MILLENNIUM MINE

Amendments to conditions as a compliance measure required by the EA

Supporting documentation to the Environmental Authority

EPML00819213 amendment application

For

MetRes Pty Ltd

Document Status Sheet

Rev	Date	Description	By	Review	Approved
1	**17-02-2023**	**Supporting documentation**	Francis Kuranchie - Environmental Superintendent		**SD**

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1 Introduction

Millennium Coal Mine is within the Bowen Basin, Queensland and is located approximately 20 kilometers (km) south-east of the township of Moranbah, and 174km east of Mackay and within the Isaac Regional Council Local Government Area (LGA) in Queensland (22° 00' 56.68" S, 148° 15' 09.28" E). The Site terrain is flat to slightly undulating. The Mine consists of two mining areas with six mining leases (ML): the Mavis Downs area (ML 70457, ML 70483 and ML 70485); and the Millennium area (ML 70313, ML 70401, ML 70344), together form a single operational project, the Millennium Mine. Millennium Mine operates under Environmental Authority (EA) EPML00819213.

The primary activities undertaken on site include:

- Open cut mining;
- Underground mining;
- Coal haulage;
- Exploration;
- Tailings and rejects disposal;
- Water management.

1.1 Purpose of this report

This report has been submitted with the Application Form *Application to amend an environmental authority* (ESR/2015/1773) online with the request to amend EA EPML00819213.

Relevantly, the EA requires:

- The provision of mine affected water contaminant release limits for turbidity and suspended solids in Table C2, which the EA states (by way of asterisked footnote at the bottom of page 12) was to be provided to the Department by 7 December 2022; and
- The updating of Table D1 with the results from the assessment required by condition D6, via an amendment process by 31 December 2022 (in accordance with the requirement in condition D7).

Information was provided to the Department on 19th December, 2022 to address the information required for Table C2 and Table D1.

The purpose of this amendment application is to ensure that site information now reflects in the EA to ensure the EA reflects current operating conditions.

The opportunity has also been taken in this amendment application to make some minor administrative updates to some naming conventions within the EA which are inconsistent with site operations, and to remove some references to structures which are no longer in existence on site.

This report supersedes MetRes' previous submission (dated 19/12/22) which was the subject of a Not Properly Made Notice from the Department (Reference A-EA-AMD-100360867) dated 19/01/23.

The information presented in this report provides further clarity on the magnitude of proposed changes, their justification and potential environmental harm (if any). In addition, where relevant, this supporting document presents proposed mitigation measures to effectively manage the proposed amendments.

It should be noted that this updated EA amendment supporting documentation does not present a different technical finding to the data as presented to the Department in the 19/12/22 lodgment but provides further clarification on why the changes are being sought. The exception is the proposed release limits to comply with condition C4, Table C2 and C7. Millennium Mine accept the limits as provided by the Department 20/01/23.

MetRes considers that the approved form and associated supporting information that has been prepared will now allow the EA amendment application to be accepted as properly made in accordance with the *Environmental Protection Act 1994* (EP Act).

It is expected that all the changes requested if granted will not cause any further environmental harm to the receiving environment, beyond current operating conditions. Also, DES proposed release limits for mine affected water have been accepted to be used for this EA

As confirmed in Section 3, the proposed amendments to the mine affected water release limits and REMP trigger values will not result in any additional contamination to receiving surface waters, will not result in any additional releases or emissions to groundwater or land, and will not result in any additional environmental harm to air and noise environmental values.

2 EA amendment application

The *Environmental Protection Act 1994* (EP Act) states the requirements for an environmental authority amendment application. The requirements have been addressed in this report as outlined (Error! Reference source not found.).

Table 1: Legislative Requirements and Response

Requirement	Response
Section 226 of the EP Act:	
a) Be made to the administering authority;	The amendment application has been submitted to the Department of Environment and Science (DES) (the administering authority).
b) Be in the approved form;	The approved form "Application to amend an environmental authority" (ESR/2015/1733), version 20, effective 14 July 2021 was used and submitted online.
c) Be accompanied by the fee prescribed by regulation;	A fee of $355.30 was paid during the online submission with the amendment application as prescribed in Part 2, Schedule 15 of the EP Regulation.
d) Describe the proposed amendment;	See Section 3
e) Describe the land that will be affected by the proposed amendment; and	See Section 4
f) Include any other document relating to the application prescribed by regulation.	All other supporting document prescribed by the regulation has been included in this application.
Section 226A of the EP Act:	
a) Describe any development permits in effect under the Planning Act for carrying out the relevant activity for the authority;	There are no development permits required for the carrying out of the proposed activity.
b) State whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity;	The relevant environmental authority was approved under a site-specific application as the activities do not comply with the eligibility criteria for mining lease activities.
c) If the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity-include a declaration that the statement is correct;	The activities do not comply with the eligibility criteria.
d) State whether the application seeks to change a condition identified in the authority as a standard condition;	The relevant environmental authority was approved under a site-specific application and therefore all conditions are site specific and not standard.
e) If the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit-state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit;	The application does not relate to a new relevant resource tenure.
f) Include an assessment of the likely impact of the proposed amendment on the environmental values, including-	See Section 3
i. A description of the environmental values likely to be affected by the proposed amendment;	

Requirement		Response
ii.	Details of emissions or releases likely to be generated by the proposed amendment;	
iii.	A description of the risk and likely magnitude of impacts on the environmental values;	
iv.	Details of the management practices proposed to be implemented to prevent or minimise adverse impacts;	
v.	If a PRCP schedule does not apply for each relevant activity-details of how the land the subject of the application will be rehabilitated after each relevant activity ends;	
g)	Include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity; and	See Section 4
h)	Include details of any site management plan or environmental protection order that relates to the land the subject of the application.	A site management plan or environmental protection order does not relate to the land subject of the application.

This application does not relate to a PRCP Schedule, CSG activity or Underground Water Rights. Therefore, section 226B, 227 and 227AA of the EP Act do not apply to this application.

2.1 Application form

This amendment has been submitted with the Application Form *Application to amend an environmental authority* (ESR/2015/1773) online with all responses checked. Other responses to relevant sections of the form can be found in this document (**Table 2**).

Table 2: Application Form Requirements and Response

Form Section	Response
Section 11 – Amend Conditions	See Section 8
Section 13 – Describe the proposed amendment	See Section 3
Section 14 – Describe the land affected	See Section 4
Section 22 – Environmental Values	See Section 5.1

3 Proposed Amendment Description

Overview: Amendments to conditions as a compliance measure required by the EA

Where relevant, this supporting documentation has been developed in consideration of the requirements listed under the following DES Guidelines (and as summarised in Table 3):

- Application requirements for activities with impacts to air (ESR2015/1840, version 4.04) (DES, 2021a);
- Application requirements for activities with impacts to land (ESR/2015/1839, version 4.03) (DES, 2021b);
- Application requirements for activities with impacts to water (ESR2015/1837, version 4.04) (DES, 2021c);
- Application requirements for activities with noise impacts (ESR2015/1838, version 3.06) (DES, 2022a);
- Application requirements for activities with waste impacts (ESR2015/1836, version 5.02) (DES,2021d); and
- Requirements for site-specific and amendment applications – underground water rights (ESR/2016/3275, version 1.03) (DES, 2021).

Based on the Department's Notice received 19/01/23, Millennium Mine has revisited the relevant EA amendment guidelines and additional information requirement as contained within the Notice received. Table 3 presents a review of guidance material, with section 5 presenting a review against assessment level decision for the amendments seeking change in this application.

Table 3: Review of guidance material

Relevant section	Action required	
266A (1)(f)(i)	Describe the environmental values that are likely to be impacted	Summarised in Section 3, Table 4 Appendix B – surface water Appendix C – groundwater
266A (1)(f)(ii)	Detail of emissions and releases likely to be generated by the proposed amendment.	**Surface Water** The proposed water quality is consistent with general Millennium water quality as described 5.1.2 and 5.1.3. The mine affected water release limits and REMP trigger values proposed will not cause additional contamination to receiving waters. Also, no additional emissions are anticipated as a result of this amendment. **Groundwater** This amendment as described in section 3 will not have any additional releases or emissions to groundwater. Rather groundwater networked is being optimised. **Land** This amendment as described in section 3 will not have any additional releases or emissions to land. Also, structure of the land and aesthetics will not be affected through any release. There will be no vegetation clearing associated with this amendment. **Other** Noise and air emissions will be similar to the currently approved impacts.

266A (1)(f)(iii)	Describe the risk and likely magnitude of impacts of the amendment on identified environmental values	Summarised in Section 3, Table 4 Appendix B – surface water Appendix C – groundwater
266A (1)(f)(iv)	Details of management practices proposed to be implemented to prevent or minimise adverse impacts	Summarised in Section 3, Table 4 Appendix B – surface water Appendix C – groundwater
266A (1)(f)(v)	Provide the details of rehabilitation to land that will be impacted by activities associated with this application.	All amendments seeking change (as listed in section 3, Table 4) do not involve any clearing of vegetation or excavation of land. Therefore, no land will be affected as a result of this EA amendment.

The proposed amendments seeking a change to EPML00819213, as part of this application, are summarised in Table 4.

Technical reports to support the information presented in Section 3 is provided in Appendix A through to E.

Table 4: summary table of proposed EA amendments

EA reference	Technical area	Proposed change	Magnitude of change proposed	Level of environmental harm assessed	Where addressed in supporting documentation
CONDITION CHANGES PROPOSED					
Schedule C: Surface Water					
Table C2	Mine affected water release limits	Compliance with condition (footnote) to insert release limits for turbidity and suspended solids.	Release limits provided by DES (21/01/23) are accepted by Millennium Mine	The proposed release limits are achievable to facilitate controlled releases of mine-affected water. The conservative nature of the proposed release limits ensures that any releases would not cause impacts to the downstream environmental values.	Section 3.2 Appendix B, Table 1
Table C7		Replace suspended solids Trigger Level of 258 with 1404 mg/L from Table C7 based on the technical study report submitted.	Release limits provided by DES (21/01/23) are accepted by Millennium Mine	The proposed release limits are achievable to facilitate controlled releases of mine-affected water. The conservative nature of the proposed release limits ensures that any releases would not cause impacts to the downstream environmental values.	Section 3.2 Appendix B, Table 2
Schedule D: Groundwater					
Table D1	Mavis UG compliance	Proposed addition of two new monitoring bores to the groundwater monitoring program in Table D1, as a result of the assessment undertaken in accordance with condition D6 and the requirement in condition D7 to update Table D1.	Groundwater monitoring program proposed: Section 3 Table 7 and repeated in Appendix C, Table 4.	Current monitoring network is suitable with proposed two additional bores. In order to avoid any unnecessary disturbance to the groundwater system, the two bores to be included in the network were selected from existing bores of a neighbouring mine. No impacts to the groundwater system are predicted. It is recommended to undertake downhole camera investigation, check or iron bacterial and to re-develop the existing groundwater monitoring bores	Section 3.3 Appendix C. S3.2.3

EA reference	Technical area	Proposed change	Magnitude of change proposed	Level of environmental harm assessed	Where addressed in supporting documentation
				to improve the connection to the screened aquifer section. None of these actions are predicted to have an impact on the groundwater system.	
Table D2	Mavis UG compliance	Proposed amendment of some groundwater contaminant trigger values in Table D2, as a result of the assessment undertaken by SLR in accordance with condition D6 and the requirement in condition D7 to update Table D2.	New trigger limits proposed: Table 8 and repeated in Appendix C, Table 17.	The groundwater contamination trigger levels were developed based on the DES, 2021 Guideline. Using monitoring data to assess groundwater quality and potential environmental impacts. There are no predicted impacts to groundwater from this change of trigger limits. Rather, they will be more suitable to pick up any impact should they occur.	Section 3.3 Appendix C. S3.5
ADMINISTRATIVE CHANGES PROPOSED					
Table C4 Table C8	Table C4: Mine affected water release during flow events. Table C8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points	Remove reference to RP1. This release point no longer exists as there is no release source water Dam.	No discernable impact, as replaced, as covered with current authorisation to release water from the Mavis ROM Dam through to release point RP2 in the EA	No impact due to change. If RP1 and Southern void (which no longer exist) are removed from the EA, dewatered water from the Mavis underground E pit which is currently sent to either B pit water storage Dam or Mavis ROM water storage dam will make it possible to release the water from the Mavis ROM Dam through release point RP2 to New Chum Creek. The change will not cause any additional environmental harm as a result of removing RP1 and Southern void from the EA.	Section 3.3

EA reference	Technical area	Proposed change	Magnitude of change proposed	Level of environmental harm assessed	Where addressed in supporting documentation
		Request removal of Goonyella Gauging Station #130414A (Department of Resources). Gauging station is outside of Millennium Mine ML boundary and site does not have access to it.	Referencing has removed from the Department of Regional Development system and no longer accessible.	No impact due to change. This because the same purpose monitoring is conducted at the Railway Culvert (GS1) as in EA Table C4 and therefore same purpose will be achieved to get the receiving water quality results	Not discussed further in supporting documentation
Table C5	Table C5: Water Storage Monitoring	Request to remove Southern Void reference. The water storage no longer exists and is now an active mining pit	As above for RP1. Mine affected water dam Southern Void is now an active E pit Mavis underground Mining area and no longer exists in our current operations as a mine affected water dam. Also remove Southern void from Table C5 for the same reason	No impact due to change	Not discussed further in supporting documentation
		Request to change Mavis Northern ROM Dam to Carborough ROM Dam.	Naming reference is incorrect as the two are the same.	No impact	Not discussed further in supporting documentation
Condition C22	REMP design document	This obligation has now been fulfilled	REMP design document was submitted to the DES compliance unit on 02/08/2022.	No impact	Not discussed further in supporting documentation
Condition F5	Rehabilitation Management Plan	Remove date (31/12/2020) reference as this obligation has now been fulfilled	No impact as obligation complete	No impact	Not discussed further in supporting documentation
Condition F7	Landform design criteria	Remove date reference (31/12/2020) as this obligation has now been	No impact as obligation complete	No impact	Not discussed further in supporting documentation

EA reference	Technical area	Proposed change	Magnitude of change proposed	Level of environmental harm assessed	Where addressed in supporting documentation
		fulfilled			
Condition F11	Post Closure Management Plan	Remove date reference (31/12/2020) as this obligation has now been fulfilled	No impact as obligation complete	No impact	Not discussed further in supporting documentation

Surface Water assessment

Hydrology

Millennium Mine is located in the Isaac River drainage basin sub-area of the wider Fitzroy Drainage Basin. The Isaac River, to the south-west of Millennium, is the major drainage feature of the region and flows in a southeasterly direction. New Chum Creek runs parallel to Millennium Mine, between the existing Millennium and Mavis open cut pits, and is a tributary of the Isaac River. New Chum Creek and Isaac River are classified as third order and sixth order streams respectively, and both are ephemeral, experiencing short periods of flow following high rainfall events over the summer months.

The catchment area of New Chum Creek is approximately 51 km2, with Millennium Mine, as well as Poitrel and Daunia Mines, located within the catchment. The main channel of New Chum Creek typically has a base width of approximately 3 m and a depth of up to 2 m. Although minor waterholes can persist in the channel for several weeks following high rainfall events, there is little to no aquatic vegetation due to the stream being ephemeral, with streamflow expected to occur less than 30% of the time (Peabody, 2020). New Chum Creek has been diverted downstream as part of a neighbouring mining operation at Poitrel Mine.

The south-western part of Millennium Mine drains south to West Creek, another tributary of Isaac River. The West Creek confluence with the Isaac River is approximately 9 km upstream of that of New Chum Creek. West Creek has a catchment area of approximately 22 km2. West Creek acts as an ephemeral minor watercourse.

Surface water in the area is ephemeral and does not have a groundwater baseflow component (SLR, 2021).

The receiving environment of Millennium Mine includes the New Chum Creek, West Creek and North Creek and connected waterways 10 km downstream of release points which will include the Isaac River. The New Chum Creek is the closest area where water flows during heavy rainfall. The New Chum Creek begins east of the Peak Downs Highway and continues through to the site, bisecting the space between the Millennium and Mavis areas of the site. Flows are generally in the south-east direction through the mine site. The West and North Creeks are tributaries that connect the main New Chum Creek that feed into the Isaac River. There are no Wetlands located within 10 km radius of the Millennium Mine operations.

Proposed EA condition changes

Propose site-specific WQOs for turbidity and suspended solids

In order to meet the requirements with respect to EA conditions described in **Section 1.1** of this report, MetRes contracted C and R Consulting (C&R) to undertake a technical assessment in relation to the proposed new contaminant release limits for turbidity and suspended solids. This assessment informed the updates to EA table C2 and C7 for Mine affected water release limits and receiving waters contaminant trigger levels respectively. Results are presented below and in detail in **Appendix B**.

Based on the specialist technical assessment (**Appendix B**), and consideration of values as provided by the Department (20/01/23), the following calculated release limits and trigger values have been proposed.

The changes affect EA Tables C2 (Mine affected water release limits) and C7 (Receiving water contaminant trigger levels) and is duplicated in Tables 5 and 6 below respectively.

Table 5: Proposed Release limits for mine affected water EA Table C2

EA Table C2 – Mine affected water release limits	
Total Suspended solids (TSS) mg/L	265
Turbidity (NTU)	500

Table 6: Proposed contaminants trigger levels for receiving environment EA Table C7

EA Table C7 – Receiving water contaminant trigger levels	
Total suspended solids (TSS) mg/L	400
Turbidity (NTU)	750

The Mine affected water proposed release limits and REMP trigger values in this amendment as described in section 3 and full details attached in C and R Consulting report (Appendix B) if adopted will not cause any additional environmental harm to the downstream environmental values of the receiving environment. This outcome is further reinforced by the background data for the Isaac River that C&R reviewed in the November 2022 letter (Appendix A) to M Mining.

C&R calculated 50th percentiles for turbidity (933 NTU) and SS (601 mg/L) above the proposed guideline values, suggesting that the levels within the upstream receiving environment are generally above the proposed release limits and therefore any releases in accordance with the limits will not adversely influence the levels of these quality characteristics within the receiving environment. These new proposed values are consistent with the surrounding Companies EA's as also calculated by the Department (DES) (refer to Appendix A and B). Also, generally our current water storage quality levels are consistent with new proposed release limits and trigger values and no additional environmental harm to waters is anticipated in times of water release.

The only exception dam on Millennium Mine site is the Build pad dam which has slightly elevated water quality values. However, this water is circulated to other water dams on site as seen in our water management system flow chart in Figure 1. Therefore, time and dilution factor reduces the elevated water quality numbers to be consistent with the general water quality on site and will not have any special concern.

Impact of proposed changes to the surface water system

As outlined in the sections below, removal of the RP1, Southern Void, change of name from Mavis Northern ROM Dam to Carborough ROM Dam, removal of EA condition 22 will have no bearing with groundwater pollution and no additional environmental impact for groundwater is anticipated.

Removal of RPI, Southern Void

RP1 has its mine affected water release source as the Southern Void which is now the active Mavis underground mining area. Currently there is no permanent mine affected water storage dam at the Mavis E pit as it is currently an active underground mining area. From time to time there is dewatering from this Mavis Underground area and water is sent through to either B pit water storage dam or the Mavis ROM Dam in the water management system. This is presented in Figure 1 below.

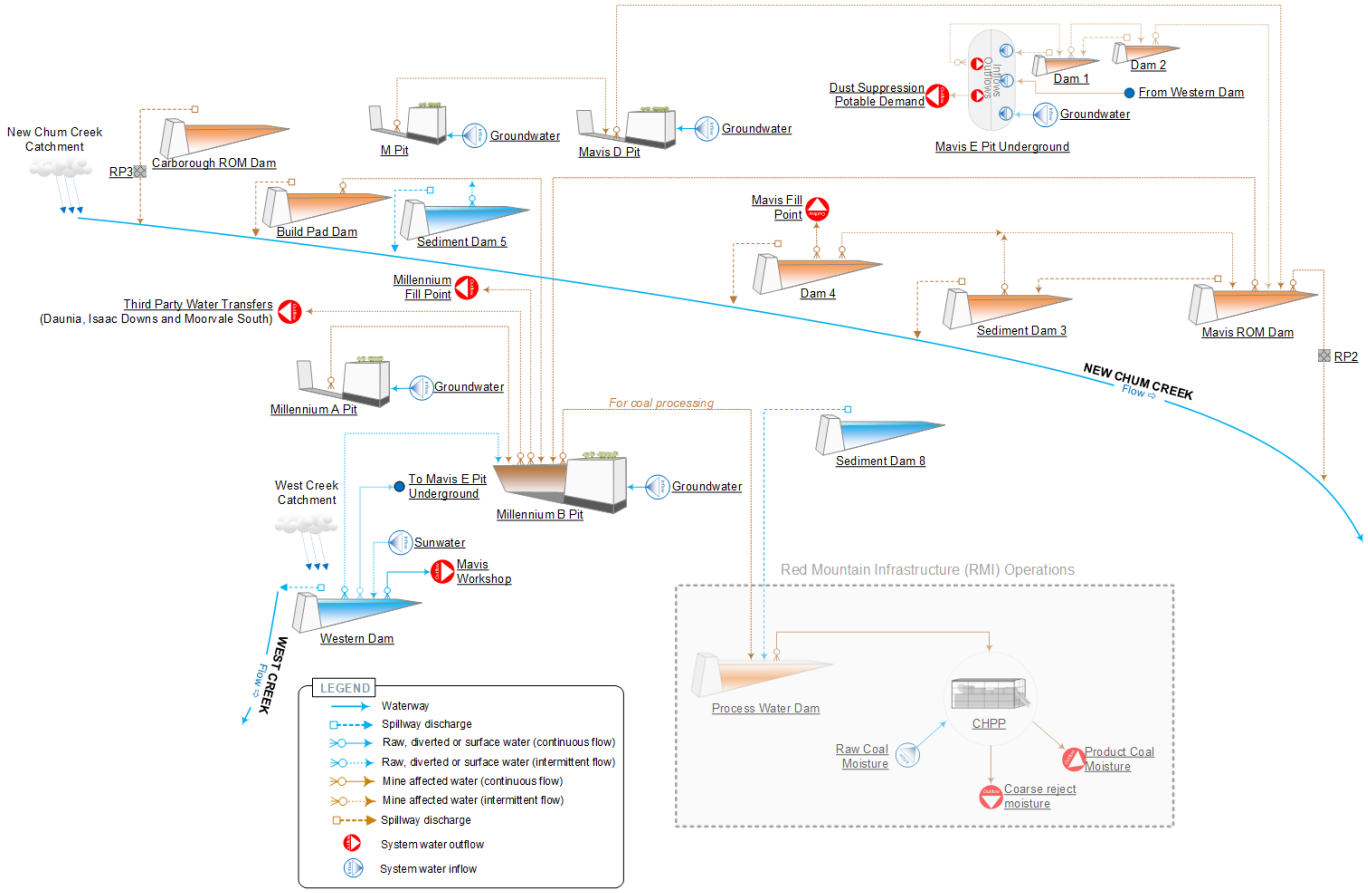

Figure 1: Millennium Mine Water Management System Schematic.

Millennium Mine currently has an authorisation to release water from the Mavis ROM Dam through to release point RP2 in the EA. Therefore, if RP1 and Southern void (which no longer exist) is removed from the EA, dewatered water from the Mavis underground E pit (which is currently sent to either B pit water storage Dam or Mavis ROM water storage dam), will make it possible to release the water from the Mavis ROM Dam through release point RP2 to New Chum Creek. This will not cause any additional environmental harm as a result of removing RP1 and Southern void from the EA.

In addition, dewatered water quality from the Mavis underground E pit area is not different from the Mavis ROM Dam water quality and is not likely to affect the mine affected water release limits in EA Table C2. See Appendix E updated water quality results spreadsheet.

Removal of Goonyella Gauging Station #130414A in EA Table C4

Request for removal of Goonyella Gauging Station #130414A in EA Table C4 as this has been removed from the Department of Regional Development system and no longer accessible and will not cause any additional environmental harm to waters. The receiving environment monitoring is also conducted at the Railway Culvert (GS1) as in EA Table C4 and therefore same purpose will be achieved to get the receiving water quality results.

Request for change of Mavis Northern ROM Dam from EA Table C5 to Carborough ROM Dam Request

Request for change of Mavis Northern ROM Dam from EA Table C5 to Carborough ROM Dam in the naming convention will bring consistency in the EA as Carborough ROM Dam is already mentioned in EA Table C1 and will also match with WaTERS reporting system of the same EA. The name change request will only be an administrative correction and will not add any additional environmental harm to waters and other environmental values on the Millennium Mine site.

Compliance with EA condition 22 regarding REMP design document

EA condition 22 regarding REMP design document was submitted to DES compliance unit on 02/08/2022. This condition has now been fulfilled. REMP is already in place and monitoring is ongoing. Removing of this condition from the EA will only tidy up the EA and bring consistency. Therefore, it is not anticipated there will be any additional environmental harm to waters and other environmental values.

Groundwater assessment

SLR Consulting Australia Pty Ltd (**SLR**) has undertaken a technical review of the proposed EA amendment changes relating to groundwater. Results are presented in full in Appendix C.

The information presented in this supporting documentation is consistent with information presented to DES as part of the EA amendment application lodged 19th December 2022 but has been updated to consider the request for further information as presented in the DES Notice (dated 19/01/23).

Groundwater environment

Millennium is located within the Isaac Connors Groundwater Management Area (GMA) (Zone 34) of the Fitzroy Basin under the Water Plan (Fitzroy Basin) 2011 (DES, 2011). The management objective of the Water Plan (Fitzroy Basin) 2011 is to maintain the 20th, 50th and 80th percentiles water quality results in order to preserve or enhance groundwater quality for its recognised uses. These percentiles are available for 'shallow' bores (less than 30m deep) and 'deep' bores (more than 30m deep).

In the case of Isaac groundwaters, these values include aquatic ecosystems, irrigation, farm supply/ use, stock watering, primary recreation, drinking water as well as being of cultural and spiritual value.
The identified Environmental Values (EVs) of groundwater most applicable to Millennium are listed Appendix C, **Table 9** together with the respective water quality guideline or water quality objective (WQO) that applies to the identified EV. The guideline value for each proposed analyte is listed in Appendix C, **Table 10.**

The Millennium Expansion Project Environment Management Plan (Peabody, 2011) found that groundwater is largely associated with the coal seam aquifers and is neutral to alkaline (pH 7.2 to 8.2) and slightly to highly saline (electrical conductivity (EC) 840 to 25,500 µS/cm). There is no realistic re-use value for this groundwater, either for agricultural, domestic, or industrial purposes.

Three main aquifers exist in the MCM area, though they are not hydrologically connected due to large layers of predominantly impermeable overburden separating the seams, as described below:

- unconfined fractured rock aquifers of the Triassic and Permian coal sediments;
- confined aquifers within Permian coal measure sequences; and
- unconfined aquifers in unconsolidated Quaternary sand and gravel alluvium associated with creeks and rivers.

Groundwater monitoring program

The current groundwater monitoring network at Millennium Mine available to assess impacts from the Mavis UG mine is as per the current EA EPML00819213. It is comprised of one groundwater bore targeting the Permian Rangal Coal Measures and six groundwater bores targeting the Permian Fort Cooper Coal Measures. The locations of groundwater bores in relation to Mavis UG area are shown in **Figure 2**, together with the mapped surface geology.

Based on the technical report for the groundwater (**Appendix C**), new EA Tables D1 and D2 have been proposed and as duplicated below in Tables 7 and 8.

Note that the two new additions for the groundwater bores CS_MB2 and CS_VWP1 are located in Carborough Downs Mining Lease. However, Millennium Mine has data sharing agreement (**Appendix D**) with Carborough Downs Mines and will be able to obtain the quarterly results.

To addresses Condition D6 of EA EPML00819213, it is recommended to:

- Expand the coverage of the Mavis UG monitoring network to capture the predicted groundwater drawdown impacts in the areas where potential changes to the groundwater regime can be attributed to Mavis UG mining activities. In particular, the areas related to the low potential terrestrial GDE associated with North Creek and to the Rangal CM (Leichhardt Seam) to the east and north of Mavis Pit should be captured by the Mavis UG monitoring network:
  - Include the piezometer CS_VWP1 and bore CS_MB2 from the Carborough Downs mine groundwater network in the Mavis UG groundwater monitoring network, in order to target the areas listed above; and
  - Undertake logger downloads at CS_VWP1 and manual water level monitoring at CS_MB2 on a quarterly basis.

As part of the full water quality monitoring suite, in addition to collecting field parameters (EC and pH), water samples will be submitted to a NATA accredited laboratory for the analysis of:

- Physiochemical indicators (TDS);
- Major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate and carbonate);
- Total and dissolved metals: aluminium, iron, copper, zinc, silver, arsenic, mercury, antimony, molybdenum and selenium; and
- Total petroleum hydrocarbons (C6-C9, C10-C14, C15-C28 and C29-C36) with silica gel clean-up.

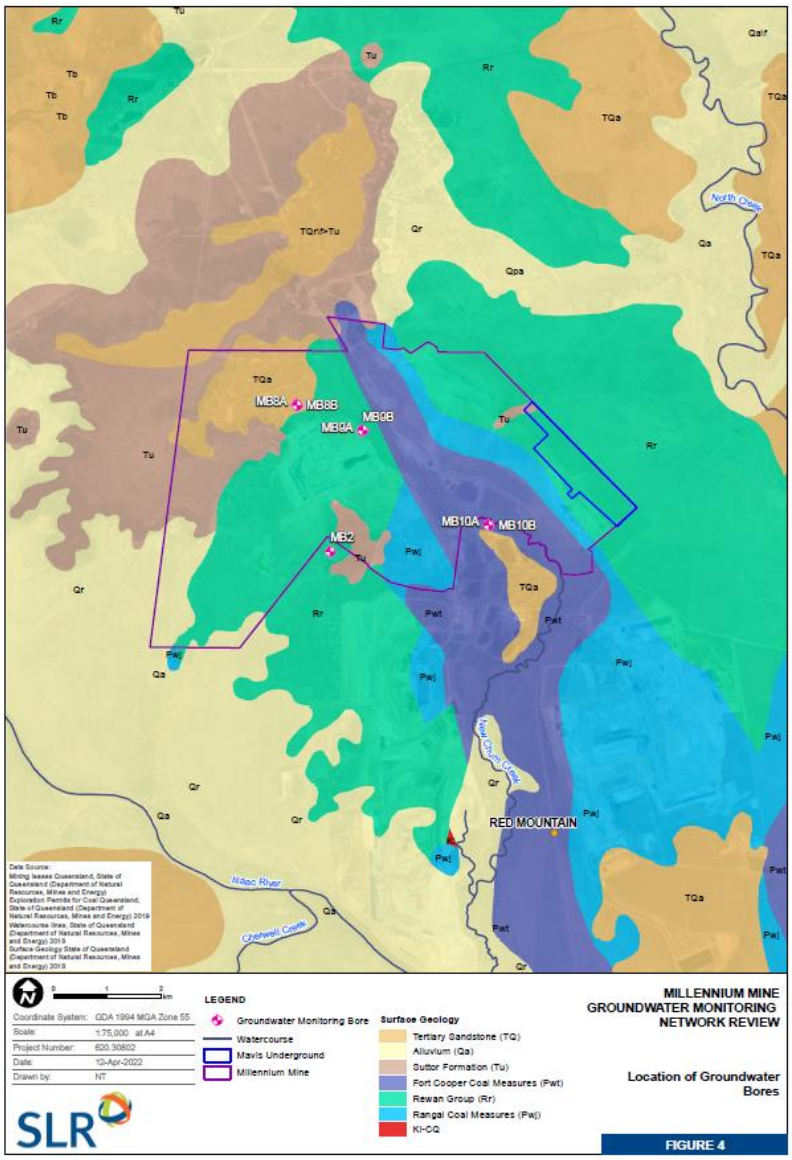

Figure 2: Existing groundwater bore network (SLR, 2023)

Proposed EA condition changes

Proposed groundwater monitoring network and ground water management plan

The proposed groundwater monitoring locations for compliance with the EA to assess impacts of the Mavis UG mine are presented in **Table 7** and **Figure 3.** The locations have been based on the assessment of potential impacts (SLR, 2021) as well as the suitability of the current network and Carborough Downs groundwater monitoring network. **Table 7** presents the groundwater monitoring names with their depth and target aquifer, and locations are shown on **Figure 3**.

For the Carborough Downs monitoring bores, CS_MB2 and CS_VWP1, the proposed monitoring frequency is quarterly. These two bores are monitoring water levels only as per their original purpose.

Justification for the proposed monitoring network is provided in **Appendix C, Sections 3.2.**

Table 7: Proposed new EA Table D1 (SLR, 2023)

Monitoring Site ID	Latitude (GDA 94)	Longitude (GDA 94)	Bore Depth (mBGL[1])	Target Aquifer	Monitoring Frequency	Status	Sampling
MB2	22° 10′ 49″ S	148° 14′ 18″ E	90	Permian Rangal	Quarterly	Existing	SWL
MB8A	22° 00′ 27″ S	148° 14′ 20″ E	30	Fort Cooper CM - Sandstone	Quarterly	Existing	SWL and Quality
MB8B	22° 00′ 27″ S	148° 14′ 20″ E	80	Fort Cooper CM - Sandstone	Quarterly	Existing	SWL and Quality
MB9A	22° 00′ 34″ S	148° 14′ 43″ E	30	Moranbah Coal Seam	Quarterly	Existing	SWL and Quality
MB9B	22° 00′ 34″ S	148° 14′ 43″ E	80	Moranbah Coal Measures Sandstone	Quarterly	Existing	SWL and Quality
MB10A	22° 10′ 33″ S	148° 16′ 00″ E	35	Fort Cooper Sandstone	Quarterly	Existing	SWL and Quality
MB10B	22° 10′ 33″ S	148° 16′ 00″ E	80	Fort Cooper Sandstone	Quarterly	Existing	SWL and Quality
CS_MB2	22° 1' 10"S	148° 17' 16"E	170	Rangal CM (Leichhardt Seam)	Quarterly	**Recommended for inclusion**	SWL only
CS_VWP1	21° 59' 55"S	148° 16' 56"E	196	Sensor 1 - Rewan group Sensor 2 - Permian overburden Sensor 3 - Rangal CM (Leichhardt Seam)	Quarterly	**Recommended for inclusion**	SWL only

1.Metres below ground level
2.MB8A/B could be either attributed to the Rewan Formation or to the overburden of the Rangal Coal measures, to be confirmed with a site geologist (SLR, 2021)
3.SWL= standing water level

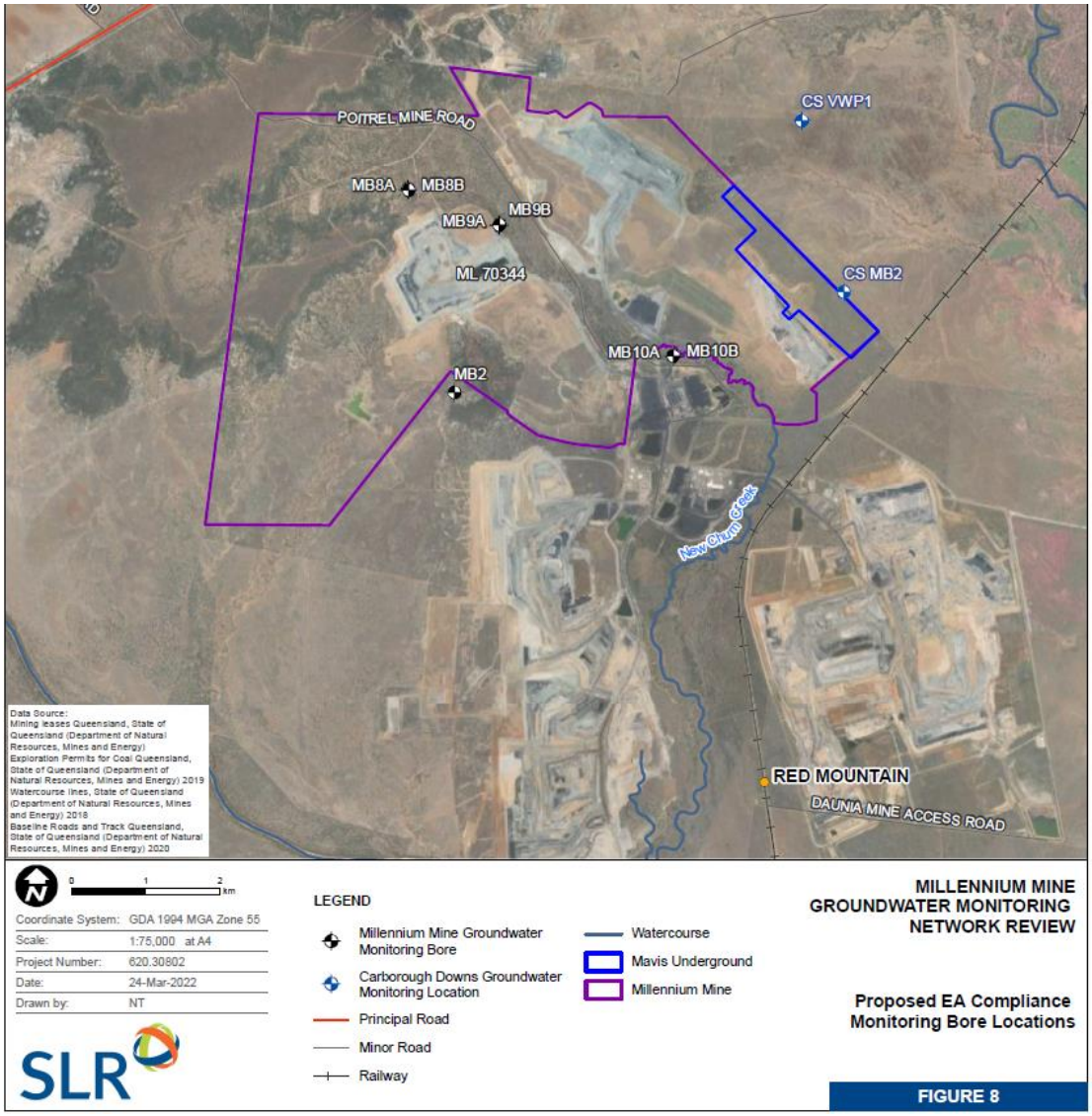

Figure 3: Proposed groundwater bore locations (SLR, 2023)

Groundwater quality parameters

A review of the data collected in the groundwater sampling network was undertaken and opportunities for improvements in data collection were identified. Review findings are presented in **Appendix C, Section 3.4**.

The current EA groundwater quality trigger limits were developed in the early 2010s. Since then, DES has published the guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021), which describes a more modern approach to derive trigger limits based on monitoring data.

The analytes with their current trigger limit and limit type are listed in **Table 8.** In the last column, a comment has been included on the applicability of the trigger and analytes, in the context of DES (2021). It is proposed to remove trigger limits for major ions (except chloride and sulfate), TDS, total suspended solids (TSS) and chlorine.

It is further proposed to add copper and zinc to the analytes list. The trigger limits for the metals will be derived for the dissolved concentrations.

The final proposed water quality trigger limits are presented in Table 8 with justification provided in Appendix C, Section 4.3. As per the chosen approach (Appendix C, **Section 4.4.2**), three consecutive exceedances would result in a non-compliance and trigger an investigation.

Impact of proposed changes to the groundwater

All items addressed in this supporting documentation were stipulated by the current EA Condition D6:

For the Mavis underground operations, an assessment by an appropriately qualified person must be undertaken to determine the following: a) Number and location of groundwater monitoring sites; b) Suitability of the monitoring network; and c) Groundwater contaminant trigger levels.

Table 9 summarises the predicted impacts of the proposed changes to the network and the trigger limits.

No impacts to the groundwater system are predicted as a result of the proposed EA amendment changes.

Table 9: Detailed environmental impact assessment for groundwater in the proposed amendment.

Condition D6	Impact
Number and location of groundwater monitoring sites	The number of bores was increased by two. In order to avoid any unnecessary disturbance to the groundwater system, the two bores to be included in the network were selected from existing bores of a neighbouring mine. No impacts to the groundwater system are predicted. Millennium Mine has a data sharing agreement in place to receive the data at a regular frequency.
Suitability of the monitoring network	The network was reviewed for suitability. Some bores showed signs of the potential presence of iron bacteria and potential sedimentation (turbid samples). SLR Consulting has recommended to undertake downhole camera investigation, check or iron bacterial and to re-develop the existing groundwater monitoring bores to improve the connection to the screened aquifer section. None of these actions are predicted to have an impact on the groundwater system. The airlifting will produce some groundwater to the surface. The water quality in all bores is unimpacted and as such, no impact to the surface environment is predicted. An exception is the salinity, but given this naturally occurring and they are no sensitive receptors near the bores, no impact is predicted. If the airlift water is a concern, it could alternatively be captured.

Condition D6	Impact
Groundwater contaminant trigger levels.	The groundwater contamination trigger levels were developed based on the DES, 2021 Guideline. Using monitoring data to assess groundwater quality and potential environmental impacts. The methodology allows to set triggers either site based or based on guideline values. This approach results in suitable triggers limits that will pick up any changes in groundwater quality. There are no predicted impacts to groundwater from this change of trigger limits. Rather, they will be more suitable to pick up any impact should they occur.

Table 8: Proposed Trigger Limits for EA Table D2

Water Quality Guideline	Field pH	Field EC	Sulfate as SO4	Cl[1]	Al[1]	Sb[1]	As[1]	Cu[1]	Hg[1]	Mo[1]	Se[1]	Ag[1]	Zn[1]	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	(µg/L)	(µg/L)
MB08B	6.0-7.5	24240	483	8520	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.317	20	100
MB09A	6.0-7.5	20329	109	6785	0.055	0.009	0.013	0.030	0.0006	0.034	0.011	below LOR	0.060	20	100
MB09B	6.0-7.5	16000	79	5905	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.008	20*	100
MB10A	6.0-7.5	3998	75	789	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.060	20	100
MB10B	6.0-7.5	10265	174	5905	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.008	20*	100

4 Other considerations

Land

All amendments seeking change (as listed in section 3, Table 4) do not involve any clearing of vegetation or excavation of land. Therefore, no land will be affected as a result of this EA amendment.

Land use

The area surrounding Millennium Mine is classified as "grazing native vegetation" in Queensland Globe (2023). The closest sensitive receptors are shown in Table 7.
This amendment such as the new water quality parameters proposed will not cause any potential environmental harm to the current land uses.

Air and Acoustics

Sensitive receptors in the vicinity of Millennium Mine include individual residences or homesteads as well as the Towns of Moranbah and Coppabella. This is shown in Table 10 below;

Table 10: Nearest sensitive receptors to the Millennium Mine

Sensitive Receptor	Description	Distance and direction from Millennium Mine
Most affected receptors in Millennium's Project EIS		
Annandale	Homestead	6.8 km north-northeast
Moorvale	Homestead	6.3 km north-northeast
Winchester Downs	Homestead	9 km south-southwest
Watonga	Homestead	4.8 km West
Broadlea	Homestead	7.7 km northwest
Other Receptors		
Moranbah	Town	13.8 km west
Coppabella	Town	13.8 km northeast
Wanella	Homestead	15.3 km northeast
Mavis Downs	Homestead	5.7 km east
Daunia	Homestead	8.0 km southeast
Olive Downs	Homestead	9.1 km south-southeast
Coolibah	Homestead	12.0 km southwest
Kurrali Park	Homestead	14.8 km west-southwest
Grosvenor Downs	Homestead	12.8 km west
Moranbah	Homestead	11.1 km west

There are eight main sensitive receptors within 10 km of Millennium Mine. The closest is the Watonga Homestead which is 4.8 km West of the Mine.

All amendments (as listed in Section 3, Table 4) do not involve changes to currently approved activities relating to air and noise values. Therefore, no additional potential environmental harm to air and noise environmental values will be affected as a result of this EA amendment.

Waste

The proposed amendment described in section 3 above is not associated with additional waste generation.

All amendments seeking change (as listed in Section 3, Table 4) do not involve change to currently approved activities relating to waste. Therefore, no change is required to approved waste management practices for Millennium Mine.

Risk and Impact

This amendment as described in section 3 will not be associated with any additional risks and impacts to surface water, groundwater, land, waste and others. Rather groundwater monitoring network will be optimised and in general the EA will be improved.

Management and Mitigation Practices

In general, this amendment is not expected to introduce any additional environmental impact to surface water, groundwater, land, waste, etc. to be managed differently other than the current environmental management practices on site. Therefore, current Environmental management plans and systems will still be relevant and same will be used such as waste management plan, water management plan, Erosion, and sediment control management plan, etc.

Rehabilitation

This requested amendment will not bring any changes to the rehabilitation objectives of the site. Therefore, the existing Rehabilitation Management Plan will still be relevant and remain unchanged as an outcome of the proposed amendments (Section 3, Table 4).

Reef Discharge Standards

The Reef Discharge Standards are described in section 41AA of the Environmental Protection Regulation 2019 and apply to EA applications where there are proposed impacts to the Great Barrier Reef (GBR) catchment waters or other coastal waters from the release of fine sediment and dissolved inorganic nitrogen. The guideline *Reef discharge standards for industrial activities* (ESR/2021/5627) (the Reef Discharge Guideline) describes how the standards will be applied and assessed.

This EA amendment has no impacts to the Great Barrier Reef and therefore Reef discharge standards does not apply to this amendment.

5 Regulatory Requirements

5.1 EA amendment assessment level decision

Under s.228 of the EP Act, the Department as the administering authority, must decide whether the proposed amendment to the EA is a minor or a major amendment.

Reference has been made to the DES Guideline 'Major and minor amendments' (ESR/2015/1684, version 10.01) (DES, 2022). The threshold criteria for a minor EA amendment and their relevance for the proposed EA amendment are described in Table 9.

Based on this analysis, MetRes is of the view that the proposed EA amendment is a 'minor' EA amendment.

Table 9: Minor Amendment Criteria

Minor amendment (threshold) criteria	Proposed Amendment
Is not a change to a condition identified in the authority as a standard condition.	NO There are no standard conditions as the Millennium EA was approved under a site-specific application.
Does not significantly increase the level of environmental harm caused by the relevant activity.	NO As confirmed in Section 3, the proposed amendments will not result in any additional contamination to receiving surface waters, will not result in any additional releases or emissions to groundwater or land, and will not result in any additional environmental harm to air and noise environmental values. This EA amendment will not increase the level of environmental harm caused by the activity. The existing disturbance will not increase by the 10% threshold. Also, as per the SLR report no other significant environmental harm is expected in terms of the groundwater network changes.
Does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority.	NO This EA amendment will not change the existing rehabilitation objectives of the Millennium Mine site.
Does not significantly increase the scale or intensity of the relevant activity.	NO The proposed amendment will not introduce any additional disturbance or undermine the monitoring regime of the environmental management requirements.

Minor amendment (threshold) criteria	Proposed Amendment
Does not relate to a new relevant resource tenure for the authority that is- a) a new mining lease; b) a new petroleum lease; c) a new geothermal lease under the Geothermal Energy Act; or d) a new GHG injection and storage lease under the GHG storage Act.	NO This EA Amendment does not relate to a new resource tenure.
Involves an addition to the surface area for the relevant activity of no more than 10 % of the existing area.	NO The proposed amendment will not introduce any additional disturbance of the surface area.
For an environmental authority for a petroleum activity- a) involves constructing a new pipeline that does not exceed 150 km b) involves extending an existing pipeline so that the extension does not exceed 10 % of the existing length of the pipeline.	NO The EA does not relate to a petroleum activity.
If the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit – seeks, in the amendment application under section 224, an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	NO The amendment does not relate to a new resource tenure.

From this self-assessment, the activities relating to the proposed EA amendment (both the amendments to the conditions for compliance under the EA, and minor administrative amendments) are in accordance with a minor amendment application. In addition, consideration of what defines a significant impact has been considered in this supporting documentation to further support this self-assessment for a minor amendment decision level.

Additional consideration is provided below in relation to considerations for a major amendment application as set out in the Department's Guideline 'Major and minor amendments' (ESR/2015/1684 Version 10.01, May 2022). Table 9 demonstrates that the proposed EA amendment does not trigger a major amendment.

Table 10: Major Amendment considerations (DES, 2022)

The following matters will usually be significant, and therefore be assessed as major amendments	**Relevance to proposed Amendment**
Increasing impacts to Category A or B environmentally sensitive areas	No
Increasing impacts to waters with limited assimilative capacity measured against environmental values and management objectives as prescribed in the Environmental Protection (Water) Policy 2019 (e.g. a discharge to a river which is already not meeting the required water quality objectives prescribed in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019)	No
Increasing impacts to air quality such that the air quality objectives in the Environmental Protection (Air) Policy 2019 may not, or will not be achieved.	No
Increasing noise emissions such that the acoustic quality objectives in the Environmental Protection (Noise) Policy 2019 may not, or will not be achieved	No

The following matters will usually be significant, and therefore be assessed as major amendments	**Relevance to** proposed Amendment
Increasing scale and nature of disturbances by a prescribed activity that will, or are likely to, result in a significant residual impact on a prescribed environmental matter (Note - these changes may trigger a requirement for an offset under the *Environmental Offsets Act 2014*)	No
Diverting a natural watercourse	No
Changing fuel type being used (i.e. from gas to coal or coal to waste)	No
Discharging contaminants directly to groundwater	No
Deeper extraction that intersects groundwater or where the depth of groundwater is not known	No
Increasing the height or area of a mine tailings dam by more than 10% of the existing height or area of that dam	No
Constructing and/or operating a new coal seam gas brine dam	N/A
Using emerging technologies (e.g. a new type of mining)	No
Changes to the final landform design that compromise landform stability and increase erosion potential (e.g. increasing the gradient of final slopes)	No
Changes which are part of staged development	No
A 5% volume increase of waste production with potentially acid forming or neutral mine drainage properties	No
A change in the type of minerals being mined	No
A change of a post-mining land use for an area	No
The addition of a mining lease to an EA, due to the increase in the risk of environmental harm	No
Discharging contaminants which differ to those authorised in the existing EA	No
Increasing emissions to the environment either by substantial volume or concentration or load	No
Changing the final rehabilitation acceptance criteria for an activity to a lower standard such that proposed rehabilitated land has a lower environmental value than that originally authorised in the existing EA	No
Moving a contaminant release location to a place with different environmental values	No
Using different industrial processes which will result in different emissions and impacts which are not authorised by the EA	No
Changing the design of an engineered capping layer to be installed over a waste rock dump	No
Increasing annual throughput for the relevant activity beyond that authorised in the existing EA	No
Increasing the quantity of chemicals, hazardous materials or wastes stored on the site beyond that authorised in the existing EA	No
Increasing operating hours into evening hours and Sundays where not previously authorised in the existing EA and the site of the activity(ies) is within close proximity to sensitive receptors.	No

5.2 Public Notification

Section 230 of the EP Act states the circumstances for when public notification may apply to major EA amendments. Given that this EA amendment is likely to be a minor amendment it is anticipated that no public notification will be required.

References

Application requirements for activities with impacts to air (ESR2015/1840, version 4.04) (DES, 2021a);

Application requirements for activities with impacts to land (ESR/2015/1839, version 4.03) (DES, 2021b);

Application requirements for activities with impacts to water (ESR2015/1837, version 4.04) (DES, 2021c);

Application requirements for activities with noise impacts (ESR2015/1838, version 3.06) (DES, 2022a);

Application requirements for activities with waste impacts (ESR2015/1836, version 5.02) (DES,2021d); and

Requirements for site-specific and amendment applications – underground water rights (ESR/2016/3275, version 1.03) (DES, 2021).

Groundwater Network and Trigger Review Report for Millennium Mine, (SLR, 2023).

Appendix A: C&R Consulting Background review

Appendix B: C&R Consulting. Environmental Authority Table C2 and Table C7 Amendment. Memo. 31 January 2023.

Appendix C: SLR Consulting Australia Pty Ltd. Groundwater Network Review and Trigger Assessment. February 2023. Reference: SLR Ref No: 620.30802.00000-R02-v3.0-20230202

Appendix D: Data sharing agreement with Carborough Downs Mines

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13 November 2022

Francis Kuranchie
Environmental Superintendent
Millennium Mine
M Mining Pty Ltd

Dear Mr Kuranchie,

Re: Environmental Authority Table C2 Amendment

M Mining Pty Ltd (M Mining) are in the process of amending the contaminant release limits for turbidity and suspended solids (SS) (in '*Table C2: Mine affected water release limits'*) in the Millennium Mine (MM) environmental authority (EA) EPML00819213. Currently, the contaminant release limits within Table C2 for turbidity and SS are listed as '*TBA*' (i.e. 'to be advised'). The footnote below Table C2 within the EA states that M Mining must amend the contaminant release limits for these two quality characteristics prior to 7 December 2022.

Consequently, M Mining requested the assistance of C&R Consulting Pty Ltd (C&R) in determining appropriate site-specific levels of turbidity and SS to ensure the protection of downstream environmental values. The receiving environments of MM are stated within the EA as New Chum Creek, West Creek and North Creek – as well as any connected waterways within 10 km downstream of the release points. Therefore, the receiving environments include the Isaac River.

In a letter dated 23 August 2022, C&R provided M Mining an assessment of background water quality from the Isaac River to meet data requirements for deriving site-specific water quality objectives in accordance with the *Queensland water quality guidelines* (DEHP, 2009[1]), ANZECC and ARMCANZ, 2000[2] and DES, 2021[3]. The letter proposed contaminant release limits for turbidity and SS based on the 80th percentiles of the background data to be submitted to the Department of Environment and Science (the Department).

Subsequently, M Mining has advised C&R that the Department provided feedback on the proposed contaminant release limits, requesting any available background data from New Chum Creek and the

[1] DEHP (2009) *Queensland water quality guidelines*, Version 3. Department of Environment and Heritage Protection, Queensland. ISBN 978-0-9806986-0-2, pp. 184..
[2] ANZECC and ARMCANZ (2000). *Australian and New Zealand guidelines for fresh and marine water quality.* National Water Quality Management Strategy. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
[3] DES (2021). *Using monitoring data to assess groundwater quality and potential environmental impacts. Version 2*. Department of Environment and Science (DES), Queensland Government, Brisbane, pp. 60.

receiving waters contaminant trigger level for SS (258 mg/L) from Table C7 of the EA, be considered when determining the release limits.

Table 1 below provides summary statistics for background (i.e. upstream of M Mining operations) samples collected from New Chum Creek or its tributaries in 2021 and 2022. The validity of the data were questioned and, subsequently not included in the initial assessment undertaken by C&R (detailed in the letter dated 23 August 2022), as many of the results are from rising stage samplers or gauging stations, where samples can sit for long periods before being assessed by the laboratory. Further, many of these samples were collected from tributaries of New Chum Creek and were not sampled from the New Chum Creek reference point designated within the EA (i.e. MP1; Table 1).

Table 1: Summary statistics for background samples collected from New Chum Creek.

Date	Sample ID	Turbidity (NTU)	Suspended Solids (mg/L)
17/06/2021	GS_MP_US3_3	362	162
17/06/2021	GS_MP_US3_2	593	396
18/06/2021	RSS1	2,160	1,460
18/06/2021	GS_MP_US3_1	1,190	367
18/06/2021	RSS2	1,450	330
17/06/2021	NCGULLY	1,210	437
6/07/2021	RSS1	1,380	550
3/07/2021	GS_MP1-1	858	435
15/11/2021	GS1_MP1_AS	1,650	1,760
15/11/2021	RSS1	2,350	960
2/07/2022	US Access Road	329	154
Descriptive statistics			
Count		11	11
Minimum		329	154
50th percentile		1,210	435
80th percentile		1,650	960
95th percentile		2,255	1,610
Maximum		2,350	1,760
Mean		1,230	637
Standard deviation		638	506
Coefficient of variance		52%	79%
Outlier identifier		3,782	2,661

The summary statistics reveal that the minimum background SS for New Chum Creek (329 mg/L) is greater than the current receiving waters contaminant trigger level (258 mg/L as outlined in Table C7 of the EA). This suggests that MM is unlikely to meet this downstream objective during natural flow

events (i.e. regardless of undertaking releases), and that the current receiving waters contaminant trigger level (from EA Table C7) may not be suitable. It is not known how the 258 mg/L trigger level detailed for SS in Table C7 of the EA was developed. However, it is highly recommended that this value also be amended to the 80th percentile of reference site(s), equivalent to the proposed release objective.

Table 2 compares the summary statistics for New Chum Creek to those developed for the Isaac River (from the initial C&R letter dated 23 August 2022), while also providing statistics for a pooled dataset of both watercourses. Table 2 shows that there are differences between the median (50th percentile) values of the two watercourses' datasets (for both quality characteristics) but these differences are within the standard deviation range of each dataset. Based on these results an independent samples test was performed on each quality characteristic, comparing the datasets from New Chum Creek and Isaac River. Table 3 shows that while there appears to be a significant difference in the variance of the two datasets for turbidity (i.e. a significant result for Levene's test), there is no significant difference between the means of either dataset for each quality characteristic (i.e. $p > 0.05$ for both t-test results). This suggests that the two datasets are similar and can be combined to develop site-specific objectives. Therefore, if the validity of the New Chum Creek data are ignored, it is appropriate to adopt the 80th percentile of the pooled dataset as the site-specific trigger levels for turbidity and SS within EA Table C2, as well as for SS in Table C7.

Table 2: Summary statistics for background samples collected from New Chum Creek and Isaac River.

Statistic	New Chum Creek	Isaac River	Pooled data
Turbidity (NTU)			
Count	11	25	36
Minimum	329	169	169
50th percentile	1,210	933	1,145
80th percentile	1,650	2,314	2,160
95th percentile	2,255	3,716	3,513
Maximum	2,350	5,210	5,210
Mean	1,230	1,451	1,384
Standard deviation	638	1,322	1,161
Coefficient of variance	52%	91%	84%
Outlier identifier	3,782	6,738	6,028
Suspended solids (mg/L)			
Count	11	24	35
Minimum	154	21	21
50th percentile	435	601	437
80th percentile	960	1,574	1,404
95th percentile	1,610	3,160	2,940
Maximum	1,760	4,780	4,780

Statistic	New Chum Creek	Isaac River	Pooled data
Mean	637	1,023	902
Standard deviation	506	1,188	1,039
Coefficient of variance	79%	116%	115%
Outlier identifier	2,661	5,774	5,058

Table 3: Independent samples test results to determine the significant difference between the two sets of data (i.e. New Chum Creek data and Isaac River data).

Quality characteristic		Levene's Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean diff.	Std. err. diff.	95% CI	
									Lower	Upper
Turbidity	Equal variances assumed	4.812	.035	-.513	34	.611	-220.94	430.57	-1095.97	654.09
	Equal variances not assumed			-.656	33.33	.516	-220.94	336.89	-906.09	464.22
Suspended solids	Equal variances assumed	3.983	.054	-1.004	33	.323	-385.47	383.84	-1166.39	395.45
	Equal variances not assumed			-1.307	32.99	.200	-385.47	294.84	-985.33	214.39

Where:
F = the test statistic of Levene's test.
Sig. = the p-value corresponding to Levene's test statistic (we assume a p-value of <0.05 is a significant relationship).
t = the t-test statistic.
df = degrees of freedom.
Sig. (2-tailed) = p-value corresponding to the given t-test statistic and degrees of freedom.
Mean diff. = difference between the sample means.
Std. err. diff. = standard error of the mean difference estimate.
CI = confidence interval.

If you have any further questions, please do not hesitate to contact me.

Regards,

Matt Knott

Senior Scientist/Manager
C&R Consulting Pty Ltd

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31 January 2023

Francis Kuranchie
Environmental Superintendent
Millennium Mine
M Mining Pty Ltd

Re: Environmental Authority Table C2 and Table C7 Amendment

Dear Mr Kuranchie,

M Mining Pty Ltd (M Mining) are in the process of amending the contaminant release limits for turbidity and suspended solids (SS; in '*Table C2: Mine affected water release limits'*) in the Millennium Mine (MM) environmental authority (EA) EPML00819213. Currently, the contaminant release limits for turbidity and SS within Table C2 are listed as '*TBA*' (i.e. 'to be advised'). The footnote below Table C2 within the EA states that M Mining must amend the contaminant release limits for these two quality characteristics prior to 7 December 2022.

Consequently, M Mining requested the assistance of C&R Consulting Pty Ltd (C&R) in determining appropriate, site-specific water quality objectives (WQOs) for turbidity and SS, based on a provided background dataset, to ensure the protection of downstream environmental values. The receiving environments of MM are stated within the EA as New Chum Creek, West Creek and North Creek – as well as any connected waterways within 10 km downstream of the release points. Therefore, the receiving environments also include the Isaac River.

Environmental values of the receiving environment

Draft environmental values have been developed under the framework of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water and Wetland Biodiversity) for the Fitzroy Basin (Department of Science, Information Technology and Innovation [DSITI], 2017[1]). DSITI (2017) separates the Isaac River sub-basin into several smaller environmental value zones, with Millennium associated with the *Isaac northern tributaries* and the *Isaac and lower Connors River main channel* zones. These two environmental value zones have the same allocated environmental values, which include:

- Aquatic ecosystems;
- Irrigation;
- Farm supply;
- Stock water;
- Human consumer;

[1] DSITI (2017). *Draft environmental values and water quality guidelines: Fitzroy Basin fresh, estuarine and marine waters, including Keppel Bay*. Newham, M., Moss, A., Moulton, D., Honchin, C., Thames, D., Shrestha, K., Elledge, A. Department of Science, Information Technology and Innovation, Queensland Government.

- Primary recreation;
- Secondary recreation;
- Visual recreation;
- Drinking water;
- Industrial use; and
- Cultural and spiritual values.

Based on these environmental values, the EPP Water and Wetland Biodiversity outlines the level of protection (or management intent) required to maintain these values (DSITI, 2017).

The EPP Water and Wetland Biodiversity outlines the management framework applicable to different aquatic ecosystems. The framework provides threshold levels of change that are acceptable for each aquatic ecosystem condition and involves maintaining the waters in good condition and seeking to sustainably manage water quality in modified waters (DSITI, 2017).

DSITI (2017) characterises the management intent for most of the Isaac/Connors River sub-basin (including the MM mining leases and receiving environment) as moderately disturbed. For moderately disturbed systems (*waters in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree*; EPP Water and Wetland Biodiversity), the intent is to achieve specified WQOs and – where appropriate WQOs do not exist – develop site-specific WQOs (DSITI, 2017).

Proposed site-specific WQOs for turbidity and SS

In a letter dated 13 November 2022 (C&R, 2022[2]), C&R provided M Mining an assessment of background water quality from New Chum Creek and the Isaac River against the data requirements for deriving site-specific WQOs in accordance with the *Queensland water quality guidelines* (DEHP, 2009[3]), ANZECC and ARMCANZ (2000[4]) and DES (2021[5]). The letter proposed contaminant release limits for turbidity and SS based on the 80th percentiles of the pooled background data (combined data from New Chum Creek and the Isaac River) to be submitted to the Department of Environment and Science (the Department), although the validity of background data from New Chum Creek was questioned. The site-specific derived WQOs for turbidity and SS were 2,160 NTU and 1,404 mg/L, respectively. Because these values were far greater than those provided within Table C7 of the EA for the receiving environment, C&R further recommended that Table C7 also adopt 2,160 NTU and 1,404 mg/L for turbidity and SS, respectively.

Following submission of the supporting information (including the C&R letter) to the Department (for the proposed EA amendment application), the Department provided feedback on the proposed contaminant release limits / WQOs, within an email dated 20 January 2023 from Team Leader Kathryn Eller. The email stated that the Department was able to review additional data (not available to C&R) collected from New Chum Creek by neighbouring mines (Poitrel Mine and Red Mountain Mine) that further reinforced C&R's initial findings about the questionable validity of M Mining's New Chum Creek

[2] C&R (2022). Letter: *Turbidity and TSS Release Limits,* Version 2. 13 November 2022.
[3] DEHP (2009). *Queensland water quality guidelines*, Version 3. Department of Environment and Heritage Protection, Queensland. ISBN 978-0-9806986-0-2, pp. 184..
[4] ANZECC and ARMCANZ (2000). *Australian and New Zealand guidelines for fresh and marine water quality.* National Water Quality Management Strategy. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
[5] DES (2021). *Using monitoring data to assess groundwater quality and potential environmental impacts. Version 2.* Department of Environment and Science (DES), Queensland Government, Brisbane, pp. 60.

background dataset. Therefore, the Department suggested that the site-specific WQOs determined by C&R were unsuitable.

Instead, the Department proposed release limits for Table C2 (Table 1) and receiving environment trigger levels for Table C7 (Table 2) based on turbidity limits already imposed within EAs of neighbouring mines – and the SS values then determined via a correlation equation using the background dataset for New Chum Creek. C&R have various concerns with this approach / the Department's derived values, including:

- Unlike the site-specific WQOs developed by C&R, the proposed criteria are not derived using best-practice guidelines such as ANZECC and ARMCANZ (2000) or DEHP (2009[6]), nor have more rigorous statistical analysis – such as those recommended in DES (2021) – been applied.
- The proposed turbidity WQOs – that the SS WQOs are based on – are arbitrary values that are not based on site-specific data.
- The Department determined the SS WQOs based on a correlation factor with turbidity that was derived using a background dataset for New Chum Creek that the Department stated was inappropriate for developing site-specific WQOs from. It is unclear how this dataset can be relied on for a correlation value if its validity has already been questioned.
- The correlation figure provided by the Department showing the line-of-best-fit and the associated equation does not provide the corresponding R-value and p-value for the line to allow C&R to determine the effectiveness of the equation for the proposed use. From reviewing the figure, the correlation appears to be poor at higher levels of both SS and turbidity. This is not unexpected because additional factors can influence turbidity that do not affect SS and vice-versa, and this is generally accentuated at higher values.
- It is noted that the Poitrel Mine EA has adopted the arbitrary 500 NTU turbidity limit for releases and 750 NTU for receiving environment contaminant trigger level. However, no SS values have been imposed on Poitrel Mine at this stage, with the EA simply stating that site-specific SS WQOs must be developed when sufficient suitable data are available. This may also be an approach for MM.

Table 1: The Department's proposed release limits for EA Table C2.

EA Table C2 – Mine-affected water release limits	
Total suspended solids (mg/L)	265
Turbidity (NTU)	500

Table 2: The Department's proposed amendments to EA table C7.

EA Table C7 – Receiving water contaminant trigger levels	
Total suspended solids (mg/L)	400
Turbidity (NTU)	750

[6] DEHP (2009). *Queensland water quality guidelines,* Version 3. Department of Environment and Heritage Protection, Queensland. ISBN 978-0-9806986-0-2, pp. 184.

Impact to environmental values

Environmental values and water quality guidelines for the Fitzroy Basin are presented in DSITI (2017). The water quality guidelines are intended to protect the aquatic ecosystem environmental value for the respective sub-basin and are derived from both state and national guidelines, as well as site-specific data. A review of available guidelines for all other identified environmental values (where guidelines/objectives have been developed) found the objectives for aquatic ecosystems are the most stringent and are therefore suitable for protecting all other environmental values.

DSITI (2017) provides water quality guidelines for suspended solids (380 mg/L) and turbidity (590 NTU) – for event flows in the Upper Isaac River sub-basin – that are derived from the 80th percentile of data from the Isaac River gauging station at Deverill (downstream monitoring point MP7 in the MM EA). These guideline values are higher than the release limits proposed by the Department (Table 1). If MM undertake releases of mine affected water during event flows in the Isaac River, releases from the mine that adhere to the Department's proposed criteria (i.e. turbidity < 500 NTU and suspended solids < 265 mg/L) will not impact the downstream environmental values of the receiving environment of the Isaac River. This outcome is further reinforced by the background data for the Isaac River that C&R reviewed in the November 2022 letter to M Mining that calculated 50th percentiles for turbidity (933 NTU) and SS (601 mg/L) above the proposed guideline values, suggesting that the levels within the upstream receiving environment are generally above the proposed release limits and therefore any releases in accordance with the limits will not adversely influence the levels of these quality characteristics within the receiving environment.

Recommendations for Millennium

Despite concerns over the derivation methods of the release limits proposed by the Department, water quality data from stored waters at MM suggests that the proposed release limits are easily achievable to facilitate controlled releases of mine-affected water. Furthermore, the conservative nature of the proposed release limits ensures that any releases would not cause impacts to the downstream environmental values. Therefore, C&R recommend that MM accept the release limits proposed by the Department in Table 1.

With respect to the receiving water contaminant trigger levels proposed by the Department (Table 2), water quality collected from background sites on New Chum Creek and the Isaac River (C&R, 2022[2]) suggest that the turbidity and SS levels within the receiving environments are regularly recorded above this proposed objectives regardless of releases from MM, suggesting false-positive non-compliances are likely. However, a mechanism is built into the EA to address this potential issue (Condition C5), by comparing downstream results with the background levels during the same flow event. Therefore, C&R recommend that Millennium also accept the receiving water contaminant trigger levels proposed by the Department in (Table 2), with the provision that the receiving water contaminant trigger levels be reviewed once sufficient, appropriate, site-specific data are available.

Regards,

Matt Knott
Senior Scientist / Manager
C&R Consulting Pty Ltd

APPENDIX 2: GROUNDWATER NETWORK AND TRIGGER REVIEW

MILLENNIUM MINE

Groundwater Network Review and Trigger Assessment

Prepared for:

MetRes Pty Ltd

SLR Ref: 620.30802.00000-R02
Version No: -v3.0
February 2023

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BASIS OF REPORT

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

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

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

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.30802.00000-R02-v3.0	2 February 2023	I Epari	KJ Wallis	I Epari
620.30802.00000-R02-v2.0	8 December 2022	I Epari, K Selvaratnam	KJ Wallis	I Epari
620.30802.00000-R02-v1.0	6 December 2022	I Epari, K Selvaratnam	KJ Wallis	I Epari

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APPENDICES

1 Introduction

Millennium Coal Mine is located approximately 20 kilometres (km) south-east of the township of Moranbah, within the Isaac Regional Council Local Government Area (LGA) in Queensland (Figure 1). The Millennium Mine consists of two mining areas with six contiguous mining leases (ML): the Mavis Downs area (ML 70457, ML 70483 and ML 70485); and the Millennium area (ML 70313, ML 70401, ML 70344), which together form a single operational project, the Millennium Mine.

Millennium Mine operates under Environmental Authority (EA) EPML00819213. Millennium Mine was in care and maintenance between May 2018 and June 2021. Mining recommenced in July 2021 after a change of ownership. Since then, several open cut related mining activities have been commenced in the Mavis Downs and Millennium areas.

Approval was sought and obtained to change the mining method from open cut to underground for an area located in the south-east of ML70547. The portal for the Mavis UG mine will be within the historical Mavis open-cut Pit.

1.1 Scope

SLR Consulting Australia Pty Ltd (SLR) has been engaged by MetRes Pty Ltd (MetRes) to produce a Groundwater Monitoring Network Review, for the purpose of identifying possible impacts on groundwater attributed to the mining operations at Millennium Mine, specifically the area identified as Mavis underground (Figure 1). This report addresses Condition D6 of EA EPML00819213.

Condition D6 stipulates:

> For the Mavis underground operations as detailed in Figure 3, an assessment by an appropriately qualified person must be undertaken to determine the following: a) Number and location of groundwater monitoring sites; b) Suitability of the monitoring network; and c) Groundwater contaminant trigger levels.

The scope of this groundwater network suitability assessment includes:

- Review of the number and location of groundwater monitoring sites;
- Assessment of the suitability of the current network to monitor potential impacts on the groundwater environment;
- Review the bore logs of additional sites from the adjacent Carborough Downs mine's monitoring network and assess if the bores are suitable for inclusion in the Groundwater Monitoring Program (GMP) for Mavis underground (UG) mining. If these bores are not suitable for inclusion in the GMP, and the suitability of the current network is deemed insufficient to monitor potential impacts, propose new monitoring bores including bore locations and target depths;
- Recommendation of suitable locations for hydraulic testing; and
- Determination of trigger levels for groundwater quality.

Data Source:
Mining leases Queensland, State of Queensland (Department of Natural Resources, Mines and Energy)
Exploration Permits for Coal Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2019
Watercourse lines, State of Queensland (Department of Natural Resources, Mines and Energy) 2018
Baseline Roads and Track Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2020

0 1 2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.30802
Date:	12-Apr-2022
Drawn by:	NT

SLR

LEGEND

- Principal Road
- Minor Road
- Railway
- Watercourse
- Mavis Underground
- Millennium Mine

MILLENNIUM MINE GROUNDWATER MONITORING NETWORK REVIEW

Millennium Mine Location and Mining Leases

FIGURE 1

H:\Projects-SLR\620-BNE\620.30802.00000 Millennium Mine Annual report and network\06 SLR Data\01 CAD\GIS\GIS\MXD\GWMN Review\620308802_F01_Project Location.mxd

1.2 Previous Studies

Details on key previous studies that informed this assessment including potential impacts on groundwater attributed to the mining operations at Mavis Downs are provided in Table 1.

Table 1 Previous Studies and Potential Impacts as a Result of the Mining at Millennium Mine

Report	Description	Potential Impacts and Recommendations
Groundwater Impact Assessment for Millennium Expansion Project EIS (MatrixPlus, 2010)	A summary of regional and site geology and hydrogeology. This report provides a description of groundwater occurrence and use. Numerical groundwater modelling was undertaken to predict the impacts of the proposed expansion project on regional groundwater levels. Mining at Mavis Downs was assessed and modelled as open-cut mining.	Nine landholder bores targeting the Rangal Coal Measures were predicted to be impacted by drawdowns between 0.1m and 27.9m. No potential impacts on groundwater quality in the Rangal Coal Measures was predicted. Ten monitoring bores were recommended be installed within the Rangal Coal Measures to monitor drawdown.
Millennium Mine Supporting documentation to the Environmental Authority (EPML00819213) amendment application Mavis Underground operations - Groundwater Impact Assessment. State considerations (SLR, 2021)	This report provided a conceptualisation of the groundwater assessment based on MatrixPlus (2010) that was updated with newly available data gathered. A regional groundwater model was constructed and used to quantify the incremental and cumulative impacts of the mining at Mavis on the groundwater regime.	Predicted impacts on groundwater users resulting from the Mavis UG project are as follows: No incremental impacts from Mavis UG were identified. Drawdown is predicted in the Leichardt Seam of the Rangal Coal Measures there are no known groundwater users targeting this aquifer. Low potential terrestrial groundwater dependent ecosystems (GDEs) 2 km north of the Project and 4 km south of the Project (between neighbouring mines) are predicted to be impacted by up to 2 m of drawdown in the regolith (Quaternary/Tertiary Alluvium) under the cumulative impact scenario. Two landholder bores were identified to be within the predicted water table drawdown extent under the cumulative impact scenario:

Report	Description	Potential Impacts and Recommendations
		- A drawdown of 17.0m at bore RN105427 screened in the Rewan Group, and - A drawdown of 6.3m at Bore 8 (unregistered landholder bore), screened in the Quaternary Alluvium The cumulative impact modelling results indicate that the predicted impacts may stem from surrounding operations rather than the project. The installation of two additional monitoring bores ('Proposed 1' and 'Proposed 2') was recommended to confirm the drawdown extents to the north of the Project.

2 Environmental Setting

This section provides a summary of the environmental setting of Millennium Mine.

2.1 Climate

Regional climatic conditions at the Millennium are that of a sub-tropical nature, with higher temperatures, higher rainfall, and higher evaporation occurring in the summer months (December through February).

For the purposes of this assessment, SILO Grid point data at latitude: -22.00, longitude: 148.25 (Queensland Government, 2021) was used to assess long-term climate trends in the vicinity of Millennium. This dataset is interpolated from quality checked observational timeseries data collected at nearby stations by the BoM.

Data spanning January 1970 until April 2021 was used for assessing the long-term trends in the vicinity of the Millennium Mine. Based on this data, the average annual site rainfall is 602 millimetres (mm). The two highest annual rainfalls were recorded for the years 1998 and 2010, with annual rainfalls of 968 mm and 1,133 mm, respectively. The minimum annual rainfall occurred in 1982 with 261 mm.

Long-term rainfall trends, based on the SILO Grid Point Data, are indicated by analysis of the cumulative rainfall deficit/ deviation from the mean (CRD). Positive gradients on this curve (rising limbs) confirm wetter conditions than normal, while negative gradients (falling limbs) indicate dry conditions. Average rainfall conditions are inferred during periods of stable residual mass. Figure 2 shows that, over the past 50 years, the wettest periods occurred during 1973 to 1979, 1988 to 1991, 2007 to 2008, and in 2010. The driest periods were between 1991 to 1998, 2001 to 2006, and 2017 to 2021. As shown by the declining trend in the CRD, Millennium is currently experiencing drier than average conditions.

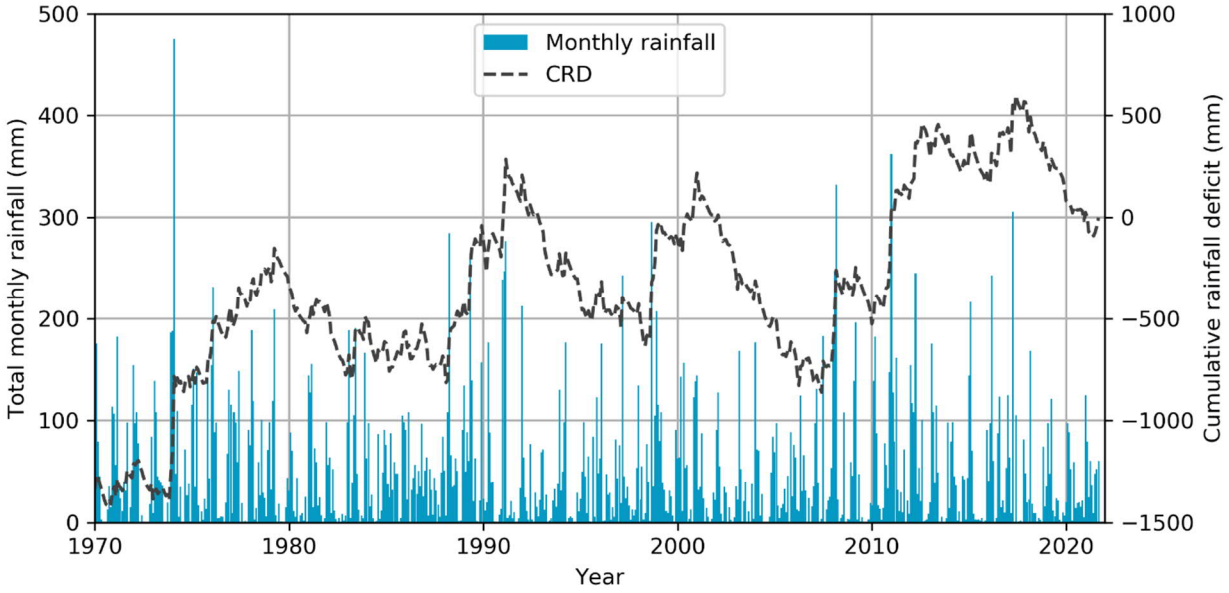


Figure 2 Long-term Monthly Rainfall and Cumulative Rainfall Deficit Curve at the Study Area

2.2 Hydrology

Millennium Mine is located in the Isaac River drainage basin sub-area of the wider Fitzroy Drainage Basin. The Isaac River, to the south-west of Millennium, is the major drainage feature of the region and flows in a south-easterly direction. New Chum Creek runs parallel to Millennium Mine, between the existing Millennium and Mavis open cut pits, and is a tributary of the Isaac River. New Chum Creek and Isaac River are classified as third order and sixth order streams respectively, and both are ephemeral, experiencing short periods of flow following high rainfall events over the summer months.

The catchment area of New Chum Creek is approximately 51 km^2, with Millennium Mine, as well as Poitrel and Daunia Mines, located within the catchment. The main channel of New Chum Creek typically has a base width of approximately 3 m and a depth of up to 2 m. Although minor waterholes can persist in the channel for several weeks following high rainfall events, there is little to no aquatic vegetation due to the stream being ephemeral, with streamflow expected to occur less than 30% of the time (Peabody, 2020). New Chum Creek has been diverted downstream as part of a neighbouring mining operation at Poitrel Mine.

The south-western part of Millennium Mine drains south to West Creek, another tributary of Isaac River. The West Creek confluence with the Isaac River is approximately 9 km upstream of that of New Chum Creek. West Creek has a catchment area of approximately 22 km^2. West Creek acts as an ephemeral minor watercourse.

Surface water in the area is ephemeral and does not have a groundwater baseflow component (SLR, 2021).

2.3 Geology

Millennium Mine is located in the Bowen Basin, a basin spanning an extent of approximately 200,000 km^2 and one of five major foreland sedimentary basins formed along the eastern side of Australia during the Permian Period. The Bowen Basin extends in a north to south direction from Townsville, Queensland at its northern extent to Moree, New South Wales at its southern extent. In the southern parts, the extent of the Bowen Basin and the Great Artesian Basin (GAB) overlap. The Bowen Basin has two north trending depocentres (a depocenter being the geographic location of the thickest part of any specific geographic unit in a depositional basin), the eastern Taroom Trough and western Denison Trough (Geoscience Australia, 2021). Millennium Mine lies within the Collinsville Shelf, north of the Taroom Trough depocentre.

Basin geology within the Collinsville Shelf includes the basal Permian aged Back Creek Group, which is comprised of generally fine-grained clastic sedimentary rocks deposited in a fluvial to shallow marine environment. The Back Creek Group is conformably overlain by the Blackwater Group, which includes the Rangal Coal Measures, Fort Cooper Coal Measures, and Moranbah Coal Measures. The economic seams of Millennium Mine are contained in the Late Permian Rangal Coal Measures. The Permian strata occur at outcrop on the eastern and western edges of the Basin and are unconformably overlain by the Triassic aged terrestrial sedimentary rocks of the Rewan Group. While not present at the Millennium Mine, isolated pockets of remnant quartzose sandstones of the Middle Triassic Clematis Group are mapped.

The Permian and Triassic units are covered by a thin layer of unconsolidated to semi-consolidated Cainozoic sediments (Tertiary to Quaternary alluvium and colluvium). The alluvial sediments are localised along rivers and creeks (Isaac River). Volcanic intrusions and extrusions are also present within the region.

The bedrock stratigraphy at Millennium Mine typically comprises of Triassic aged deposits, namely the Rewan Formation, which unconformably overlie Permian Coal Measures, inclusive of the Rangal Coal Measures and Fort Cooper Coal Measures. Operations at Millennium Mine extract from the Leichhardt coal seam in the Rangal Coal Measures Formation, whereas Millennium and Vermont coal seams (also within the Rangal Coal Measures) are not targeted by Millennium.

2.4 Hydrogeology

For a comprehensive review of the hydrogeology in the vicinity of Millennium Mine, the reader is directed to SLR (2021). In summary, the three main hydrostratigraphic units relevant to Millennium Mine are:

- The Quaternary alluvial sand of the Isaac River Alluvium, located along Isaac River and New Chum Creek. These are predominantly recharged by rainfall and stream flow infiltration during high streamflow events. Typically, they are high-yielding aquifers (albeit of limited areal extent and depth);
- Quaternary/ Tertiary alluvial and colluvial sediments, an unconfined perched aquifer that is predominantly recharged by rainfall; and
- Permian Rangal Coal Measures and Fort Cooper Coal Measures - semi-confined to confined aquifers with most groundwater flow occurring through the higher permeability coal seam layers. These aquifers are predominantly recharged through rainfall where the deposit outcrops at surface, or by leakage from alluvium. The siltstones and sandstones that make up the majority of the interburden are considered to act as confining layers, due to their low permeabilities compared to the coal seams.

A conceptual groundwater model showing the pre-mining and current mining with Millennium and Mavis Pits is shown in Figure 3. With the EA amendment in 2021, the mining at Mavis open-cut is now approved to go underground.

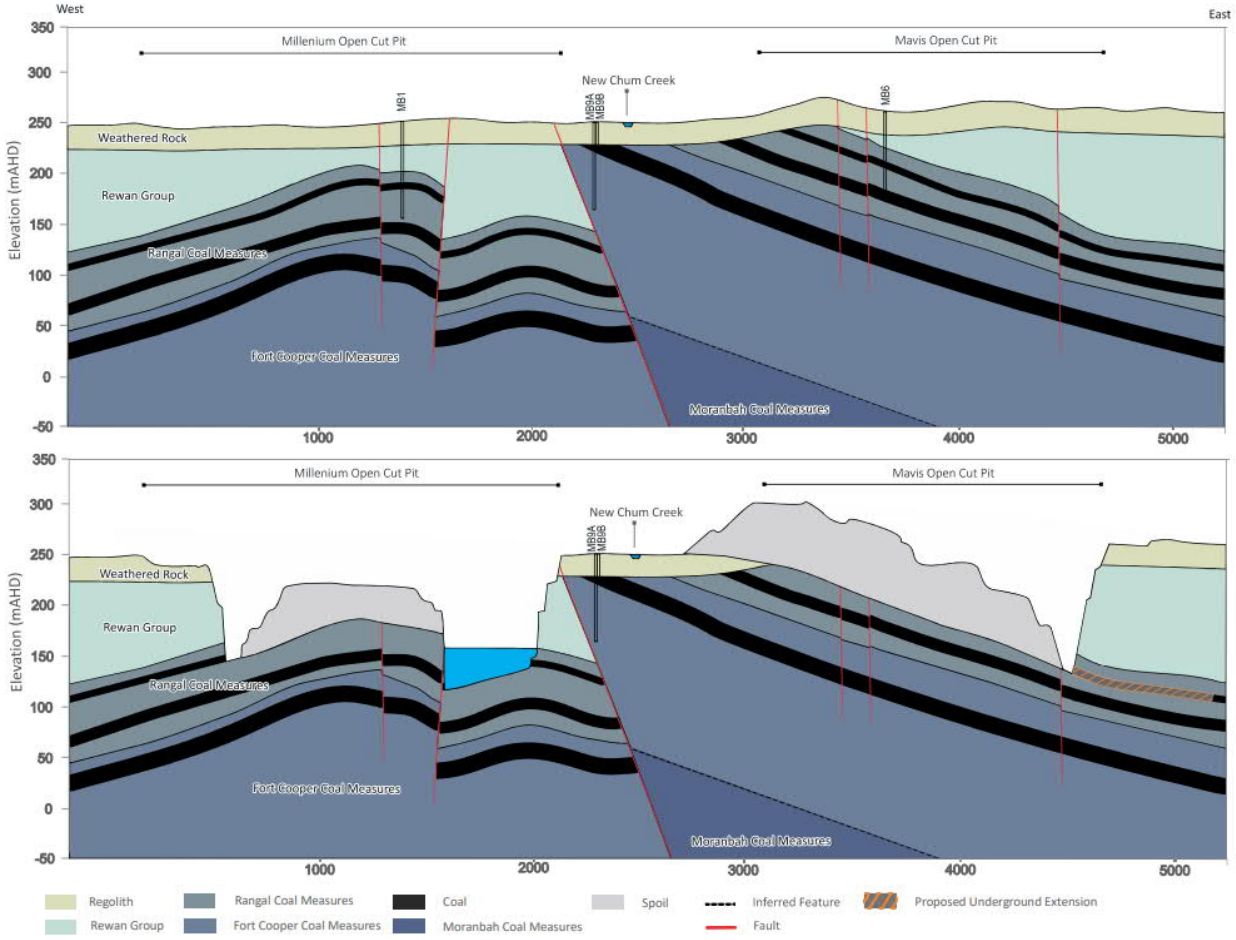


Figure 3 Conceptual Groundwater Model – Pre-Mining (Top) and Current (Bottom)

3 Groundwater Network Suitability Assessment

3.1 Current Groundwater Monitoring Sites

The current groundwater monitoring network at Millennium Mine available to assess impacts from the Mavis UG mine is as per the current EA EPML00819213. It is comprised of one groundwater bore targeting the Permian Rangal Coal Measures and six groundwater bores targeting the Permian Fort Cooper Coal Measures. Construction details of these groundwater bores is provided in Table 2, including provision of the monitoring data captured. The locations of groundwater bores in relation to Mavis UG area are shown in Figure 4, together with the mapped surface geology.

Table 2 Mavis UG Mine Groundwater monitoring locations and frequency

Monitoring Site ID	Screened Unit[1]	Ground Elevation (mAHD[2])	Depth (mBGL[3])	Screen (mBGL)	Gravel pack (mBGL)	Monitoring Parameters
MB2	Rangal CM[4]	262.38	90	72 - 90	69 - 90	Quarterly SWL[5]
MB8A	Fort Cooper CM – Sandstone[6]	259.1	30	22 - 28	20-30	Quarterly SWL & Quality
MB8B	Fort Cooper CM - Sandstone[6]	259.1	80	62 - 74	60 - 80	Quarterly SWL & Quality
MB9A	Fort Cooper CM – Coal Seam	251.8	30	22 - 30	20 - 30	Quarterly SWL & Quality
MB9B	Fort Cooper CM – Sandstone below coal	251.8	80	60 - 74	58 - 80	Quarterly SWL & Quality
MB10A	Fort Cooper CM – Sandstone	233.9	35	27 - 35	25.5 - 35	Quarterly SWL & Quality
MB10B	Fort Cooper Coal Measures – Sandstone	233.9	80	64 - 76	62 - 80	Quarterly SWL and Quality

[1]Reflects SLR's understanding of the screened aquifer, rather than the aquifer listed in Table D1 of the current EA EPML00819213

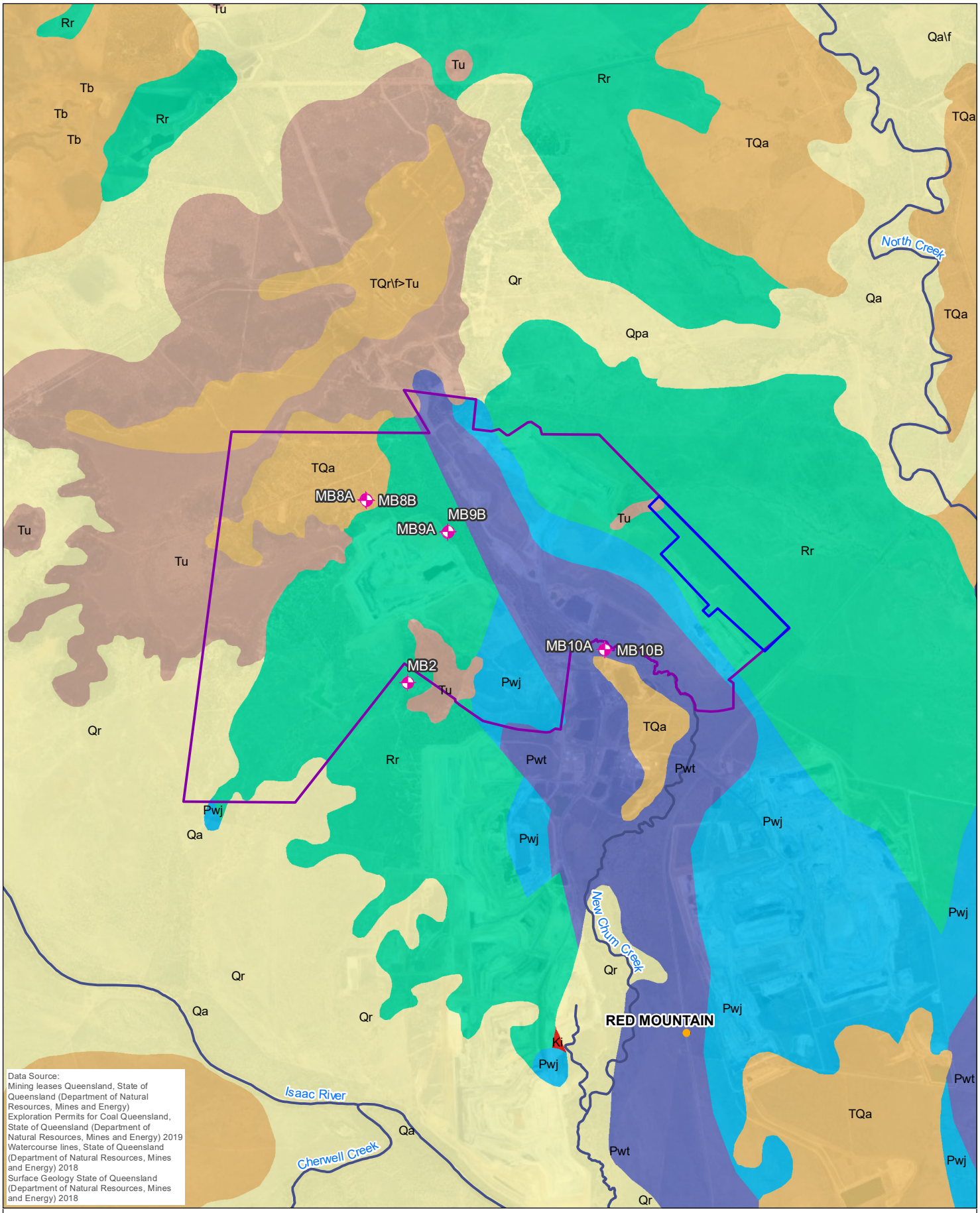
[2]Metres Australian Height Datum

[3]Metres below ground level

[4]Coal Measures

[5]Standing water level

[6] MB8A/B could be either attributed to the Rewan Formation or to the overburden of the Rangal Coal measures, to be confirmed with a site geologist (SLR, 2021)



Coordinate System:	GDA 1994 MGA Zone 55
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Project Number:	620.30802
Date:	12-Apr-2022
Drawn by:	NT

SLR

MILLENNIUM MINE GROUNDWATER MONITORING NETWORK REVIEW

Location of Groundwater Bores

FIGURE 4

H:\Projects-SLR\620-BNE\620.30802.00000 Millennium Mine Annual report and network\06 SLR Data\01 CAD\GIS\GIS\MXD\GWMN Review\620308002_F04 Monitoring Bore Network.mxd

3.2 Groundwater Network Review

3.2.1 Current Groundwater Monitoring Network

The current groundwater monitoring network was revised for its suitability to detect impacts from the Mavis UG operations. The following observations were made:

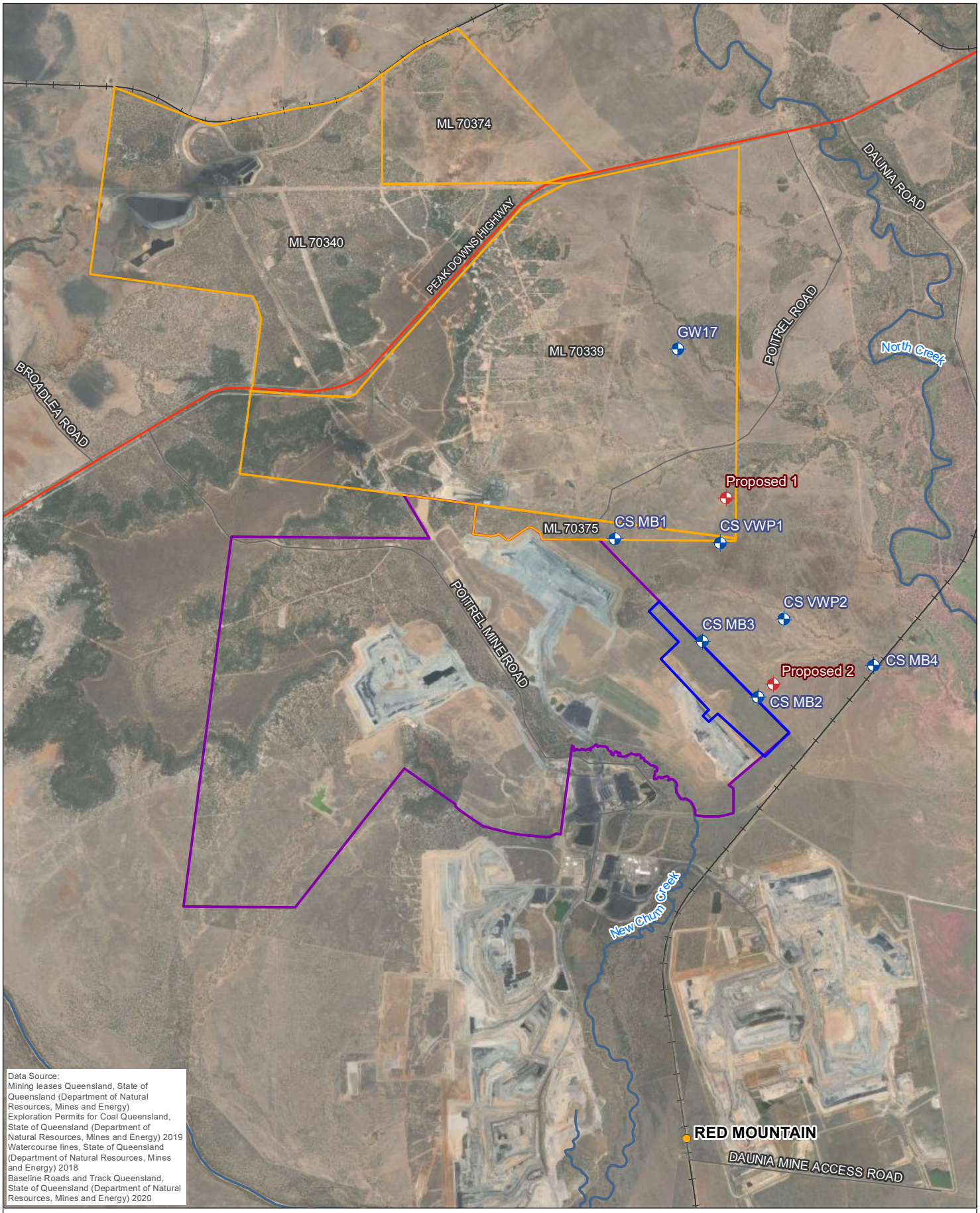
- The data available from the groundwater bores in the current network was assessed as being adequate for monitoring the potential drawdown to the west of Mavis UG mine, in the coal seams and in the sandstone unit below. Monitoring and data capture are recommended to continue for the duration of mining operations at Millennium; and
- Predicted groundwater drawdown impacts from the activities at Mavis UG mine was identified in SLR (2021) and are presented in Table 1. Two groundwater bores are recommended to be located in areas where changes in the groundwater regime can be attributed to the cumulative mining impacts from Millennium and surrounding mines. These areas are:
    - In the Quaternary/Tertiary Alluvium, approximately 2 km north of Mavis UG, on the outside of the Carborough Downs mining lease, within the area designated as a low potential terrestrial GDE associated with North Creek; and
    - In the Rangal Coal Measures (Leichardt Seam) to the east and north Mavis Pit.

3.2.2 Carborough Downs Monitoring Network

The Carborough Downs groundwater monitoring network was assessed for suitability for inclusion in the Mavis UG groundwater monitoring network, and if appropriate, to revise and update the proposed bores in SLR (2021).

MetRes has a data sharing agreement in place with Fitzroy Coal, which would allow to share the data from those bores. If monitoring frequencies or analytes differ, MetRes would be responsible for the additional monitoring. Monitoring locations are shown in Figure 5 and available data is provided in Table 3.

The bore construction of the Carborough Downs bores was reviewed to assess the appropriateness for inclusion of these bores in the Mavis UG groundwater monitoring network. A summary of this review is presented in Table 3. It is proposed to replace bores “Proposed 1” and “Proposed 2” with the inclusion of Carborough Downs monitoring bore; CS_MB2 and vibrating wire piezometer (VWP) CS_VWP1 in the Mavis UG groundwater monitoring network, with the rationale further explained in 3.2.2.1 and 3.2.2.2.



Data Source:
Mining leases Queensland, State of Queensland (Department of Natural Resources, Mines and Energy)
Exploration Permits for Coal Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2019
Watercourse lines, State of Queensland (Department of Natural Resources, Mines and Energy) 2018
Baseline Roads and Track Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2020

0 1 2 km

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Drawn by:	NT

SLR

LEGEND

- Carborough Downs Groundwater Monitoring Location
- Proposed Groundwater Monitoring Location (SLR, 2021)
- Principal Road
- Minor Road
- Railway
- Watercourse
- Carborough Downs Mine
- Mavis Underground
- Millennium Mine

MILLENNIUM MINE GROUNDWATER MONITORING NETWORK REVIEW

Carborough Downs Groundwater Monitoring Locations

FIGURE 5

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Table 3 Carborough Downs groundwater monitoring network

Monitoring Site ID[1]	Target Aquifer	Depth (mBGL)	Ground Elevation (mAHD)	Comment on Suitability for Inclusion in the Mavis UG Network	Inclusion Proposed
CS_MB1	Rangal CM (Leichhardt Seam)	160	254.35	Located in the area of maximum predicted drawdown of the Leichhardt Seam in both the incremental and cumulative impact scenarios. With CS_MB1 located on the Carborough Downs boundary, CS_MB2 located immediately east of Mavis UG on the boundary, and CS_MB3 located in between CS_MB1 and CS_MB3, CS_MB2 is best positioned to indicate potential drawdown.	No
CS_MB2	Rangal CM (Leichhardt Seam)	170	236.63		Yes
CS_MB3	Rangal CM (Leichhardt Seam)	164	249.21		No
CS_MB4	Rewan group	80.5	219.68	Can inform drawdown impact in the Rewan group, however the impact of drawdown on the Rewan group is already observed through CS_VWP1.	No
CS_VWP1	Sensor 1 - Rewan group Sensor 2 - Permian overburden Sensor 3 - Rangal CM (Leichhardt Seam)	196	246.59	Has the potential to inform on the extent of the drawdown in the Leichhardt Seam of the Rangal CM, due to the depth of Sensor 3 and to the location being to the north of Mavis Pit. It is also well positioned to function as an early indicator of potential impacts to the low potential terrestrial GDE associated with North Creek. As such, this VWP is suitable to indicate potential water level changes in the groundwater regime attributable to Mavis UG mining activities.	Yes
CS_VWP2	Sensor 1 - Rewan group Sensor 2 - Permian overburden Sensor 3 - Rangal CM (Leichhardt Seam)	244	231.64	Location and construction of this VWP suggests that it has the potential to inform on the extent of the drawdown in the Leichhardt Seam of the Rangal CM. However, in reviewing the CS_VWP2 hydrograph, it appears that the sensors are faulty, and no data is available after mid-2020.	No
GW17	Unknown, likely targeting Tertiary Sandstone or Rewan Group	25	246.00	Dry from 2010 to 2016 (latest known reported date). Located on an unnamed tributary of North Creek in an area of Brigalow vegetation. Located in a low potential terrestrial GDE that is predicted to be unaffected by incremental and cumulative impacts of the mining at Mavis UG.	No

1. For the benefit of this document "CS_" has been added to bore names to distinguish Millennium bores from Carborough Downs (Carborough South) bores.

3.2.2.1 CS_VWP1 Rationale

The justification for replacing "Proposed 1" with the Carborough Downs bore CS_VWP1 is that Sensor 1 of the CS_VWP1 piezometer targets the Rewan Group and will act as an early warning system for drawdown at the low potential terrestrial GDE associated with North Creek.

Previously, it was intended that "Proposed 1" was installed in the Quaternary/Tertiary Alluvium of North Creek at an approximate depth of 20 mbgl. As shown in Figure 6, while drawdown is observed in the Permian overburden (Sensor 2) at CS_VWP1 in May 2021, the Rewan group (Sensor 1) and Rangal CM (Leichhardt Seam) (Sensor 2) appear to be unaffected, and it can be assumed that the shallower units are not impacted by drawdown due to mining activities. With CS_VWP1 returning consistent pressures in the Rewan Group, and the likely hydraulic separation of the Quaternary/Tertiary Alluvium and the Rangal Coal Measures by the Rewan Group, this existing VWP is proposed for inclusion in the network in lieu of a new shallower bore at "Proposed 1". As such, the piezometer at CS_VWP1 provides sufficient monitoring in the north, which negates the need to install a bore at "Proposed 1".

The existing Carborough Downs piezometer CS_VWP1 can appropriately indicate potential changes in the groundwater regime attributable to Mavis UG mining activities, and is suitable for inclusion in the Mavis UG groundwater monitoring network. It is recommended to include CS_VWP1, Sensor 1 as a minimum, and all three sensors as an optimum.

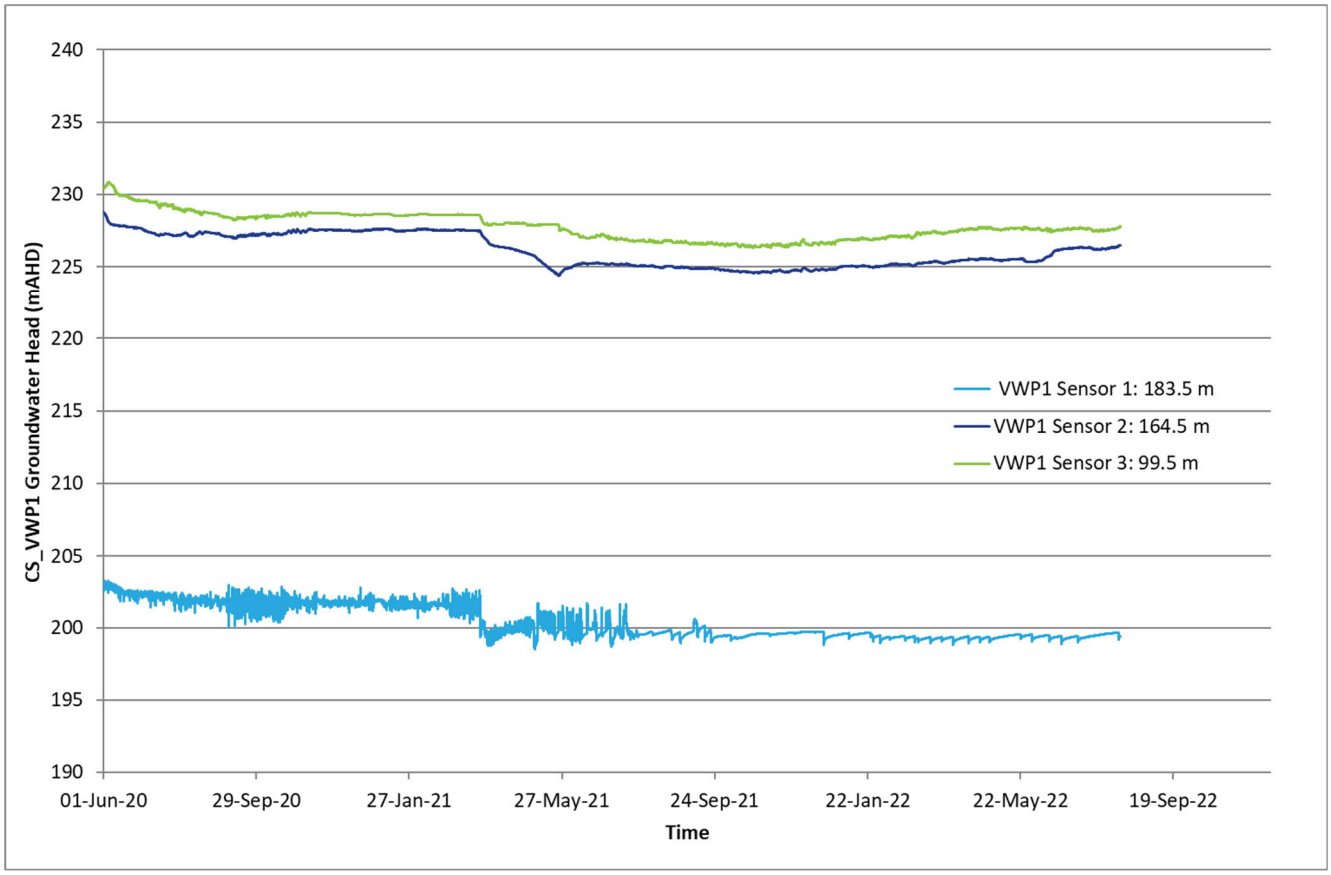


Figure 6 CS_VWP1 Hydrograph (adapted from Fitzroy Coal, September 2022)

3.2.2.2 CS_MB2 Rationale

The justification for replacing "Proposed 2" with the Carborough Downs bore CS_MB2 is that the CS_MB2 bore targets the Leichardt Seam of the Rangal CM for drawdown monitoring, is located close to "Proposed 2" to the east of Mavis Pit, and is suitable for monitoring the water level impacts from mining at Mavis UG. As shown in Figure 7, the observed standing water level at CS_MB2 has slightly increased since mid-2020, peaking at 155 mAHD in late 2022 before stabilising at approximately 152 mAHD in 2021.

Previously, it was intended that "Proposed 2" was to be installed in the Permian Rangal at an approximate depth of 200 m to intersect the Leichhardt Seam. Currently, the CS_MB2 bore is installed at a depth of 164 mbgl with a screen interval of 155 – 158 mbgl. Therefore, bore CS_MB2 can fulfil the same role as "Proposed 2", which negates the need to install a bore at "Proposed 2".

The existing Carborough Downs bore CS_MB2 can appropriately indicate potential changes in the groundwater levels attributable to Mavis UG mining activities, and is suitable for inclusion in the Mavis UG groundwater monitoring network.

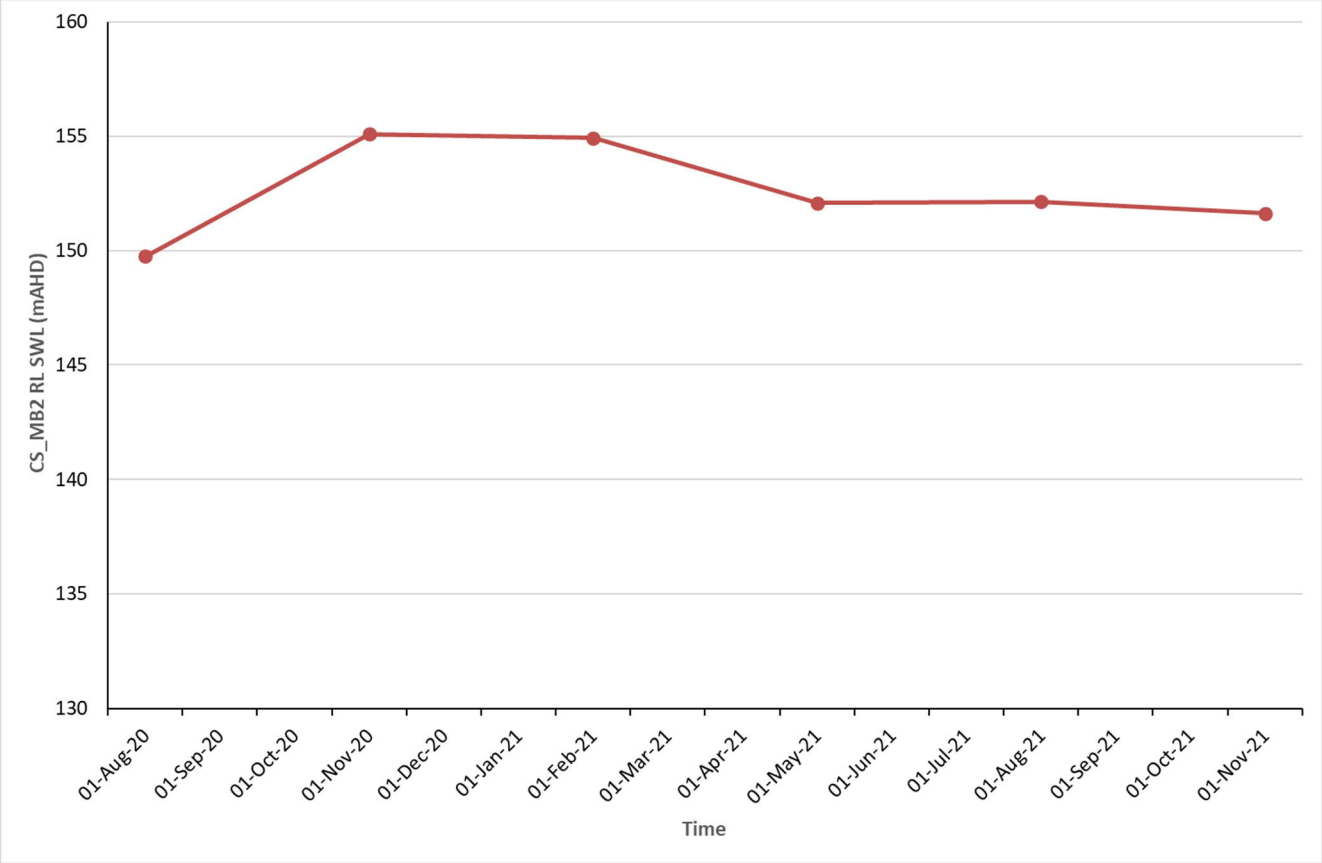


Figure 7 CS_MB2 Hydrograph (adapted from Fitzroy Coal, September 2022)

3.2.3 Proposed Groundwater Monitoring Network and GMP

The proposed groundwater monitoring locations for compliance with the EA to assess impacts of the Mavis UG mine are presented in Table 4 and Figure 8. The locations have been based on the assessment of potential impacts (SLR, 2021) as well as the suitability of the current network and Carborough Downs groundwater monitoring network. Table 4 presents the groundwater monitoring names with their depth and target aquifer, and locations are shown on Figure 8.

For the Carborough Downs monitoring bores, CS_MB2 and CS_VWP1, the proposed monitoring frequency is quarterly. These two bores are monitoring water levels only as per their original purpose.

As part of the full water quality monitoring suite, in addition to collecting field parameters electrical conductivity (EC) and pH, water samples will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory for the analysis of:

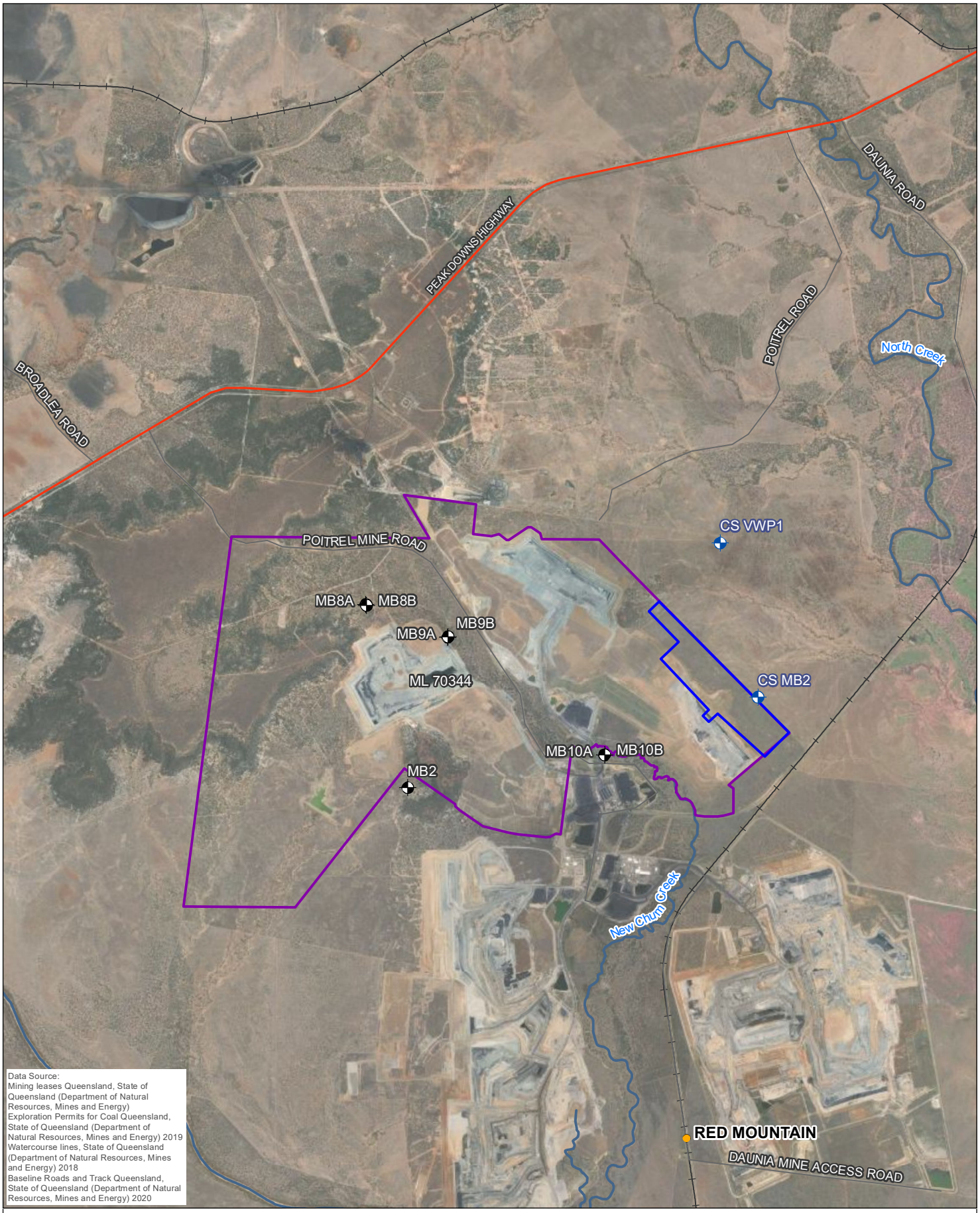
- Physiochemical indicators (total dissolved solids (TDS));
- Major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate, carbonate);
- Total and dissolved metals: iron, silver, arsenic, mercury, antimony, molybdenum and selenium; and
- Total petroleum hydrocarbons (C6-C9, C10-C14, C15-C28 and C29-C36) with silica gel clean-up.

Table 4 Proposed Groundwater Monitoring Program

Monitoring Site	Latitude (GDA94 Z54)	Longitude (GDA94 Z54)	Bore Depth (mBGL)	Target Aquifer	Status	Sampling[1]
MB2	22 10'49"S	148 14'18"E	90	Permian Rangal	Existing	WL & WQ
MB8A	22 00'27"S	148 14'20"E	30	Fort Cooper CM – Sandstone[2]	Existing	WL & WQ
MB8B	22 00'27"S	148 14'20"E	80	Fort Cooper CM – Sandstone[2]	Existing	WL & WQ
MB9A	22 00'34"S	148 14'43"E	30	Moranbah Coal Seam	Existing	WL & WQ
MB9B	22 00'34"S	148 14'43"E	80	Moranbah Coal Measures Sandstone	Existing	WL & WQ
MB10A	22 10'33"S	148 16'00"E	35	Fort Cooper (Sandstone)	Existing	WL & WQ
MB10B	22 10'33"S	148 16'00"E	80	Fort Cooper (Sandstone)	Existing	WL & WQ
CS_MB2	22° 1' 10"S	148° 17' 16"E	170	Rangal CM (Leichhardt Seam)	Recommended for inclusion	WL only
CS_VWP1	21° 59' 55"S	148° 16' 56"E	196	Sensor 1 - Rewan group Sensor 2 - Permian overburden Sensor 3 - Rangal CM (Leichhardt Seam)	Recommended for inclusion	WL only

[1] WL: Water Level, WQ Water quality

[2] The geological model shows the FFCM at 200m depth. As no coal was intersected for the 80m of the deep bores, these two bores could be either in the Rewan or Rangal Coal Measures.



Data Source:
Mining leases Queensland, State of Queensland (Department of Natural Resources, Mines and Energy)
Exploration Permits for Coal Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2019
Watercourse lines, State of Queensland (Department of Natural Resources, Mines and Energy) 2018
Baseline Roads and Track Queensland, State of Queensland (Department of Natural Resources, Mines and Energy) 2020

0 1 2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:75,000 at A4
Project Number:	620.30802
Date:	24-Mar-2022
Drawn by:	NT

SLR

LEGEND

- Millennium Mine Groundwater Monitoring Bore
- Carborough Downs Groundwater Monitoring Location
- Principal Road
- Minor Road
- Railway
- Watercourse
- Mavis Underground
- Millennium Mine

MILLENNIUM MINE GROUNDWATER MONITORING NETWORK REVIEW

Proposed EA Compliance Monitoring Bore Locations

FIGURE 8

H:\Projects-SLR\620-BNE\620.30802.00000 Millennium Mine Annual report and networ\06 SLR Data\01 CAD\GIS\GIS\MXD\GWMN Review\620308802_F06_EA ComplianceBore.mxd

3.3 Suitability For Hydraulic Testing

During the EA amendment process in 2021, the Department of Environment and Science (DES) requested hydraulic testing be undertaken to determine local aquifer properties. A review of the current and potential future bores showed that MB2 and MB8A are not suitable for testing due to low water levels and dry conditions respectively. Hydraulic testing is not recommended for CS_VWP1. Hydraulic testing is only recommended for the bores detailed in Table 5, where access is available. Based on field records, CS_MB02 has an obstruction in the bore that may make testing impossible.

Table 5 Bores suitable for hydraulic testing

Monitoring Site ID	Aquifer	Ground Elevation (mAHD)	Depth (mBGL)	Screen (mBGL)	Gravel pack (mBGL)
MB8B	Fort Cooper CM – Sandstone	259.1	80	62 – 74	60 – 80
MB9A	Fort Cooper CM – Coal Seam	251.8	30	22 – 30	20 – 30
MB9B	Fort Cooper CM – Sandstone below coal	251.8	80	60 – 74	58 – 80
MB10A	Fort Cooper CM – Sandstone	233.9	35	27 – 35	25.5 – 35
MB10B	Fort Cooper Coal Measures – Sandstone	233.9	80	64 – 76	62 – 80
CS_MB02	Rangal CM – Leichhardt Seam	236.6	170	161 -164	158 – 170

3.4 Groundwater Sampling Review

A review of the data collected in the groundwater sampling network was undertaken and opportunities for improvements in data collection were identified and are discussed in this section.

It is understood that HydraSleeves are the current sampling methodology used to collect groundwater samples for EA compliance. HydraSleeves sampling is a “grab sample” of water chemistry and is recommended at bores where recharge is too low to maintain laminar flow required for low flow sampling. The correct HydraSleeve sampling method requires a prior knowledge of the screened depths of bores where the sampler is positioned to sample. These screen depths are known for the Millennium monitoring bores (Table 5).

Field data were reviewed for 12 sampling rounds from the current EA compliance bores. The amounts of times each bore recorded a colour or odour is provided in Table 6. Both features may be indicative of stagnant water and the HydraSleeve sampling methodology is not able to collect a representative sample of the aquifer. This can be potentially rectified by airlifting the bores to re-instate a good contact to the aquifer.

Table 6 Groundwater Sampling Field Observations

Bore	Colour cloudy, slightly dark, dark colour, coal fines present	Odour
MB8B	0	6
MB9A	7	11
MB9B	6	2

Bore	Colour cloudy, slightly dark, dark colour, coal fines present	Odour
MB10A	2	2
MB10B	0	1

3.5 Groundwater Quality Parameters

The current EA groundwater quality trigger limits were developed in the early 2010s. Since then, DES has published the guideline Using monitoring data to assess groundwater quality and potential environmental impacts (DES, 2021), which describes a more modern approach to derive trigger limits based on monitoring data.

The analytes with their current trigger limit and limit type are listed in Table 7. In the last column, a comment has been included on the applicability of the trigger and analytes, in the context of DES (2021). It is proposed to remove trigger limits for major ions (except chloride and sulfate), TDS, total suspended solids (TSS) and chlorine. It is further proposed to add copper and zinc to the analytes list. The trigger limits for the metals will be derived for the dissolved concentrations.

Table 7 Current Groundwater Quality Triggers and proposed changes

Water Quality Indicator	Unit	Current Trigger (EA)	Current Limit Type	Comment on Applicability
Aluminium	mg/L	0.02	Maximum	Derive updated trigger limit (Section 4)
Antimony	mg/L	0.002	Maximum	Derive updated trigger limit (Section 4)
Arsenic	mg/L	0.003	Maximum	Derive updated trigger limit (Section 4)
Chlorine	mg/L	0.04	Maximum	Remove from EA, add Chloride instead (see next line)
Chloride	mg/L	-	Maximum	Derive updated trigger limit (Section 4)
Carbonate (CO3-)	mg/L	8	Maximum	Major ions for information only, no compliance level suggested.
Total Dissolved Solids	mg/L	2,200	Maximum	EC and TDS are commonly related – suggested to use EC only, as there is a regional WQO value available.
Electrical Conductivity	µS/cm	4,000	Maximum	Derive updated trigger limit (Section 4)
Bicarbonate (HCO3)	mg/L	900	Maximum	Major ions for information only, no compliance level suggested.
Iron	mg/L	0.3	Maximum	Derive updated trigger limit (Section 4)
Mercury	mg/L	0.0001	Maximum	Derive updated trigger limit (Section 4)
Molybdenum	mg/L	0.003	Maximum	Derive updated trigger limit (Section 4)
pH	pH units	6.5 to 9	Minimum / Maximum	Derive updated trigger limit (Section 4)
Selenium	mg/L	0.01	Maximum	Derive updated trigger limit (Section 4)
Silver	mg/L	0.004	Maximum	Derive updated trigger limit (Section 4)
Sulfate (SO4 2-)	mg/L	70	Maximum	Derive updated trigger limit (Section 4)

Water Quality Indicator	Unit	Current Trigger (EA)	Current Limit Type	Comment on Applicability
Total Suspended Solids	mg/L	30	Maximum	Remove from EA, TSS is an analyte that is relevant in surface water environments.
Total Petroleum Hydrocarbons	mg/L	0.1	Maximum	Derive updated trigger limit (Section 4), split into two fractions
Copper	mg/L	NA	NA	Not currently in the EA. It is advised that groundwater will be analysed for copper in the future.
Zinc	mg/L	NA	NA	Not currently in the EA. It is advised that groundwater will be analysed for copper in the future.

4 Water Quality Trigger Review

4.1 Methodology

The scope of work addressed in this groundwater contaminant limits review includes the review of groundwater monitoring data and derivation of proposed revised groundwater quality limits for each EA monitoring bore based on the process outlined in DES (2021):

1. Determine summary statistics (i.e. 20th, 50th, 80th and 95th percentiles) for each bore or group of bores for all indicators using all available data.

2. Identify relevant default toxicant guidelines and relevant WQOs.

3. The 80th percentile of each indicator at each bore should be compared with the guideline and WQO. Use dissolved metal concentrations for default toxicant guideline values (ANZG 2018).

4. If less than 8 samples were available or are greater than the limit of reporting (LoR) the default toxicant guideline is applied.

5. Site specific values are determined using the 80th and 95th percentile at each bore or group of bores if required.

6. Box plots and time series plots should be produced and compared to the default toxicant guidelines, relevant WQOs and site specific values.

7. Determine appropriate site specific limits. The limits are appropriate if they are sufficiently conservative to ensure environmental impact does not occur, but do not result in false non-compliances.

8. Determine an appropriate compliance approach.

9. Evaluate the proposed limits and compliance approach.

The process described above is based on the latest guidelines published by DES (2021), the reference guideline for the analysis of water quality data and derivation of site-specific groundwater limits. It

As described in Section 2 of DES (2021), The guideline "outlines a process to review groundwater quality monitoring data, including (i) the information required to assess groundwater quality, (ii) approaches used to define site-specific groundwater guidelines and (iii) comparisons of measured values with default guidelines, WQOs, site-specific guidelines derived from locally relevant background, reference or baseline groundwater quality data".

This report follows the process to review groundwater quality monitoring data and the adoption of site-specific groundwater limits or an alternative compliance approach as summarised in Section 2 of DES (2021). Each stage, as detailed in DES (2021), is presented in Table 8 along with the corresponding section in this report (or companion reports developed concurrently).

Table 8 DES (2021) Methodology and Corresponding Sections in this Report

DES (2021) Methodology - Stages	Corresponding Sections in this Report or Companion Report
Identify EVs for groundwater and relevant default guidelines and WQOs	Section 4.2
Describe site characteristics	Section 2
Describe bore characteristics	Section 3
Analyse groundwater quality monitoring data	Section 4.3
Identifying site-specific guidelines for groundwater quality, if required	Section 4.4.4
Determine an appropriate compliance approach	Section 4.5
Evaluate site-specific groundwater guidelines, triggers, limits and compliance approach	Section 6

4.2 Environmental Values and Guidelines

Millennium is located within the Isaac Connors Groundwater Management Area (GMA) (Zone 34) of the Fitzroy Basin under the Water Plan (Fitzroy Basin) 2011 (DES, 2011). The management objective of the Water Plan (Fitzroy Basin) 2011 is to maintain the 20th, 50th and 80th percentiles water quality results in order to preserve or enhance groundwater quality for its recognised uses. These percentiles are available for 'shallow' bores (less than 30m deep) and 'deep' bores (more than 30m deep). In the case of Isaac groundwaters, these values include aquatic ecosystems, irrigation, farm supply/ use, stock watering, primary recreation, drinking water as well as being of cultural and spiritual value.

The identified Environmental Values (EVs) of groundwater most applicable to Millennium (SLR, 2021) are listed Table 9 together with the respective water quality guideline or water quality objective (WQO) that applies to the identified EV.

Table 9 Identified EVs and applicable Water Quality Guidelines

Identified EV	Applicable Guideline	WQO
Use of groundwater for domestic and agricultural purposes by landholders within the area	ANZECC Guideline (Stock watering) ANZECC Guideline (Irrigation)	Fitzroy Water plan, WQ1310, Zone 34
Use of groundwater by GDE and potentially (although considered unlikely) groundwater contribution to palustrine wetlands;	Default Toxicant Guideline (ANZG, 2018)	Fitzroy Water plan, WQ1310, Zone 34

The guideline value for each proposed analyte is listed in Table 10.

Table 10 Potentially Applicable Guidelines and WQOs

Water Quality Guideline	Field pH	Field EC	Sulfate as SO4	Cl[1]	Al[1]	Sb[1]	As[1]	Cu[1]	Fe[1]	Hg[1]	Mo[1]	Se[1]	Ag[1]	Zn[1]	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L
ANZECC Aquatic Ecosystem (95%) Protection Guideline (ANZG, 2018)	6.0-7.5	250			0.055	0.009	0.013	0.0014		0.0006	0.034	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500[2]	1000		5		0.5	0.4		0.002	0.15	0.02		20		
ANZECC Guidelines – Irrigation short-term	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation Long-term	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Fitzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185				0.03	0.14					0.06		
Fitzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	398	5905				0.03	0.246					0.317		
DES (2013)															20	100

Notes: [1] Dissolved
2. the stock watering guidelines present salinity values as total dissolved solids (TDS) for different animal species. This has been converted to EC by dividing by 0.67
WQO = Water Quality Objective
ANZECC = Australian and New Zealand Environment and Conservation Council

4.3 Water Quality Monitoring Data Analysis

4.3.1 Availability

In preparing the data for the trigger limit review, the monitoring network was assessed for suitability. Table 11 lists the EA bores with water quality monitoring with the minimum and maximum date of data available at each bore. Of the six bores recording water quality, five had enough site-specific data to undertake the trigger limit derivation according to DES (2021).

One bore is found dry and therefore no site-specific data is available for the trigger limit assessment. Three bores are not assessed as they are recording water level only.

Table 11 Review of data availability for the trigger assessment

Monitoring point	Data available from	Data available to	Number of data points	Target aquifer	Monitoring point status
GW02			NA	RCM	Water Level only
GW08A	Jan-2014	Oct-2022	0	FCCM - Sandstone	Dry since installation
GW08B	Jan-2014	Oct-2022	33	FCCM - Sandstone	Active
GW09A	Jan-2014	Oct-2022	33	FCCM – Coal	Active
GW09B	Jan-2014	Oct-2022	34	FCCM – Sandstone underburden	Active
GW10A	Jan-2014	Oct-2022	29	FCCM - Sandstone	Active
GW10B	Jan-2014	Oct-2022	30	FCCM - Sandstone	Active
CS_MB2			NA		Water Level only
CS_VWP1			NA		Water Level only

Notes: RCM = Rangal Coal Measures. FCCM: Fort Cooper Coal Measures.

4.3.2 Ionic Composition

The proportions of the major anions and cations were used to determine the hydrochemical facies of groundwaters sampled. The anion-cation balance from the Millennium monitoring bores is shown on the Piper diagram in Figure 9, based on the data collected in February 2022. The results indicate that the dominant water type across the network is sodium (Na) - chloride (Cl) type, with the bore MB10A showing a ‘mixed type’ water signature. Given there is a long standing data set for analysis, potential grouping of bores is not required.

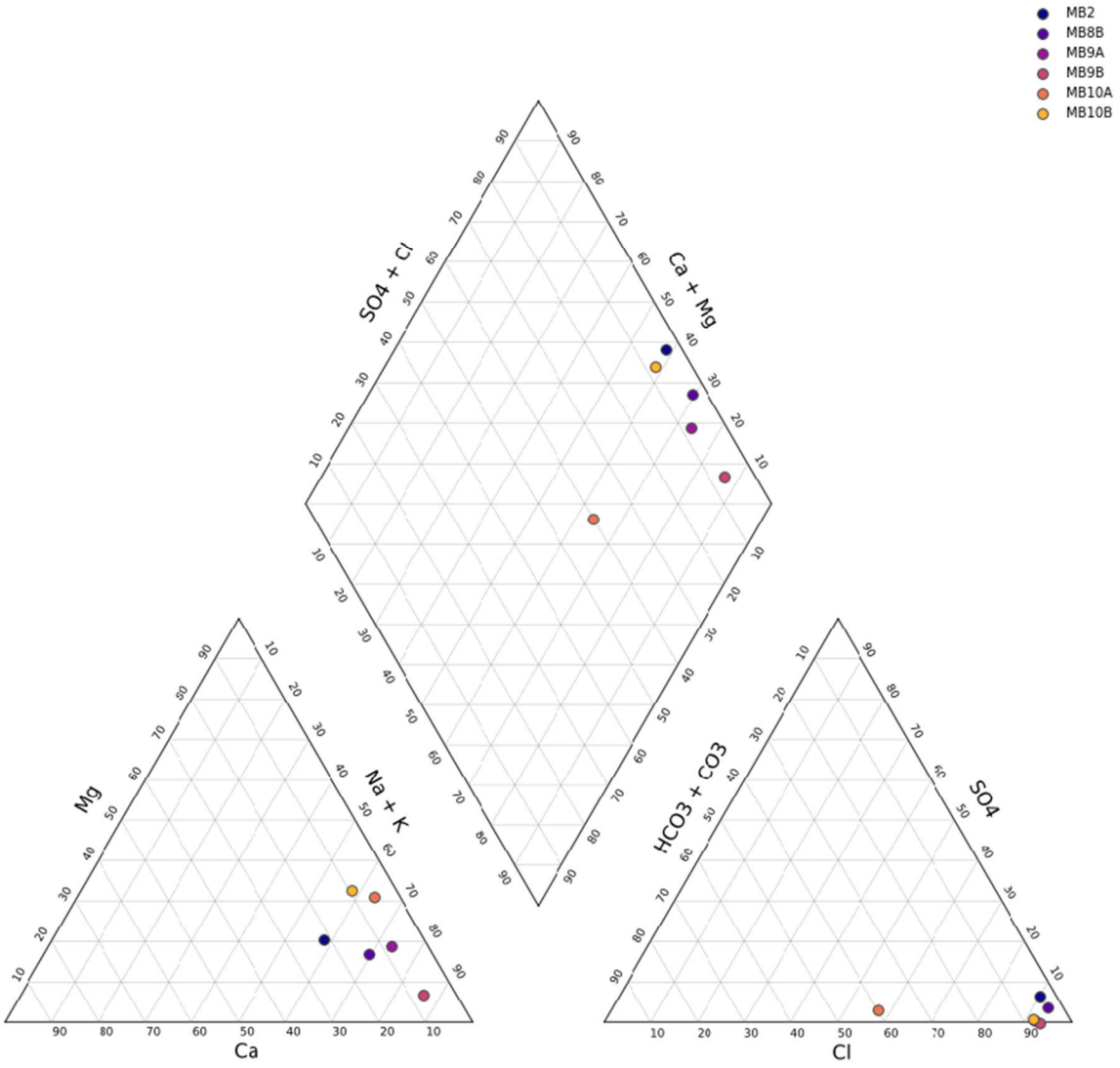


Figure 9 Piper plot for the current EA bores (February 2022)

4.3.3 Time Series Analysis

Time series plots for all bores are presented as Appendix A. An example plot from Appendix A is shown here to describe the methodology used to analyse each bore and analyte:

1. Plot time series of the raw data (Figure 10, left), including Mann-Kendall statistics (trends)
2. Plot the boxplot for the raw data to identify statistical outliers (Figure 10, middle)
3. Review the statistical outliers, remove outliers (Section 4.3.4)
4. Plot time series with outliers removed (Figure 10, right)
5. Apply the 80th and 95th percentile of the data set (outlier removed)
6. Analyse trends for the data set (outlier removed), Section 4.3.5.

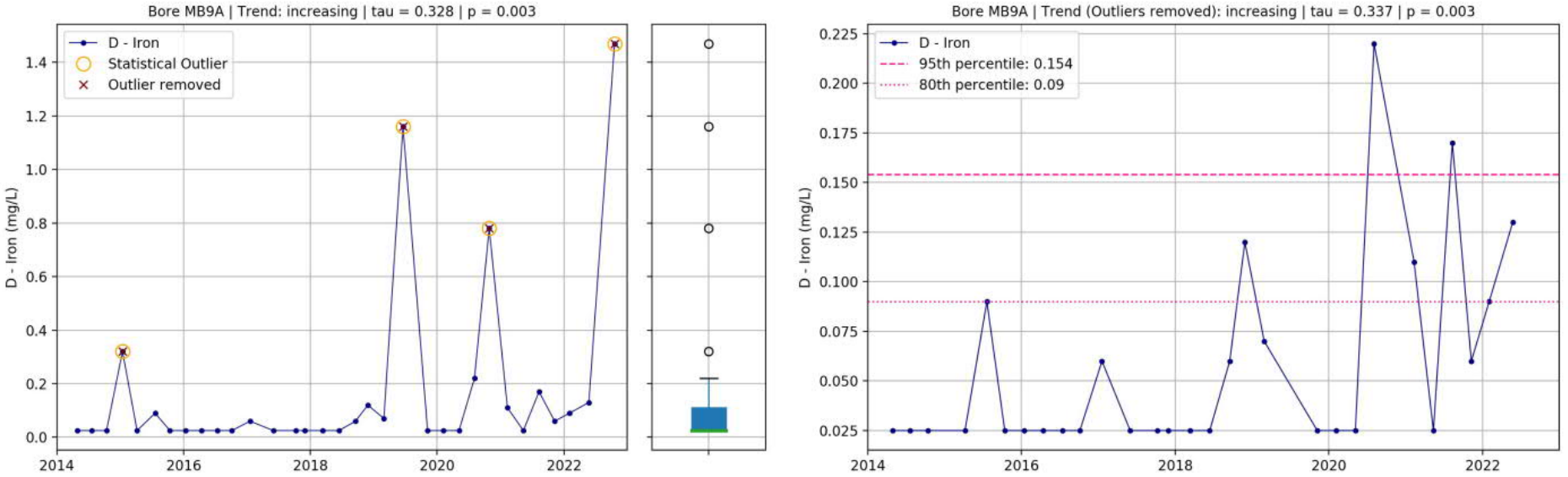


Figure 10 Example for a time series, with outlier identification and trend analysis

4.3.4 Outliers

Outliers have been screened statistically using the 1.5-times interquartile range rule (DES, 2021). Any data point that is more than 1.5 times the interquartile range above the third quartile or below the first quartile is identified as a statistical outlier. All statistical outliers were removed to derive trigger limits. This process can remove valid data points, for example, when an analyte is mostly found below the Limit of Reporting (LOR), but has a reading above LOR for single occurrences. However, in order to make the trigger value derivation process repeatable and objective, the automated removal of statistical outliers was applied.

The removed outliers are visualised in Appendix A (refer to Figure 10 for an example). A summary statistic table (i.e. without outliers) is shown in Appendix B.

4.3.5 Time Series Trends

The Mann-Kendall statistical trend test was used to detect potential trends in the dataset (once outliers were removed, refer to Section 4.3.4) for all bores where sufficient data is available, with the results shown in Appendix B.

The Mann-Kendal test is used as a first pass check if a dataset contains a statistically significant trend that warrants further analysis to assess if a real trend exists, and therefore the data may be inappropriate to use in the derivation of site-specific triggers. Interpretation of Mann-Kendall results relies on the p-value and the Kendall rank correlation coefficient, tau. A p-value less than 0.05 means that there is statistically significant trend in the data. The Kendall rank correlation coefficient (tau) shows the relation between the variance of data, with a positive tau indicating a positive trend and a negative tau indicating a negative trend. If the p-value is greater than 0.05, no statistically significant trend is present in the data.

Table 12 lists the identified trends per bore and parameter with an assessment whether the identified trend is real or whether some potential outlier data cause the trend. This could be for example higher concentrations at the start of the data record, that decreases and has been stable for a while. The removal of early data would result in no statistical trends and make the data set suited for trigger derivation.

Table 12 Assessment of Identified Statistical Trends

Bore	Parameter (trend direction)	Trend assessment
MB08B	Sulfate (increasing)	The time series shows a shift in sulfate concentration from an average of approximately 250 mg/L before 2015 to an average of approximately 450 mg/L after 2015. Since 2015 there is no further trend. Due to the large data set, it is still deemed appropriate to use the percentiles for trigger limit derivation.
	Aluminium (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Antimony (decreasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Iron (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.

Bore	Parameter (trend direction)	Trend assessment
	TPH C6-C10 Fraction (increasing)	Due to this trend, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality. It is further recommended to include "silica gel clean up" to the analysis to remove any naturally occurring TPHs from the results.
MB09A	Aluminium (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Iron (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
MB09B	Field pH (decreasing)	The time series shows a mild decrease in pH, however within the limits of the freshwater quality guidelines, which have been applied for the triggers.
	Field EC (increasing)	The time series shows a shift in EC from an average of approximately 5,500 µS/cm before 2018 to an average of approximately 12,000 µS/cm after 2018. Regional WQO are applied to maintain water quality.
	Sulfate (decreasing)	The time series shows very variable sulfate concentrations (either around 6 mg/L or around 65 mg/L. Given the values are well below the regional WQO objectives, it is proposed to use site specific triggers despite the trend.
	Chloride (increasing)	The time series shows a shift in chloride concentration from an average of approximately 1,500 mg/L before 2015 to an average of approximately 4,000 mg/L after 2015. WQO will be used as trigger limits to maintain the water quality.
	Iron (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Molybdenum (decreasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
MB10A	Sulfate (decreasing)	The time series shows decreasing trend from 75 mg/L to around 60 mg/L. Given the values are well below the regional WQO objectives, it is proposed to use site specific triggers despite the trend.
	Iron (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Molybdenum (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
MB10B	Field pH (decreasing)	The time series shows a mild decrease in pH, however within the limits of the freshwater quality guidelines, which have been applied for the triggers.
	Field EC (increasing)	The time series shows an increasing trend in EC, however with the EC below the region WQO, which are applied as trigger limits to maintain water quality.

Bore	Parameter (trend direction)	Trend assessment
	Sulfate (decreasing)	The time series shows decreasing trend from 200 mg/L to around 40 mg/L. Given the values are well below the regional WQO objectives, it is proposed to use site specific triggers despite the trend.
	Chloride (increasing)	The time series shows a shift in chloride concentration from an average of approximately 1,500 mg/L before 2015 to an average of approximately 4,000 mg/L after 2015. WQO will be used as trigger limits to maintain the water quality.
	Aluminium (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Iron (increasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	Molybdenum (decreasing)	Due to a high percentage below LOR, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality.
	TPH C6-C10 Fraction (decreasing)	Due to this trend, no site-specific triggers to be developed. WQO will be used to triggers to maintain the water quality. It is further recommended to include “silica gel clean up” to the analysis to remove any naturally occurring TPHs from the results.

4.4 Site Specific Limit Derivation

The updated (outliers removed) dataset summary statistics shown in Appendix B were to derive appropriate water quality limits for the EA.

Appendix B summarises all the findings below in table format, as per Figure 11 below. For each of the assessed ten bores, a table is provided with the following:

- Water quality guideline and WQO for each parameter, row 1-8
- Summary statistics (after outlier removal), row 9-20
  - Comparison of the 80th percentile with the guideline (20th and 80th percentile for pH), row 18
- Trigger derivation considerations: number of samples, percentage LOR and trends (row 21-24).
  - If all three rows are blank (ie more than 8 samples, less than 15% of LORs and no trends identified, site specific Limits A and B were derived
  - If any of those rows have an “x” or trend identified, no site specific data could be derived, and the guidelines were applied as Limit B (colour coded according to rows 2-8).

		Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved
		pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l
1	Water quality Guidelines							
2	ANZECC Aquatic Ecosystem (95%) Protection Guideline (ANZG 2018)	6.0-7.5	250	-		0.055	0.009	0.013
3	ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5
4	ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2
5	ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1
6	Fitzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-		-
7	Fitzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	398	5905			
8	DES, 2013							
9	Statistics							
10	Count	29	25	33	30	29	28	4
11	% of values below LOR	0	0	0	0	100	79	100
12	Minimum Date	30/01/2014	14/04/2016	30/01/2014	30/01/2014	30/01/2014	30/01/2014	25/04/2011
13	Maximum Date	18/10/2022	18/10/2022	18/10/2022	18/10/2022	18/10/2022	18/10/2022	24/05/2022
14	Minimum	6.3	19720	232	7540	0.0025	0.0005	0.0005
15	5th percentile	6.4	20340	235	7599	0.0025	0.0005	0.0005
16	20th Percentile	6.7	20832	250	7778	0.0025	0.0005	0.0005
17	Median	6.9	21620	430	8060	0.0025	0.0005	0.0005
18	80th Percentile	7.1	23140	470	8334	0.0035	0.0008	0.0005
19	95th Percentile	7.3	24240	483	8520	0.005	0.00365	0.0005
20	Maxiumum	7.4	24400	503	8600	0.005	0.004	0.0005
21	Trigger derivation considerations							
22	Trigger Development not possbile due less than 8 samples							x
23	Trigger Development not possbile due to more than 15% of values <LOR					x	x	x
24	Mann Kendall trend			increasing		increasing	decreasing	
25	Proposed Trigger limits							
26	Limit A (80th Percentile)		23140	470	8334			
27	Limit B (95th Percentile) or applicable guideline	6.0-7.5	24240	483	8520	0.055	0.009	0.013

Figure 11 Example for the trigger derivation tables

4.4.1 Number of Relevant Sampling Events

The first step to identifying site-specific guidelines (and therefore limits) for groundwater quality (DES, 2021; Section 5) is to confirm the number of sampling events (data points) available for each bore and analyte. DES (2021) recommends a minimum of 18 samples over at least 12 months but allows using eight or more samples to derive site specific guidelines.

Table 13 shows the number of samples for each bore and analyte in the updated (outliers removed) dataset. The cells highlighted in blue indicate that the data set is too small to derive triggers.

Further, the guideline specifies a maximum limit of 10-15% of values below LOR for a data set to be suitable to derive trigger from. Table 14 lists each bore and analyte with their respective percentage of values below LOR. Highlighted cells indicate that the data set is not suitable for trigger limit derivation (more than 15% of values below LOR) for the particular bore and parameter.

Table 13 Number of Sampling Events for Bores (outliers removed)

Bore	pH	EC	SO4	Cl	Al	Sb	As	Cu	Fe	Hg	Mo	Se	Au	Zn	C6 - C10	C10 - C40
MB08B	29	25	33	30	29	28	25	2	33	31	28	26	29	2	25	28
MB09A	27	30	33	31	31	26	26	2	29	31	31	26	33	2	28	25
MB09B	27	34	34	32	32	34	34	3	33	34	31	27	34	3	25	28
MB10A	28	29	25	27	22	24	28	3	28	28	25	23	29	3	23	24
MB10B	30	28	30	25	25	27	25	3	30	29	24	24	29	3	26	27

Table 14 Percentage of data points below LOR

Bore	pH	EC	SO4	Cl	Al	Sb	As	Cu	Fe	Hg	Mo	Se	Au	Zn	C6 - C10	C10 - C40
MB08B	0	0	0	0	100	79	100	100	48	100	100	100	100	0	68	100
MB09A	0	0	0	0	81	88	100	50	62	100	68	100	100	50	100	100
MB09B	0	0	12	0	59	65	26	100	52	100	0	100	100	67	40	100
MB10A	0	0	0	0	100	100	18	67	43	100	36	100	100	67	100	100
MB10B	0	0	0	0	100	100	100	100	40	100	83	100	100	67	8	100

4.4.2 Proposed Limits and Compliance Approach

The proposed EA compliance approach follows the recommended compliance approach as per DES (2021). The two approaches are:

- A single Limit per parameter (called limit B here), or
- A dual limit (Limit A and Limit B) approach as follows:
    - Limit A: 20th (pH only) and/or 80th percentile of site specific data.
    - Limit B: Reference guideline value or reference WQO or 95th percentile of site data.

Given that for many of the analytes, no site-specific limits can be derived due to the percentage of values below LOR, it is proposed to use only a Limit B approach, to be applied to 3 consecutive samples, i.e. consecutive sampling events show concentrations above the relevant Limit are required to constitute a Limit exceedance in the EA.

Proposed limits based on the assessment provided in Section 4.4 are summarised in Table 15.

Table 15 Initial Proposed EA Parameter Limits

Parameter	Bore	Limit B	Limit B justification
pH - Field	MB08B MB09A MB09B MB10A MB10B	6.0-7.5	ANZECC 95% protection limit, freshwater
Electrical Conductivity - Lab (µS/cm)	MB08B	24240	95th percentile of bore specific dataset
	MB09A	20329	95th percentile of bore specific dataset
	MB09B	16000	WQO Fitzroy WQ1310, Zone 34, deep
	MB10A	3998	95th percentile of bore specific dataset
	MB10B	10265	95th percentile of bore specific dataset

Parameter	Bore	Limit B	Limit B justification
Sulfate (mg/L)	MB08B	483	95th percentile of bore specific dataset
	MB09A	109	95th percentile of bore specific dataset
	MB09B	79	95th percentile of bore specific dataset
	MB10A	75	95th percentile of bore specific dataset
	MB10B	174	95th percentile of bore specific dataset
Chloride (mg/L)	MB08B	8520	95th percentile of bore specific dataset
	MB09A	6785	95th percentile of bore specific dataset
	MB09B	5905	WQO Fitzroy WQ1310, Zone 34, deep
	MB10A	789	95th percentile of bore specific dataset
	MB10B	5905	WQO Fitzroy WQ1310, Zone 34, deep
Aluminium Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.055	ANZECC 95% protection limit, freshwater
Antimony Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.009	ANZECC 95% protection limit, freshwater
Arsenic Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.013	ANZECC 95% protection limit, freshwater
Copper Dissolved (mg/L)	MB08B MB09B MB10A MB10B	0.0014	ANZECC 95% protection limit, freshwater
	MB09A	0.0002	WQO Fitzroy WQ1310, Zone 34, shallow
Iron Dissolved (mg/L)	MB09A MB10A	0.14	WQO Fitzroy WQ1310, Zone 34, shallow
	MB08B MB09B MB10B	0.246	WQO Fitzroy WQ1310, Zone 34, deep

Parameter	Bore	Limit B	Limit B justification
Mercury Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.0006	ANZECC 95% protection limit, freshwater
Molybdenum Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.034	ANZECC 95% protection limit, freshwater
Selenium Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	0.011	ANZECC 95% protection limit, freshwater
Silver Dissolved (mg/L)	MB08B MB09A MB09B MB10A MB10B	"Below LOR"	The current LOR is higher than the ANZECC 95% protection limit, freshwater Guideline value for Silver. However, none of the bores has ever recorded a value above LOR. The current water quality will be maintained if the future observations remain below LOR.
Zinc Dissolved (mg/L)	MB08A	0.317	WQO Fitzroy WQ1310, Zone 34, deep
	MB09A MB1A	0.060	WQO Fitzroy WQ1310, Zone 34, shallow
	MB09B MB10B	0.008	ANZECC 95% protection limit, freshwater
TRH, C6-C10 Fraction (µg/L)	MB08B MB09A MB09B MB10A MB10B	20	DES, 2013
TRH, C10-C40 Fraction (µg/L)	MB08B MB09A MB09B MB10A MB10B	100	DES, 2013 The guideline suggests TRH values for the C10-C36fraction of 100 µg/L. This was applied to a larger faction here (C10-C40, due to the laboratory values)

4.4.3 Testing of proposed limits

The initial proposed limits presented above have been tested against the historical dataset using the proposed compliance approach (Appendix C). Notable exceedances and proposed changes are documented in Table 16. The final proposed trigger values are presented in Section 5.4, Table 17.

Table 16 Trigger testing results

Trigger testing	Notes	Changes proposed
Dissolved Iron	For all bores, the regional WQO was used as trigger Limit B. Four out of the five bores trigger the iron limits. It is likely that the iron concentrations stem from iron bacteria. As recommended in Section 5.2, the bores should be treated and airlifted, which may get rid of the iron bacteria. As those are not related to the mining operations, it is proposed to remove the trigger limit for iron at this stage.	Remove iron from compliance table until cause of iron is identified and resolved
Field pH	For pH, the national freshwater guidelines were used for simplicity. Three out of the five bores showed three exceedances in a row, which would be a non-compliance. However, these exceedances occurred in 2014-1016 and the pH has since been stable within the proposed trigger limits	No.
TPH C6-C10 Fraction	The trigger limits for these were derived based on Guideline values (DES, 2013). Two of the bores exceed the limits on a few occasions. It is recommended to add “silica gel clean up” to the analysis, which could potentially exclude naturally occurring hydrocarbons. The C6-C10 fraction is related to Gasoline and if exceedances persist, an investigation into the occurrence of the triggers is recommended.	No.

5 Conclusions and Recommendations

5.1 Groundwater Monitoring Network

The existing groundwater monitoring network at Millennium Mine, as documented in EA EPML00819213, is deemed to be generally suitable for the purpose of monitoring the variations in groundwater level and quality in a manner that would allow for the early detection of significant groundwater changes, which may be attributed to the mining operations at Millennium Mine. Although, it is noted that significant groundwater changes are not likely to be attributable to mining operations, based on the results of the relevant groundwater impact assessments.

However, to addresses Condition D6 of EA EPML00819213, it is recommended to:

- Expand the coverage of the Mavis UG monitoring network to capture the predicted groundwater drawdown impacts in the areas where potential changes to the groundwater regime can be attributed to Mavis UG mining activities. In particular, the areas related to the low potential terrestrial GDE associated with North Creek and to the Rangal CM (Leichhardt Seam) to the east and north of Mavis Pit should be captured by the Mavis UG monitoring network:
    - Include the piezometer CS_VWP1 and bore CS_MB2 from the Carborough Downs mine groundwater network in the Mavis UG groundwater monitoring network, in order to target the areas listed above; and
    - Undertake logger downloads at CS_VWP1 and manual water level monitoring at CS_MB2 on a quarterly basis.

As part of the full water quality monitoring suite, in addition to collecting field parameters (EC and pH), water samples will be submitted to a NATA accredited laboratory for the analysis of:

- Physiochemical indicators (TDS);
- Major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate and carbonate);
- Total and dissolved metals: aluminium, iron, copper, zinc, silver, arsenic, mercury, antimony, molybdenum and selenium; and
- Total petroleum hydrocarbons (C6-C9, C10-C14, C15-C28 and C29-C36) with silica gel clean-up.

5.2 Groundwater Bore Status

Given the Millennium monitoring bores have reported odours and visually disturbed samples (cloudy, particles etc), it is recommended to address the potential for stagnant water by:

- Undertake a downhole camera investigation to confirm bore construction details and check for bore integrity;
- Test and if present, treat the bores for potential iron bacteria occurrence; and
- Re-develop bores by airlifting (this might improve the contact between bore and aquifer).
- These three steps above should be carried out after a sampling round to let the bores recover until the next round of sampling.

5.3 Sampling Methodology

DES (2018) states that "Purging or low flow sampling methods are preferred for accurate groundwater sampling. Low flow methods minimise the impact of the sampling method on the aquifer and are more likely to obtain a representative sample, while some high flow pumps can sometimes induce water chemistry changes."

For this site it is understood that low flow sampling might not be feasible. However, it is recommended to attempt low flow sampling for one monitoring round to assess the feasibility.

If the bore recharge is too low to maintain laminar flow required for low flow sampling, it is recommended that Hydrasleeve sampling to remain the preferred method, noting that:

- The bore is properly developed as per Minimum Construction Requirements for Water Bores in Australia (NDULC, 2020);
- It is used to collect groundwater samples directly from the screened interval of a bore without having to purge the bore prior to sample collection (i.e. the screened section must be known);
- Sample collection depth should be noted in the field notes; and
- It is a single-use (disposable) sampler that is not intended for reuse.
- To allow the collection of a representative groundwater sample, the aquifer requires time to re-equilibrate following the installation of the HydraSleeve within the monitoring well. As a bare minimum, it is recommended the well is allowed between 15 minutes to three hours to equilibrate. To optimise efficiency when sampling multiple monitoring wells, it is recommended that all HydraSleeve be first installed in sequential order before beginning the groundwater sampling following the same order or alternatively a new HydraSleeve is installed in the bore after the sampling and remains there between sampling rounds.

5.4 Groundwater Quality Triggers

The final proposed water quality trigger limits are presented in Table 17. As per the chosen approach (Section 4.4.2), three consecutive exceedances would result in a non-compliance and trigger an investigation.

Table 17 Proposed trigger limits

Water Quality Guideline	Field pH	Field EC	Sulfate as SO4	Cl[1]	Al[1]	Sb[1]	As[1]	Cu[1]	Hg[1]	Mo[1]	Se[1]	Ag[1]	Zn[1]	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	(µg/L)	(µg/L)
MB08B	6.0-7.5	24240	483	8520	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.317	20	100
MB09A	6.0-7.5	20329	109	6785	0.055	0.009	0.013	0.030	0.0006	0.034	0.011	below LOR	0.060	20	100
MB09B	6.0-7.5	16000	79	5905	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.008	20*	100
MB10A	6.0-7.5	3998	75	789	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.060	20	100
MB10B	6.0-7.5	10265	174	5905	0.055	0.009	0.013	0.0014	0.0006	0.034	0.011	below LOR	0.008	20*	100

Notes: 1: Dissolved metals * will likely be exceeded, investigation recommended.
Shades: no shade: Site specific Limit B, blue shade: Default Guideline values (ANZG, 2018), yellow shade: Fitzroy WQO (GW, Zone 34), grey shade: DES, 2013.

5.5 Impacts of proposed changes to the groundwater

The conclusions presented in Section 5.1 to 5.4 are proposed to be included for an EA amendment. All items addressed in this study were stipulated by the current EA Condition D6:

> For the Mavis underground operations [...], an assessment by an appropriately qualified person must be undertaken to determine the following: a) Number and location of groundwater monitoring sites; b) Suitability of the monitoring network; and c) Groundwater contaminant trigger levels.

Table 18 summarises the predicted impacts of the proposed changes to the network and the trigger limits. No impacts to the groundwater system are predicted.

Table 18 Impacts of the proposed network and trigger limit changes

Condition D6	Impact
Number and location of groundwater monitoring sites	The number of bores was increased by two. In order to avoid any unnecessary disturbance to the groundwater system, the two bores to be included in the network were selected from existing bores of a neighbouring mine. No impacts to the groundwater system are predicted. Millennium Mine has a data sharing agreement in place to receive the data at a regular frequency.
Suitability of the monitoring network	The network was reviewed for suitability. Some bores showed signs of the potential presence of iron bacteria and potential sedimentation (turbid samples). It is recommended to undertake downhole camera investigation, check or iron bacterial and to re-develop the existing groundwater monitoring bores to improve the connection to the screened aquifer section. None of these actions are predicted to have an impact on the groundwater system. The airlifting will produce some groundwater to the surface. The water quality in all bores is unimpacted and as such, no impact to the surface environment is predicted. An exception is the salinity, but given this naturally occurring and they are no sensitive receptors near the bores, no impact is predicted. If the airlift water is a concern, it could alternatively be captured.
Groundwater contaminant trigger levels.	The groundwater contamination trigger levels were developed based on the DES, 2021 Guideline. Using monitoring data to assess groundwater quality and potential environmental impacts. The methodology allows to set triggers either site based or based on guideline values. This approach results in suitable triggers limits that will pick up any changes in groundwater quality. There are no predicted impacts to groundwater from this change of trigger limits. Rather, they will be more suitable to pick up any impact should they occur.

6 References

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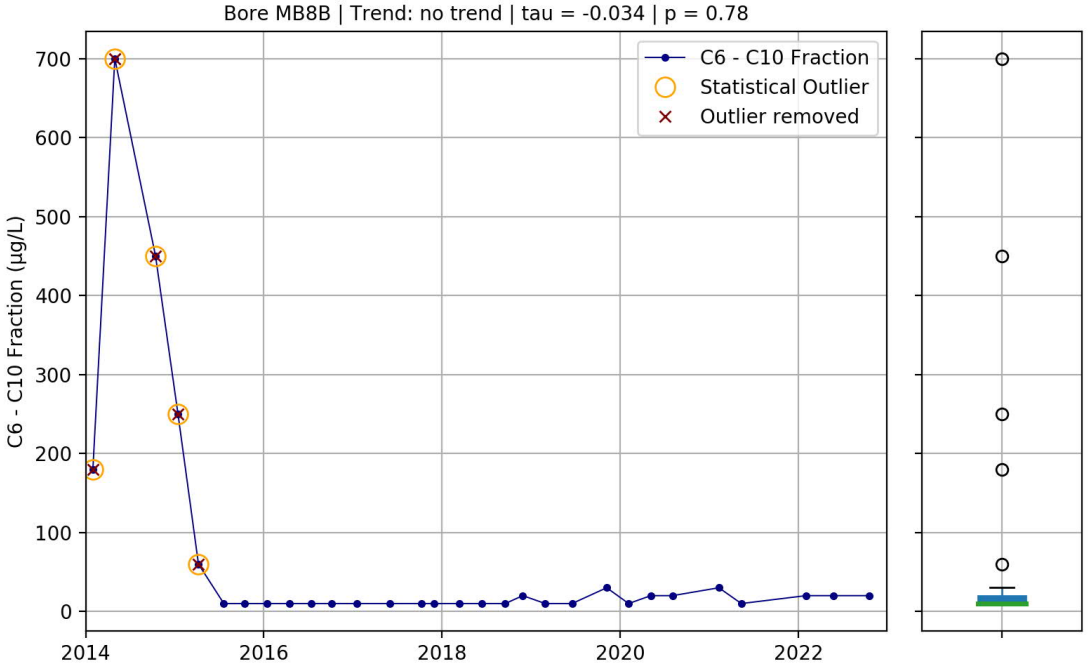
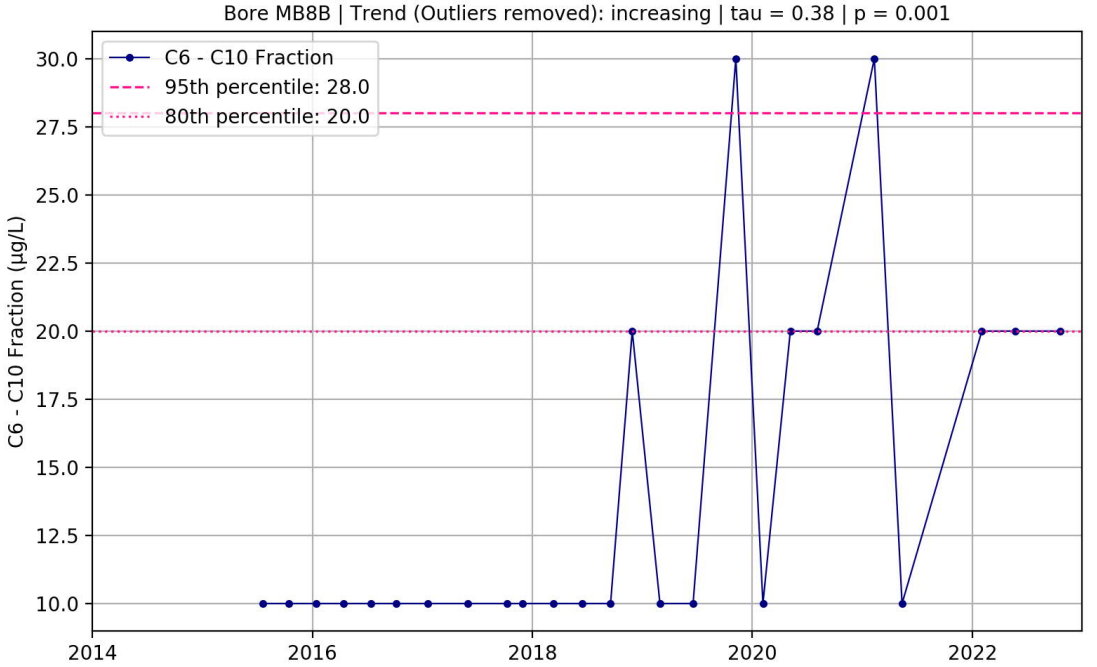
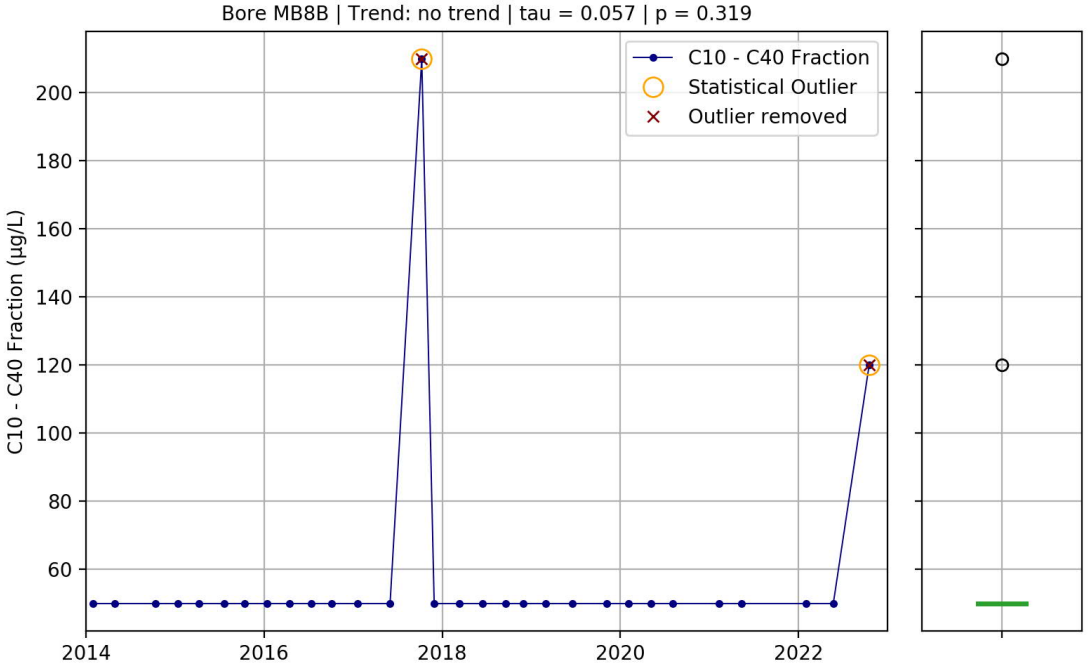
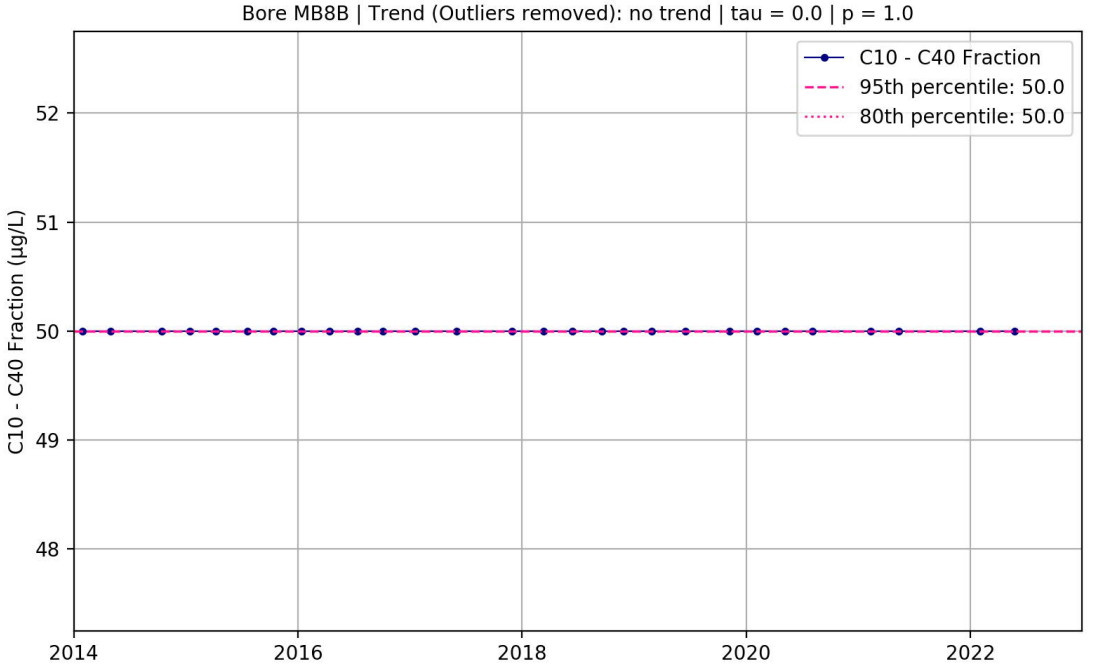
APPENDIX A

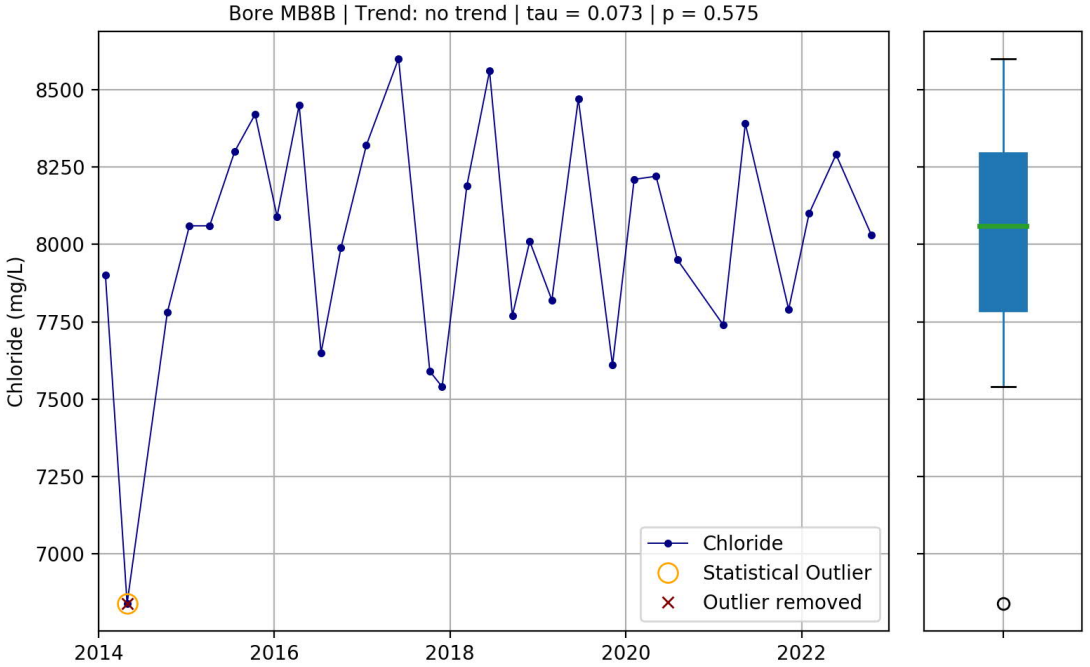
Time series, trends and outliers

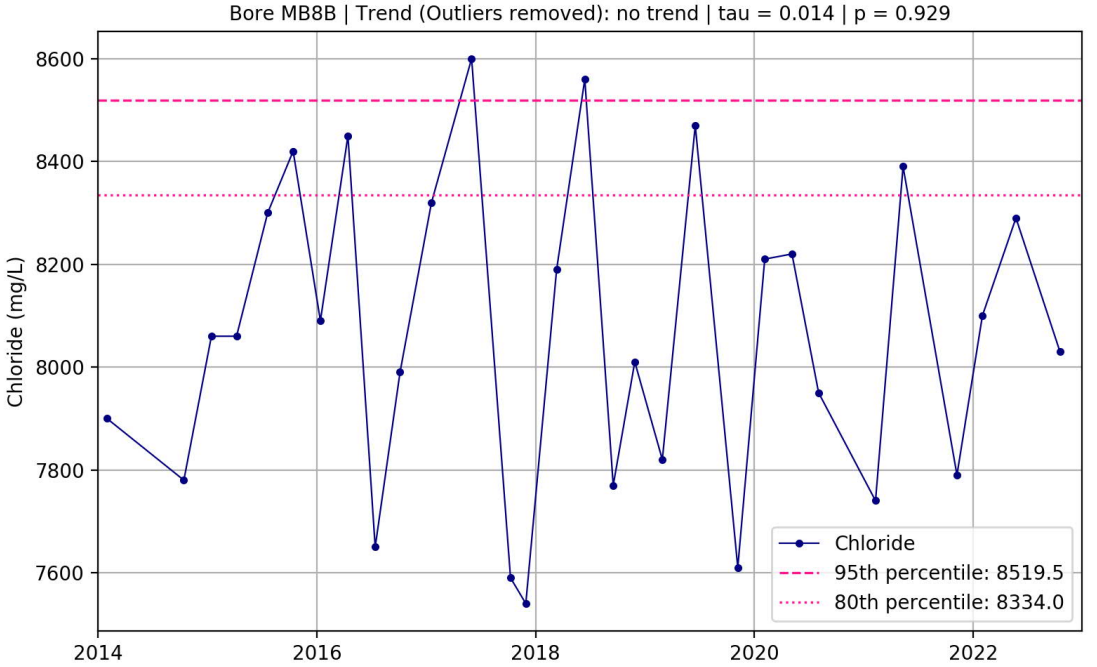

Bore MB8B | Trend: no trend | tau = -0.034 | p = 0.78
C6 - C10 Fraction
Statistical Outlier
Outlier removed
C6 - C10 Fraction (µg/L)
0
100
200
300
400
500
600
700
2014
2016
2018
2020
2022

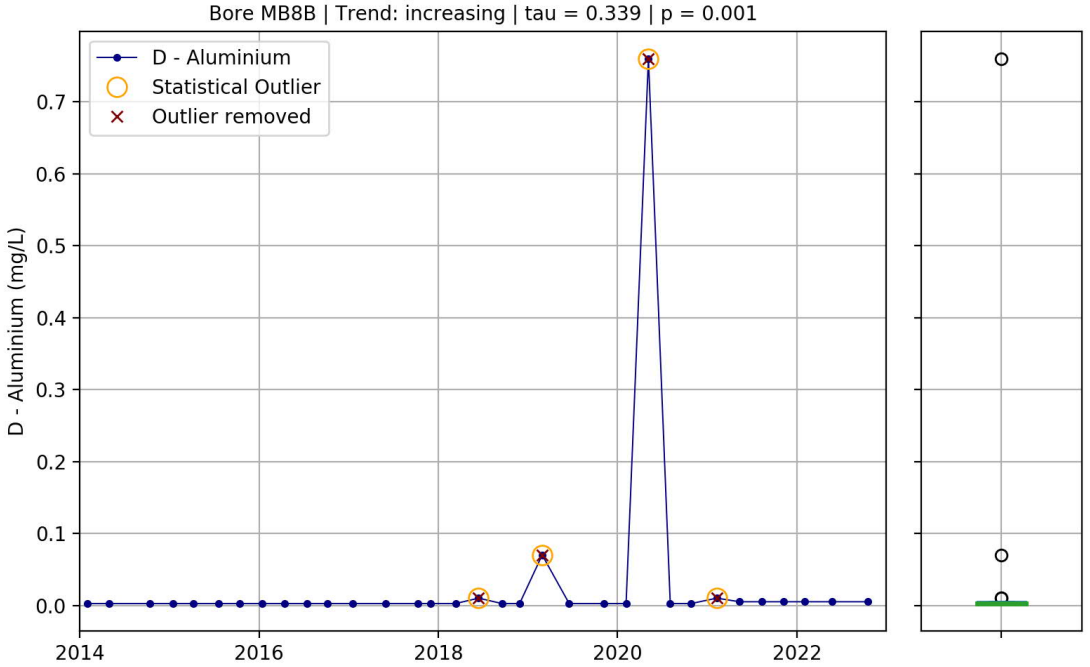

Bore MB8B | Trend (Outliers removed): increasing | tau = 0.38 | p = 0.001
C6 - C10 Fraction
95th percentile: 28.0
80th percentile: 20.0
C6 - C10 Fraction (µg/L)
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0
2014
2016
2018
2020
2022

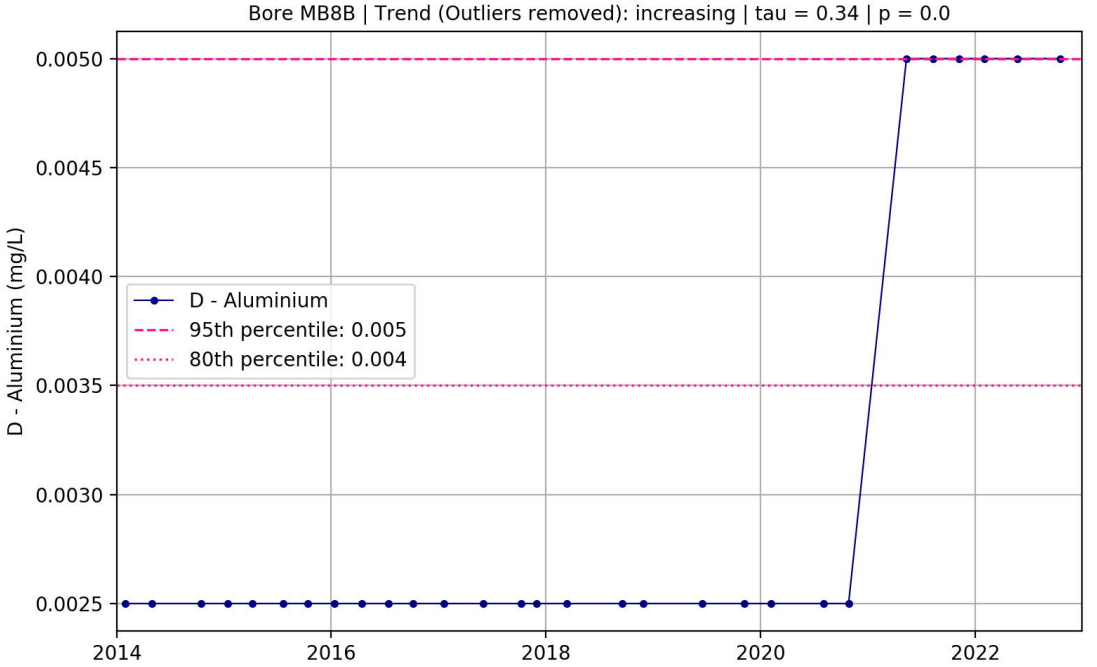

Bore MB8B | Trend: no trend | tau = 0.057 | p = 0.319
C10 - C40 Fraction
Statistical Outlier
Outlier removed
C10 - C40 Fraction (µg/L)
60
80
100
120
140
160
180
200
2014
2016
2018
2020
2022

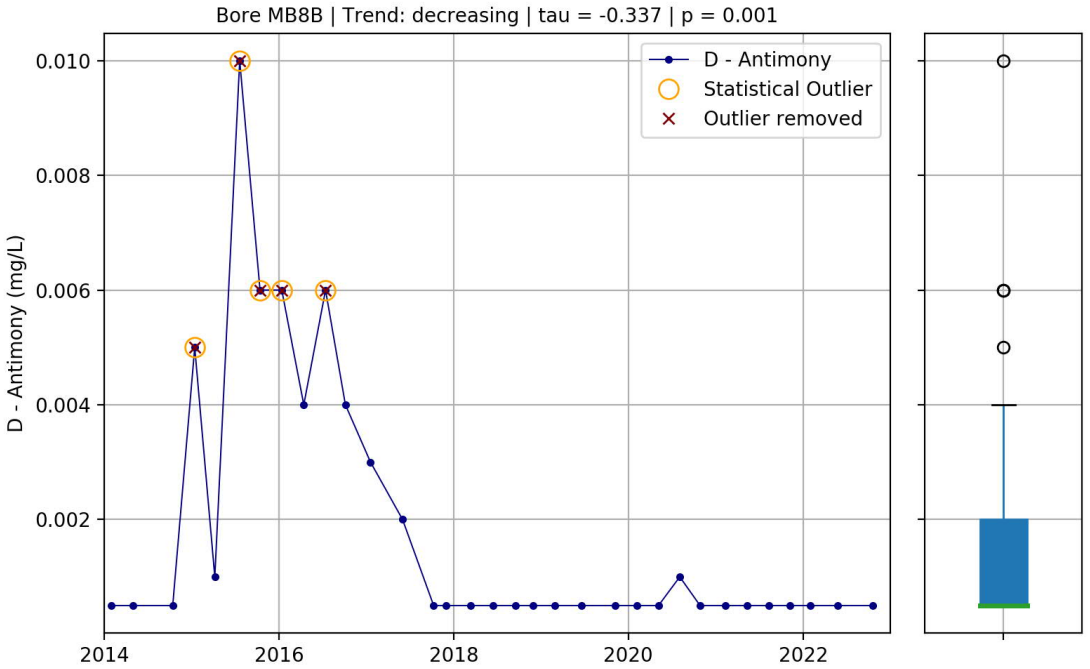

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
95th percentile: 50.0
80th percentile: 50.0
C10 - C40 Fraction (µg/L)
48
49
50
51
52
2014
2016
2018
2020
2022

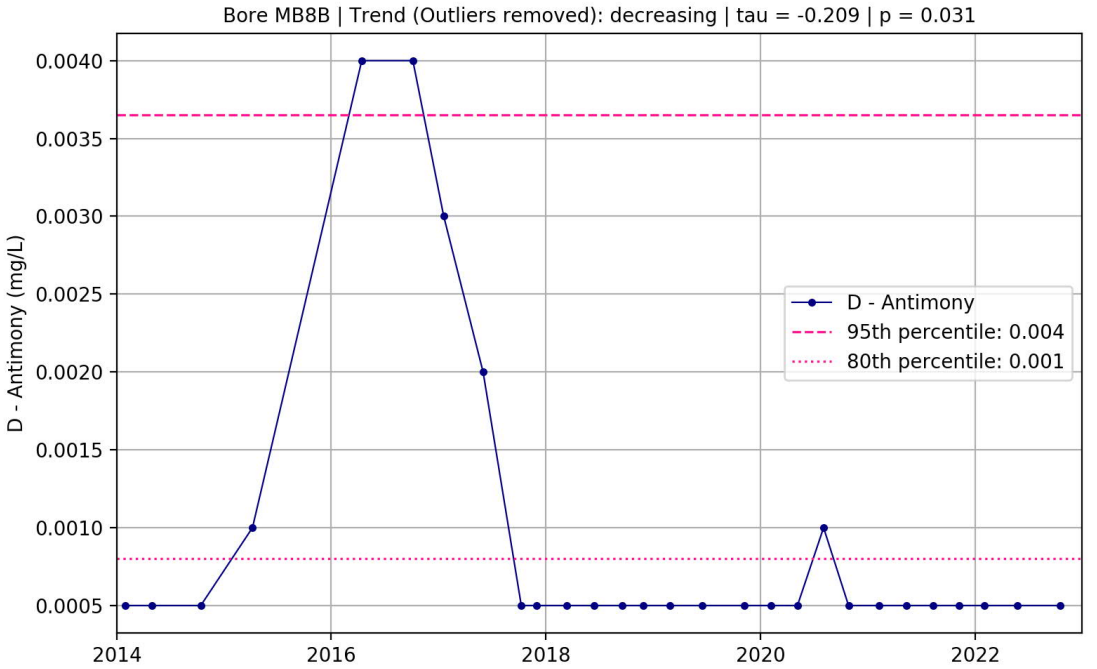

Bore MB8B | Trend: no trend | tau = 0.073 | p = 0.575
Chloride (mg/L)
Chloride
Statistical Outlier
Outlier removed

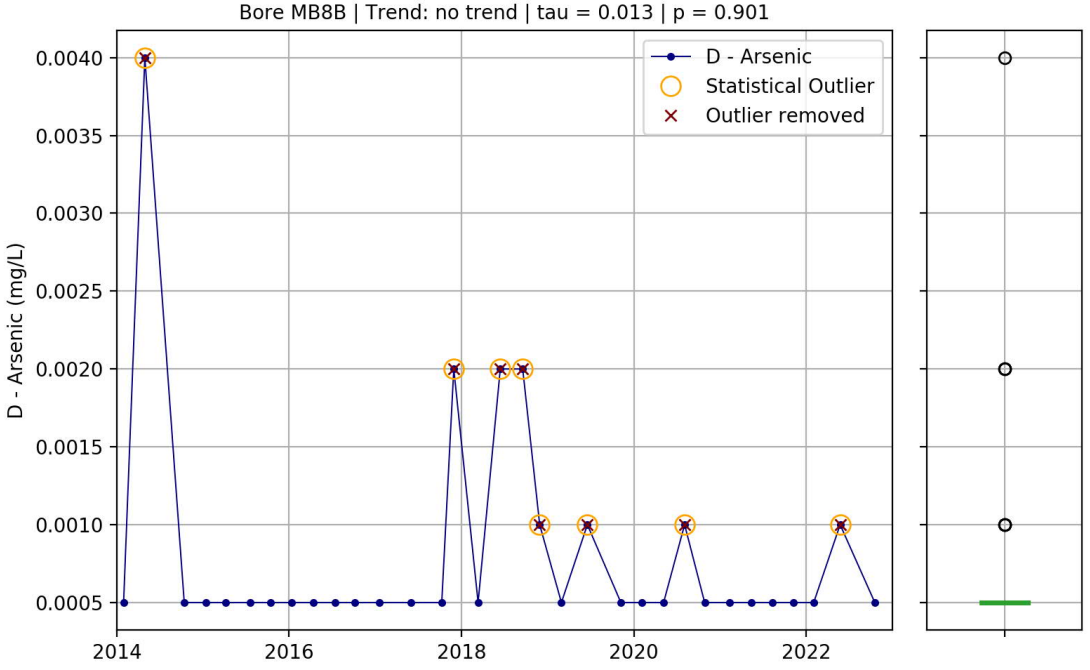

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.014 | p = 0.929
Chloride (mg/L)
Chloride
95th percentile: 8519.5
80th percentile: 8334.0

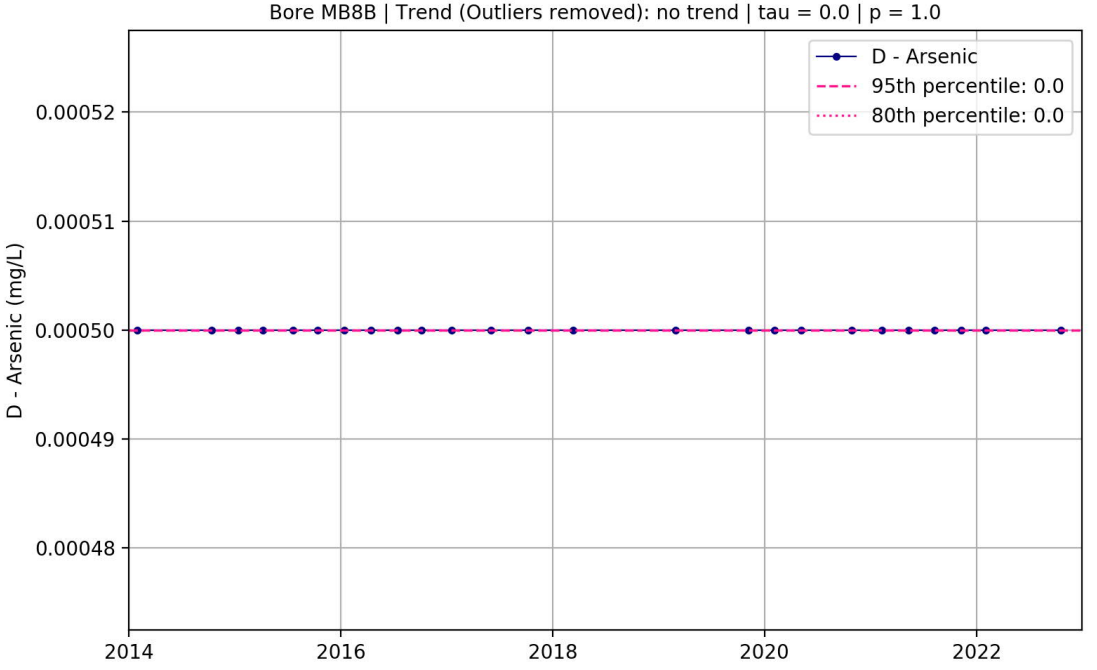

Bore MB8B | Trend: increasing | tau = 0.339 | p = 0.001
D - Aluminium (mg/L)
D - Aluminium
Statistical Outlier
Outlier removed

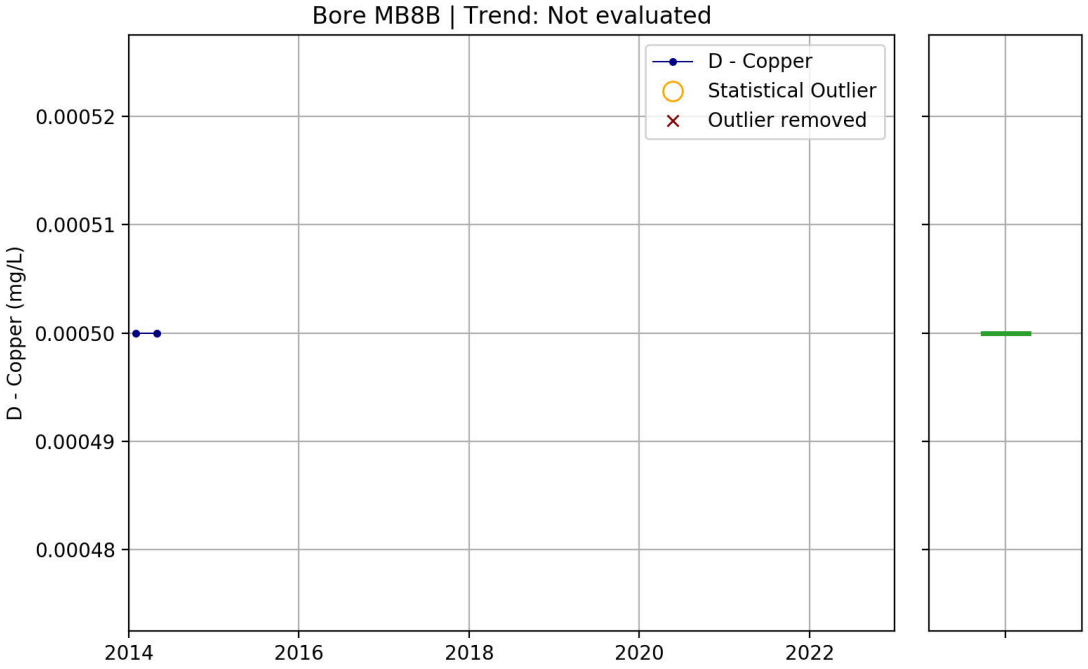

Bore MB8B | Trend (Outliers removed): increasing | tau = 0.34 | p = 0.0
D - Aluminium (mg/L)
D - Aluminium
95th percentile: 0.005
80th percentile: 0.004

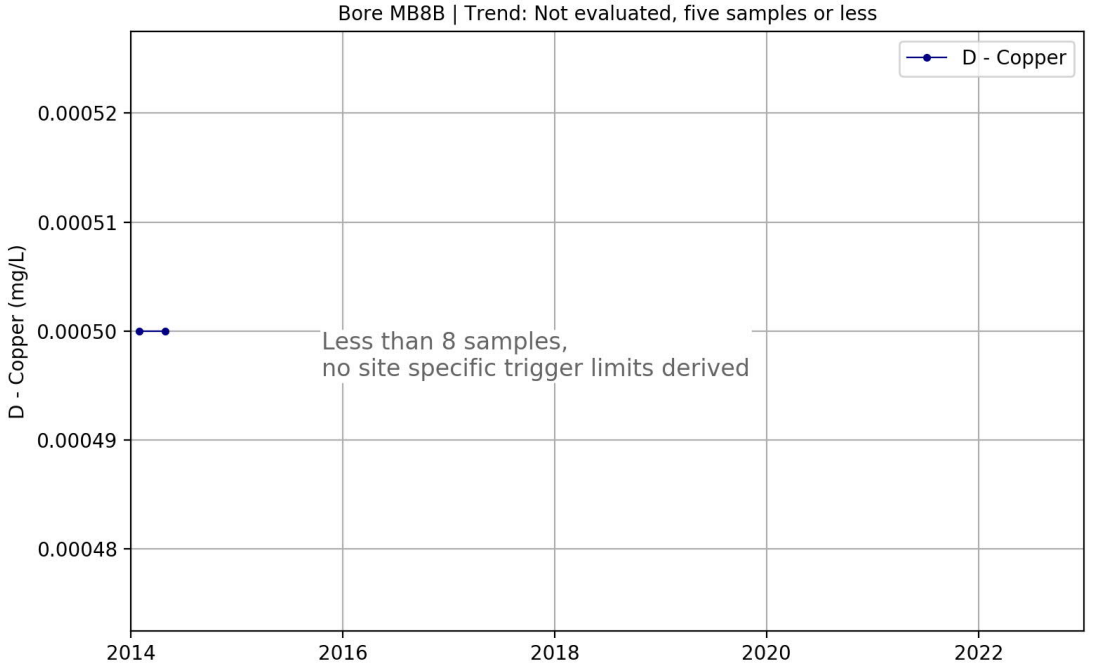

Bore MB8B | Trend: decreasing | tau = -0.337 | p = 0.001
D - Antimony
Statistical Outlier
Outlier removed
D - Antimony (mg/L)
0.010
0.008
0.006
0.004
0.002
2014
2016
2018
2020
2022

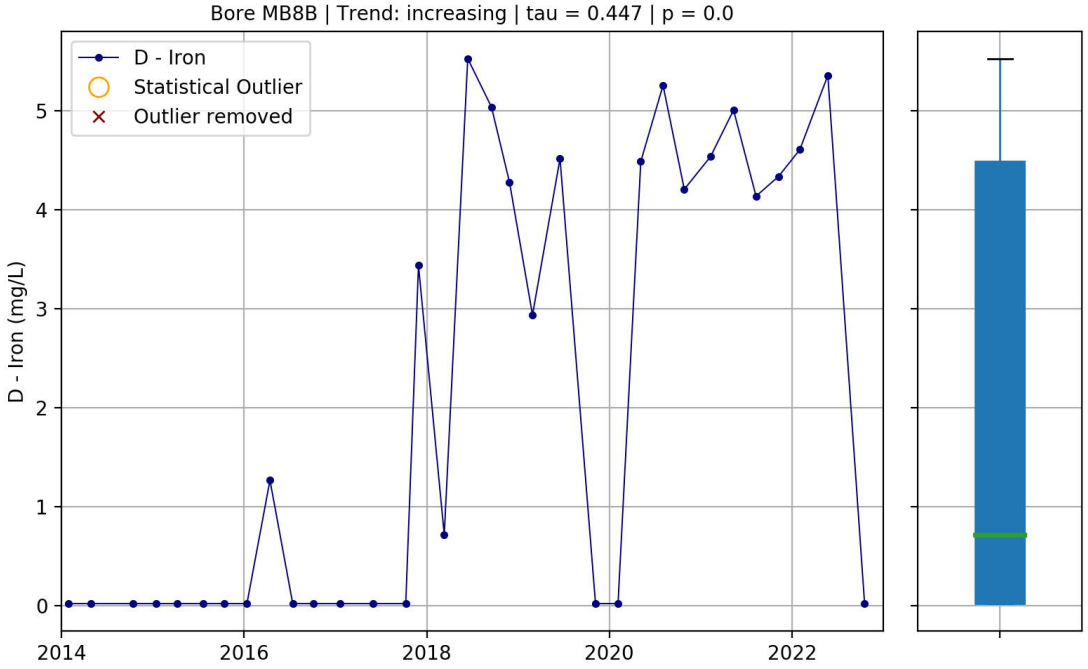

Bore MB8B | Trend (Outliers removed): decreasing | tau = -0.209 | p = 0.031
D - Antimony
95th percentile: 0.004
80th percentile: 0.001
D - Antimony (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

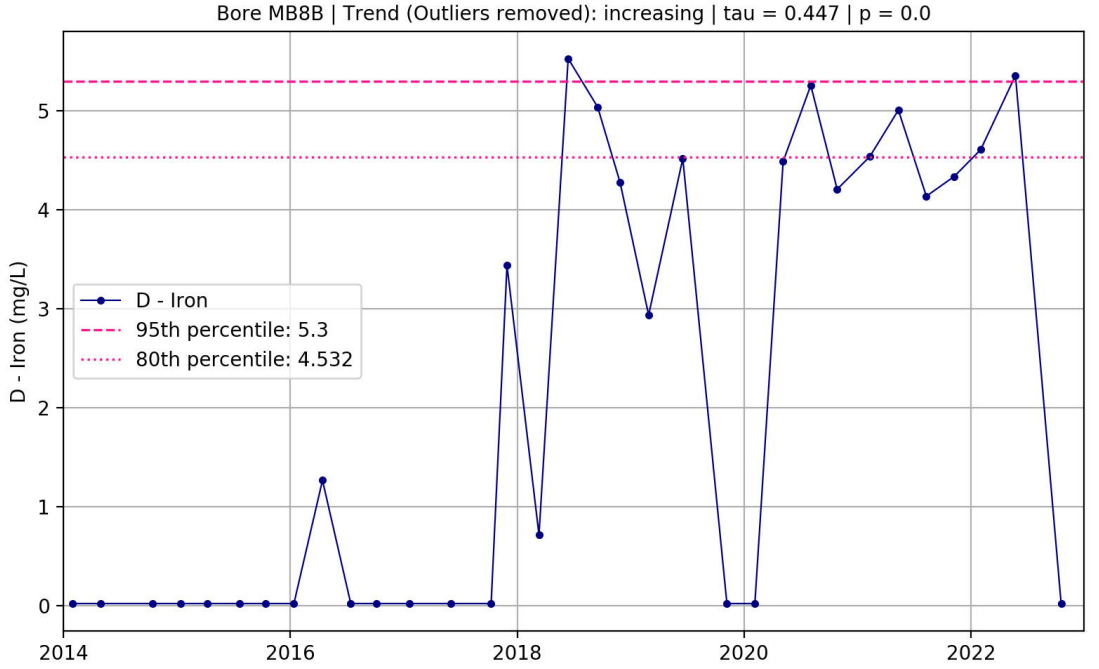

Bore MB8B | Trend: no trend | tau = 0.013 | p = 0.901
D - Arsenic
Statistical Outlier
Outlier removed
D - Arsenic (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

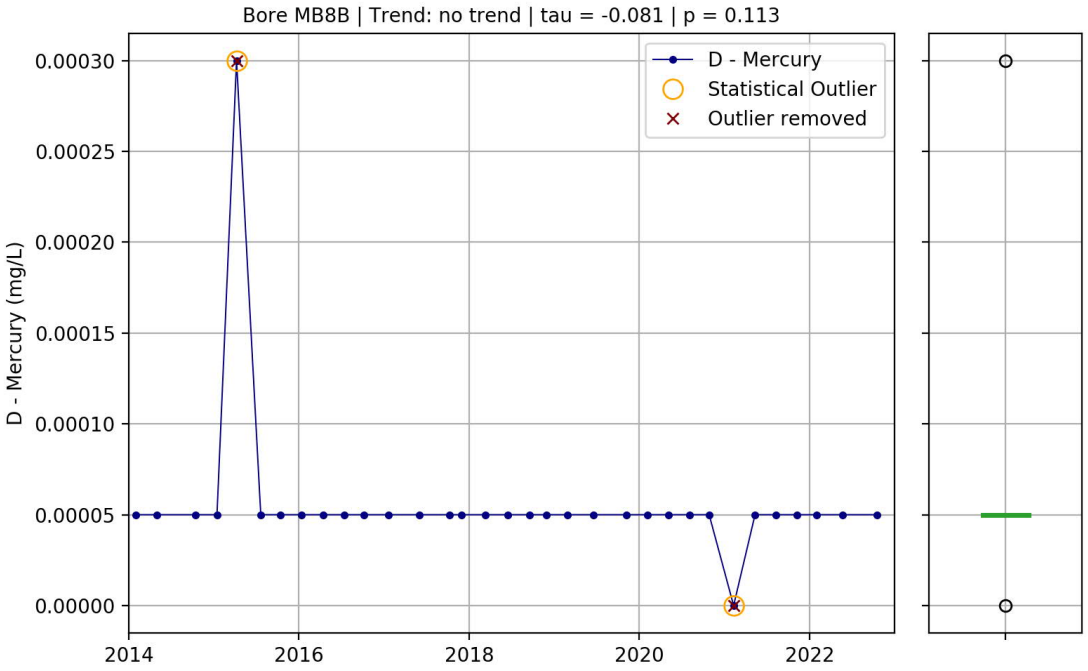

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Arsenic
95th percentile: 0.0
80th percentile: 0.0
D - Arsenic (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

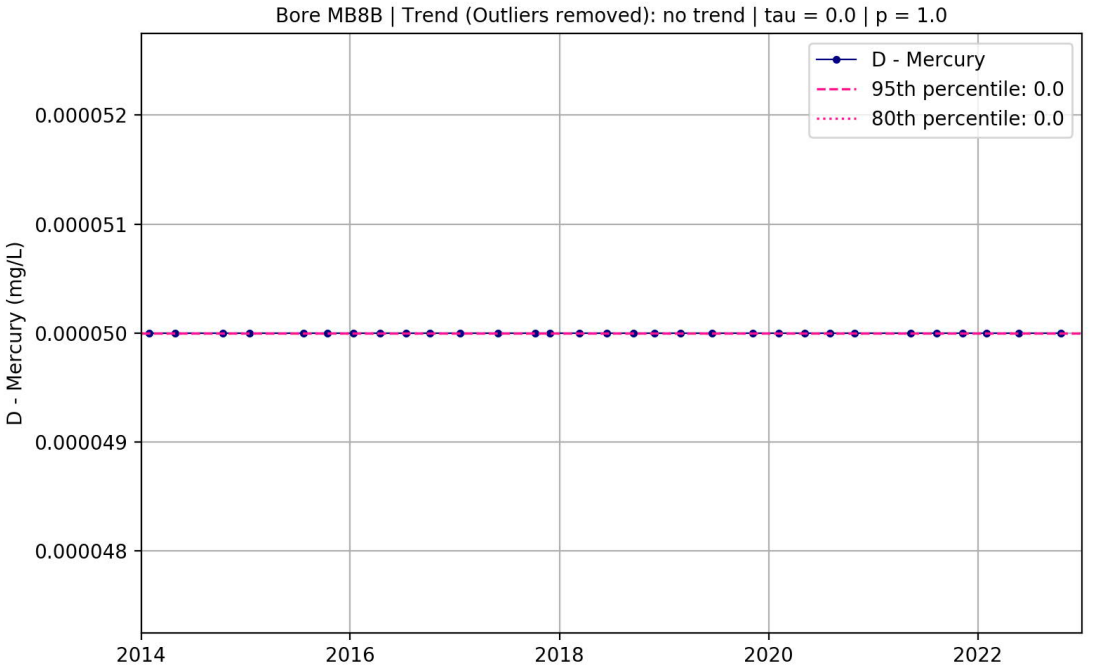

Bore MB8B | Trend: Not evaluated
D - Copper
Statistical Outlier
Outlier removed
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

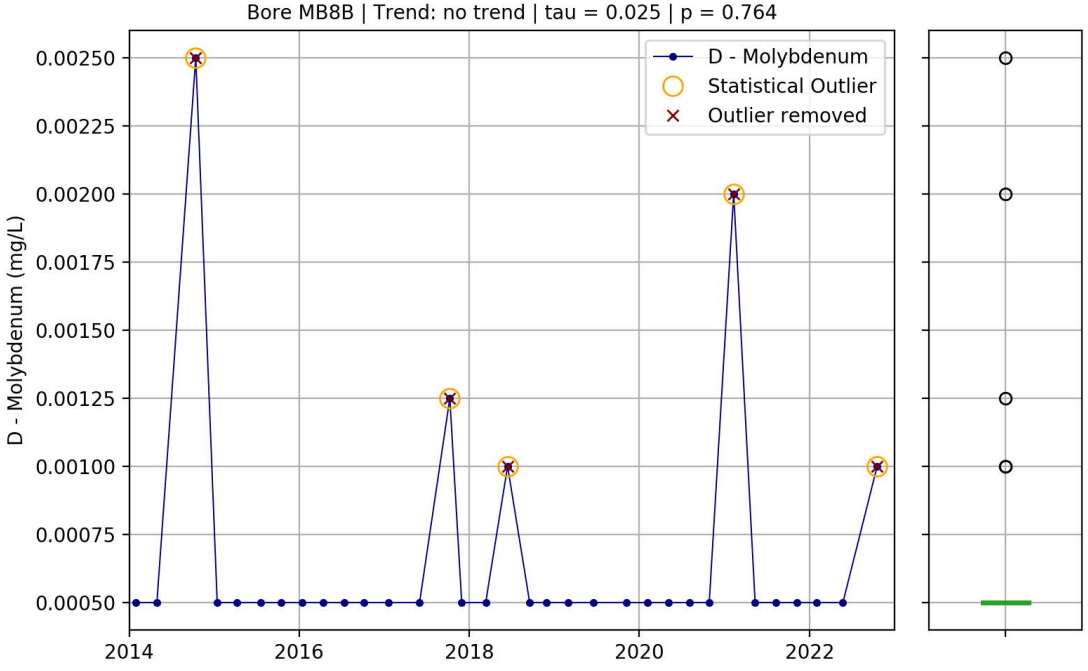

Bore MB8B | Trend: Not evaluated, five samples or less
D - Copper
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
Less than 8 samples,
no site specific trigger limits derived
2014
2016
2018
2020
2022

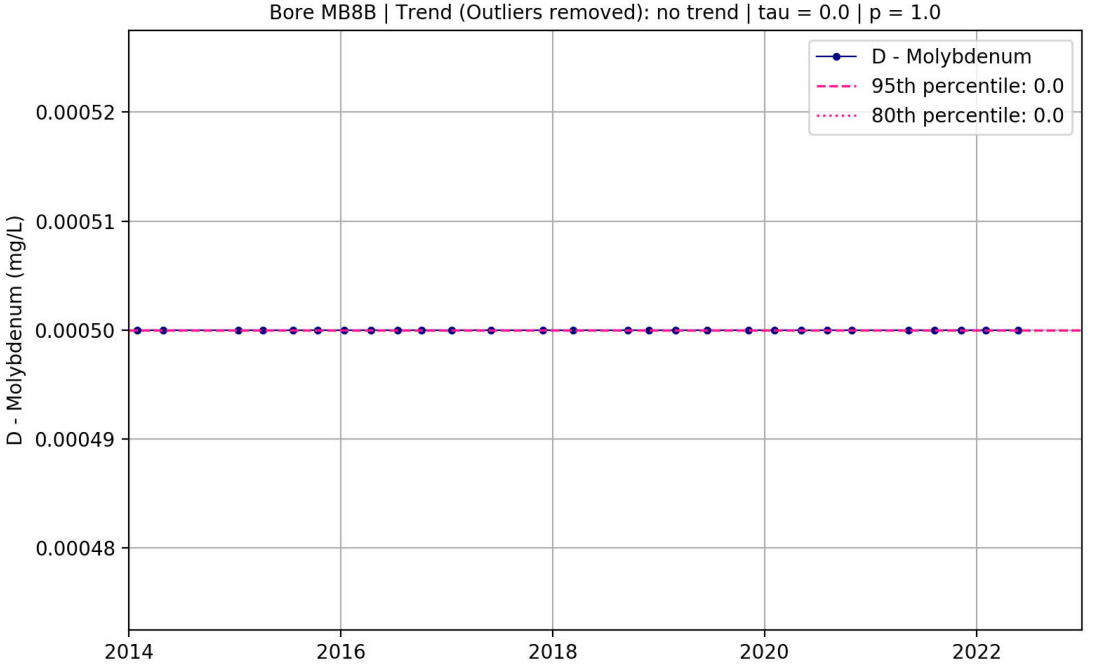

Bore MB8B | Trend: increasing | tau = 0.447 | p = 0.0
D - Iron
Statistical Outlier
Outlier removed
D - Iron (mg/L)
0
1
2
3
4
5
2014
2016
2018
2020
2022

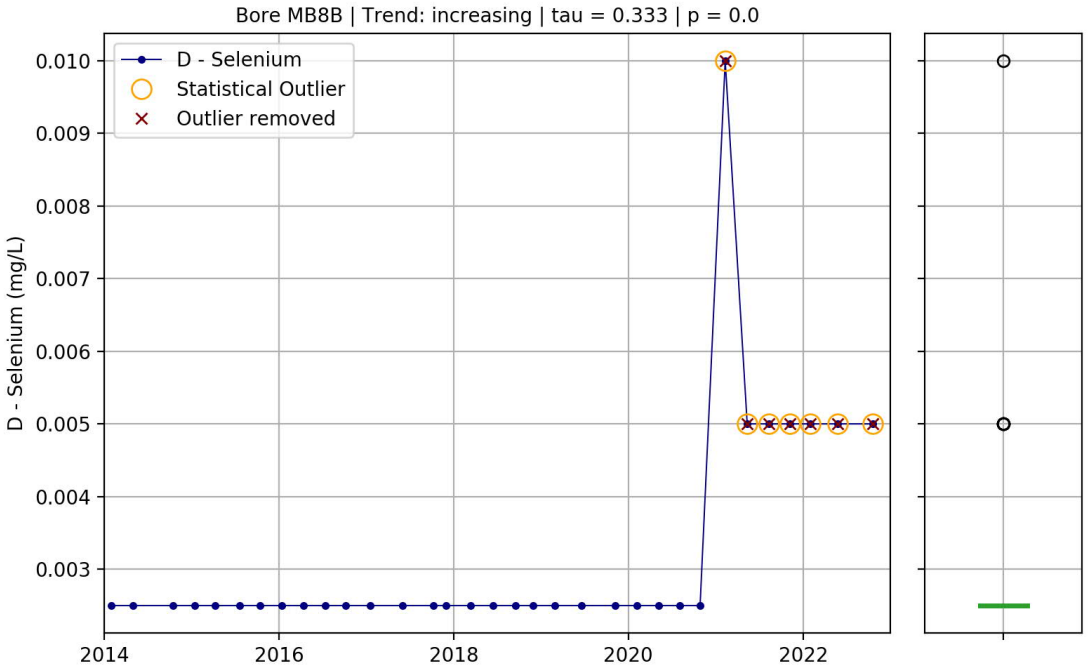

Bore MB8B | Trend (Outliers removed): increasing | tau = 0.447 | p = 0.0
D - Iron
95th percentile: 5.3
80th percentile: 4.532
D - Iron (mg/L)
0
1
2
3
4
5
2014
2016
2018
2020
2022

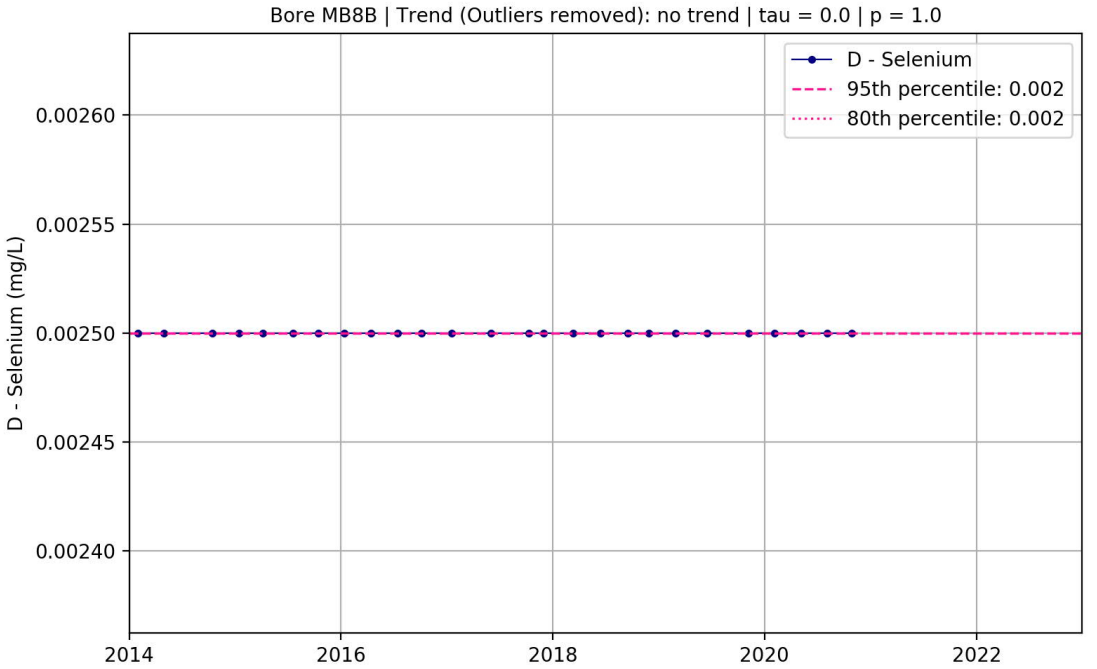

Bore MB8B | Trend: no trend | tau = -0.081 | p = 0.113
D - Mercury
Statistical Outlier
Outlier removed
D - Mercury (mg/L)
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
2014
2016
2018
2020
2022

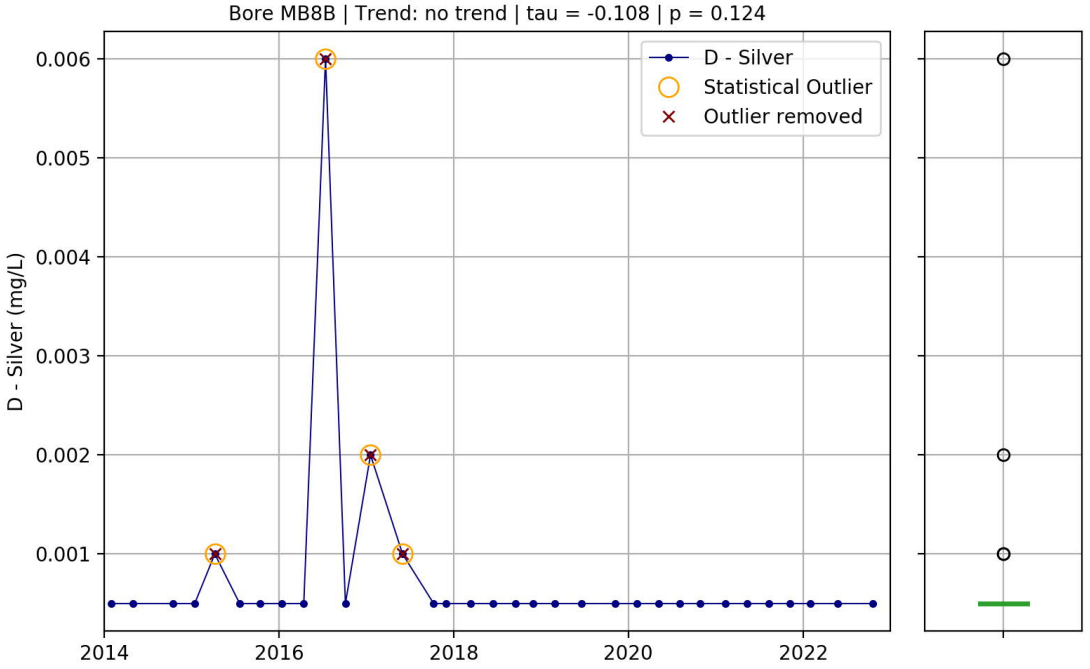

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Mercury
95th percentile: 0.0
80th percentile: 0.0
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022

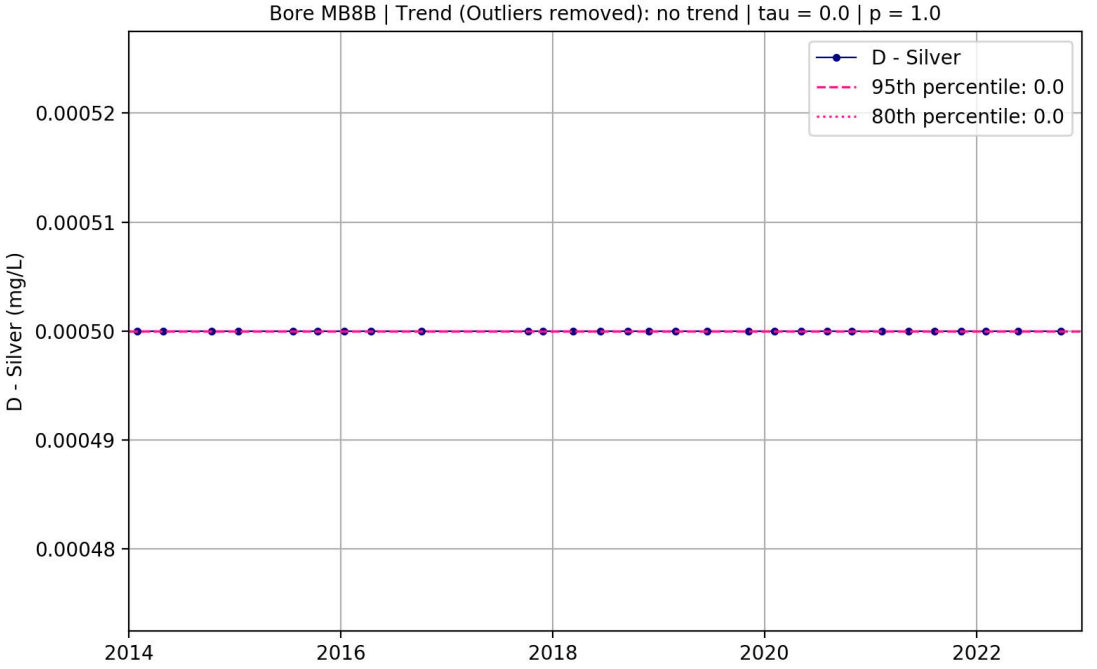

Bore MB8B | Trend: no trend | tau = 0.025 | p = 0.764
D - Molybdenum
Statistical Outlier
Outlier removed
D - Molybdenum (mg/L)
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
2014
2016
2018
2020
2022

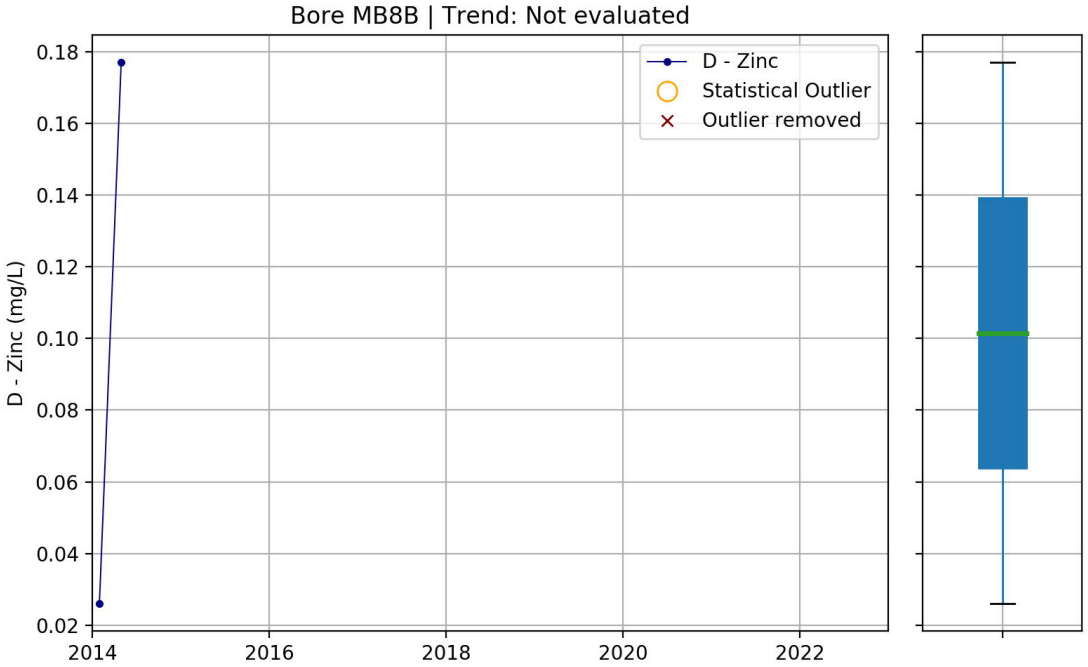

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Molybdenum
95th percentile: 0.0
80th percentile: 0.0
D - Molybdenum (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

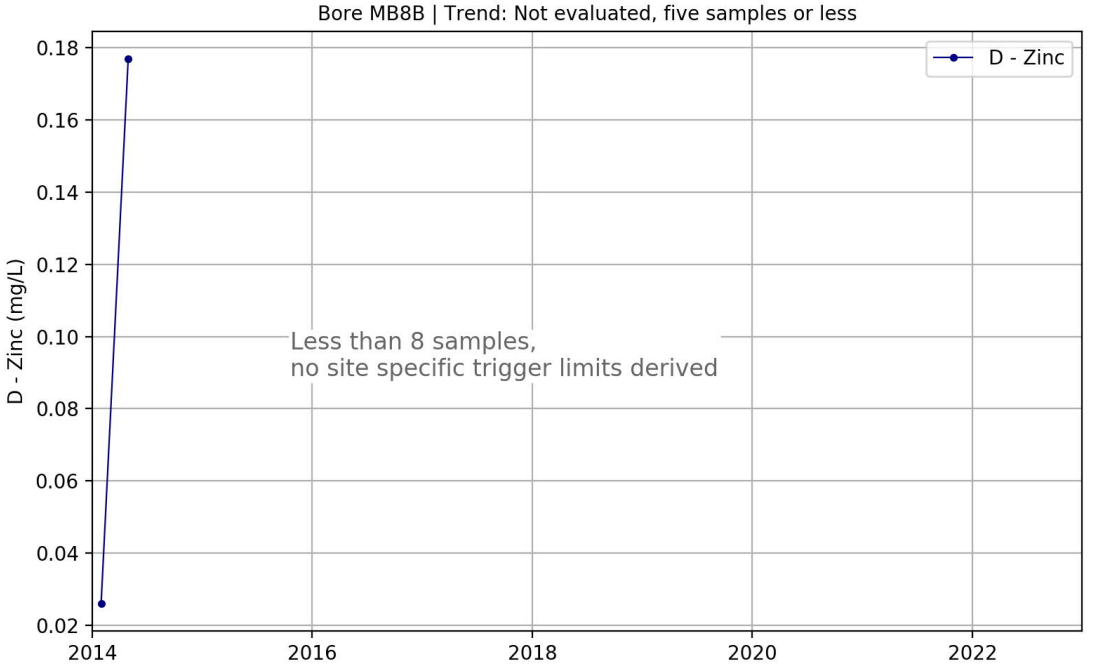

Bore MB8B | Trend: increasing | tau = 0.333 | p = 0.0
D - Selenium
Statistical Outlier
Outlier removed
D - Selenium (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
2014
2016
2018
2020
2022

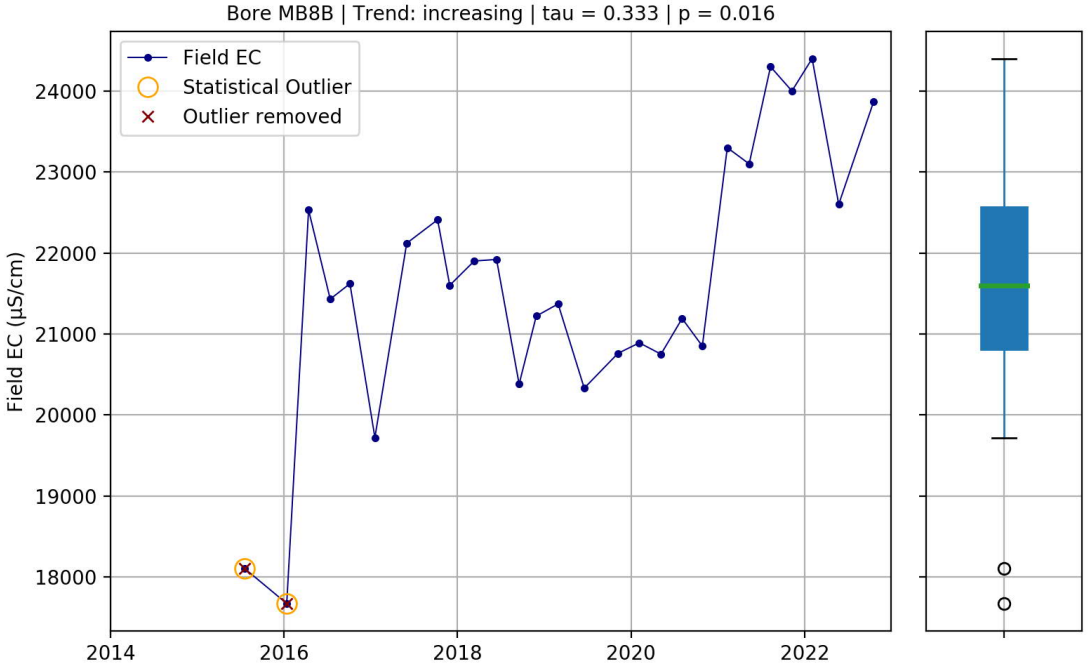

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Selenium
95th percentile: 0.002
80th percentile: 0.002
D - Selenium (mg/L)
0.00260
0.00255
0.00250
0.00245
0.00240
2014
2016
2018
2020
2022

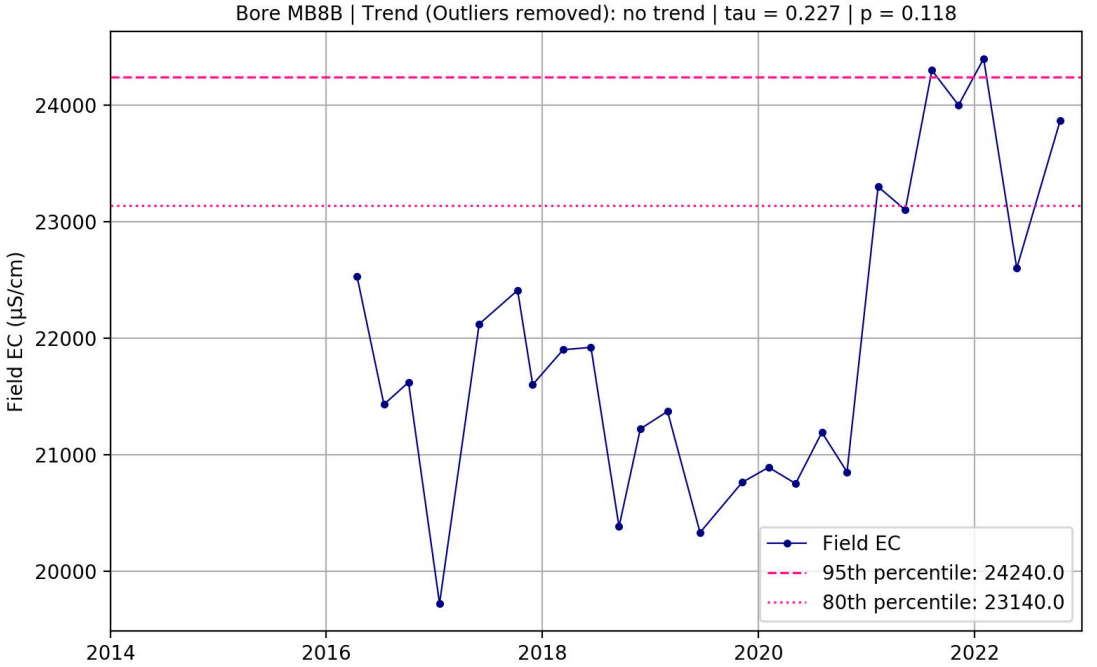

Bore MB8B | Trend: no trend | tau = -0.108 | p = 0.124
D - Silver
Statistical Outlier
Outlier removed
D - Silver (mg/L)
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

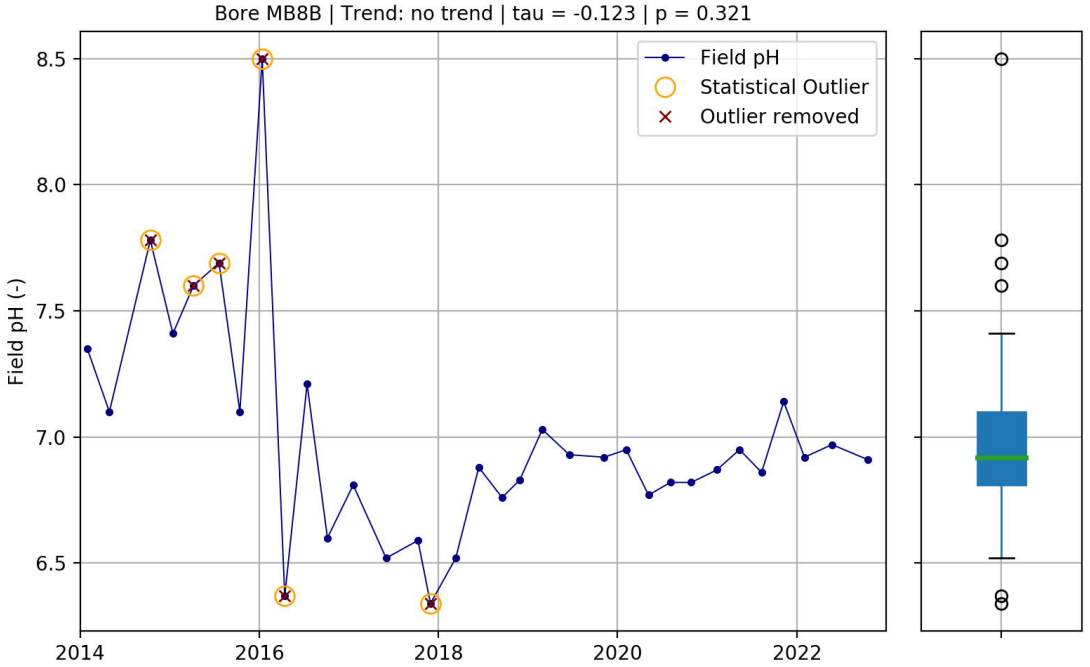

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Silver
95th percentile: 0.0
80th percentile: 0.0
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

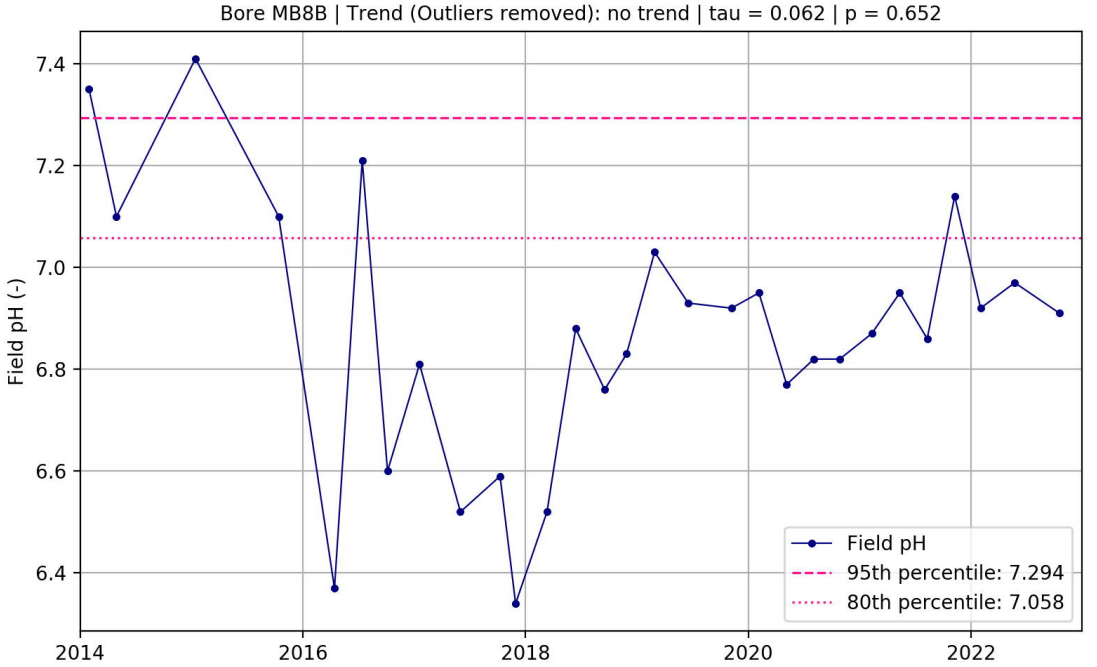

Bore MB8B | Trend: Not evaluated
D - Zinc
Statistical Outlier
Outlier removed
D - Zinc (mg/L)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
2014
2016
2018
2020
2022

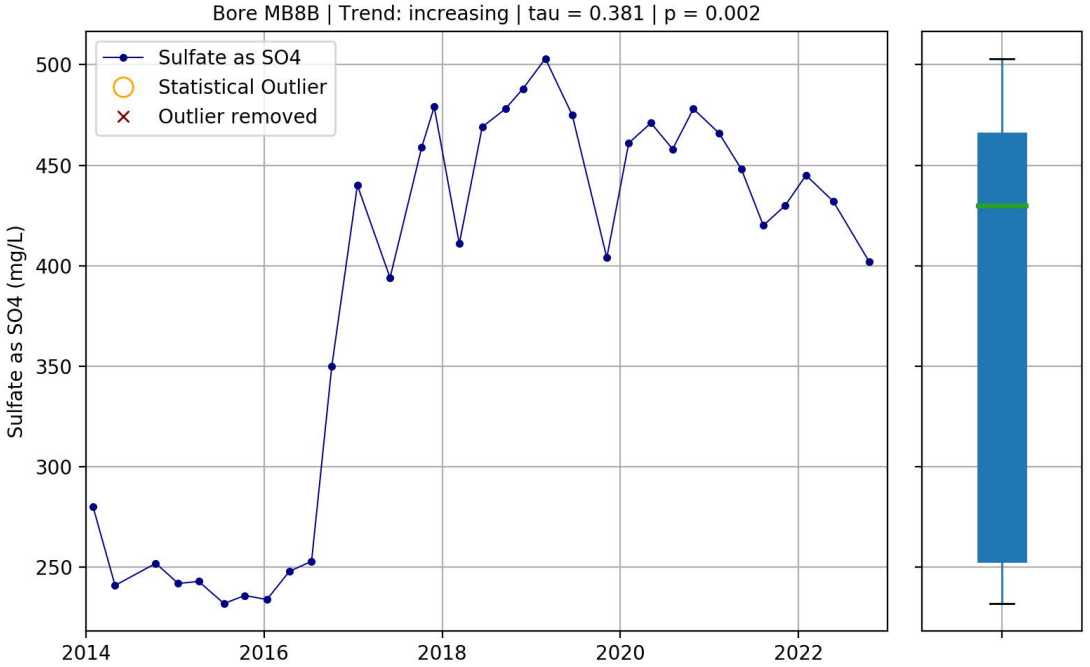

Bore MB8B | Trend: Not evaluated, five samples or less
D - Zinc
D - Zinc (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
2014
2016
2018
2020
2022

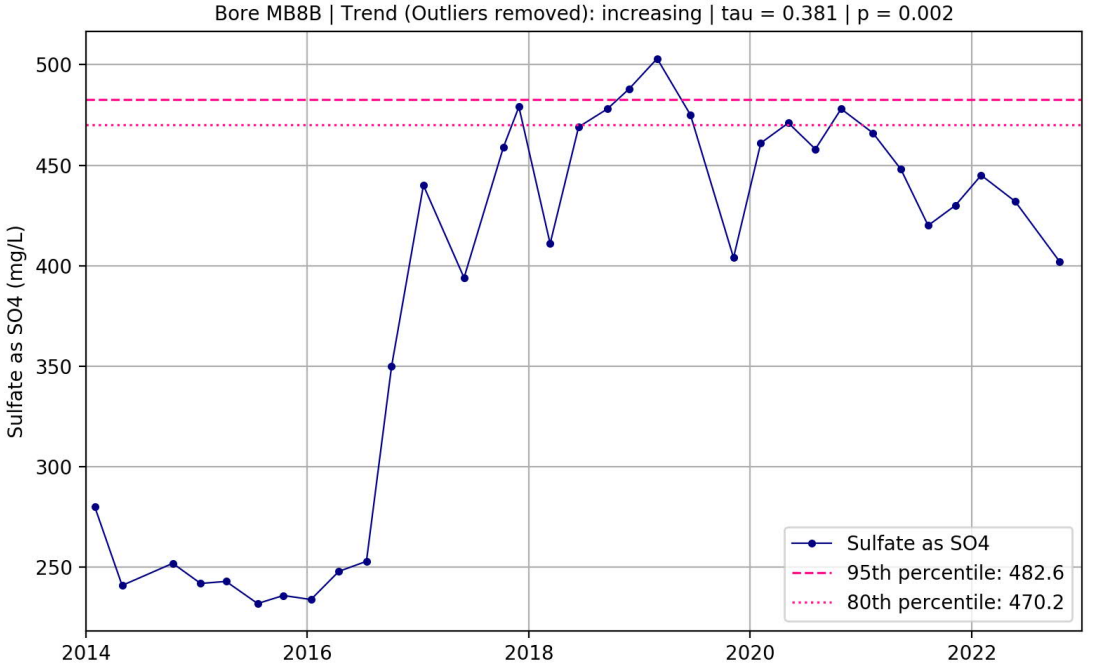

Bore MB8B | Trend: increasing | tau = 0.333 | p = 0.016
Field EC
Statistical Outlier
Outlier removed
Field EC (µS/cm)
24000
23000
22000
21000
20000
19000
18000
2014
2016
2018
2020
2022

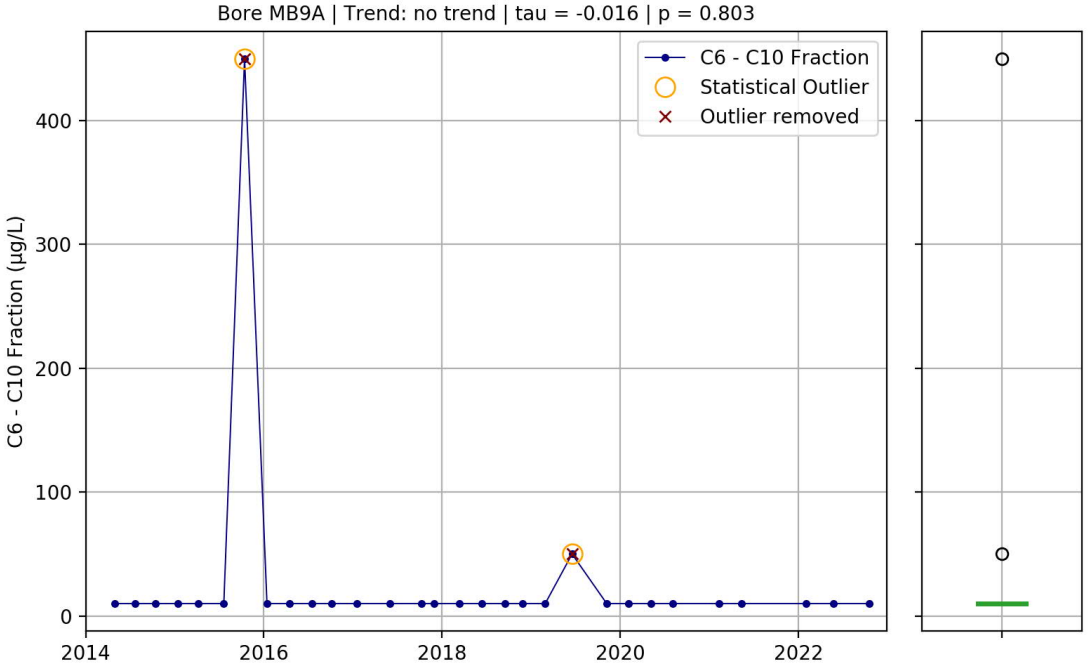

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.227 | p = 0.118
Field EC (µS/cm)
24000
23000
22000
21000
20000
Field EC
95th percentile: 24240.0
80th percentile: 23140.0
2014
2016
2018
2020
2022

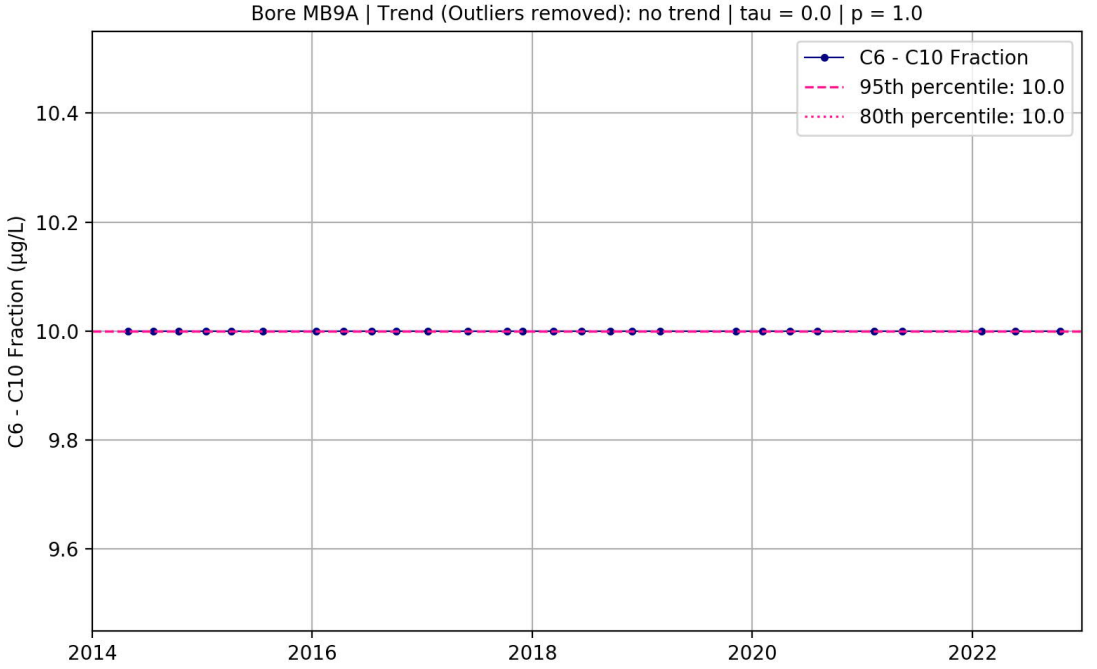

Bore MB8B | Trend: no trend | tau = -0.123 | p = 0.321
Field pH
Statistical Outlier
Outlier removed
Field pH (-)
8.5
8.0
7.5
7.0
6.5
2014
2016
2018
2020
2022

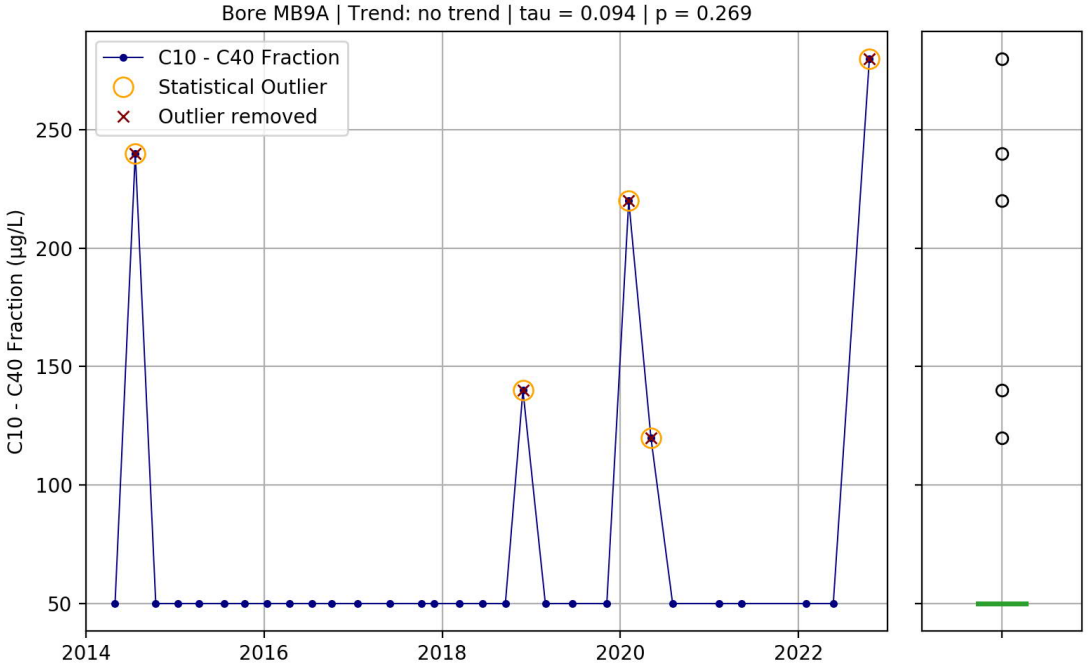

Bore MB8B | Trend (Outliers removed): no trend | tau = 0.062 | p = 0.652
Field pH (-)
7.4
7.2
7.0
6.8
6.6
6.4
Field pH
95th percentile: 7.294
80th percentile: 7.058
2014
2016
2018
2020
2022

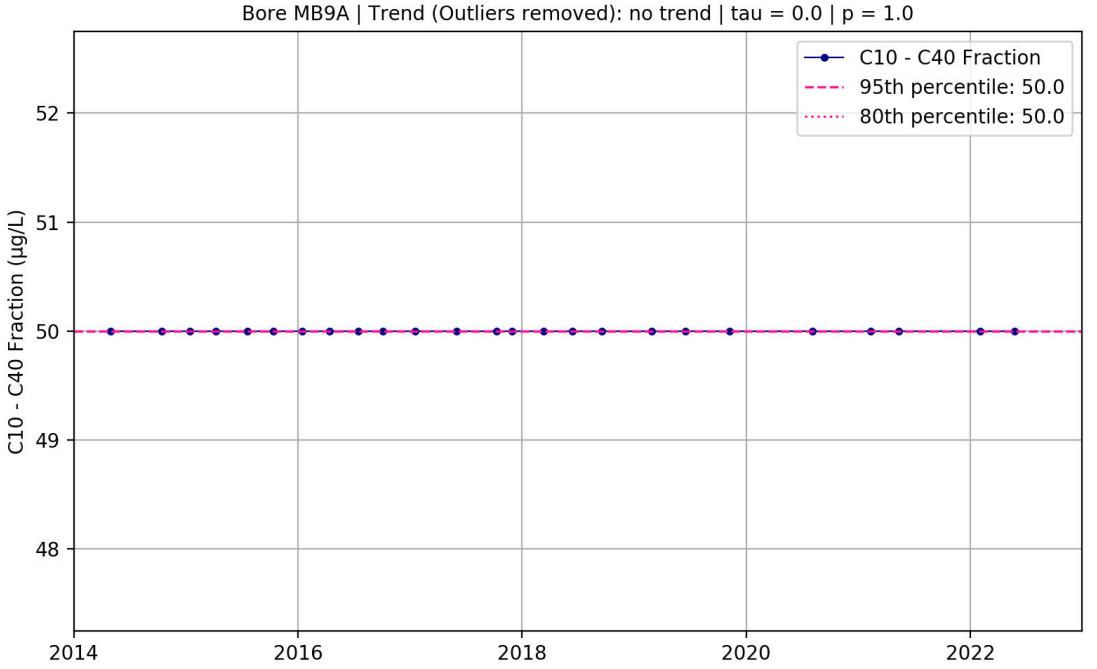

Bore MB8B | Trend: increasing | tau = 0.381 | p = 0.002
Sulfate as SO4
Statistical Outlier
Outlier removed
Sulfate as SO4 (mg/L)
500
450
400
350
300
250
2014
2016
2018
2020
2022

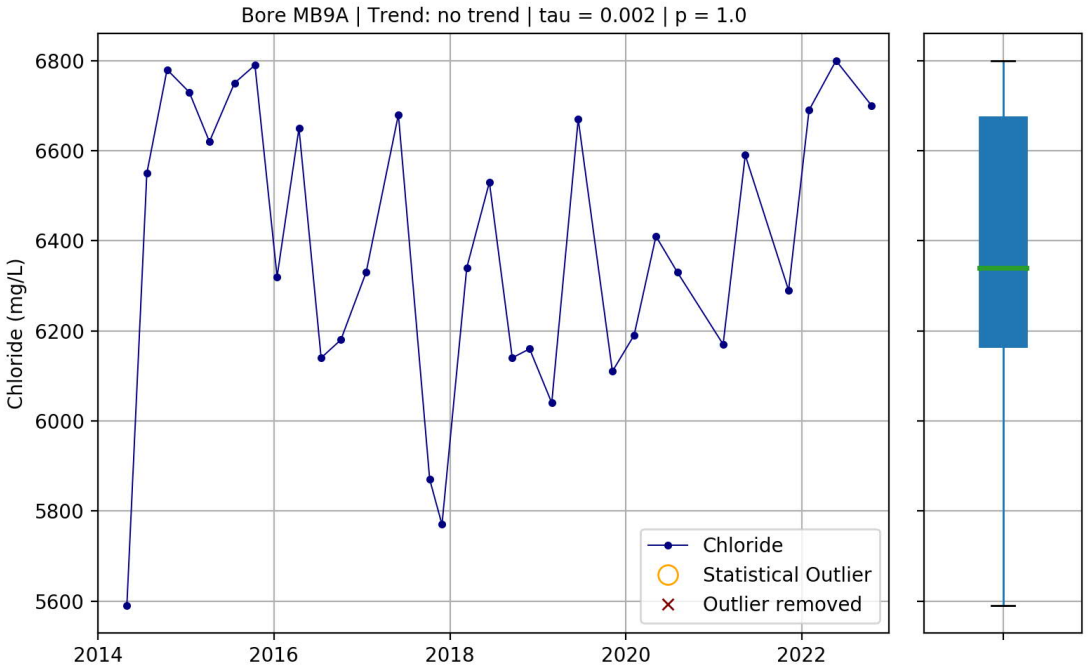

Bore MB8B | Trend (Outliers removed): increasing | tau = 0.381 | p = 0.002
Sulfate as SO4 (mg/L)
500
450
400
350
300
250
Sulfate as SO4
95th percentile: 482.6
80th percentile: 470.2
2014
2016
2018
2020
2022

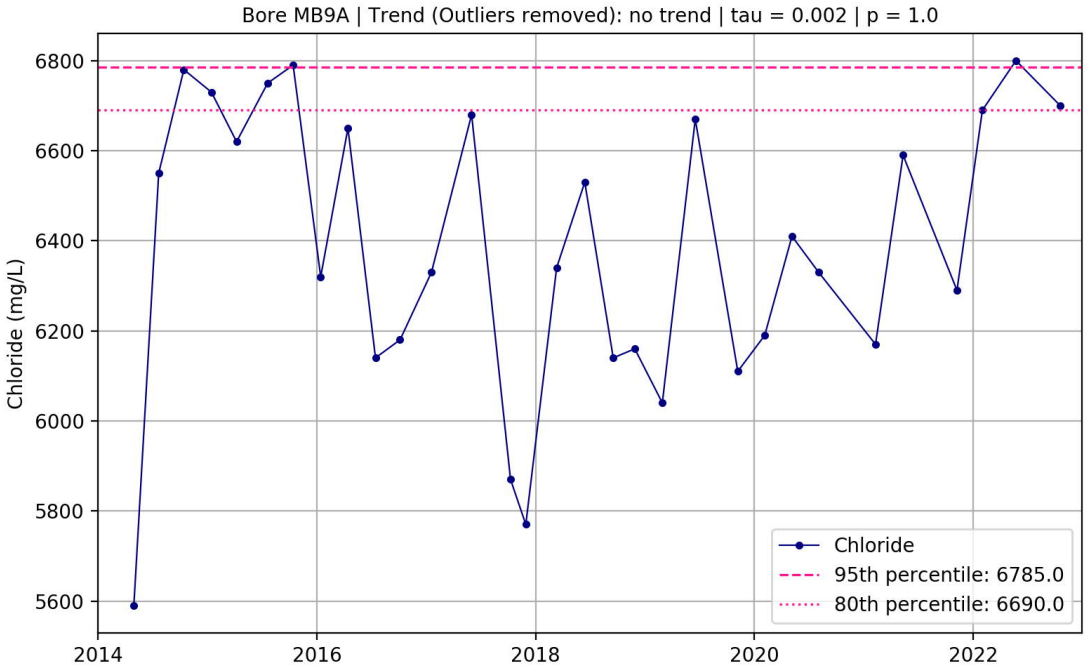

Bore MB9A | Trend: no trend | tau = -0.016 | p = 0.803
C6 - C10 Fraction
Statistical Outlier
Outlier removed
C6 - C10 Fraction (µg/L)
0
100
200
300
400
2014
2016
2018
2020
2022

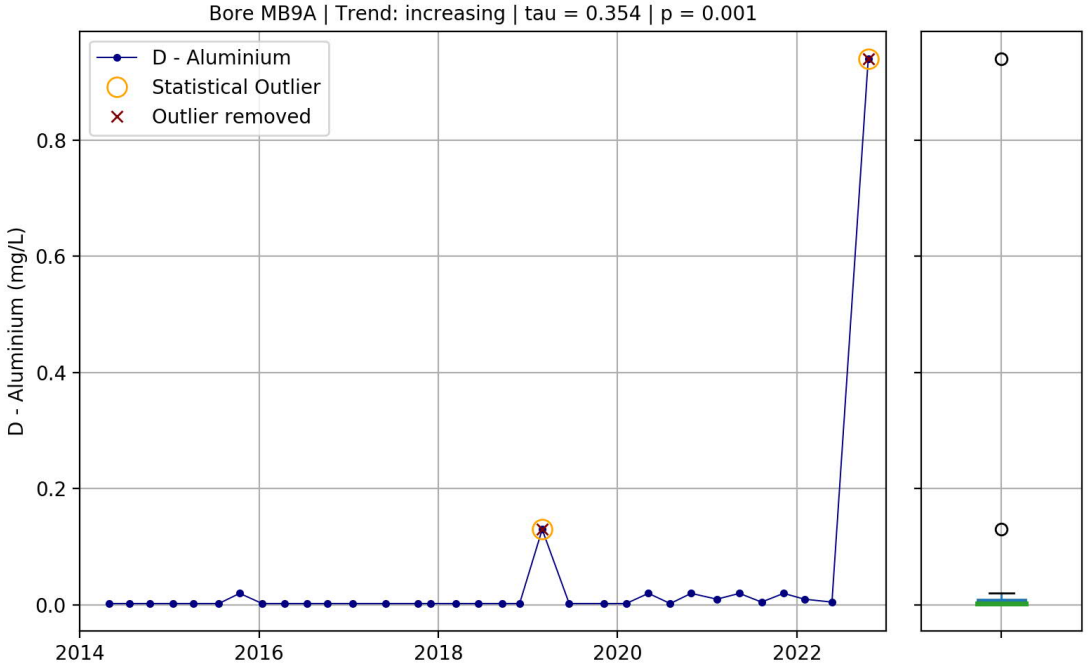

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C6 - C10 Fraction
95th percentile: 10.0
80th percentile: 10.0
C6 - C10 Fraction (µg/L)
9.6
9.8
10.0
10.2
10.4
2014
2016
2018
2020
2022

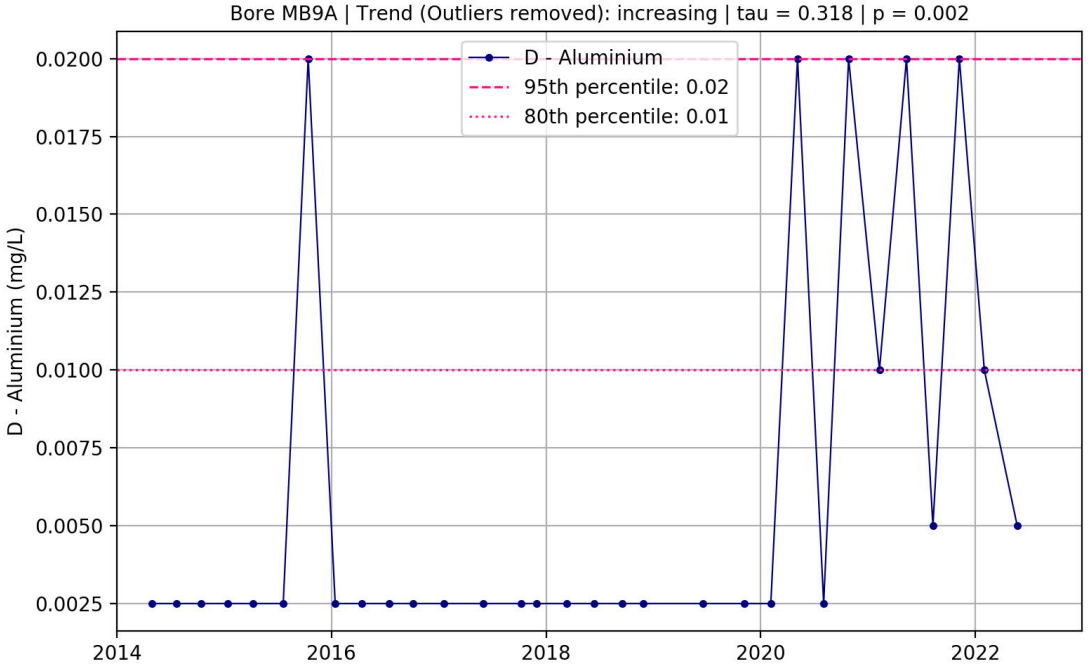

Bore MB9A | Trend: no trend | tau = 0.094 | p = 0.269
C10 - C40 Fraction
Statistical Outlier
Outlier removed
C10 - C40 Fraction (µg/L)
50
100
150
200
250
2014
2016
2018
2020
2022

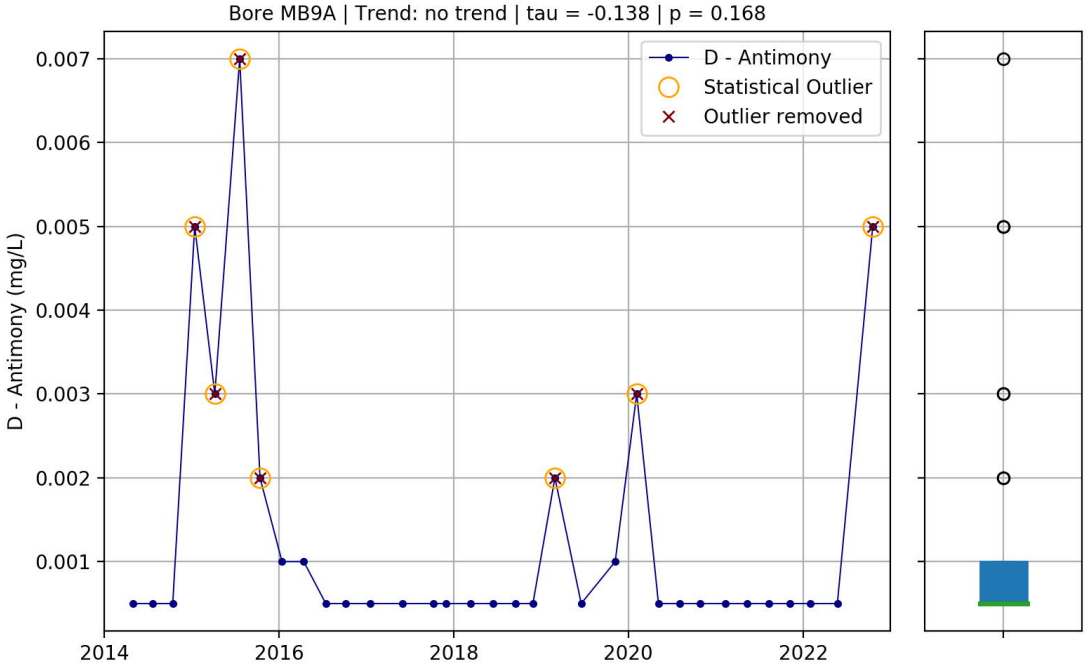

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
95th percentile: 50.0
80th percentile: 50.0
C10 - C40 Fraction (µg/L)
48
49
50
51
52
2014
2016
2018
2020
2022

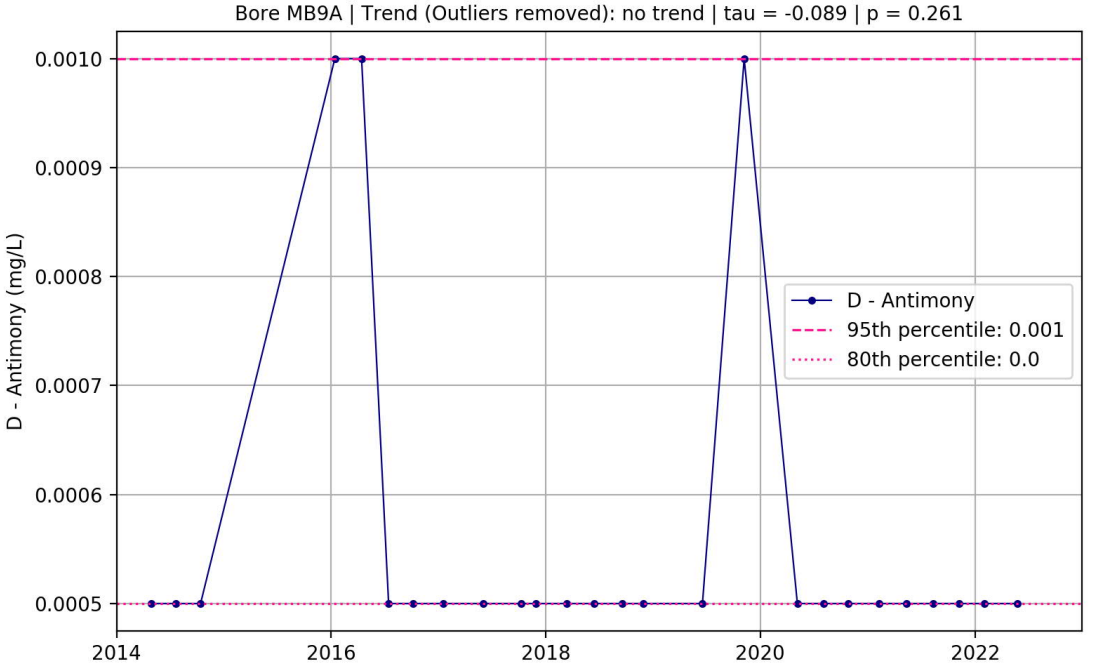

Bore MB9A | Trend: no trend | tau = 0.002 | p = 1.0
Chloride (mg/L)
Chloride
Statistical Outlier
Outlier removed

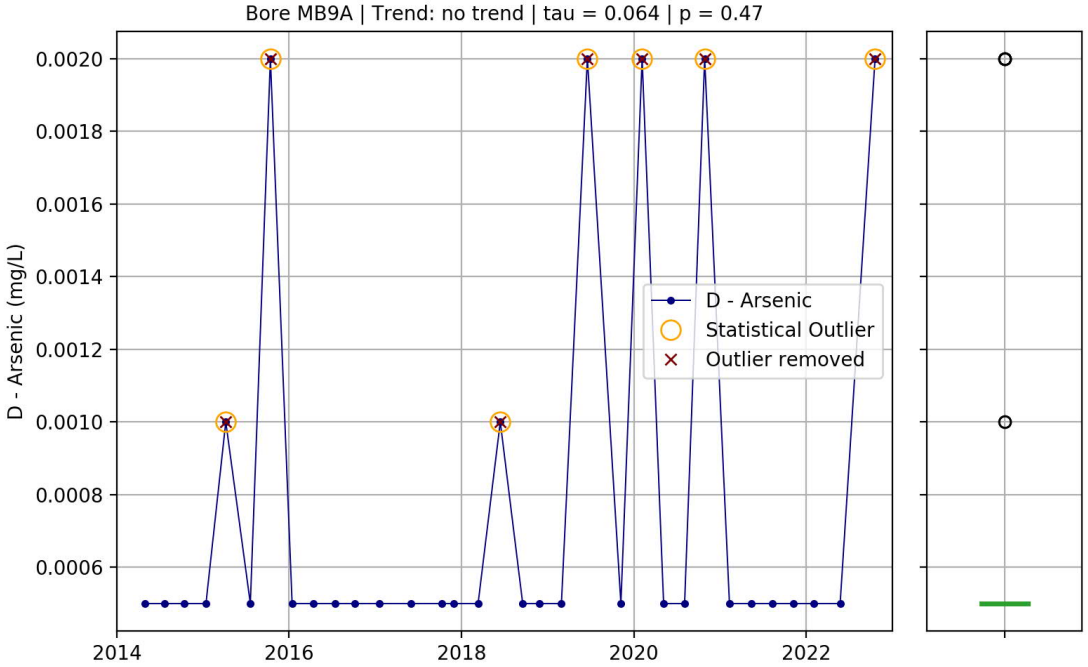

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.002 | p = 1.0
Chloride (mg/L)
Chloride
95th percentile: 6785.0
80th percentile: 6690.0

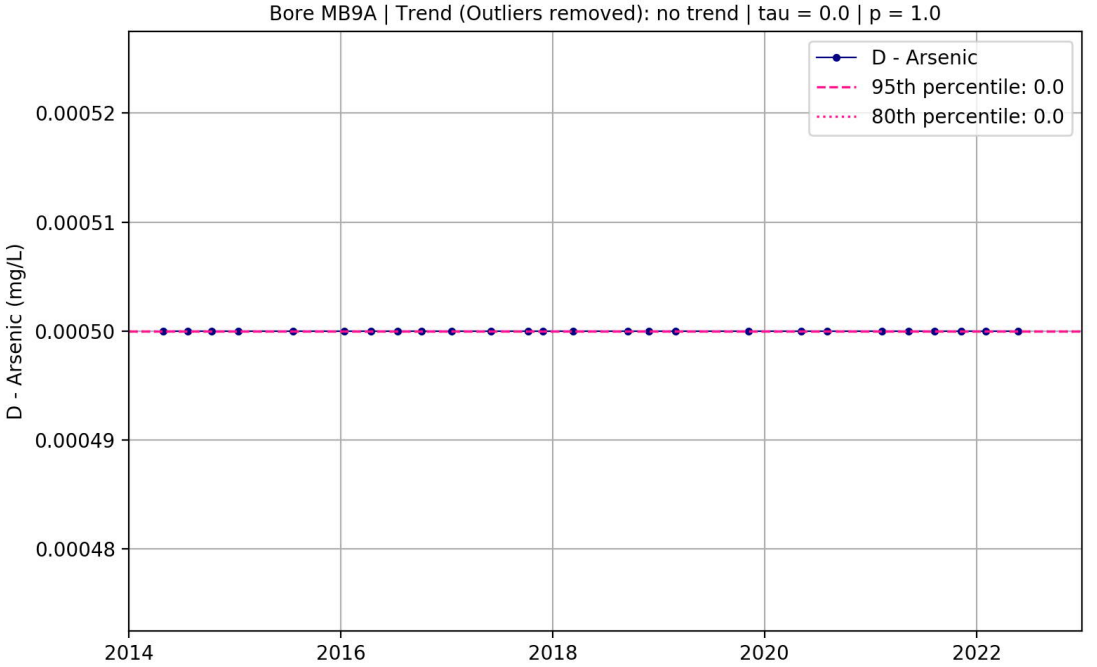

Bore MB9A | Trend: increasing | tau = 0.354 | p = 0.001
D - Aluminium (mg/L)
D - Aluminium
Statistical Outlier
Outlier removed

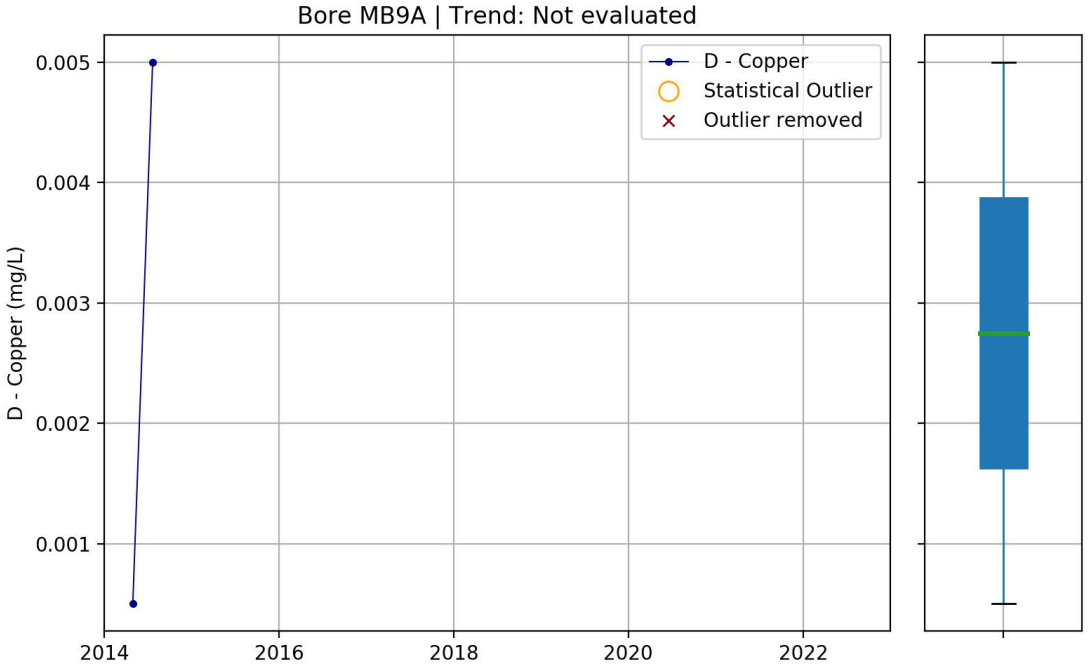

Bore MB9A | Trend (Outliers removed): increasing | tau = 0.318 | p = 0.002
D - Aluminium (mg/L)
D - Aluminium
95th percentile: 0.02
80th percentile: 0.01

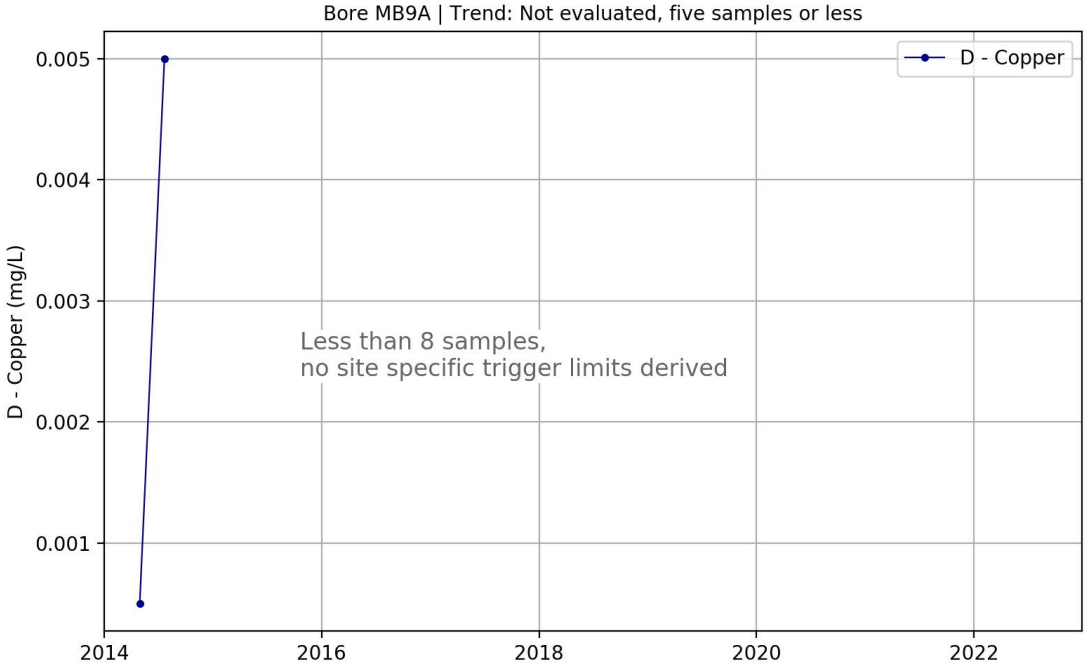

Bore MB9A | Trend: no trend | tau = -0.138 | p = 0.168
D - Antimony
Statistical Outlier
Outlier removed
D - Antimony (mg/L)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

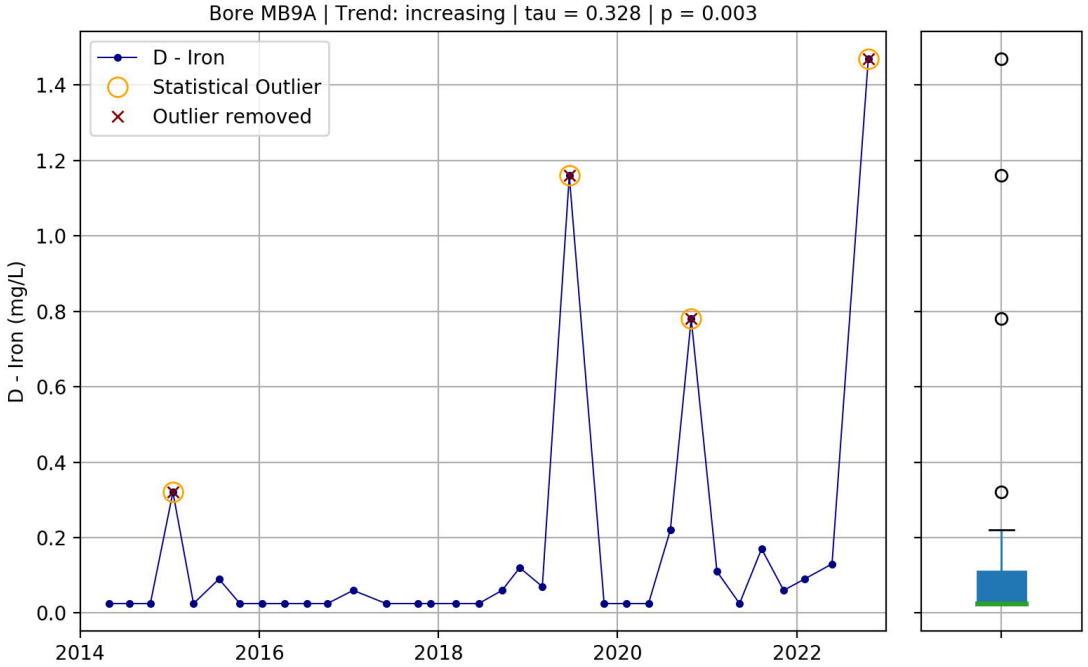

Bore MB9A | Trend (Outliers removed): no trend | tau = -0.089 | p = 0.261
D - Antimony
95th percentile: 0.001
80th percentile: 0.0
D - Antimony (mg/L)
0.0010
0.0009
0.0008
0.0007
0.0006
0.0005
2014
2016
2018
2020
2022

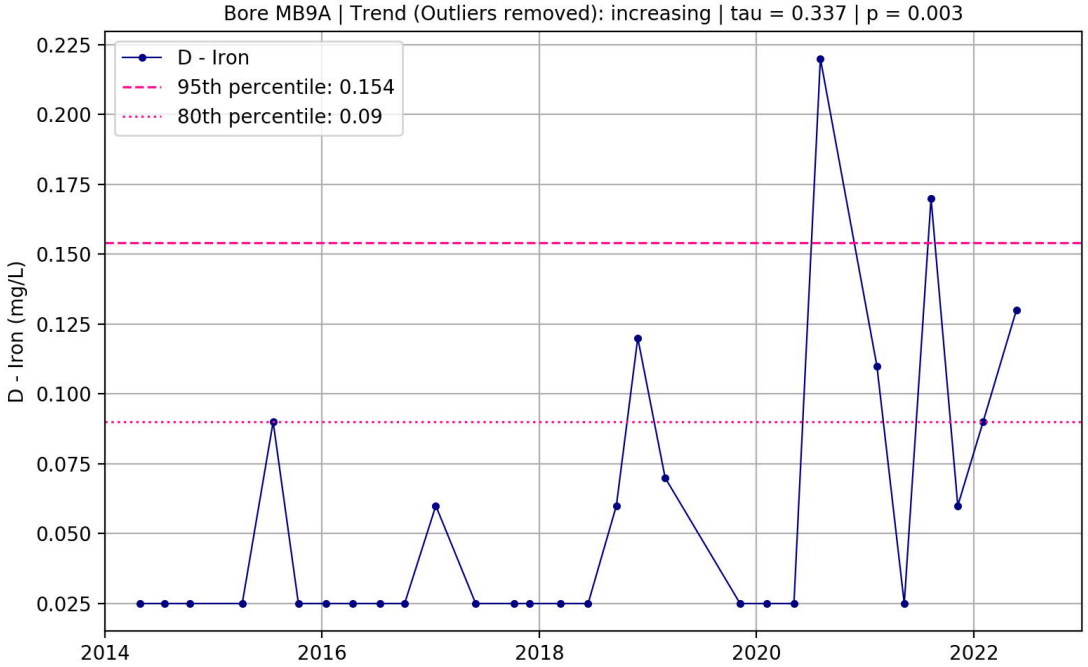

Bore MB9A | Trend: no trend | tau = 0.064 | p = 0.47
D - Arsenic
Statistical Outlier
Outlier removed
D - Arsenic (mg/L)
0.0020
0.0018
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
2014
2016
2018
2020
2022

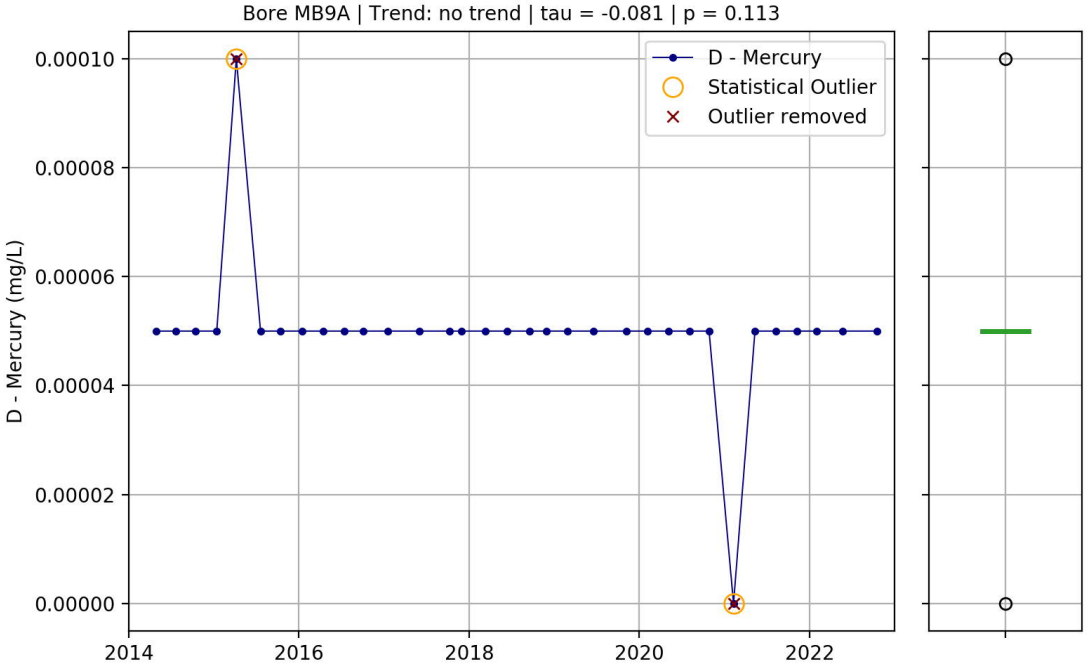

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Arsenic
95th percentile: 0.0
80th percentile: 0.0
D - Arsenic (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

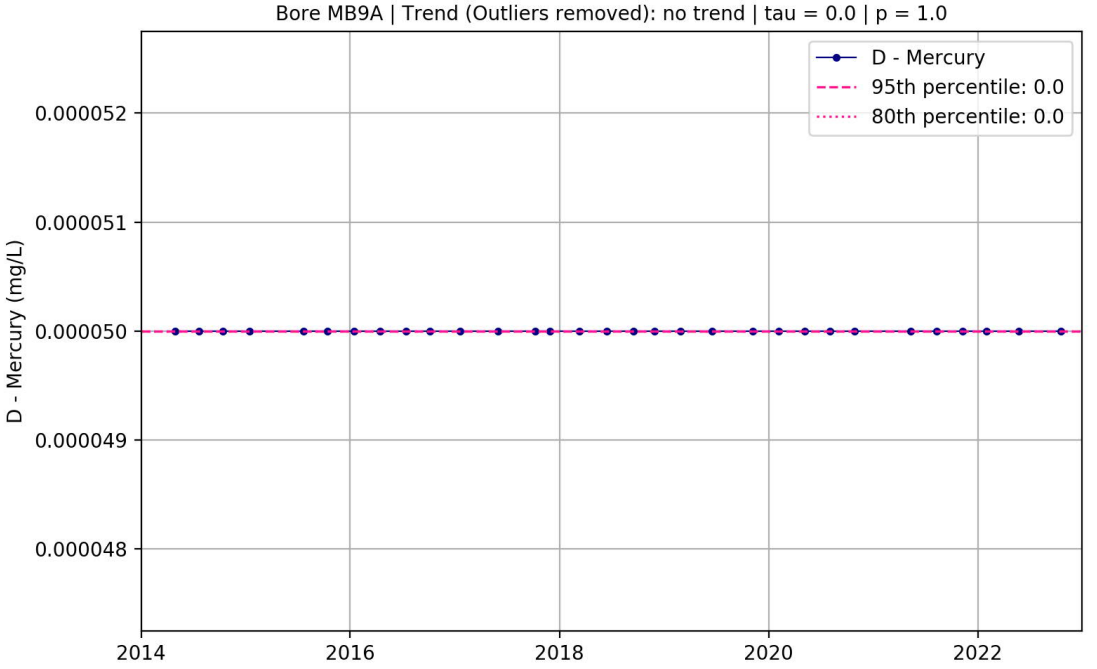

Bore MB9A | Trend: Not evaluated
D - Copper
Statistical Outlier
Outlier removed
D - Copper (mg/L)
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

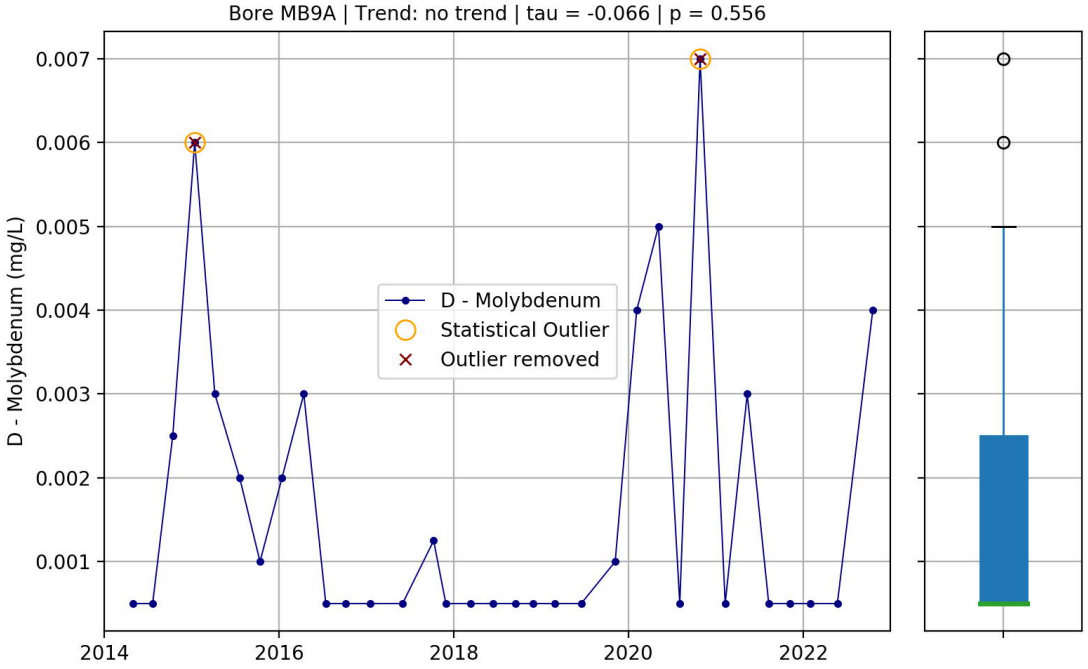

Bore MB9A | Trend: Not evaluated, five samples or less
D - Copper
D - Copper (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

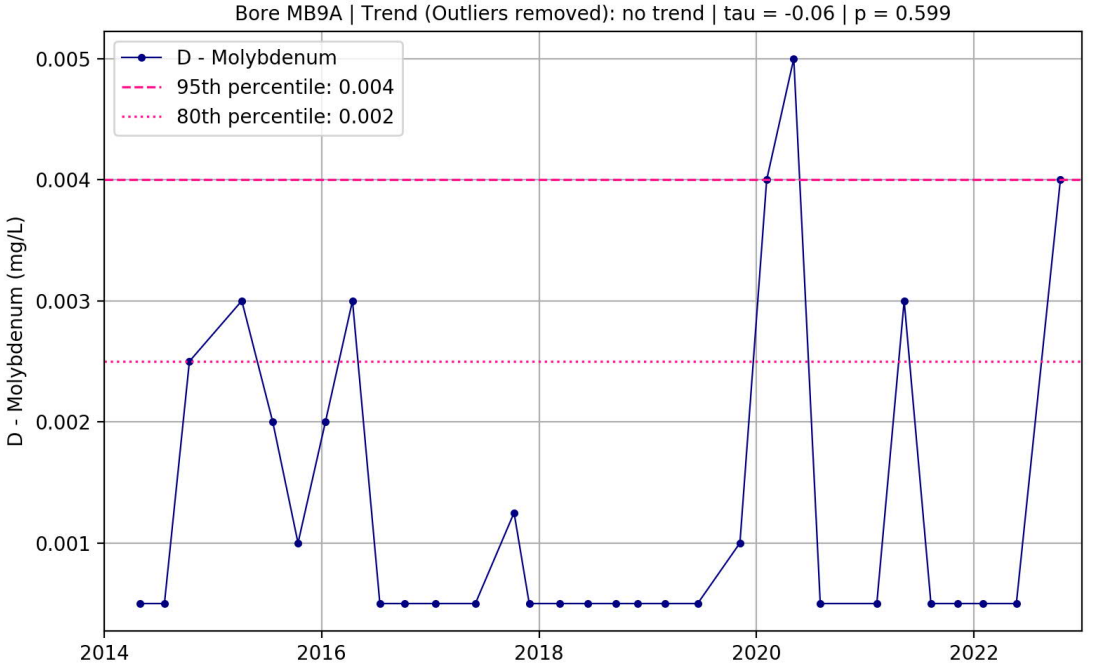

Bore MB9A | Trend: increasing | tau = 0.328 | p = 0.003
D - Iron
Statistical Outlier
Outlier removed
D - Iron (mg/L)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2014
2016
2018
2020
2022

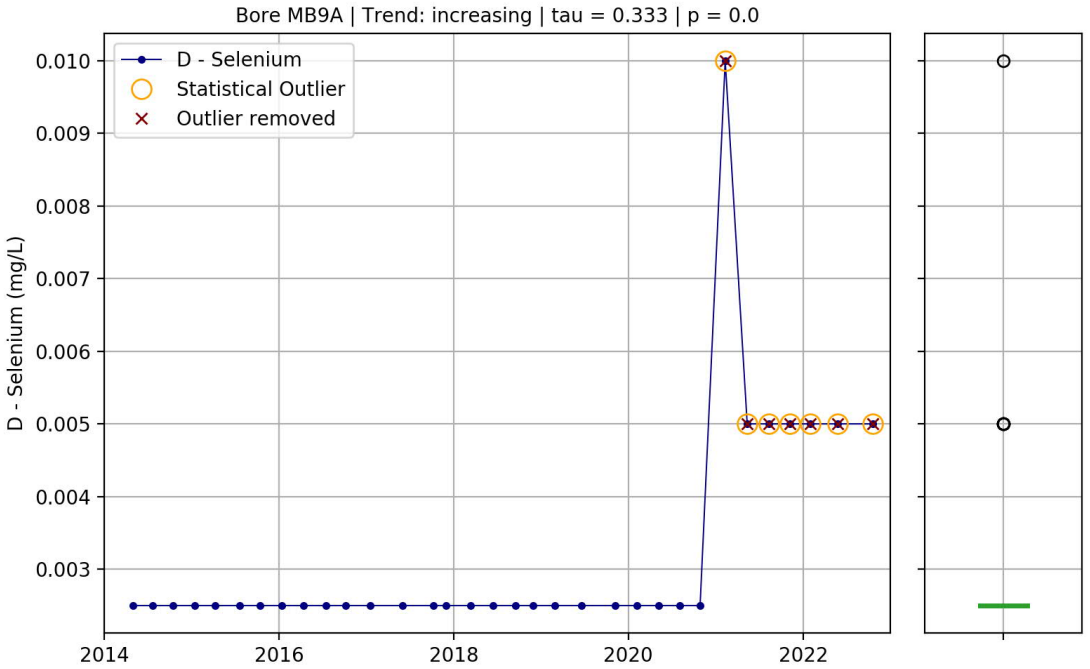

Bore MB9A | Trend (Outliers removed): increasing | tau = 0.337 | p = 0.003
D - Iron
95th percentile: 0.154
80th percentile: 0.09
D - Iron (mg/L)
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
2014
2016
2018
2020
2022

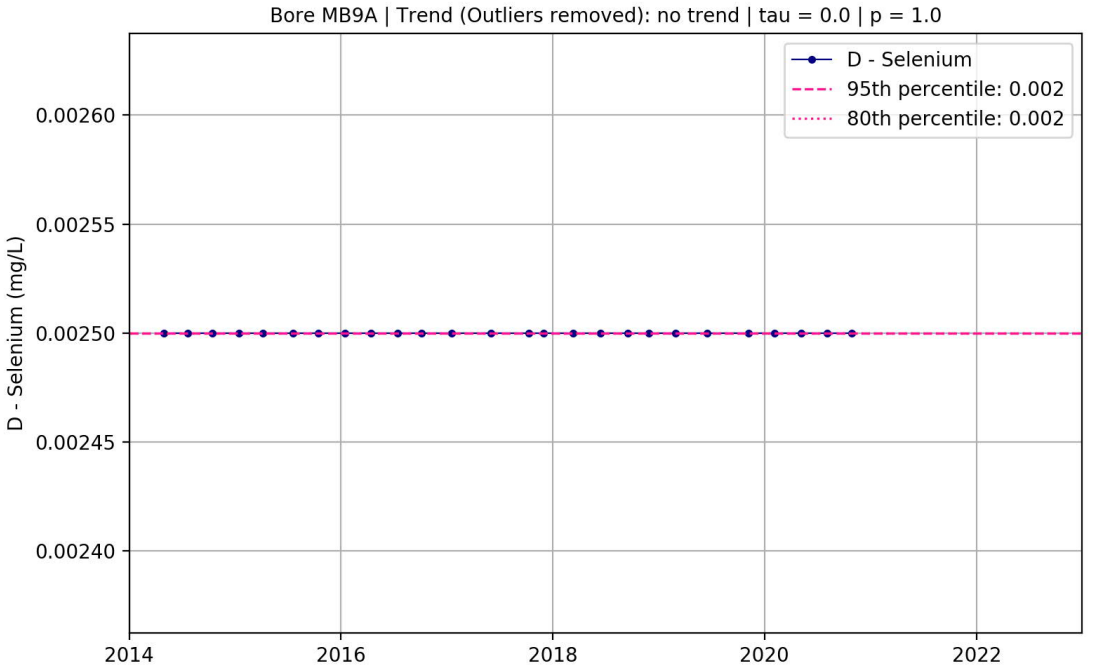

Bore MB9A | Trend: no trend | tau = -0.081 | p = 0.113
D - Mercury
Statistical Outlier
Outlier removed
D - Mercury (mg/L)
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
2014
2016
2018
2020
2022

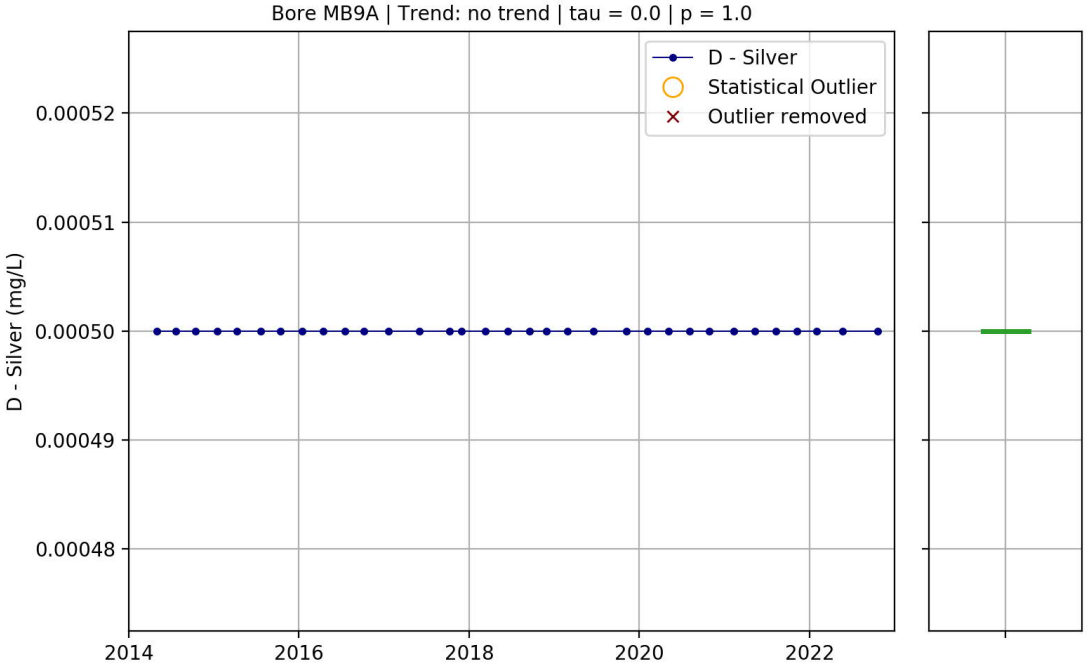

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Mercury
95th percentile: 0.0
80th percentile: 0.0
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022

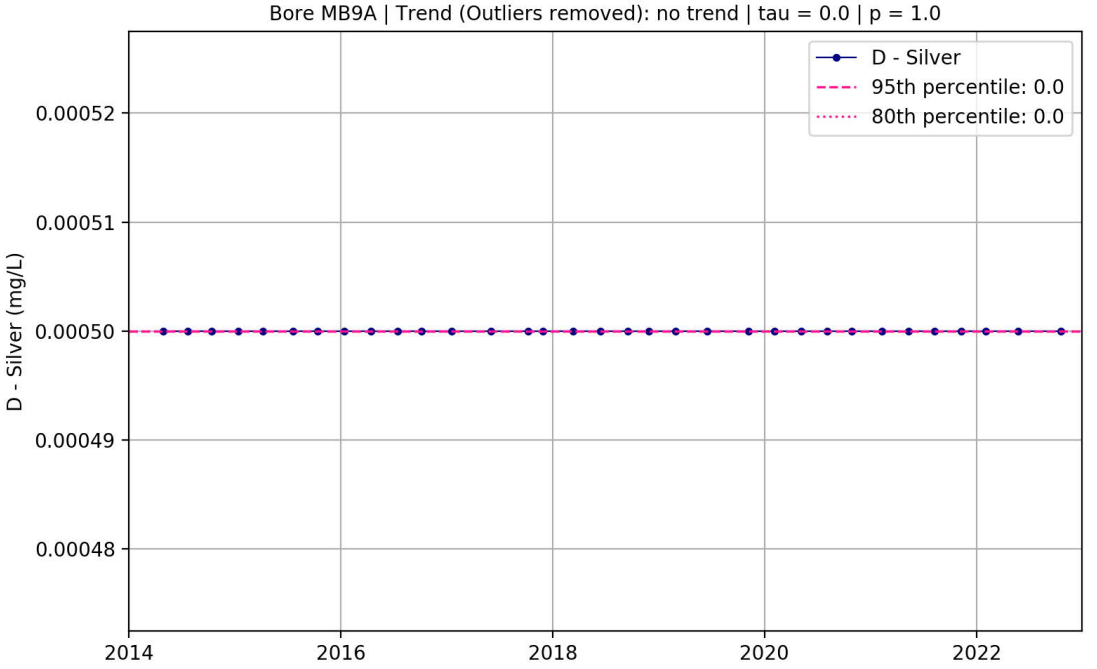

Bore MB9A | Trend: no trend | tau = -0.066 | p = 0.556
D - Molybdenum
Statistical Outlier
Outlier removed
D - Molybdenum (mg/L)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

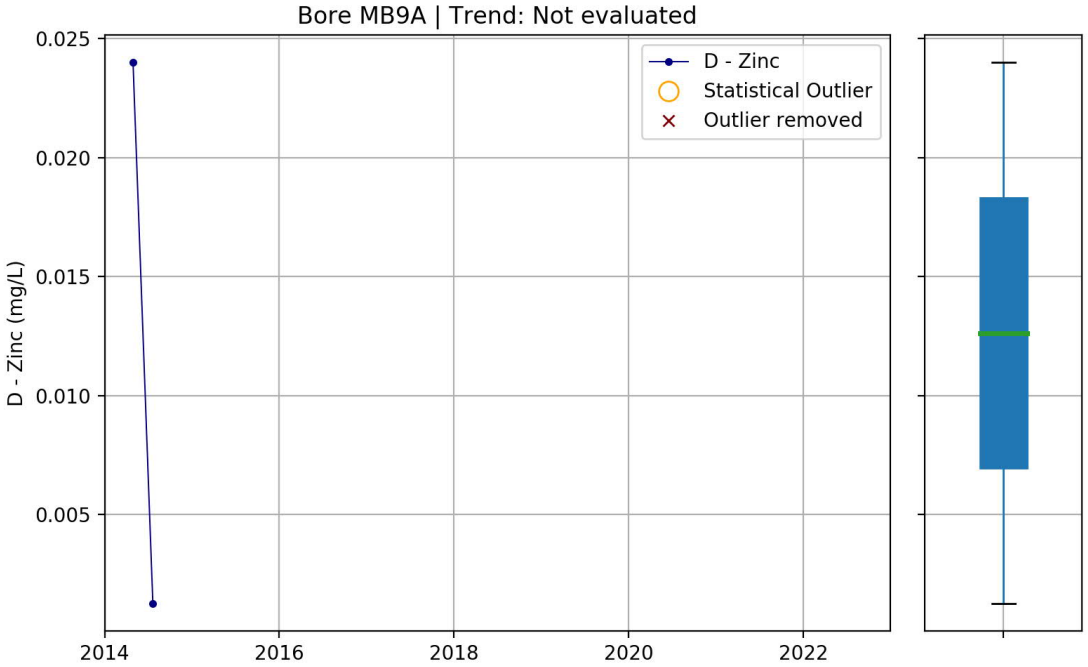

Bore MB9A | Trend (Outliers removed): no trend | tau = -0.06 | p = 0.599
D - Molybdenum
95th percentile: 0.004
80th percentile: 0.002
D - Molybdenum (mg/L)
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

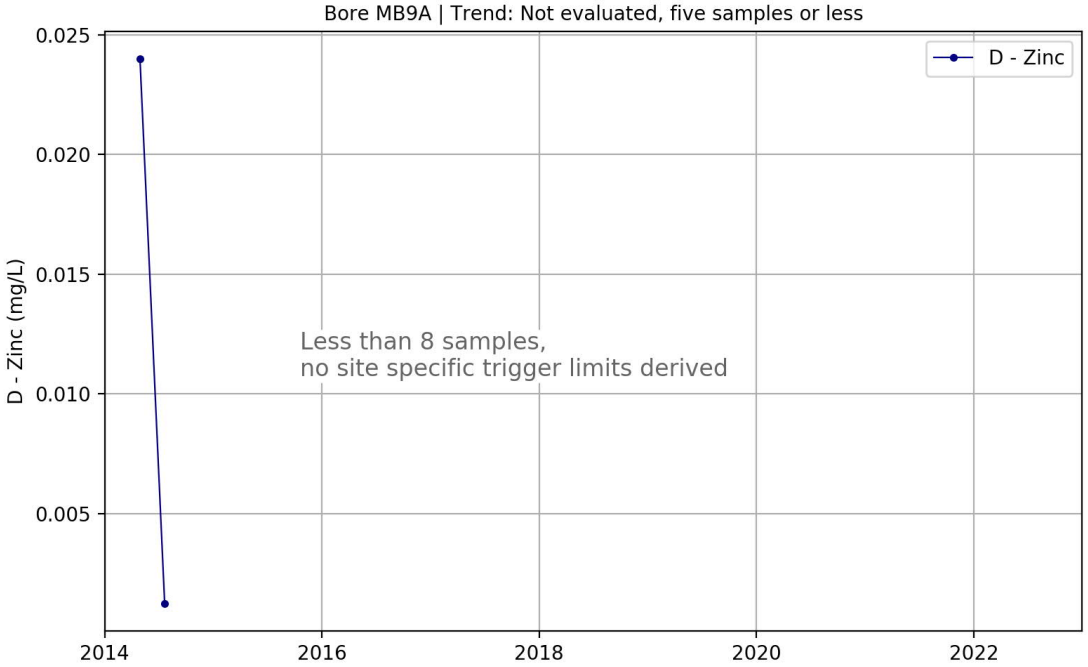

Bore MB9A | Trend: increasing | tau = 0.333 | p = 0.0
D - Selenium
Statistical Outlier
Outlier removed
D - Selenium (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
2014
2016
2018
2020
2022

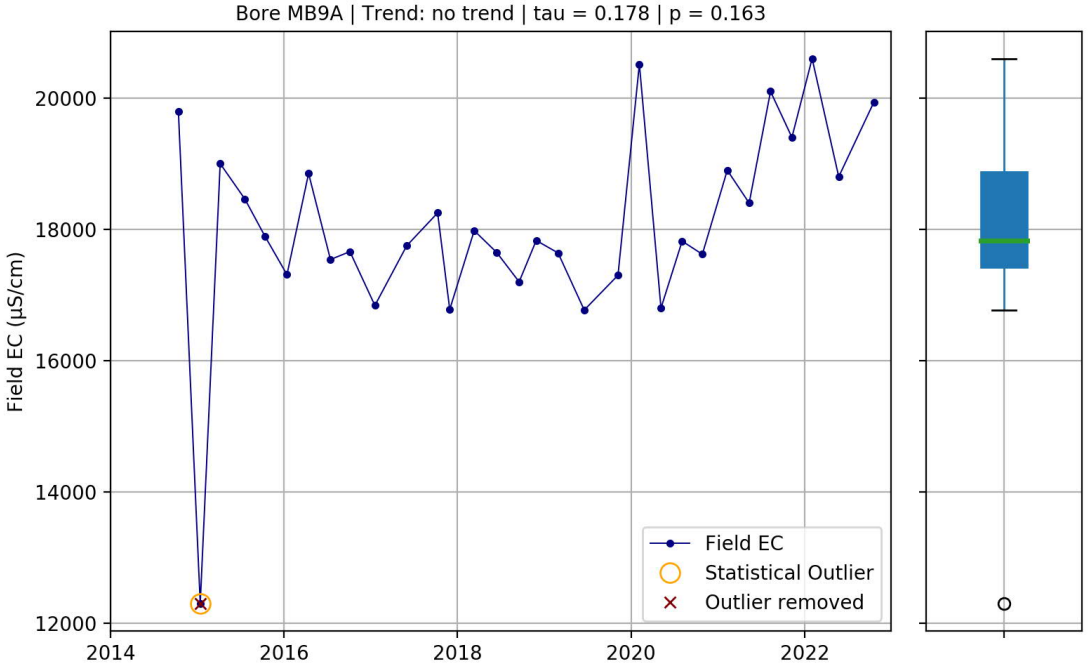

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Selenium
95th percentile: 0.002
80th percentile: 0.002
D - Selenium (mg/L)
0.00260
0.00255
0.00250
0.00245
0.00240
2014
2016
2018
2020
2022

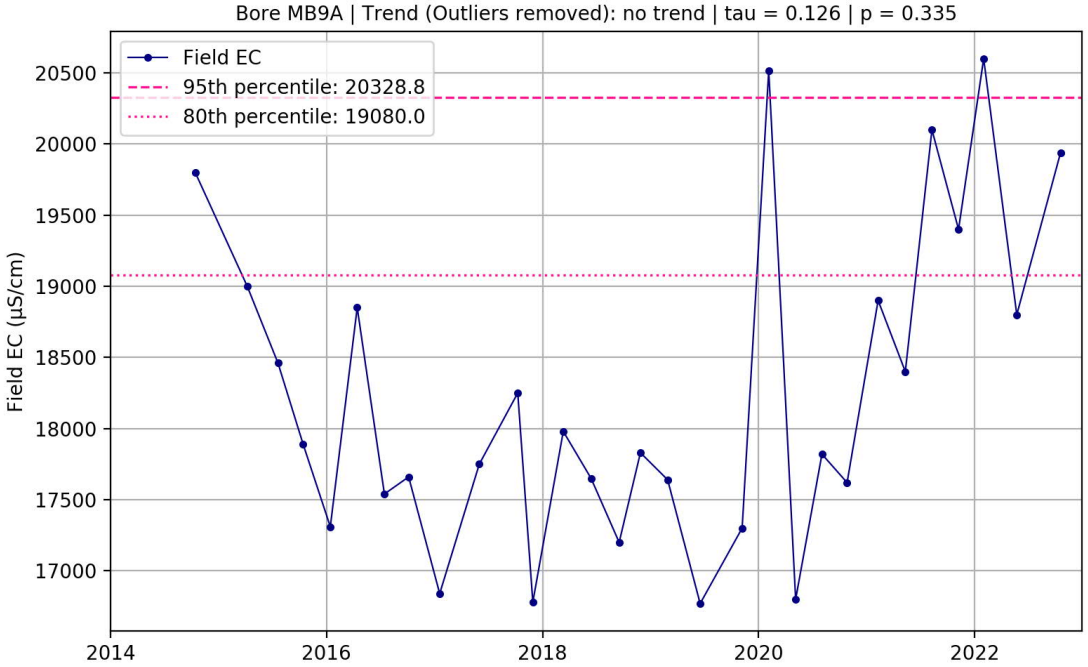

Bore MB9A | Trend: no trend | tau = 0.0 | p = 1.0
D - Silver
Statistical Outlier
Outlier removed
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

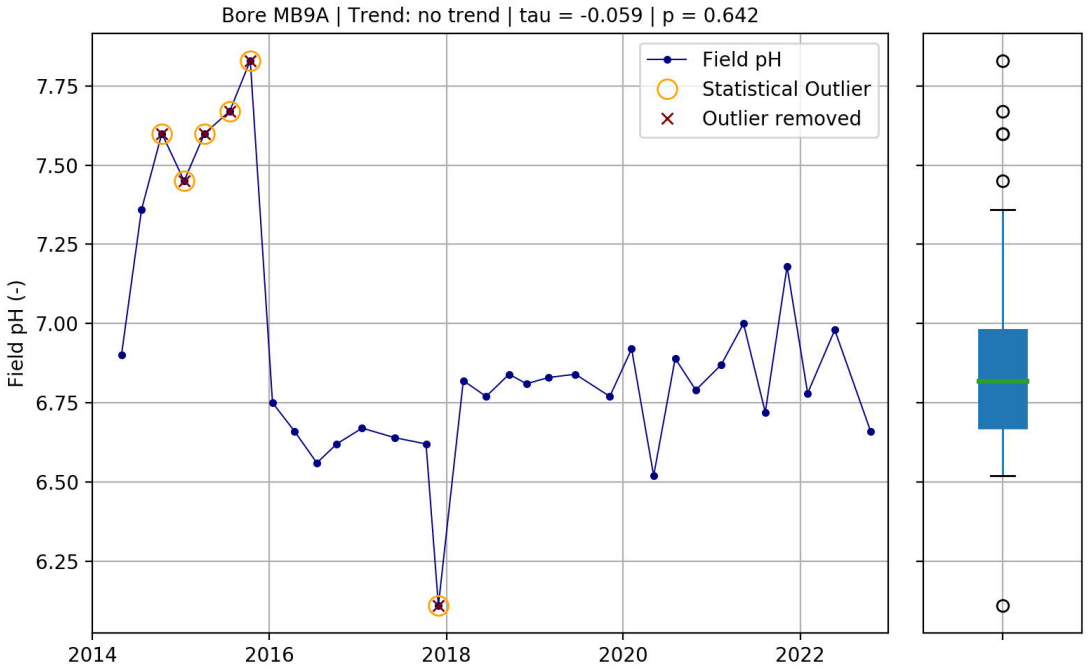

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Silver
95th percentile: 0.0
80th percentile: 0.0
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

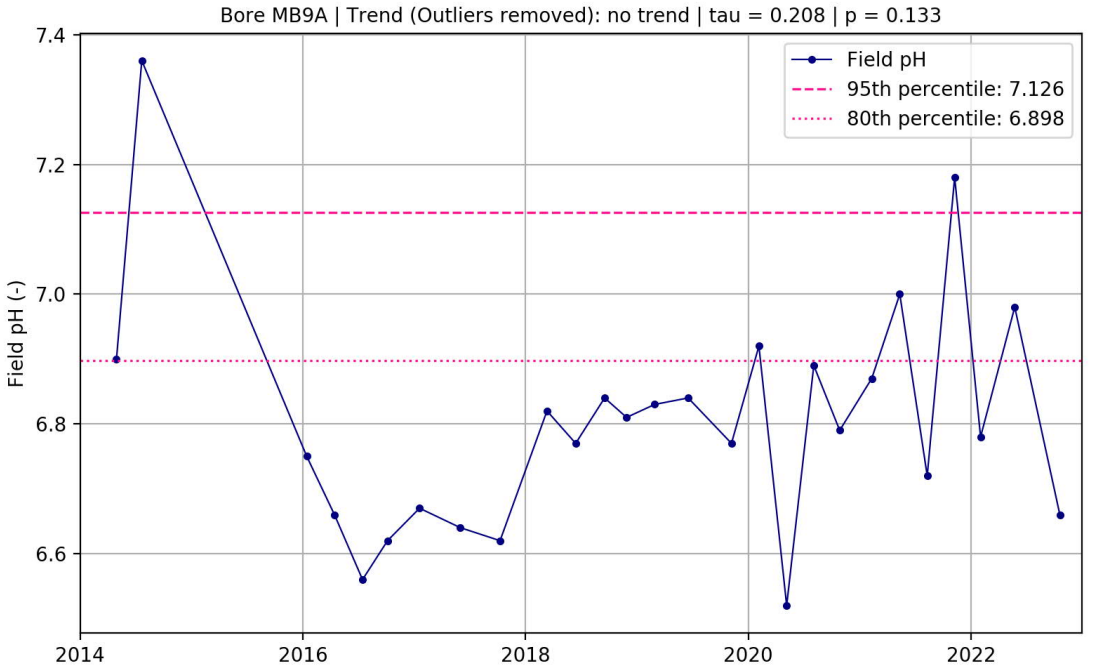

Bore MB9A | Trend: Not evaluated
D - Zinc
Statistical Outlier
Outlier removed
D - Zinc (mg/L)
0.025
0.020
0.015
0.010
0.005
2014
2016
2018
2020
2022

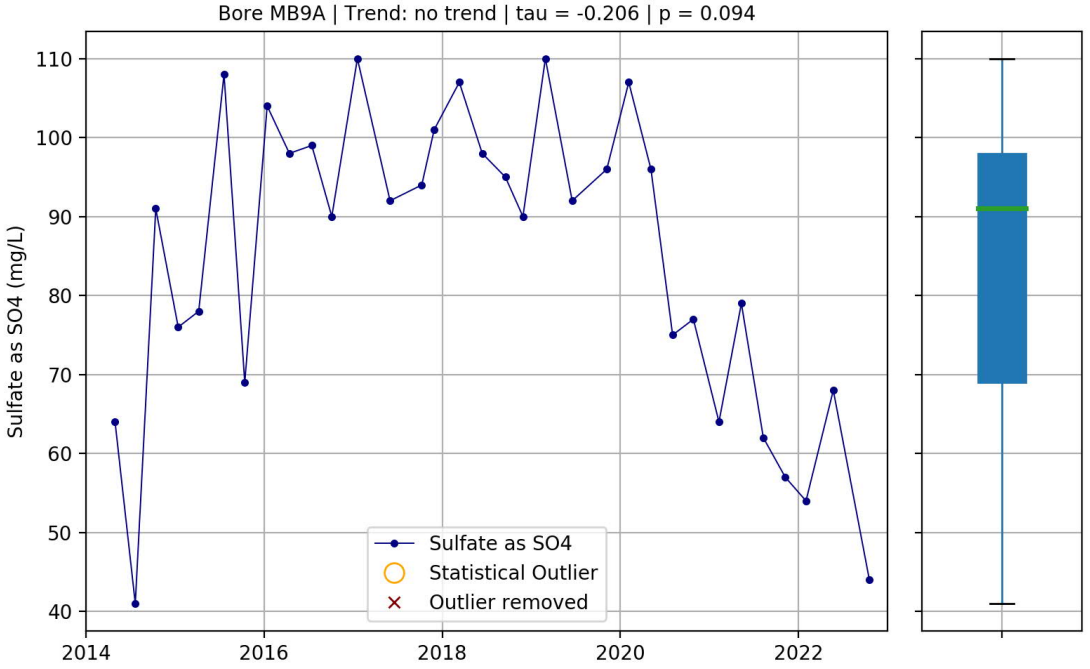

Bore MB9A | Trend: Not evaluated, five samples or less
D - Zinc
D - Zinc (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.025
0.020
0.015
0.010
0.005
2014
2016
2018
2020
2022

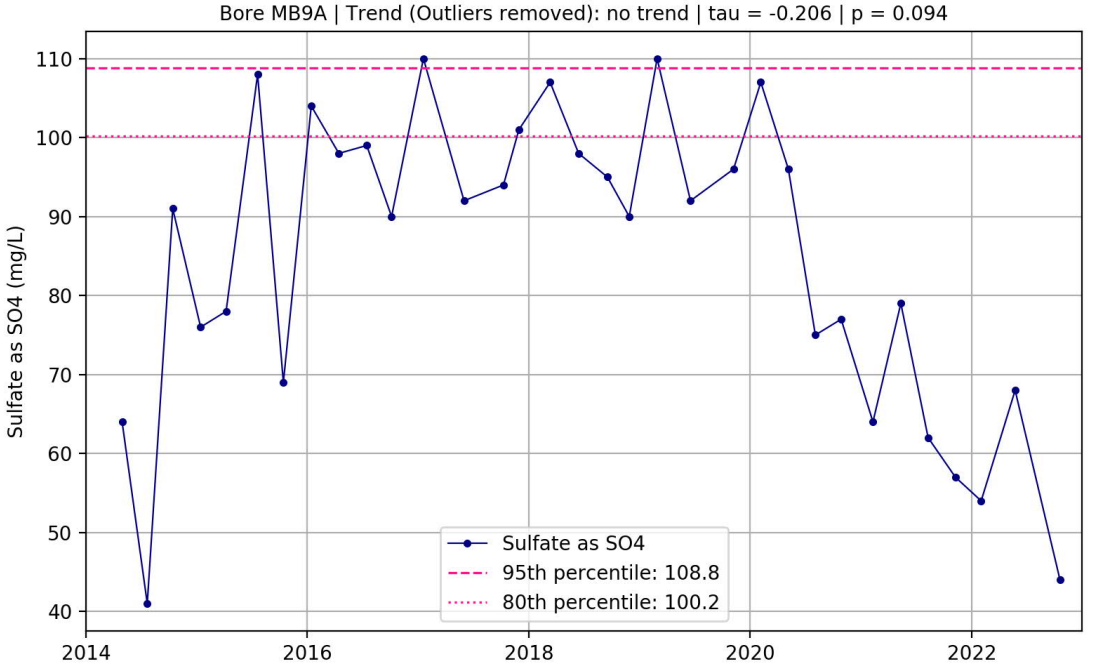

Bore MB9A | Trend: no trend | tau = 0.178 | p = 0.163
Field EC
Statistical Outlier
Outlier removed
Field EC (µS/cm)
20000
18000
16000
14000
12000
2014
2016
2018
2020
2022

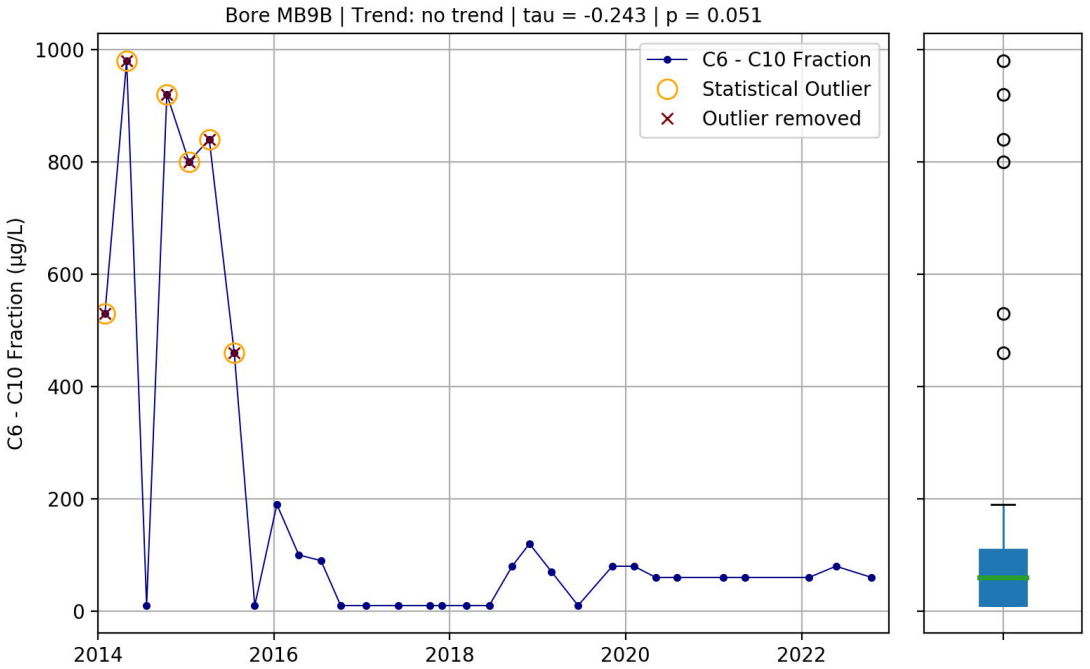

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.126 | p = 0.335
Field EC
95th percentile: 20328.8
80th percentile: 19080.0
Field EC (µS/cm)
20500
20000
19500
19000
18500
18000
17500
17000
2014
2016
2018
2020
2022

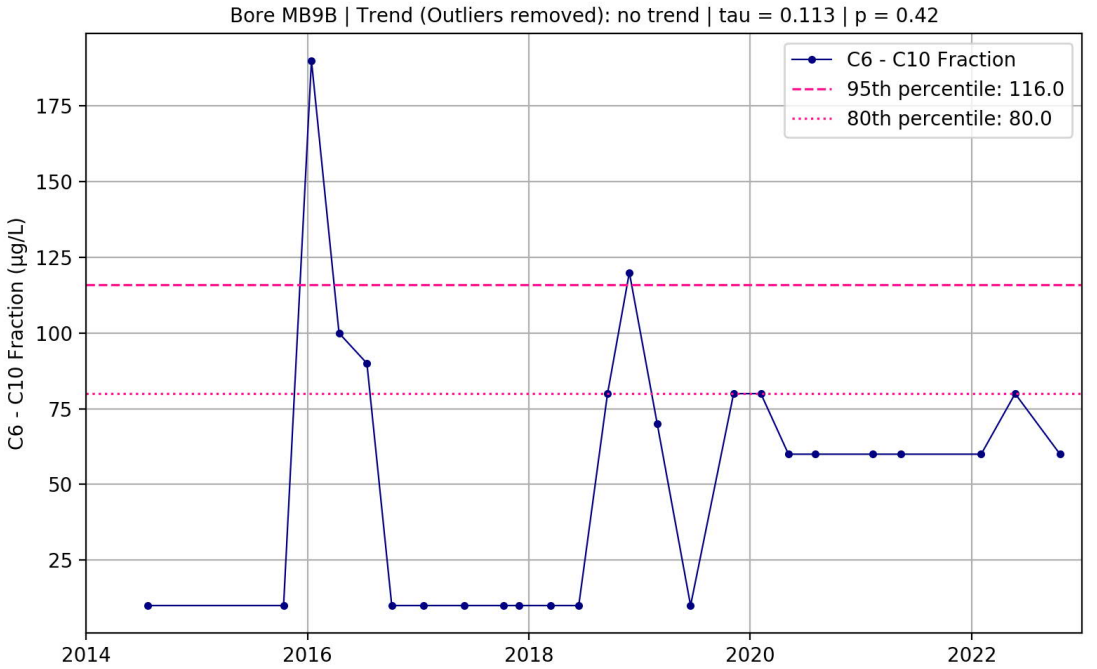

Bore MB9A | Trend: no trend | tau = -0.059 | p = 0.642
Field pH
Statistical Outlier
Outlier removed
Field pH (-)
7.75
7.50
7.25
7.00
6.75
6.50
6.25
2014
2016
2018
2020
2022

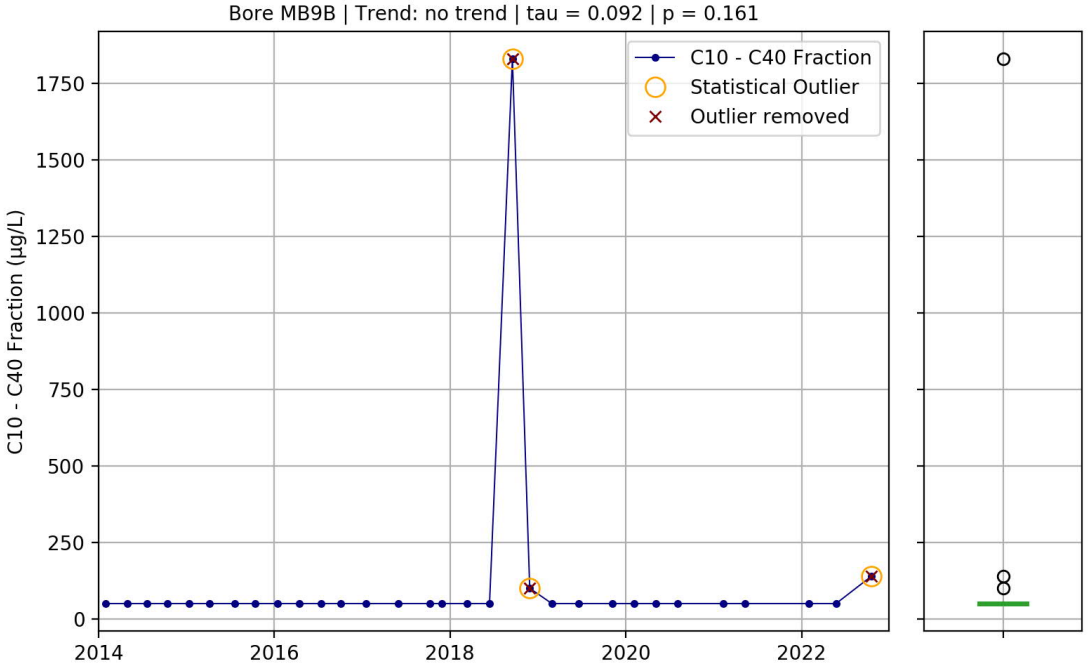

Bore MB9A | Trend (Outliers removed): no trend | tau = 0.208 | p = 0.133
Field pH
95th percentile: 7.126
80th percentile: 6.898
Field pH (-)
7.4
7.2
7.0
6.8
6.6
2014
2016
2018
2020
2022

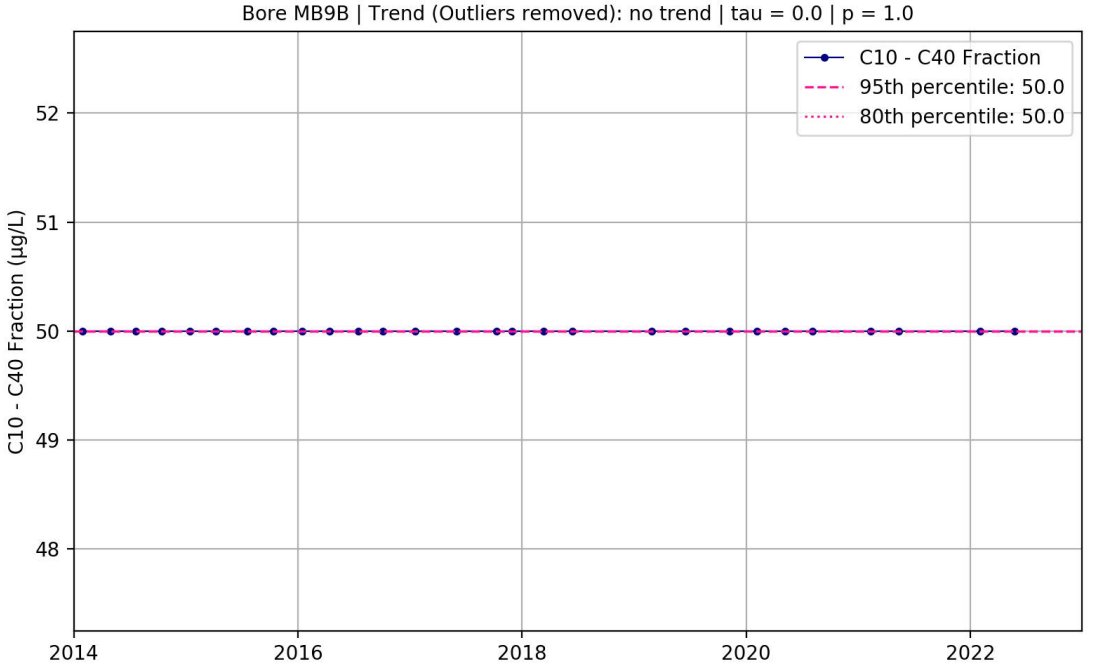

Bore MB9A | Trend: no trend | tau = -0.206 | p = 0.094
Sulfate as SO4
Statistical Outlier
Outlier removed
Sulfate as SO4 (mg/L)
110
100
90
80
70
60
50
40
2014
2016
2018
2020
2022

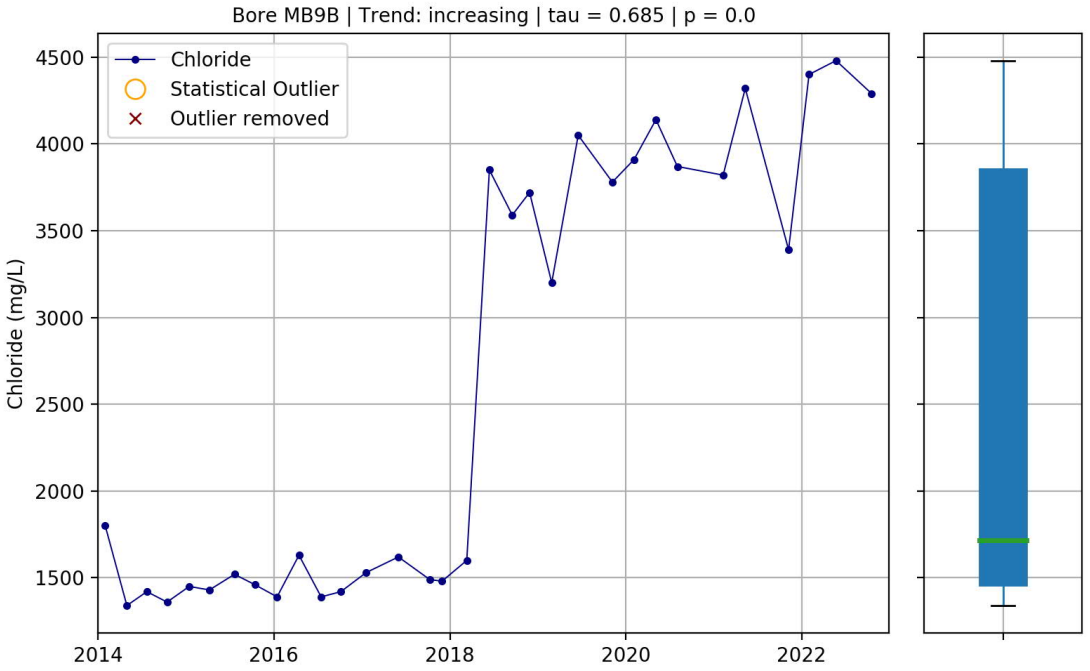

Bore MB9A | Trend (Outliers removed): no trend | tau = -0.206 | p = 0.094
Sulfate as SO4
95th percentile: 108.8
80th percentile: 100.2
Sulfate as SO4 (mg/L)
110
100
90
80
70
60
50
40
2014
2016
2018
2020
2022

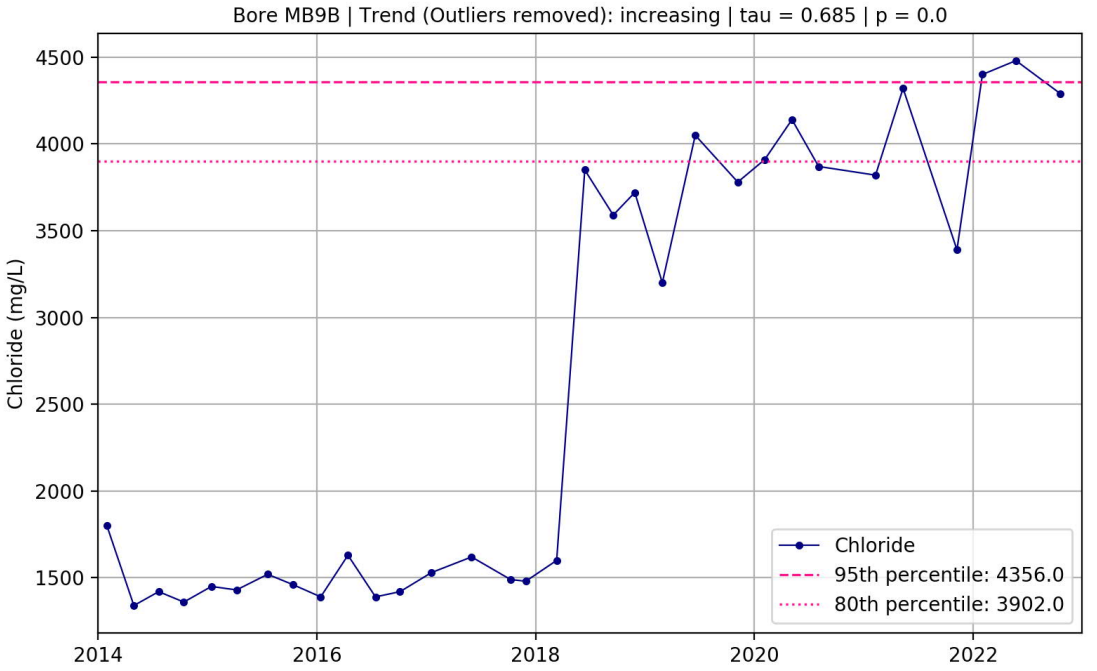

Bore MB9B | Trend: no trend | tau = -0.243 | p = 0.051
C6 - C10 Fraction
Statistical Outlier
Outlier removed
C6 - C10 Fraction (µg/L)
0
200
400
600
800
1000
2014
2016
2018
2020
2022

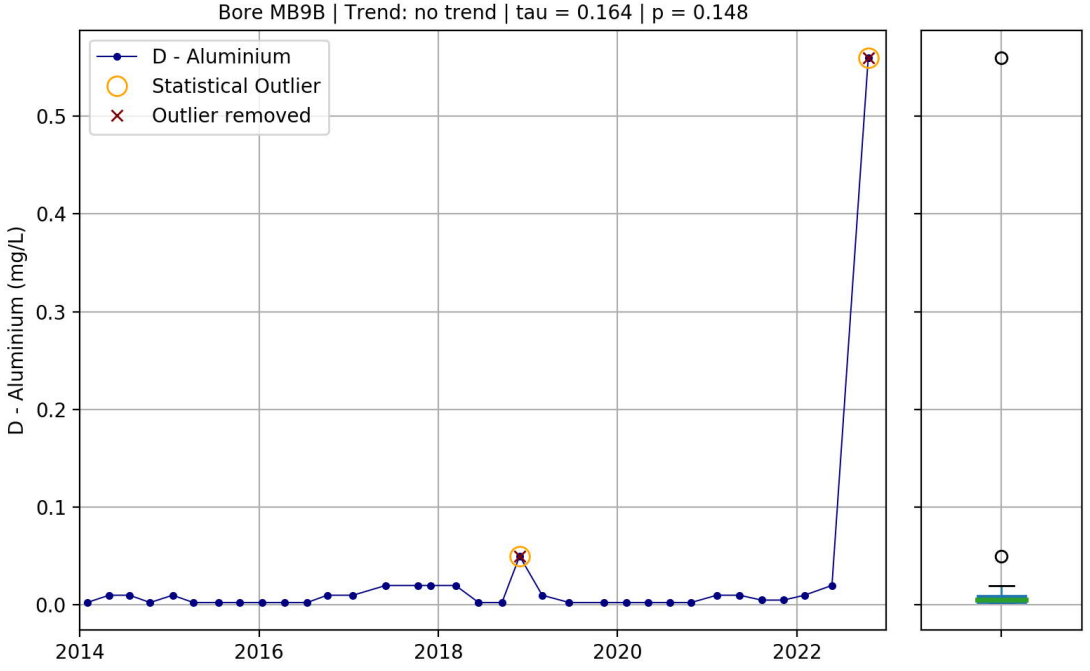

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.113 | p = 0.42
C6 - C10 Fraction
95th percentile: 116.0
80th percentile: 80.0
C6 - C10 Fraction (µg/L)
25
50
75
100
125
150
175
2014
2016
2018
2020
2022

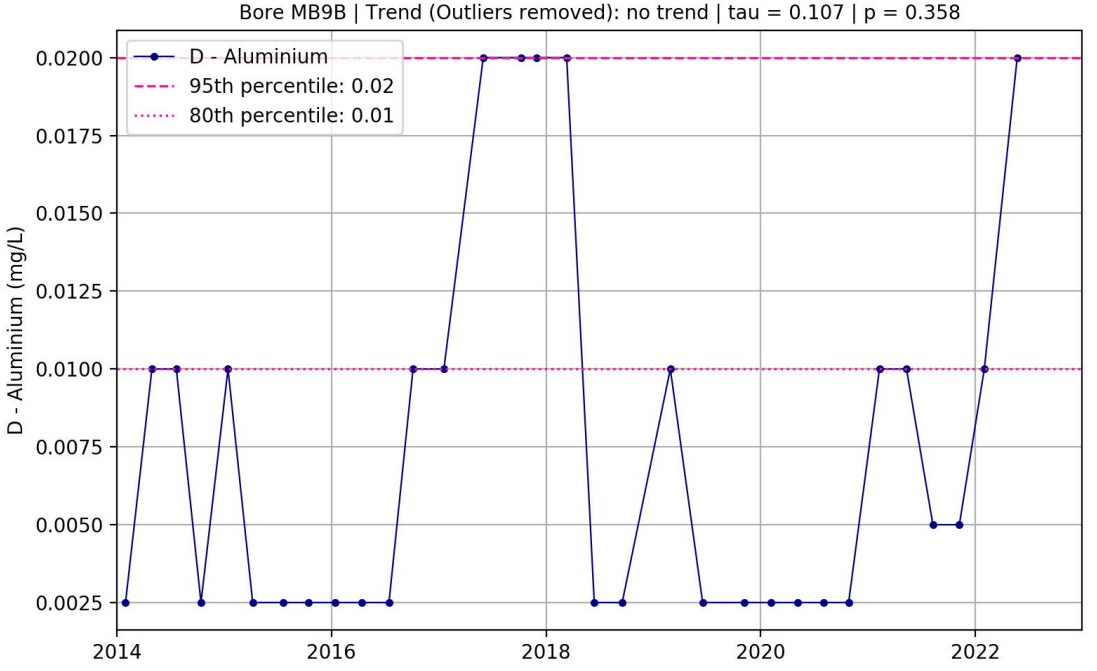

Bore MB9B | Trend: no trend | tau = 0.092 | p = 0.161
C10 - C40 Fraction
Statistical Outlier
Outlier removed
C10 - C40 Fraction (µg/L)
0
250
500
750
1000
1250
1500
1750
2014
2016
2018
2020
2022

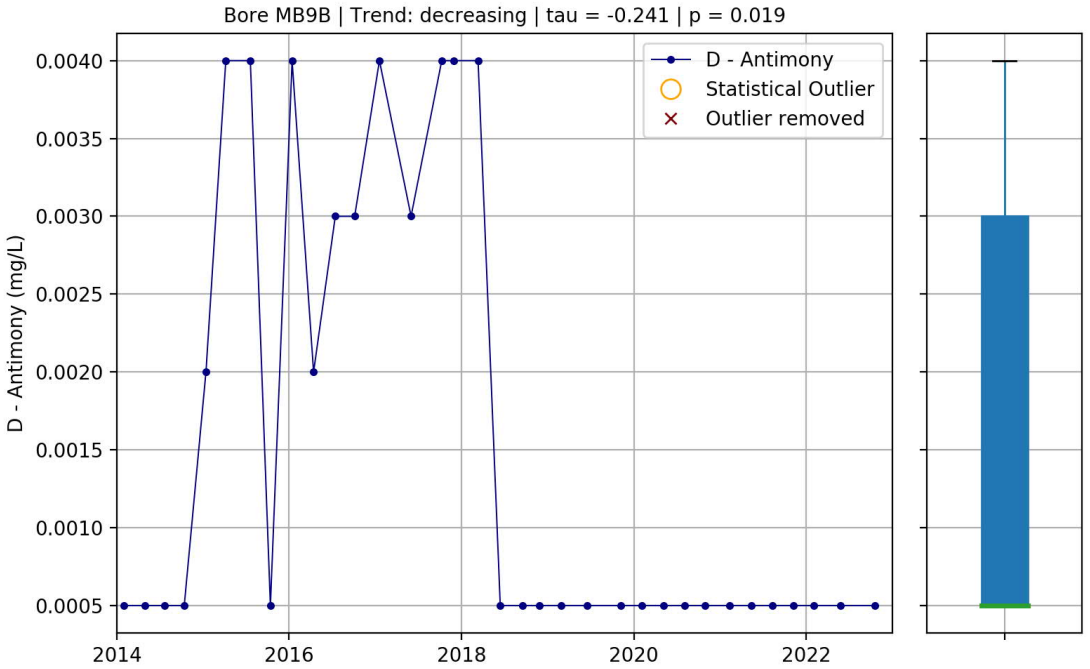

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
95th percentile: 50.0
80th percentile: 50.0
C10 - C40 Fraction (µg/L)
48
49
50
51
52
2014
2016
2018
2020
2022

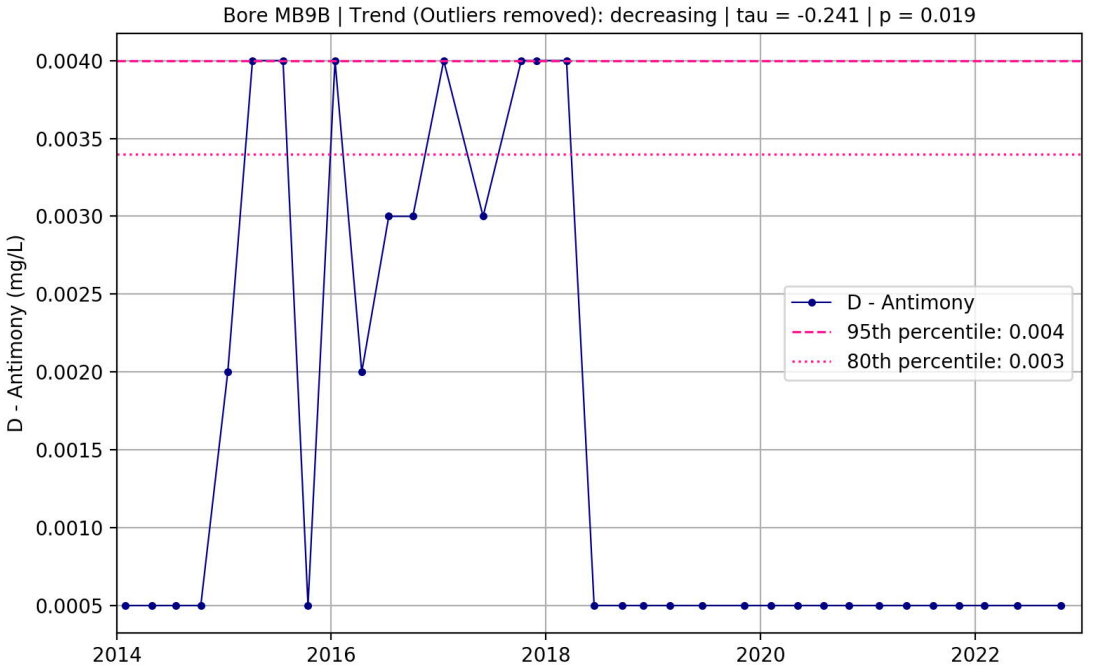

Bore MB9B | Trend: increasing | tau = 0.685 | p = 0.0
Chloride
Statistical Outlier
Outlier removed
Chloride (mg/L)
4500
4000
3500
3000
2500
2000
1500
2014
2016
2018
2020
2022

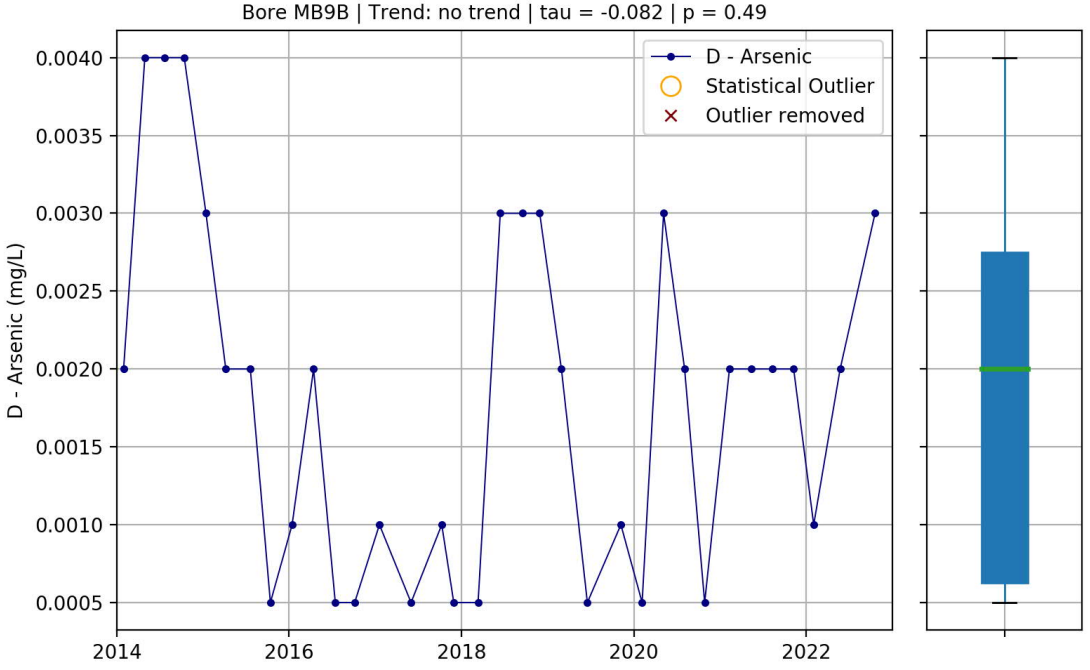

Bore MB9B | Trend (Outliers removed): increasing | tau = 0.685 | p = 0.0
Chloride (mg/L)
4500
4000
3500
3000
2500
2000
1500
2014
2016
2018
2020
2022
Chloride
95th percentile: 4356.0
80th percentile: 3902.0

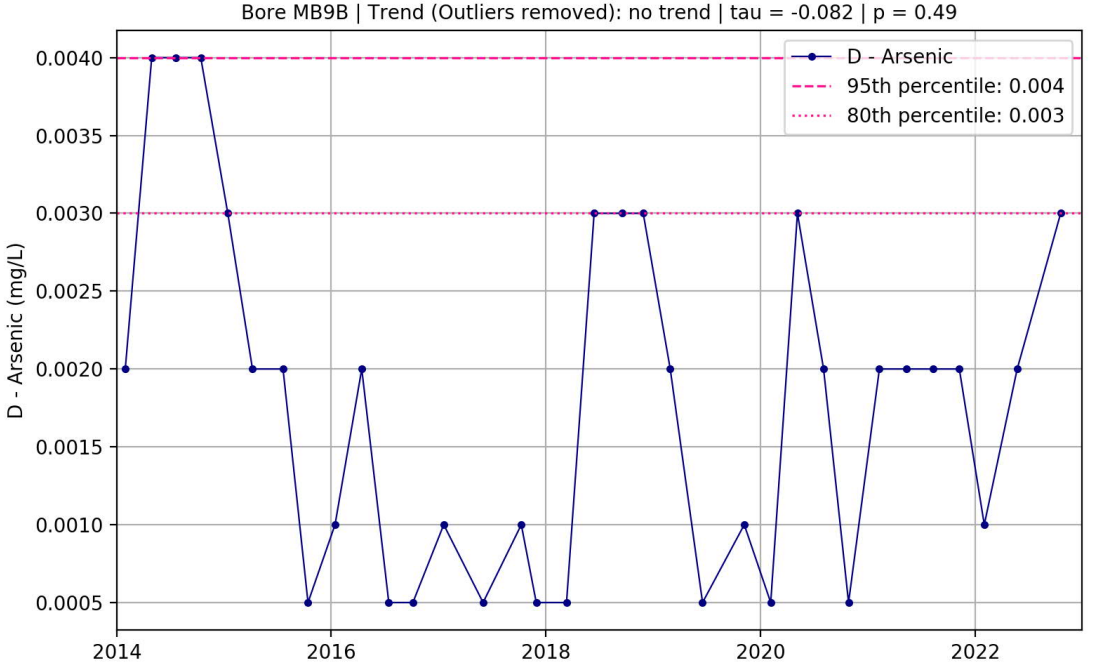

Bore MB9B | Trend: no trend | tau = 0.164 | p = 0.148
D - Aluminium
Statistical Outlier
Outlier removed
D - Aluminium (mg/L)
0.5
0.4
0.3
0.2
0.1
0.0
2014
2016
2018
2020
2022

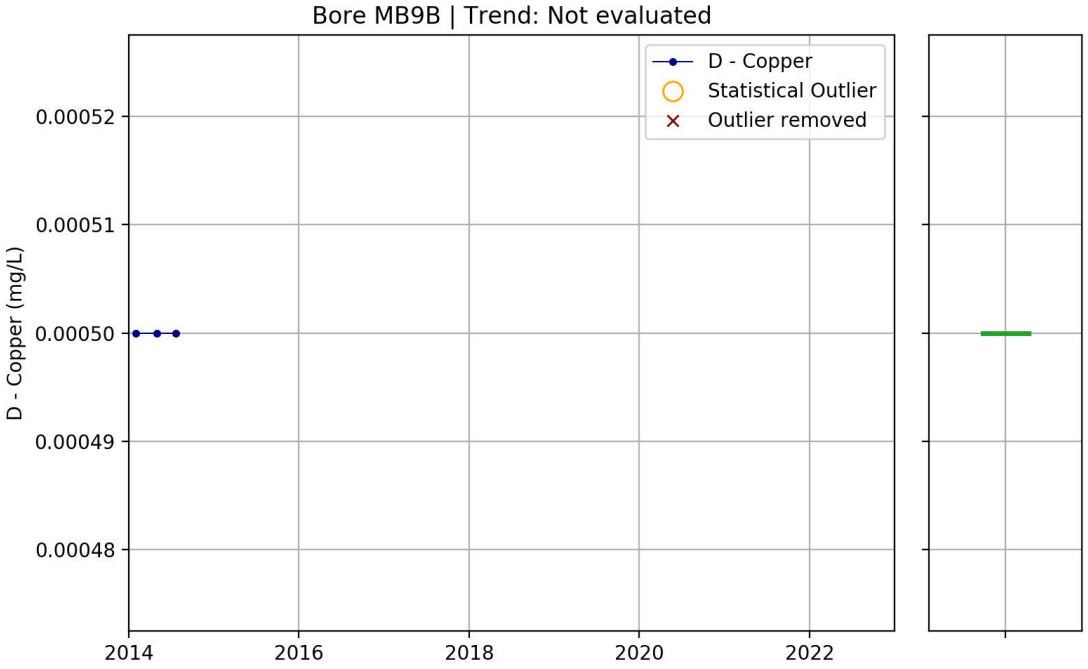

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.107 | p = 0.358
D - Aluminium
95th percentile: 0.02
80th percentile: 0.01
D - Aluminium (mg/L)
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
2014
2016
2018
2020
2022

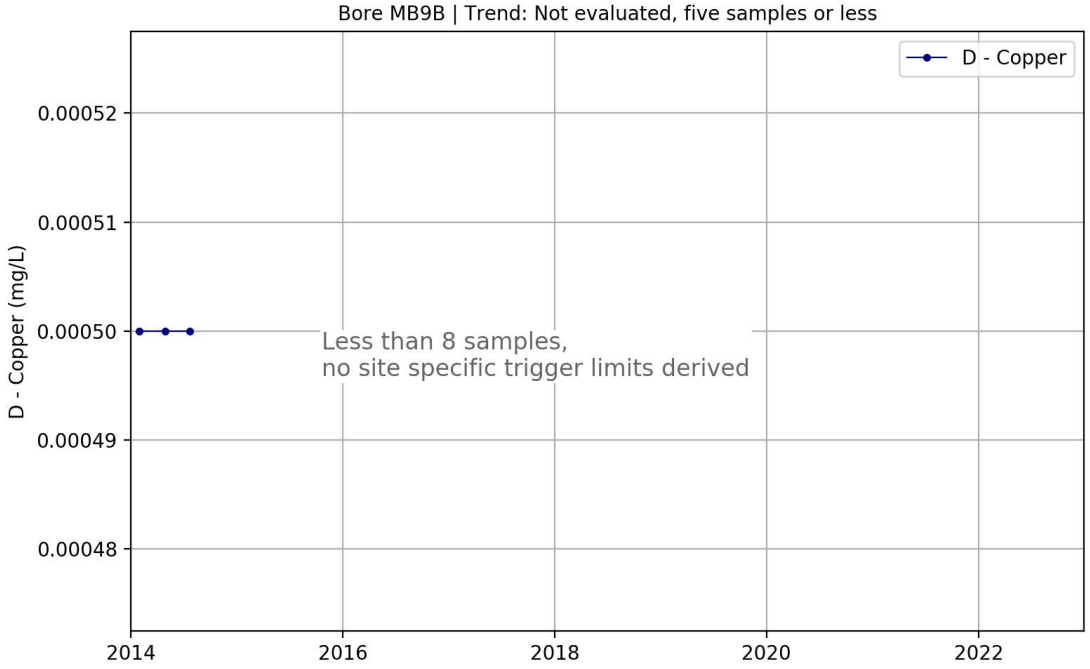

Bore MB9B | Trend: decreasing | tau = -0.241 | p = 0.019
D - Antimony
Statistical Outlier
Outlier removed
D - Antimony (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

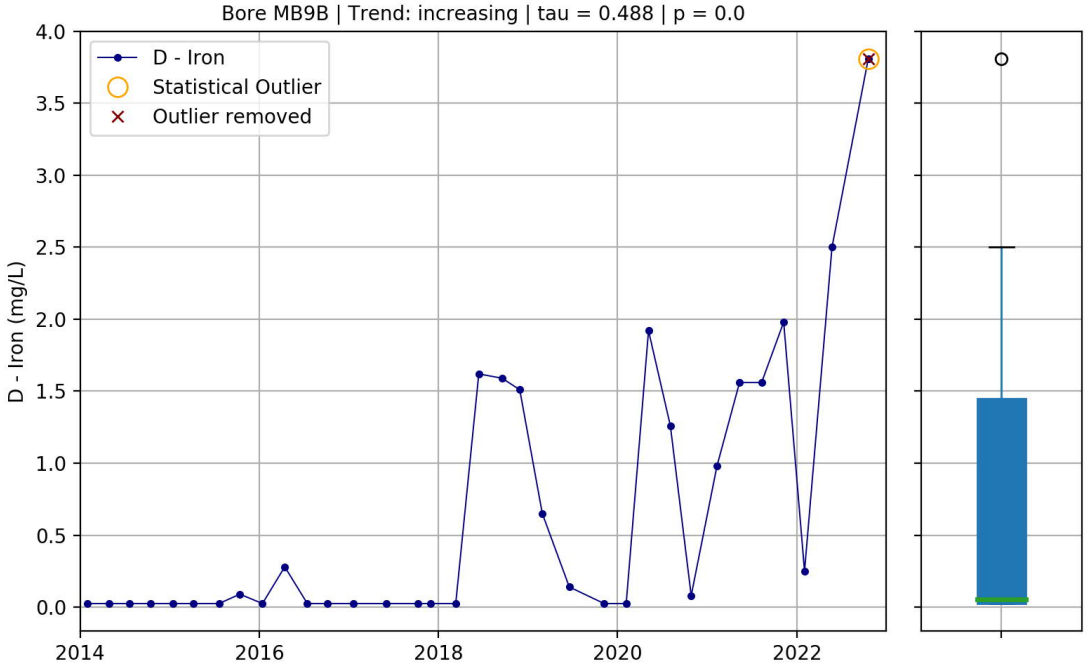

Bore MB9B | Trend (Outliers removed): decreasing | tau = -0.241 | p = 0.019
D - Antimony
95th percentile: 0.004
80th percentile: 0.003
D - Antimony (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

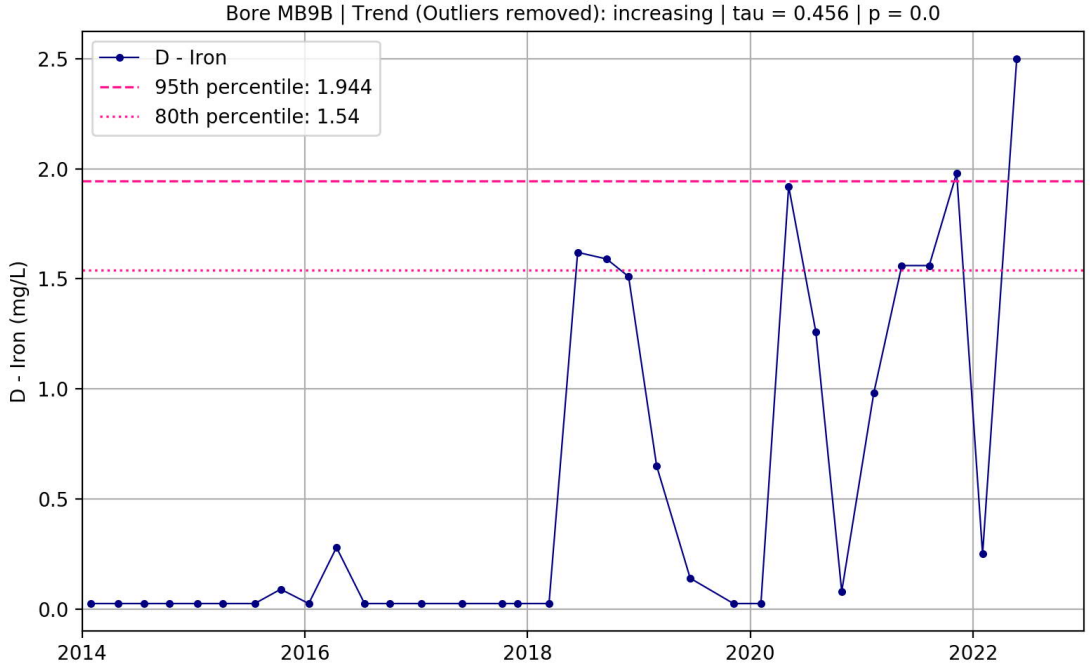

Bore MB9B | Trend: no trend | tau = -0.082 | p = 0.49
D - Arsenic
Statistical Outlier
Outlier removed
D - Arsenic (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

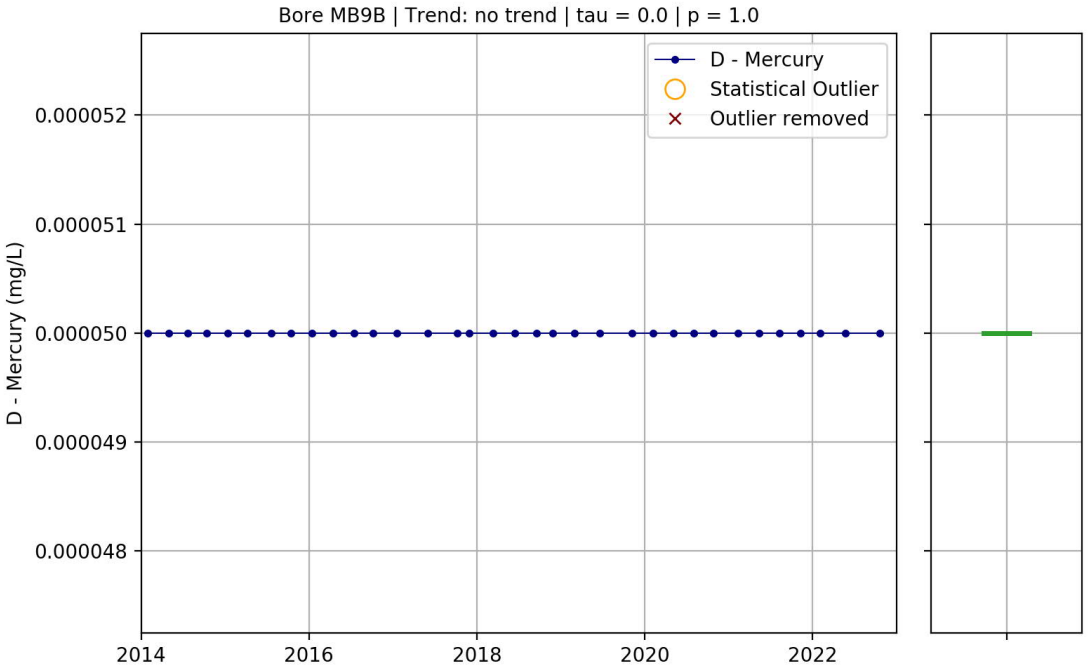

Bore MB9B | Trend (Outliers removed): no trend | tau = -0.082 | p = 0.49
D - Arsenic
95th percentile: 0.004
80th percentile: 0.003
D - Arsenic (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

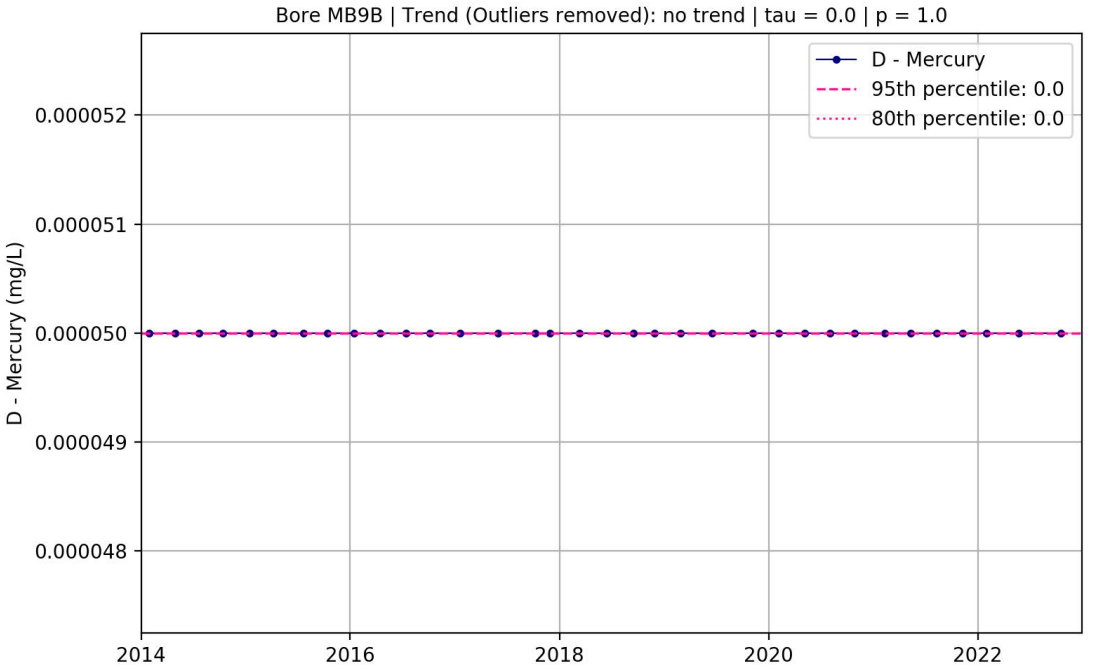

Bore MB9B | Trend: Not evaluated
D - Copper
Statistical Outlier
Outlier removed
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

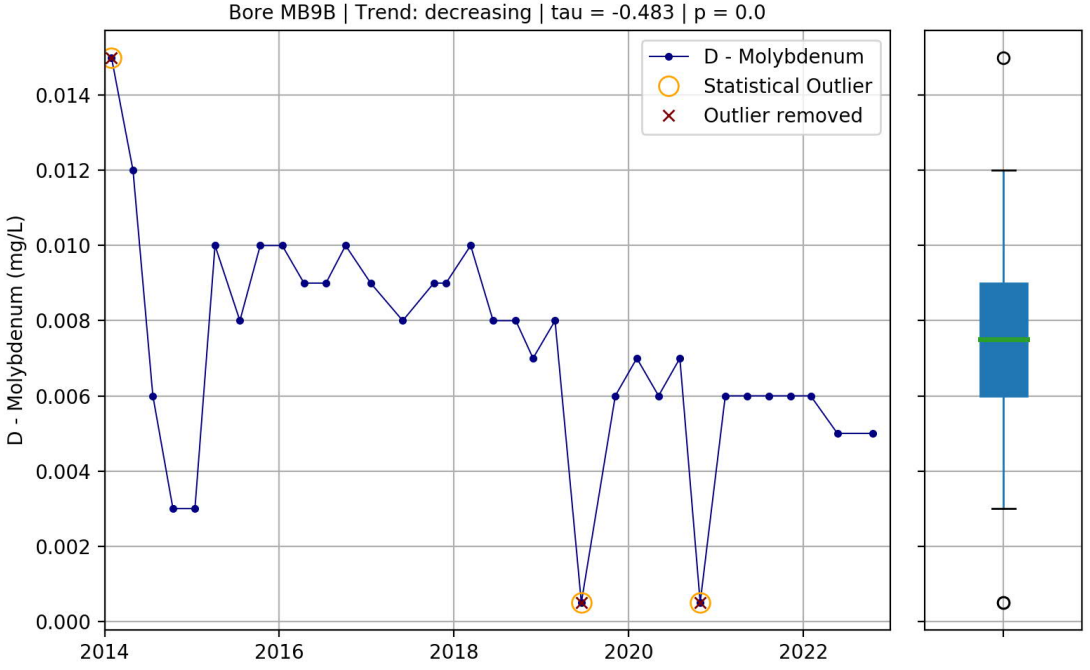

Bore MB9B | Trend: Not evaluated, five samples or less
D - Copper
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
Less than 8 samples,
no site specific trigger limits derived
2014
2016
2018
2020
2022

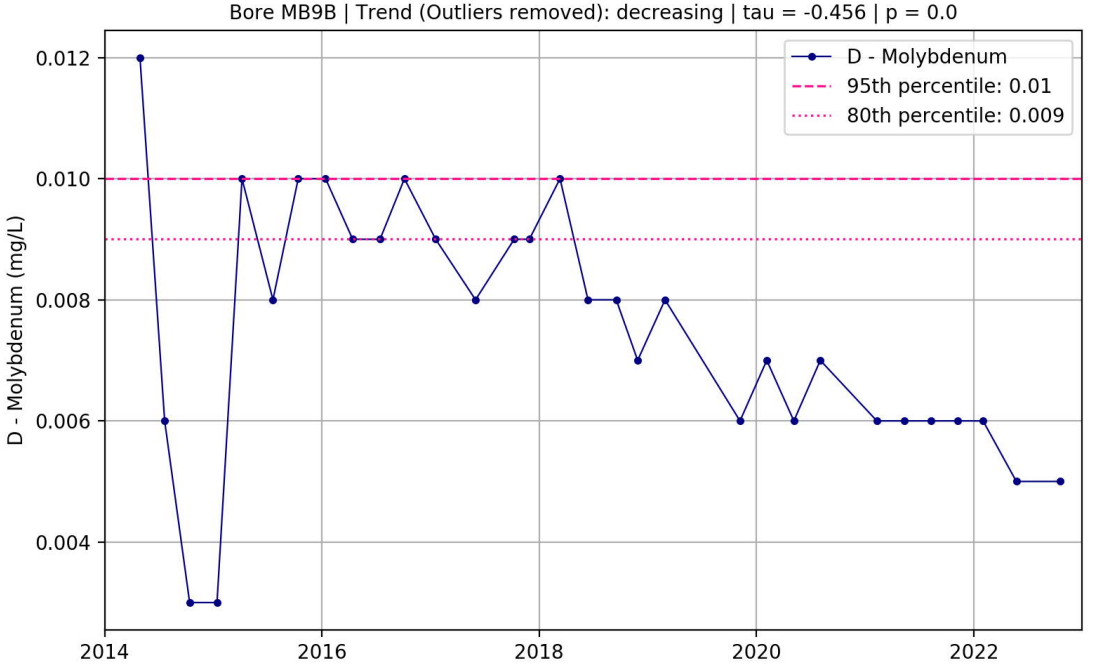

Bore MB9B | Trend: increasing | tau = 0.488 | p = 0.0
D - Iron
Statistical Outlier
Outlier removed
D - Iron (mg/L)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2014
2016
2018
2020
2022

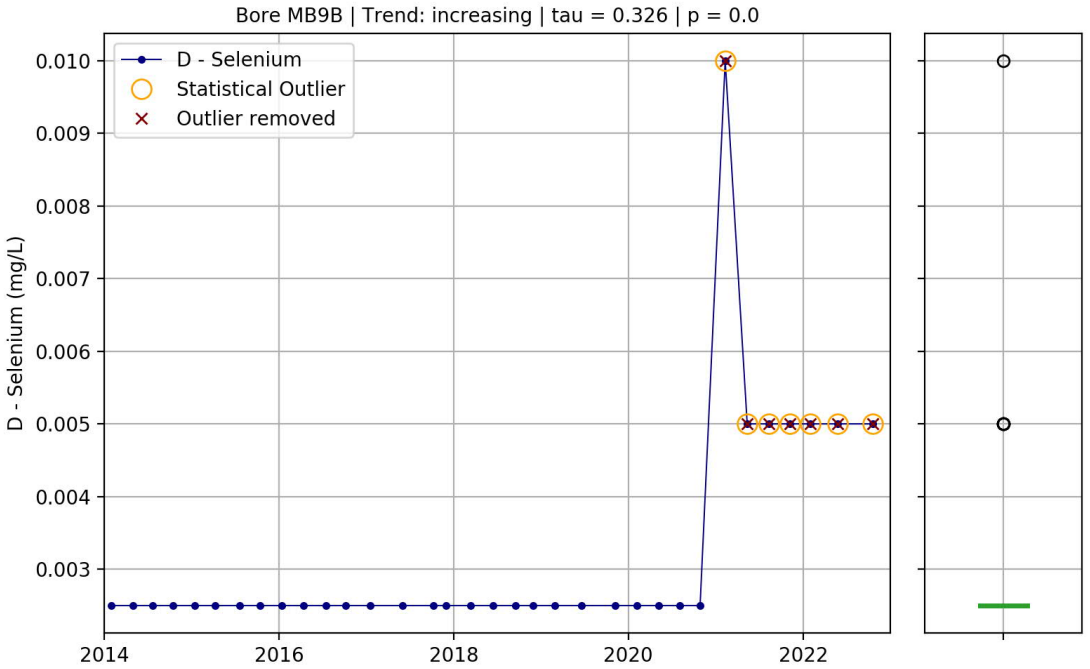

Bore MB9B | Trend (Outliers removed): increasing | tau = 0.456 | p = 0.0
D - Iron
95th percentile: 1.944
80th percentile: 1.54
D - Iron (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
2014
2016
2018
2020
2022

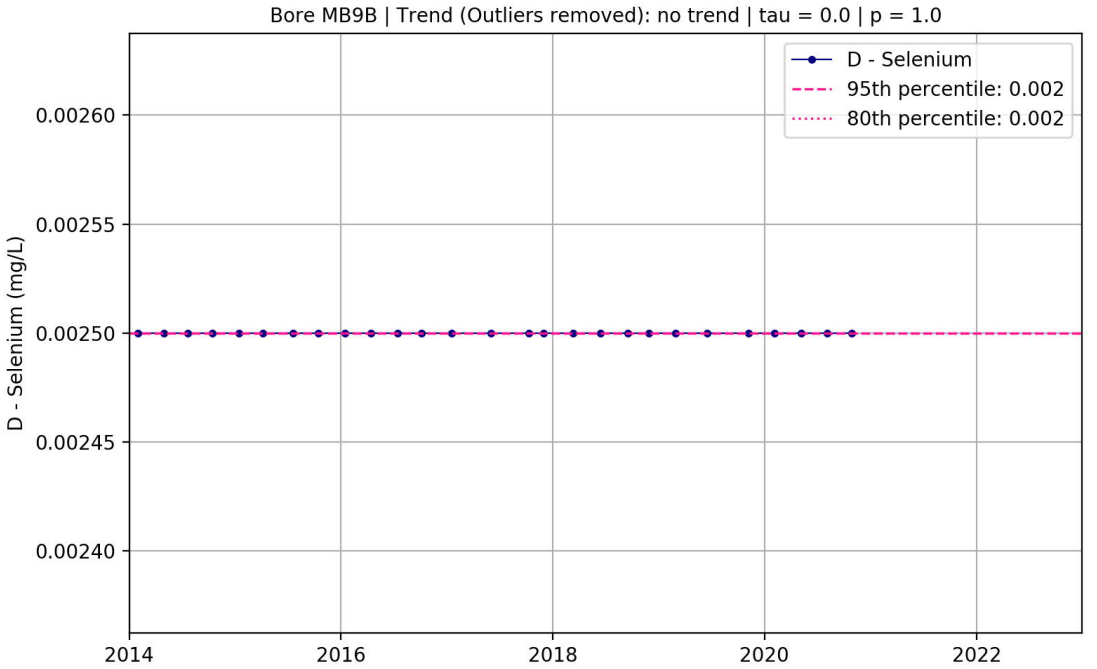

Bore MB9B | Trend: no trend | tau = 0.0 | p = 1.0
D - Mercury
Statistical Outlier
Outlier removed
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022

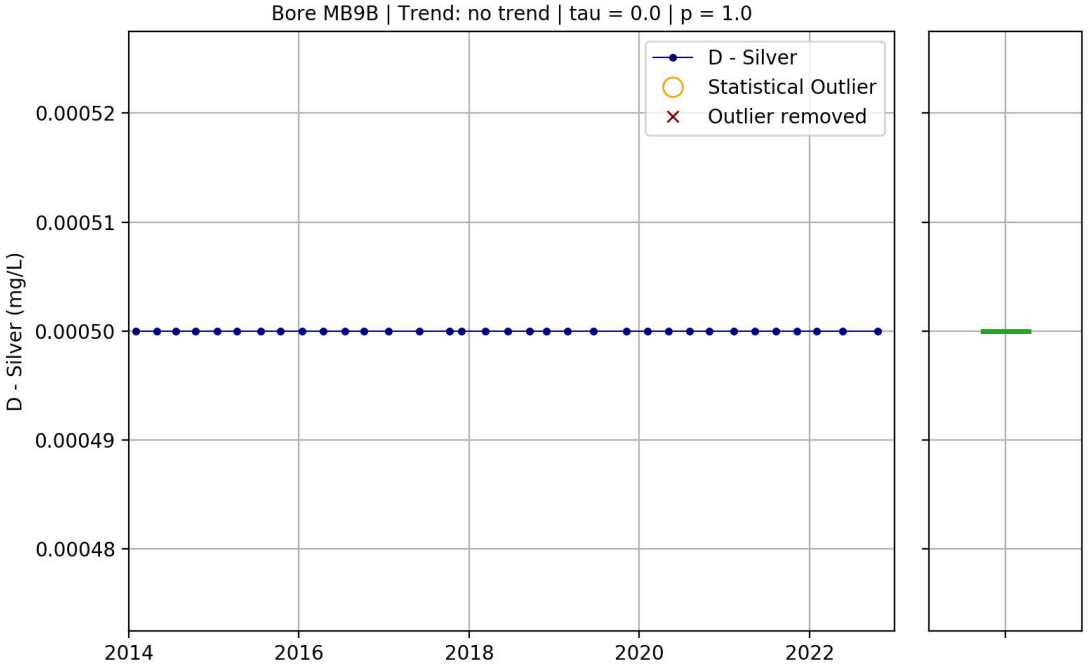

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Mercury
95th percentile: 0.0
80th percentile: 0.0
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022

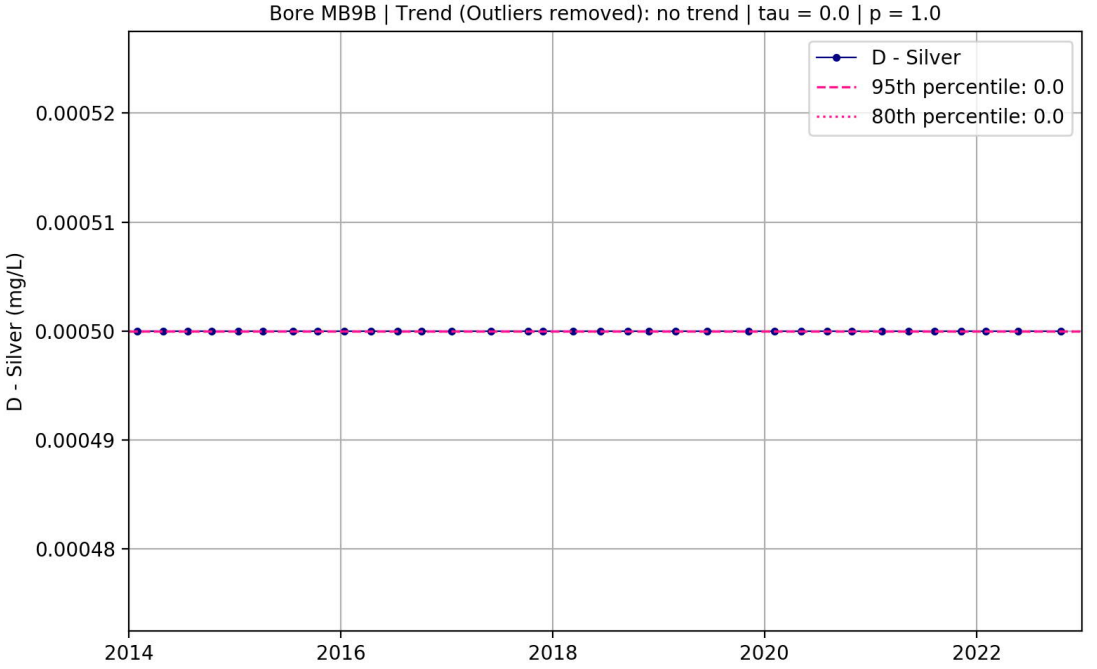

Bore MB9B | Trend: decreasing | tau = -0.483 | p = 0.0
D - Molybdenum
Statistical Outlier
Outlier removed
D - Molybdenum (mg/L)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
2014
2016
2018
2020
2022


Bore MB9B | Trend (Outliers removed): decreasing | tau = -0.456 | p = 0.0
D - Molybdenum
95th percentile: 0.01
80th percentile: 0.009
D - Molybdenum (mg/L)
0.012
0.010
0.008
0.006
0.004
2014
2016
2018
2020
2022

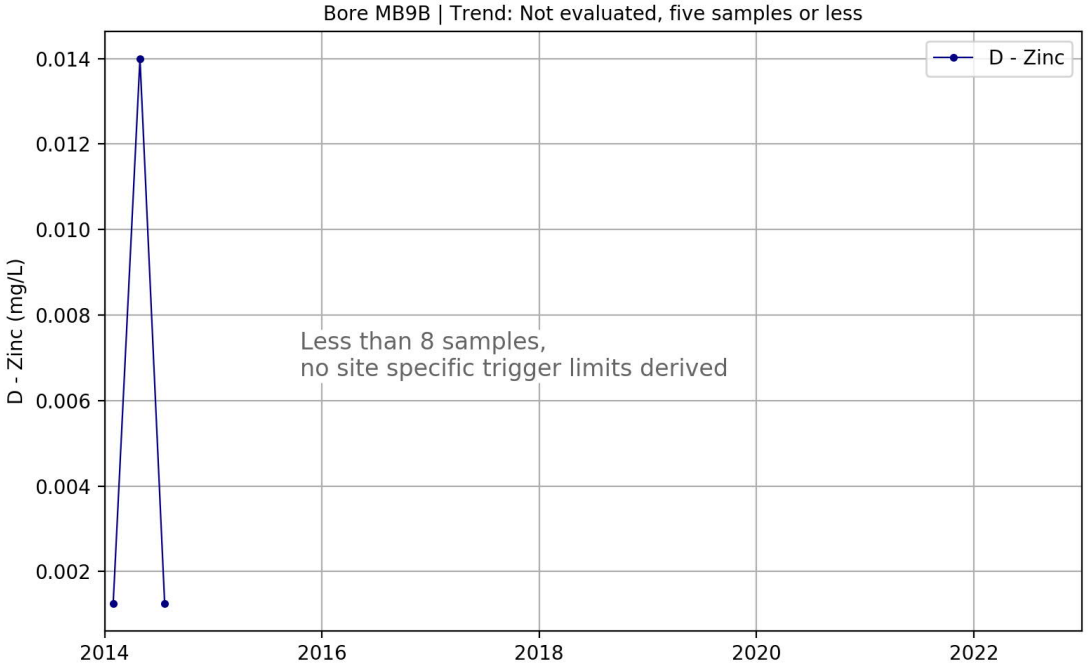

Bore MB9B | Trend: increasing | tau = 0.326 | p = 0.0
D - Selenium
Statistical Outlier
Outlier removed
D - Selenium (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
2014
2016
2018
2020
2022

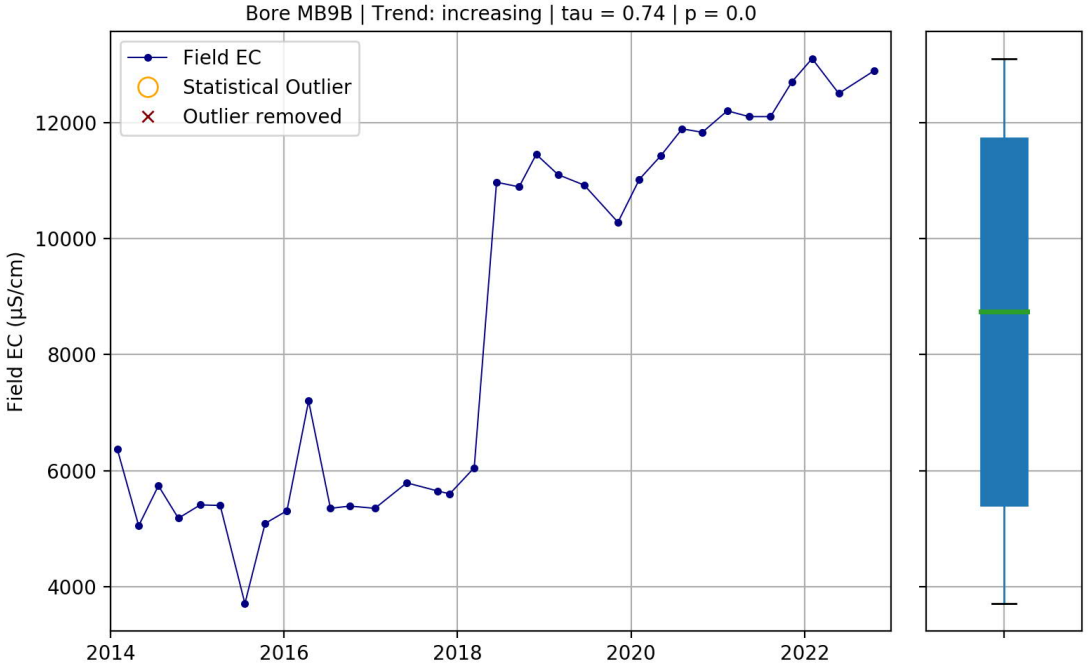

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Selenium
95th percentile: 0.002
80th percentile: 0.002
D - Selenium (mg/L)
0.00260
0.00255
0.00250
0.00245
0.00240
2014
2016
2018
2020
2022

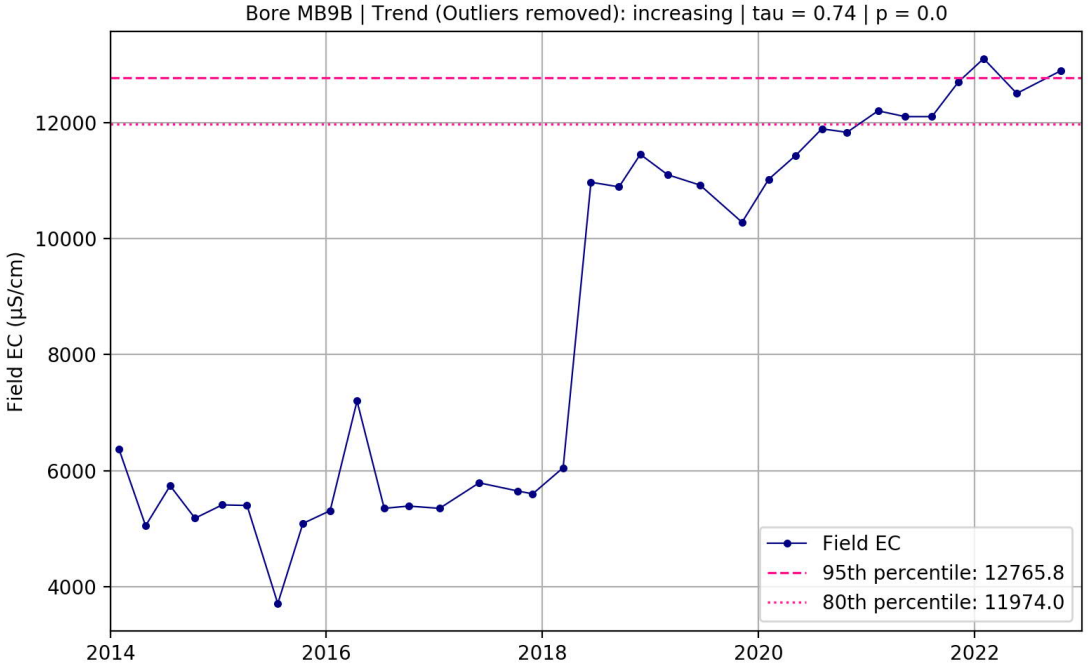

Bore MB9B | Trend: no trend | tau = 0.0 | p = 1.0
D - Silver
Statistical Outlier
Outlier removed
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

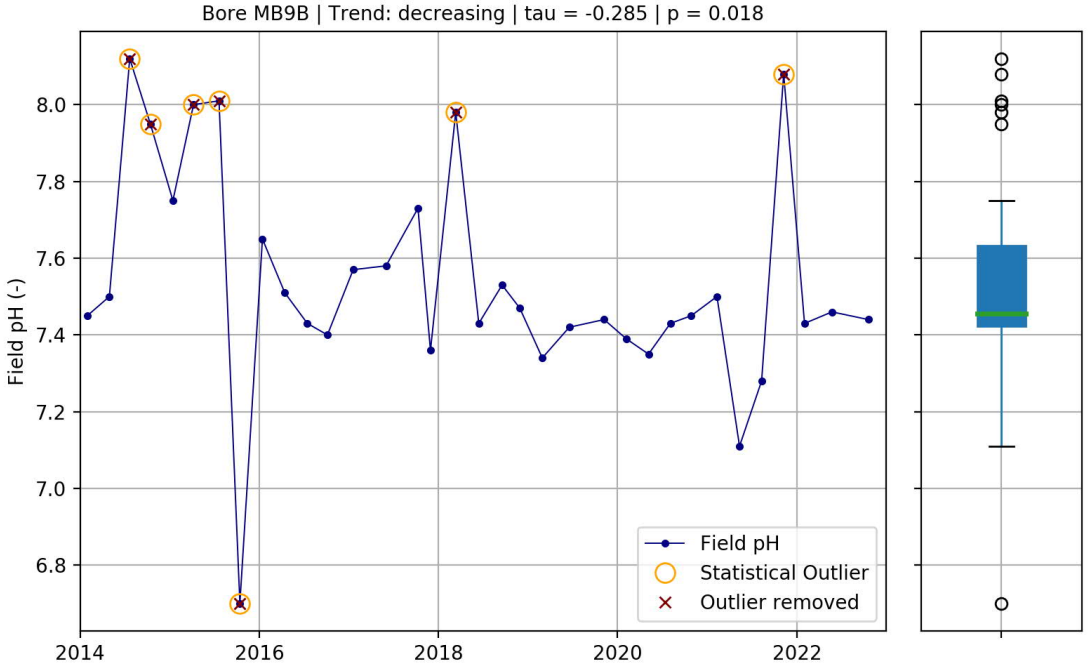

Bore MB9B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Silver
95th percentile: 0.0
80th percentile: 0.0
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

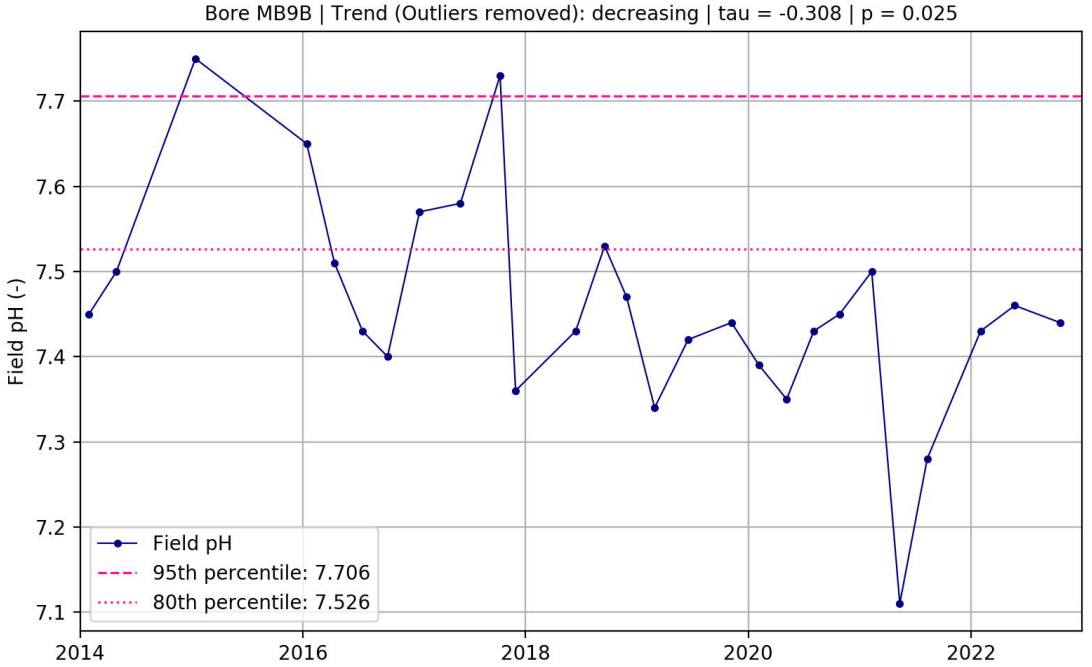

Bore MB9B | Trend: Not evaluated
D - Zinc
Statistical Outlier
Outlier removed
D - Zinc (mg/L)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
2014
2016
2018
2020
2022

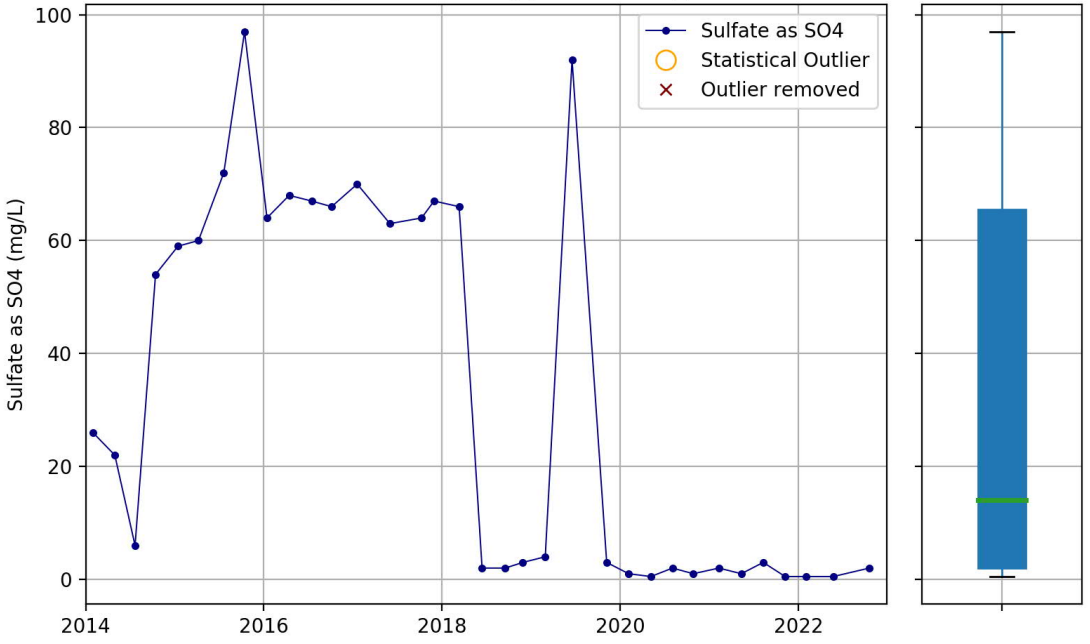

Bore MB9B | Trend: Not evaluated, five samples or less
D - Zinc
D - Zinc (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.014
0.012
0.010
0.008
0.006
0.004
0.002
2014
2016
2018
2020
2022

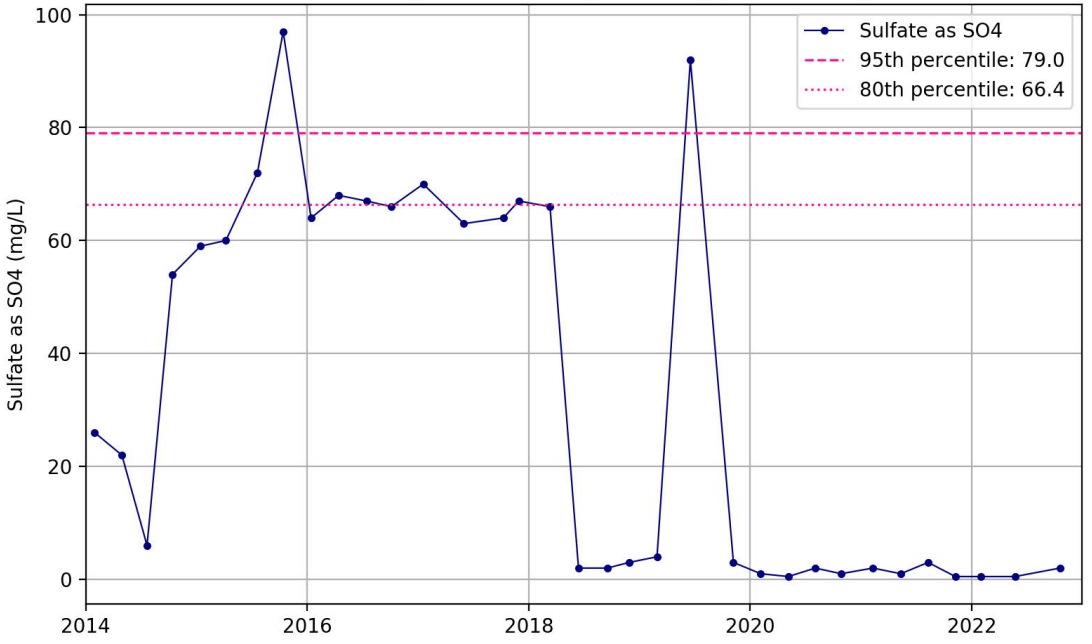

Bore MB9B | Trend: increasing | tau = 0.74 | p = 0.0
Field EC
Statistical Outlier
Outlier removed
Field EC (µS/cm)
12000
10000
8000
6000
4000
2014
2016
2018
2020
2022

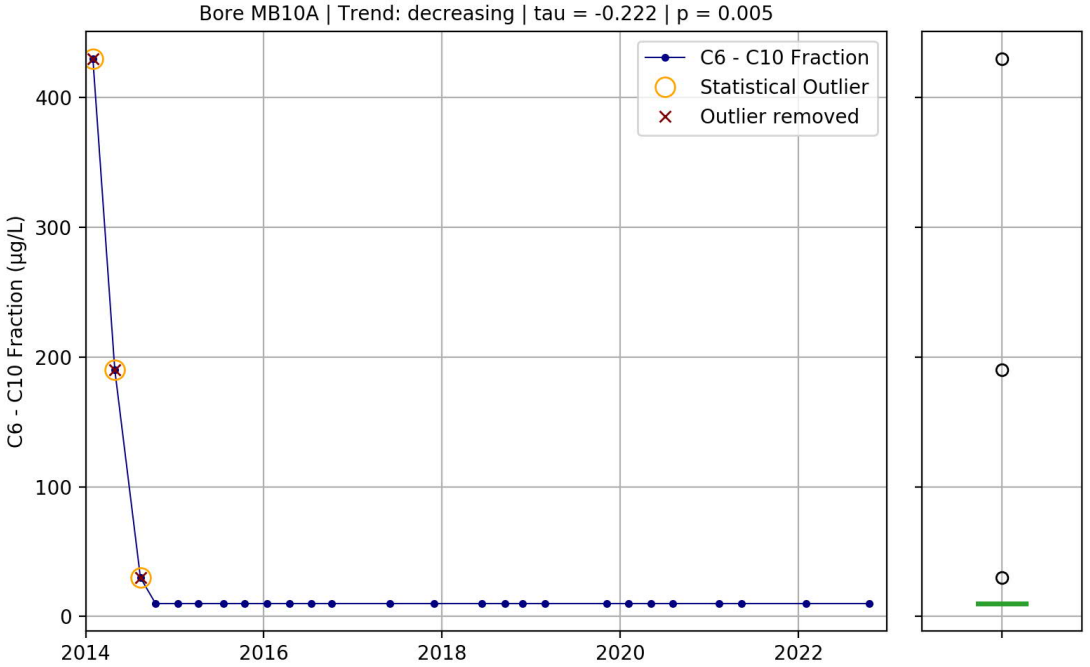

Bore MB9B | Trend (Outliers removed): increasing | tau = 0.74 | p = 0.0
Field EC (µS/cm)
Field EC
95th percentile: 12765.8
80th percentile: 11974.0
12000
10000
8000
6000
4000
2014
2016
2018
2020
2022

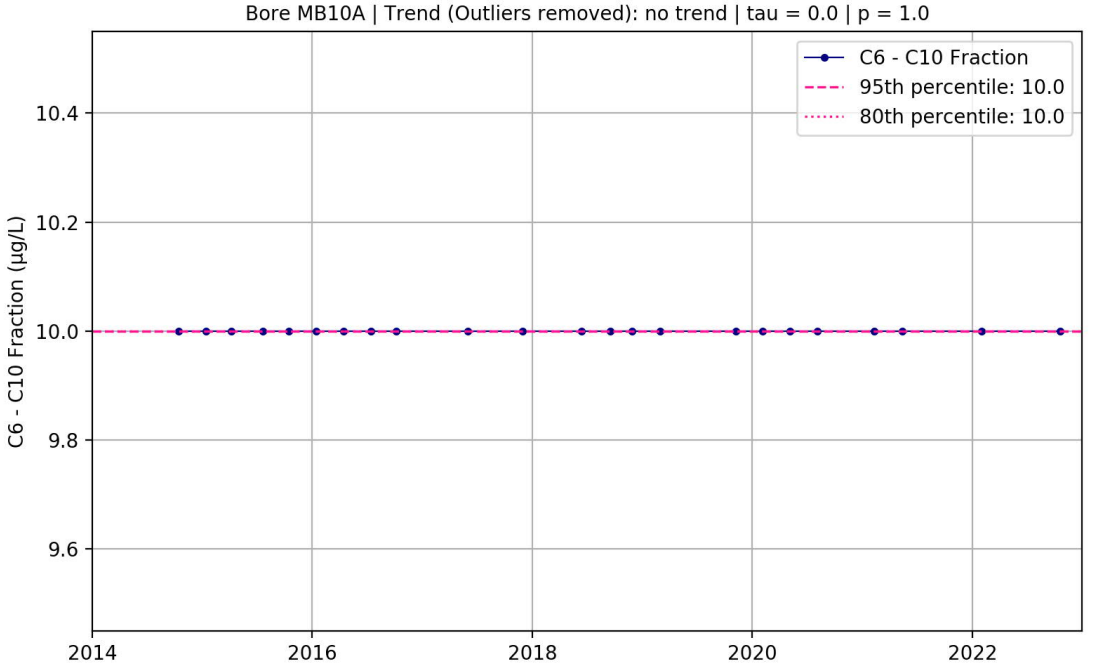

Bore MB9B | Trend: decreasing | tau = -0.285 | p = 0.018
Field pH (-)
Field pH
Statistical Outlier
Outlier removed

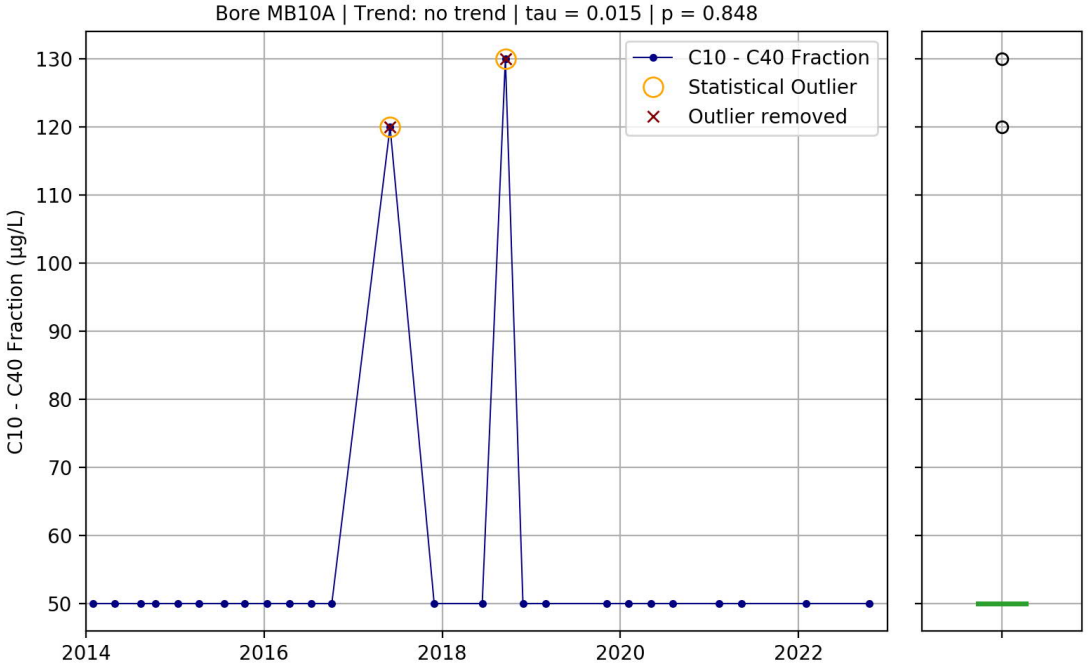

Bore MB9B | Trend (Outliers removed): decreasing | tau = -0.308 | p = 0.025
Field pH (-)
Field pH
95th percentile: 7.706
80th percentile: 7.526

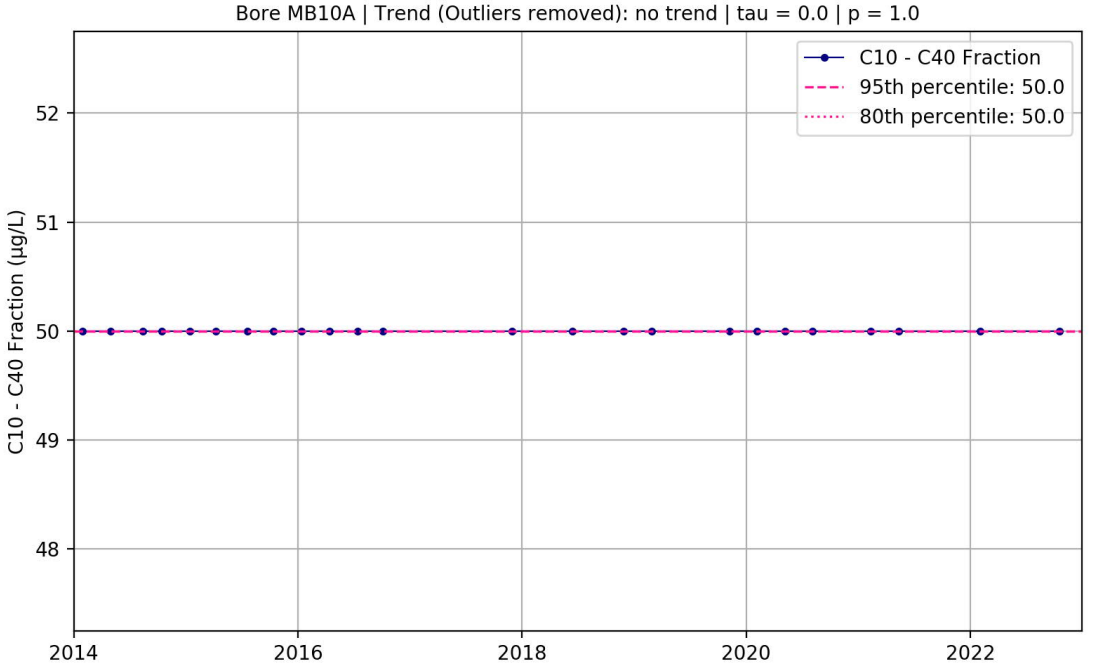

Bore MB9B | Trend: decreasing | tau = -0.446 | p = 0.0
Sulfate as SO4 (mg/L)
Sulfate as SO4
Statistical Outlier
Outlier removed

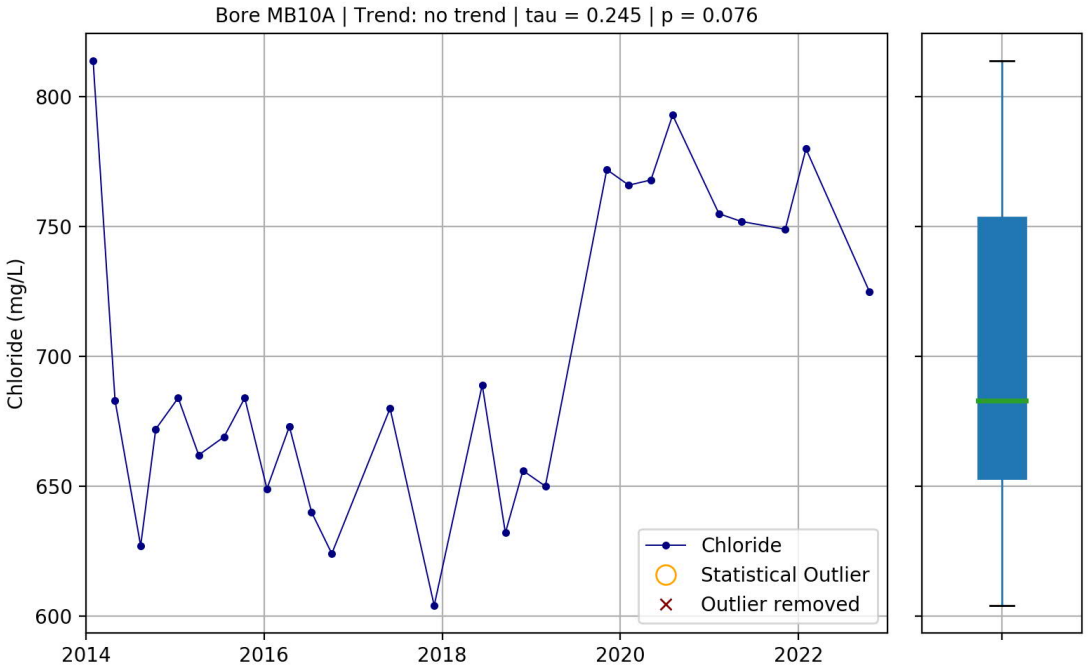

Bore MB9B | Trend (Outliers removed): decreasing | tau = -0.446 | p = 0.0
Sulfate as SO4 (mg/L)
Sulfate as SO4
95th percentile: 79.0
80th percentile: 66.4

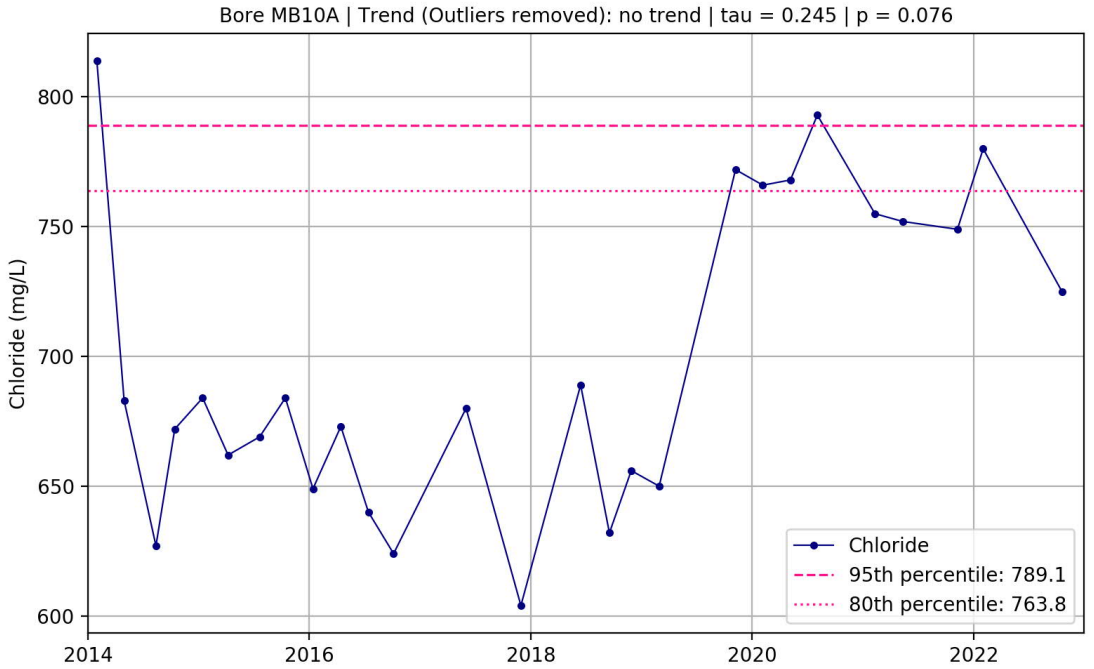

Bore MB10A | Trend: decreasing | tau = -0.222 | p = 0.005
C6 - C10 Fraction
Statistical Outlier
Outlier removed
C6 - C10 Fraction (µg/L)
0
100
200
300
400
2014
2016
2018
2020
2022

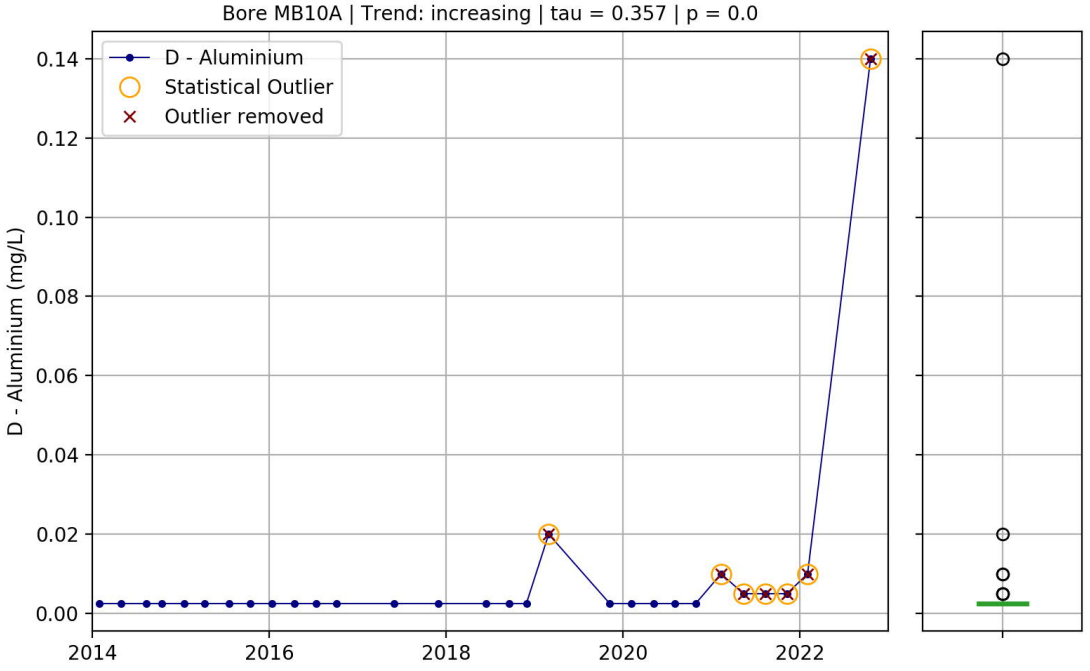

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C6 - C10 Fraction
95th percentile: 10.0
80th percentile: 10.0
C6 - C10 Fraction (µg/L)
9.6
9.8
10.0
10.2
10.4
2014
2016
2018
2020
2022

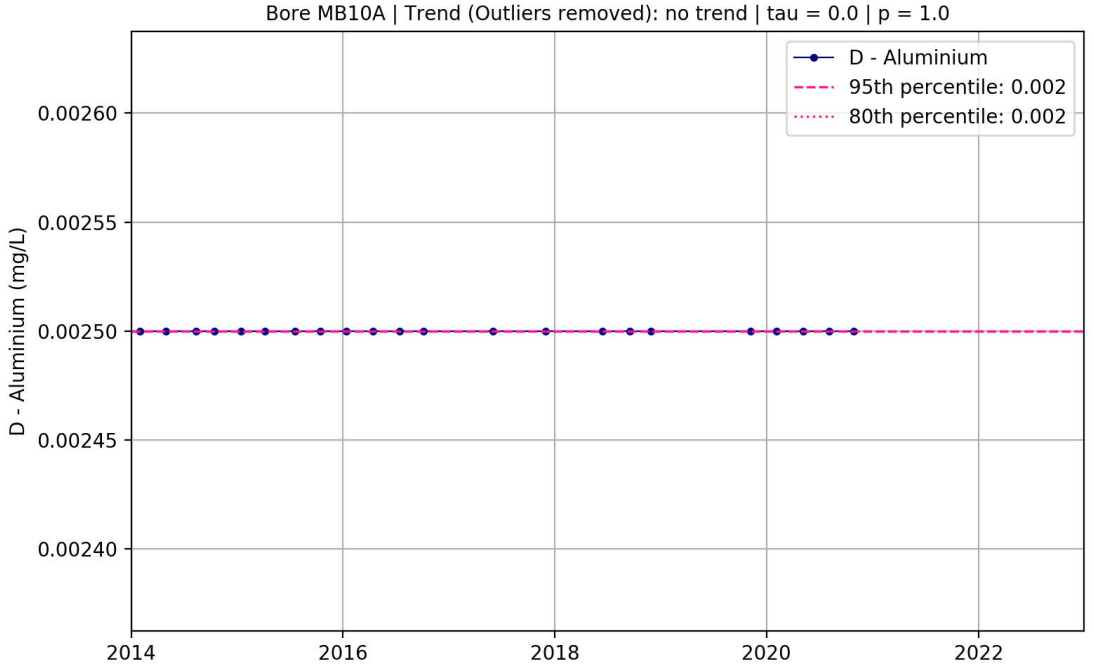

Bore MB10A | Trend: no trend | tau = 0.015 | p = 0.848
C10 - C40 Fraction
Statistical Outlier
Outlier removed
C10 - C40 Fraction (µg/L)
50
60
70
80
90
100
110
120
130
2014
2016
2018
2020
2022

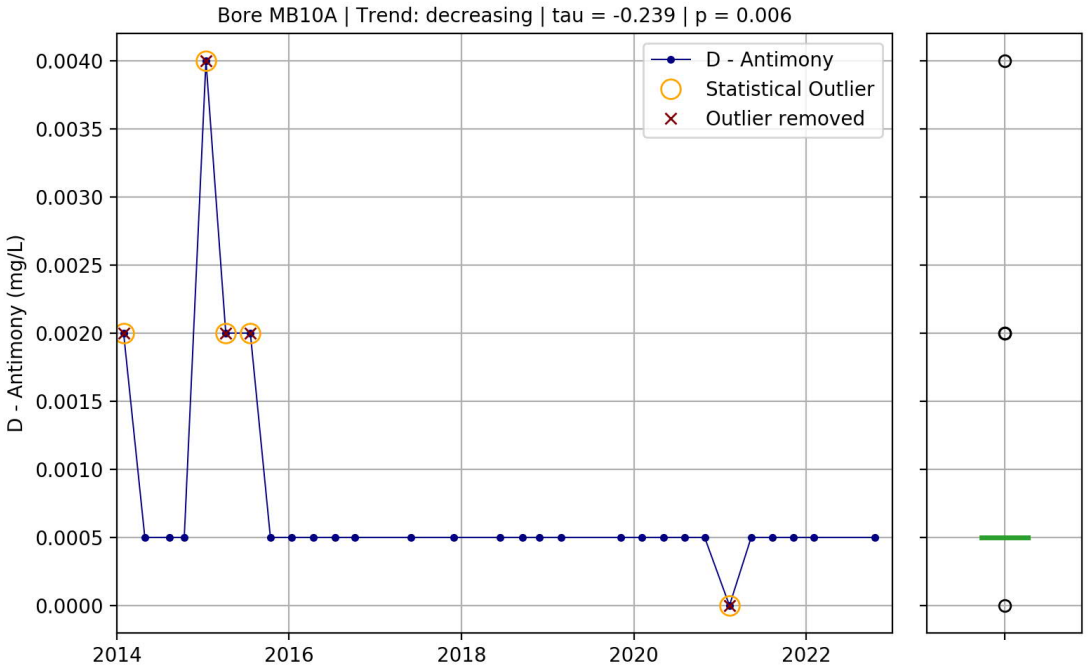

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
95th percentile: 50.0
80th percentile: 50.0
C10 - C40 Fraction (µg/L)
48
49
50
51
52
2014
2016
2018
2020
2022

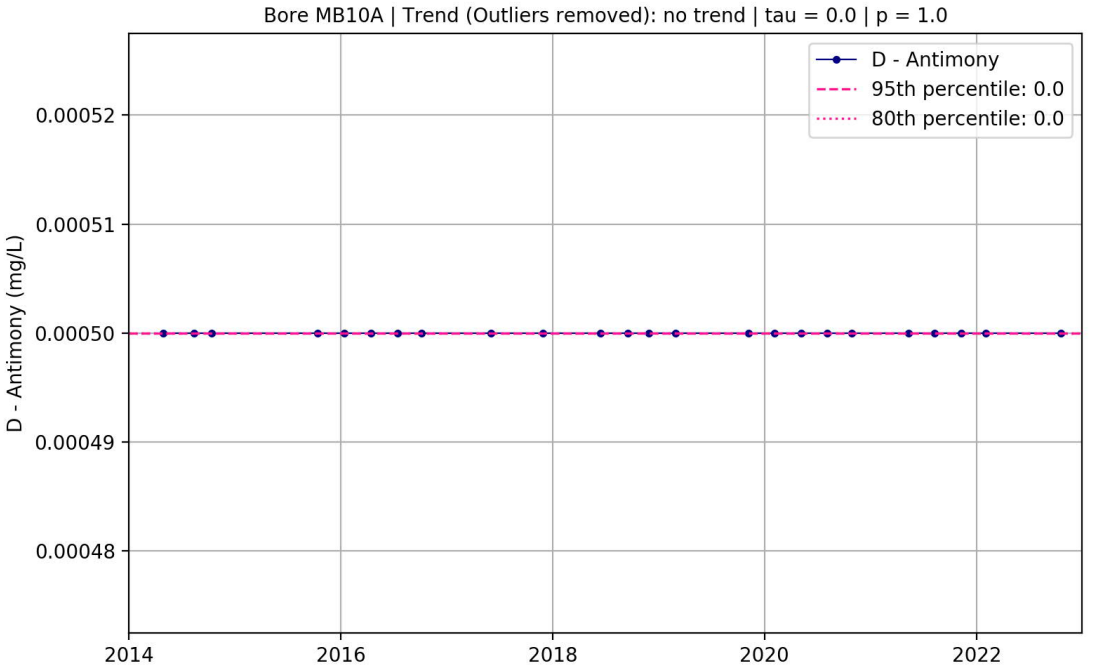

Bore MB10A | Trend: no trend | tau = 0.245 | p = 0.076
Chloride (mg/L)
Chloride
Statistical Outlier
Outlier removed

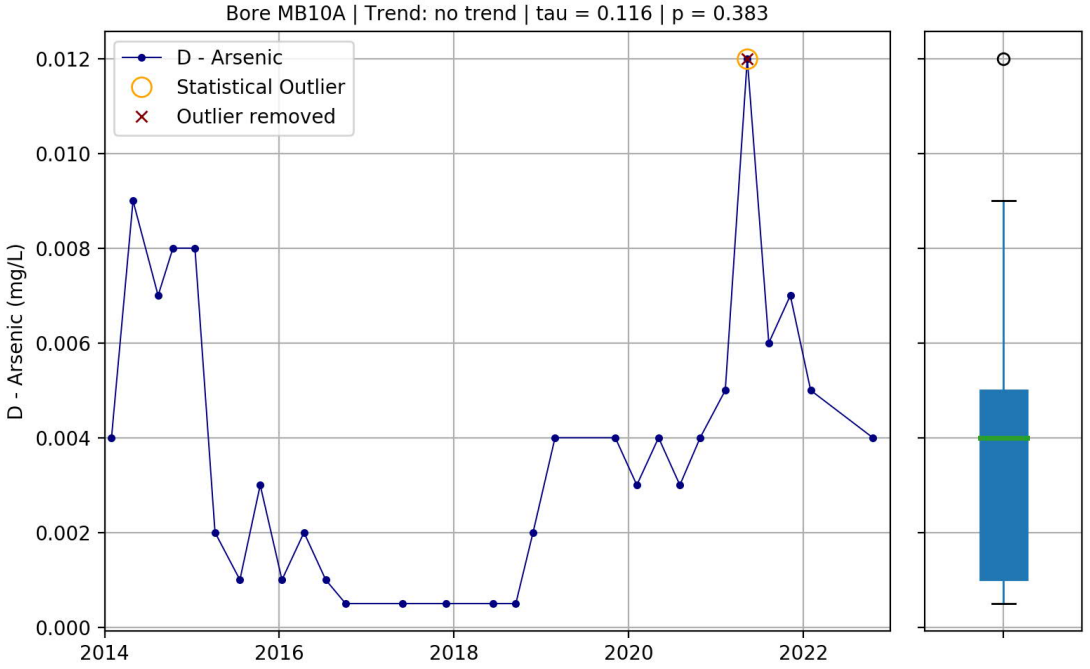

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.245 | p = 0.076
Chloride (mg/L)
Chloride
95th percentile: 789.1
80th percentile: 763.8

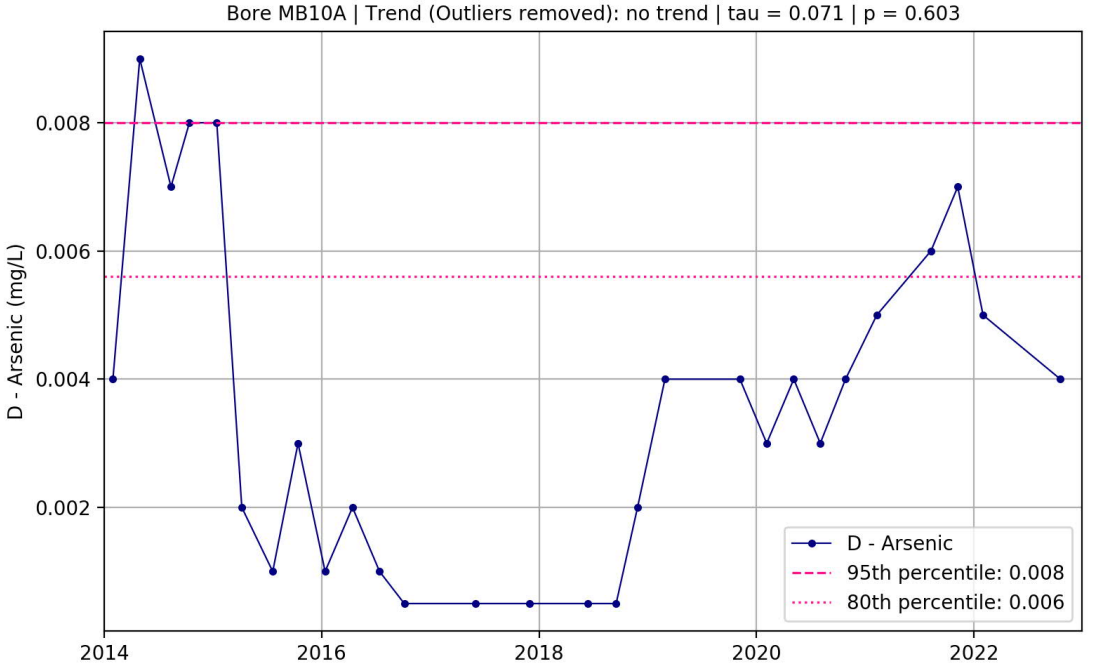

Bore MB10A | Trend: increasing | tau = 0.357 | p = 0.0
D - Aluminium (mg/L)
D - Aluminium
Statistical Outlier
Outlier removed


Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Aluminium (mg/L)
D - Aluminium
95th percentile: 0.002
80th percentile: 0.002

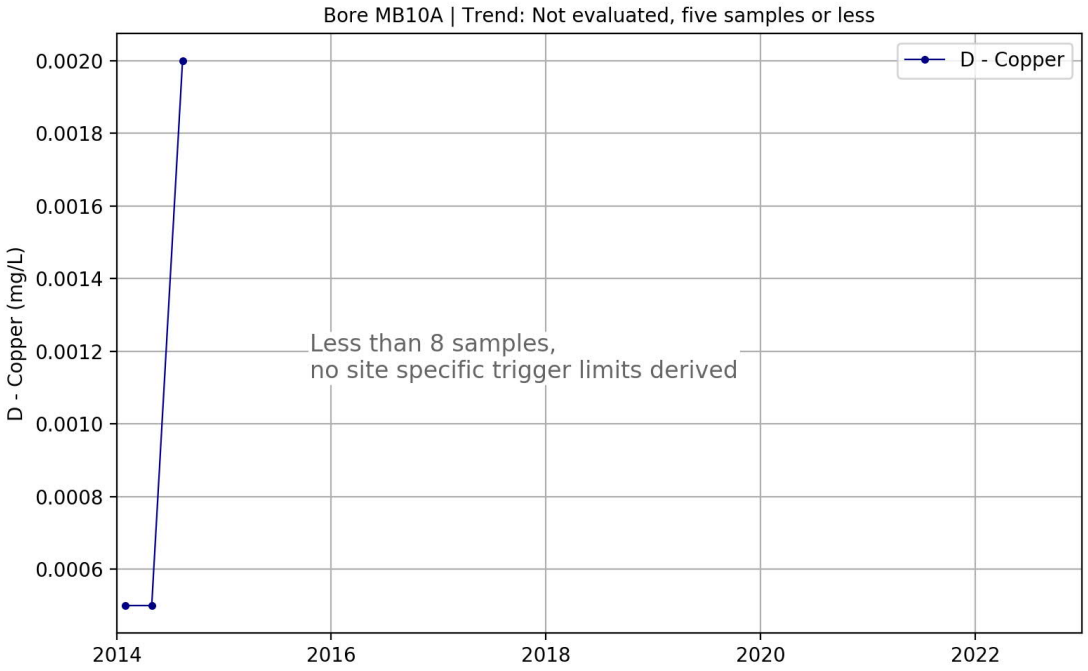

Bore MB10A | Trend: decreasing | tau = -0.239 | p = 0.006
D - Antimony
Statistical Outlier
Outlier removed
D - Antimony (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
2014
2016
2018
2020
2022

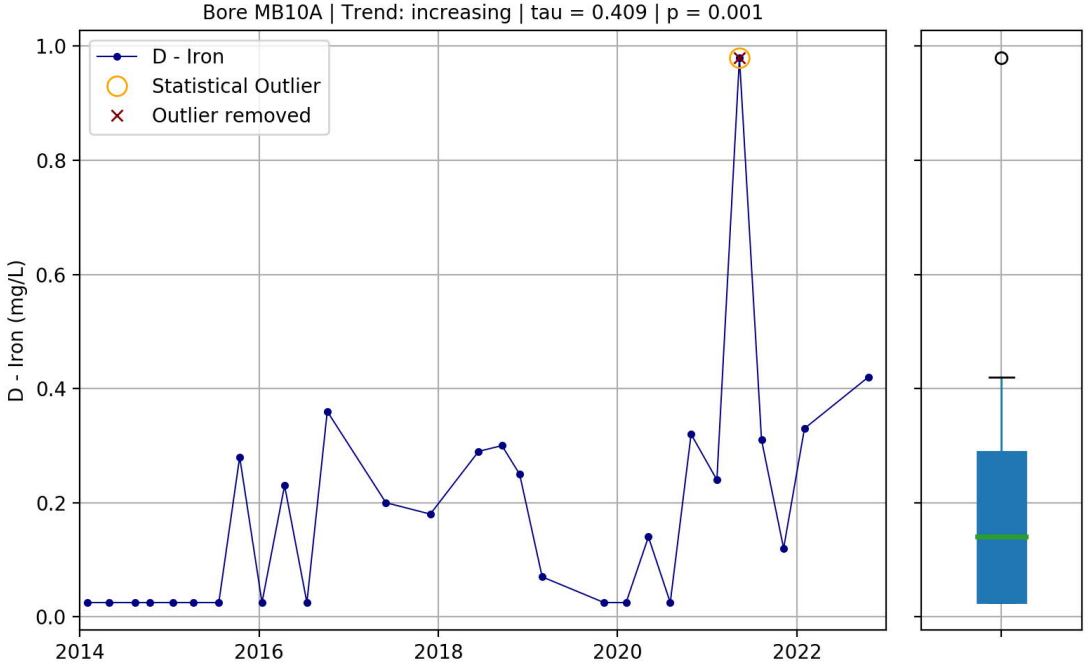

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Antimony
95th percentile: 0.0
80th percentile: 0.0
D - Antimony (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

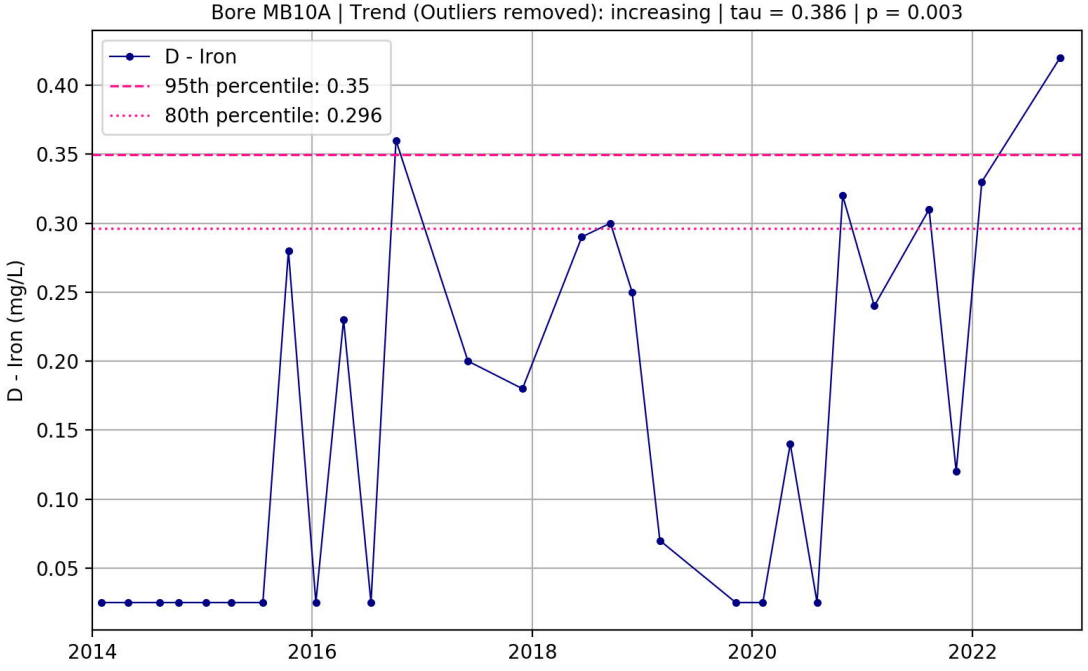

Bore MB10A | Trend: no trend | tau = 0.116 | p = 0.383
D - Arsenic
Statistical Outlier
Outlier removed
D - Arsenic (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
2014
2016
2018
2020
2022

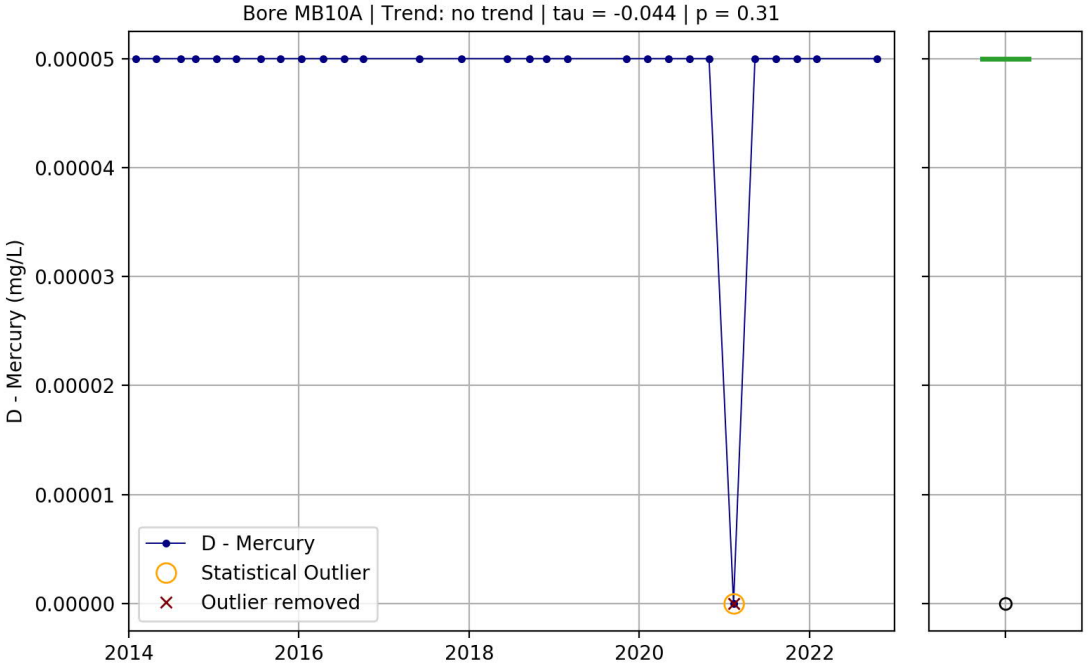

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.071 | p = 0.603
D - Arsenic
95th percentile: 0.008
80th percentile: 0.006
D - Arsenic (mg/L)
0.008
0.006
0.004
0.002
2014
2016
2018
2020
2022

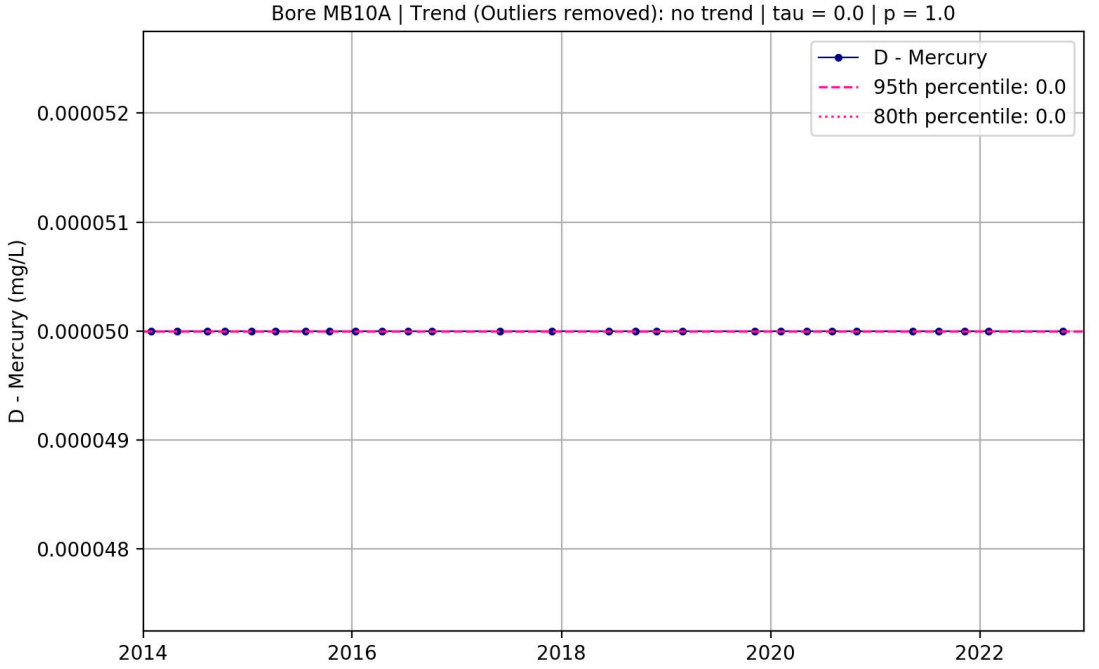

Bore MB10A | Trend: Not evaluated
D - Copper
Statistical Outlier
Outlier removed
D - Copper (mg/L)
0.0020
0.0018
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
2014
2016
2018
2020
2022

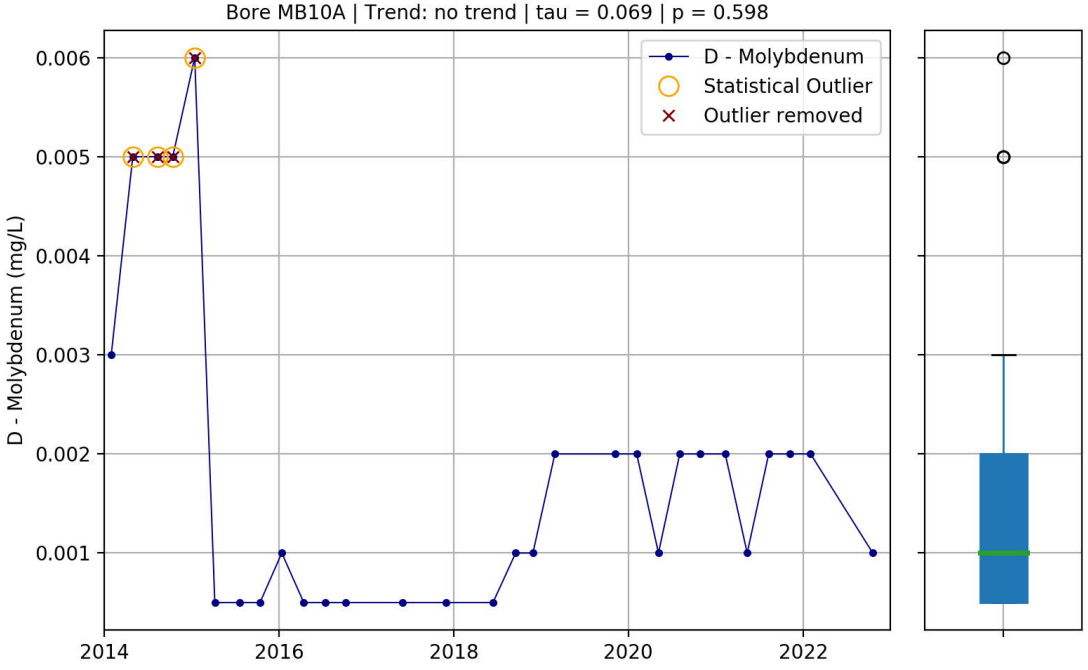

Bore MB10A | Trend: Not evaluated, five samples or less
D - Copper
D - Copper (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.0020
0.0018
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
2014
2016
2018
2020
2022

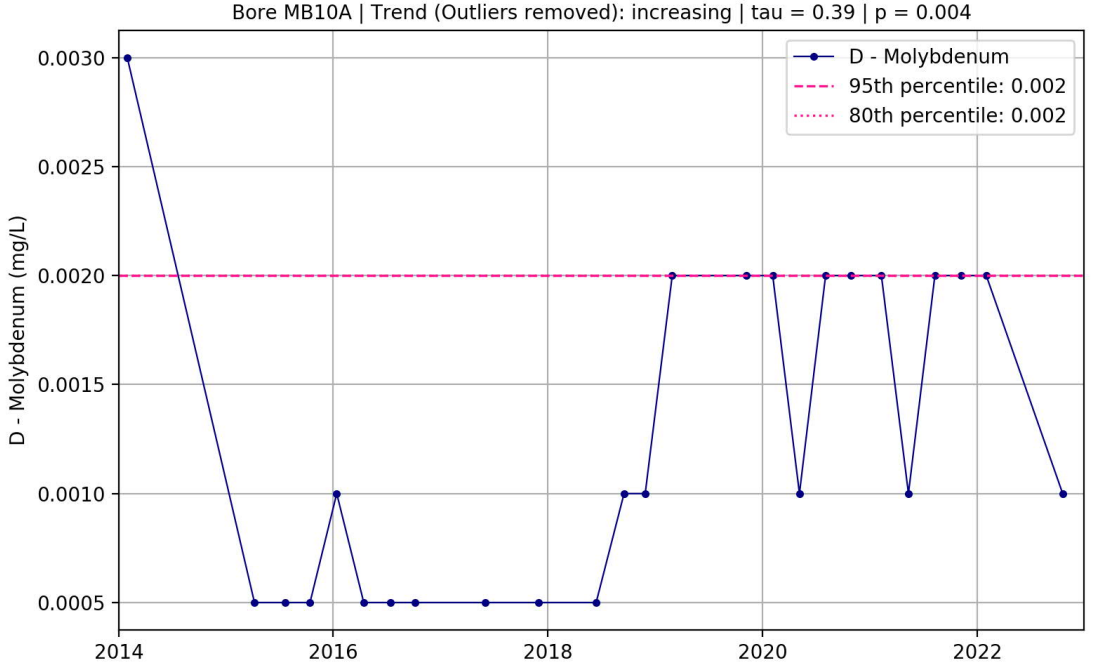

Bore MB10A | Trend: increasing | tau = 0.409 | p = 0.001
D - Iron
Statistical Outlier
Outlier removed
D - Iron (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
2014
2016
2018
2020
2022

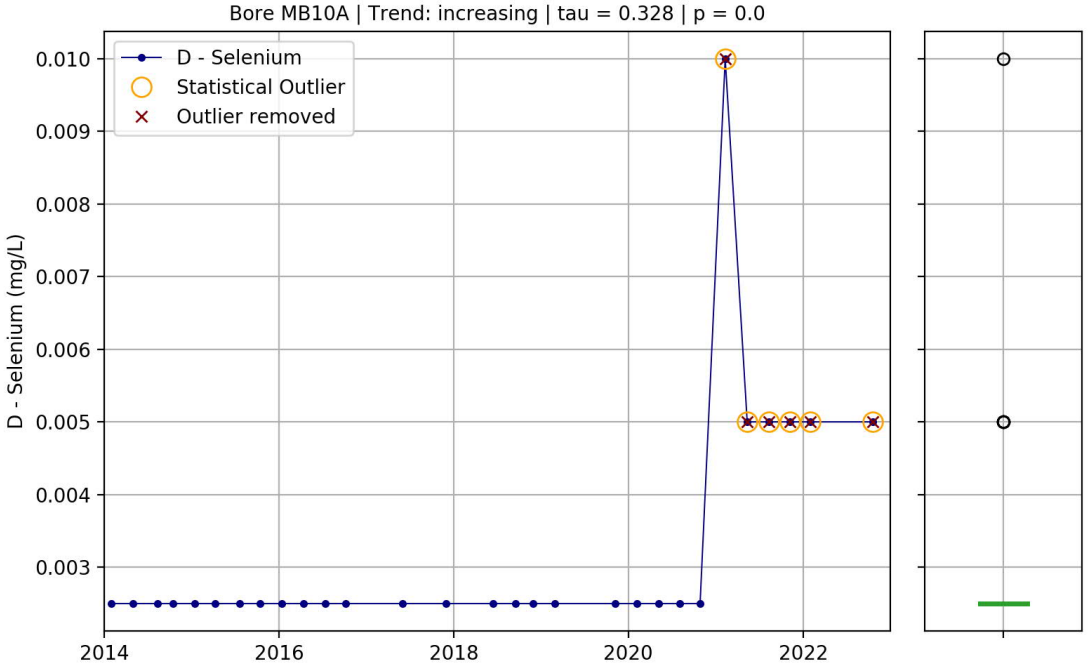

Bore MB10A | Trend (Outliers removed): increasing | tau = 0.386 | p = 0.003
D - Iron
95th percentile: 0.35
80th percentile: 0.296
D - Iron (mg/L)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
2014
2016
2018
2020
2022

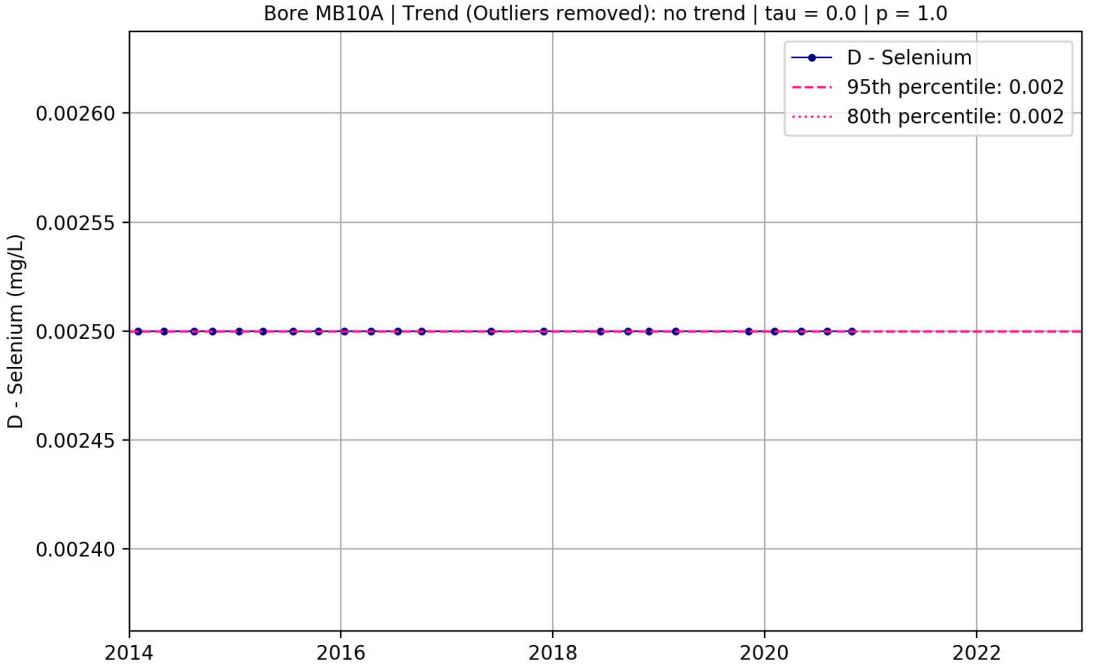

Bore MB10A | Trend: no trend | tau = -0.044 | p = 0.31
D - Mercury (mg/L)
0.00005
0.00004
0.00003
0.00002
0.00001
0.00000
2014
2016
2018
2020
2022
D - Mercury
Statistical Outlier
Outlier removed

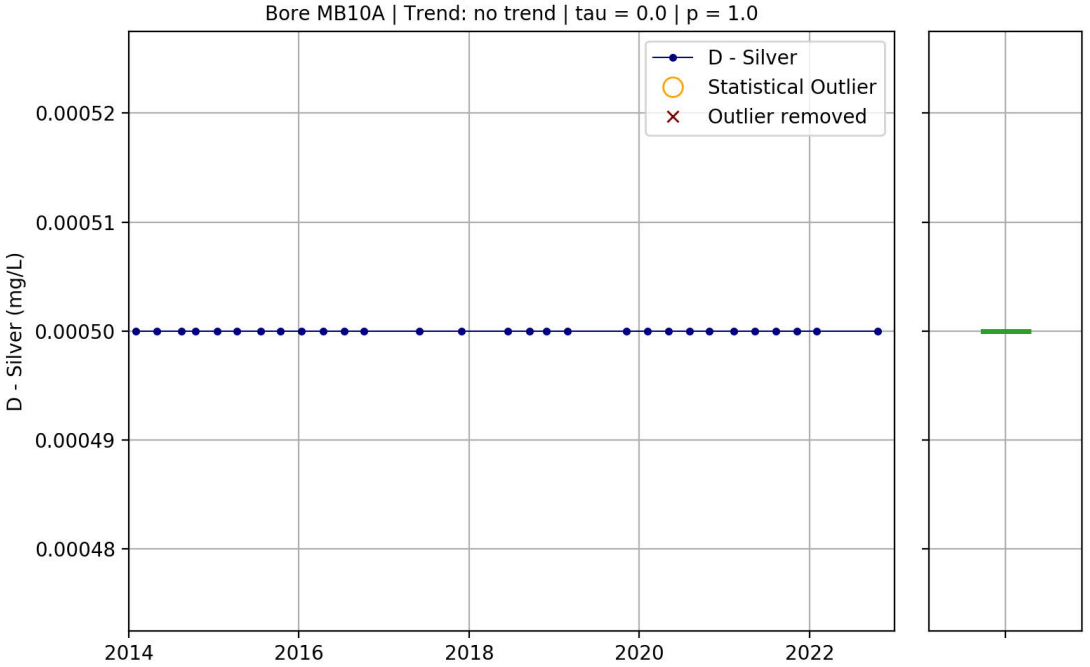

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022
D - Mercury
95th percentile: 0.0
80th percentile: 0.0

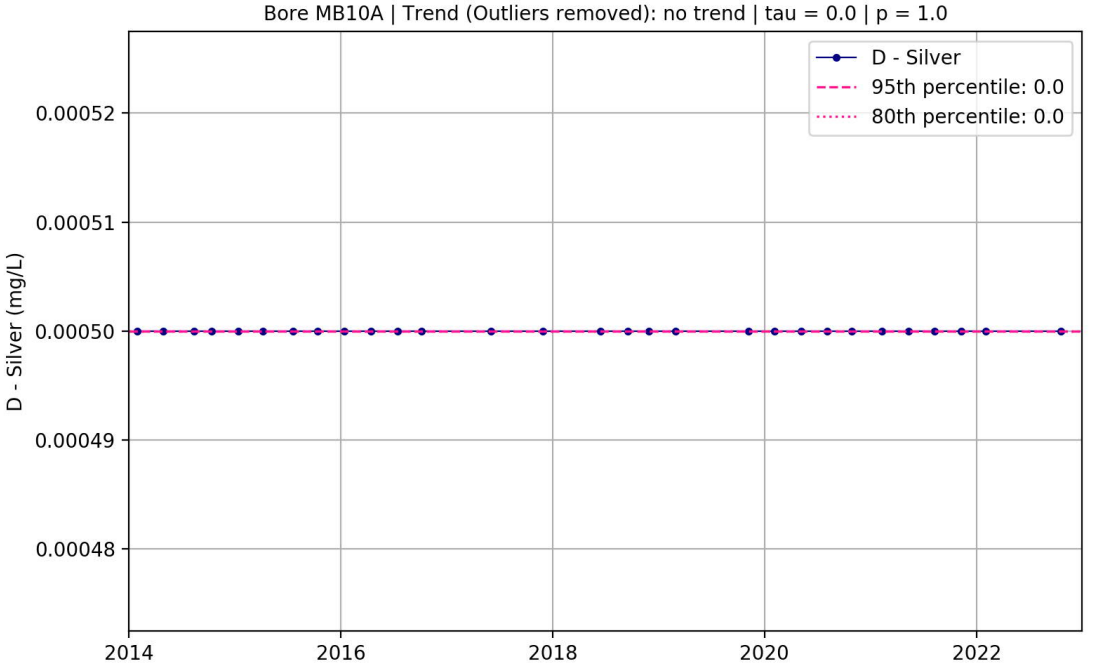

Bore MB10A | Trend: no trend | tau = 0.069 | p = 0.598
D - Molybdenum (mg/L)
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022
D - Molybdenum
Statistical Outlier
Outlier removed

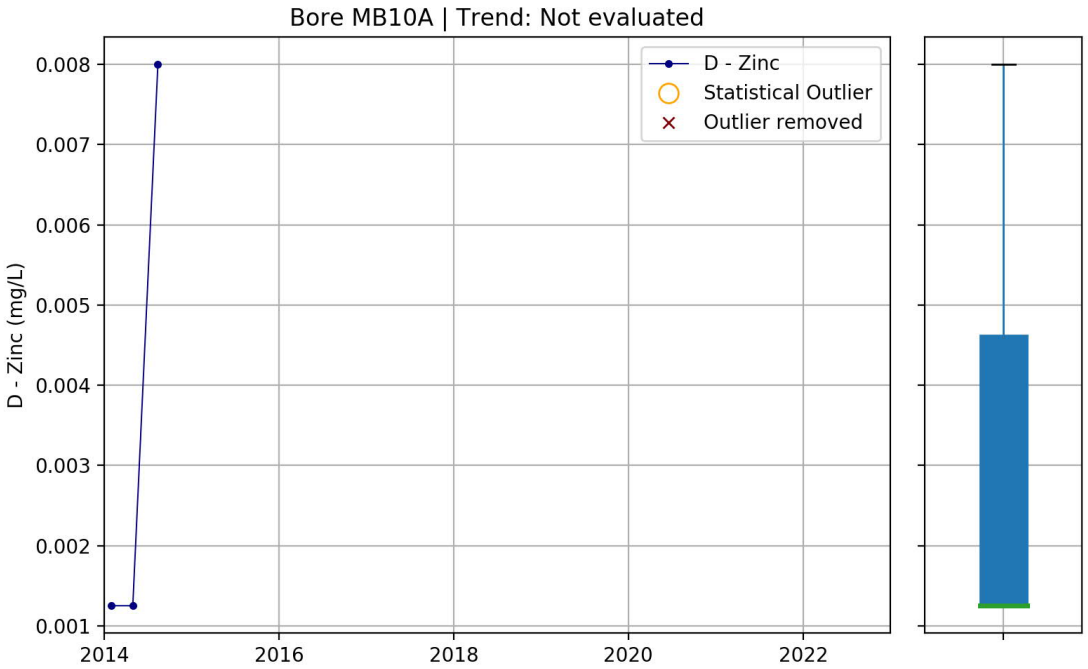

Bore MB10A | Trend (Outliers removed): increasing | tau = 0.39 | p = 0.004
D - Molybdenum (mg/L)
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022
D - Molybdenum
95th percentile: 0.002
80th percentile: 0.002

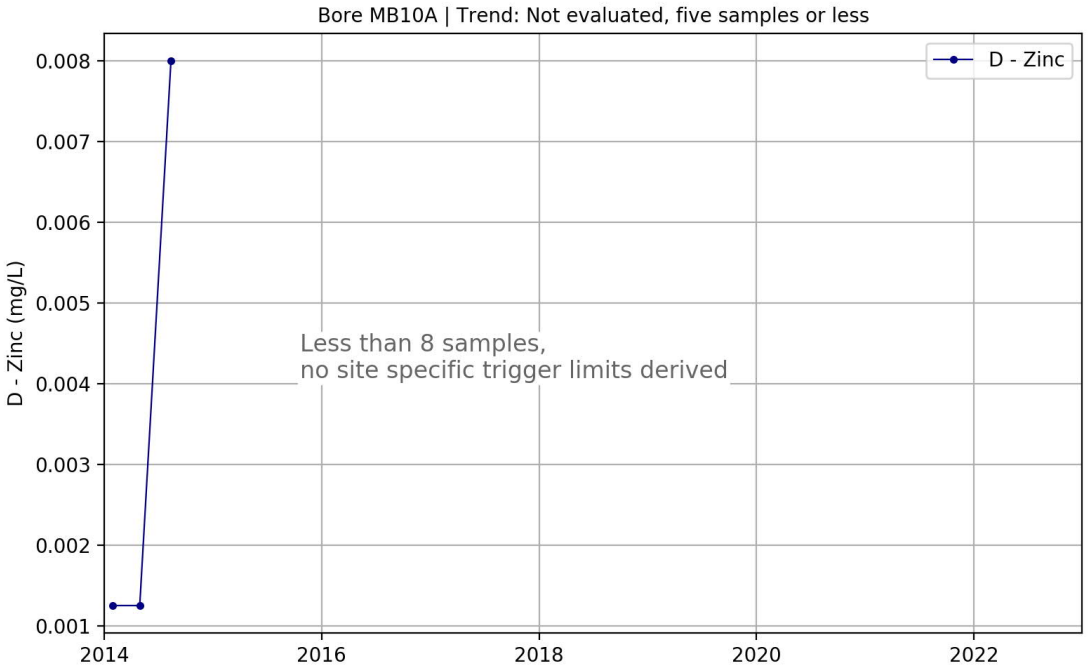

Bore MB10A | Trend: increasing | tau = 0.328 | p = 0.0
D - Selenium
Statistical Outlier
Outlier removed
D - Selenium (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
2014
2016
2018
2020
2022

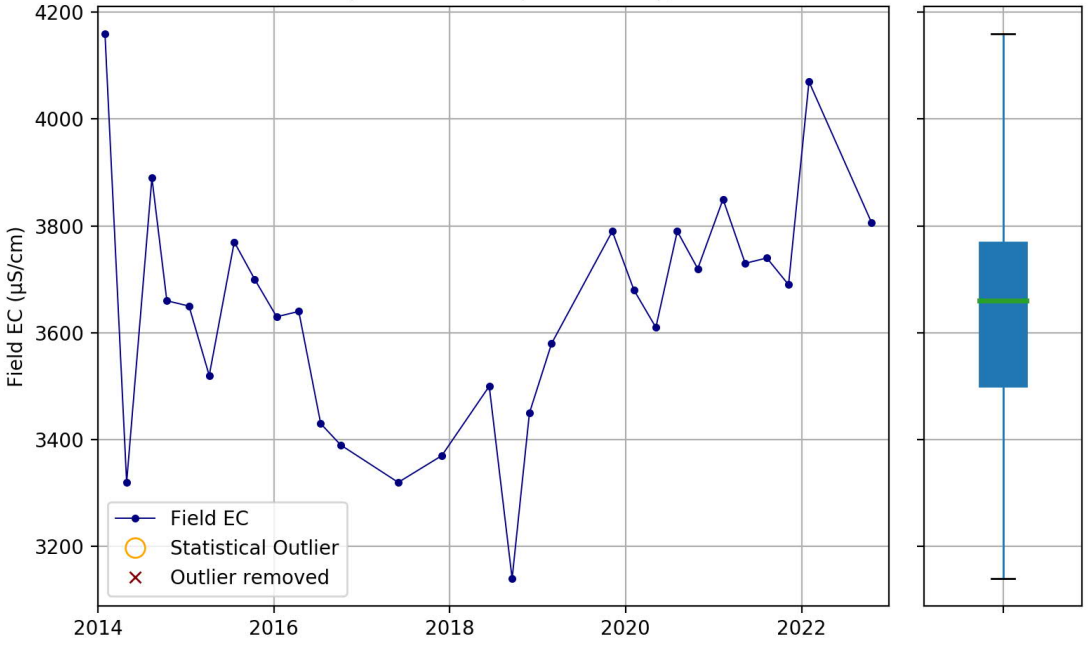

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Selenium
95th percentile: 0.002
80th percentile: 0.002
D - Selenium (mg/L)
0.00260
0.00255
0.00250
0.00245
0.00240
2014
2016
2018
2020
2022

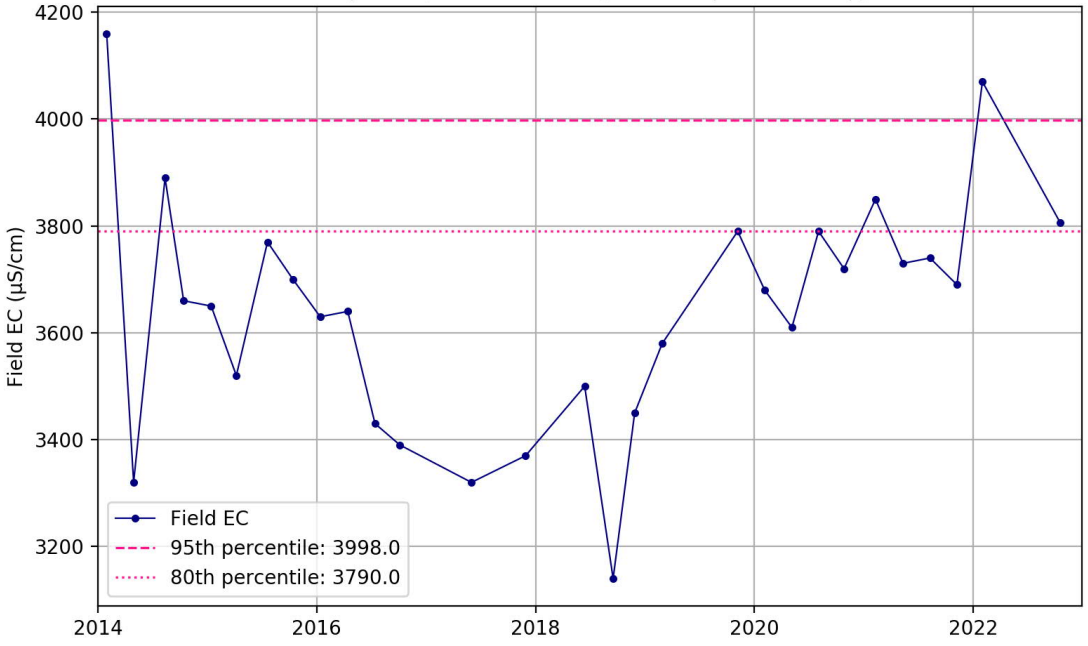

Bore MB10A | Trend: no trend | tau = 0.0 | p = 1.0
D - Silver
Statistical Outlier
Outlier removed
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

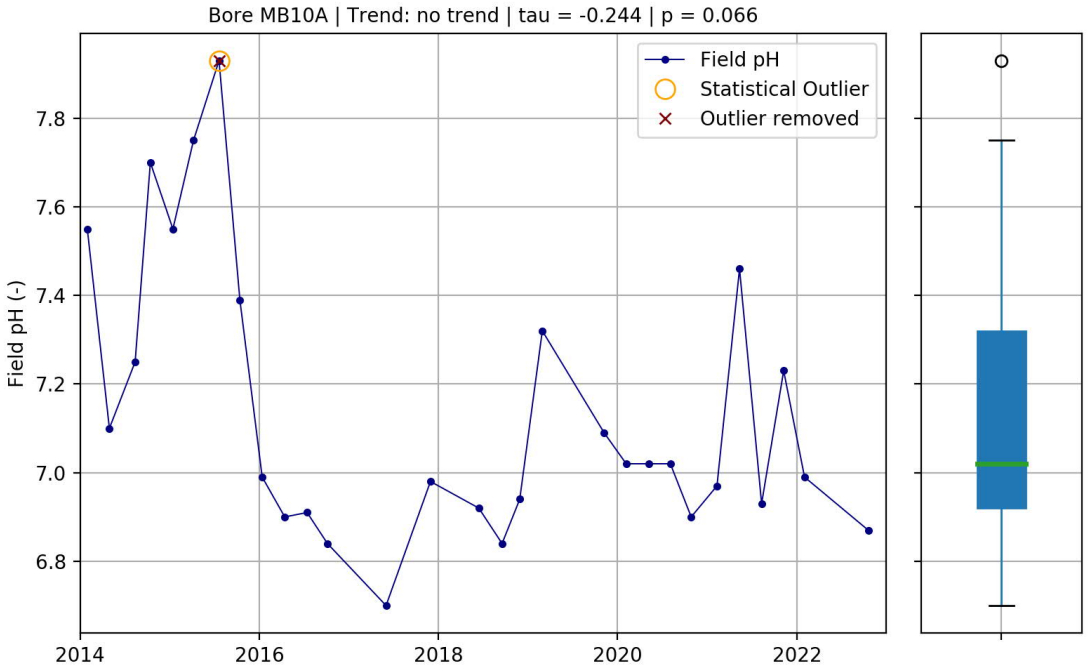

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Silver
95th percentile: 0.0
80th percentile: 0.0
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

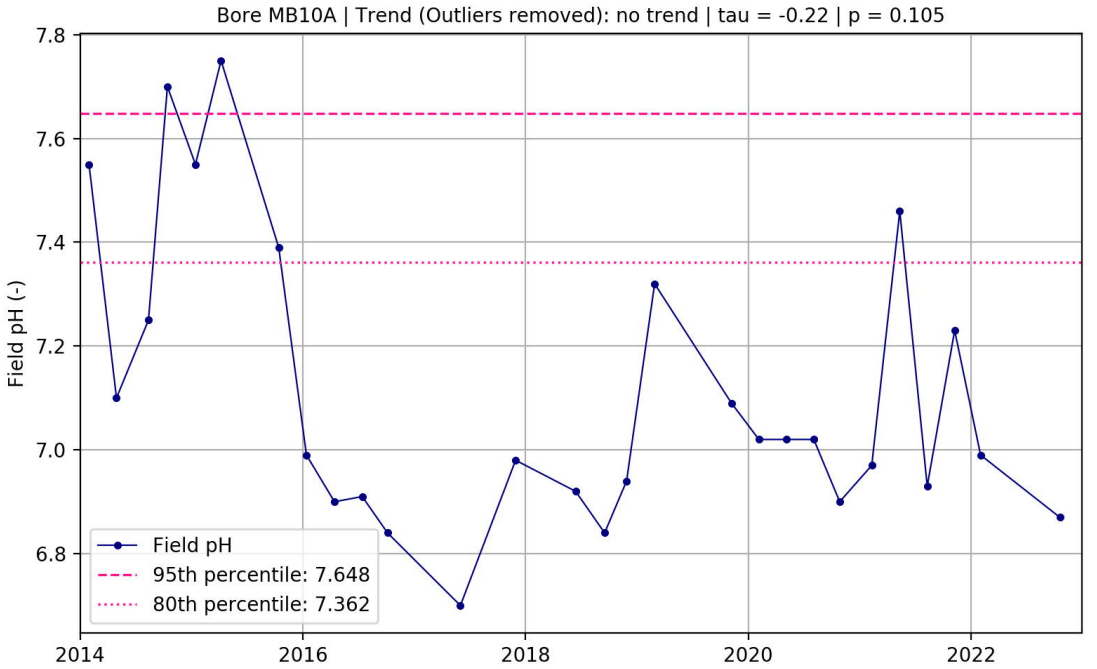

Bore MB10A | Trend: Not evaluated
D - Zinc
Statistical Outlier
Outlier removed
D - Zinc (mg/L)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

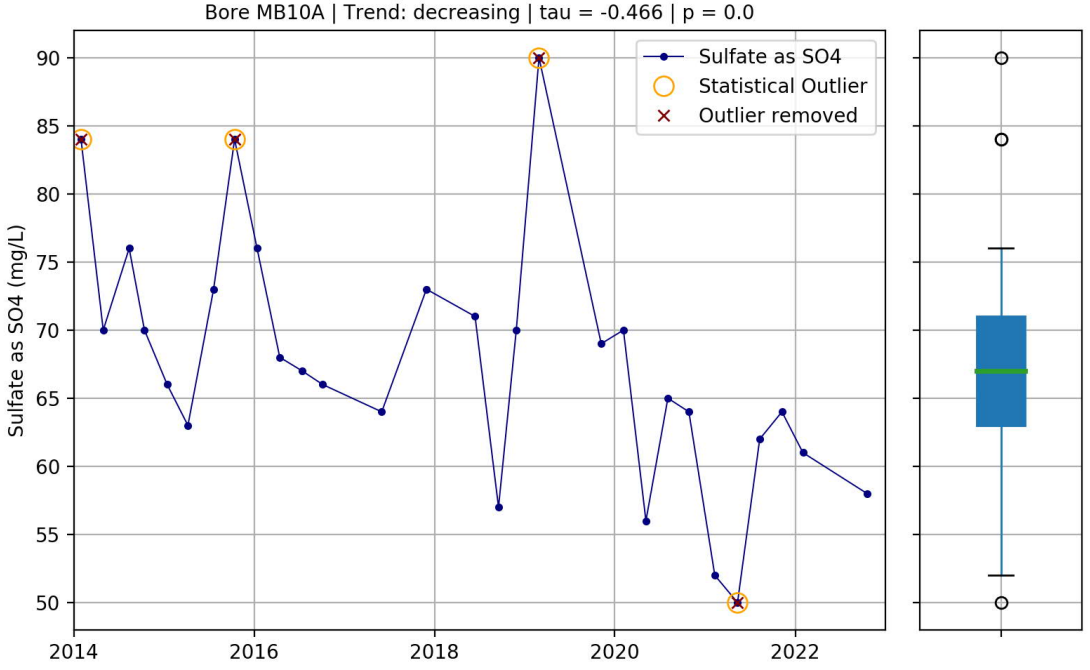

Bore MB10A | Trend: Not evaluated, five samples or less
D - Zinc
D - Zinc (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

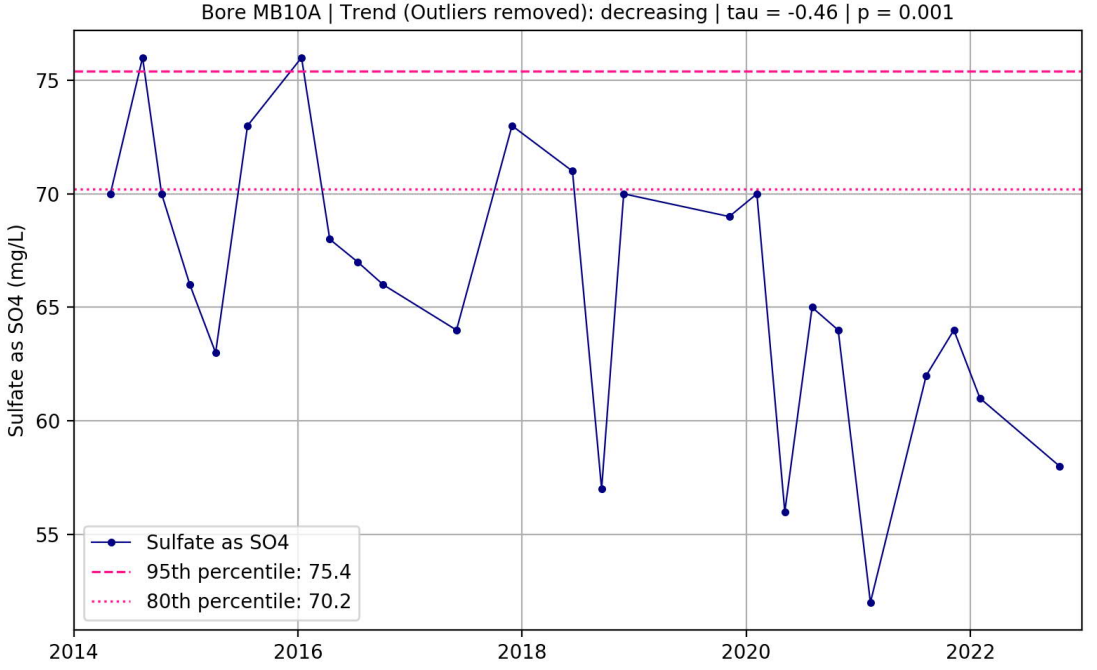

Bore MB10A | Trend: no trend | tau = 0.187 | p = 0.159
Field EC
Statistical Outlier
Outlier removed
Field EC (µS/cm)
4200
4000
3800
3600
3400
3200
2014
2016
2018
2020
2022

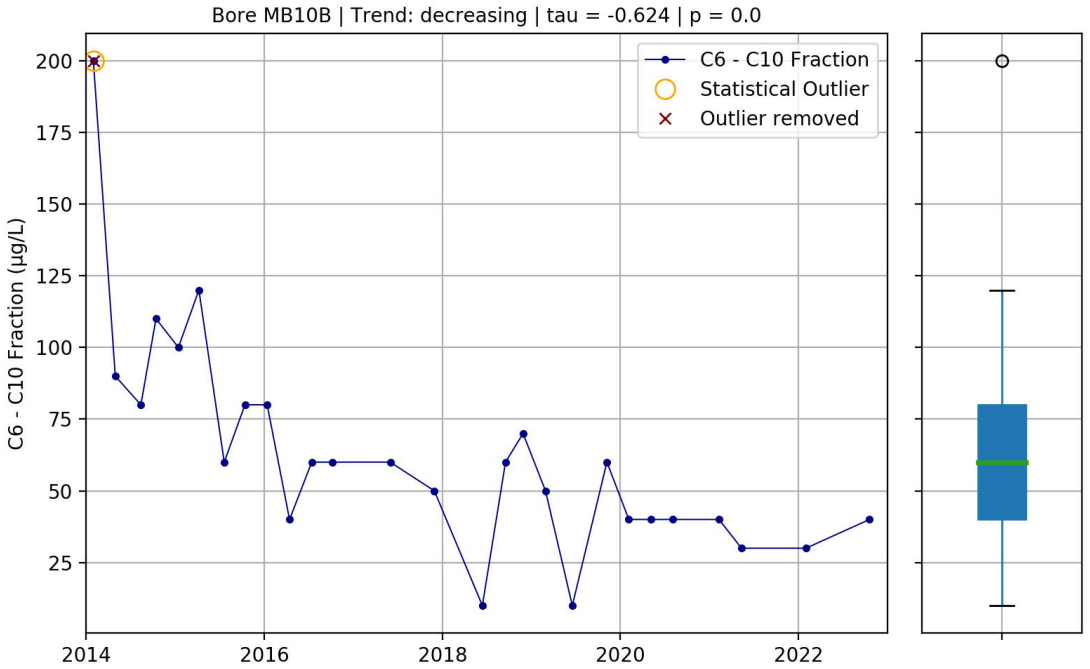

Bore MB10A | Trend (Outliers removed): no trend | tau = 0.187 | p = 0.159
Field EC
95th percentile: 3998.0
80th percentile: 3790.0
Field EC (µS/cm)
4200
4000
3800
3600
3400
3200
2014
2016
2018
2020
2022

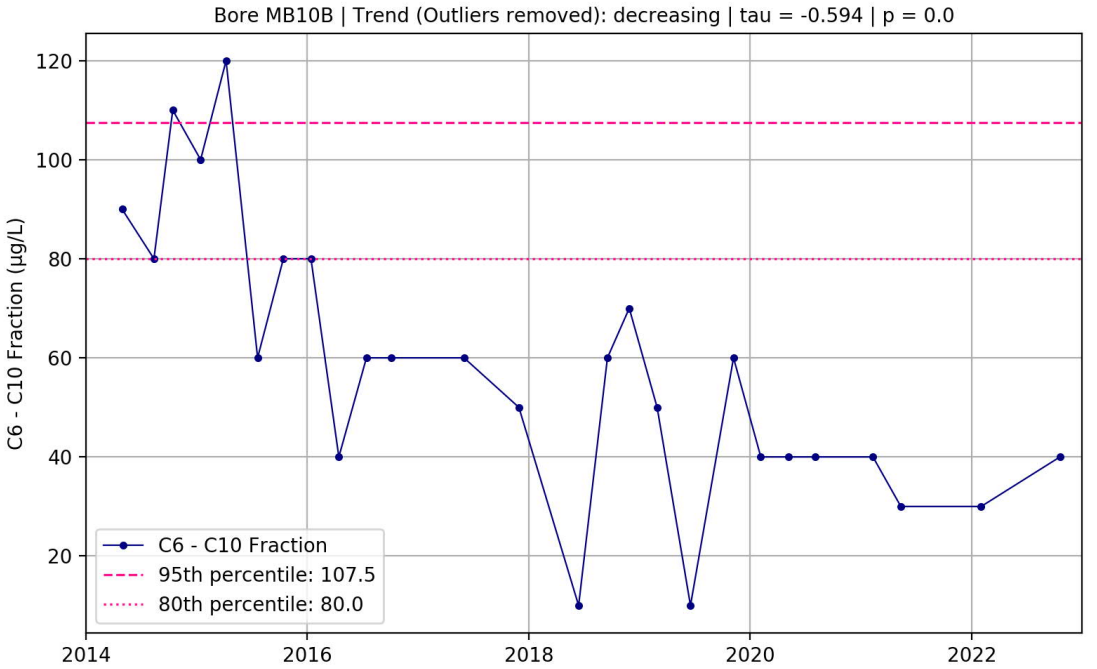

Bore MB10A | Trend: no trend | tau = -0.244 | p = 0.066
Field pH
Statistical Outlier
Outlier removed
Field pH (-)
7.8
7.6
7.4
7.2
7.0
6.8
2014
2016
2018
2020
2022

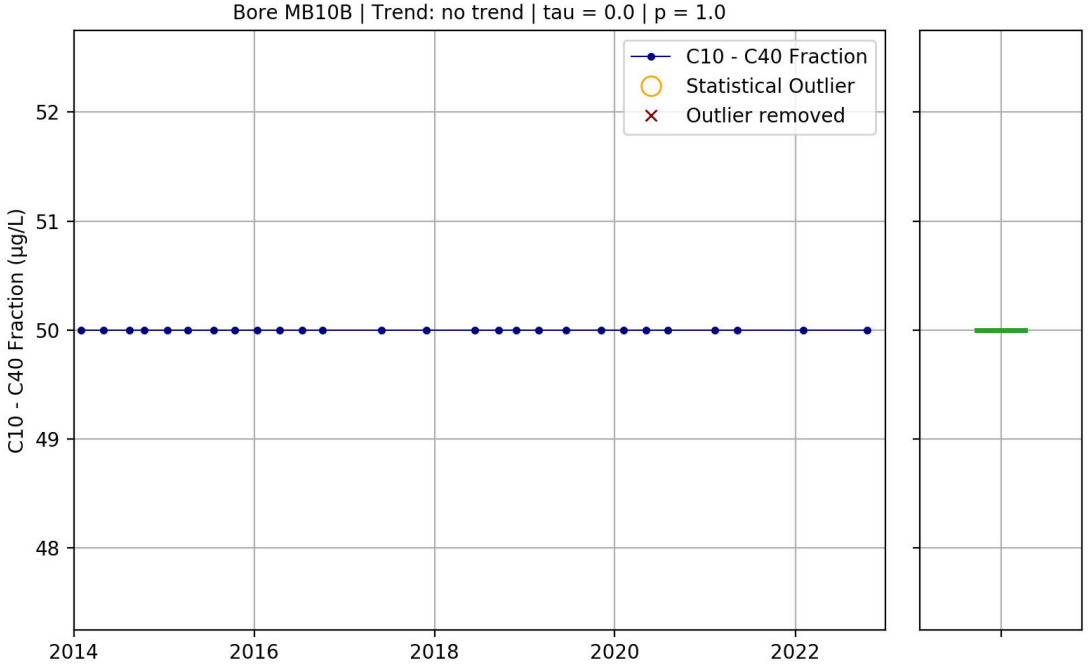

Bore MB10A | Trend (Outliers removed): no trend | tau = -0.22 | p = 0.105
Field pH (-)
7.8
7.6
7.4
7.2
7.0
6.8
Field pH
95th percentile: 7.648
80th percentile: 7.362
2014
2016
2018
2020
2022

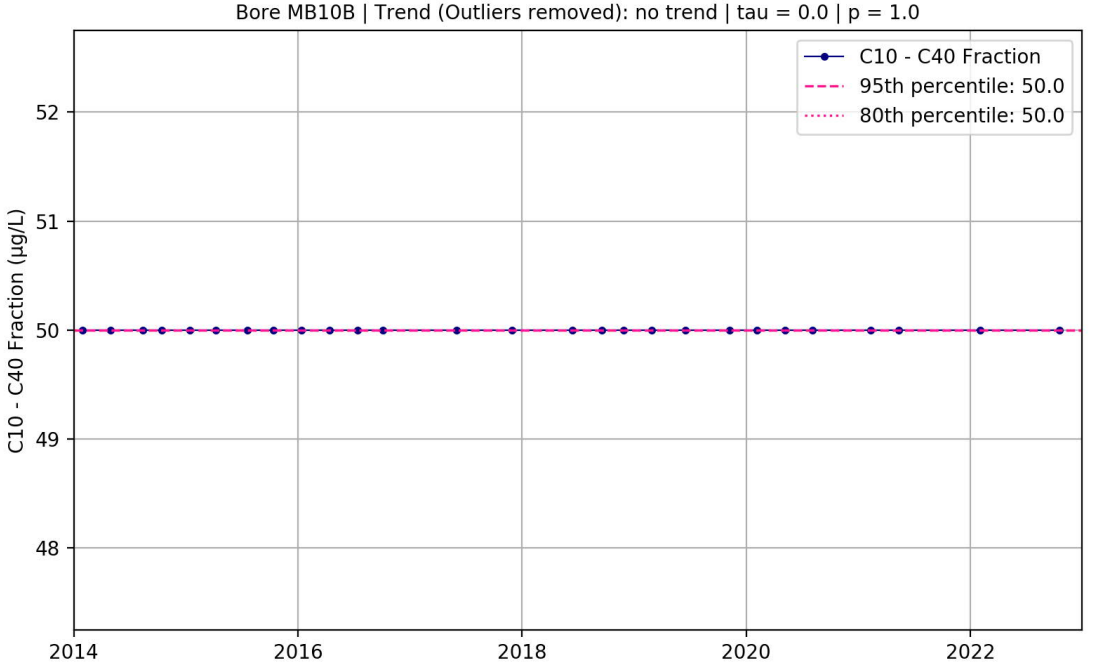

Bore MB10A | Trend: decreasing | tau = -0.466 | p = 0.0
Sulfate as SO4
Statistical Outlier
Outlier removed
Sulfate as SO4 (mg/L)
90
85
80
75
70
65
60
55
50
2014
2016
2018
2020
2022

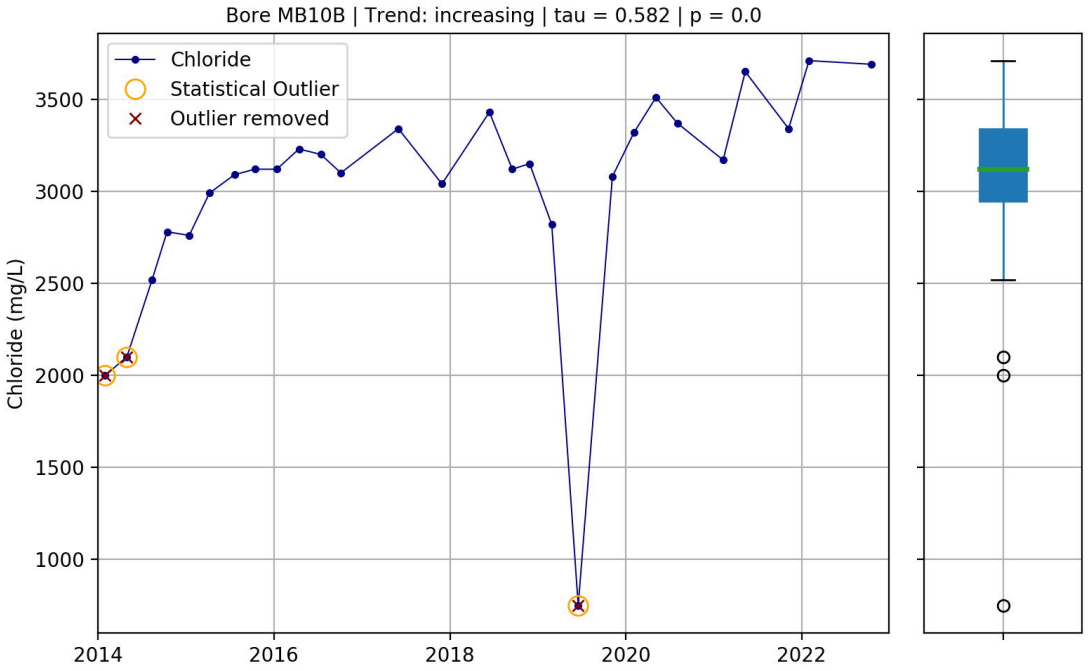

Bore MB10A | Trend (Outliers removed): decreasing | tau = -0.46 | p = 0.001
Sulfate as SO4 (mg/L)
75
70
65
60
55
Sulfate as SO4
95th percentile: 75.4
80th percentile: 70.2
2014
2016
2018
2020
2022

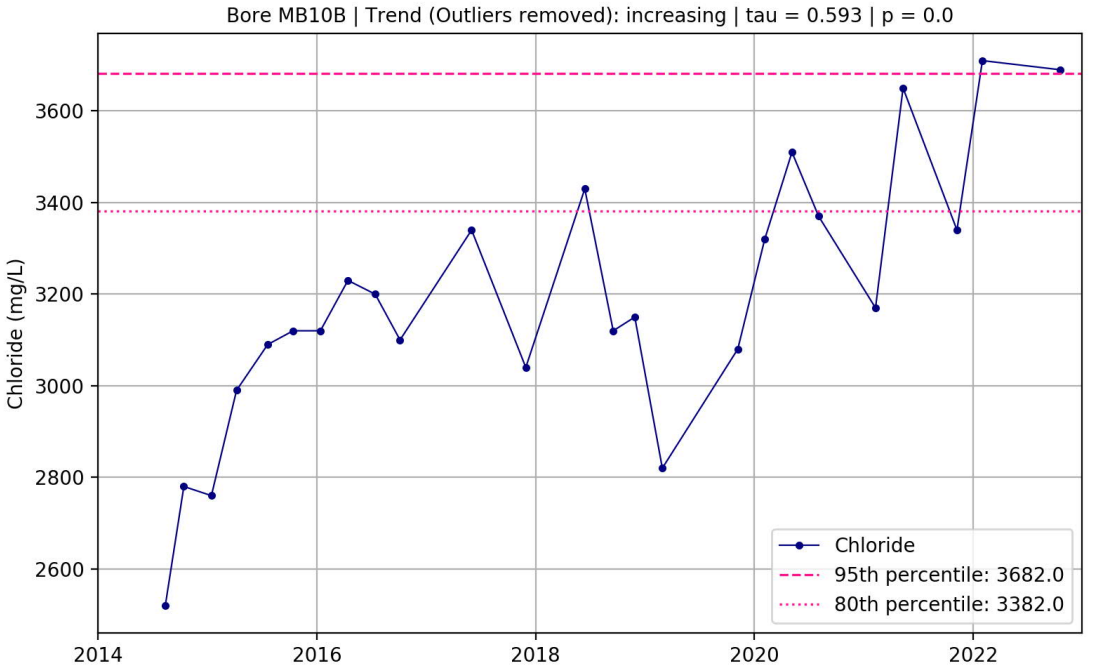

Bore MB10B | Trend: decreasing | tau = -0.624 | p = 0.0
C6 - C10 Fraction
Statistical Outlier
Outlier removed
C6 - C10 Fraction (µg/L)
200
175
150
125
100
75
50
25
2014
2016
2018
2020
2022

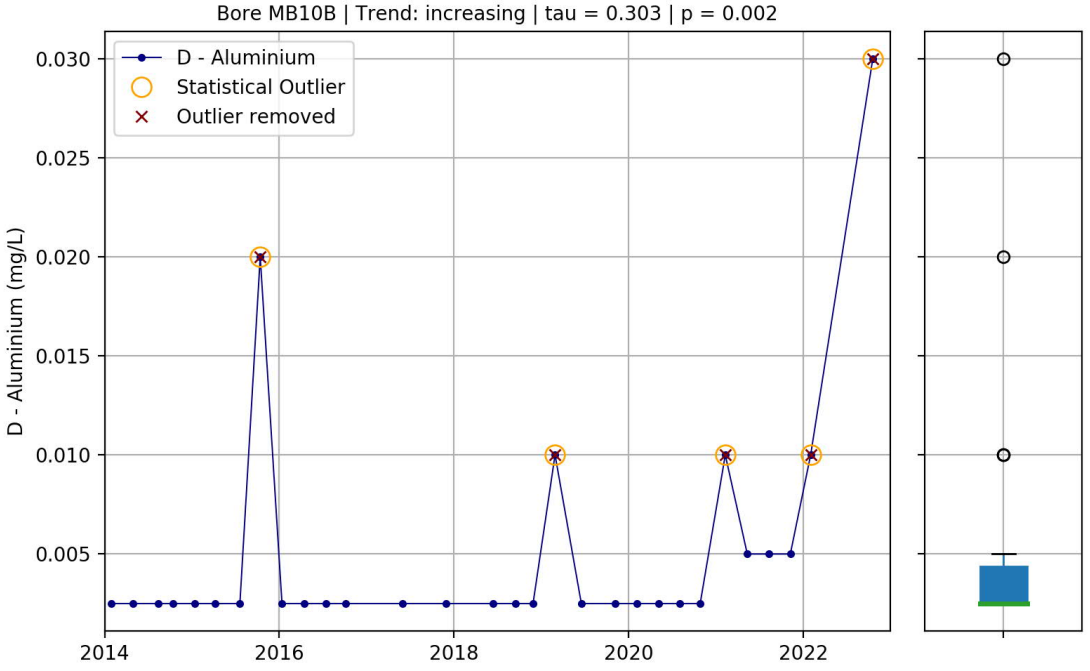

Bore MB10B | Trend (Outliers removed): decreasing | tau = -0.594 | p = 0.0
C6 - C10 Fraction (µg/L)
120
100
80
60
40
20
C6 - C10 Fraction
95th percentile: 107.5
80th percentile: 80.0
2014
2016
2018
2020
2022

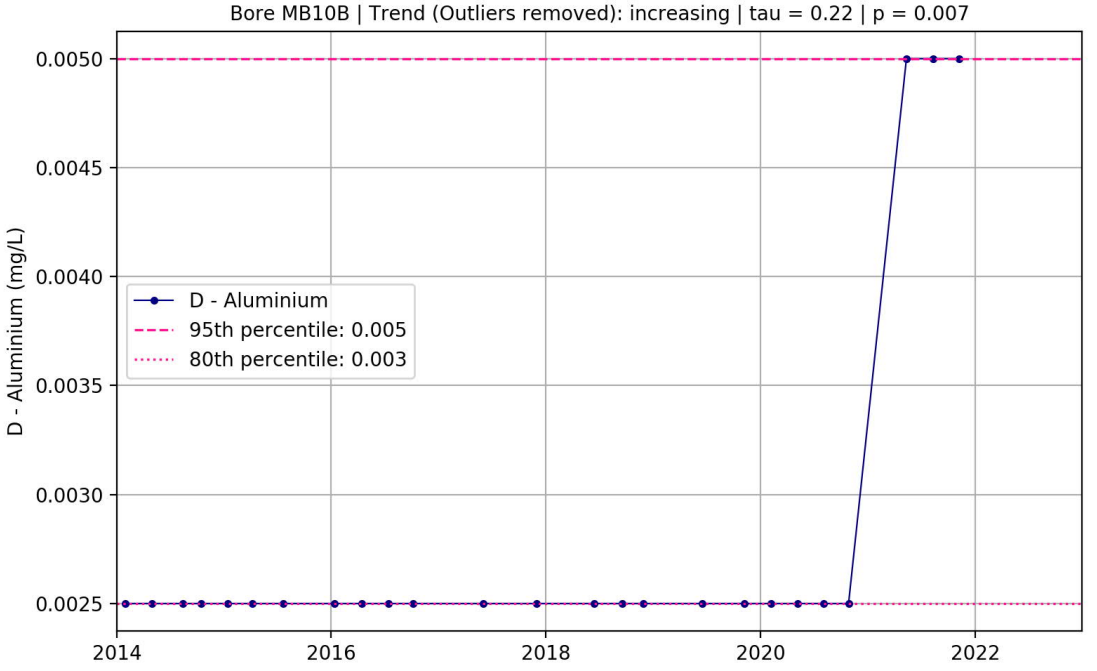

Bore MB10B | Trend: no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
Statistical Outlier
Outlier removed
C10 - C40 Fraction (µg/L)
52
51
50
49
48
2014
2016
2018
2020
2022

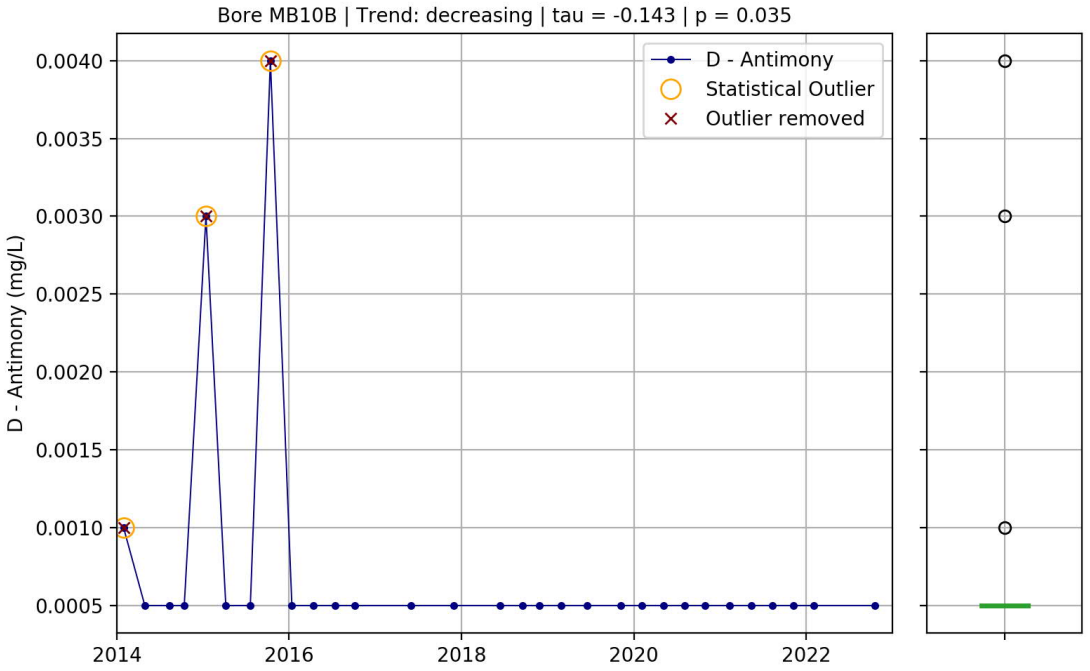

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
C10 - C40 Fraction
95th percentile: 50.0
80th percentile: 50.0
C10 - C40 Fraction (µg/L)
52
51
50
49
48
2014
2016
2018
2020
2022

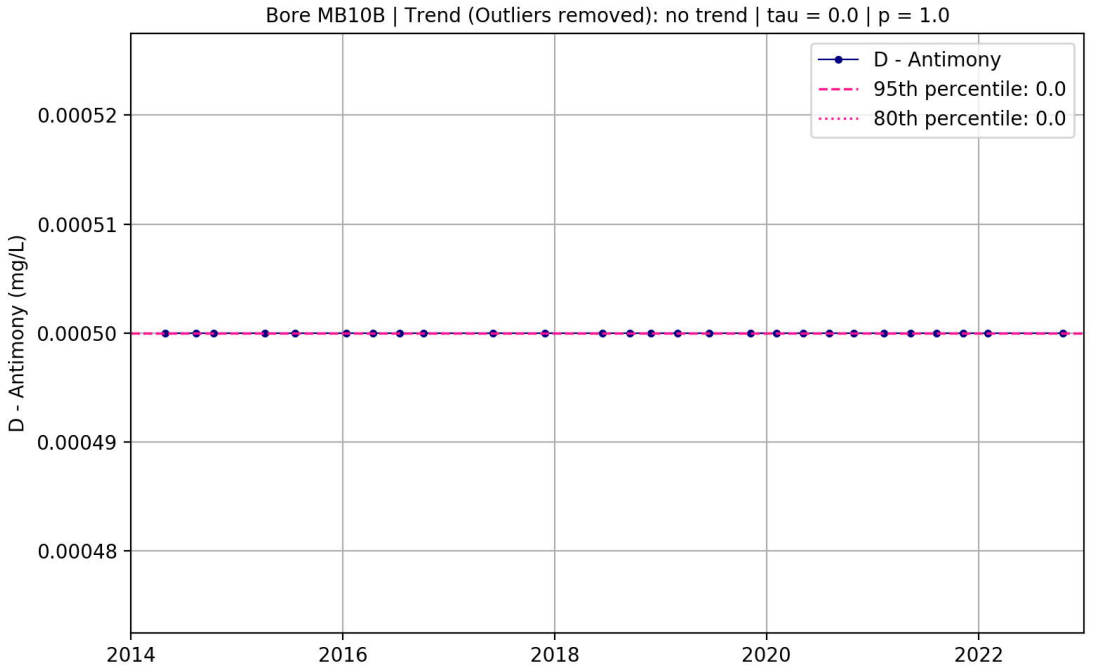

Bore MB10B | Trend: increasing | tau = 0.582 | p = 0.0
Chloride
Statistical Outlier
Outlier removed
Chloride (mg/L)
3500
3000
2500
2000
1500
1000
2014
2016
2018
2020
2022

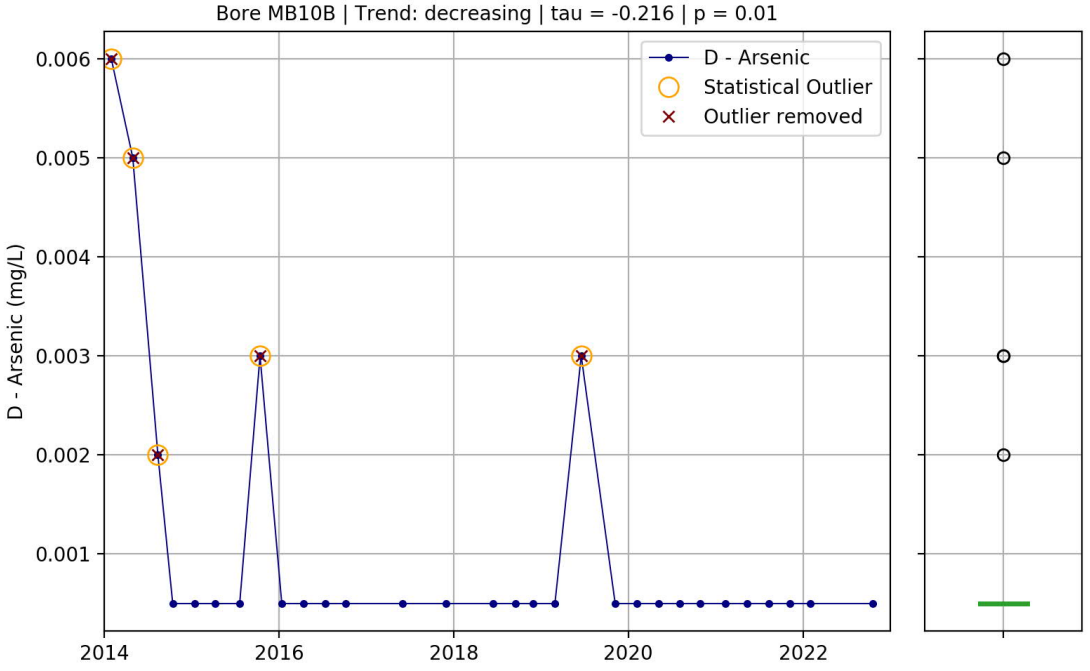

Bore MB10B | Trend (Outliers removed): increasing | tau = 0.593 | p = 0.0
Chloride (mg/L)
3600
3400
3200
3000
2800
2600
Chloride
95th percentile: 3682.0
80th percentile: 3382.0
2014
2016
2018
2020
2022

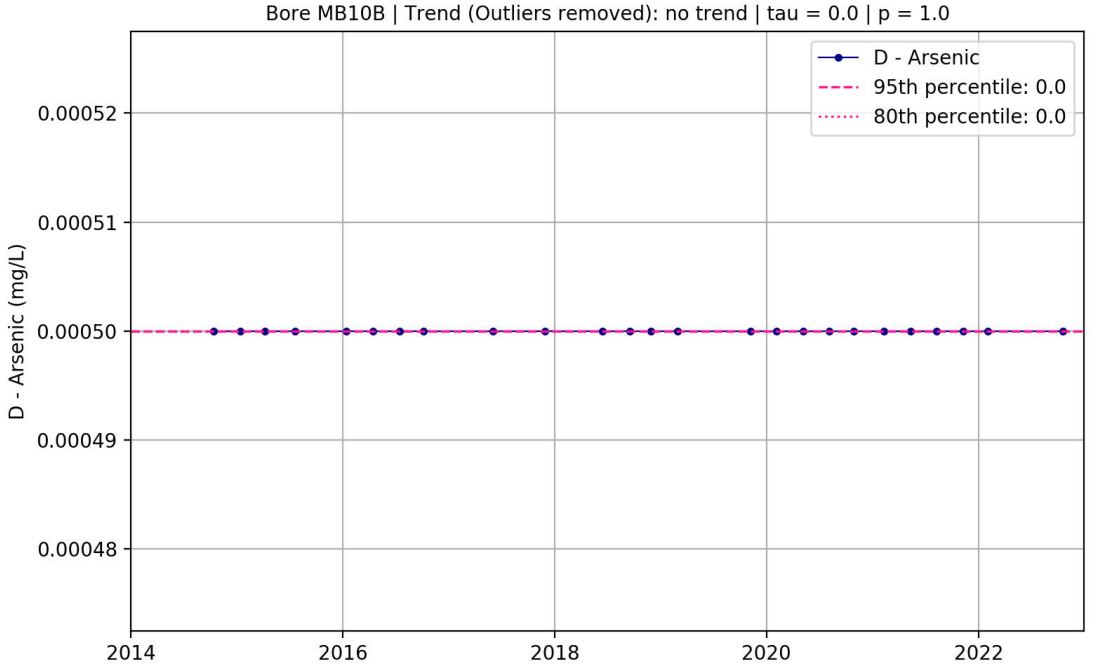

Bore MB10B | Trend: increasing | tau = 0.303 | p = 0.002
D - Aluminium
Statistical Outlier
Outlier removed
D - Aluminium (mg/L)
0.030
0.025
0.020
0.015
0.010
0.005
2014
2016
2018
2020
2022

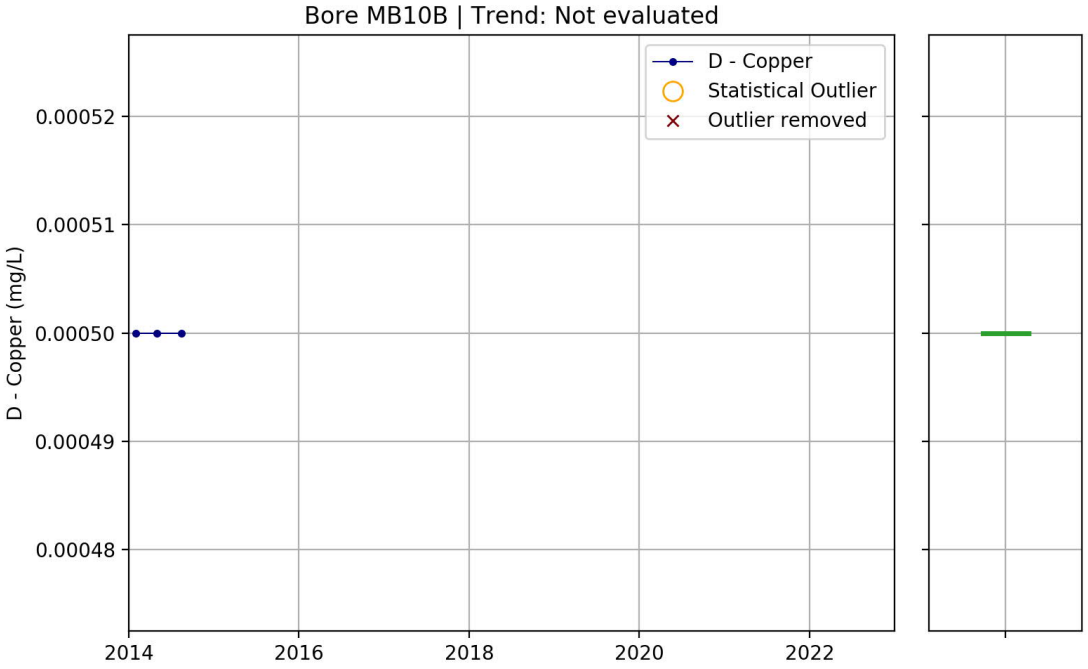

Bore MB10B | Trend (Outliers removed): increasing | tau = 0.22 | p = 0.007
D - Aluminium (mg/L)
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
D - Aluminium
95th percentile: 0.005
80th percentile: 0.003
2014
2016
2018
2020
2022

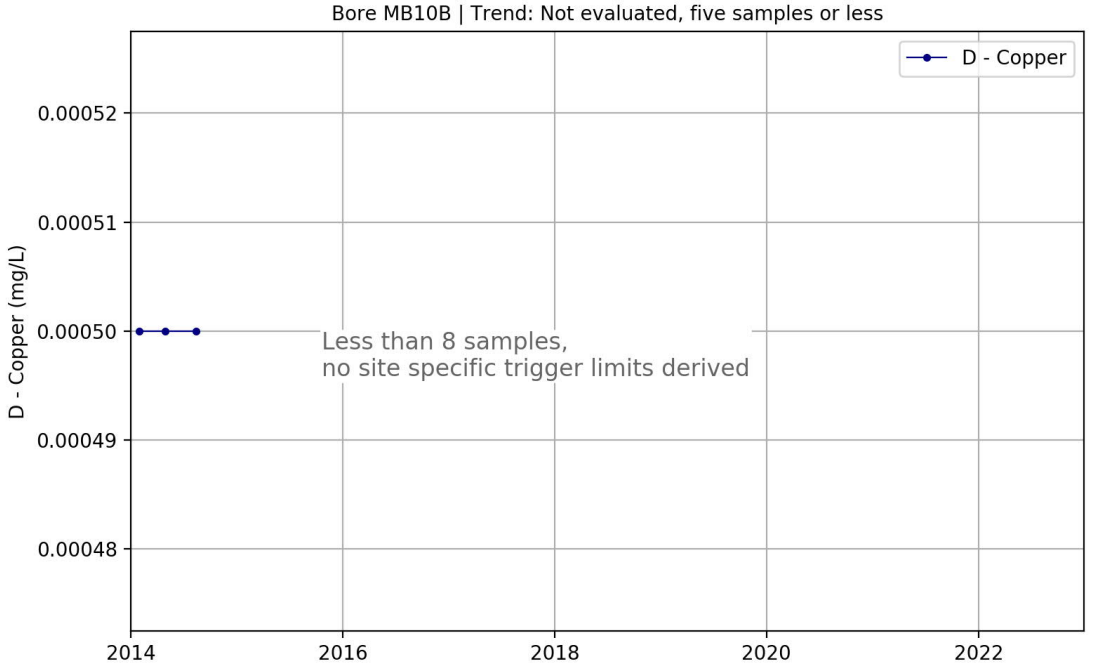

Bore MB10B | Trend: decreasing | tau = -0.143 | p = 0.035
D - Antimony
Statistical Outlier
Outlier removed
D - Antimony (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

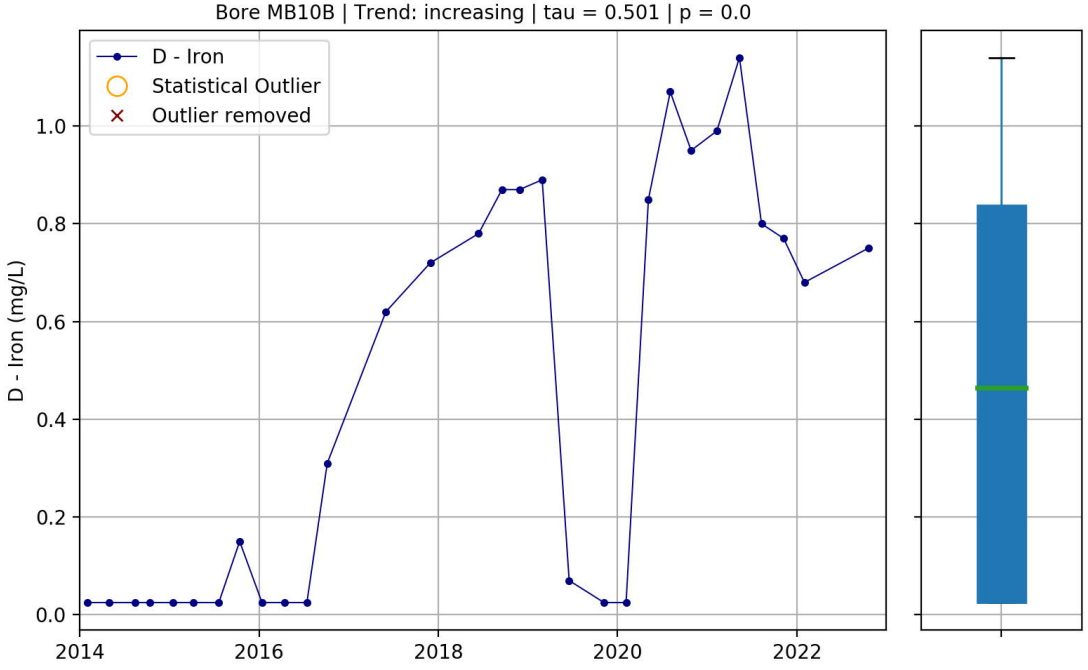

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Antimony
95th percentile: 0.0
80th percentile: 0.0
D - Antimony (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

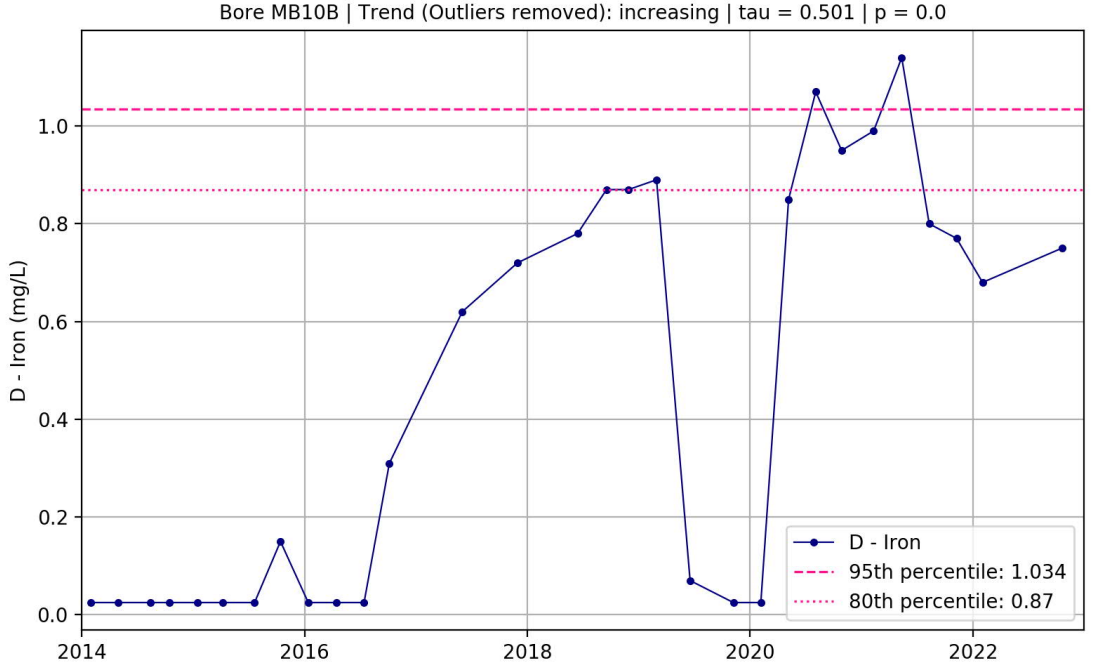

Bore MB10B | Trend: decreasing | tau = -0.216 | p = 0.01
D - Arsenic
Statistical Outlier
Outlier removed
D - Arsenic (mg/L)
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

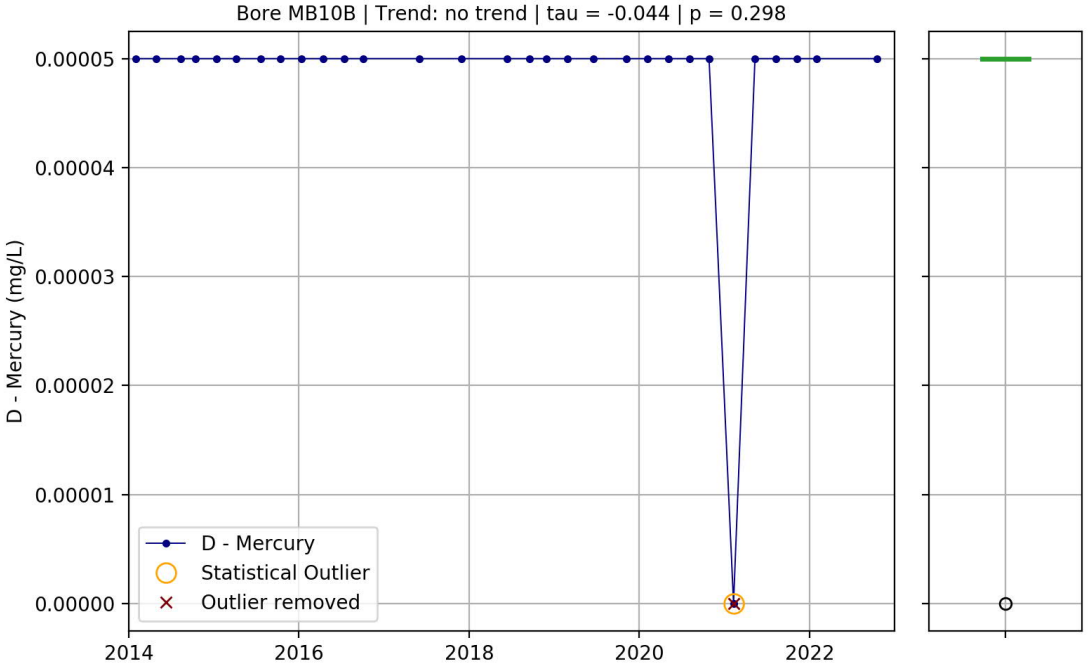

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Arsenic
95th percentile: 0.0
80th percentile: 0.0
D - Arsenic (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

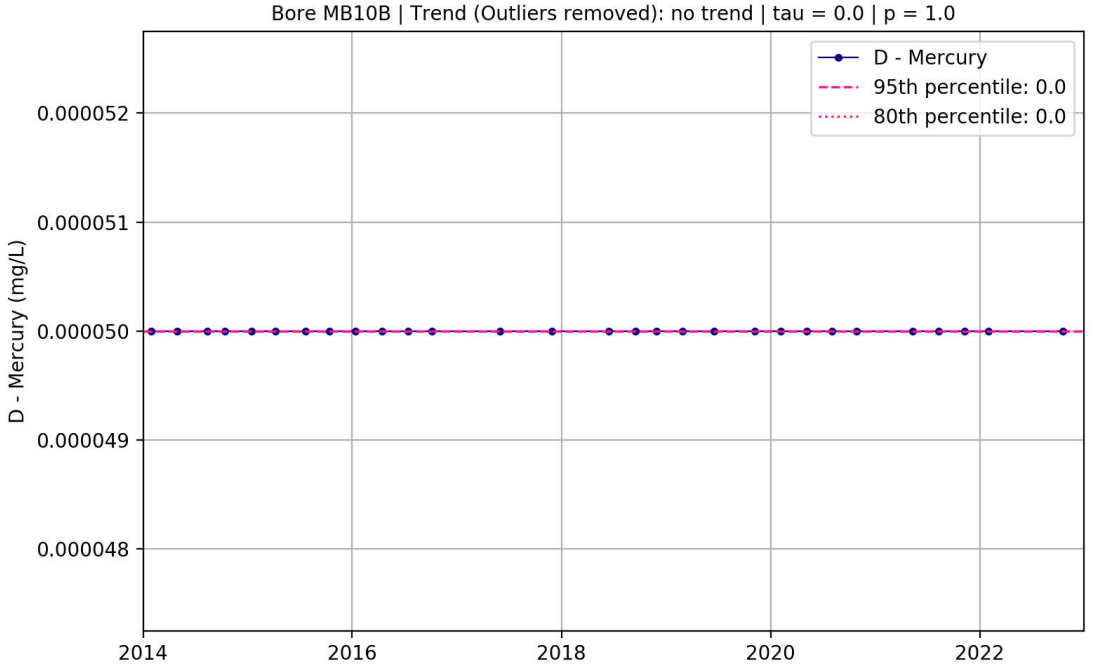

Bore MB10B | Trend: Not evaluated
D - Copper
Statistical Outlier
Outlier removed
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

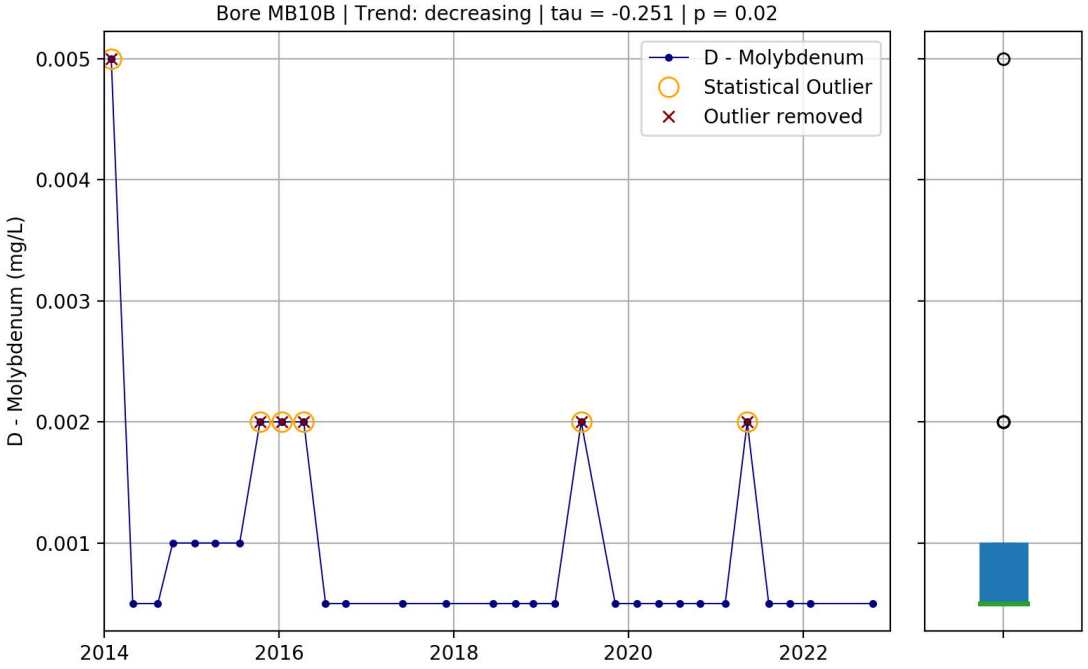

Bore MB10B | Trend: Not evaluated, five samples or less
D - Copper
D - Copper (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
Less than 8 samples,
no site specific trigger limits derived
2014
2016
2018
2020
2022

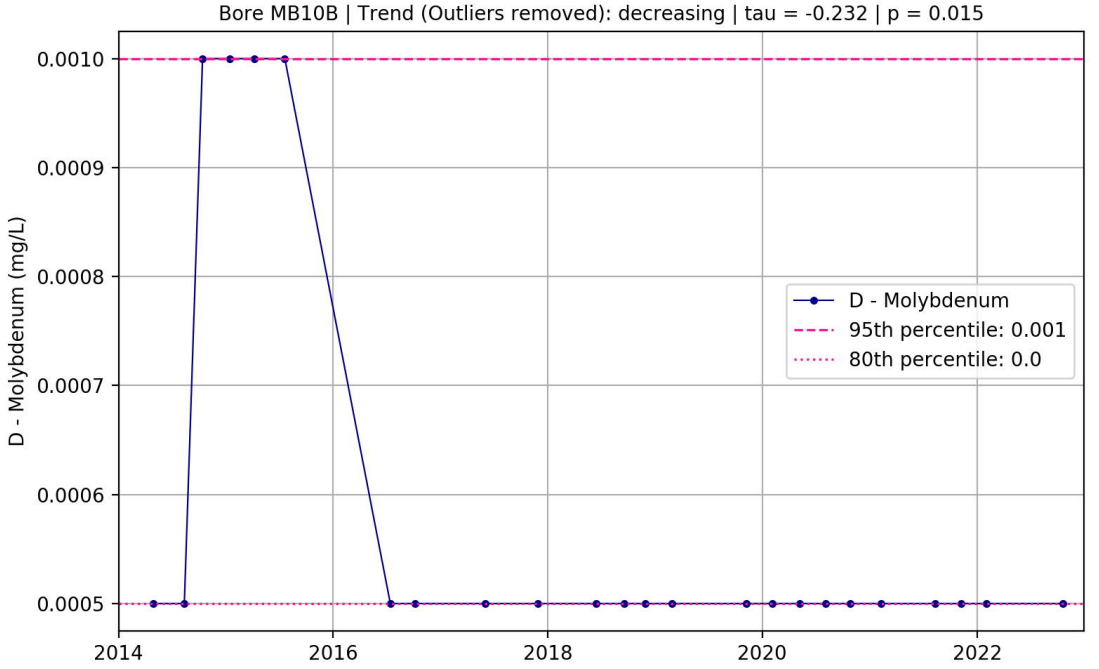

Bore MB10B | Trend: increasing | tau = 0.501 | p = 0.0
D - Iron
Statistical Outlier
Outlier removed
D - Iron (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
2014
2016
2018
2020
2022

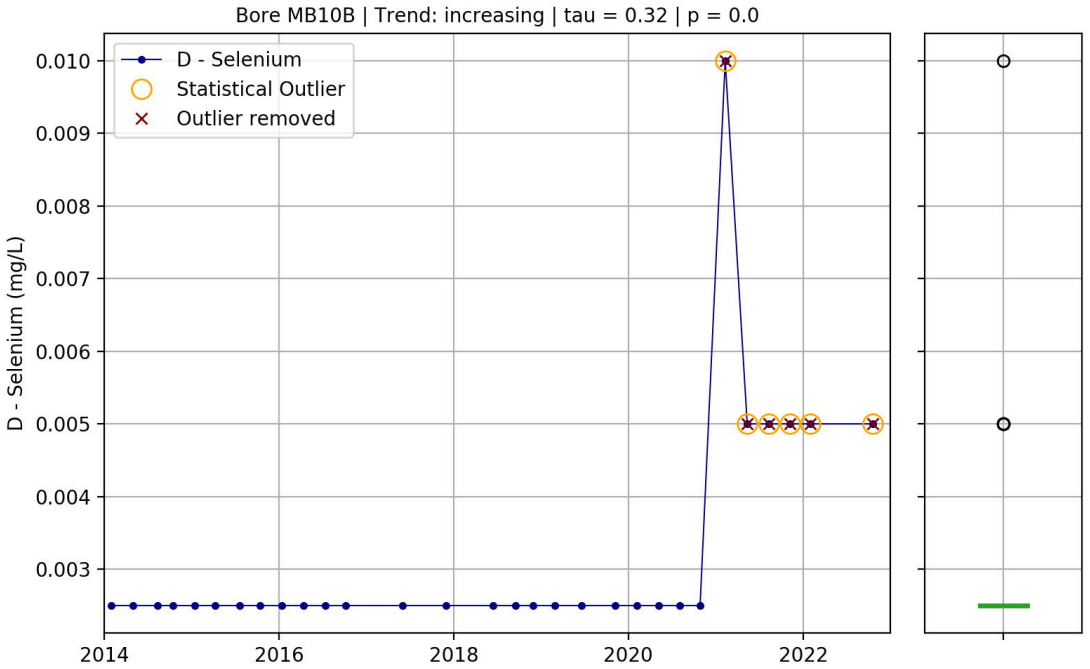

Bore MB10B | Trend (Outliers removed): increasing | tau = 0.501 | p = 0.0
D - Iron (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
D - Iron
95th percentile: 1.034
80th percentile: 0.87
2014
2016
2018
2020
2022

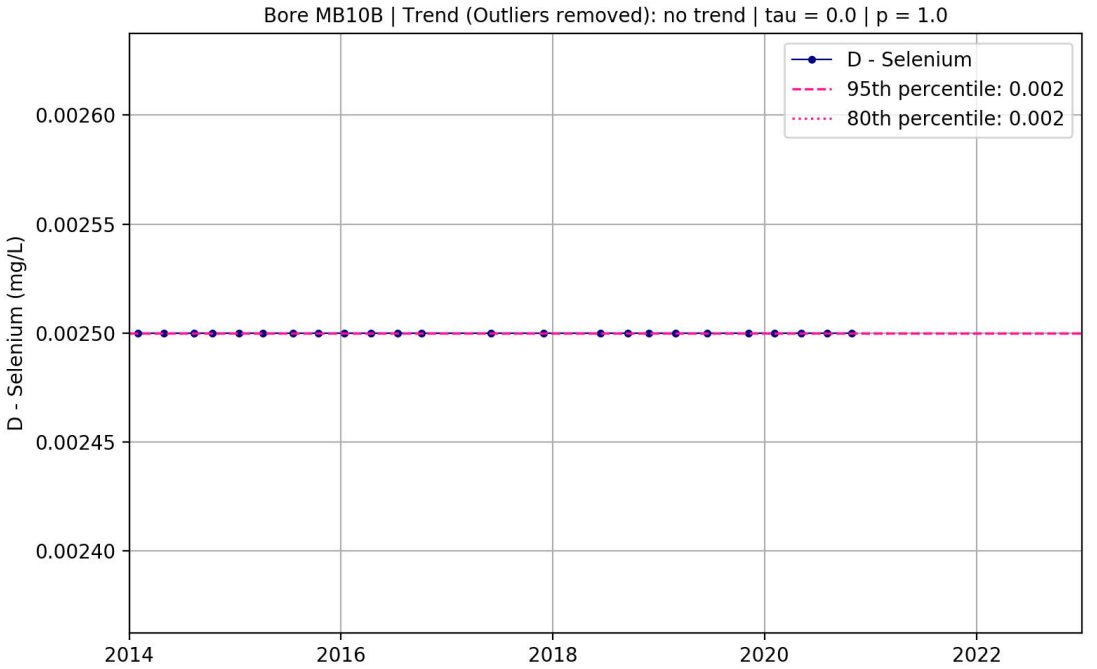

Bore MB10B | Trend: no trend | tau = -0.044 | p = 0.298
D - Mercury (mg/L)
0.00005
0.00004
0.00003
0.00002
0.00001
0.00000
2014
2016
2018
2020
2022
D - Mercury
Statistical Outlier
Outlier removed

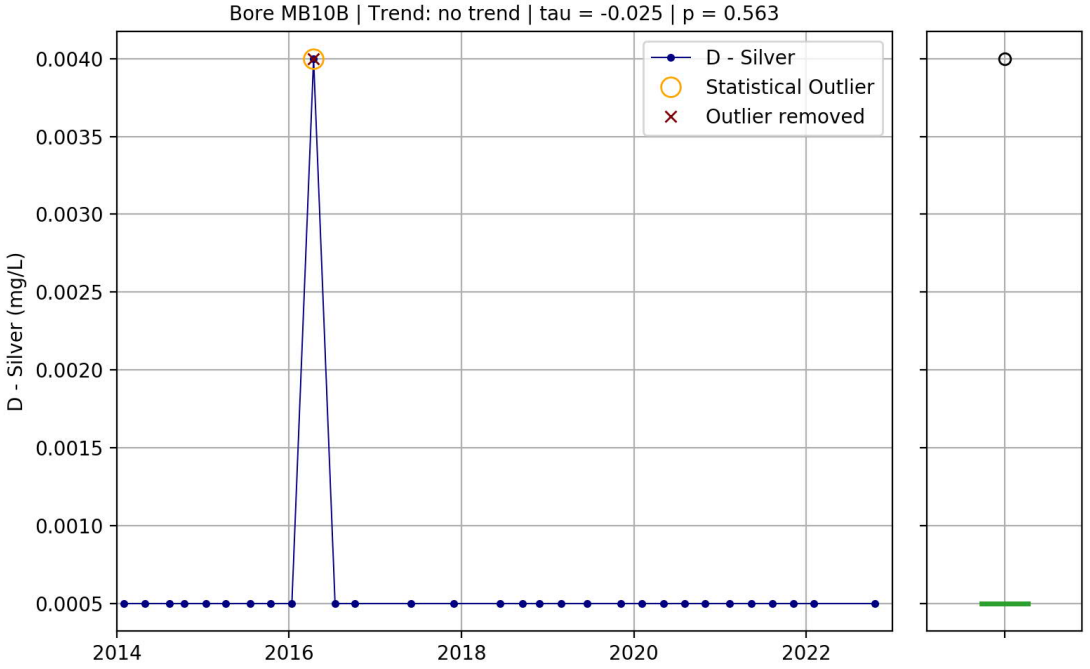

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Mercury (mg/L)
0.000052
0.000051
0.000050
0.000049
0.000048
2014
2016
2018
2020
2022
D - Mercury
95th percentile: 0.0
80th percentile: 0.0

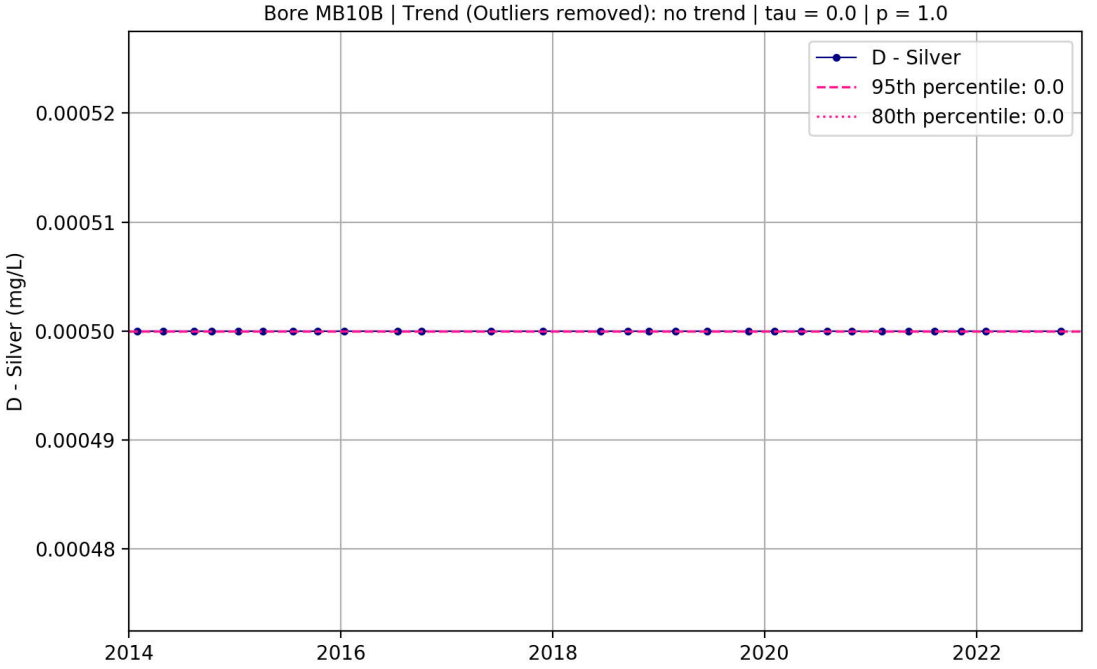

Bore MB10B | Trend: decreasing | tau = -0.251 | p = 0.02
D - Molybdenum (mg/L)
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022
D - Molybdenum
Statistical Outlier
Outlier removed


Bore MB10B | Trend (Outliers removed): decreasing | tau = -0.232 | p = 0.015
D - Molybdenum (mg/L)
0.0010
0.0009
0.0008
0.0007
0.0006
0.0005
2014
2016
2018
2020
2022
D - Molybdenum
95th percentile: 0.001
80th percentile: 0.0

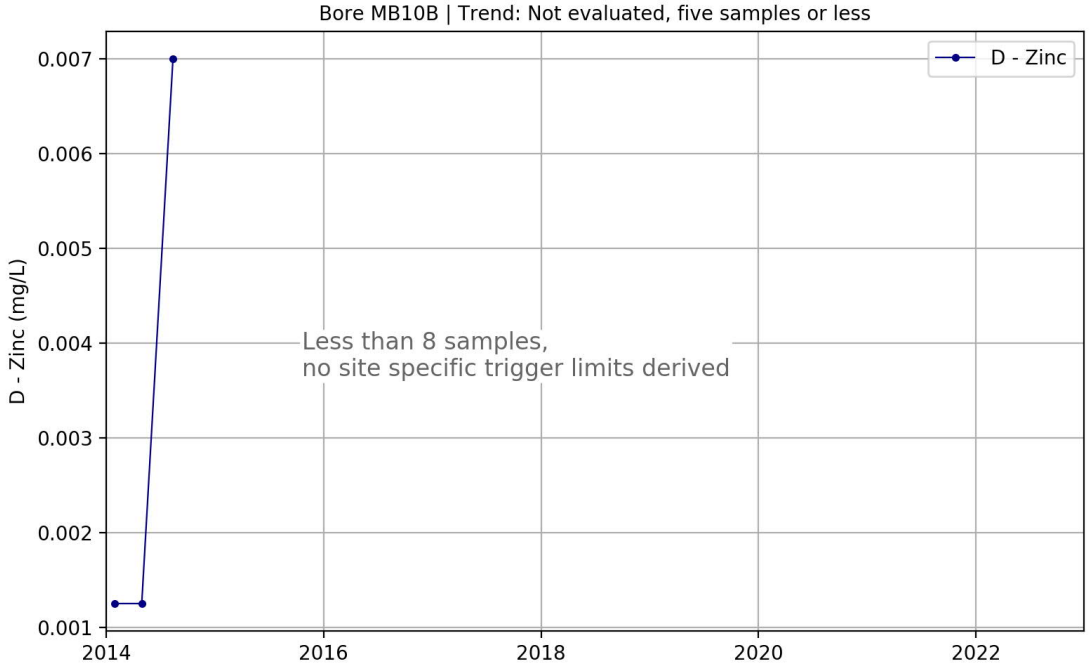

Bore MB10B | Trend: increasing | tau = 0.32 | p = 0.0
D - Selenium
Statistical Outlier
Outlier removed
D - Selenium (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
2014
2016
2018
2020
2022

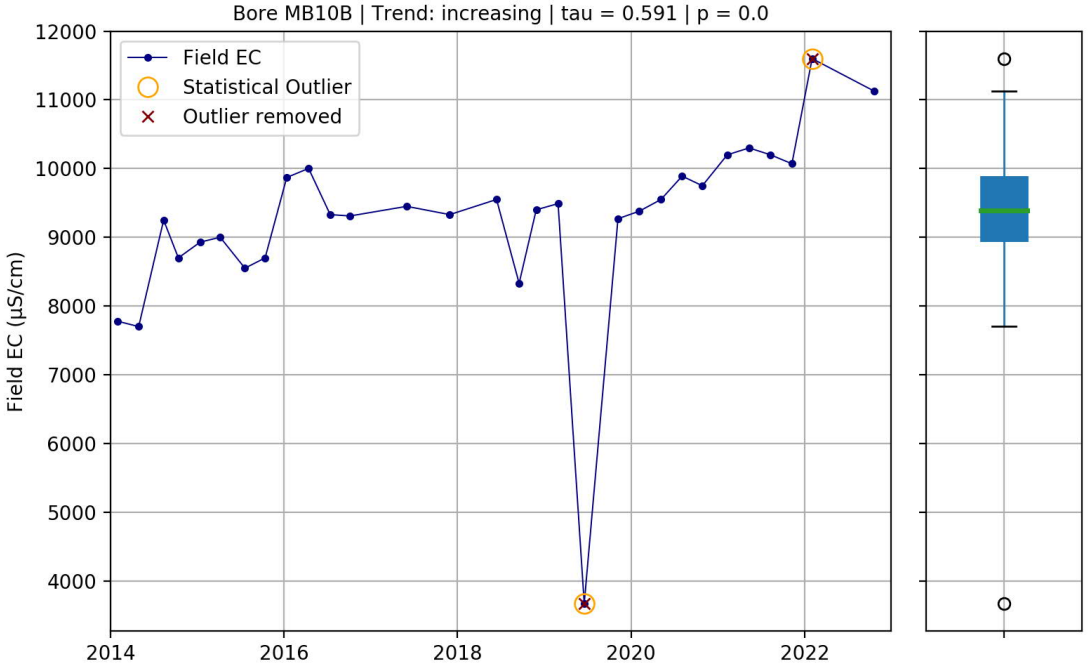

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Selenium
95th percentile: 0.002
80th percentile: 0.002
D - Selenium (mg/L)
0.00260
0.00255
0.00250
0.00245
0.00240
2014
2016
2018
2020
2022

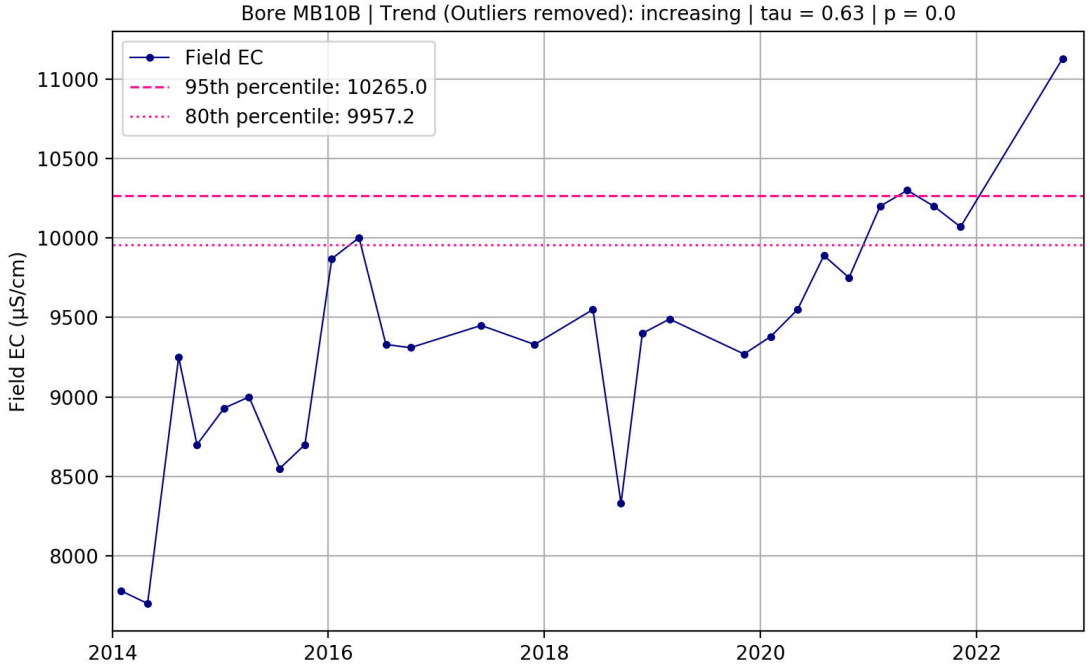

Bore MB10B | Trend: no trend | tau = -0.025 | p = 0.563
D - Silver
Statistical Outlier
Outlier removed
D - Silver (mg/L)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
2014
2016
2018
2020
2022

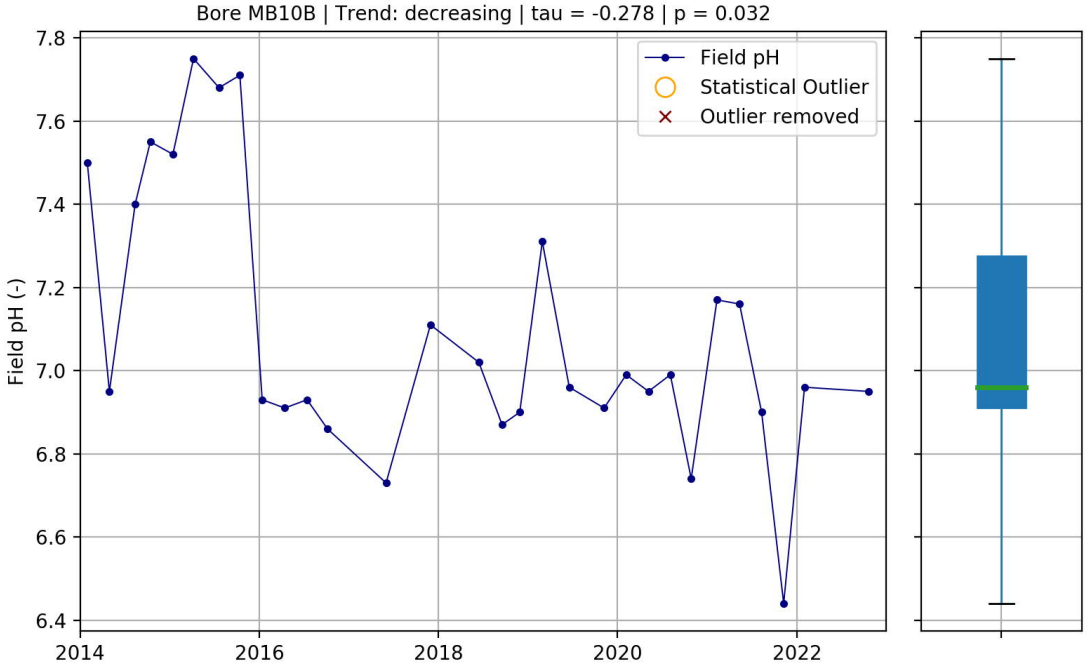

Bore MB10B | Trend (Outliers removed): no trend | tau = 0.0 | p = 1.0
D - Silver
95th percentile: 0.0
80th percentile: 0.0
D - Silver (mg/L)
0.00052
0.00051
0.00050
0.00049
0.00048
2014
2016
2018
2020
2022

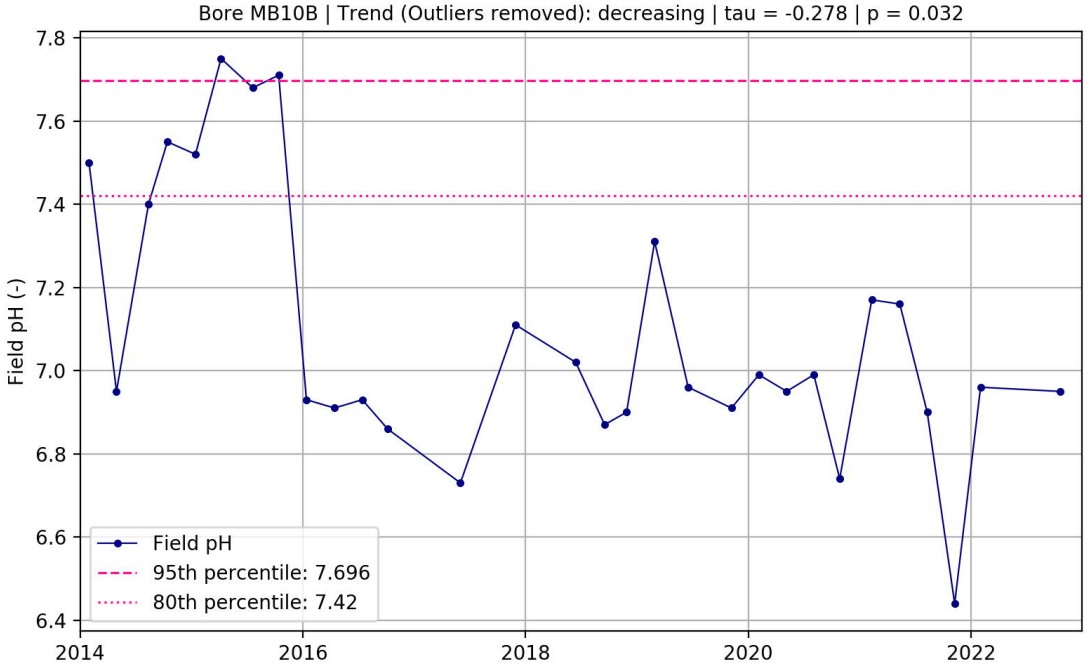

Bore MB10B | Trend: Not evaluated
D - Zinc
Statistical Outlier
Outlier removed
D - Zinc (mg/L)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

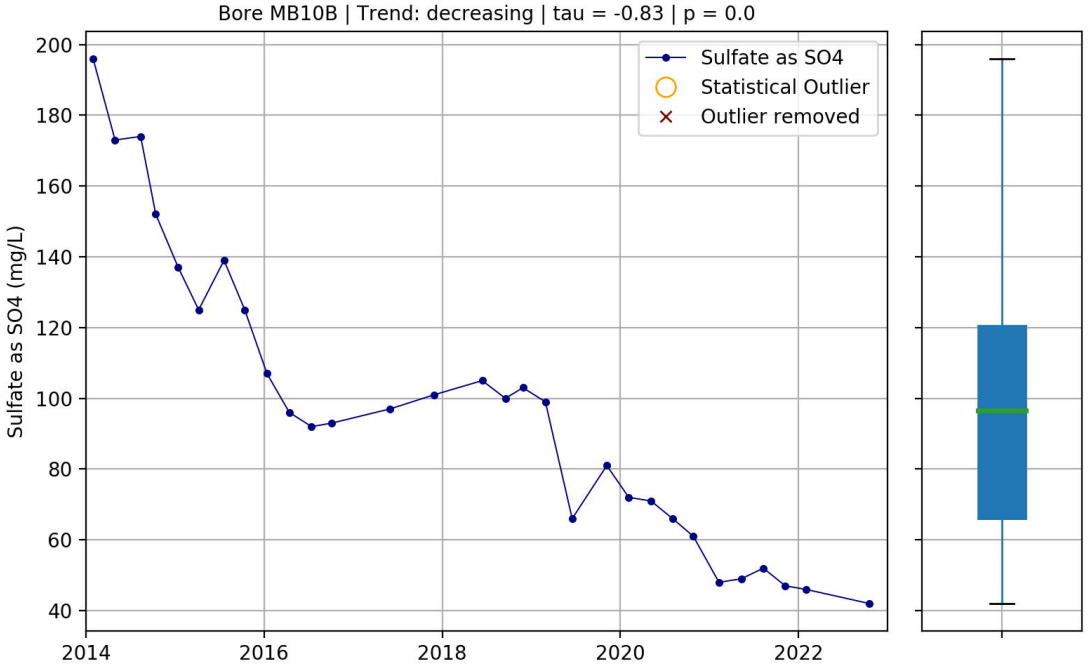

Bore MB10B | Trend: Not evaluated, five samples or less
D - Zinc
D - Zinc (mg/L)
Less than 8 samples,
no site specific trigger limits derived
0.007
0.006
0.005
0.004
0.003
0.002
0.001
2014
2016
2018
2020
2022

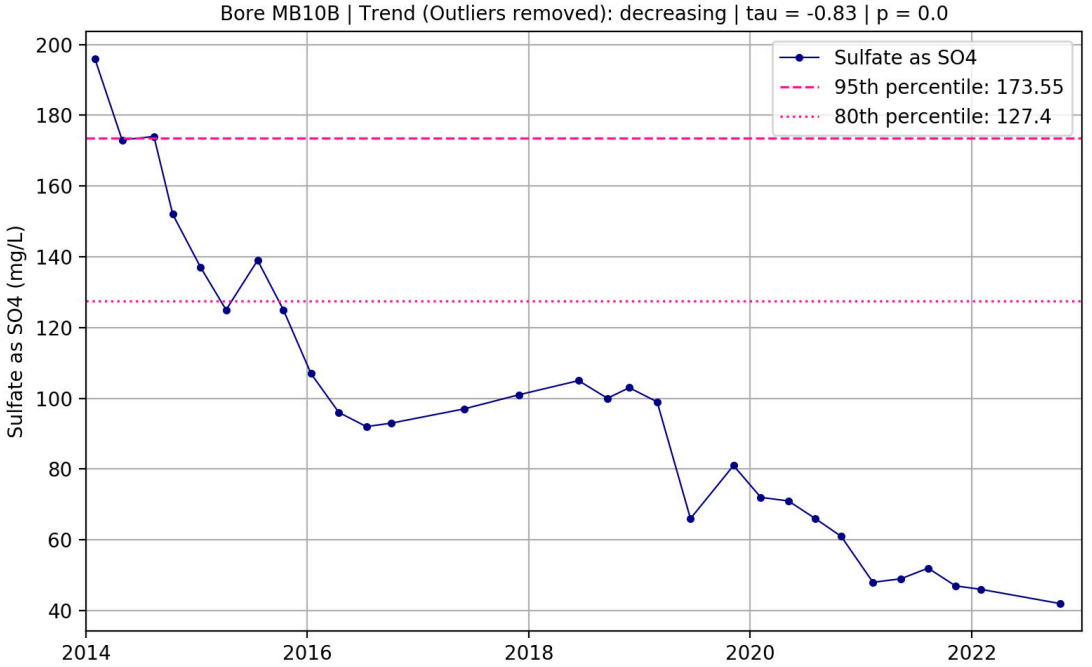

Bore MB10B | Trend: increasing | tau = 0.591 | p = 0.0
Field EC
Statistical Outlier
Outlier removed
Field EC (µS/cm)
12000
11000
10000
9000
8000
7000
6000
5000
4000
2014
2016
2018
2020
2022


Bore MB10B | Trend (Outliers removed): increasing | tau = 0.63 | p = 0.0
Field EC
95th percentile: 10265.0
80th percentile: 9957.2
Field EC (µS/cm)
11000
10500
10000
9500
9000
8500
8000
2014
2016
2018
2020
2022


Bore MB10B | Trend: decreasing | tau = -0.278 | p = 0.032
Field pH
Statistical Outlier
Outlier removed
Field pH (-)


Bore MB10B | Trend (Outliers removed): decreasing | tau = -0.278 | p = 0.032
Field pH
95th percentile: 7.696
80th percentile: 7.42
Field pH (-)


Bore MB10B | Trend: decreasing | tau = -0.83 | p = 0.0
Sulfate as SO4
Statistical Outlier
Outlier removed
Sulfate as SO4 (mg/L)


Bore MB10B | Trend (Outliers removed): decreasing | tau = -0.83 | p = 0.0
Sulfate as SO4
95th percentile: 173.55
80th percentile: 127.4
Sulfate as SO4 (mg/L)

APPENDIX B

Summary statistics and trigger derivation

MB08B

	Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved	Copper - Dissolved	Iron Dissolved	Mercury Dissolved	Molybdenum Dissolved	Selenium Dissolved	Silver Dissolved	Zinc Dissolved	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	(µg/L)	(µg/L)
Water quality Guidelines																
ANZECC Marine Ecosystem (95%) Protection Guideline (ANZG 2018)	6.0-7.5	500			0.055	0.009	0.013	0.0014	-	0.0006	0.034	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5	0.4	-	0.002	0.15	0.02	-	20		
ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Hidrosy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-		-	0.03	0.14	-	-	-		0.06		
Hidrosy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	388	5905				0.03	0.246					0.317		
DES, 2013															20	100
Statistics																
Count	29	25	33	30	29	28	25	2	33	31	28	26	29	2	25	28
% of values below LOR	0	0	0	0	100	79	100	100	48	100	100	100	100	0	68	100
Minimum Date	30/01/2014	14/04/2016	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	21/07/2015	30/01/2014
Maximum Date	18/10/2022	18/10/2022	18/10/2022	18/10/2022	18/10/2022	18/10/2022	18/10/2022	30/04/2014	18/10/2022	18/10/2022	24/05/2022	27/10/2020	18/10/2022	30/04/2014	18/10/2022	24/05/2022
Minimum	6.3	19720	232	7540	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.026	10	50
5th percentile	6.4	20340	235	7599	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.03355	10	50
20th Percentile	6.7	20832	250	7778	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.0562	10	50
Median	6.9	21620	430	8060	0.0025	0.0005	0.0005	0.0005	0.72	0.00005	0.0005	0.0025	0.0005	0.1015	10	50
80th Percentile	7.1	23140	470	8334	0.0035	0.0008	0.0005	0.0005	4.53	0.00005	0.0005	0.0025	0.0005	0.1468	20	50
95th Percentile	7.3	24240	483	8520	0.005	0.00365	0.0005	0.0005	5.30	0.00005	0.0005	0.0025	0.0005	0.16945	28	50
Maximum	7.4	24400	503	8600	0.005	0.004	0.0005	0.0005	5.53	0.00005	0.0005	0.0025	0.0005	0.177	30	50
Trigger derivation considerations																
Trigger Development not possible due less than 8 samples								x						x		
Trigger Development not possible due to more than 15% of values <LOR					x	x	x	x	x	x	x	x	x		x	x
Mann Kendall trend			increasing		increasing	decreasing			increasing						decreasing	
Proposed Tripper limits																
Limit A (80th Percentile)		23140	470	8334												
Limit B (95th Percentile) or applicable guideline	6.0-7.5	24240	483	8520	0.055	0.009	0.013	0.001	0.246	0.0006	0.034	0.011	below LOR	0.317	20	100

MB09A

	Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved	Copper - Dissolved	Iron Dissolved	Mercury Dissolved	Molybdenum Dissolved	Selenium Dissolved	Silver Dissolved	Zinc Dissolved	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	(µg/L)	(µg/L)
Water quality Guidelines																
ANZECC Freshwater Ecosystem (95%) Protection Guideline (ANZG 2018)	6.5-7.5	350			0.055	0.009	0.013	0.0014	-	0.0006	0.034	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5	0.4	-	0.002	0.15	0.02	-	20		
ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Fitzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-	-	-	0.03	0.14	-	-	-	-	0.06		
Fitzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	398	5505	-	-	-	0.03	0.246	-	-	-	-	0.317		
DES, 2013															20	100
Statistics																
Count	27	30	33	31	31	26	26	2	29	31	31	26	33	2	28	25
% of values below LOR	0	0	0	0	81	88	100	50	62	100	68	100	100	50	100	100
Minimum Date	30/04/2014	14/10/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014	30/04/2014
Maximum Date	19/10/2022	19/10/2022	19/10/2022	19/10/2022	24/05/2022	24/05/2022	24/05/2022	22/07/2014	24/05/2022	19/10/2022	19/10/2022	27/10/2020	19/10/2022	22/07/2014	19/10/2022	24/05/2022
Minimum	6.5	16770	41	5590	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	10	50
5th percentile	6.6	16789	50	5820	0.0025	0.0005	0.0005	0.000725	0.025	0.00005	0.0005	0.0025	0.0005	0.0023875	10	50
20th Percentile	6.7	17308	66	6140	0.0025	0.0005	0.0005	0.0014	0.025	0.00005	0.0005	0.0025	0.0005	0.0058	10	50
Median	6.8	17860	91	6340	0.0025	0.0005	0.0005	0.00275	0.025	0.00005	0.0005	0.0025	0.0005	0.012625	10	50
80th Percentile	6.9	19080	100	6690	0.01	0.0005	0.0005	0.0041	0.09	0.00005	0.0025	0.0025	0.0005	0.01945	10	50
95th Percentile	7.3	20329	109	6785	0.02	0.001	0.0005	0.004775	0.15	0.00005	0.004	0.0025	0.0005	0.0228625	10	50
Maximum	7.5	20600	110	6800	0.02	0.001	0.0005	0.005	0.22	0.00005	0.005	0.0025	0.0005	0.024	10	50
Trigger derivation considerations																
Trigger Development not possible due less than 8 samples								x						x		
Trigger Development not possible due to more than 15% of values <LOR					x	x	x	x	x	x	x	x	x	x	x	x
Mann Kendall trend					increasing				increasing							
Proposed Tripper limits																
Limit A (80th Percentile)		19080	100	6690												
Limit B (95th Percentile) or applicable guideline	6.0-7.5	20329	109	6785	0.055	0.009	0.013	0.030	0.14	0.0006	0.034	0.011	below LOR	0.060	20	100

MB09B

	Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved	Copper - Dissolved	Iron Dissolved	Mercury Dissolved	Molybdenum Dissolved	Selenium Dissolved	Silver Dissolved	Zinc Dissolved	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	(µg/L)	(µg/L)
Water quality Guidelines																
ANZECC Drinking Environment (DW) Protection Guideline (ANZG 2018)	6.5-7.5	900			0.055	0.009	0.013	0.0014	-	0.0006	0.05	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5	0.4	-	0.002	0.15	0.02	-	20		
ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Hzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-		-	0.03	0.14	-	-	-		0.06		
Hzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	388	5905				0.03	0.246					0.317		
DES, 2013															20	100
Statistics																
Count	27	34	34	32	32	34	34	3	33	34	31	27	34	3	25	28
% of values below LOR	0	0	12	0	59	65	26	100	52	100	0	100	100	67	40	100
Minimum Date	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/04/2014	30/01/2014	30/01/2014	30/01/2014	22/07/2014	30/01/2014
Maximum Date	19/10/2022	19/10/2022	19/10/2022	19/10/2022	24/05/2022	19/10/2022	19/10/2022	22/07/2014	24/05/2022	19/10/2022	19/10/2022	27/10/2020	19/10/2022	22/07/2014	19/10/2022	24/05/2022
Minimum	7.1	3710	1	1340	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.003	0.0025	0.0005	0.00125	10	50
5th percentile	7.3	5076	1	1377	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.004	0.0025	0.0005	0.00125	10	50
20th Percentile	7.4	5374	2	1434	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.006	0.0025	0.0005	0.00125	10	50
Median	7.4	8740	14	1715	0.00375	0.0005	0.002	0.0005	0.025	0.00005	0.008	0.0025	0.0005	0.00125	60	50
80th Percentile	7.5	11874	66	3932	0.01	0.0034	0.003	0.0005	1.54	0.00005	0.009	0.0025	0.0005	0.0089	80	50
95th Percentile	7.7	12766	79	4356	0.02	0.004	0.004	0.0005	1.94	SE-05	0.01	0.0025	0.0005	0.012725	116	50
Maximum	7.8	13100	97	4480	0.02	0.004	0.004	0.0005	2.5	0.00005	0.012	0.0025	0.0005	0.014	190	50
Trigger derivation considerations																
Trigger Development not possible due less than 8 samples								x						x		
Trigger Development not possible due to more than 15% of values <LOR					x	x	x	x	x	x		x	x	x	x	x
Mann Kendall trend	decreasing	increasing	decreasing	increasing					increasing		decreasing					
Proposed Tripper limits																
Limit A (80th Percentile)			66													
Limit B (95th Percentile) or applicable guideline	6.0-7.5	16000	79	5905	0.055	0.009	0.013	0.0014	0.246	0.0006	0.034	0.011	below LOR	0.008	20	100

MB10A

	Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved	Copper - Dissolved	Iron Dissolved	Mercury Dissolved	Molybdenum Dissolved	Selenium Dissolved	Silver Dissolved	Zinc Dissolved	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	(µg/L)	(µg/L)
Water quality Guidelines																
ANZECC Freshwater Ecosystem 95% Protection Guideline (ANZG 2018)	6.5-7.5	350			0.055	0.009	0.013	0.0014	-	0.0006	0.034	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5	0.4	-	0.002	0.15	0.02	-	20		
ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Fitzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-	-	-	0.03	0.14	-	-	-		0.06		
Fitzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	398	5505	-	-	-	0.03	0.246	-	-	-		0.317		
DES, 2013															20	100
Statistics																
Count	28	29	25	27	22	24	28	3	28	28	25	23	29	3	23	24
% of values below LOR	0	0	0	0	100	100	18	67	43	100	36	100	100	67	100	100
Minimum Date	30/01/2014	30/01/2014	30/04/2014	30/01/2014	30/01/2014	30/04/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014	30/01/2014
Maximum Date	19/10/2022	19/10/2022	19/10/2022	19/10/2022	27/10/2020	19/10/2022	19/10/2022	13/08/2014	19/10/2022	19/10/2022	19/10/2022	27/10/2020	19/10/2022	13/08/2014	19/10/2022	19/10/2022
Minimum	6.7	3140	52	604	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	10	50
5th percentile	6.8	3320	56	625	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	10	50
20th Percentile	6.9	3442	62	649	0.0025	0.0005	0.001	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	10	50
Median	7.0	3660	66	683	0.0025	0.0005	0.0035	0.0005	0.13	0.00005	0.001	0.0025	0.0005	0.00125	10	50
80th Percentile	7.4	3790	70	764	0.0025	0.0005	0.0056	0.0014	0.30	0.00005	0.002	0.0025	0.0005	0.0053	10	50
95th Percentile	7.6	3998	75	789	0.0025	0.0005	0.008	0.00185	0.35	0.00005	0.002	0.0025	0.0005	0.007325	10	50
Maximum	7.8	4160	76	814	0.0025	0.0005	0.009	0.002	0.42	0.00005	0.003	0.0025	0.0005	0.008	10	50
Trigger derivation considerations																
Trigger Development not possible due less than 8 samples								x						x		
Trigger Development not possible due to more than 15% of values <LOR					x	x	x	x	x	x	x	x	x	x	x	x
Mann Kendall trend			decreasing						increasing		increasing					
Proposed Tripper limits																
Limit A (80th Percentile)		3790	70	764												
Limit B (95th Percentile) or applicable guideline	6.0-7.5	3998	75	789	0.055	0.009	0.013	0.0014	0.14	0.0006	0.034	0.011	below LOR	0.060	20	100

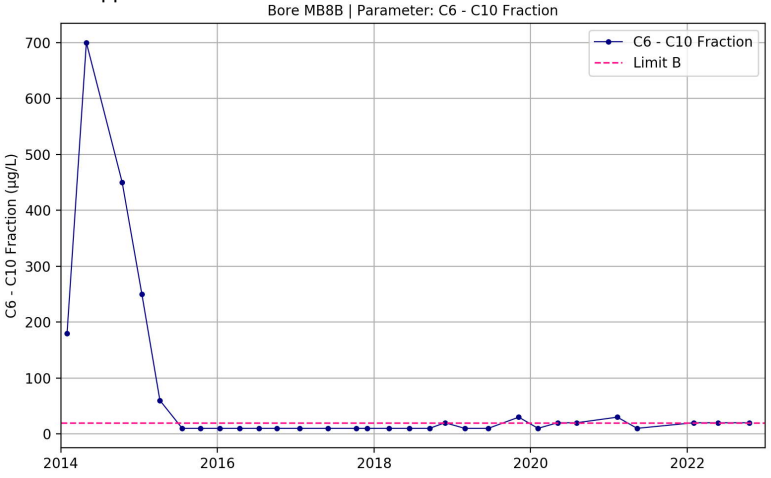
MB10B

	Field pH	Field EC	Sulfate as SO4	Chloride	Aluminium Dissolved	Antimony Dissolved	Arsenic Dissolved	Copper - Dissolved	Iron Dissolved	Mercury Dissolved	Molybdenum Dissolved	Selenium Dissolved	Silver Dissolved	Zinc Dissolved	C6 - C10 Fraction	C10 - C40 Fraction
	pH Unit	(µS/cm)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	(µg/L)	(µg/L)
Water quality Guidelines																
ANZECC Aquatic Ecosystem (95%) Protection Guideline (ANZG 2018)	6.5-7.5	350			0.055	0.009	0.013	0.0014		0.0006	0.034	0.011	0.00001	0.008		
ANZECC Stock watering Guidelines	6.0 - 8.5	7500	1000		5	-	0.5	0.4	-	0.002	0.15	0.02	-	20		
ANZECC Guidelines – Irrigation ST	6.0 - 8.5				20		2	5	10	0.002	0.05	0.05		5		
ANZECC Guidelines – Irrigation LT	6.0 - 8.5				5		0.1	0.2	0.2	0.002	0.01	0.02		2		
Fitzroy WQ1310 WQO Zone 34 (shallow)	7.1-8.1	8910	318	3185	-		-	0.03	0.14	-	-	-		0.06		
Fitzroy WQ1310 WQO Zone 34 (deep)	7.4-8.0	16000	398	5905	-			0.03	0.246					0.317		
DES, 2013															20	100
Statistics																
Count	30	28	30	25	25	27	25	3	30	29	24	24	29	3	26	27
% of values below LOR	0	0	0	0	100	100	100	100	40	100	83	100	100	67	8	100
Minimum Date	30/01/2014	30/01/2014	30/01/2014	13/08/2014	30/01/2014	30/04/2014	14/10/2014	30/01/2014	30/01/2014	30/01/2014	30/04/2014	30/01/2014	30/01/2014	30/01/2014	30/04/2014	30/01/2014
Maximum Date	19/10/2022	19/10/2022	19/10/2022	19/10/2022	08/11/2021	19/10/2022	19/10/2022	13/08/2014	19/10/2022	19/10/2022	19/10/2022	27/10/2020	19/10/2022	13/08/2014	19/10/2022	19/10/2022
Minimum	6.4	7700	42	2520	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	10	50
5th percentile	6.7	7973	46	2764	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	15	50
20th Percentile	6.9	8792	59	3030	0.0025	0.0005	0.0005	0.0005	0.025	0.00005	0.0005	0.0025	0.0005	0.00125	40	50
Median	7.0	9360	97	3150	0.0025	0.0005	0.0005	0.0005	0.465	0.00005	0.0005	0.0025	0.0005	0.00125	60	50
80th Percentile	7.4	9957	127	3382	0.0025	0.0005	0.0005	0.0005	0.87	0.00005	0.0005	0.0025	0.0005	0.0047	80	50
95th Percentile	7.7	10265	174	3682	0.005	0.0005	0.0005	0.0005	1.03	0.00005	0.001	0.0025	0.0005	0.006425	107.5	50
Maximum	7.8	11129	196	3710	0.005	0.0005	0.0005	0.0005	1.14	0.00005	0.001	0.0025	0.0005	0.007	120	50
Trigger Exhaution considerations																
Trigger Development not possible due less than 8 samples								x						x		
Trigger Development not possible due to more than 15% of values <LOR					x	x	x	x	x	x	x	x	x	x		x
Mann Kendall trend	decreasing	increasing	decreasing	increasing	increasing				increasing		decreasing				decreasing	
Proposed Trigger limits																
Limit A (80th Percentile)		9957	127													
Limit B (95th Percentile) or applicable guideline	6.5-7.5	10265	174	5905	0.055	0.009	0.013	0.0014	0.246	0.0006	0.034	0.011	below LOR	0.008	20	100

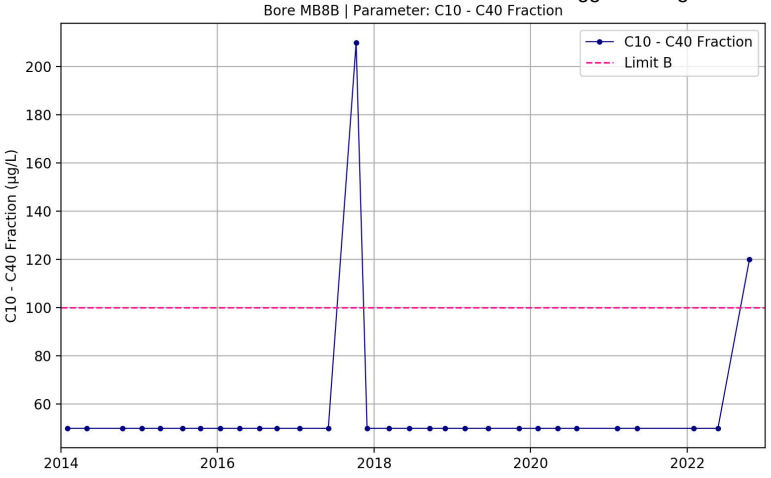
APPENDIX C

Trigger testing on original data set

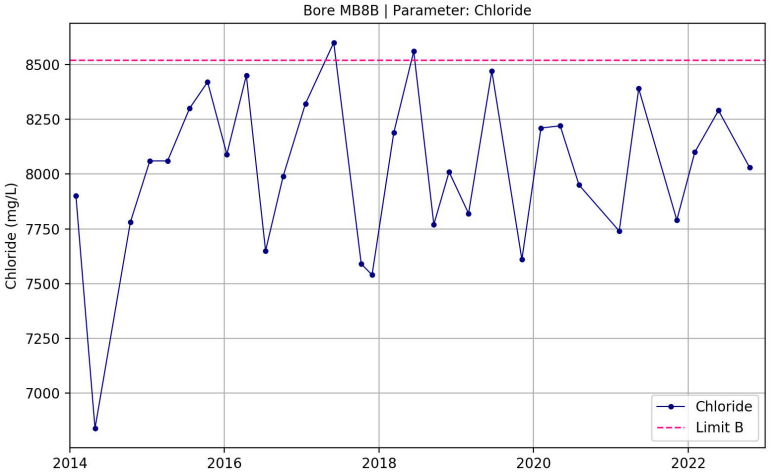
Bore MB8B | Parameter: C6 - C10 Fraction



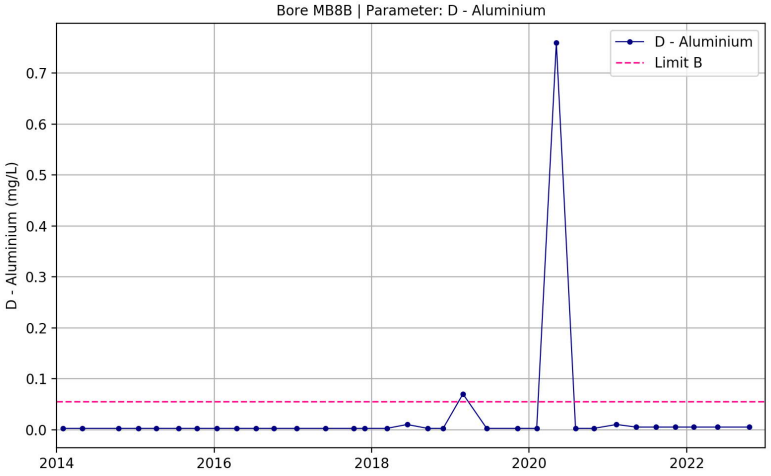
Bore MB8B | Parameter: C10 - C40 Fraction



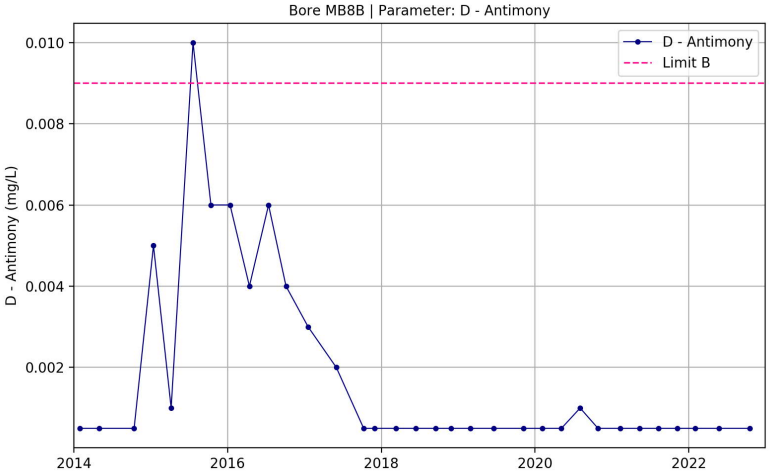
Bore MB8B | Parameter: Chloride



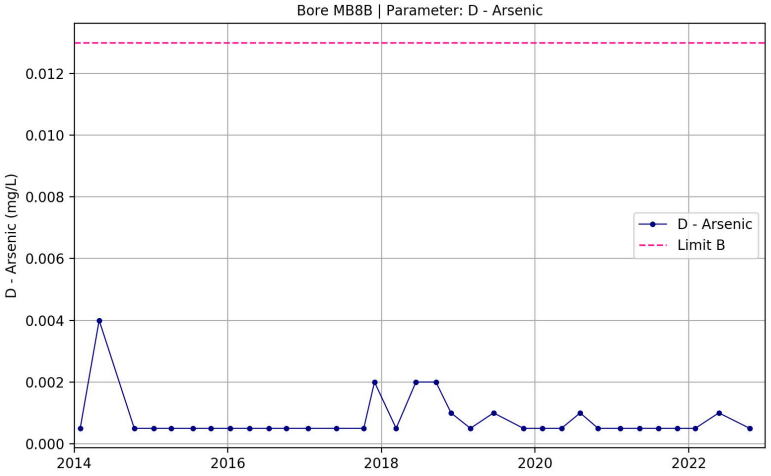
Bore MB8B | Parameter: D - Aluminium



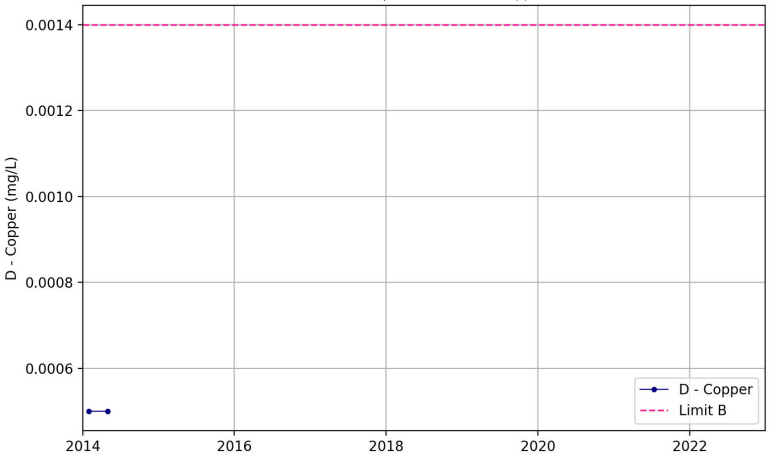
Bore MB8B | Parameter: D - Antimony



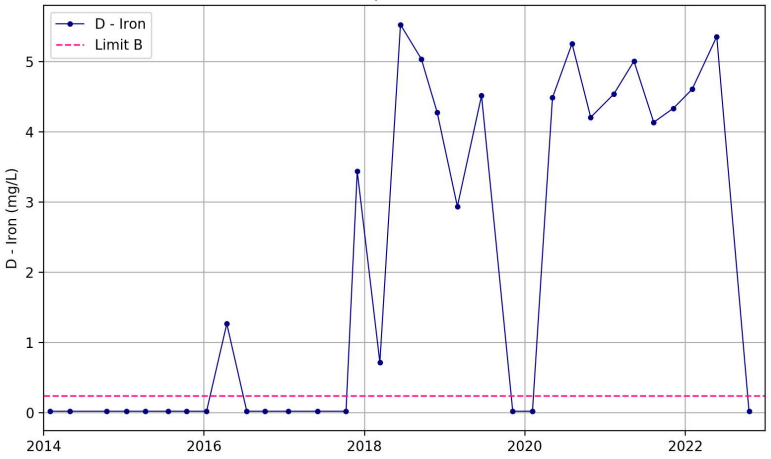
Bore MB8B | Parameter: D - Arsenic



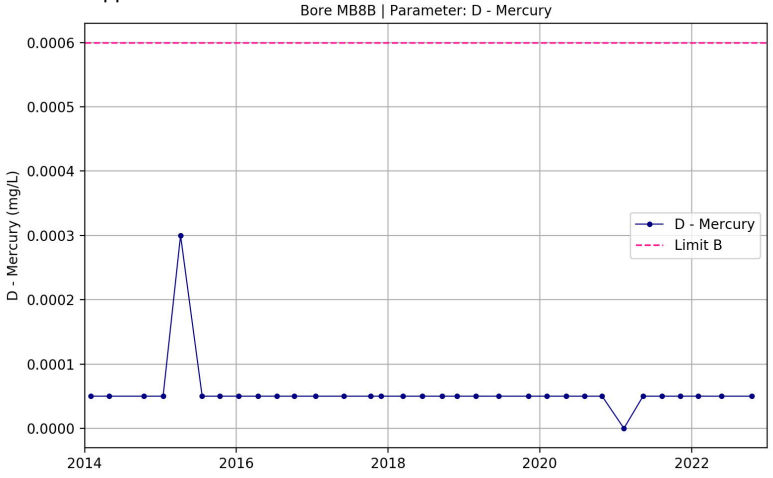
Bore MB8B | Parameter: D - Copper



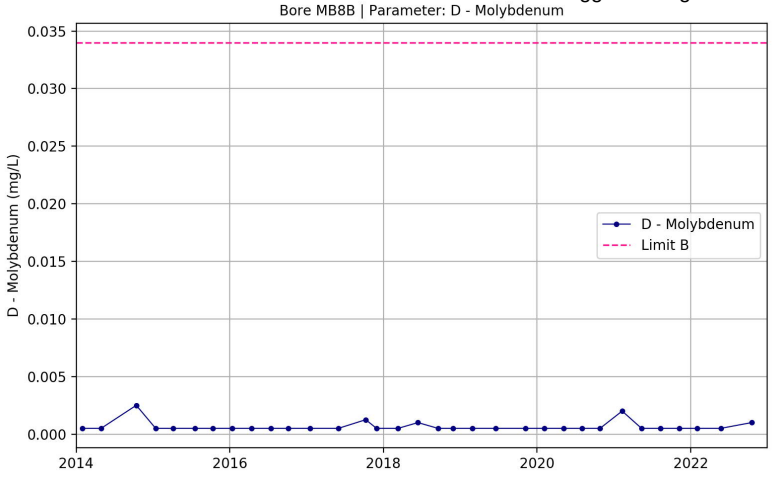
Bore MB8B | Parameter: D - Iron



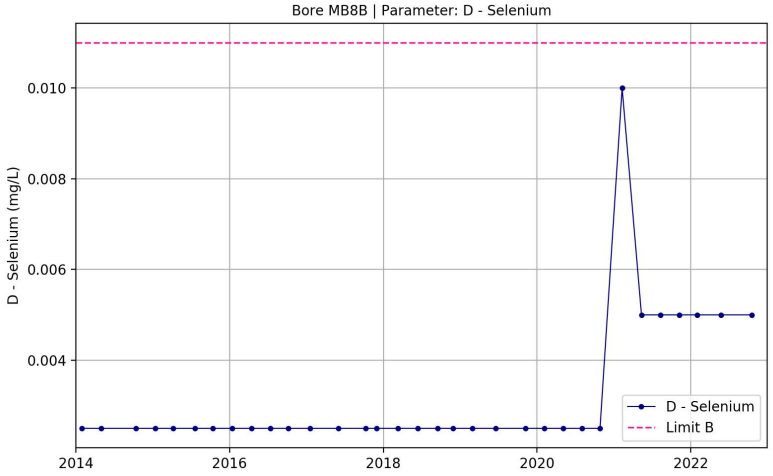
Bore MB8B | Parameter: D - Mercury



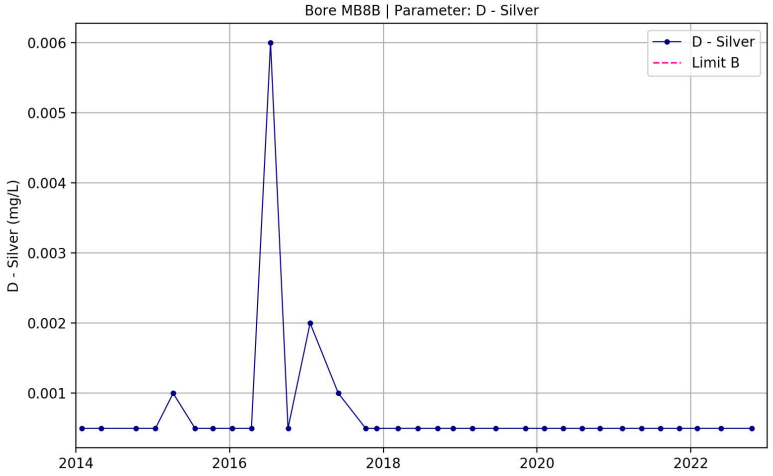
Bore MB8B | Parameter: D - Molybdenum



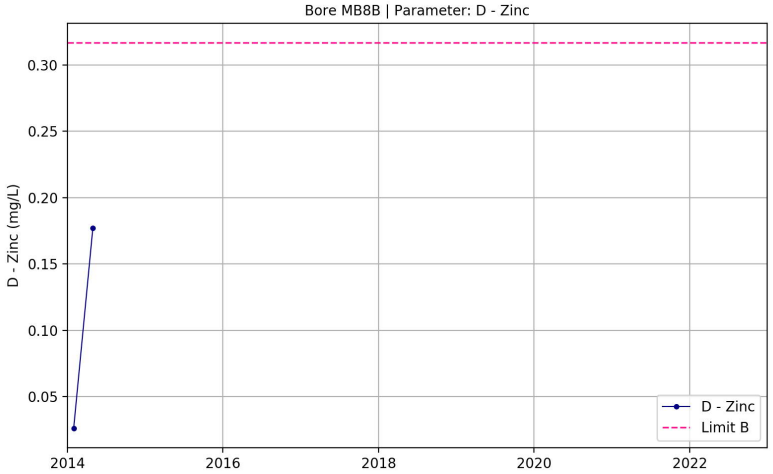
Bore MB8B | Parameter: D - Selenium



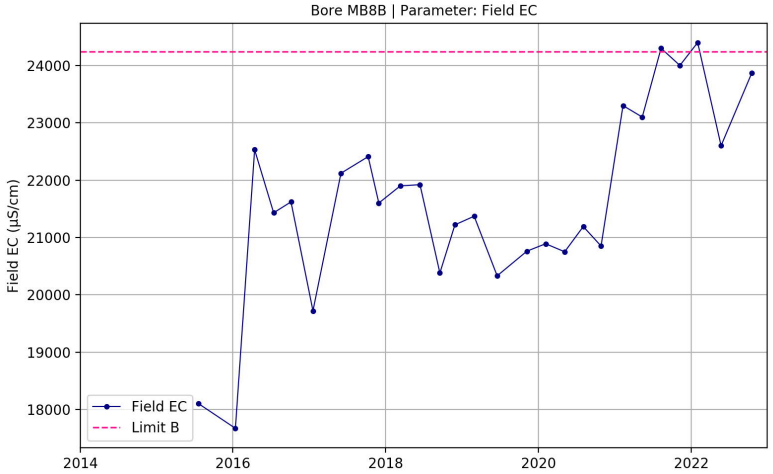
Bore MB8B | Parameter: D - Silver



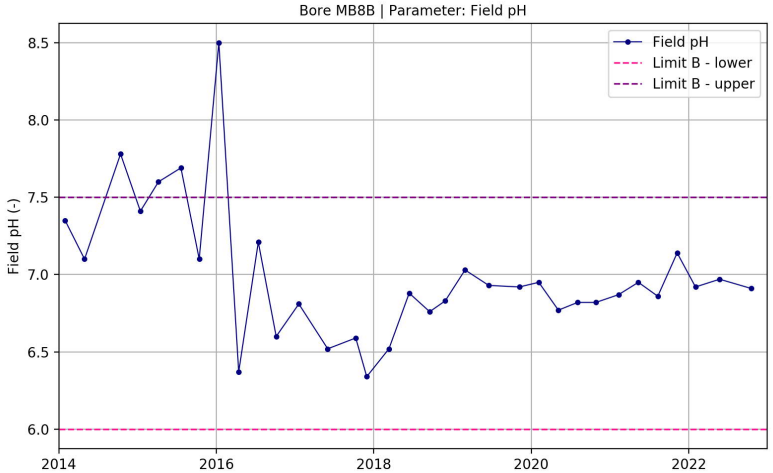
Bore MB8B | Parameter: D - Zinc



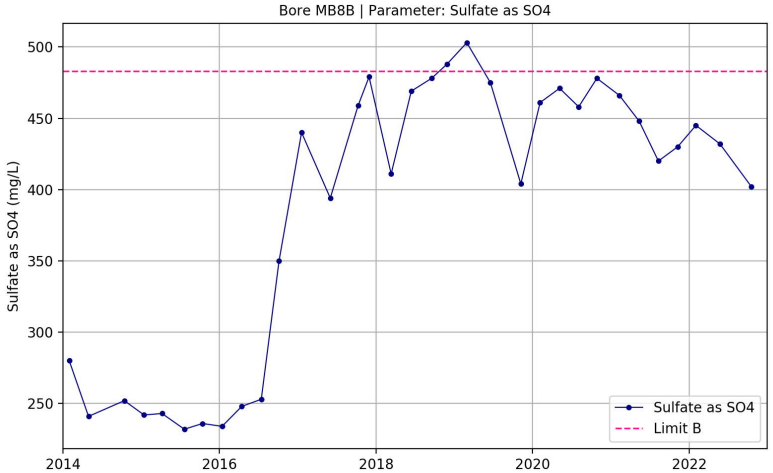
Bore MB8B | Parameter: Field EC

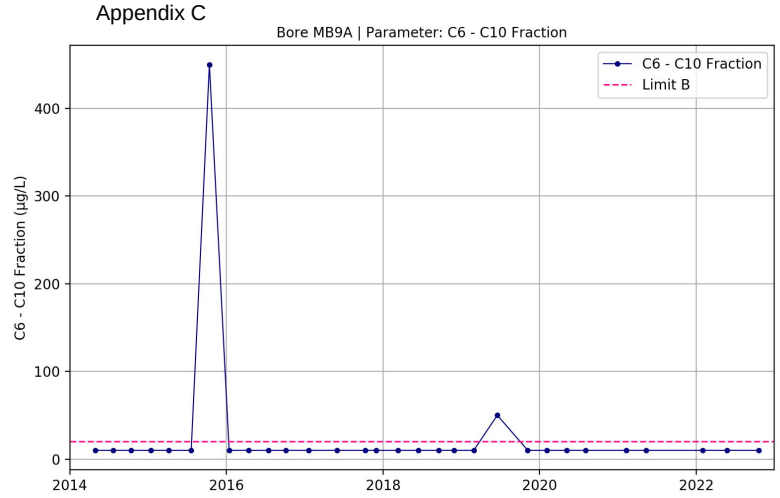


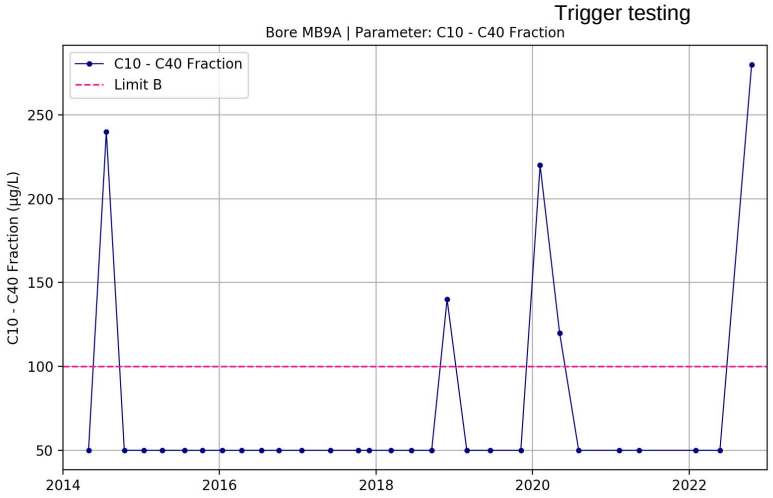
Bore MB8B | Parameter: Field pH

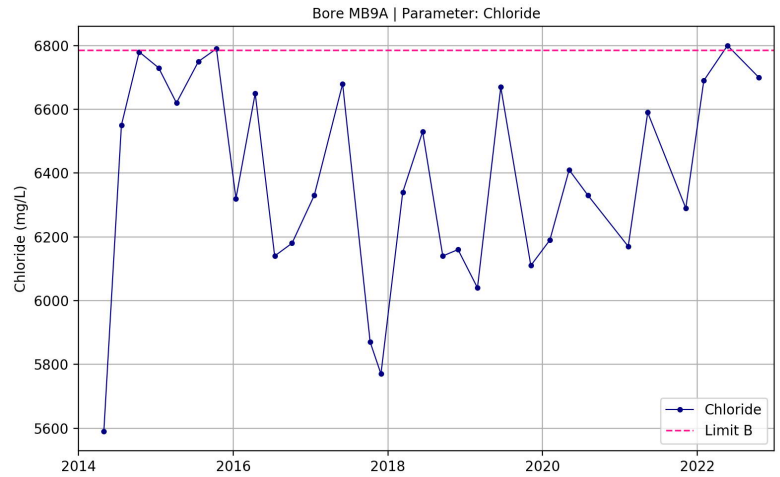


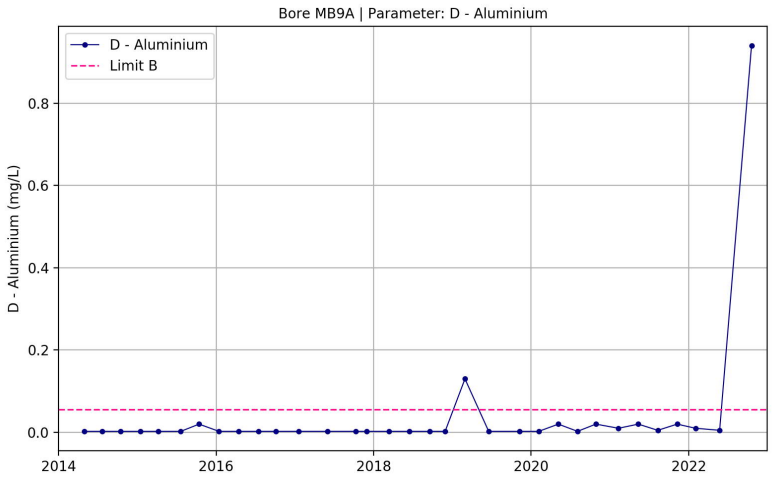
Bore MB8B | Parameter: Sulfate as SO4

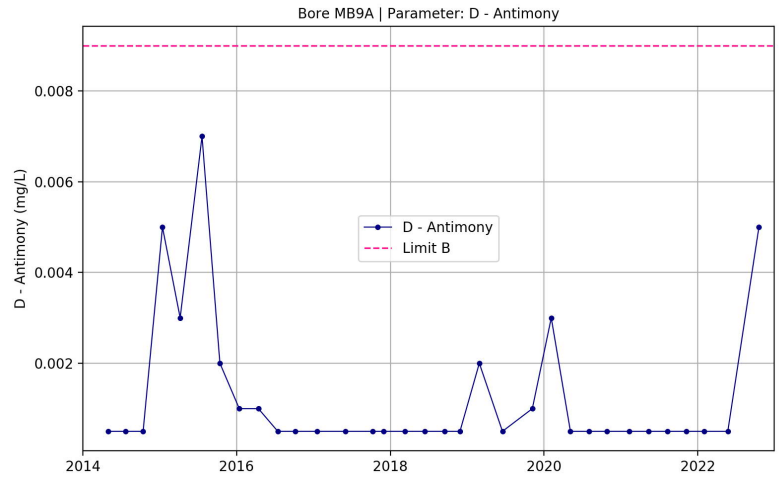


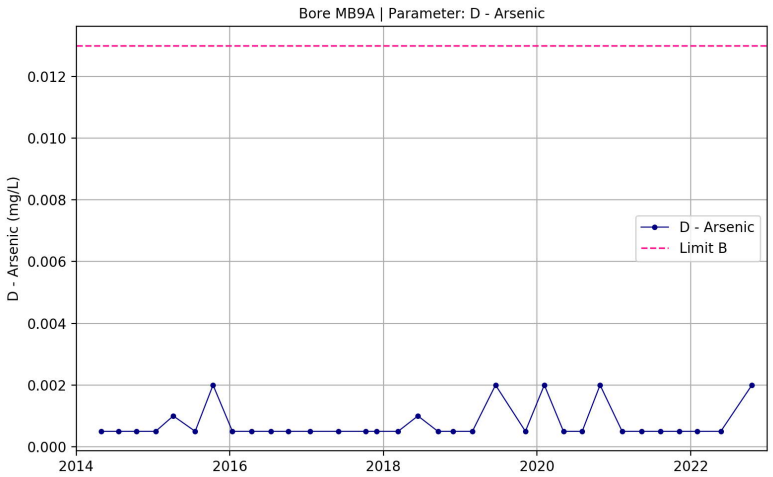

Bore MB9A | Parameter: C6 - C10 Fraction
C6 - C10 Fraction
Limit B
C6 - C10 Fraction (µg/L)

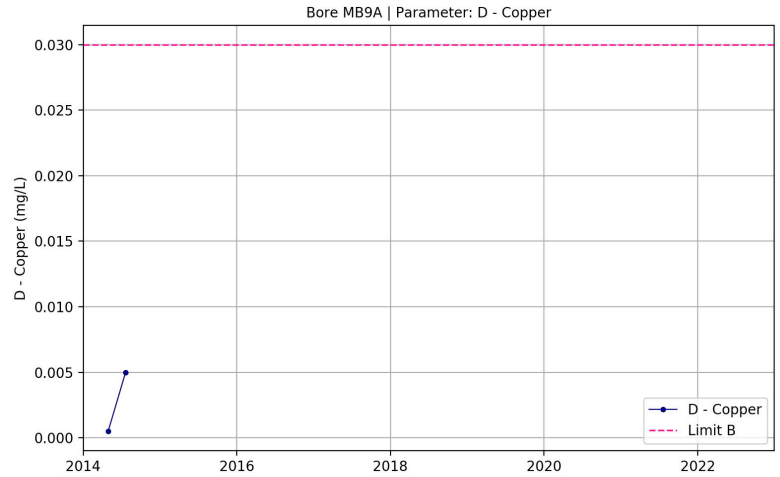

Bore MB9A | Parameter: C10 - C40 Fraction
C10 - C40 Fraction
Limit B
C10 - C40 Fraction (µg/L)

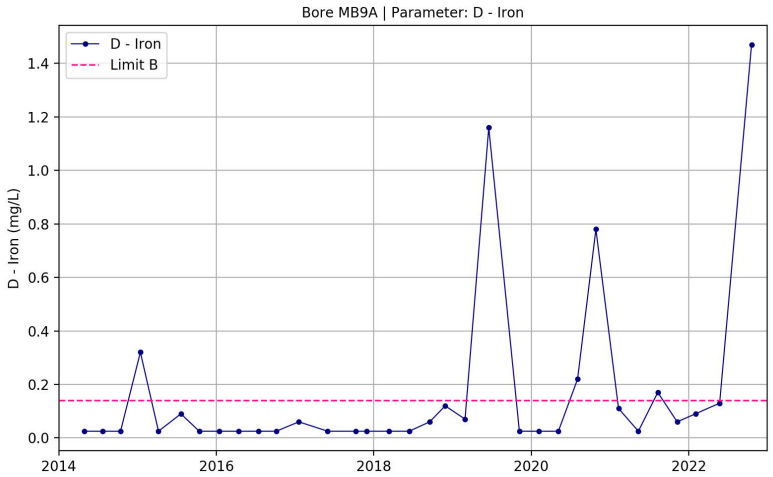

Bore MB9A | Parameter: Chloride
Chloride
Limit B
Chloride (mg/L)


Bore MB9A | Parameter: D - Aluminium
D - Aluminium
Limit B
D - Aluminium (mg/L)

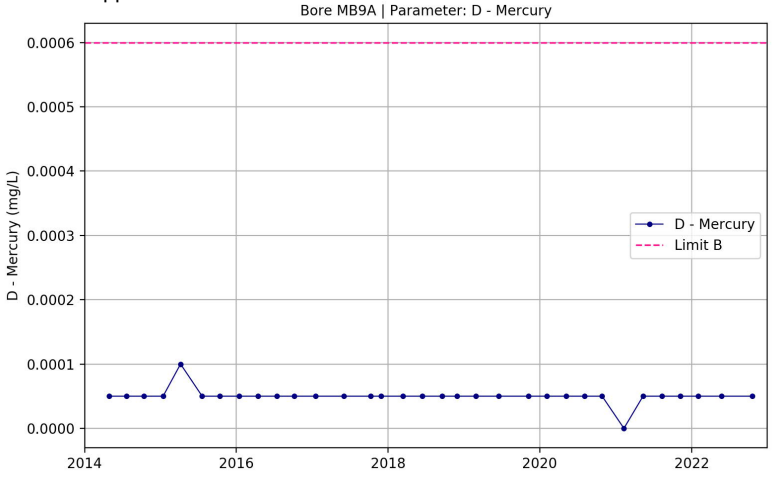

Bore MB9A | Parameter: D - Antimony
D - Antimony
Limit B
D - Antimony (mg/L)


Bore MB9A | Parameter: D - Arsenic
D - Arsenic
Limit B
D - Arsenic (mg/L)

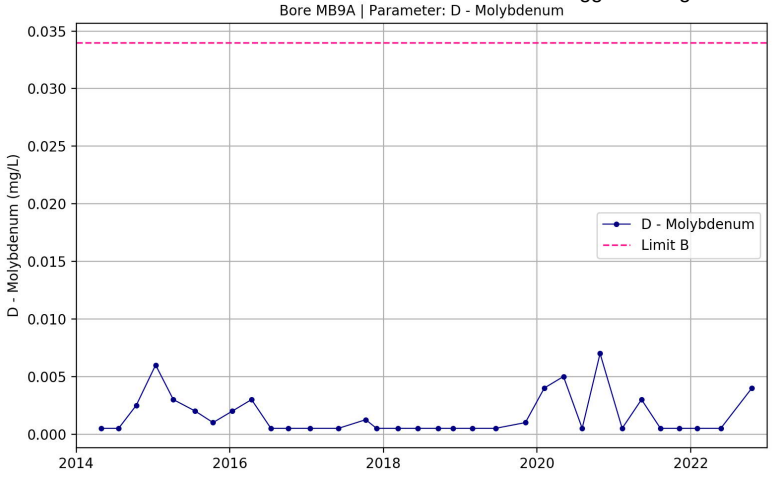

Bore MB9A | Parameter: D - Copper
D - Copper
Limit B
D - Copper (mg/L)


Bore MB9A | Parameter: D - Iron
D - Iron
Limit B
D - Iron (mg/L)

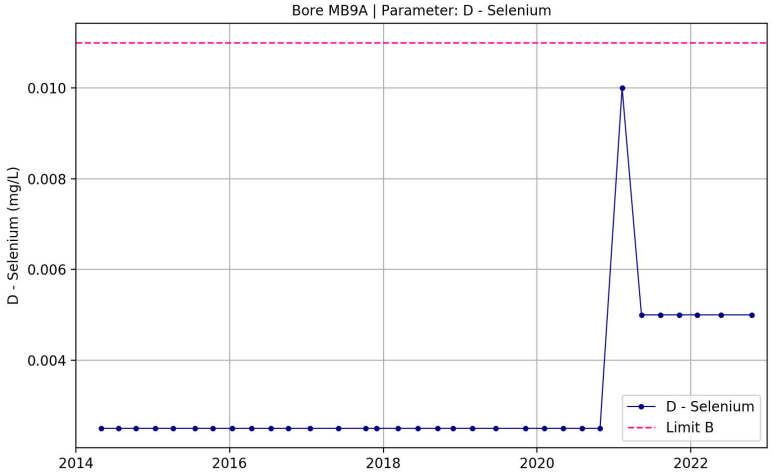
Bore MB9A | Parameter: D - Mercury



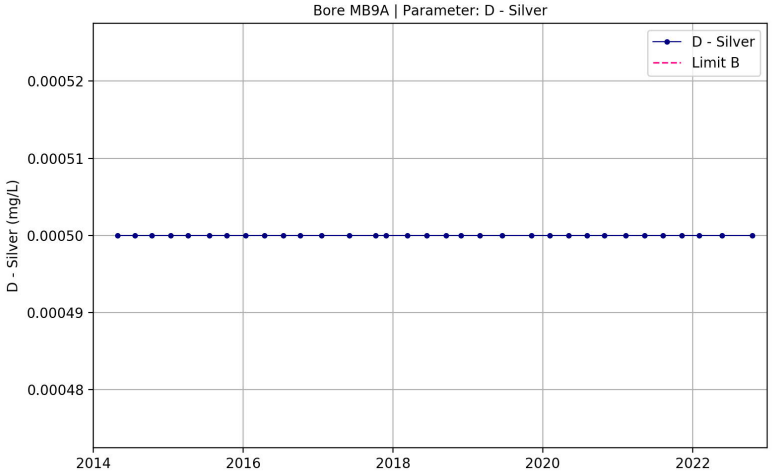
Bore MB9A | Parameter: D - Molybdenum



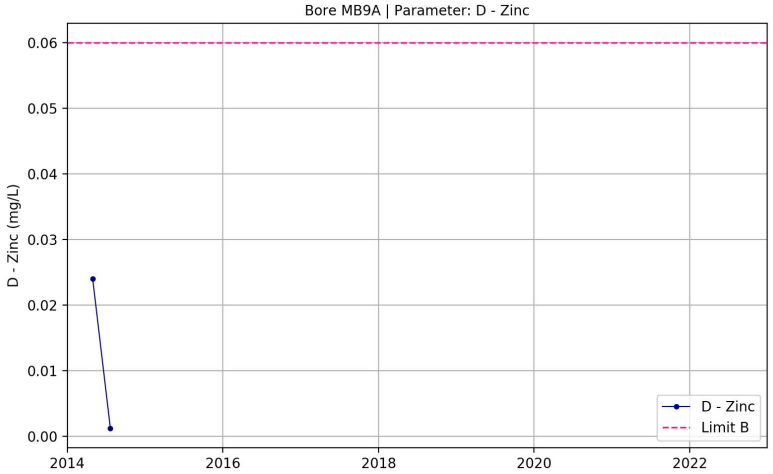
Bore MB9A | Parameter: D - Selenium



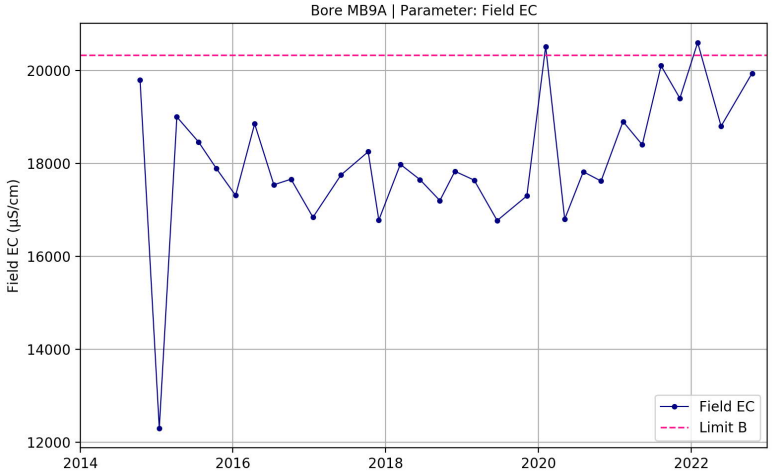
Bore MB9A | Parameter: D - Silver



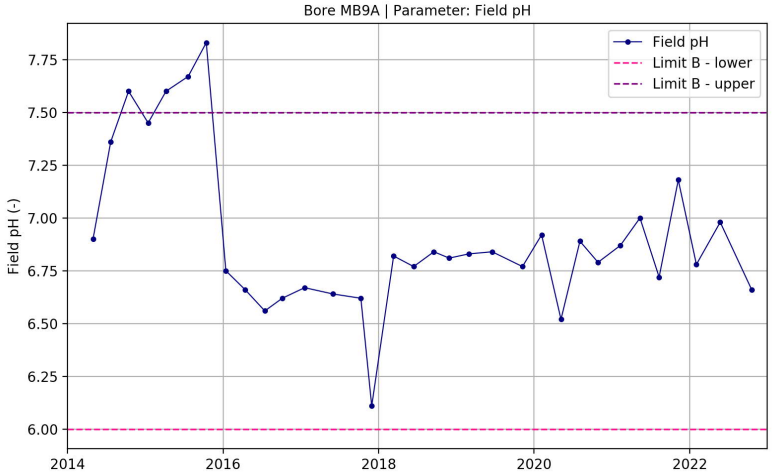
Bore MB9A | Parameter: D - Zinc



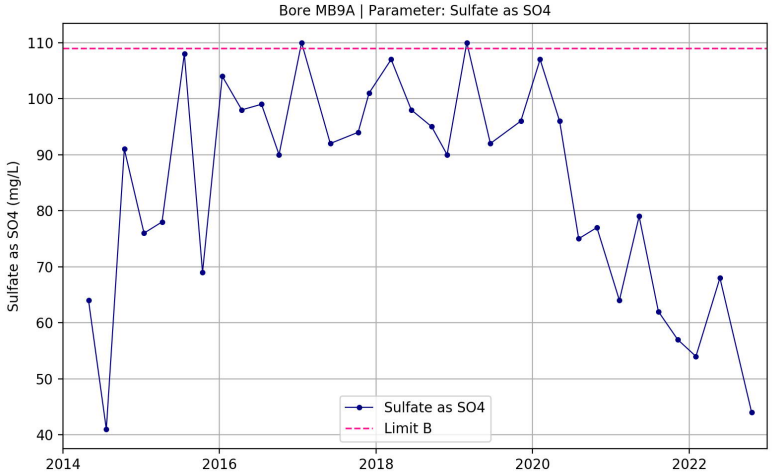
Bore MB9A | Parameter: Field EC



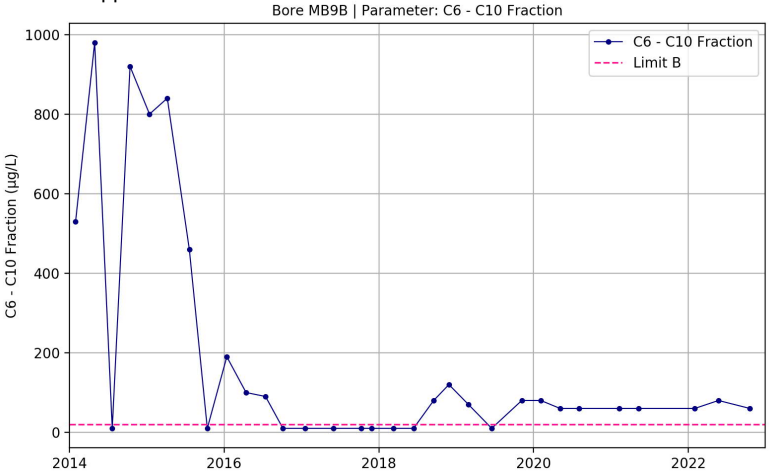
Bore MB9A | Parameter: Field pH



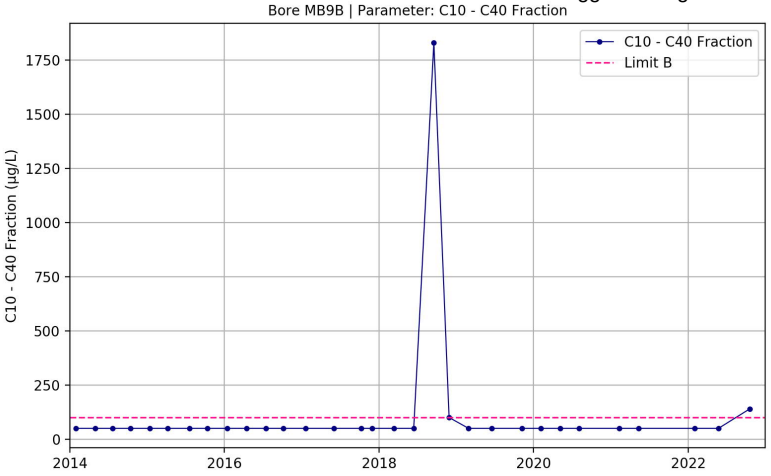
Bore MB9A | Parameter: Sulfate as SO4



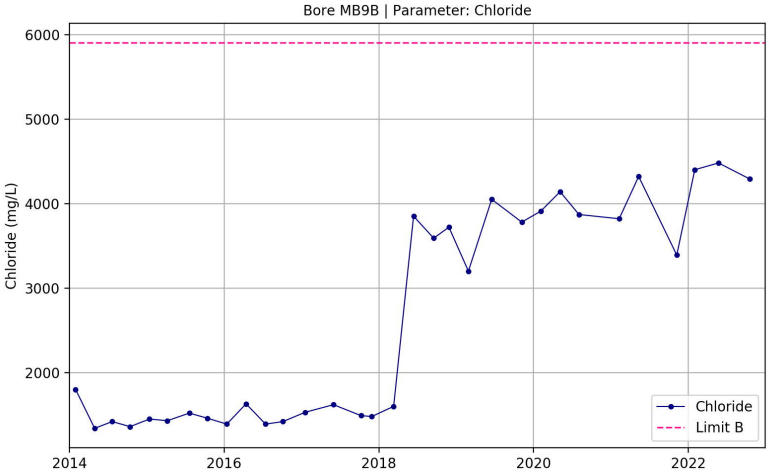
Bore MB9B | Parameter: C6 - C10 Fraction



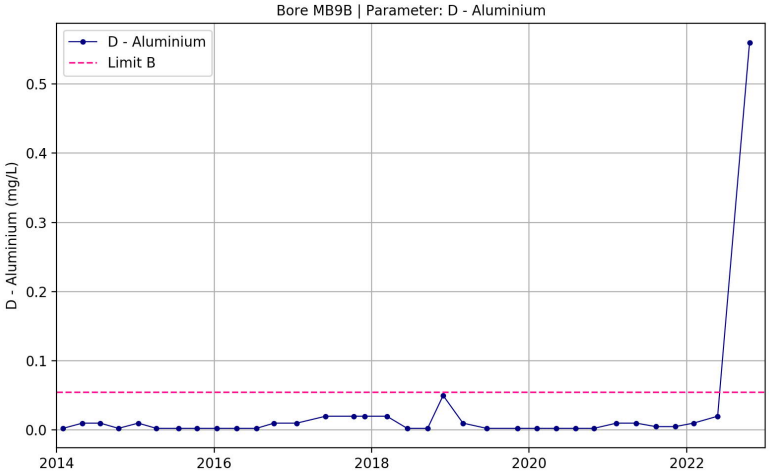
Bore MB9B | Parameter: C10 - C40 Fraction



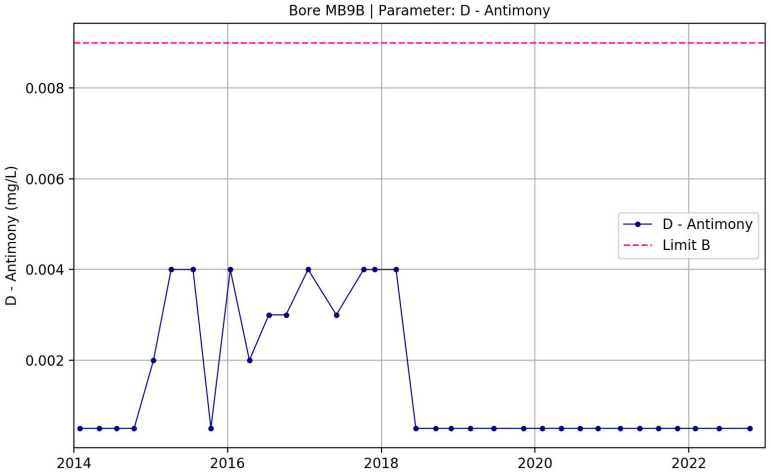
Bore MB9B | Parameter: Chloride



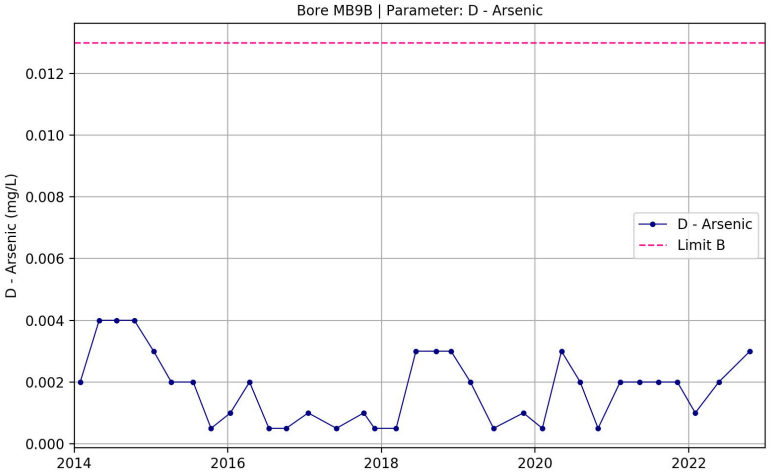
Bore MB9B | Parameter: D - Aluminium



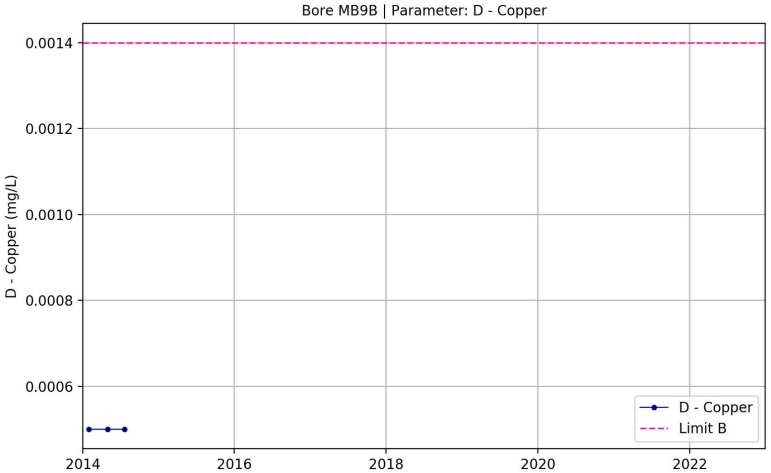
Bore MB9B | Parameter: D - Antimony



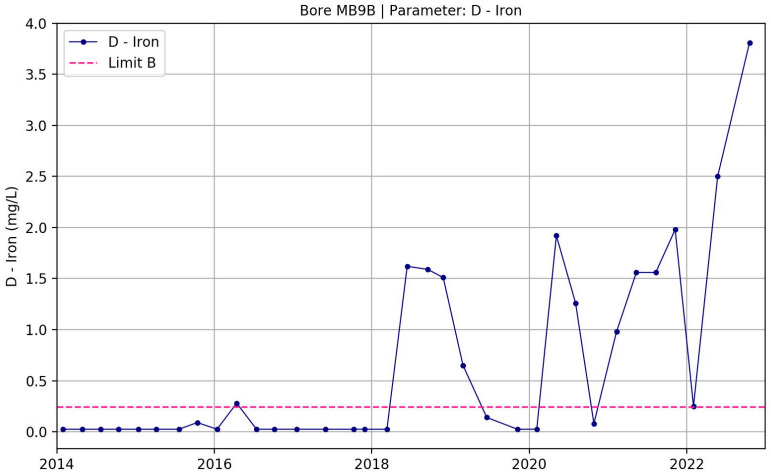
Bore MB9B | Parameter: D - Arsenic



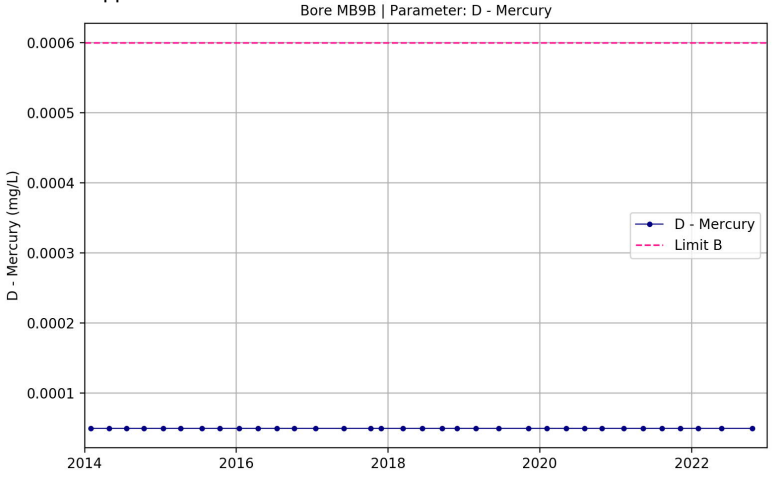
Bore MB9B | Parameter: D - Copper



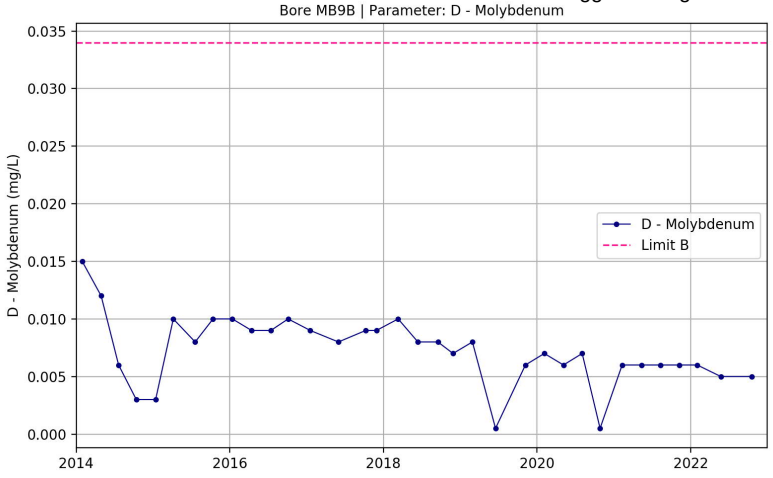
Bore MB9B | Parameter: D - Iron



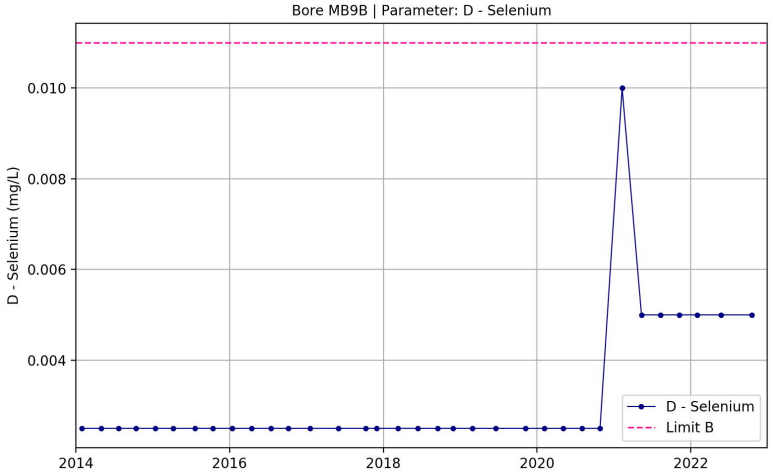
Bore MB9B | Parameter: D - Mercury



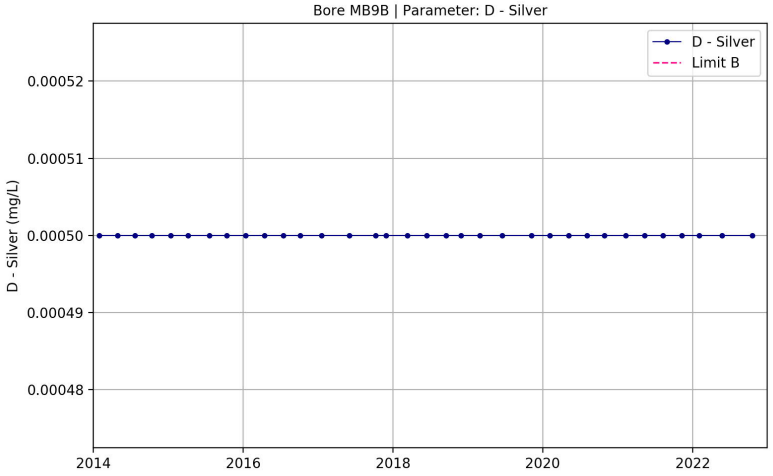
Bore MB9B | Parameter: D - Molybdenum



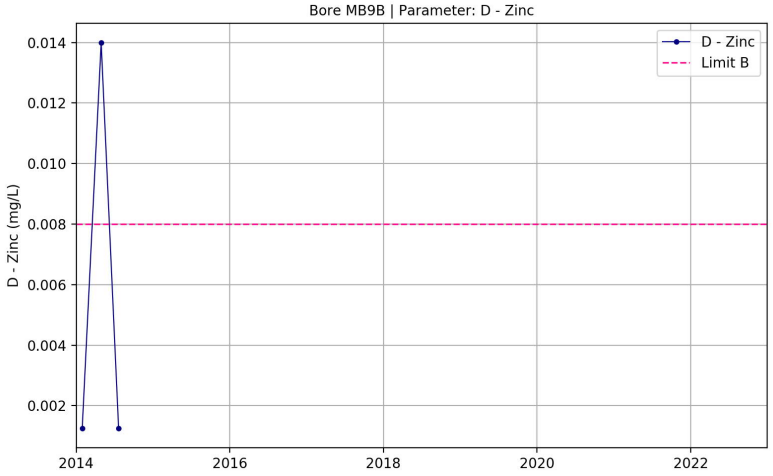
Bore MB9B | Parameter: D - Selenium



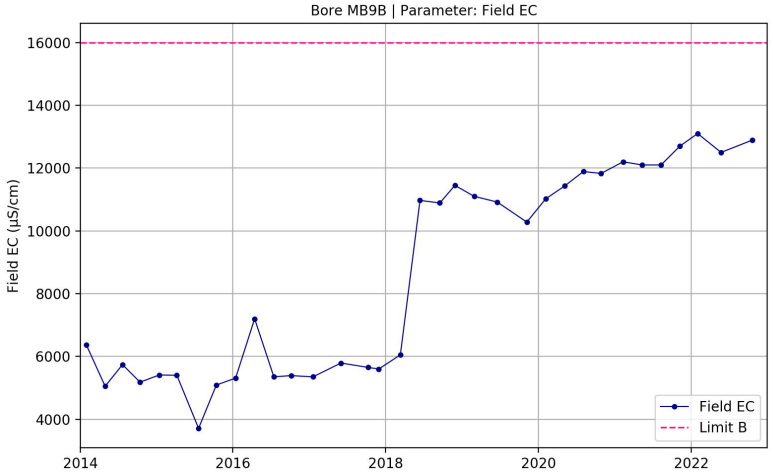
Bore MB9B | Parameter: D - Silver



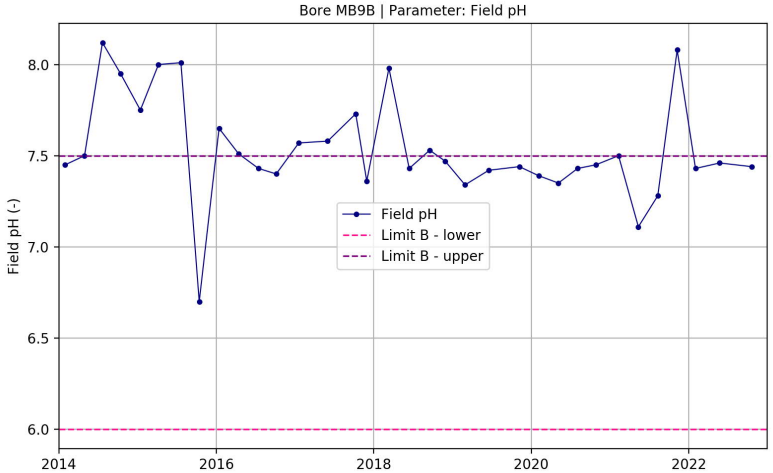
Bore MB9B | Parameter: D - Zinc



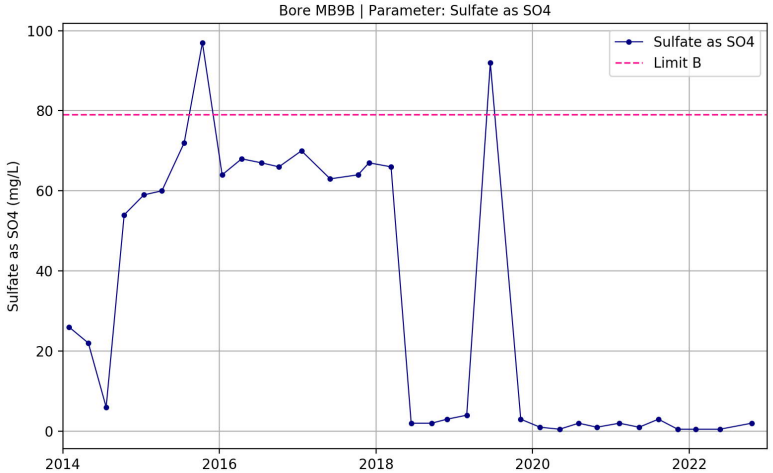
Bore MB9B | Parameter: Field EC



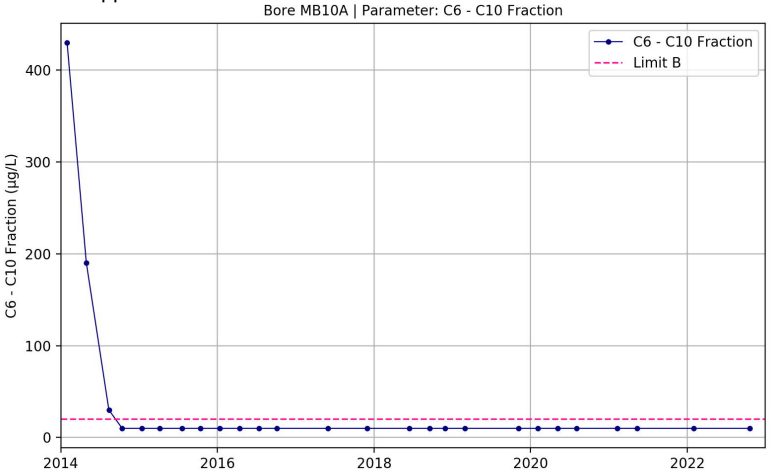
Bore MB9B | Parameter: Field pH



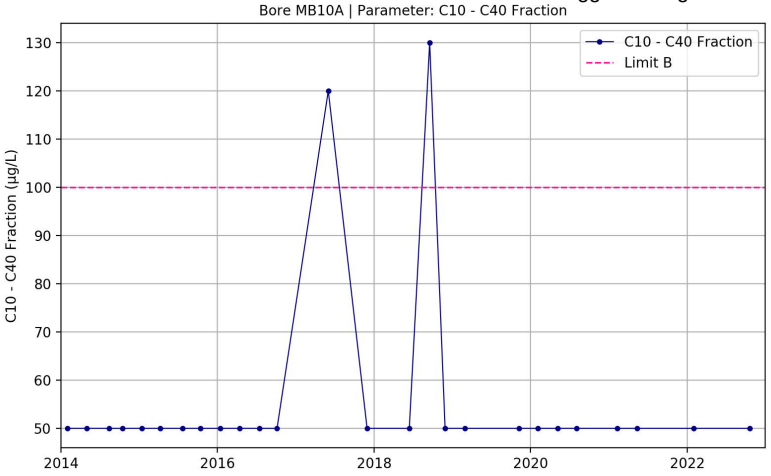
Bore MB9B | Parameter: Sulfate as SO4



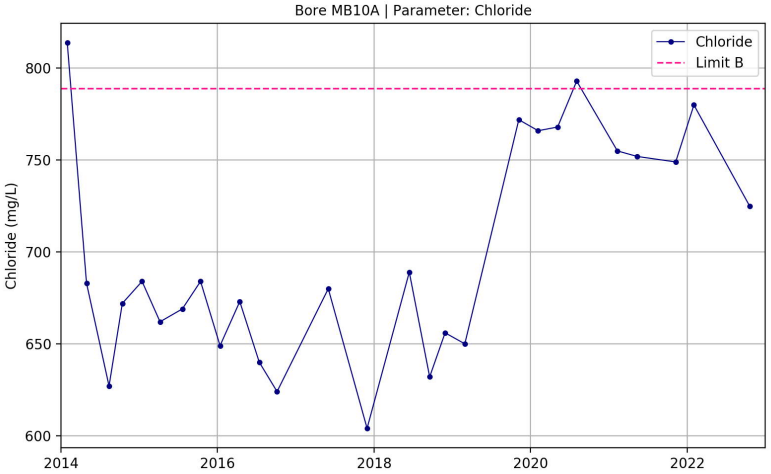
Bore MB10A | Parameter: C6 - C10 Fraction



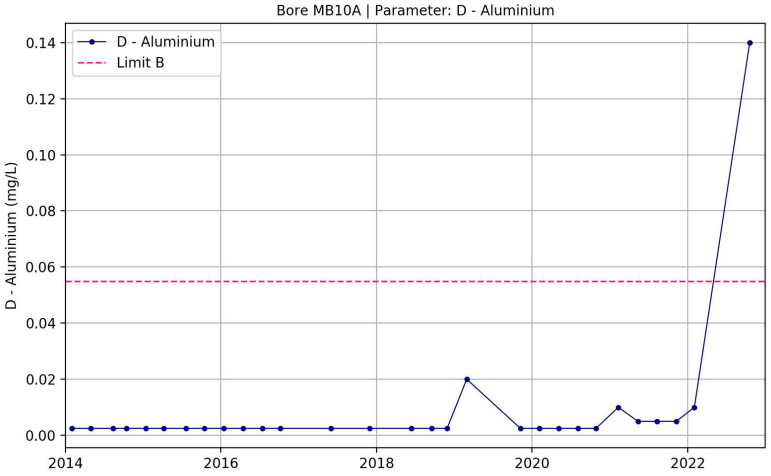
Bore MB10A | Parameter: C10 - C40 Fraction



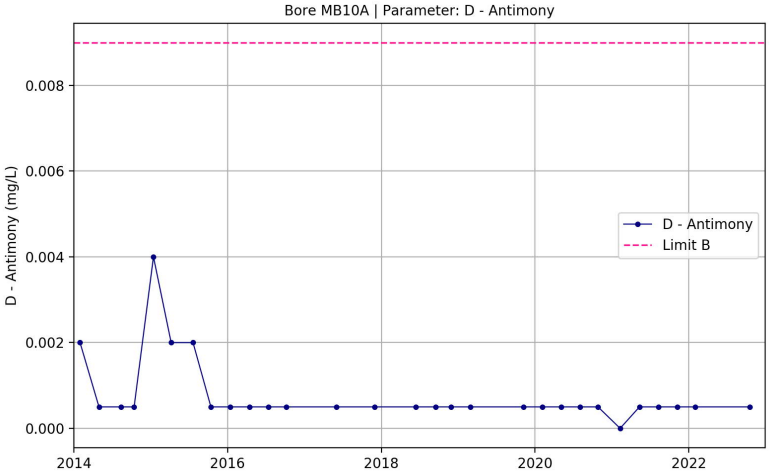
Bore MB10A | Parameter: Chloride



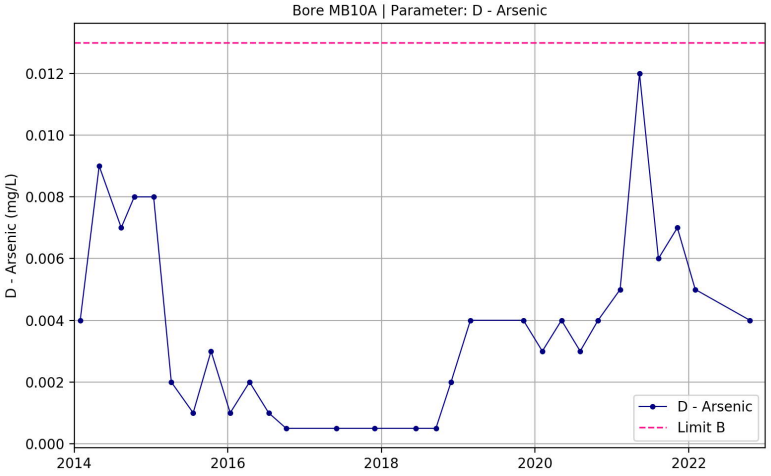
Bore MB10A | Parameter: D - Aluminium



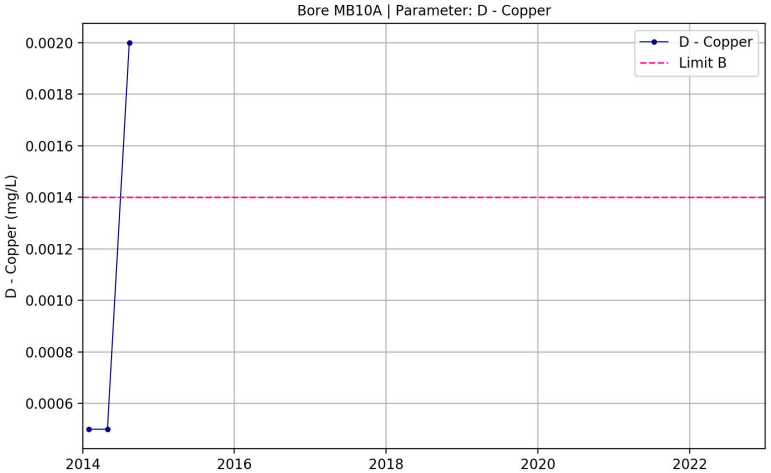
Bore MB10A | Parameter: D - Antimony



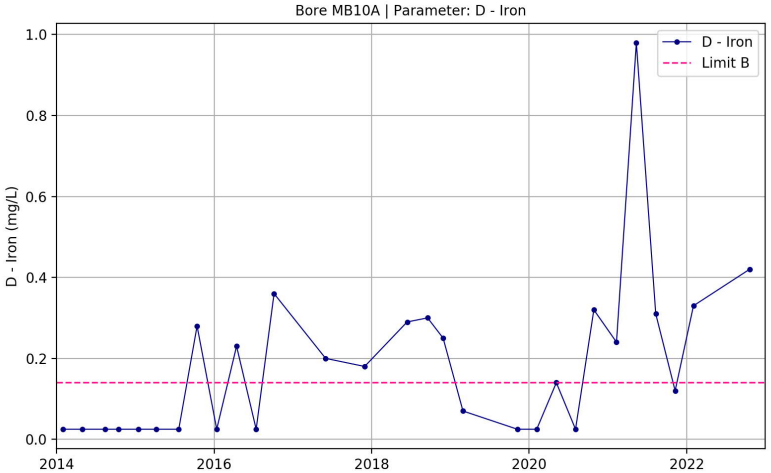
Bore MB10A | Parameter: D - Arsenic



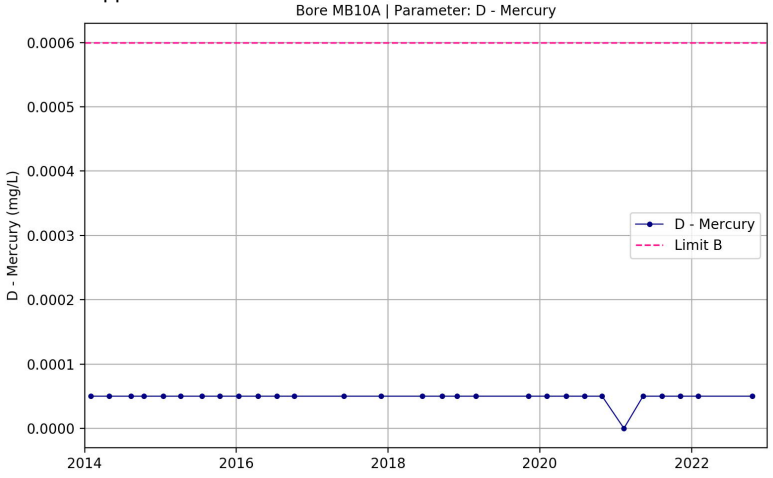
Bore MB10A | Parameter: D - Copper



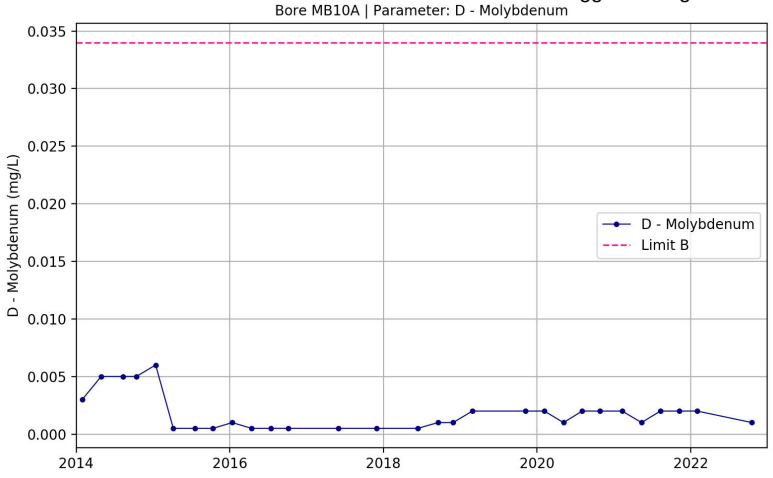
Bore MB10A | Parameter: D - Iron



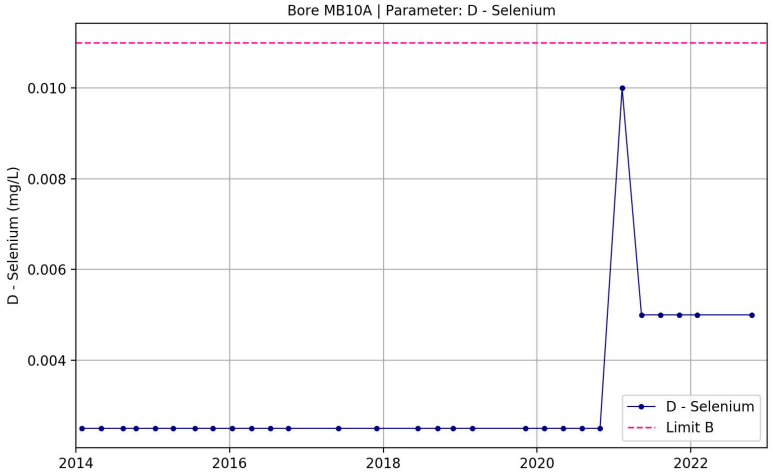
Bore MB10A | Parameter: D - Mercury



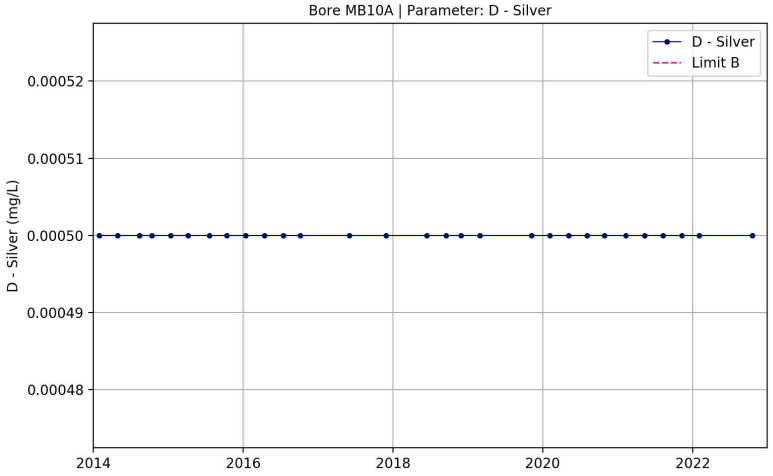
Bore MB10A | Parameter: D - Molybdenum



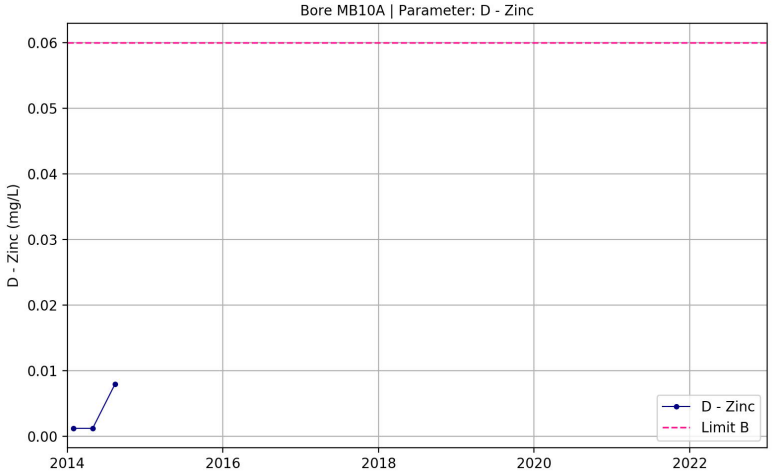
Bore MB10A | Parameter: D - Selenium



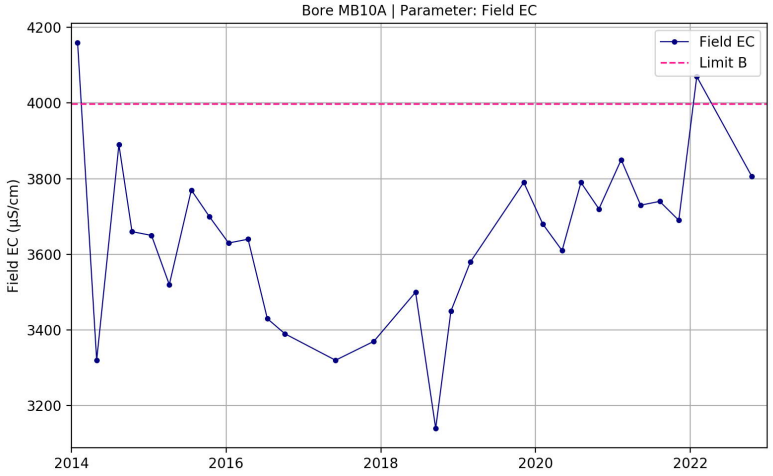
Bore MB10A | Parameter: D - Silver



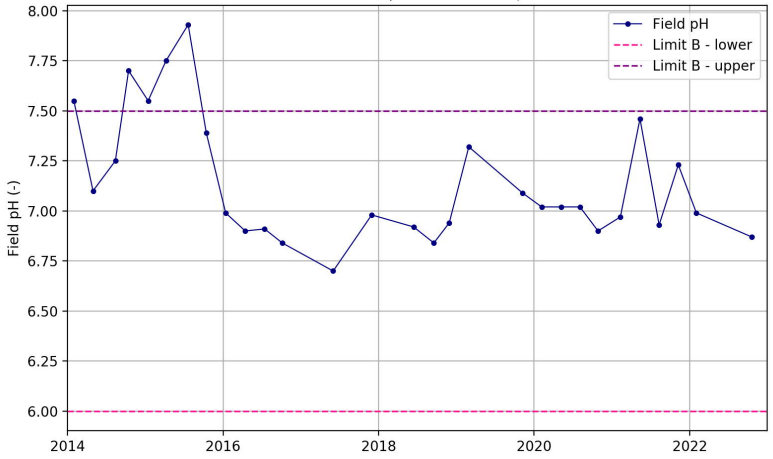
Bore MB10A | Parameter: D - Zinc



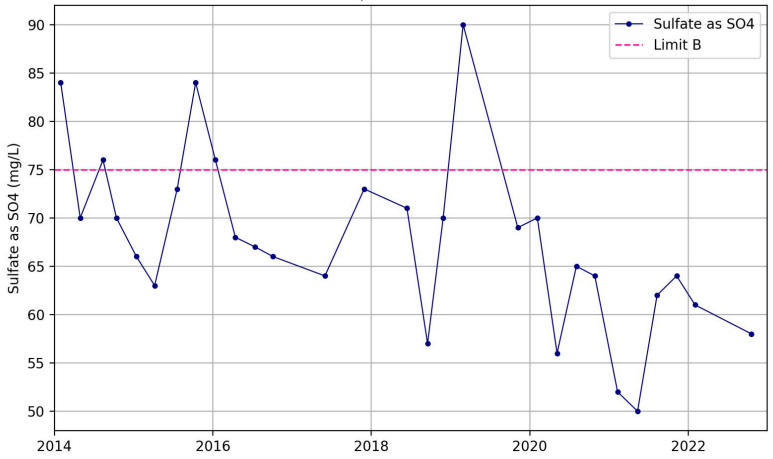
Bore MB10A | Parameter: Field EC

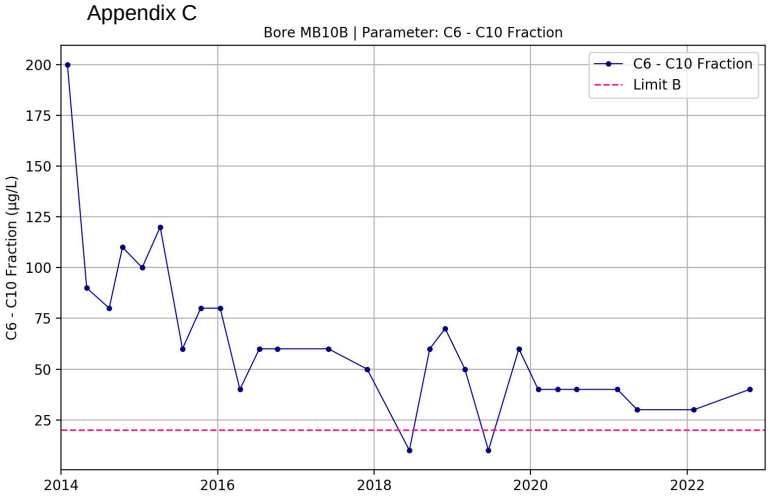


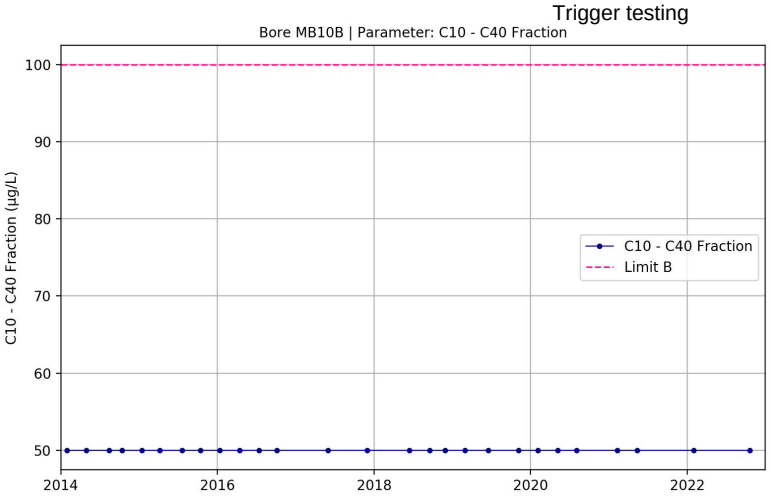
Bore MB10A | Parameter: Field pH

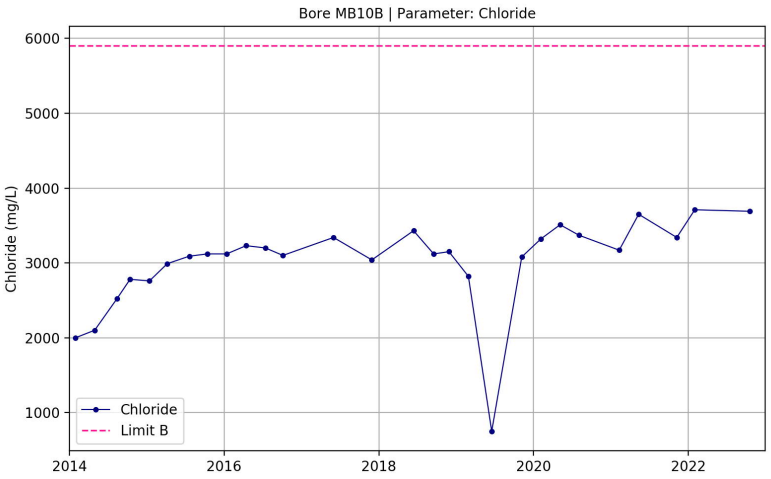


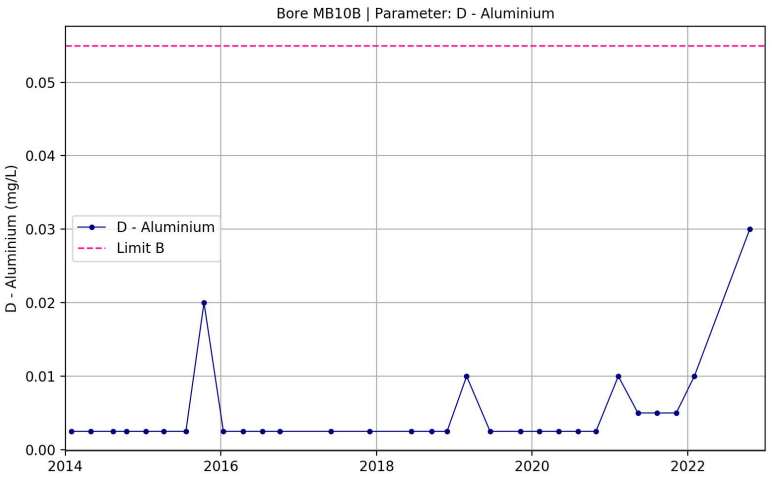
Bore MB10A | Parameter: Sulfate as SO4

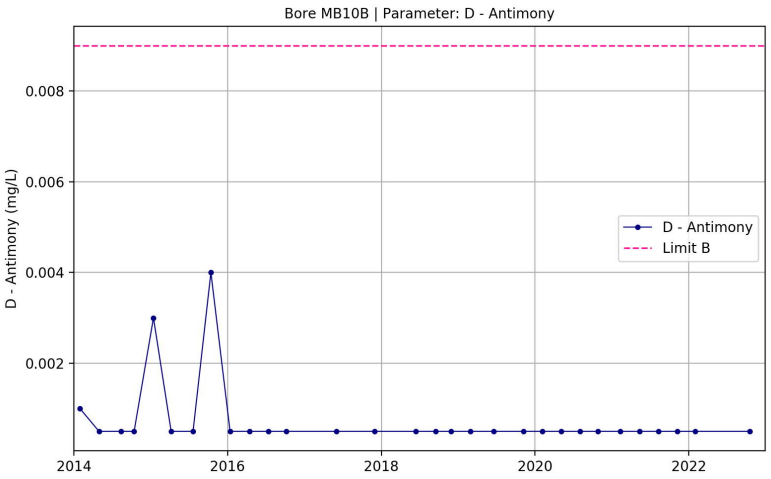


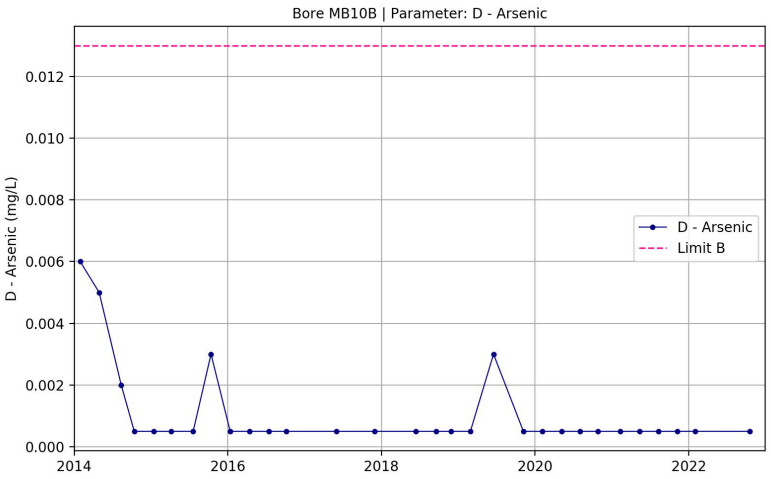

Bore MB10B | Parameter: C6 - C10 Fraction
C6 - C10 Fraction (µg/L)
C6 - C10 Fraction
Limit B

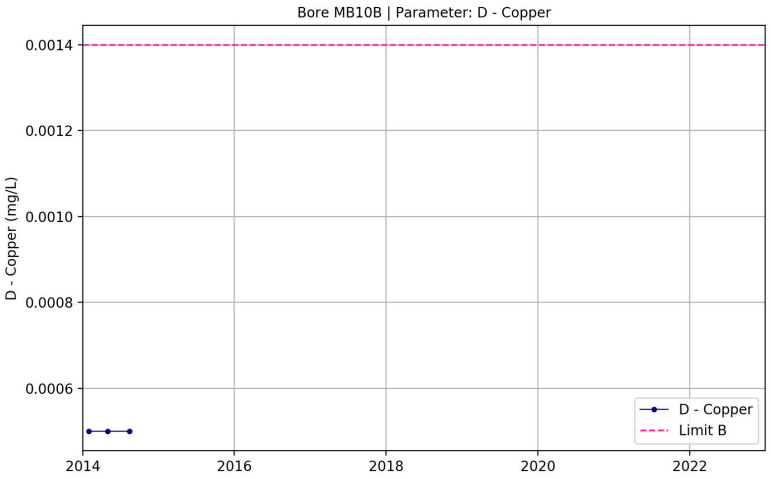

Bore MB10B | Parameter: C10 - C40 Fraction
C10 - C40 Fraction (µg/L)
C10 - C40 Fraction
Limit B

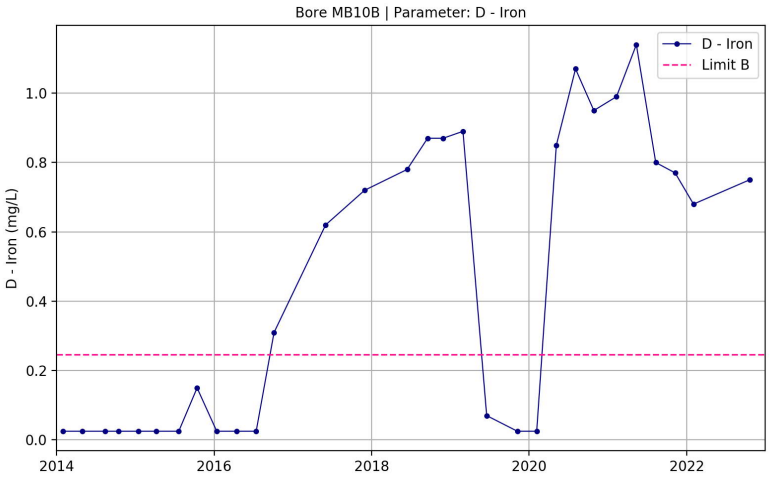

Bore MB10B | Parameter: Chloride
Chloride (mg/L)
Chloride
Limit B


Bore MB10B | Parameter: D - Aluminium
D - Aluminium (mg/L)
D - Aluminium
Limit B

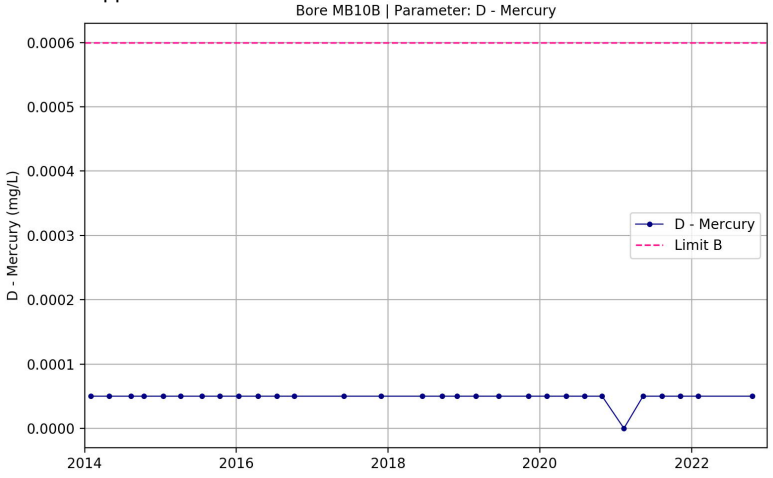

Bore MB10B | Parameter: D - Antimony
D - Antimony (mg/L)
D - Antimony
Limit B


Bore MB10B | Parameter: D - Arsenic
D - Arsenic (mg/L)
D - Arsenic
Limit B

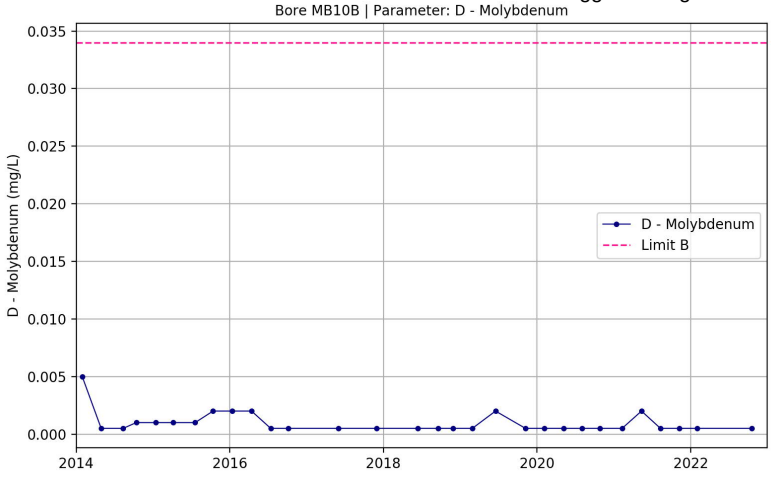

Bore MB10B | Parameter: D - Copper
D - Copper (mg/L)
D - Copper
Limit B


Bore MB10B | Parameter: D - Iron
D - Iron (mg/L)
D - Iron
Limit B

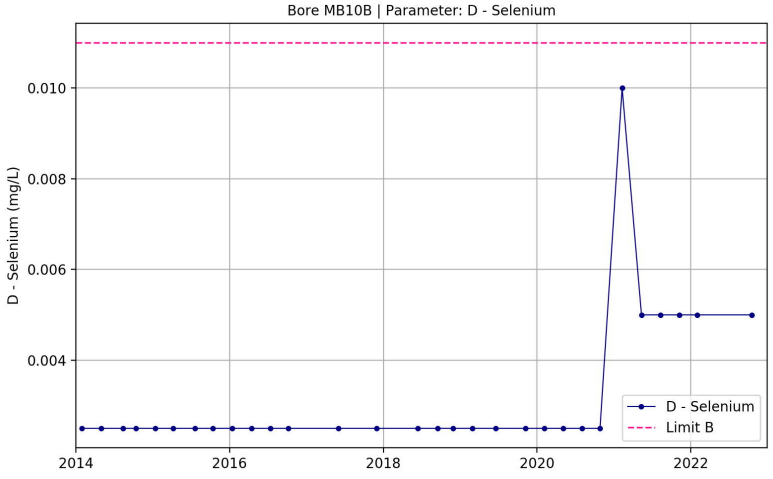
Bore MB10B | Parameter: D - Mercury



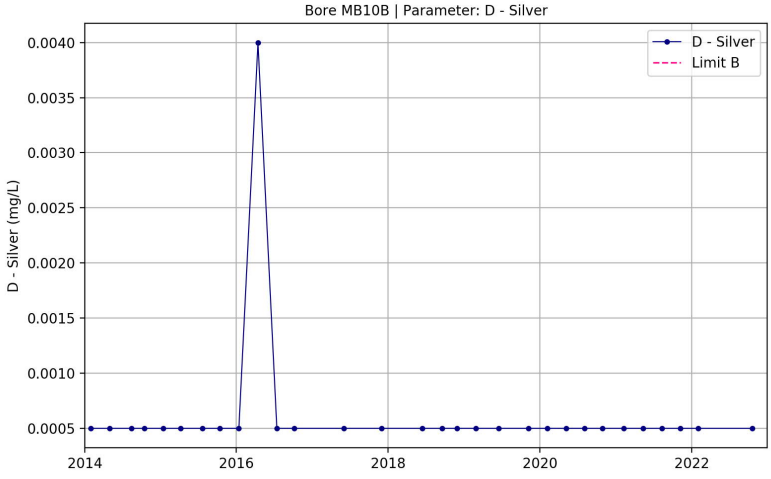
Bore MB10B | Parameter: D - Molybdenum



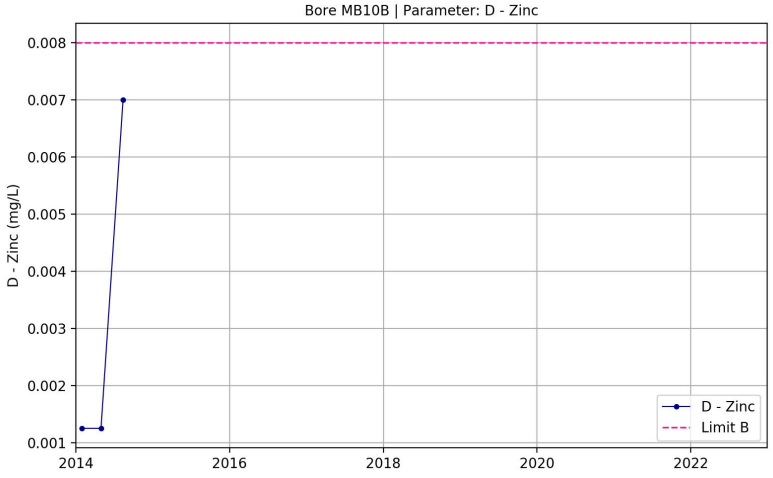
Bore MB10B | Parameter: D - Selenium



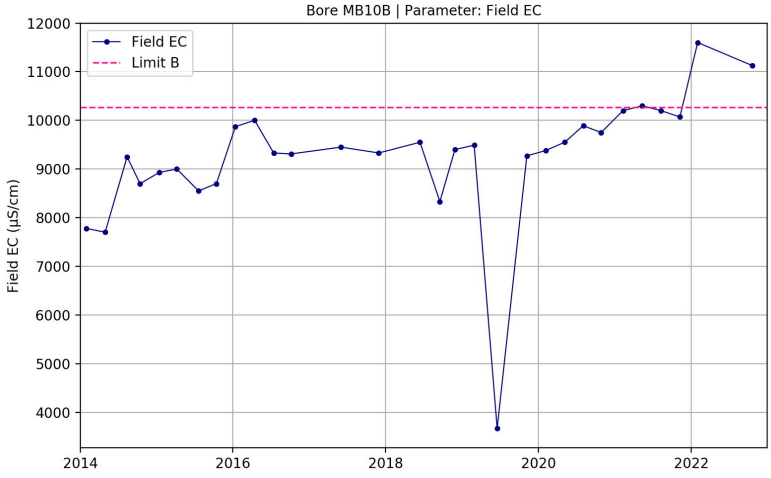
Bore MB10B | Parameter: D - Silver



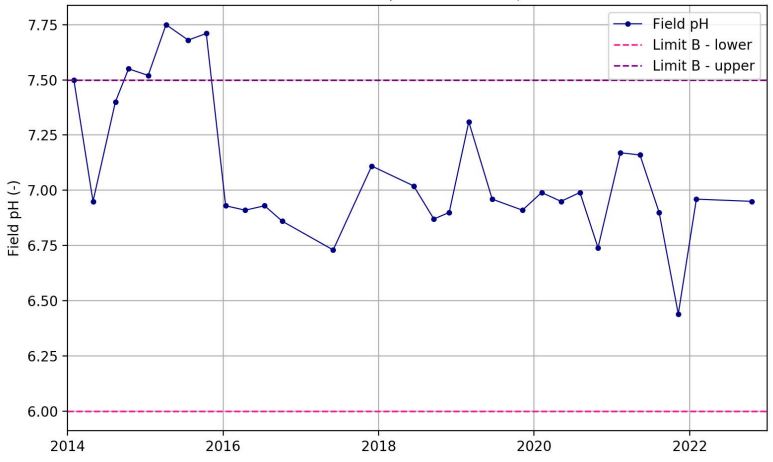
Bore MB10B | Parameter: D - Zinc



Bore MB10B | Parameter: Field EC



Bore MB10B | Parameter: Field pH



Bore MB10B | Parameter: Sulfate as SO4

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