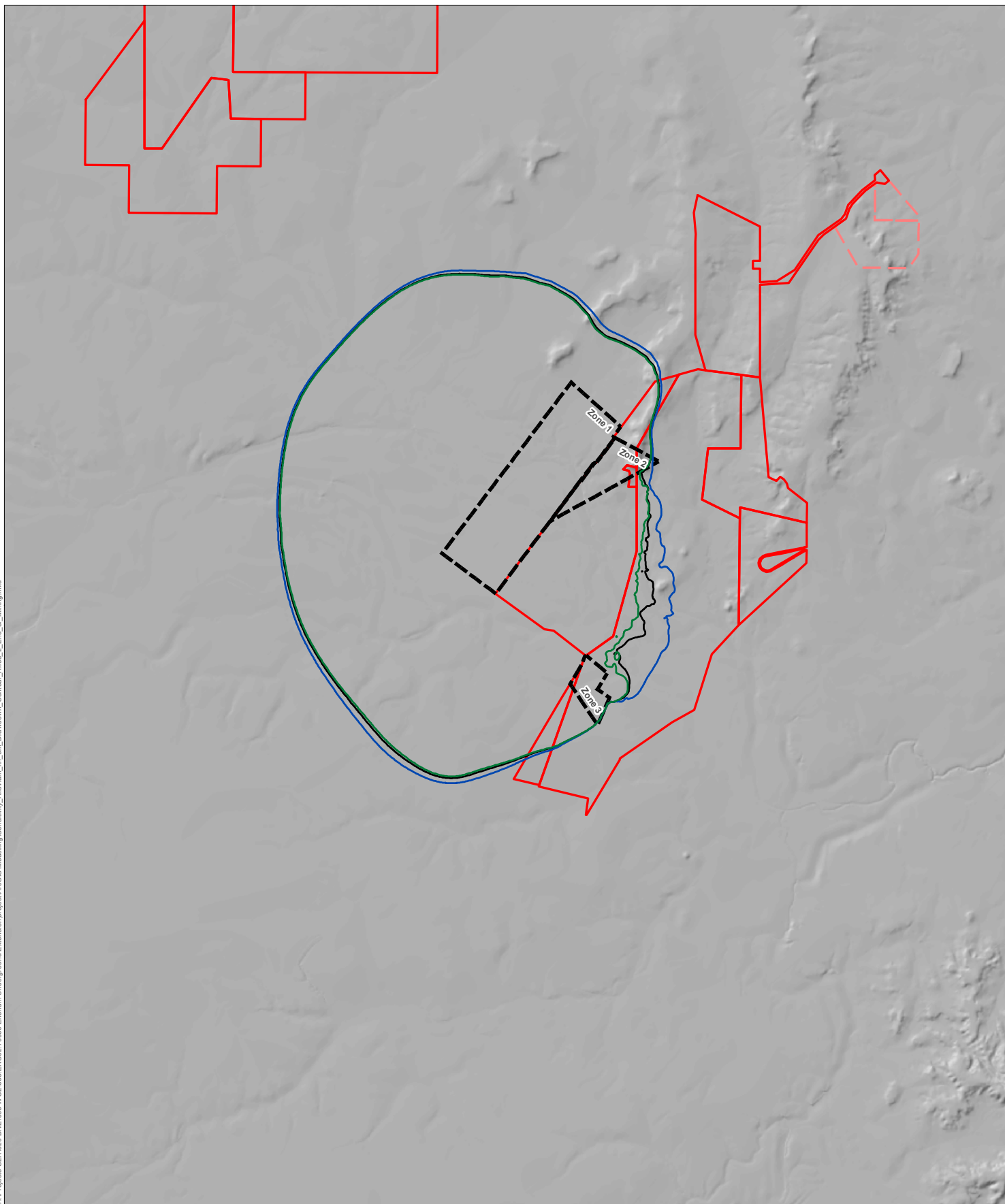
Stream conductance (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Stream Conductance 5m Drawdown Contour Aries 2 End of Mining

L-1

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Ensham Underground Extension project\AccGIS Modelling\Sensitivity_Alluvium_kh_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



0 2
km

Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 11/02/2020

Drawn by: PM

Sheet Size: A4

Legend

-  Mining Lease (Granted)
-  Mining Lease (Application)
-  Project Area

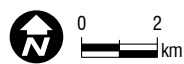
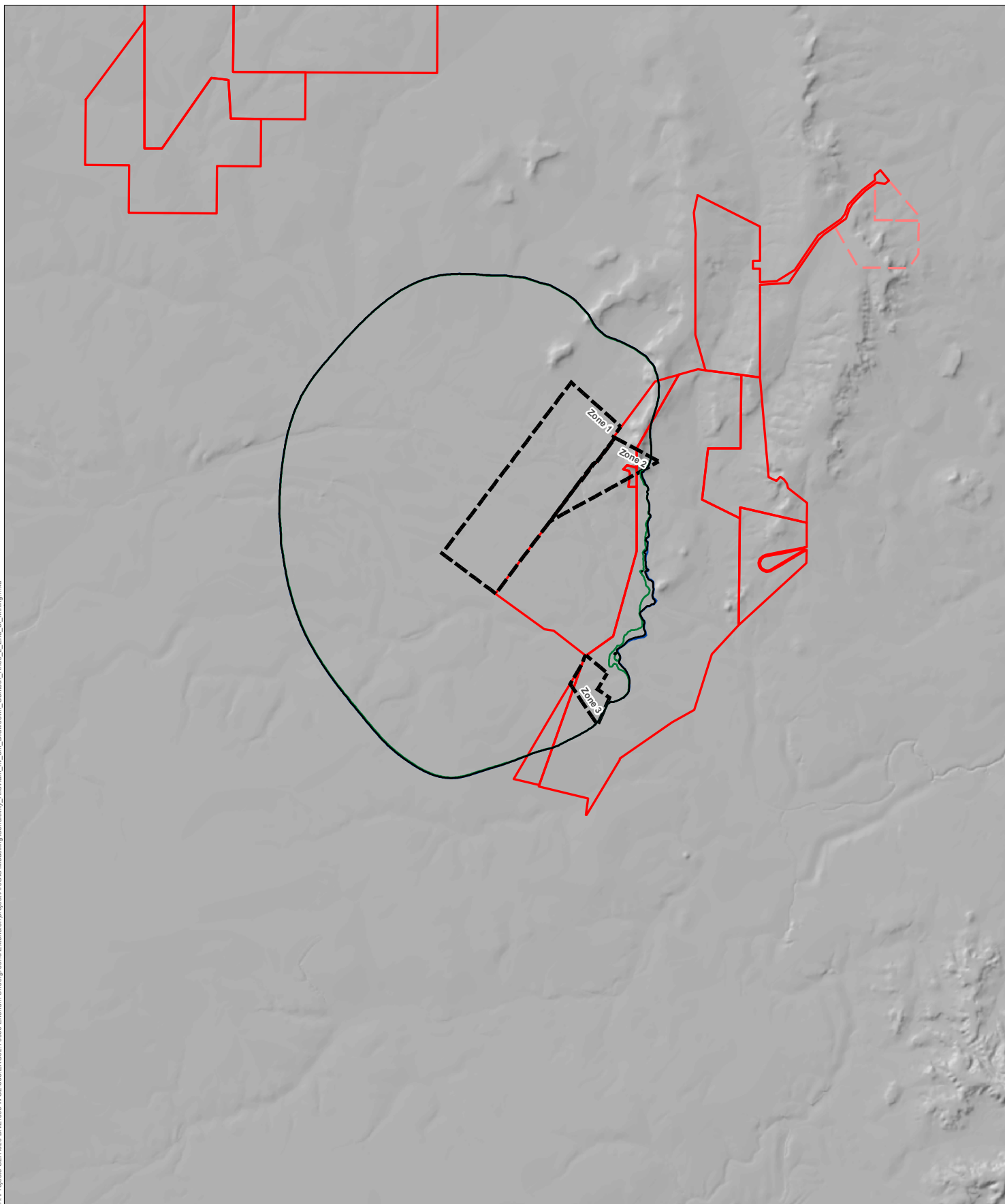
-  Alluvium Kh (lower)
-  Alluvium Kh (higher)
-  Proposed Case

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Alluvium kh 5m Drawdown Contour Aries 2 End of Mining

L-2

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Ensham Underground Extension project\AccGIS Modelling\Sensitivity_Alluvium_kv_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

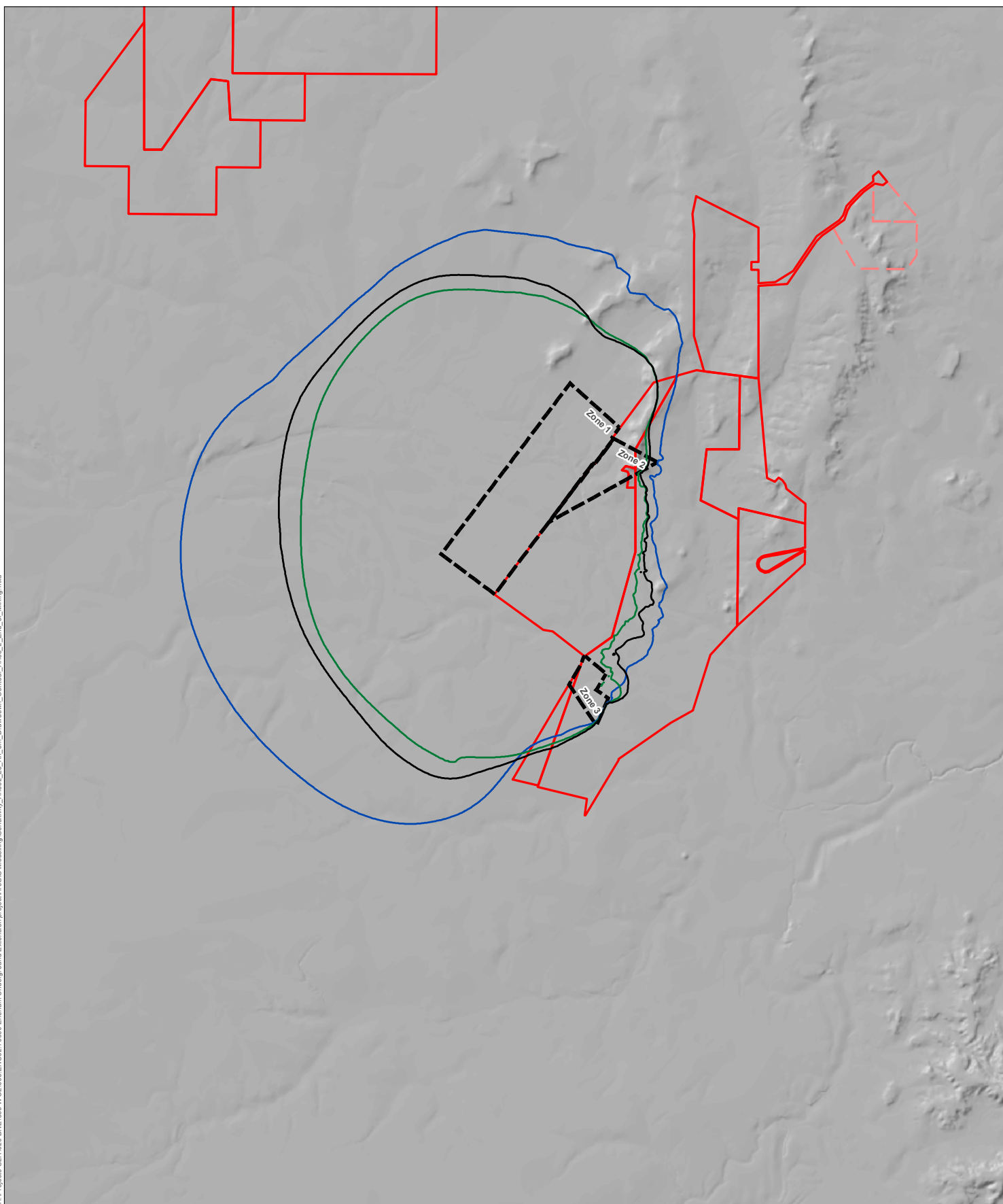
- Proposed Case
- Alluvium Kv (lower)
- Alluvium Kv (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Alluvium kv 5m Drawdown Contour Aries 2 End of Mining

L-3

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Enrichment Underground Extension project\AccGIS Modelling\Sensitivity_Aries2_L8_Kh_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

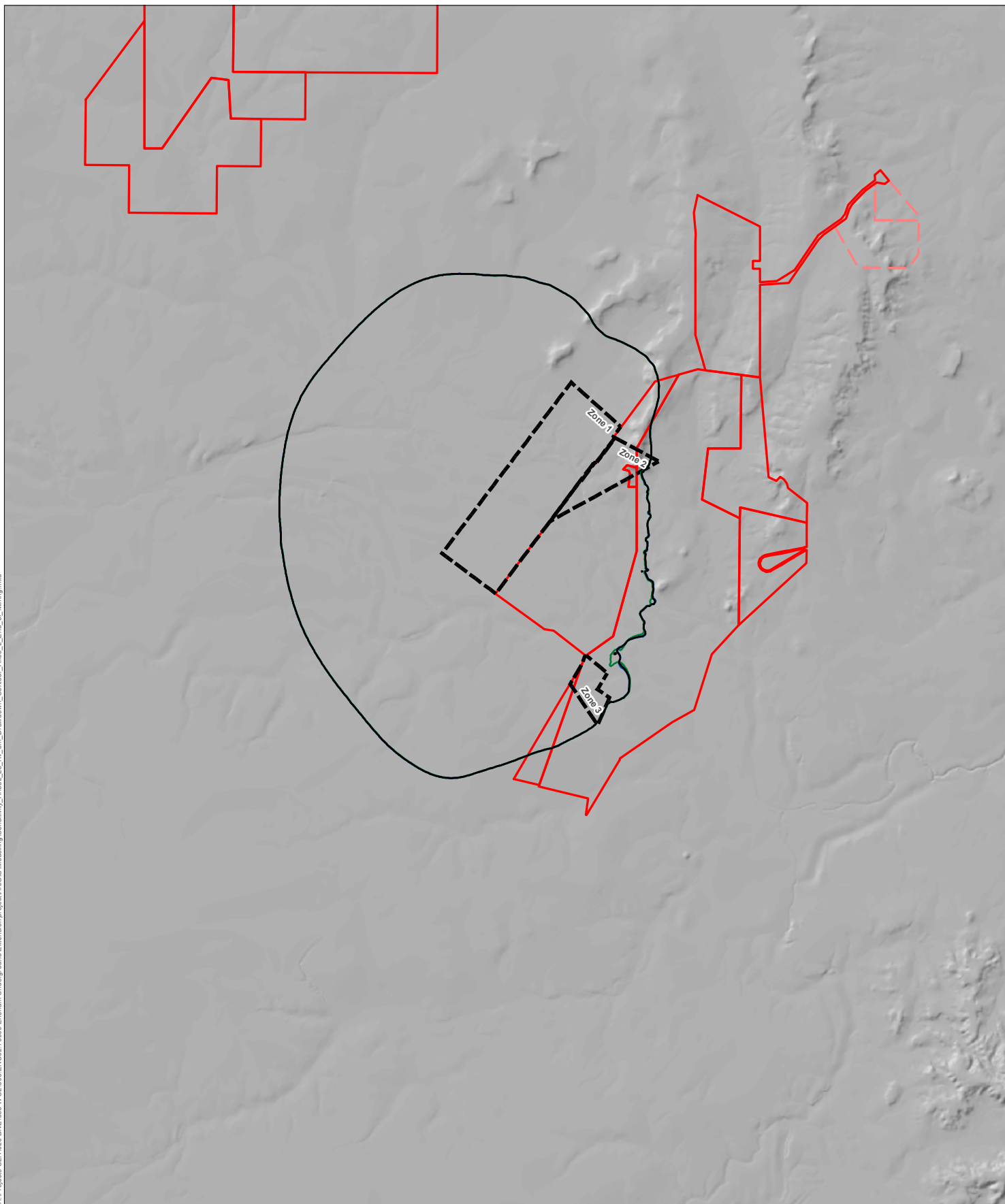
- Proposed Case
- Coal L8 Kh (lower)
- Coal L8 Kh (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Aries2 L8 Kh 5m Drawdown Contour Aries 2 End of Mining

L-4

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Enrichment Underground Extension project\AccGIS Modelling\Sensitivity_Aries2_L8_Kv_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000

Date: 11/02/2020

Drawn by: PM

Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

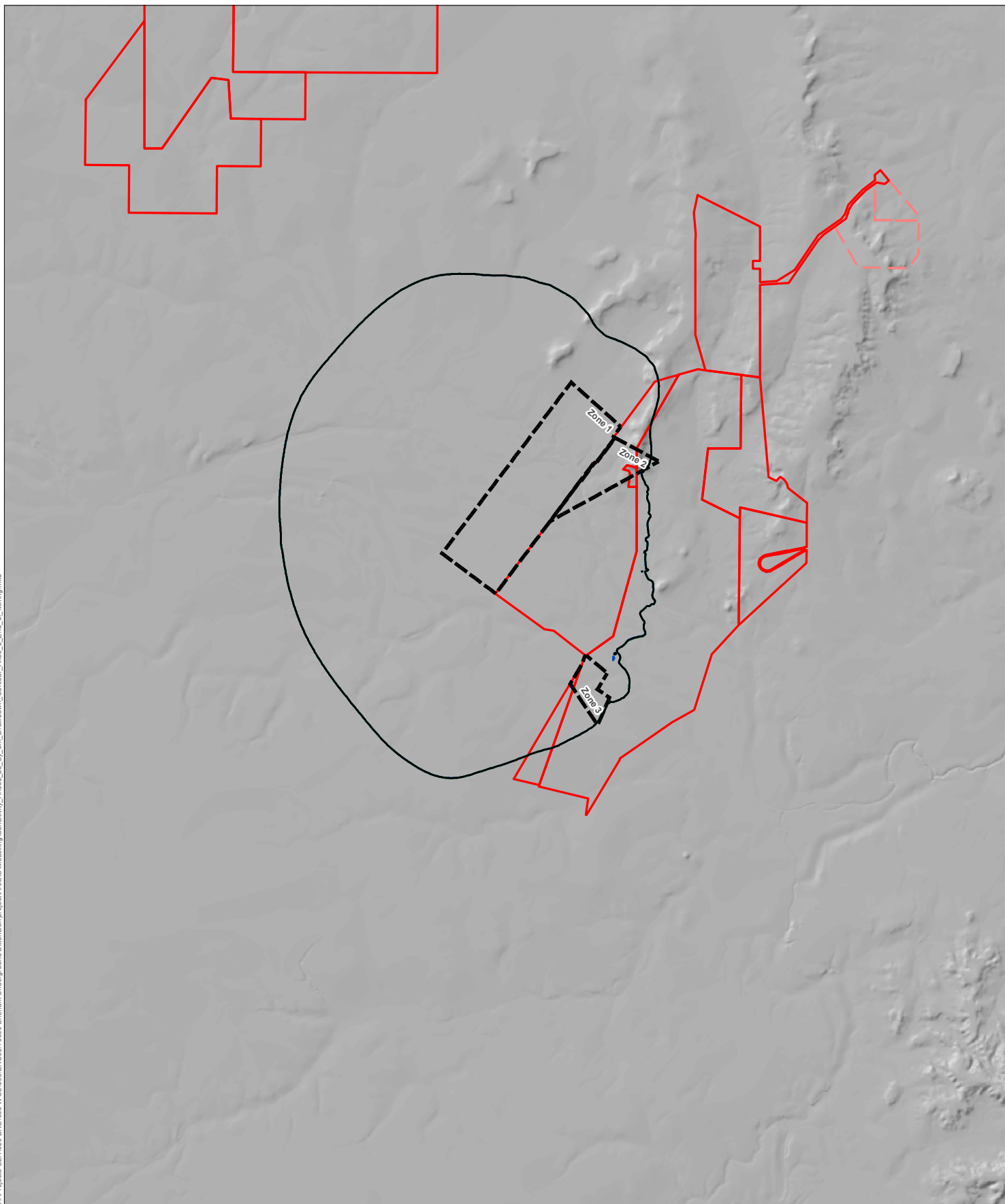
- Proposed Case
- Coal L8 Kv (lower)
- Coal L8 Kv (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Aries2 L8 Kv 5m Drawdown Contour Aries 2 End of Mining

L-5

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Enrichment Underground Extension project\Access Modelling\Sensitivity_Aries2_L8_Sy_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

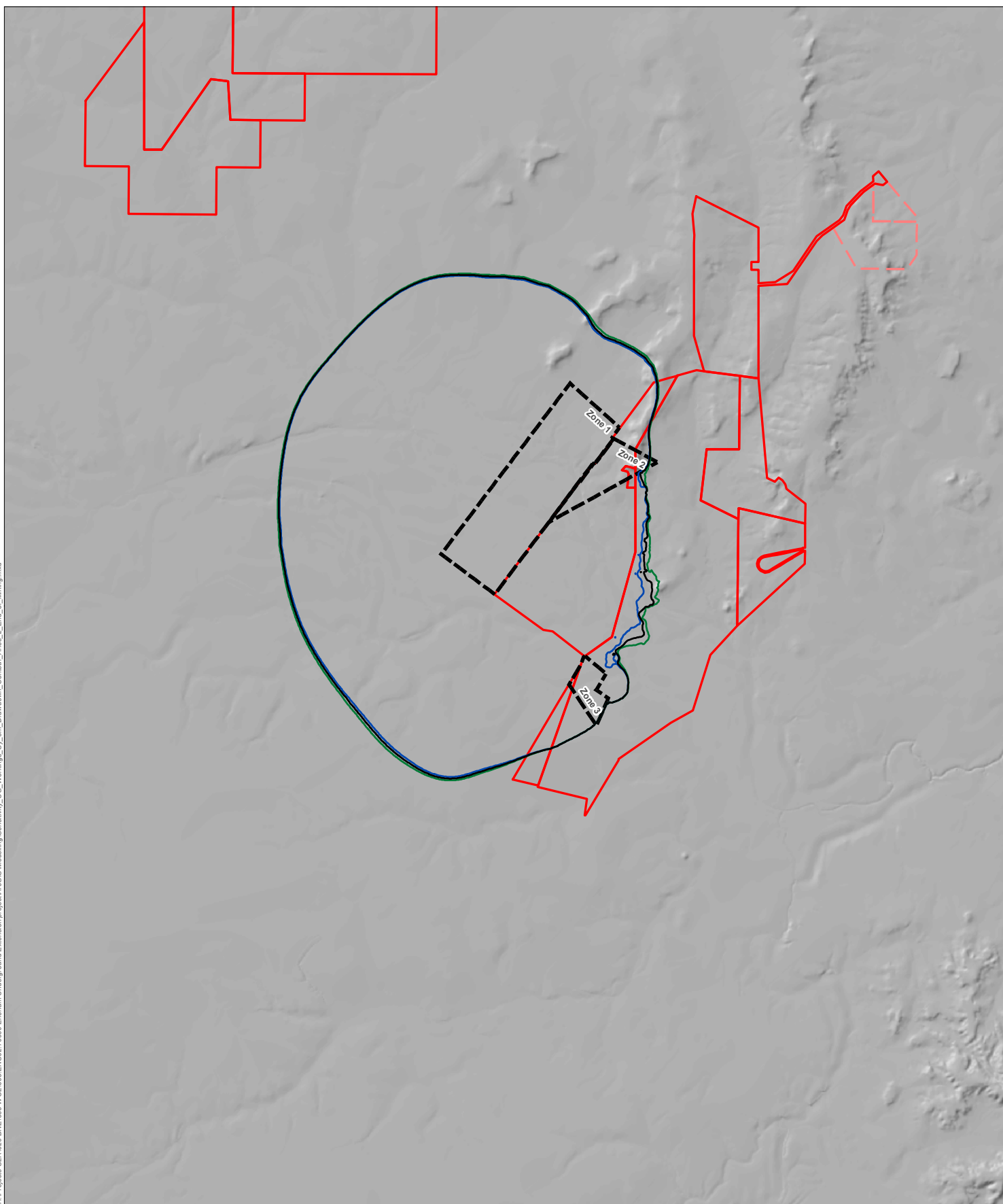
- Proposed Case
- Coal L8 Sy (lower)
- Coal L8 Sy (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Aries2 L8 Sy 5m Drawdown Contour Aries 2 End of Mining

L-6

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Enrichment Underground Extension project\Access Modelling\Sensitivity_UG_Workings_Sy_5m_Drawdown_Contrib_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

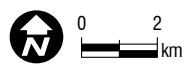
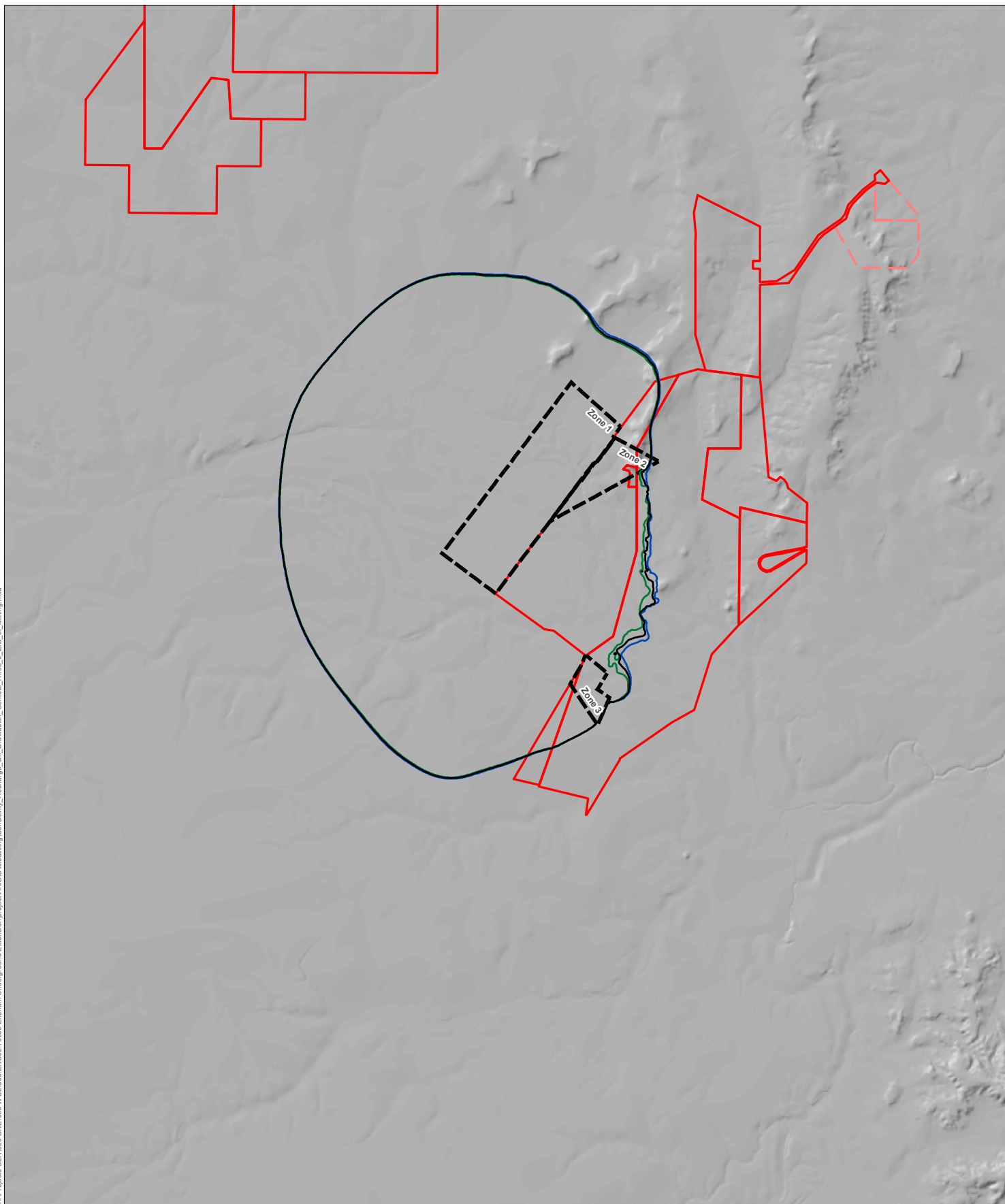
- Proposed Case
- UG Workings Sy (lower)
- UG Workings Sy (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - UG Workings Sy 5m Drawdown Contour Aries 2 End of Mining

L-7

H:\Projects\SLR\620-ENE\665-WOL\665-ENS02.10000-Enrichment Underground Extension project\AccGIS Modelling\Sensitivity_Recharge_5m_Drawdown_Conbour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 11/02/2020
Drawn by: PM
Sheet Size: A4

Legend

- Mining Lease (Granted)
- Mining Lease (Application)
- Project Area

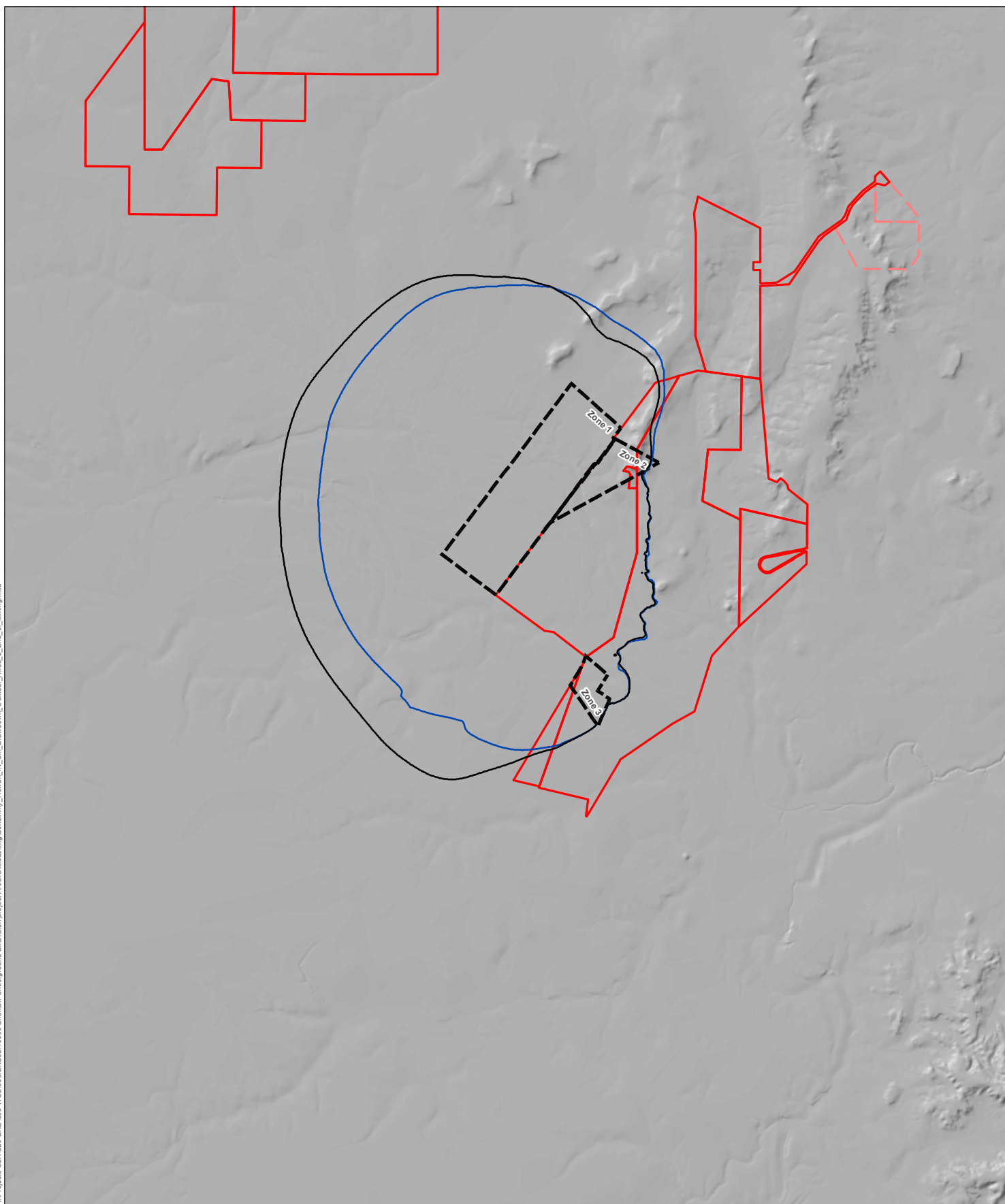
- Proposed Case
- Recharge (lower)
- Recharge (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Recharge 5m Drawdown Contour Aries 2 End of Mining

L-8

H:\Projects-SLR\620-BNE\665-WOL\665.ENS02.10000 Ensham Underground Extension project\ArcGIS\Modelling\Sensitivity_Rewan_Lv_5m_Drawdown_Contour_Aries_2_End_of_Mining.mxd



Projection: GDA 1994 MGA Zone 55
Scale: 1:200,000

Project No.: 665.ENS02.10000
Date: 20-Feb-2020
Drawn by: PM
Sheet Size: A4

Legend

- Project Area
- Mining Lease (Granted)
- Mining Lease (Application)

- Proposed Case
- Rewan L3 and L4 Kv (higher)

GROUNDWATER IMPACT ASSESSMENT

Sensitivity - Rewan L3 and L4 Kv - 5m Drawdown Contour Aries 2 End of Mining

L-9

APPENDIX M

Wetland Info Report

WetlandMaps Report



For selected area of interest

Current as at 24/10/2019

Environmental Reports - General Information

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the Area of Interest(AOI) (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the mapping of water bodies and wetland regional ecosystems across Queensland. The Queensland wetland mapping was produced using existing information including water body mapping derived from Landsat satellite imagery, regional ecosystem mapping, topographic data, and a springs database. The result is a consistent wetland map for the whole of Queensland.

Ancillary data, such as higher resolution imagery (for example SPOT and aerial photographs), other vegetation and wetland mapping, geology, soil and land system mapping was also used in attributing and assessing the derived Queensland Wetlands Program wetland mapping products.

The wetland mapping was done in accordance with a detailed peer reviewed methodology which included quality assurance measures for all steps in the process. For more detailed information on how the Queensland Wetlands Program wetland mapping was produced, please see the [Wetland Mapping and Classification Methodology](#).

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Summary Information

The following table provides an overview of the area of interest.

Table 1. Area of interest details

Size (ha)	548,857.61
Local Government(s)	Isaac Regional, Central Highlands Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Isaac - Comet Downs, Basalt Downs
Catchment(s)	Fitzroy
Drainage sub-basin	Mackenzie River, Comet River, Nogo River

NRM Regions

The following NRM region(s) are in the area of interest:

Fitzroy Basin
Association

Water Resource Plan Boundaries

The following Water Resource Plan(s) are in the area of interest:

Fitzroy Basin

Learn more about how Wetlands are mapped in Queensland:

Queensland Wetlands Mapping Definitions

Wetlands are areas of permanent or periodic/intermittent inundation, with water that is static or flowing fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 metres. To be a wetland the area must have one or more of the following attributes:

- at least periodically the land supports plants or animals that are adapted to and dependent on living in wet conditions for at least part of their life cycle, or
- the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or
- the substratum is not soil and is saturated with water, or covered by water at some time.

Examples under this definition **include**:

- those areas shown as a river, stream, creek, swamp, lake, marsh, waterhole, wetland, billabong, pool or spring on the latest Sunmap 1:25,000, 1:50,000, 1:100,000 or 1:250,000 topographic map
- areas defined as wetlands on local or regional maps prepared with the aim of mapping wetlands
- wetland regional ecosystems (REs) as defined by the Queensland Herbarium (Environmental Protection Agency 2005a)
- areas containing recognised hydrophytes as provided by the Queensland Herbarium
- saturated parts of the riparian zone
- artificial wetlands such as farm dams
- water bodies not connected to rivers or flowing water such as billabongs and rock pools.

Examples under this definition **exclude**:

- areas that may be covered by water but are not wetlands according to the definition
- floodplains that are intermittently covered by flowing water but do not meet the hydrophytes and soil criteria
- riparian zone above the saturation level.

Wetland Systems

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water.

Palustrine wetlands are primarily vegetated non-channel environments of less than 8 hectares. They include billabongs, swamps, bogs, springs, soaks etc, and have more than 30% emergent vegetation.

Lacustrine wetlands are large, open, water-dominated systems (for example, lakes) larger than 8ha. This definition also applies to modified systems (for example, dams), which are similar to lacustrine systems (for example, deep, standing or slow-moving waters).

Marine wetlands include the area of ocean from the coastline or estuary, extending to the jurisdictional limits of Queensland waters (3 nautical mile limit). This definition differs from that in Ramsar, as it includes waters deeper than 6m below the lowest astronomical tide.

Estuarine wetlands are those with oceanic water sometimes diluted with freshwater run-off from the land.

Subterranean wetlands are wetlands occurring below the surface of the ground and that are fed by groundwater i.e. caves and aquifers. These wetlands provide water to groundwater dependent ecosystems.

Methodology and Wetland Classification: <https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/wetland-background/>

Links and support

Other sites that deliver wetland related information include:

WetlandSummary tool: <https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/>

Queensland Spatial Catalogue: <http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

Queensland Globe: <https://qldglobe.information.qld.gov.au/>

Environmental reports online: <https://environment.ehp.qld.gov.au/report-request/environment/>

Wetland on-line education modules: <https://wetlandinfo.des.qld.gov.au/wetlands/resources/training/>

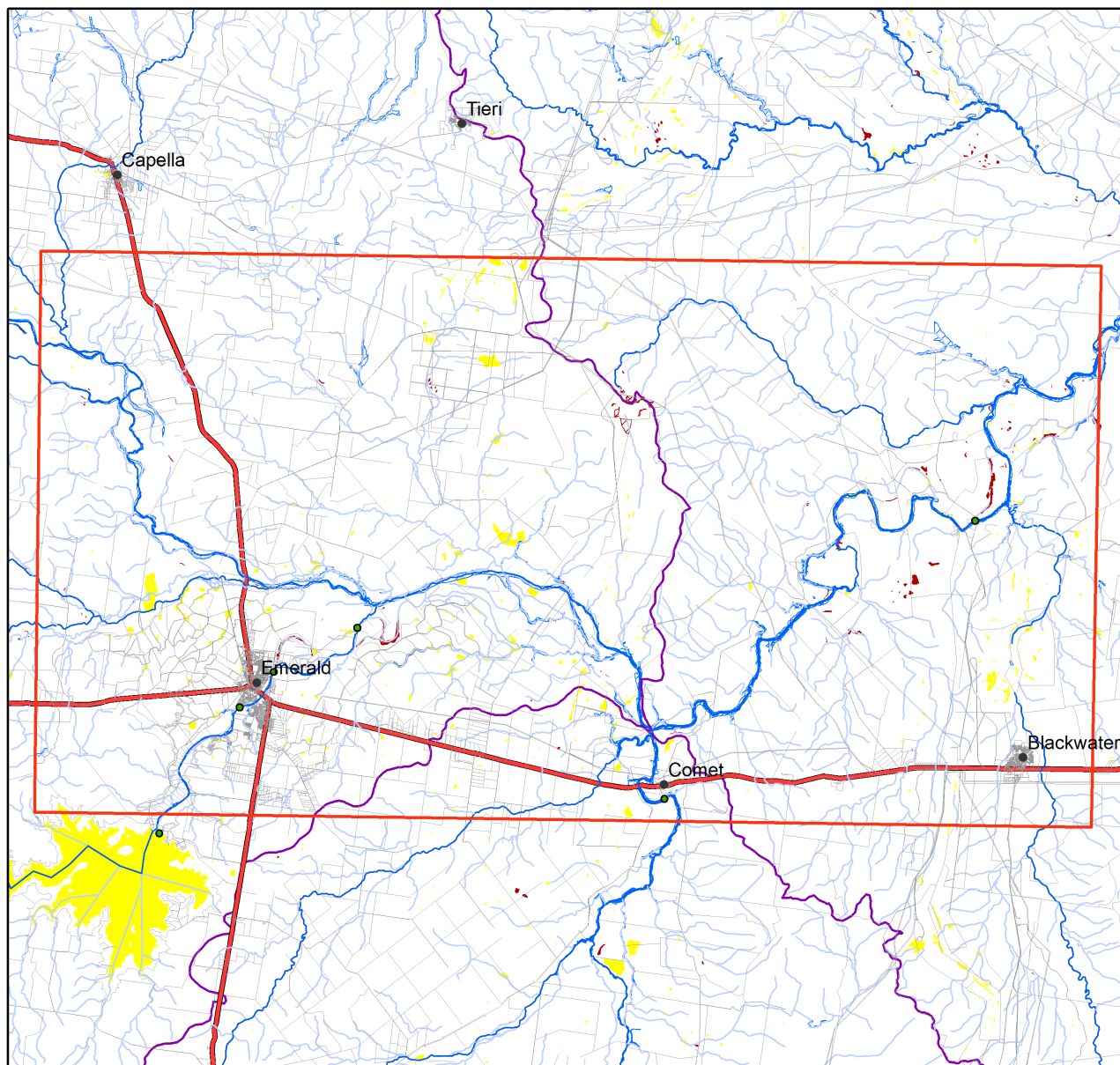
Regional Ecosystem Mapping information: :

<https://www.qld.gov.au/environment/plants-animals/plants/herbarium/mapping-ecosystems>

Aquatic Conservation Assessments: : <https://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca/>

Groundwater Dependant Ecosystems information:

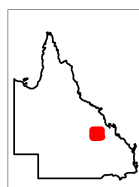
<https://wetlandinfo.des.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/>



Legend

- polygon
- ▲ Springs
- Dams and weirs
- Towns
- Highways
- Roads
- Cadastral boundaries
- Sub-basin
- Wetland Mapping**
- Wetland System - Water Bodies**
- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Wetland System - Regional Ecosystems**
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51_80% wetland (mosaic units)
- Riverine System Drainage Lines**
- Major
- Minor

Queensland Wetland Map

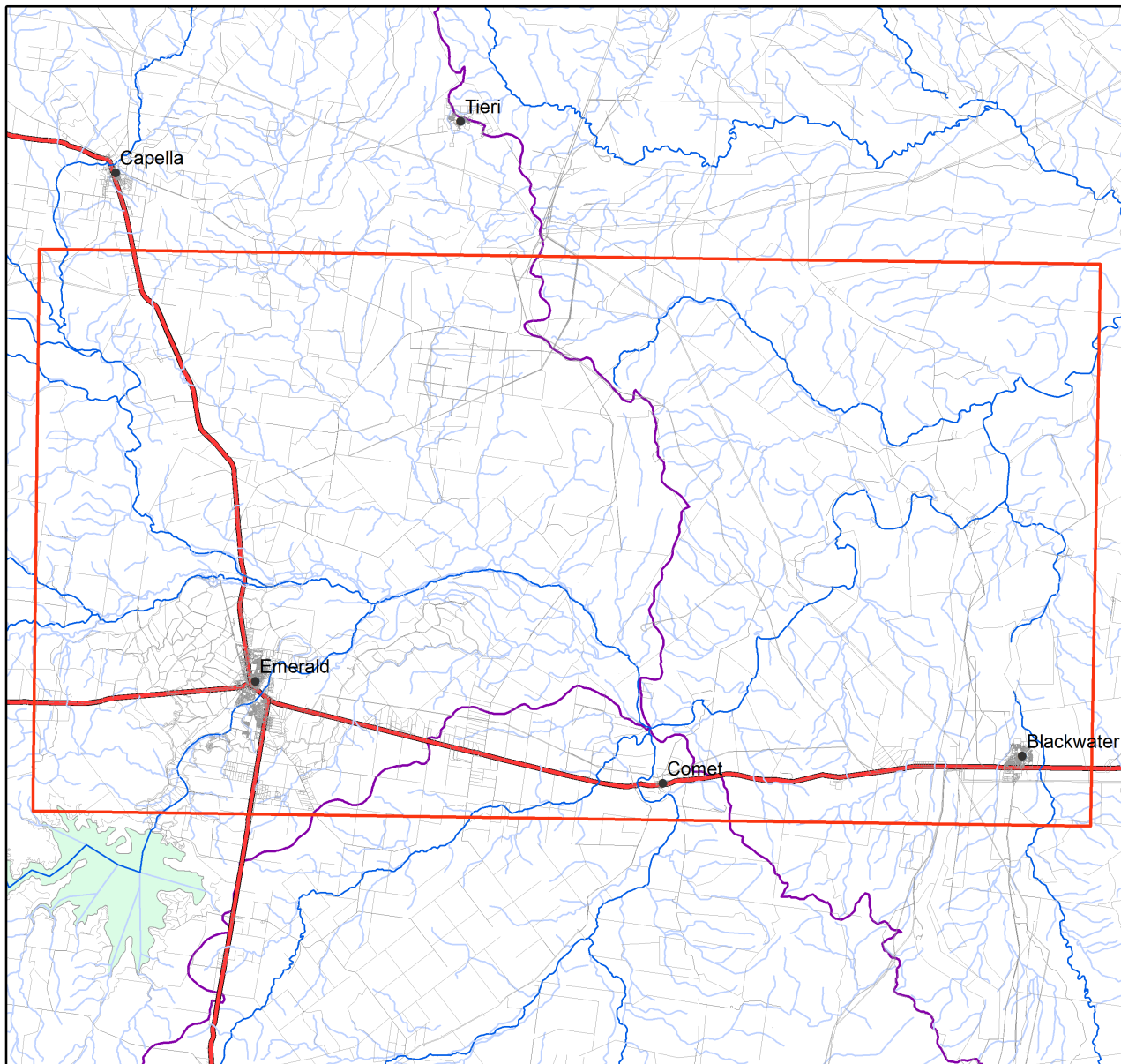


Horizontal Datum: Geographic Datum of Australia 1994 (GDA94)

This map was produced by the Queensland Wetlands Program, Department of Environment and Science, October 2019.

For further information contact: wetlands@des.qld.gov.au

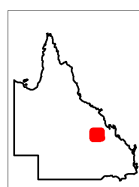
© The State of Queensland, 2019



Queensland Wetlands of Importance Map

Legend

- polygon
- Towns
- Cadastral boundaries
- Highways
- Roads
- Sub-basin
- Directory of Important Wetlands
- Ramsar Wetlands
- Riverine System Drainage Lines**
- Major
- Minor



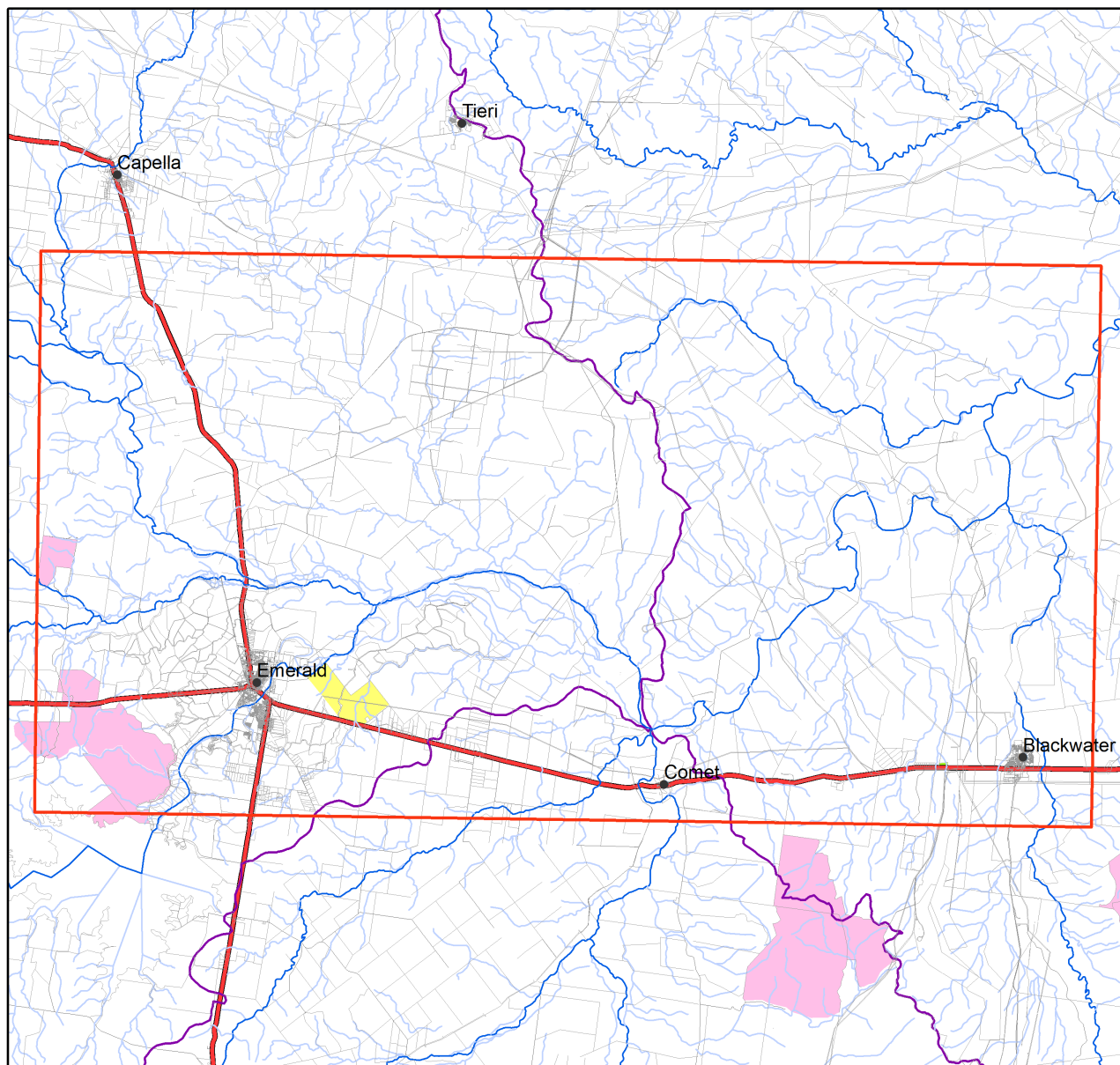
0 5750 11500 17250 23000 28750 m

Horizontal Datum: Geographic Datum of Australia 1994 (GDA94)

This map was produced by the Queensland Wetlands Program, Department of Environment and Science, October 2019.

For further information contact: wetlands@des.qld.gov.au

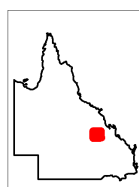
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Legend

- polygon
- Towns
- Cadastral boundaries
- Highways
- Roads
- Sub-basin
- Riverine System Drainage Lines**
 - Major
 - Minor
- Protected Areas**
 - National Park
 - National Park (Scientific)
 - National Park (CYPAL)
 - Conservation Park
 - Resources Reserve
 - Forest Reserve
 - State Forest
 - Timber Reserve
- Marine Parks**
 - General Use Zone
 - Habitat Protection Zone
 - Estuarine Conservation Zone
 - Conservation Park Zone
 - Buffer Zone
 - Scientific Research Zone
 - Marine National Park Zone
 - Preservation Zone

Queensland Protected Area Map



0 5750 11500 17250 23000 28750 m

Horizontal Datum: Geographic Datum of Australia 1994 (GDA94)

This map was produced by the Queensland Wetlands Program, Department of Environment and Science, October 2019.

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Wetland habitat types in the AOI. Total area: 55844.3ha

Wetland Class	Habitat type	Area (ha)
None	Coastal/ Sub-Coastal non-floodplain tree swamps (Melaleuca and Eucalypt)	23710.81
None	Coastal/ Sub-coastal floodplain tree swamps (Melaleuca and Eucalypt)	17502.41
Riverine	Riverine	9230.77
Lacustrine	Artificial/ highly modified wetlands (dams, ring tanks, irrigation channel)	4231.28
Palustrine	Coastal/ Sub-coastal floodplain tree swamps (Melaleuca and Eucalypt)	677.29
Palustrine	Coastal/ Sub-Coastal non-floodplain tree swamps (Melaleuca and Eucalypt)	199.39
Palustrine	Coastal/ Sub-coastal floodplain grass, sedge and herb swamps	126.55
Palustrine	Coastal/ Sub-coastal non-floodplain grass, sedge and herb swamps	105.69
Palustrine	Artificial/ highly modified wetlands (dams, ring tanks, irrigation channel)	60.11

Queensland wetland habitat typology: Major wetland habitat types for wetland conceptual models and wetland management profiles

Wetland name	Conceptual model	Wetland profile
Mangrove Wetlands	Not developed	Mangrove Wetlands
Saltmarsh Wetlands	Not developed	Saltmarsh Wetlands
Coastal and subcoastal saline swamps of all substrates, water regimes, topographic types and vegetation communities	Coastal and subcoastal saline swamps	Coastal grass-sedge wetlands
Coastal and subcoastal non-floodplain tree swamps (Melaleuca and Eucalypt) of all substrates and water regimes	Coastal and subcoastal non-floodplain tree swamps - melaleuca and eucalypt	Coastal and subcoastal tree swamps
Coastal and subcoastal non-floodplain wet heath swamps of all substrates and water regimes	Coastal and subcoastal non-floodplain wet heath swamps	Coastal and subcoastal wet heath swamps
Coastal and subcoastal non-floodplain grass, sedge and herb swamps of all substrates and water regimes	Coastal and subcoastal non-floodplain grass, sedge and herb swamps	Coastal grass-sedge wetlands
Coastal and subcoastal spring swamps of all substrates, water types, water regimes and vegetation communities	Coastal and subcoastal spring swamps	Great Artesian Basin spring wetlands
Coastal and subcoastal floodplain tree swamps - melaleuca and eucalypt of all substrates and water regimes	Coastal and subcoastal floodplain tree swamps - melaleuca and eucalypt	Coastal and subcoastal tree swamps
Coastal and subcoastal floodplain wet heath swamps of all substrates and water regimes	Coastal and subcoastal floodplain wet heath swamps	Coastal and subcoastal wet heath swamps
Coastal and subcoastal floodplain, grass, sedge herb swamps of all substrates and water regimes	Coastal and subcoastal floodplain grass, sedge, herb swamps	Coastal grass-sedge wetlands
Coastal and subcoastal tree swamps - palm of all substrates, topographic types and water regimes	Coastal and subcoastal floodplain tree swamps - palm	Coastal Palm Swamps
Coastal and subcoastal Floodplain Lakes of all substrates, water types and water regimes	Coastal and subcoastal Floodplain Lakes	Coastal and subcoastal floodplain lakes and non-floodplain soil lakes

Wetland name	Conceptual model	Wetland profile
Coastal and subcoastal non-floodplain rock lakes of all water types and water regimes	Coastal and subcoastal non-floodplain rock lakes	Coastal and subcoastal non-floodplain rock lakes
Coastal and subcoastal non-floodplain sand lakes (window) of all water types and water regimes	Coastal and subcoastal non-floodplain sand lakes - window	Coastal non-floodplain sand lakes
Coastal and subcoastal non-floodplain sand lakes (perched) of all water types and water regimes	Coastal and subcoastal non-floodplain sand lakes - perched	Coastal non-floodplain sand lakes
Coastal and subcoastal non-floodplain soil lakes of all water types and water regimes	Coastal and subcoastal non-floodplain soil lakes	Coastal and subcoastal floodplain lakes and non-floodplain soil lakes
Arid and semi-arid saline swamps of all substrates, water regimes, topographic types and vegetation communities	Arid and semi-arid saline swamps	Semi-arid swamps
Arid and semi-arid fresh tree swamps of all substrates, and water regimes and topographic types	Arid and semi-arid tree swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid lignum swamps of all substrates, and water regimes and topographic types	Arid and semi-arid lignum swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid grass, sedge, herb swamps of all substrates, water regimes and topographic types	Arid and semi-arid grass, sedge, herb swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain tree swamps of all substrates and water regimes	Arid and semi-arid non-floodplain tree swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain lignum swamps of all substrates and water regimes	Arid and semi-arid non-floodplain lignum swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid fresh non-floodplain grass, sedge, herb swamps of all substrates and water regimes	Arid and semi-arid non-floodplain grass, sedge, herb swamps	Arid swamps Semi-Arid swamps
Arid and semi-arid, non-floodplain swamps - springs of all substrates, water regimes and vegetation communities	Arid and semi-arid spring swamps	Great Artesian Basin spring wetlands
Arid and semi-arid, saline lakes of all substrates, topographic types and water regimes	Arid and semi-arid saline lakes	Arid and semi-arid lakes
Arid and semi-arid, floodplain lakes of all, substrates and water regimes	Arid and semi-arid floodplain lakes	Arid and semi-arid lakes
Arid and semi-arid, non-floodplain Lakes of all substrates and water regimes	Arid and semi-arid non-floodplain lakes	Arid and semi-arid lakes
Arid/ semi-arid, non-floodplain (clay pans) lakes of all substrates and water regimes	Arid and semi-arid fresh non-floodplain lakes (clay pans)	Arid and semi-arid lakes
Arid and semi-arid, Permanent Lakes permanently inundated lakes of all substrates, water types, topographic types and vegetation communities	Arid and semi-arid permanent lakes	Arid and semi-arid lakes

APPENDIX N

Alluvial bore reports

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
165935	Sub-Artesian Facility	Existing	10/10/2019	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL
Details		Location			
Description					
Parish	6000 - NO LONGER USED	Latitude		23-26-19	Basin 1302
Original Name	P5471 (RB7)	Longitude		148-26-46	Sub-area
		GIS Latitude		-23.43873756	Lot 8
		GIS Longitude		148.4462171	Plan TT345
		Easting		647738	
Driller Name	CONNELLAN, JUSTIN	Northing		7407169	Map Scale
Drill Company	DOWN FORCE DRILLING	Zone		55	Map Series
Const Method	ROTARY AIR	Accuracy			Map No
Bore Line		GPS Accuracy			Map Name
D/O File No	Polygon	Checked		Yes	Prog Section
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	21/10/2019	Data Owner			
Roles	Sub-Artesian Monitoring				
Casing					5 records for RN 165935

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	10/10/2019	1	0.00	9.00	Polyvinyl Chloride	6.800	WT - Wall Thickness	61
A	10/10/2019	2	9.00	15.00	Screen	0.900	AP - Aperture Size	61
X	10/10/2019	3	0.00	5.00	Grout			165
X	10/10/2019	4	5.00	7.00	Bentonite Seal			165
X	10/10/2019	5	7.00	15.00	Gravel Pack			165

From Year:

Strata Logs	3 records for RN	165935
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Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	2.00	BLACK TOPSOIL
2	2.00	9.00	FINE, GOLDEN COLOURED SAND
3	9.00	15.00	FINE/MEDIUM COARSE SAND/GRAVEL: GOLDEN BROWN IN COLOUR

Stratigraphies	0 records for RN	165935
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Aquifers	1 records for RN	165935
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Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	9.00	15.00	SAGR - Sand and Gravel			N			N	UC	NOGOA RIVER ALLUVIUM

Pump Tests Part 1	0 records for RN	165935
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Pump Tests Part 2	0 records for RN	165935
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Bore Conditions	0 records for RN	165935
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Elevations	0 records for RN	165935
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Water Analysis Part 1	0 records for RN	165935
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Water Analysis Part 2	0 records for RN	165935
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Water Levels	0 records for RN	165935
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Wire Line Logs	0 records for RN	165935
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Field Measurements	0 records for RN	165935
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Report Date: 26/10/2019 11:15

From Year:

Special Water Analysis	0	records for RN 165935
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Report Date: 26/10/2019 11:15

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020169	Sub-Artesian Facility	Abandoned but Still Usable	24/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL

Details		Location			
Description	L6 TT309	Latitude	23-26-25	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-27-11	Sub-area	
Original Name	B1S1 YAMALA LINE	GIS Latitude	-23.4402815	Lot	6
		GIS Longitude	148.453056	Plan	TT309
		Easting	648435		
Driller Name		Northing	7406991	Map Scale	104 - 1: 100 000
Drill Company		Zone	55	Map Series	M - Metric Series
Const Method	ROTARY - R.SHELLEY	Accuracy	GPS	Map No	8551
Bore Line	YAM - YAMSION LINE	GPS Accuracy	10	Map Name	CAPELLA
D/O File No	44-010	Checked	Yes	Prog Section	
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	Data Owner				
Roles	WR Investigation Sub-Artesian Monitoring				

Casing					3 records for RN 13020169
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Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	24/04/1995	1	0.00	15.80	Plastic Casing			50
A	24/04/1995	2	14.00	15.80	Perforated or Slotted Casing		1.500 AP - Aperture Size	50
A	24/04/1995	3	12.50	15.80	Gravel Pack		10.000 GR - Gravel Size	130

Strata Logs					12 records for RN 13020169
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Bore Report

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	3.70	TOPSOIL
2	3.70	5.20	BROWN SILTY CLAY
3	5.20	6.40	BROWN SANDY CLAY
4	6.40	8.80	BROWN SILT
5	8.80	12.20	CLAY WITH LENSES OF CEMENTED MEDIUM GRAVEL
6			
7	12.20	15.80	MEDIUM GRAVEL & COARSE SAND ,CEMENTED
8			AND CLAYBOUND IN PATCHES-HIGH MUDLOSS
9	15.80	18.30	FIRM MULTICOLOURED CLAYS (TERTIARY)
901			OBSERVATION BORE - NOGOA RIVER
902			SWL 1/5/95 -14.5M B.G.L.
903			AIRTEST - NO SUPPLY

Stratigraphies1 records for RN 13020169

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	15.80	NOGOIA RIVER ALLUVIUM

Aquifers1 records for RN 13020169

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	12.20	15.80	GRAV - Gravel SAND - Sand							SC	NOGOIA RIVER ALLUVIUM

Pump Tests Part 10 records for RN 13020169

Pump Tests Part 20 records for RN 13020169

From Year:

Bore Conditions				0 records for RN 13020169
Elevations				2 records for RN 13020169

Pipe	Date	Elevation (m)	Precision	Datum	Meas	Point	Survey Source
A	24/04/1995	156.22	SVY	Surveyed	AHD - Aust. Height Datum	R Reference Point	GW110
X	24/04/1995	155.41	SVY	Surveyed	AHD - Aust. Height Datum	N Natural Surface	GW110

Water Analysis Part 1				0 records for RN 13020169
Water Analysis Part 2				0 records for RN 13020169
Water Levels				37 records for RN 13020169

Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Method	Project	Quality
A	11/08/1995		-15.29	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-15.35	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-15.47	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-15.41	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-15.42	R	Reference Point	D	NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-15.39	R	Reference Point	D	NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	09/04/1997		-15.34	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	26/06/1997		-15.34	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-15.25	R	Reference Point	D	NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-14.97	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-15.00	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-15.24	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-15.05	R	Reference Point	D	NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	14/04/1999		-15.03	R	Reference Point	D	NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality

From Year:

Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Method	Project	Quality
A	25/11/1999		-15.01	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130
A	08/02/2000		-14.91	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	30/03/2000		-14.94	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	21/07/2000		-15.01	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130
A	19/12/2000		-14.99	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130
A	08/03/2001		-14.64	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	20/04/2001		-14.77	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	05/04/2002		-14.52	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	30/07/2002		-14.68	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	01/10/2002		-14.42	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	22/01/2003		-14.35	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	26/09/2003		-14.52	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	04/06/2004		-14.46	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	17/08/2006		-13.89	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	07/12/2006		-13.21	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	12/03/2007		-13.65	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	27/09/2007		-13.60	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	02/04/2008		-13.12	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	26/06/2008		-12.70	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	21/10/2008		-12.82	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
A	13/01/2009		-12.70	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1
A	06/05/2009		-12.52	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130
X	01/05/1995		-14.50	N	Natural Surface		NR	Not Recorded	NR	NR	Not Recorded		130
Wire Line Logs													0
records for RN													13020169

Report Date: 26/10/2019 11:17

From Year:

Field Measurements	0	records for RN	13020169
Special Water Analysis	0	records for RN	13020169

Report Date: 26/10/2019 11:17

From Year:

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From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	2.40	TOPSOIL
2	2.40	5.20	BROWN SILTY CLAY
3	5.20	8.50	BRITTLE BROWN CLAY
4	8.50	9.80	BROWN CLAY
5	9.80	12.20	MEDIUM SAND AND GRAVEL - OCCASIONAL
6			PATCHES OF COARSE GRAVEL
7	12.20	13.40	FINE SAND - PARTIALLY CEMENTED
8	13.40	16.20	BROWN SILT
9	16.20	17.70	GREEN KAKI CLAY (TERTIARY)
901			OBSERVATION BORE - NOGOA RIVER
902			SWL - 1/5/95 DRY
903			AIRTEST - NO SUPPLY

Stratigraphies1 records for RN 13020170

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	16.20	NOGOA RIVER ALLUVIUM

Aquifers1 records for RN 13020170

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	9.80	13.40	GRAV - Gravel SAND - Sand							UC	NOGOA RIVER ALLUVIUM

Pump Tests Part 10 records for RN 13020170

Pump Tests Part 20 records for RN 13020170

From Year:

Bore Conditions				0 records for RN 13020170
Elevations				2 records for RN 13020170

Pipe	Date	Elevation (m)	Precision	Datum	Meas	Point	Survey Source
A	25/04/1995	155.82	SVY	Surveyed	AHD - Aust. Height Datum	R Reference Point	GW110
X	25/04/1995	155.40	SVY	Surveyed	AHD - Aust. Height Datum	N Natural Surface	GW110

Water Analysis Part 1				0 records for RN 13020170
Water Analysis Part 2				0 records for RN 13020170
Water Levels				30 records for RN 13020170

Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Method	Project	Quality
A	11/08/1995		-13.42	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-13.42	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-13.42	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-13.42	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	09/04/1997		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/06/1997		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/10/1998		-13.41	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-13.42	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure	Meas Point	Remark	Meas Type	Coll Auth	Coll	Method	Project	Quality
A	14/04/1999		-13.43	R	Reference Point	D	NR	NR	Not Recorded		130
A	25/11/1999		-13.42	R	Reference Point	D	NR	NR	Not Recorded		130
A	08/02/2000		-13.42	R	Reference Point	D	NR	NR	Not Recorded		130
A	30/03/2000		-13.36	R	Reference Point		NR	NR	Not Recorded		130
A	21/07/2000		-13.15	R	Reference Point		NR	NR	Not Recorded		130
A	08/03/2001		-12.76	R	Reference Point		NR	NR	Not Recorded		130
A	20/04/2001		-12.72	R	Reference Point		NR	NR	Not Recorded		130
A	05/04/2002		-12.37	R	Reference Point		DG	MA	Manual/Hand	GWAN	1
A	30/07/2002		-12.29	R	Reference Point		DG	MA	Manual/Hand	GWAN	1
A	01/10/2002		-12.25	R	Reference Point		DG	MA	Manual/Hand	GWAN	1
A	22/01/2003		-12.20	R	Reference Point		NR	NR	Not Recorded		130
A	26/09/2003		-12.07	R	Reference Point		DG	MA	Manual/Hand	GWAN	1
A	04/06/2004		-11.99	R	Reference Point		NR	NR	Not Recorded		130
A	13/01/2009		-11.20	R	Reference Point		NR	NR	Not Recorded		130
A	06/05/2009		-11.12	R	Reference Point		NR	NR	Not Recorded		130
X	01/05/1995		-13.00	N	Natural Surface	D	NR	NR	Not Recorded		130

Wire Line Logs

0 records for RN 13020170

Field Measurements

1 records for RN 13020170

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp Method	Samp Source
A	21/07/2000		8100							BA	Groundwater - from Bore

Special Water Analysis

0 records for RN 13020170

Report Date: 26/10/2019 11:18

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020171	Sub-Artesian Facility	Abandoned but Still Usable	25/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL

Details		Location			
Description	L6 TT309	Latitude	23-27-12	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-26-24	Sub-area	
Original Name	B3S3 YAMALA LINE	GIS Latitude	-23.453570037	Lot	7
		GIS Longitude	148.43985161	Plan	TT309
Driller Name	R SHELLEY	Easting	647072		
Drill Company		Northing	7405533	Map Scale	104 - 1: 100 000
Const Method	ROTARY	Zone	55	Map Series	M - Metric Series
Bore Line	YAM - YAMSION LINE	Accuracy		Map No	8551
D/O File No	44-010	GPS Accuracy		Map Name	CAPELLA
R/O File No		Checked	Yes	Prog Section	
H/O File No					
Log Received Date					
Roles	WR Investigation				
	Sub-Artesian Monitoring				
Casing		3 records for RN 13020171			

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	25/04/1995	1	0.00	11.60	Plastic Casing			50
A	25/04/1995	2	9.80	11.60	Perforated or Slotted Casing	1.500	AP - Aperture Size	50
A	25/04/1995	3	8.00	11.60	Gravel Pack	10.000	GR - Gravel Size	130

Bore Report

From Year:

Rec Top (m) Bottom Strata Description (m)			
1	0.00	3.70	TOPSOIL
2	3.70	5.30	BROWN SILTY CLAY
3	5.30	8.40	BROWN SILT
4	8.40	10.20	CEMENTED SAND
5	10.20	11.40	CEMENTED SAND & GRAVEL WITH SOME
6			BANDS OF CLAY *
7	11.40	11.60	HARD ROCK (BASALT?)
901			OBSERVATION BORE - NOGOA RIVER
902			SWL 1/5/95 DRY
903			AIRTEST - NO SUPPLY

Stratigraphies		1 records for RN	13020171
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Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	11.40	NOGOA RIVER ALLUVIUM

Aquifers		1 records for RN	13020171
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Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	10.20	11.40	CGRY - Clayey Gravel CSAN - Clayey Sand			N			Y	SC	NOGOA RIVER ALLUVIUM

Pump Tests Part 1		0 records for RN	13020171
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Pump Tests Part 2		0 records for RN	13020171
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Bore Conditions		0 records for RN	13020171
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From Year:

Elevations	2 records for RN 13020171
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Pipe	Date	Elevation (m)	Precision	Datum	Meas	Point	Survey Source
A	28/04/1995	155.15	SVY	Surveyed	AHD - Aust.	Height Datum R Reference Point	GW110
X	28/04/1995	154.68	SVY	Surveyed	AHD - Aust.	Height Datum N Natural Surface	GW110

Water Analysis Part 1	0 records for RN 13020171
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Water Analysis Part 2	0 records for RN 13020171
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Water Levels	28 records for RN 13020171
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Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Method	Project	Quality
A	11/08/1995		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-11.67	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-11.68	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	09/04/1997		-11.67	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/06/1997		-11.67	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-11.67	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-11.68	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-11.67	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-11.68	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/10/1998		-11.68	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-11.69	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/04/1999		-11.69	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	25/11/1999		-11.68	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/02/2000		-11.69	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/2000		-11.69	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	21/07/2000		-11.69	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/03/2001		-11.41	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/04/2001		-11.44	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	05/04/2002		-11.12	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	30/07/2002		-11.07	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	01/10/2002		-11.00	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	22/01/2003		-10.83	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/09/2003		-10.87	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/06/2004		-10.82	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
X	01/05/1995		-11.20	N	Natural Surface	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Wire Line Logs	0 records for RN 13020171
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Field Measurements	0 records for RN 13020171
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Special Water Analysis	0 records for RN 13020171
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Report Date: 26/10/2019 11:18

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020172	Sub-Artesian Facility	Abandoned but Still Usable	28/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL

Details		Location			
Description	L6 TT309	Latitude	23-27-43	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-26-04	Sub-area	
Original Name	B4S4 YAMALA LINE	GIS Latitude	-23.4619385	Lot	6
		GIS Longitude	148.4344386	Plan	TT309
Driller Name	R SHELLEY	Easting	646509		
		Northing	7404612	Map Scale	104 - 1: 100 000
Drill Company		Zone	55	Map Series	M - Metric Series
Const Method	ROTARY	Accuracy	GPS	Map No	8551
Bore Line	YAM - YAMSION LINE	GPS Accuracy	10	Map Name	CAPELLA
D/O File No	44-010	Checked	Yes	Prog Section	
R/O File No					
H/O File No					
Log Received Date					
Roles	WR Investigation				
	Sub-Artesian Monitoring				

Casing				3 records for RN 13020172	
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Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	28/04/1995	1	0.00	11.40	Plastic Casing			50
A	28/04/1995	2	9.60	11.40	Perforated or Slotted Casing		1.500 AP - Aperture Size	50
A	28/04/1995	3	8.50	11.40	Gravel Pack		10.000 GR - Gravel Size	130

Strata Logs				10 records for RN 13020172	
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Bore Report

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.80	TOPSOIL
2	1.80	3.40	BROWN CLAY
3	3.40	5.50	BROWN SILTY CLAY
4	5.50	5.60	WHITE CLAY
5	5.60	7.90	BROWN SILTY CLAY WITH SEAMS OF MEDIUM SAND, PARTIALLY CEMENTED (MUD LOSS) *
7	7.90	10.40	MEDIUM SAND GRADUATING TO SAND AND GRAVEL
9	10.40	11.40	LARGE GRAVEL
10	11.40	12.20	MULTICOLOURED CLAYS

1 records for RN 13020172

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	11.40	NOGOA RIVER ALLUVIUM

1 records for RN 13020172

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	5.60	11.40	GRAV - Gravel SAND - Sand	01/05/1995	-11.00	N		0.01	Y	SC	NOGOA RIVER ALLUVIUM

0 records for RN 13020172

0 records for RN 13020172

0 records for RN 13020172

From Year:

Elevations

Pipe	Date	Elevation (m)	Precision	Datum	Meas	Point	Survey Source
A	28/04/1995	154.35	SVY	AHD - Aust. Height Datum	R	Reference Point	GW110
A	30/07/2002	154.54	SVY	AHD - Aust. Height Datum	R	Reference Point	
X	28/04/1995	153.82	SVY	AHD - Aust. Height Datum	N	Natural Surface	GW110

Water Analysis Part 1

Pipe	Date	Rec	Analyst	Analysis No	Depth (m)	Meth	Src	Cond (uS/cm)	pH	Si (mg/L)	Total Ions (mg/L)	Total Solids (mg/L)	Hard	Alk	Fig. of Merit	SAR	RAH
A	15/07/1998	1	GCL	185433		BA	GB	31900	7.4	40	22282.82	22143.76	11440	291	1.3	16.6	0.00
A	25/11/1999	1	GCL	201720		BA	GB	19300	7.8	66	13220.08	12955.47	4919	544	0.7	19.0	0.00

Water Analysis Part 2

Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	15/07/1998	1	4069.7	7.0	1855.7	1656.1	0.21	351.7	0.00	1.4	13034.0	0.14	28.5	1278.6	0.06	0.00	0.10	0.01
A	25/11/1999	1	3057.4	2.2	640.0	808.0	0.00	651.0	0.02	6.2	6685.0	0.25	47.8	1322.2	0.07	0.00	0.10	0.18

Water Levels

Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Method	Project	Quality
A	11/08/1995		-11.93	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-11.94	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-11.93	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-11.93	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-11.99	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-11.99	R	Reference Point	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Method	Project	Quality
A	09/04/1997		-11.88	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/06/1997		-11.79	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-11.75	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-11.48	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-11.42	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-11.41	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/10/1998		-11.37	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-11.15	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/04/1999		-11.10	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	25/11/1999		-10.96	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/02/2000		-10.78	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/2000		-10.73	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	21/07/2000		-10.66	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/03/2001		-10.30	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/04/2001		-10.31	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	05/04/2002		-9.99	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	30/07/2002		-9.93	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	01/10/2002		-10.08	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	22/01/2003		-9.95	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/09/2003		-9.94	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/06/2004		-9.90	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/04/2005		-10.59	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	17/08/2006		-9.45	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/12/2006		-9.32	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	12/03/2007		-9.37	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	27/09/2007		-9.39	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	02/04/2008		-9.17	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	26/06/2008		-9.12	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	21/10/2008		-9.07	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	13/01/2009		-9.00	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	06/05/2009		-8.95	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
X	01/05/1995		-11.00	N	Natural Surface		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Wire Line Logs	0 records for RN 13020172
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Field Measurements										5 records for RN 13020172			
Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp Method	Samp Source		
A	15/07/1998		32000							XX	Unknown	GB	Groundwater - from Bore
A	25/11/1999		19500							XX	Unknown	GB	Groundwater - from Bore
A	21/07/2000		13020							BA	Bailer - Other	GB	Groundwater - from Bore
A	10/08/2001	9.50	10200	6.3		25.6				PG	Pump - Grundfos	GB	Groundwater - from Bore

Special Water Analysis	0 records for RN 13020172
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Report Date: 26/10/2019 11:19

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From Year:					
Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020173	Sub-Artesian Facility	Abandoned but Still Usable	28/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL
Details		Location			
Description	L6 TT309	Latitude	23-28-00	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-25-45	Sub-area	
Original Name	B5S5 YAMALA LINE	GIS Latitude	-23.466792587	Lot	7
		GIS Longitude	148.429186914	Plan	TT309
		Easting	645968		
Driller Name		Northing	7404080	Map Scale	104 - 1: 100 000
Drill Company		Zone	55	Map Series	M - Metric Series
Const Method	ROTARY - R.SHELLEY	Accuracy		Map No	8551
Bore Line	YAM - YAMSION LINE	GPS Accuracy		Map Name	CAPELLA
D/O File No	44-010	Checked	Yes	Prog Section	
R/O File No					
H/O File No					
Log Received Date					
Roles	Sub-Artesian Monitoring				
Casing		3 records for RN 13020173			
Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description
A	28/04/1995	1	0.00	11.20	Plastic Casing
A	28/04/1995	2	9.20	11.20	Perforated or Slotted Casing
A	28/04/1995	3	8.20	11.20	Gravel Pack
Strata Logs		9 records for RN 13020173			
			Mat Size (mm)	Size Desc	Outside Diameter (mm)
					50
			1.500	AP - Aperture Size	50
			10.000	GR - Gravel Size	130

Bore Report

From Year:

Rec		Top (m)	Bottom (m)	Strata Description											
1	0.00	2.40	TOPSOIL												
2	2.40	4.90	BROWN CLAY												
3	4.90	8.50	BROWN SILTY CLAY												
4	8.50	8.80	REDDISH BROWN CLAY												
5	8.80	10.40	BROWN AND GREY CLAY												
6	10.40	12.20	GREY BRITTLE CLAY												
901				OBSERVATION BORE - NOGOA RIVER											
902				SWL 1/5/95 DRY											
903				AIRTEST - NO SUPPLY											
Stratigraphies					0 records for RN 13020173										
Aquifers					0 records for RN 13020173										
Pump Tests Part 1					0 records for RN 13020173										
Pump Tests Part 2					0 records for RN 13020173										
Bore Conditions					0 records for RN 13020173										
Elevations					2 records for RN 13020173										
Pipe	Date	Elevation (m)		Precision	Datum		Meas Point		Survey Source						
A	28/04/1995	155.43		SVY	AHD - Aust. Height Datum		R		Reference Point		GW110				
X	28/04/1995	154.78		SVY	AHD - Aust. Height Datum		N		Natural Surface		GW110				
Water Analysis Part 1					1 records for RN 13020173										

Bore Report

From Year:

(mg/L)										(mg/L)							
A	25/11/1999	1	GCL	201724	BA	GB	37500	7.0	53	26469.26	26455.94	14921	107	1.7	14.4	0.00	
Water Analysis Part 2																	
														1	records for RN 13020173		

Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	25/11/1999	1	4039.4	1.7	2292.1	2238.0	3.68	130.3	1.14	0.2	16230.0	0.03	0.0	1537.5	0.17	0.14	0.00	0.18

Water Levels														31 records for RN 13020173	
Pipe	Date	Time	Measure	Meas	Point	Remark	Meas	Type	Coll	Auth	Coll	Method	Project	Quality	
A	11/08/1995		-11.85	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	12/02/1996		-11.85	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	02/04/1996		-12.03	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	07/08/1996		-11.85	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	08/11/1996		-12.08	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	10/02/1997		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	09/04/1997		-12.08	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	26/06/1997		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	14/10/1997		-12.08	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	30/01/1998		-12.07	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	30/03/1998		-12.08	R	Reference Point	D	NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	14/07/1998		-12.07	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	06/10/1998		-12.06	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	20/01/1999		-11.92	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	14/04/1999		-11.83	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	25/11/1999		-11.68	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	
A	08/02/2000		-11.56	R	Reference Point		NR	Not Recorded	NR	NR	NR	Not Recorded		130 Data is of unknown quality	

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020174	Sub-Artesian Facility	Abandoned but Still Usable	28/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL

Details		Location			
Description	L6 TT309	Latitude	23-28-26	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-25-26	Sub-area	
Original Name	B6S6 YAMALA LINE	GIS Latitude	-23.473919	Lot	6
		GIS Longitude	148.4239947	Plan	TT309
Driller Name	R SHELLEY	Easting	645429		
Drill Company		Northing	7403296	Map Scale	104 - 1: 100 000
Const Method	ROTARY	Zone	55	Map Series	M - Metric Series
Bore Line	YAM - YAMSION LINE	Accuracy	GPS	Map No	8551
D/O File No	44-010	GPS Accuracy	10	Map Name	CAPELLA
R/O File No		Checked	Yes	Prog Section	
H/O File No					
Log Received Date					
Roles	WR Investigation				
	Sub-Artesian Monitoring				

Casing				3 records for RN 13020174	
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Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	28/04/1995	1	0.00	11.60	Plastic Casing			50
A	28/04/1995	2	9.80	11.60	Perforated or Slotted Casing	1.500	AP - Aperture Size	50
A	28/04/1995	3	8.50	11.60	Gravel Pack	10.000	GR - Gravel Size	130

Strata Logs				6 records for RN 13020174	
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Bore Report

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.80	TOPSOIL
2	1.80	3.00	HARD BROWN CLAY
3	3.00	8.50	SANDY SILTY CLAY
4	8.50	8.70	CLAYBOUND GRAVEL *
5	8.70	11.60	BROWN CLAY
6	11.60	12.20	MULTICOLOURED CLAYS

Stratigraphies1 records for RN 13020174

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	11.60	NOGOA RIVER ALLUVIUM

Aquifers1 records for RN 13020174

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow Quality	Yield (L/s)	Contr	Cond	Formation Name
1	8.50	8.70	CGRY - Clayey Gravel	01/05/1995	-10.80	N	0.01	Y	UC	NOGOA RIVER ALLUVIUM

Pump Tests Part 10 records for RN 13020174

Pump Tests Part 20 records for RN 13020174

Bore Conditions0 records for RN 13020174

Elevations2 records for RN 13020174

Pipe	Date	Elevation (m)	Precision	Datum	Meas Point	Survey Source
A	28/04/1995	155.14	SVY	Surveyed	AHD - Aust. Height Datum	R Reference Point GW110
X	28/04/1995	154.67	SVY	Surveyed	AHD - Aust. Height Datum	N Natural Surface GW110

From Year:

Water Analysis Part 1													2 records for RN 13020174				
Pipe	Date	Rec	Analyst	Analysis No	Depth (m)	Meth	Src	Cond (uS/cm)	pH	Si (mg/L)	Total Ions (mg/L)	Total Solids (mg/L)	Hard	Alk	Fig. of Merit	SAR	RAH
A	15/07/1998	1	GCL	185432		BA	GB	4200	7.8	44	2912.01	2481.72	797	773	0.6	10.1	0.00
A	25/11/1999	1	GCL	201736		BA	GB	6250	8.0	63	4238.46	3791.41	978	840	0.4	15.3	0.00

Water Analysis Part 2													2 records for RN 13020174					
Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	15/07/1998	1	652.7	3.3	116.4	123.3	4.76	932.7	0.00	5.1	960.0	0.27	1.2	117.1	0.01	0.00	0.20	0.01
A	25/11/1999	1	1102.6	3.7	128.0	160.1	0.00	1003.8	0.00	10.3	1657.0	0.33	19.0	153.6	0.01	0.09	0.10	0.01

Water Levels													37 records for RN 13020174
Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	11/08/1995		-11.60	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-11.49	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-11.53	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-11.53	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-11.54	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-11.41	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	09/04/1997		-11.37	R	Reference Point D	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/06/1997		-11.42	R	Reference Point D	D	NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-11.37	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-11.21	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-11.20	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-11.19	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	06/10/1998		-11.09	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-10.89	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/04/1999		-10.83	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	25/11/1999		-10.71	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/02/2000		-10.58	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/2000		-10.62	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	21/07/2000		-10.63	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/03/2001		-10.37	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/04/2001		-10.43	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	05/04/2002		-10.30	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	30/07/2002		-10.32	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	01/10/2002		-10.22	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	22/01/2003		-9.96	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/09/2003		-10.29	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/03/2004		-10.29	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/06/2004		-10.17	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	16/09/2004		-9.96	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/02/2005		-9.84	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/04/2005		-9.80	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	17/08/2006		-9.69	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/12/2006		-9.22	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	12/03/2007		-9.52	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	27/09/2007		-9.51	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	02/04/2008		-9.15	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
X	01/05/1995		-10.80	N	Natural Surface		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

From Year:

Wire Line Logs	0 records for RN 13020174
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Field Measurements	3 records for RN 13020174
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Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp Method	Samp	Source	
A	15/07/1998		4200							XX	Unknown	GB	Groundwater - from Bore
A	25/11/1999		6300							XX	Unknown	GB	Groundwater - from Bore
A	21/07/2000		5320							BA	Bailer - Other	GB	Groundwater - from Bore

Special Water Analysis	0 records for RN 13020174
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Report Date: 26/10/2019 11:19

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
13020175	Sub-Artesian Facility	Abandoned but Still Usable	28/04/1995	Emerald	2270 - CENTRAL HIGHLANDS REGIONAL

Details		Location			
Description	L6 TT309	Latitude	23-28-47	Basin	1302
Parish	3184 - MIDDARRA	Longitude	148-25-13	Sub-area	
Original Name	B7S7 YAMALA LINE	GIS Latitude	-23.4796334	Lot	A
		GIS Longitude	148.4202768	Plan	AP6827
Driller Name	R SHELLEY	Easting	645043		
		Northing	7402667	Map Scale	104 - 1: 100 000
Drill Company		Zone	55	Map Series	M - Metric Series
Const Method	ROTARY	Accuracy	GPS	Map No	8551
Bore Line	YAM - YAMSION LINE	GPS Accuracy	10	Map Name	CAPELLA
D/O File No	44-010	Checked	Yes	Prog Section	
R/O File No					
H/O File No					
Log Received Date					
Roles	WR Investigation				
	Sub-Artesian Monitoring				

Casing			3 records for RN 13020175		
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Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	28/04/1995	1	0.00	16.60	Plastic Casing			50
A	28/04/1995	2	14.70	16.60	Perforated or Slotted Casing		1.500 AP - Aperture Size	50
A	28/04/1995	3	13.50	16.60	Gravel Pack		10.000 GR - Gravel Size	130

Strata Logs		7 records for RN 13020175	
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Bore Report

From Year:

Rec	Top (m)	Bottom (m)	Strata Description								
1	0.00	2.40	TOPSOIL								
2	2.40	8.60	BROWN CLAY								
3	8.60	10.70	BROWN SILTY CLAY								
4	10.70	12.20	CLAYBOUND GRAVEL *								
5	12.20	16.90	CLAYBOUND GRAVEL WITH INTERMITTENT								
6			HARD BANDS OF CEMENTED GRAVEL *								
7	16.90	17.10	VERY HARD BASALT								
Stratigraphies				1 records for RN 13020175							
Source	Rec	Top (m)	Bottom (m)	Strata Description							
DNR	1	0.00	16.90	NOGOA RIVER ALLUVIUM							
Aquifers				1 records for RN 13020175							
Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	10.70	16.90	CGRY - Clayey Gravel	01/05/1995	-11.30	N		0.01	Y	SC	NOGOA RIVER ALLUVIUM
Pump Tests Part 1				0 records for RN 13020175							
Pump Tests Part 2				0 records for RN 13020175							
Bore Conditions				0 records for RN 13020175							
Elevations				3 records for RN 13020175							

From Year:

Pipe	Date	Elevation (m)	Precision	Datum	Meas	Point	Survey Source
A	06/08/1996	155.09	SVY	Surveyed	AHD - Aust. Height Datum	R	Reference Point
X	28/04/1995	155.09	SVY	Surveyed	AHD - Aust. Height Datum	N	Natural Surface GW110

Water Analysis Part 13 records for RN 13020175

Pipe	Date	Rec	Analyst	Analysis No	Depth (m)	Meth	Src	Cond (uS/cm)	pH	Si (mg/L)	Total Ions (mg/L)	Total Solids (mg/L)	Hard	Alk	Fig. of Merit	SAR	RAH
A	15/07/1998	1	GCL	185434	BA	GB	GB	2570	8.2	60	1904.35	1553.91	162	677	0.1	18.7	10.30
A	25/11/1999	1	GCL	201739	BA	GB	GB	710	7.9	18	490.44	408.01	92	164	0.4	5.1	1.44
A	21/07/2000	1	GCL	208030	PA	GB	GB	2013	8.5	59	1496.10	1232.76	84	546	0.1	21.1	9.23

Water Analysis Part 23 records for RN 13020175

Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	15/07/1998	1	547.5	4.8	18.9	27.9	0.00	807.1	0.01	9.5	435.1	0.93	9.5	43.1	0.03	0.00	0.30	0.03
A	25/11/1999	1	111.2	5.4	22.1	8.9	0.00	197.8	0.01	1.0	94.3	0.41	33.3	16.1	0.06	0.00	0.10	0.02
A	21/07/2000	1	443.1	0.9	5.6	17.0	0.01	633.2	0.00	16.1	291.2	1.15	8.0	79.8	0.00	0.00	0.30	0.00

Water Levels42 records for RN 13020175

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll	Method	Project	Quality
A	11/08/1995		-12.31	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	12/02/1996		-12.23	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	02/04/1996		-12.27	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	07/08/1996		-11.22	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	08/11/1996		-11.24	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	10/02/1997		-11.15	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality
A	09/04/1997		-11.11	R	Reference Point		NR	Not Recorded	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	26/06/1997		-11.12	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/10/1997		-11.11	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/01/1998		-10.95	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/1998		-10.90	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/07/1998		-10.83	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/10/1998		-10.76	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/01/1999		-10.54	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	14/04/1999		-10.35	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	25/11/1999		-10.27	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/02/2000		-10.15	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	30/03/2000		-10.23	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	21/07/2000		-10.24	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	08/03/2001		-9.99	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/04/2001		-10.03	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	05/04/2002		-9.95	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	30/07/2002		-9.98	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	01/10/2002		-9.95	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	22/01/2003		-9.77	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	26/09/2003		-9.99	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/03/2004		-9.97	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	04/06/2004		-9.82	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	16/09/2004		-9.74	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	02/02/2005		-9.67	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/04/2005		-9.57	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	20/10/2005		-9.54	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	17/08/2006		-9.37	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	07/12/2006		-9.05	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	12/03/2007		-9.20	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	27/09/2007		-9.21	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	20/02/2008		-8.86	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1 Good - Actual Manual Measurements
A	26/06/2008		-8.68	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	16/10/2008		-8.79	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	13/01/2009		-8.69	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
A	06/05/2009		-8.60	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality
X	01/05/1995		-11.30	N	Natural Surface		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Wire Line Logs	0 records for RN	13020175
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Field Measurements	5 records for RN	13020175
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Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp Method	Samp Source		
A	15/07/1998		2550							XX	Unknown	GB	Groundwater - from Bore
A	25/11/1999		710							XX	Unknown	GB	Groundwater - from Bore
A	21/07/2000		2000							PA	Pump Amazon	GB	Groundwater - from Bore
A	10/08/2001	14.00	1943	8.1	25.6					PG	Pump - Grundfos	GB	Groundwater - from Bore
A	30/07/2002		1810		25.6					PG	Pump - Grundfos	GB	Groundwater - from Bore

Special Water Analysis	0 records for RN	13020175
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Report Date: 26/10/2019 11:20

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