Tomingley Gold Operations Pty Ltd

Tomingley Gold Mine

Water management plan

July 2022

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Glossary

Alluvial	Deposition from running waters.
Aquifer	Underground water storage within either disturbed or undisturbed strata.
Australian Height Datum	A common national surface level datum approximately corresponding to mean sea level.
Average Recurrence Interval	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger, e.g. floods with a discharge equivalent to the 1 in 100 year average recurrence interval flood event will occur on average once every 100 years.
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means.
Catchment	The land area draining through the main stream and tributary streams to a particular location.
Clean Water	Water that has not come into physical contact with areas associated with mining, ore processing or tailings storage.
Cumulative Rainfall Departure	Cumulative rainfall departure (CRD) from normal rainfall is an approach to evaluate the temporal correlation of rainfall with surface water or ground water environments.
Datum	A level surface used as a reference in measuring distances.
Dewatering	Transfer of water from underground workings to the surface.
Dirty Water	Water that contains an elevated sediment load.
Discharge	Quantity of water per unit of time flowing in a stream, for example cubic metres per second or megalitres per day.
Drawdown	A reduction in piezometric head within an aquifer.
Electricity conductivity	A measure of the concentration of dissolved salts in water.
Ephemeral	Stream that is usually dry, but may contain water for rare and irregular periods, usually after significant rain.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or overland runoff before entering a watercourse and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.
Groundwater	Water in a saturated zone, stratum or aquifer beneath the surface of the land.
Groundwater dependant ecosystem	Communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. A GDE may either be entirely dependent on groundwater for survival or it may use groundwater opportunistically or for a supplementary source of water.
Guideline	Numerical concentration or narrative statement that provides appropriate guidance for a designated water use or impact.
Hardness	The concentration of multivalent cations present in water. Hardness is a measure of the concentration of calcium and magnesium ions in water and is expressed in units of calcium carbonate ($CaCO_3$) equivalent. Hardness may influence the toxicity and bioavailability of substances in water.
Hydraulics	The physics of channel and floodplain flow relating to depth, velocity and turbulence.

Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in soils and rocks.
Hydrology	The study of rainfall and surface runoff processes.
Infiltration	Natural flow of surface water through ground surfaces as a result of rainfall events.
MacArthur-Forrest process	The process of applying cyanide to ore to extract gold.
Mine Water	Mine water consists of water generated within the open cut pits and from underground workings.
pH	Value taken to represent the acidity or alkalinity of an aqueous solution. It is defined as the negative logarithm of the hydrogen ion concentration of the solution.
Potable Water	Water of a quality suitable for drinking.
Process water	Water associated with mining, ore processing and tailings storage.
Project	Tomingley Gold Project.
Raw Water	Water sourced from borefield or from a waterway. Raw is defined as not being treated for consumption. Also referred to as non-potable.
Riparian	Pertaining to or situated on the bank of a river of other water body.
Risk	The chance of something happening that will have an impact upon objectives. It is measured in terms of consequence and likelihood.
Runoff	Amount of rainfall that ends up as streamflow.
Sediment	Soil or other particles that settle to the bottom of lakes, rivers, oceans and other waters.
SILO	An enhanced climate data bank based on historical climate data from 1889 provided by the Bureau of Meteorology. Records are mainly based on observed data, with interpolation where there are data gaps.
Strata	Geological layers below the surface.
Surface Water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Tailings	The by-product resulting from the processing of ore.
Trigger value	The concentration or load of physicochemical characteristics of an aquatic ecosystem, below which there exists a low risk that adverse ecological effects will occur. They indicate a risk of impact if exceeded and should ‘trigger’ action to conduct further investigations or to implement management or remedial processes.

Abbreviations

AHD	Australian Height Datum
ARI	Average Recurrence Interval
BOM	Bureau of Meteorology
cm	Centimetre
CRD	Cumulative rainfall departure
DS Act	Dam Safety Act 2015
EC	Electrical conductivity
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPL	Environment protection licence
DPE	Department of Planning and Environment
GDE	Groundwater dependant ecosystem
GHD	GHD Pty Ltd
MHRDC	Maximum harvestable rights dam capacity
ML	Mining Lease
Mtpa	Million tonnes per annum
NATA	National Association of Testing Authorities
NRAR	Natural Resource Access Regulatory
PIRMP	Pollution Incident Response Management Plan
POEO Act	Protection of the Environment Operations Act 1997
RSF	Residue Storage Facility
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TSS	Total suspended solids
TGO	Tomingley Gold Mine operated by Tomingley Gold Operations Pty Ltd
WAD	Weak Acid Dissociable
WAL	Water Access Licence
Water Act	Water Act 1912
WM Act	Water Management Act 2000
WMP	Water Management Plan
WSP	Water Sharing Plan

1. Introduction

1.1 Overview

Tomingley Gold Operations Pty Ltd, a wholly owned subsidiary of Alkane Resources Ltd, operates the Tomingley Gold Mine in Central Western New South Wales (TGO). TGO is located near the village of Tomingley, approximately 50 km southwest of Dubbo and north of Peak Hill (refer to Figure 1-1).

Project approval was granted in July 2012, and the mining lease issued in 2013. The processing plant was commissioned in January 2014 and has been operating since late May 2014. Mining is based on four gold deposits (Wyoming One, Wyoming Three, Caloma One and Caloma Two). In early 2019, TGO commenced underground mining of the Wyoming ore body.

The Project includes a processing plant and two associated Residue Storage Facilities (RSFs).

The original approval has been modified five times. A summary of the site history at TGO is included in Table 1-1.

Table 1-1 Site history

Year	Month	Activity
2012	July	Project approval
2013	February	Mining lease granted
		Construction of key processing infrastructure complete including RSF, additional surface water management features constructed and in use
	November	Mining of overburden commenced only necessary surface water management features constructed
		Modification 1 approved
2014	May	Water Management Plan Revision 1 prepared
2015	April	Modification 2 approved
	July	Additional Groundwater Bores installed around Raw Water and Process Water Dam
	October	Commencement of Wyoming One Pit
		Modifications to surface water management system around Caloma One Pit
	December	Expansion of Sediment Basin 5 capacity
2016	February	Water Management Plan Revision 2 prepared
	May	Modification 3 approved
	July	Commencement of Caloma Two Pit
2017	March	Expansion of Sediment Basin 4 and alteration of clean water diversion
	November	Water Management Plan Revision 3 prepared
2019	January	Site transitions from open cut to underground operation
2020	May	Modification 4 approved
2021	May	Modification 5 approved
2022		Modification 6 approved

TGO is currently operating in accordance with the following approvals:

- Project Approval 09_0155 (as modified)
- Environment Protection Licence (EPL) 20169 (licence version date 24 October 2019)
- Mining Lease (ML) 1684

This water management plan (WMP) covers all operations at TGO and includes the approved mining operations and associated infrastructure within the site boundary (refer to Figure 1-2).

Land use within and surrounding TGO includes:

- Residential and rural residential
- Agriculture
- Transportation infrastructure (Newell Highway)
- Commercial (Tomingley township)
- Recreation and community facilities
- Former mining operations, south of Tomingley (Myall United Gold Mine)

1.2 Purpose

This WMP addresses the specific water components of the conditions of the Project Approval (PA) 09_0155 (as modified by Modification 6: refer to Appendix A) and outstanding statement of commitments as part of the Project (refer to Appendix A). TGO will implement this approved WMP.

1.3 Preparation of this plan

PA 09_0155 requires this WMP to be prepared by a suitably qualified and experienced person(s) whose appointment has been endorsed by the Secretary of the Department of Planning and Environment (refer to Appendix B). This plan was originally prepared in 2014 on behalf of TGO by:

- Mr Mark Passfield of SEEC Pty Ltd
- Mr James Barrow

The plan has subsequently been revised by TGO in consultation with:

- Mr Tyler Tinkler of GHD Pty Ltd (GHD)
- Dr Stuart Gray of GHD

1.4 Revision history

This WMP has been revised as summarised in Table 1-2.

Table 1-2 Revision history

Year	Month	Activity
2014	May	Water Management Plan Revision 1 prepared
2016	February	Water Management Plan Revision 2
2017	November	Water Management Plan Revision 3 draft
2019	July	Water Management Plan Revision 3
2021	October	Water Management Plan Revision 4
2022	July	Water Management Plan Revision 4 submitted for approval

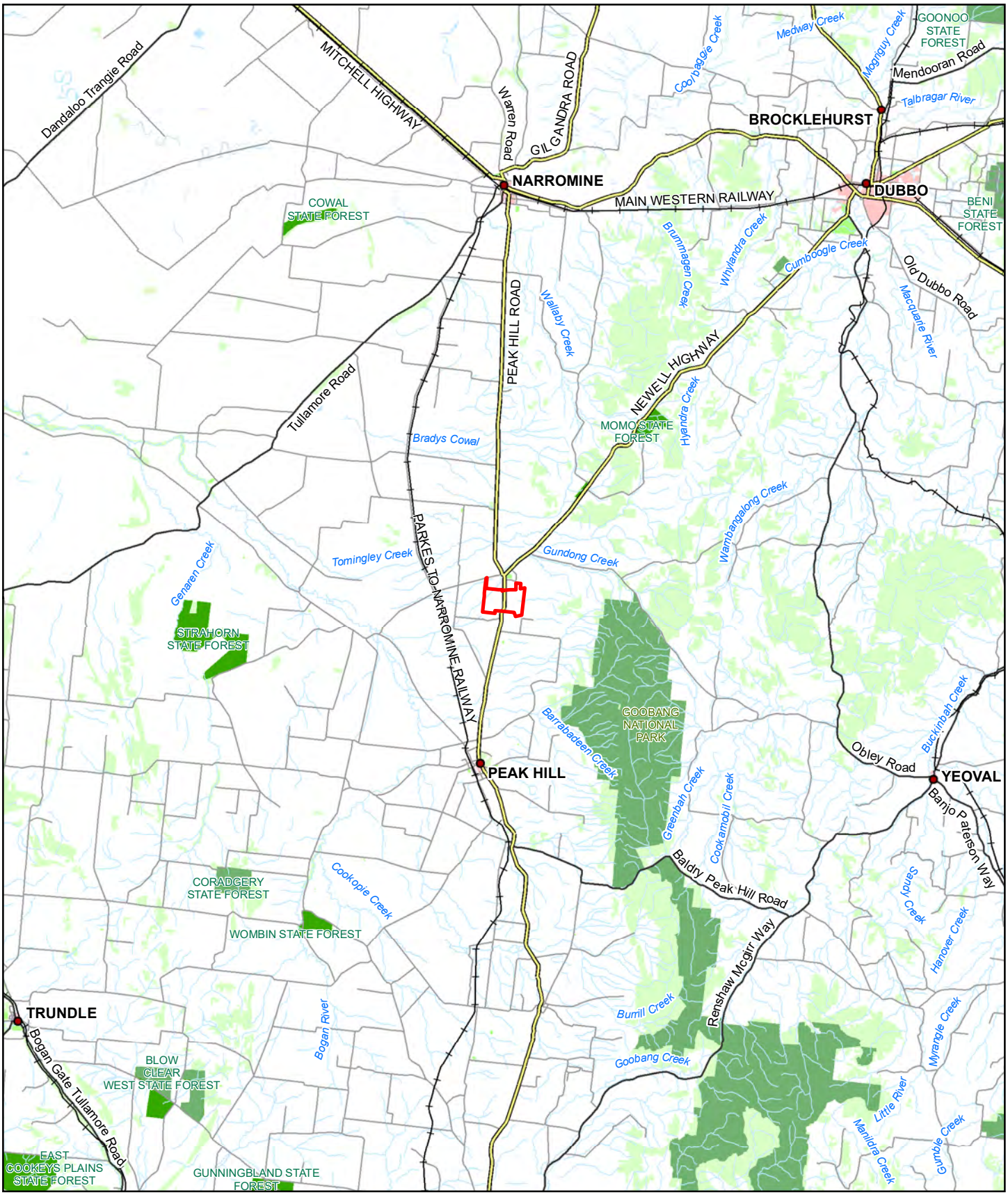
The WMP has been prepared in consultation with the NSW Environment Protection Authority (EPA), Department of Planning and Environment Water (DPE Water; formerly Department Primary Industries) and Dam Safety NSW, as required by the condition of the Project Approval 09_0155 (as modified).

Consultation with stakeholders is summarised in Table 1-3 and evidence of consultation is included in Appendix B.

Table 1-3 Consultation record

Party	Revision	Circulation date	Feedback date
NSW Office of Water (now DPE Water and NRAR)	1	4 December 2012	30 January 2013
EPA	1	6 December 2012	Circa July 2013
EPA	2	Circa February 2012	5 August 2016
EPA	4	1 February 2022	14 February 2022
Dam Safety NSW	4	14 February 2022	No feedback with 14 days of circulation date
DPE Water	4	1 February 2022	4 July 2022

TGO must notify Dams Safety NSW of its intention to construct any part of RSF1 or RSF2 prior to commencing construction.



LEGEND

- Site boundary
- Railway
- Principal Road
- Secondary Road
- Minor Road
- Watercourse
- Built Up Area
- Recreation Area
- National Park
- State Forest
- Forest Or Shrub

Paper Size A4

0 1.5 3 6 9 12 15

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Tomingley Gold Operations
Water Management Plan - 2021

Job Number 12543651
Revision 0
Date 13 Oct 2021

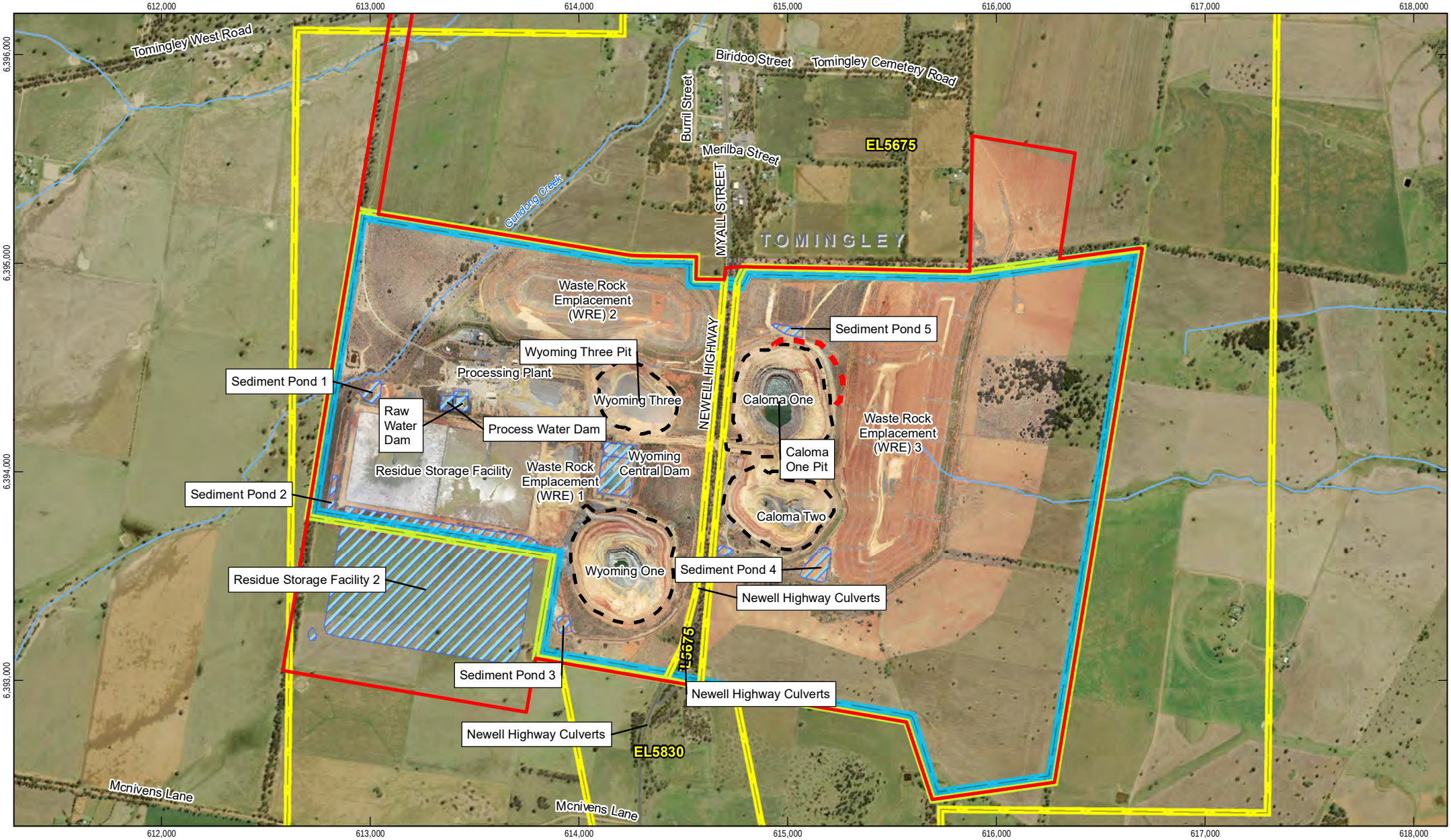
Locality plan

Figure 1-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\12543651\GIS\Maps\Deliverables\WMP\12543651_WMP001_Locality_0.mxd

Data source: Geoscience Australia: 250k Topographic Series 3, 2006; LPI: DTDB, 2012. RWC: Site boundary, 2021. Created by: gmcdiarmid, tmorton



Paper Size A4

0 90 180 360 540 720 900

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Site boundary
- Tomingley Gold Operations Pty Ltd
- Alkane Resources Ltd
- Water storages
- Existing Open Cut
- Approved Open Cut
- Watercourse

Tomingley Gold Operations
Water Management Plan - 2021

Job Number	12543651
Revision	0
Date	13 Oct 2021

Site layout and mineral titles

Figure 1-2

\\ghdnet\ghd\AU\Newcastle\Projects\22\12543651\GIS\Maps\Deliverables\WMP\12543651_WMP002_SiteLayout_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: NSW DT&I R&E: Mine titles; Tomingley Gold Operations: Imagery, 2015. LPI: DTDB, 2012; LPI, imagery, 2017. RWC: Site boundary, 2021. Created by: gmcdiarmid, tmorton

2. Regulatory requirements

2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is administered by DPE and is the core legislation relating to planning and development activities in NSW.

The Project was granted approval under Section 75J of the EP&A Act in July 2014. The potential impacts of the Project were assessed in the Environmental Impact Statement (EIS). This WMP has been prepared in accordance with the Condition 32 of Project Approval 09_0155 and the statement of commitments that formed part of the EIS.

2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the EPA. The objectives of the POEO Act are to protect, restore and enhance the quality of the environment.

Under the POEO Act, an EPL is required for premises at which a 'scheduled activity' is conducted. Activities identified as occurring at TGO include, crushing, grinding or separating; mineral processing; and mining for minerals.

TGO currently holds EPL 20169 which specifies monitoring requirements, discharge concentration limits and storage freeboard requirements for the RSF and Process Water Dam (PWD).

2.3 Water Act 1912

The Water Act 1912 is administered by DPE Water and Natural Resource Access Regular (NRAR) (formerly Department of Primary Industries – Water) and has historically been the main legislation for managing water resources in NSW. The Water Act 1912 was progressively phased out and replaced by Water Sharing Plans (WSPs) under the Water Management Act 2000 (WM Act), however the Water Act 1912 still applies to aquifer interference activities in all areas of NSW.

Several licences are held by TGO under the Water Act 1912 for groundwater monitoring bores (refer to Table 2-1).

Table 2-1 Licenced groundwater bore details

Licence number	Issue date	Expiry date	Purpose
80BL245428	23 September 2009	Perpetuity	Groundwater Monitoring
80BL245429			
80BL245430			
80BL245431			
80BL245432			
80BL620426	27 October 2014		

2.4 Water Management Act 2000

The WM Act is administered by DPE Water and NRAR. The aim of the WM Act is to ensure that water resources are conserved and properly managed for sustainable use.

Fresh water sources throughout NSW are managed via WSPs under the WM Act. Key rules within the WSPs specify when licence holders can access water and how water can be traded. An amendment to the WM Act (Section 60I) came into effect on 1 March 2013, prohibiting the taking, removal or diversion of water from a water source, or relocation of water from one part of an aquifer to another part, without an access licence. Various activities are captured by the provisions of the amendment including mining, mineral exploration and petroleum exploration.

Table 2-2 identifies the WALs currently held by TGO under the WM Act. The extraction of water under the approvals and licences for the Woodlands Borefield do not form part of TGO for the purpose of the WMP.

Table 2-2 Water sharing plan licences and approvals

WAL	Extraction limit (ML/year)	WSP	Description
Surface Water			
80CW809661	NA	NA	Diversion Works Approval (western boundary diversion structure)
Groundwater			
WAL28643	220	Lachlan Fold Belt Murray Darling Basin Groundwater Source	Aquifer
WAL29266	70		
Woodlands Borefield			
80WA705442	NA	Lower Macquarie Groundwater Source (2006), Zone 6	Works Approval
WAL20270	1000		Aquifer (Woodlands Borefield)

Maximum Harvestable Rights

Landholders are permitted to intercept and store a proportion of runoff from their property without a licence under the WM Act. In addition, no licence is required for water stored within dams that:

- Control or prevent soil erosion
- Capture, contain and recirculate drainage
- Have no catchment (i.e. “turkey’s nests”)

The existing surface water storages that are part of TGO all fall into one of the above categories and therefore do not require licensing under the WM Act.

Controlled Actions

Any works within the defined riparian zone of a creek require a Controlled Activity Approval, unless defined as exempt. NRAR has developed *Guidelines for Instream Works on Waterfront Land* (NOW, 2012a) and *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012b), which provide recommendations for the design and construction of instream works, including:

- Maintaining the natural geomorphic processes by allowing for natural movement of sediment, woody debris and not increasing scour and erosion within the existing watercourse.
- Maintaining the existing watercourses hydrologic function through accommodation of low flows and not altering the natural bank full or flood flows.
- Installation of scour protection when required.
- Undertaking visual inspections and maintenance on the watercourse during the works.

2.5 Dams Safety Act 2015

Dam safety is regulated by Dam Safety NSW under the Dam Safety Act 2015 (DS Act).) A 'declared dam' is a dam gazetted in accordance with Section 4 of 2019 regulations of the DS Act. 'Notification areas' are declared by Dam Safety NSW under Section 48 of the DS Act.

In accordance with the DS Act, the 'Tomingley Residue Storage Facility' (RSF Cells 1 and 2) and the Wyoming Central Dam are defined as declared dams, by virtue of being published in the NSW Government Gazette on 23 April 2021 (NSW Government 2021).

2.6 Policies and guidelines

NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (DPIW 2012) clarifies water licensing and approval requirements for aquifer interference activities in NSW, outlining the water licensing requirements under the Water Act and WM Act. Sufficient licences must be held to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Many mining operations continue to take water from groundwater sources after operations have ceased. This take of water continues until an aquifer system reaches equilibrium and must be licensed.

The NSW Aquifer Interference Policy requires that potential impacts on groundwater sources, including their users and groundwater dependent ecosystems (GDEs), be assessed against minimal impact considerations, outlined in Table 1 of the policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. The minimal impact considerations relevant for to the Project were assessed in the EIS.

NSW State Groundwater Policy

The objective of the NSW State Groundwater Policy Framework Document (DLWC 1997) is to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW.

This management plan will seek to follow the principles of this policy and include groundwater triggers.

Australian and New Zealand Guidelines for Fresh Water Quality

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) provide guidance for assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. ANZG (2018) was published in 2018 after a scientific review of the ANZECC (2000a) guidelines.

3. Environment

The purpose of this section is to provide details of the baseline surface and groundwater environment for TGO. Baseline monitoring data collected as part of the monitoring program is presented in Section 6.

3.1 Climate

3.1.1 Rainfall

A historical rainfall record for TGO was obtained for the Peak Hill Post Office Station (station number 50031).[1] This station was selected as it is located approximately 15 kilometres to the south of TGO. The period of rainfall data used for this assessment extended from 1 January 1889 to 1 January 2021 (a total of 132 years). The historical SILO rainfall data between 1889 and 2020 are shown in Figure 3-1.

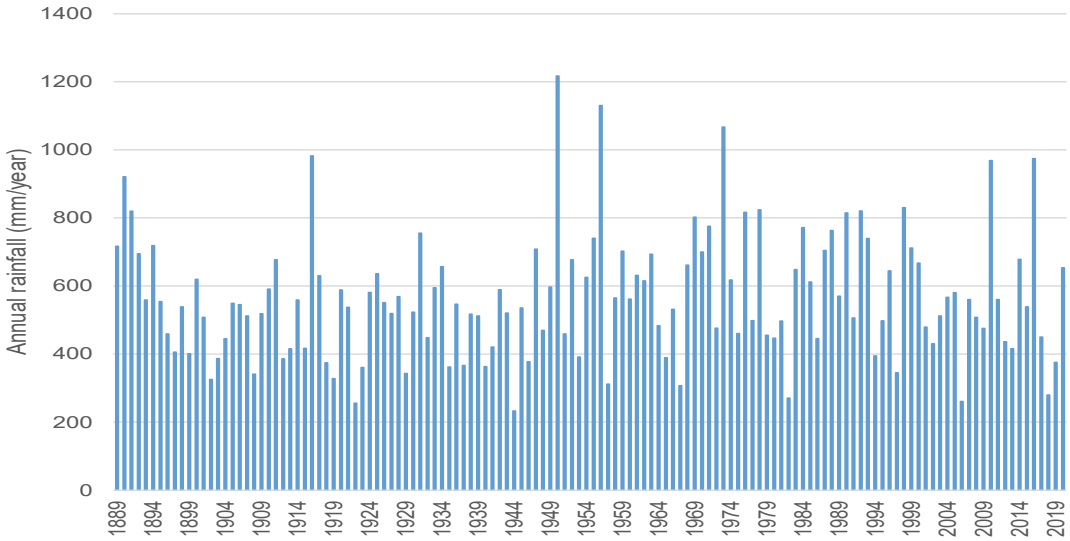


Figure 3-1 Historical rainfall record

The annual statistics associated with the SILO data represented in Figure 3-1 are:

- Minimum rainfall total – 232.6 mm in 1944
- Median rainfall total – 544.9 mm
- Average rainfall total – 563.9 mm
- Maximum rainfall total – 1217.1 in 1950

The total site rainfall for 2020 is 697.4 mm, which is above the long-term historical average rainfall total of 563.9 mm.

[1] A historical record of daily rainfall depth for TGO was obtained in the form of a patched point data set from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Science, Information Technology and Innovation (DSITI). SILO patched point data is based on observed historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' by interpolating with data from nearby stations (DSITI, 2020).

The monthly and annual rainfall totals from the SILO data set are summarised in Figure 3-2. From Figure 3-2 it can be seen that:

- Average monthly rainfall is approximately 50 mm.
- All months have experienced periods of no (or very low) rainfall.
- Rare flood events are more likely to occur around summer (October to April).
- Lowest rainfalls typically occur during April and September (based on the 25 percentile and 75 percentile range).
- Half of the years have annual rainfalls between approximately 445 mm and 670 mm (based on the 25 percentile and 75 percentile range), with a median rainfall of approximately 550 mm.

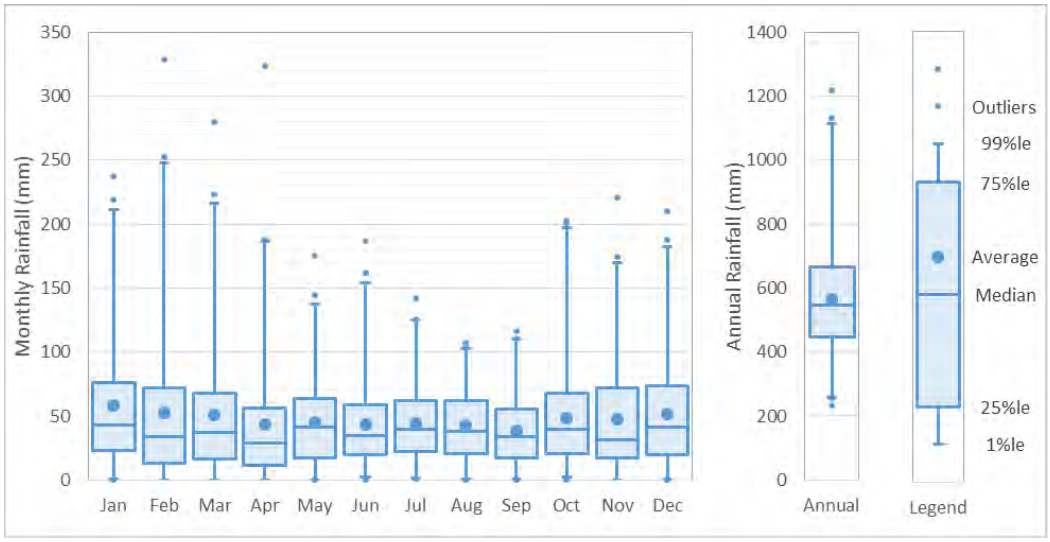


Figure 3-2 Monthly and annual rainfall range - Peak Hill Post Office

3.1.2 Evaporation

Continuous daily evaporation data were obtained from SILO (2020), based on the latitude and longitudinal location of the site, for the same period as the rainfall data series (refer to Section 3.1.1). Figure 3-3 summarises the range of daily evaporation rates for the site for each month and for the entire SILO (2020) data set. From Figure 3-3 evaporation rates within the summer months are significantly higher than those of the winter months.

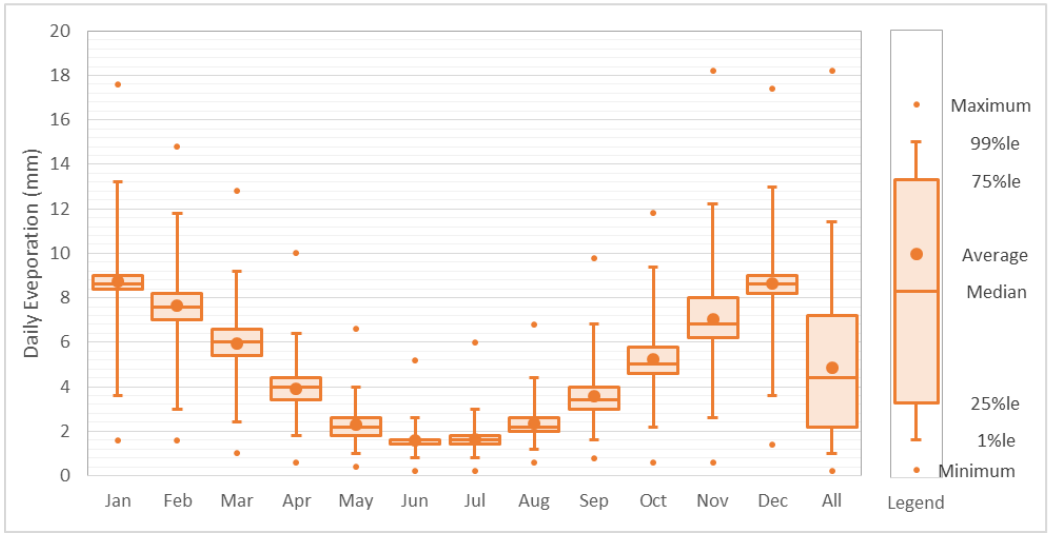


Figure 3-3 Daily evaporation range

3.2 Hydrology and waterways

TGO is located within the catchment of Gundong Creek (refer to Figure 3-5), which joins the Bogan River approximately 10 km west of TGO. The Bogan River is a part of the Macquarie-Bogan system within the Murray-Darling Basin in the central west of NSW.

Watercourses and drainage lines near TGO are generally well-defined valley fill channels, with ephemeral flows (i.e. only flowing following large or extended periods of rainfall).

Gundong Creek includes historical diversions, constructed as part of the development of the Tomingley township. Near TGO, Gundong Creek is a third order stream with a core riparian zone of approximately 60 m. Historical clearing and grazing had led to bank erosion and instability in Gundong Creek.

3.2.1 Newell Highway

Prior to construction of TGO, flows within Gundong Creek and its tributaries were influenced by the Newell Highway, which crosses Gundong Creek by way of three culverts.

Anecdotal evidence gathered during the Project EIS (SEEC, 2011) indicated that the Newell Highway periodically overtopped within the vicinity of these culverts during short duration rainfall events.

Hydrological modelling was undertaken to estimate the likely effects of TGO on flooding of the Newell Highway. The modelling includes constructed diversions, the central clean water drain and modified catchment areas that are associated with TGO. The model was used to estimate the pre-mining and post-mining hydrographs for Gundong Creek at the Newell Highway culverts for the 10 year, 20 year, 50 year and 100 year average recurrence interval (ARI) critical duration design storm events.

The modelling indicates that the maximum modelled flow rates within Gundong Creek are expected to reduce because of the Project (refer to Figure 3-4). Therefore, the potential for overtopping of the Newell Highway is expected to remain comparable (or slightly reduced) because of the Project.

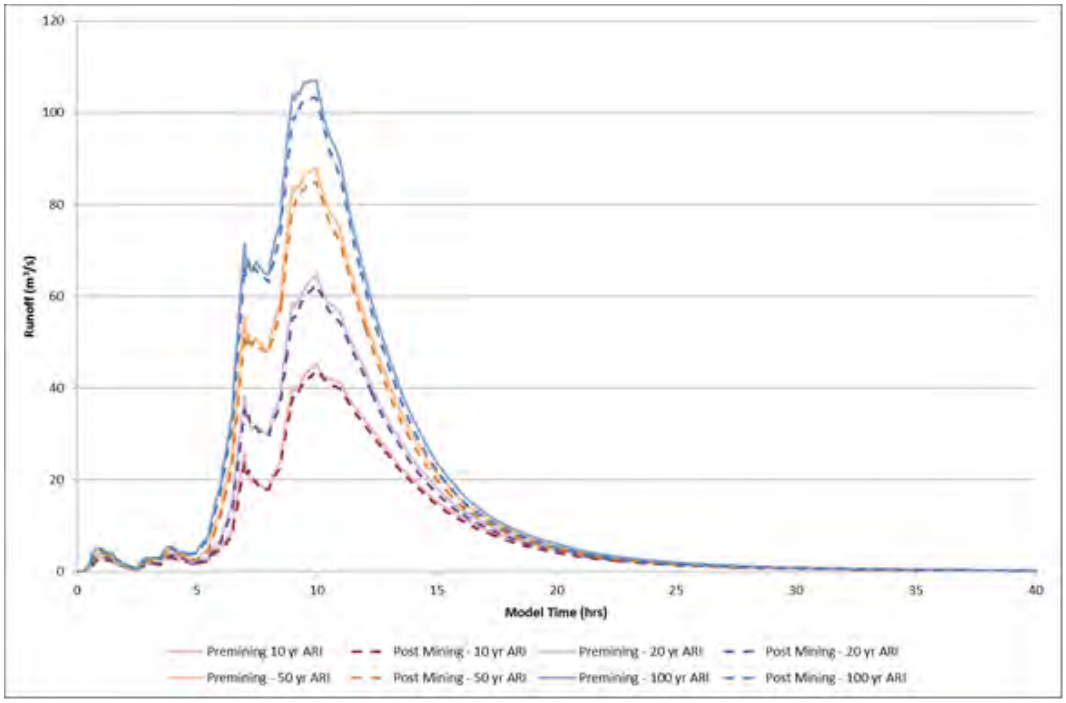
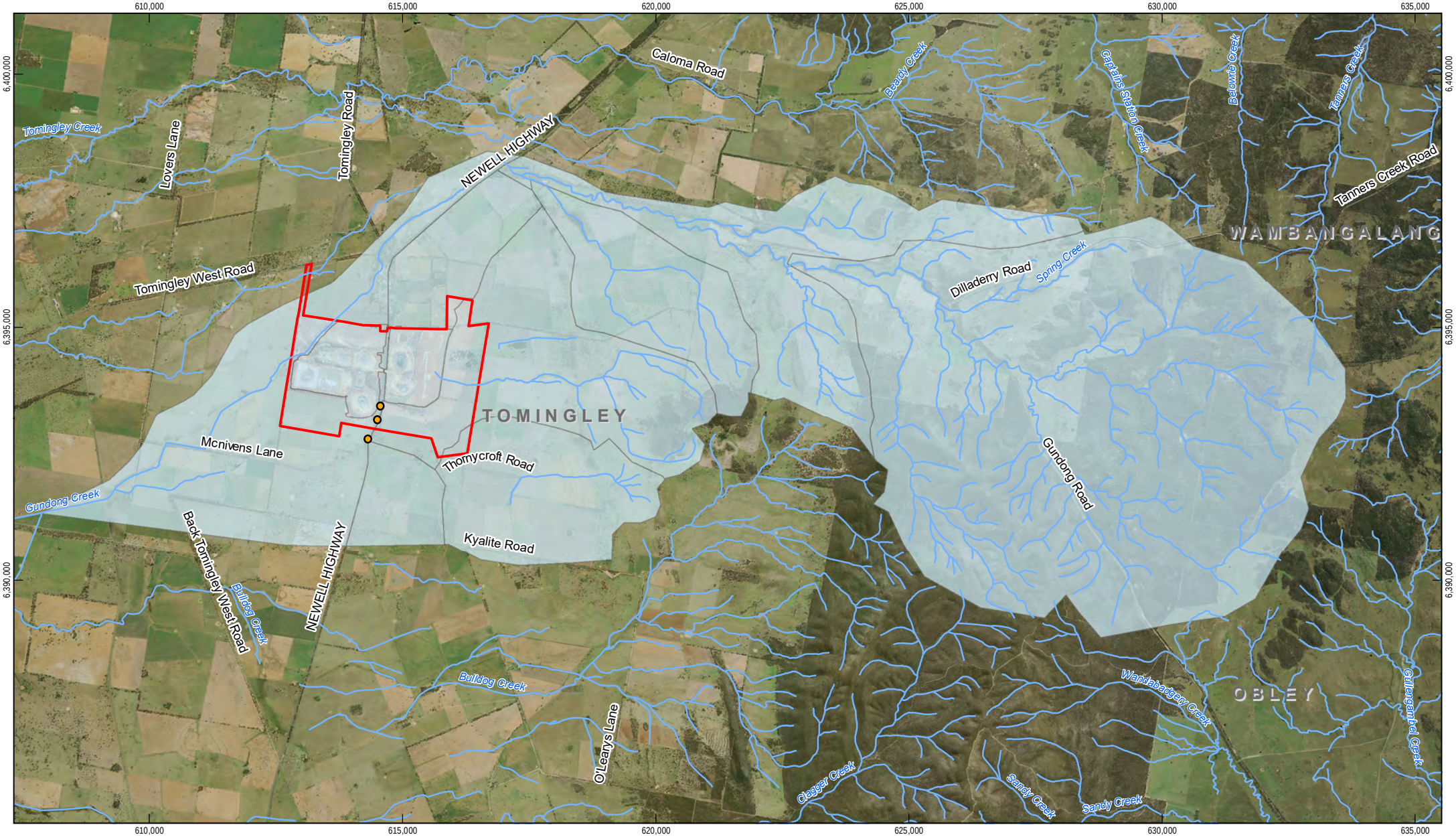


Figure 3-4 Hydrological results for Gundong Creek catchment response at the Newell Highway culverts



Paper Size A4

0 350700 1,400 2,100 2,800 3,500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Site boundary
- Regional catchment
- Highway culverts
- Watercourse

Tomingley Gold Operations
Water Management Plan

Job Number	12543651
Revision	0
Date	13 Oct 2021

Regional catchment plan

Figure 3-5

\\ghdnet\ghd\AU\Newcastle\Projects\22\12543651\GIS\Maps\Deliverables\WMP\12543651_WMP003_RegCatch_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: DTDB\Imagery, 2012, 2015. RWC: Site boundary, 2021. Created by: gmcdiarmid, tmorton

3.3 Geology and soils

TGO is located on the Junee-Narromine volcanic belt, part of the Palaeozoic Lachlan Orogen composition of sedimentary, volcanic and intrusive rock formations of early Cambrian to early Devonian age. The Ordo-Silurian sequences that comprise the Wyoming/Caloma deposits, are tight to isoclinal folding, strong axial planar cleavage with green schist metamorphic assemblages.

The area is dominated by alluvial sequences of clays, sands and gravel of Quaternary to Tertiary age, up to 50 m thick. The alluvial material dissipates to the south and north with basement outcropping. There is a well-developed weathering profile which can extend down to 70 m below ground level (Impax Group 2011).

Soil erodibility values (K factors) for the site are moderate to high at 0.04 to 0.05 (SEEC 2011). Typically, the worst soils are located to the east of the Newell Highway in the sodic Gilgaied Dermosol soils (SEEC 2011).

As part of the site Mining Operations Plan (MOP), topsoils are approximately 30 cm below natural surface with the most ideal for stripping and stockpiling being the red Dermasol. Subsoils were defined from 30 cm to 70 cm below natural surface with sodic tendencies. The typical emersion value for the subsoil material has been reported to be Class 1.

3.4 Hydrogeology

There are three distinct groundwater systems within the vicinity of TGO's mining leases, as identified by Impax Group (2011):

- Shallow alluvium – discrete, shallow alluvium (less than 10-20 m deep) dissects the plains surrounding TGO along creek flow paths. These aquifers are believed to be recharged from rainfall infiltration. Groundwater within these systems is of relatively good quality however yields are relatively low and dependent on rainfall.
- Deep alluvium – up to 100 m deep and located approximately 10 km to the northwest and west of TGO. Groundwater yields are believed to be low and of poor quality. These systems may have some interaction with underlying bedrock however are believed to be primarily recharged from rainfall.
- Fractured rock – the area surrounding Tomingley is typically underlain by shale, siltstone and chert with several fractured rock aquifers in the vicinity of TGO. Groundwater yields range from 0-3 L/s, generally less than 1.5 L/s, and water quality is poor with high salinity.

Perched groundwater occurs within the shallow alluvium however it is generally not continuous across TGO. Shallow groundwater appears to be more permanent along Gundong Creek to the northeast of the Wyoming 3 pit.

The hydraulic conductivity of the shallow alluvial clay is generally low to very low. Falling head tests on clayey strata between 1.55 and 42.5 m below ground level (bgl) at the RSF area (to the southwest of the Wyoming 3 pit) indicate hydraulic conductivities of 0.0002 to 0.002 m/d or 2.3 x 10^{-8} to 10^{-9} m/s (DE Cooper & Associates, 2011). In addition, overburden clay from the Wyoming 1 pit was tested for its potential use in the RSF embankment and found to have a compacted hydraulic conductivity of less than 10^{-10} m/s (8.6×10^{-6} m/day) (DE Cooper & Associates, 2011).

A deeper confined groundwater system occurs within the fractured sandstone and siltstone. The water bearing zone most likely occurs at a depth of greater than 100 m in the vicinity of the Wyoming 3 pit, as indicated by the lack of groundwater inflow into the pit. During exploration drilling at the Wyoming 3 pit site, there was no record of water flows into the drill hole at less than 50 m. At 50 to 100 m depth there was some water recorded during rod changes but no flow during drilling. At greater than 100 m depth, some weak flow during drilling was recorded. Therefore, the Wyoming 3 pit is predominantly within the unsaturated zone above the confined water bearing zone. Based on the information available there is no mention of potential hydraulic connectivity from the Wyoming 3 pit to the proposed underground mine 500 m to the south of the pit.

Based on groundwater monitoring data, the hydraulic gradient of the deep groundwater system is approximately 0.01 to the north. Adopting a hydraulic conductivity of 0.07 m/day, the deep groundwater moves to the north at a rate of approximately 0.0007 m/day or 0.3 m/year.

3.4.1 Groundwater bore search

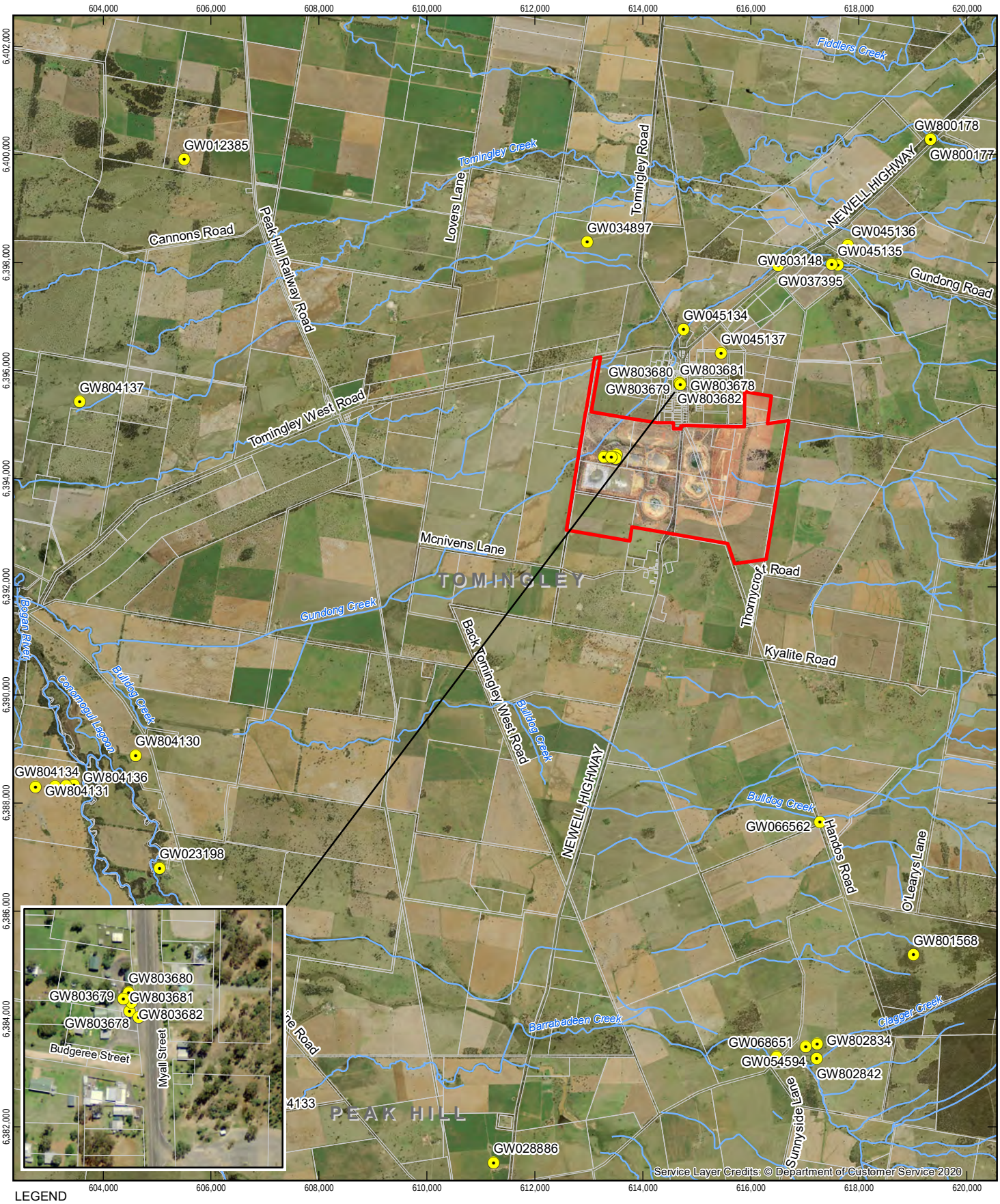
A search of the NSW Groundwater Bore Database (DPIW 2015) (now incorporated into the Australian Groundwater Explorer) was undertaken to identify registered bores within a 10 km radius of TGO. The search identified 22 bores within a 10 km radius of TGO. Licences for a number of these 22 bores were reported as cancelled, lapsed or abandoned. Of the 22 bores the majority (11) were licensed as a test or monitoring bore. Of the remaining bores four were intended for public/municipal water supply, three were registered as stock and domestic and one bore was registered as groundwater exploration, mining, irrigation and town water supply.

Licensed groundwater bores in the vicinity of TGO are shown in Figure 3-6. Details regarding licensed groundwater bores are summarised in Appendix A.

3.4.2 Groundwater dependant ecosystems

The closest high priority GDEs listed in the NSW Murray Darling Fractured Rock Groundwater Sources Water Sharing Plan are Dilladerry Spring located approximately 18.5 km east of TGO and Hyandra Hill Spring located approximately 28 km north-east of TGO. Various tributaries of the Bogan River that lie to the north of the site are potential GDEs.

The shallow aquifers are unlikely to have any significant hydraulic connection to the regional scale alluvial plains or the underlying fractured rock aquifer (The Impax Group 2013).



LEGEND

- Site boundary
- Cadastre
- Groundwater bore
- Watercourse

Paper Size A4

0 400 800 1,600 2,400 3,200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Tomingley Gold Operations
Water Management Plan

NSW groundwater bore search - TGO

Job Number	12543651
Revision	0
Date	13 Oct 2021

Figure 3-6

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

\\ghdnet\ghd\AU\Newcastle\Projects\22\12543651\GIS\Maps\Deliverables\WMP\12543651_WMP007_BoreSearchTGO_0.mxd

Data source: LPI: DTDB\DCDB, 2012. LPI: Imagery, 2015: DPI: Groundwater Bores, 2015. RWC: Site boundary, 2021. Created by: gmcdiarmid, tmorton

4. Water management system

The water management system at TGO includes the construction and operation of the water management infrastructure (drains, dams, pumps and pipelines).

The purpose of this section is to describe the water management system. The water management system includes measures that are implemented to comply with the requirements and performance criteria summarised in Section 6.2.2.

4.1 Surface water management system

The surface water management system at TGO includes the separate management systems for clean, raw, dirty, mine and process (contaminated) water.

- Clean water consists of flows onto the site from areas upslope of TGO that are intercepted by clean water diversions and flood levees and conveyed around the site.
- Raw water is externally supplied (clean) water that is used to supply potable water and as make up water to meet site water demands.
- Dirty water typically consists of surface runoff generated within disturbed areas of the site (outside of the mining areas) that reports to sediment basins.
- Mine water typically consists of groundwater intercepted during mining and surface runoff generated from mining areas and is reused on site for dust control as well as make up water for the process water system.
- Process water consists of water that has been used for mining, ore processing and tailings storage.

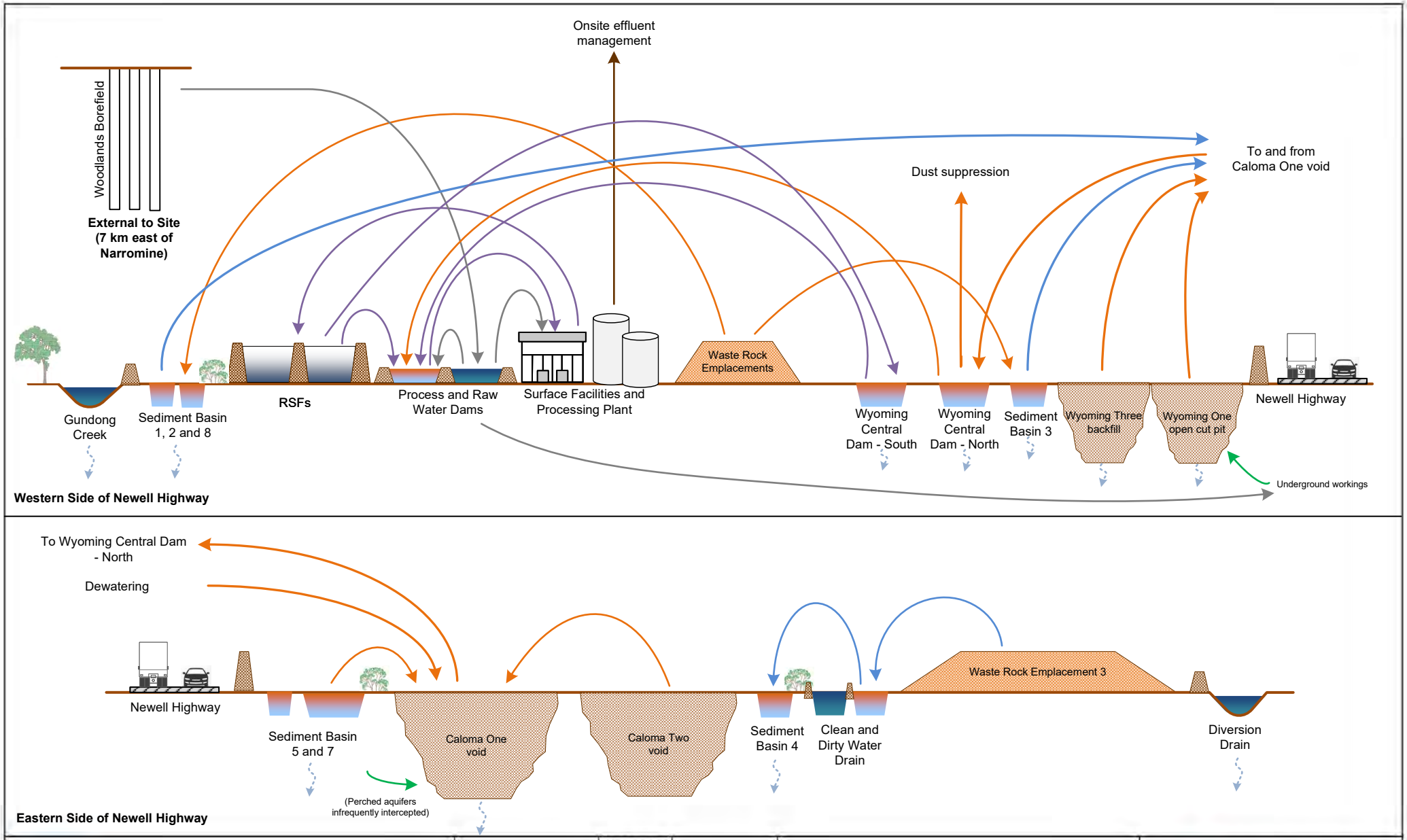
The interactions between the raw, dirty and process water systems are summarised in Figure 4-1.

Table 4-1 Water storages

Storage	Capacity (ML)	Primary usage/transfer to	Indicative dewatering pump rate (L/s)
Raw water			
Raw Water Dam	10.7	Process Water Dam Wyoming Central Dam - South	-
Dirty water			
Sediment Basin 1	35.0	Wyoming Three Discharged via LDPs	50 L/s
Sediment Basin 2	8.0		10 L/s
Sediment Basin 3	11.7		20 L/s
Sediment Basin 4	36.0		40 L/s
Sediment Basin 5	12.8		20 L/s
Sediment Basin 7	3.5		5 L/s
Sediment Basin 8[A]	5.7 (design)		15 L/s (design)

Storage	Capacity (ML)	Primary usage/transfer to	Indicative dewatering pump rate (L/s)
Mine water			
Wyoming Central Dam – North	17.4	Dust suppression Process water dam	-
Caloma One void	2130	Wyoming Three	
Wyoming One open cut pit sump (below underground portal)	195	Wyoming Three	-
Caloma Two void	3200		-
Wyoming Three	1300		
Process water			
Process Water Dam	9.2	Processing plant	-
Settling pond	1.05	Process Water Dam	-
Wyoming Central Dam - South	162.5	Process Water Dam	-
Residue Storage Facilities (decant ponds)	2 x 200	Wyoming Central Dam - South Process Water Dam	-

[A] Construction anticipated to begin in Q1 2022



LOCATION	Tomingley
DRAWN	JM
CHECKED	TT
APPROVED	SG
SCALE	NTS

Tomingley Gold Operations
Water management plan

Water management schematic

ALKANE RESOURCES LTD

DATE January 2022

Figure 4-1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12543651\Tech\Visio\WMP\12543651-VIS-Water_management_schematic.vsdx

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Site boundary
- Licensed Discharge Points
- Clean Water Drain
- Dirty Water Drain
- Diversion Drain
- Flood Protection/Diversion Bund
- Noise/Visual Bund
- Spillway Flow Path
- Raw
- Dirty
- Mine
- Process

Tomingley Gold Operations
Water Management Plan - 2021

Job Number	12543651
Revision	0
Date	13 Oct 2021

Water management system

Figure 4-2

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Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: Google Earth Pro: Imagery, 2015; LPI: DTDB, 2012. RWC: Site boundary, 2021. Created by: ttinkler, gmcdiarmid, tmorton

4.1.1 Clean water

4.1.1.1 Clean water diversions

Clean water diversions and levees on the northern, eastern and western boundaries provide flood protection to site facilities and infrastructure for flood events up to (and including) the 100 year ARI flood event.

4.1.1.2 Clean water drain

Clean water from the north of the site is conveyed by a clean water drain between the Caloma One and Caloma Two pits and the WRE3. The clean water drain is separated from the dirty water management system by the clean water and dirty water separation levee.

4.1.1.3 Gundong Creek

Within the vicinity of TGO, Gundong Creek is a third order watercourse, requiring a total core riparian protection zone of approximately 60 m be maintained. Signage and training are used to avoid unauthorised activities that may impact on the creek.

Infrastructure constructed as part of Project within 40 m of Gundong Creek is maintained generally in accordance with the:

- Guidelines for controlled activities on waterfront land (NRAR 2018; formerly DPI 2007)
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003)

4.1.2 Raw water

4.1.2.1 Woodlands Borefield

Raw water is supplied from a licensed bore located approximately 7 km to the east of Narromine (Woodlands Borefield), by a water pipeline to TGO.

4.1.2.2 Raw water dam

Raw water stored in the RWD from where it is distributed to the processing plant and for potable use.

The RWD is maintained with a minimum freeboard of 200 mm.

4.1.3 Dirty water

Dirty water runoff is intercepted and managed by a series of dirty water drains and sediment basins to allow for treatment and reuse on site.

4.1.3.1 Sediment basins

Water intercepted by the sediment basins may be transferred to the partially backfilled Wyoming Three void and subsequently to the north cell of the Wyoming Central Dam (WCD – North) for reuse in dust suppression and as process water make up.

The sediment basins at TGO were originally designed to provide adequate treatment for sediment laden runoff for design rainfall events up to the 90th percentile 5-day rainfall event.

During operations, to reduce the risk of uncontrolled discharges, the site adopted 90th percentile, 10 day criteria (50.5 mm) for design volume of sediment basins. The existing and design capacity of the sediment basins are summarised in Table 4-2, based on 50% volumetric runoff coefficient and 50% allowance for sediment storage.

Table 4-2 Assessment of sediment basin volume

Storage	Catchment area (ha)	Existing capacity (ML)	Required settling zone (ML)	Required sediment storage zone (ML)	Total design capacity (ML)
Sediment Basin 1	93.4	35.0	23.6	11.8	35.4
Sediment Basin 2	5.6	8	1.4	0.7	2.1
Sediment Basin 3	49.4	11.7	12.5	6.2	18.7
Sediment Basin 4	85.4	36	21.6	10.8	32.4
Sediment Basin 5	18.2	12.8	4.6	2.3	6.9
Sediment Basin 7	4.9	3.5	1.2	0.6	1.8
Sediment Basin 8 (design)	22.4	35.0	5.7	2.8	8.5

Table 4-2 shows that all sediment basins exceed the design capacity, except for Sediment Basin 1 and 3. Sediment Basin 1 and 3 are compliant with the original 90th percentile 5 day criteria and given reduced disturbance as the site transitions to underground operations, an upgrade of the capacity of this storage is not considered necessary.

4.1.3.2 Potential off-site discharges

During rainfall events that exceed the design criteria, discharges off site may occur via the licensed discharge points.

The risk of uncontrolled discharges may be minimised by:

- Maintaining minimum retained water levels within the sediment ponds by actively treating and transferring intercepted water for reuse on site for environmental purposes.
- Regularly removing accumulated sediment to ensure no loss of storage capacity.
- Providing additional pumping capacity to allow for increased transfer of intercepted runoff into alternative storages, such as open cut pits or other water storages.

Discharges from the sediment basin will only occur after all reasonable measures to prevent the discharges have been exhausted. If the intercepted water is required to be discharged, it would be first flocculated (with gypsum). Jar testing indicates that at least 300 mg/L of gypsum is required to reduce TSS to a concentration of 50 mg/L (PSM 2014).

EPL 20169 allows for discharges from the site to occur at six Licensed Discharge Points (LDPs) (refer to Figure 4-2):

- Sediment Basin 1 (EPA 4)
- Sediment Basin 2 (EPA 5)
- Sediment Basin 3 (EPA 6)
- Sediment Basin 4 (EPA 7)
- Sediment Basin 5 (EPA 8)
- Sediment Basin 7 (EPA 18)

Construction of a seventh sediment basin is anticipated to begin in Q1 of 2022. This sediment basin is associated with the approved RSF2 construction. Upon completion of the sediment basin, TGO will seek an amendment to add the sediment basin as a monitoring/discharge point in EPL 20169.

Whilst EPL 20169 includes no limit on how much water may be discharged from these LDPs, the concentration of a range of pollutants in the discharge water is limited (refer to Section 7.2.1).

4.1.4 Mine water

Mine water is managed by in-pit sumps, WCD – North and the Wyoming Three. The mine water system removes water accumulating in the open cuts sumps and transfers to either Wyoming Three or WCD – North for use preferentially for dust suppression activities.

4.1.4.1 Open cut pit voids

Open cut pit sumps provide a collection point for any groundwater and direct rainfall that may enter the pits. Water collected from the open cut pit sumps is likely to have elevated electrical conductivity (EC).

Following the completion of open cut mining, four open cut pit voids were formed.

- The Caloma One void is dewatered to maintain critical levels of the ventilation portal and can be dewatered to minimise the overall use of raw water.
- The Caloma Two void can be dewatered to minimise the overall use of raw water where possible.
- The Wyoming One void is used to access the underground mine area, and therefore dewatering of the void continues from a sump at the base.
- The Wyoming Three void is partially backfilled, and is the central point for dirty water management, receiving water from the sediment basins and open cut pits, which is used for dust suppression and as process water make up.

4.1.4.2 Final voids

Design objectives and performance criteria for the final voids are defined in the Mining Operations Plan for TGO. The objectives and criteria currently consider issues such as:

- Ensure all final voids are safe, stable, and secure.
- Continued secure access to accumulated water storage.
- Construct a safety bund around all open cut and install a man-proof fence and lockable gate.
- Continued access to the Wyoming 1 portal for mining-related purposes.

4.1.4.3 Wyoming Central Dam - North

WCD – North acts as a staging point for mine water used for dust suppression and supplied to the process water system. WCD – North may also be supplemented by the raw water dam and external water supplies. By shandying the pit water with low EC water from other parts of the site, EC levels within WCD – North are maintained below 4500 µS/cm.

4.1.5 Process water and residue storage facility

Process water is stored within the PWD (including a settling pond), the south cell of the Wyoming Central Dam (WCD – South) and the residue storage facilities (RSF1 and RSF2).

4.1.5.1 Process water dam

The PWD supplies water to the processing plant, receiving return water recovered from the processing plant and make up water from the RWD, RSF, WCD – North and WCD – South as necessary.

The PWD has been constructed with a settling pond (both HPDE lined) to assist in improving sediment loads that are returned to the PWD from the processing plant. This improves the quality of the feed water to the plant and reduces the sediment accumulation within the PWD.

The PWD is operated with a minimum freeboard of at least 500 mm as required by EPL 20169.

4.1.5.2 Wyoming Central Dam - South

WCD – South acts as an external decant water storage for the RSFs. WCD – South was previously a mine water dam but was modified and enlarged in 2017 when it became part of the process water system. Typically, WCD - South receives excess decant water from the RSFs during winter and returns process water to the RSF during summer to maximise evaporative losses.

4.1.5.3 Residue storage facilities

RSF1 and the approved RSF2 are dual cell tailings (residue) storage facilities, comprising of a foundation embankment, residue emplacement, decant pond and decant tower. Residue from the processing plant is pumped as a slurry into one of the RSF storage cells. The placement of residue may be alternated between the two cells within each RSF to allow the accumulated residue to consolidate and additional lifts of the RSF dam walls constructed as required.

Water that enters an RSF, either with the residue or as direct rainfall, accumulates within a decant pond located within the centre of each RSF cell. Water from these decant ponds is returned to the PWD for reuse in the processing plant. Excess decant water is transferred to the WCD – South for storage.

RSF1 and RSF2 have been designed to:

- Provide a minimum freeboard to contain a rainfall depth equivalent to the 72-hour duration probable maximum flood, which exceeds the minimum freeboard of at least 500 mm required by EPL 20169. The freeboard is maintained by continuous monitoring of water levels in the decant pond by the site supervisory control and data acquisition (SCADA) system and decant pumps to transfer excess decant water is transferred to the WCD – South for storage.
- Incorporate a 1 m thick zone of in-situ material which will be ripped and recompacted and tested in accordance with a quality assurance / quality control plan to form a low permeability layer (of less than 1 x 10^{-9} m/s) across the foundation of the RSF. The material specifications for the construction of RSF2 require a minimum permeability test frequency of once every 5 000m^3 and per 10 000m^3 of volume placed.

4.2 Potable water and wastewater

4.2.1 Potable supply

Potable water is produced onsite by treating water supplied from the Woodlands Borefield pipeline and is stored within a 50-kL potable water tank. Potable water is used in crib rooms, ablutions, safety showers, and as drinking water.

4.2.2 Wastewater systems

All effluent generated on site is managed on site by an aerated wastewater treatment system with the treated water reused in drip irrigation along the mine access road. The wastewater treatment system is approved by Narromine Shire Council.

4.3 Hydrocarbon and chemical storage

Fuels, hydrocarbons, and reagents are securely stored. Hydrocarbon and chemical storage tanks are either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum 110 % of the largest storage tank capacity.

Storage, delivery, and handling areas are appropriately sealed and bunded. Overflow pipes are installed in a manner that would minimise the potential for pollution in the event of overfilling.

Refuelling and maintenance involving hydrocarbons occur within designated areas including the maintenance workshop. Water from wash-down areas and workshops report to oil/water separators within the mine water catchment.

EPL 210169 requires that all above ground storage facilities containing flammable and combustible liquids must be bunded in accordance with Australian Standard AS 1940-2004.

4.4 Groundwater management system

The groundwater management system at TGO comprises the dewatering of the underground workings and the groundwater monitoring network.

4.4.1 Groundwater monitoring bores

The existing groundwater monitoring network has been progressively established at TGO since 2006. Details of groundwater bores are summarised in Table 4-3. Monitoring bore locations and the groundwater monitoring program are described in Section 5.3. As part of the construction of RSF2, three additional bores will be established on the southern perimeter and one additional of each on the eastern and western perimeter.

Table 4-3 Groundwater monitoring bore details

Bore	Depth (m)	Top of Casing (TOC) Elevation (m AHD)	Monitoring Period	Lithology
WYMB01	90	270.046	April 2007 – present	Unknown
WYMB02	114	267.634	April 2007 – present	Unknown
WYMB03	84	274.77	April 2007 – present	Unknown
WYMB04	78	271.211	April 2007 – present	Unknown
WYMB06	90	268.091	April 2007 – present	Unknown
WYMB10	150	272.757	November 2012 – present	Unknown
GDCMB01	3.5	273.222	November 2012 – present	Gundong Creek Alluvium
RSFMP01	10.95	269.290	March 2014 – present (dry since installation)	Shallow strata
RSFMP02	10.58	268.650	March 2014 – present (dry since installation)	Shallow strata
RSFMP03A	11.88	267.854	March 2014 – present	Shallow strata
RSFMP04	5.28	266.964	March 2014 – present	Shallow strata

Bore	Depth (m)	Top of Casing (TOC) Elevation (m AHD)	Monitoring Period	Lithology
RSFMP05	13	266.524	March 2014 – present	Shallow strata
RSFMP06	4.08	265.826	March 2014 – present	Shallow strata
RSFMP07	5.5	265.694	March 2014 – present	Shallow strata
RSFMP08	4.43	266.953	March 2014 – present	Shallow strata
RSFMP11	5.74	269.434	March 2014 – present (dry since installation)	Shallow strata
PWMP01	11.49	268.962	January 2015 – present	Shallow strata
PWMP01A	12	268.602	December 2019 – present	Shallow strata
PWMP02	12	269.414	January 2015 – present	Shallow Strata
PWMP02D	15	268.918	December 2019 – present	Base of Shallow Strata
PWMP03	12	268.655	July 2015 – present	Shallow Strata
PWMP04	11.56	269.283	July 2015 – present	Shallow Strata
PWMP05	11.59	270.153	July 2015 – present	Shallow Strata
PWMP06	12.91	269.933	July 2015 – present	Shallow Strata
PWMP07	11.82	269.522	July 2015 – present	Shallow Strata
PWMP08	9.56	270.667	July 2015 – present	Shallow Strata
PWMP09	12	268.18p	December 2019 – present	Shallow strata
WCD-P1	11	273.636		Shallow Strata
WCD-P2	11	273.594		Shallow Strata
WCD-P3	11	273.574		Shallow Strata
WCD-P4	11	273.495		Shallow Strata
WCD-P5	11	273.521		Shallow Strata
WCD-P6	11	273.527		Shallow Strata
WCD-P7	11	273.494		Shallow Strata
WCD-P8	11	273.473		Shallow Strata

4.4.2 Underground water management

Groundwater encountered within the underground workings is removed by pumping into the mine water management system (refer to Section 4.1.4).

4.5 Water balance

The site water balance at TGO comprises the sources of water, water use and management on site and potential off-site discharge, within the raw water, dirty water and process water management systems. The site water balance has been estimated using a numerical model implemented using the modelling software GoldSim (version 12.1). A detailed description of the site water balance model is included in the annual update to the site water balance (refer to Section 8.4).

4.5.1 Water balance modelling results

The water balance modelling results for the short-term future is summarised in Table 4-4.

Table 4-4 Modelled average annual site water balance

Mine Stage	Forecast period (average forecast 2021) (ML/year)
Inputs	
Direct rainfall and catchment runoff	435
Supplied from Woodlands Borefield	809
External water delivery	0
Moisture in ore	51
Secondary release from residue	21
Groundwater inflows	0
Total Inputs	**1316**
Outputs	
Evaporation from water storages	148
Discharge from sediment dams	2
Potable use	1
Water in residue	509
Evaporation from active residue	126
Losses from rewetting of inactive residue	212
Dust Suppression	249
Losses from underground workings	6
Total Outputs	**1254**
Change in Storage	**61**

Table 4-4 shows an average annual increase in water inventory of 61 ML. This minor increase (less than 5% of average total average annual inflows) corresponds to the below average rainfall observed in the 2020 calendar year compared to the average of the range of potential rainfall in the future.

4.5.2 Water supply and security

The water balance modelling results presented in Table 4-4 indicates that the main water supply at TGO is raw water from the Woodlands Borefield. The groundwater source is considered inherently secure. The entitlement of 1000 ML held for TGO (refer to Section 2.4) is sufficient for the net requirements at TGO (considering minimal evaporation from storage during drought conditions). Outside of drought conditions, surface runoff in the dirty and mine water management system is reused preferentially to minimise the use of clean (raw) water but is not relied on as a secure water supply. Groundwater intercepted by mine workings available for reuse has been considered negligible and is not relied on as a secure water supply.

4.5.3 Water use

The water balance modelling results presented in Table 4-4 indicates that the main water use at the Mine is processing ore, where water is ultimately lost by entrainment in residue or evaporation, and dust suppression.

4.5.4 Off-site discharges

The modelling also indicates that discharges from the site are estimated to account for less than 1 % of water outputs (refer to Table 4-4). Discharges would only occur via LDPs (refer to Section 4.1.3.2) due to rare rainfall events that exceed the relevant design criteria or in periods of above rainfall when all reasonable measures to prevent the discharges have been exhausted (refer to Section 4.1.3.2).

4.5.5 Potable water use

No municipal potable water supply is available at TGO. Therefore, potable water use is inherently minimised.

4.6 Erosion and sediment control

The dirty water management system (refer to Section 4.1.3) forms the permanent erosion and sediment control system for operations at TGO. Erosion and sediment control plans have been previously developed for specific construction activities at TGO that are now completed, including the construction of the water pipeline from the Woodlands Borefield. The purpose of this section is to define the basis for activity specific erosion and sediment control plans.

4.6.1 Guidelines and standards

The reference guidelines and standards that are considered for erosion and sediment control are:

- Managing Urban Stormwater, Soils and Construction, Volume 1 (Landcom 2004)
- Managing Urban Stormwater, Soils and Construction, Mines and Quarries, Volume 2E (DECC 2008)
- International Erosion Control Association, Best Practice Erosion and Sediment Control (IECA 2008)

4.6.2 Disturbance activities

Disturbance activities on site include:

- Clearing activities and remnant disturbed areas
- Stockpiling
- Construction of access roads and ongoing use of unsealed roads
- Pit backfilling
- Reshaping of final landform

When practical, erosion and sediment controls are installed prior to any disturbance activities, and only removed when disturbance activities are completed, and the site stabilised.

4.6.3 Erosion risk

Erosion risk has been estimated on a monthly basis, assuming a hypothetical hillslope with 1 in 3 batter of at least 5 m in length. This was considered typical of constructed features at TGO.

From Table 4-5 it can be seen that the lowest ratings for erosion risk occur through winter, with the greatest risks associated with summer. Despite these elevated risk ratings through summer, the potential for soil loss is still relatively low given the R factor for the site (refer to Table 4-6) and flat grades. The most significant risks for erosion at TGO are considered to be dams, hard stand areas and stockpiles.

Table 4-5 Monthly site erosion risk

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average monthly rainfall (mm)	57.2	51.7	51.1	41.8	43.6	41.9	44.7	42.1	37.1	48.3	48.7	52.4
Erosion Risk Rating	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low-moderate	Low-moderate	Moderate

Controls and constraints

Table 4-6 presents the site constraints that have been considered in the development of erosion and sediment control.

Table 4-6 Constraints table

Aspect	Factor
Sediment Basins	10 day, 90th percentile – 50.5 mm
Soil Type	D (fine dispersible material)
Soil Erodibility - K Factor	0.05
Rainfall – R Factor	1320
Volumetric Runoff Coefficient	0.51
Sediment Volume Allowance	50 % of settling volume will be applied (DECC; 2008)
Batter Slopes	Maximum: 1V in 3H (33%)
Sediment Basin Requirement	Expected soil loss is greater than 150 m^3/yr

4.6.3.1 Erosion controls

The following erosion controls are implemented on site:

- Temporary groundcover, including rolled erosion control products (RECP) and mulch
- Application of gypsum (10 t/ha) to improve soil structure
- Placed rock and energy dissipaters

Temporary groundcovers are flexible, quick to apply and come in a variety of forms. They are a key control measure for the management of exposed soils.

Placed rock are more permanent erosion controls typically included within concentrated flow paths to minimise scouring. The size (D_{50}) of placed rock is dependent on flow velocities (refer to Table 4-7), and typically placed at a thickness of 1.5 times the D_{50} rock size over a suitable geotextile underlay.

Energy dissipaters and level spreaders are typically located at the discharge point of an open channel and include rock or fabric lining. They are intended to reduce the velocity of discharges and spread flows over a larger area and encouraging sheet flow.

Soil binders and dust suppressants have been used on site previously and have had very limited success and can be used if appropriate for specific purposes.

Table 4-7 Placed rock specification (Fischenich, 2001)

D_{50} Rock Size (mm)	Permissible Velocity
150 mm	3.1 m/s
250 mm	3.4 m/s
300 mm	4.0 m/s
450 mm	4.9 m/s
600 mm	5.5 m/s

4.6.3.2 Sediment controls

The following sediment controls are to be implemented on site:

- Sediment basins/sumps (type D / wet), where soil loss is above the threshold
- Sediment filter fence
- Dirty water channels
- Flow breaks on areas with slope lengths greater than 40 m
- Filter berms/logs/socks
- Straw bale filters
- Stabilised site access points

Sediment basins are constructed at TGO to capture sediment laden runoff from disturbed areas of the site. Sediment basins are typically constructed in areas where disturbance activities are expected to result in soil loss greater than 150 m^3/yr. The design of sediment basins will consider cleanout requirements, stable banks and pump out facilities.

Filter fences are to be implemented in locations of temporary disturbance and stockpiling. For works that are expected to be long term, the construction of a dirty water channel directing runoff to a sediment basin should be considered, however in areas where grades are a constraint, the use of sediment filter fences may prove a more effective long-term strategy.

For disturbed areas, a dirty water channel should be constructed to direct sediment laden runoff to a sediment basin. Dirty water channels are typically formed via excavation of a small channel, with the excavated material being placed on the downslope side to further increase the diversion capacity.

To prevent tracking of sediment and mud onto public roads, access points are to be stable and properly maintained. A gravel cover is maintained on the site access road to provide stabilisation and minimise the tracking of mud offsite.

4.7 Rehabilitated areas

The existing landform at TGO includes the rehabilitated areas of WRE1 and WRE2 The final landform at TGO includes rehabilitated areas of the remainder of the site. Plans of the final landform and design objectives and performance criteria are included in the Mining Operations Plan (R. W. Corkery 2014). The final landform surface is designed to minimise the potential for pollution from rehabilitated areas. No pollution from rehabilitated areas of the site have been identified. The surface existing monitoring program will continue during rehabilitation to identify any potential water pollution from the rehabilitated areas of the site.

4.8 Potential pipeline leakage or spillage

Pipelines conveying dirty water, mine water, process water or chemicals are contained with the TGO water management system. Potential for leakage or spillage would be identified through regular inspection of operational assets or by changes in water quality detected by the surface water monitoring program described in Section 5.2.

5. Monitoring requirements

TGO undertake regular monitoring to measure environmental performance and the effectiveness of the water management system described in Section 4. Monitoring observations are compared to triggers values presented in Section 7 and reported in accordance with Section 8.

5.1 Inspections

Environment personnel undertake site inspections on a weekly basis. Additional site inspections are undertaken prior to forecast rainfall events that may exceed 25 mm in 24 hours. As part of these inspections, mine personnel review all water management structures, including pipelines, and complete an inspection checklist.

5.2 Surface water monitoring program

TGO undertakes surface water quality monitoring at several locations within and surrounding the site. Water quality monitoring locations include those locations specified in EPL 20169, as well as additional sampling locations. The intent of the surface water monitoring program is to ensure that the water quality impacts associated with the mining operations at TGO are minimised.

EPL 20169 requires that surface water quality be monitored following certain events at two locations within the process water system (EPA 2 and EPA 19), six locations within the dirty water system (EPA 4 to EPA 8 and EPA 18) and two locations within the surrounding clean water system (i.e. Gundong Creek: EPA 16 and EPA 17). The quality of groundwater to be re-used on site is monitored by sampling of the water extracted from the underground workings and open cut pit sumps in the first surface water storage prior to any reuse.

Surface water quality monitoring of clean, dirty and process water management systems is to be undertaken by a suitably qualified professional. The samples collected are to be sent to a NATA accredited laboratory for testing. Sampling frequency and parameters are summarised in Table 5-1. Monitoring locations are shown in Figure 5-1.

Table 5-1 Surface water monitoring program

Location	Frequency	Parameters
EPL 20169		
EPA 16 - SW1 EPA 17 - SW2	During discharge	pH, EC, TSS, As, Cd, Cn (total), Cu, P (total), Pb, Ni, N (total), Oil and Grease, Zn
EPA 4 – SP1 EPA 5 – SP2 EPA 6 – SP3 EPA 7 – SP4 EPA 8 – SP5 EPA 18 – SP7	During discharge	pH, EC, TSS, Al, As, B, Cd, Cr, Cn (total and WAD), Cu, P (total), Pb, Hg, Mo, Ni, N (total), Oil and Grease, Se, Zn
EPA 2 – RSF EPA 19 – WCD - South	Daily during discharge	Cn (WAD)
Additional monitoring		
EPA 16 - SW1 EPA 17 - SW2	Weekly (when flowing)	pH, EC, TSS, Al, As, B, Cd, Cr, Cn (total and WAD), Cu, P (total), Pb,

Location	Frequency	Parameters
EPA 4 – SP1 EPA 5 – SP2 EPA 6 – SP3 EPA 7 – SP4 EPA 8 – SP5 EPA 18 – SP7	Following rainfall exceeding 25 mm in 24 hours	Hg, Mo, Ni, N (total), Oil and Grease, Se, Zn Ca, Mg, Na, K, sulphate, Cl, alkalinity, Fe For locations in Gundong Creek: presence of flow (flowing, not flowing)
Underground dewatering (in WY3) Open cut pit sumps (where accessible) WCD - North WCD – South Process Water Dam	Monthly	

5.3 Groundwater monitoring program

The purpose of the groundwater monitoring program is to provide a framework for monitoring and management of groundwater quality and levels. The aim of groundwater monitoring is to:

- Ensure that requirements of the NSW Aquifer Interference Policy are met.
- Ensure groundwater drawdown is within the predictions of the groundwater modelling undertaken as part of the EIS for the Project (Impax Group, 2011).
- Monitor any leachate from the RSFs and process water storages.
- Detect any potential impact on surrounding groundwater users.

The groundwater monitoring program outlines the locations, parameter, frequency and methodology of monitoring.

5.3.1 Monitoring methodology

As specified by DIPNR (2003) (to be adopted as a minimum standard), groundwater monitoring should be undertaken in general accordance with Groundwater Sampling and Analysis – A Field Guide (Geoscience Australia 2009).

Groundwater monitoring methodology includes the following:

- Measurement of groundwater levels prior to sampling.
- In the deep bores to limit the disturbance of possible sediments in the base of each bore, interval sampling (by Hydrasleeve) is completed by lowering the sampling device to the screened interval and collecting a sample directly from the point water is entering the borehole casing.
- For the shallow bores, where interval sampling is not required, water is removed from the borehole by using a hand bailer.
- Measurement of groundwater field parameters (pH, EC) using a calibrated water quality meter. The pH and EC readings are recorded in the field once they have stabilised.
- Groundwater samples are transferred into suitably preserved laboratory supplied sample containers once field parameters have stabilised. Samples to be analysed for dissolved metals are to be filtered in the field using 0.45 µm filters. All sample containers are to be clearly labelled with sample number, sample location, sample depth and sample date. The sample containers are to be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. A Chain-of-Custody form should be forwarded with the samples to the testing laboratory.

- Decontamination of all non-dedicated sampling equipment between monitoring locations.

5.3.2 Groundwater transfer metering

To monitor and assess groundwater make at TGO, dewatering volumes from all open cut pits require to be metered. Volumetric metering must continue as long as dewatering continues.

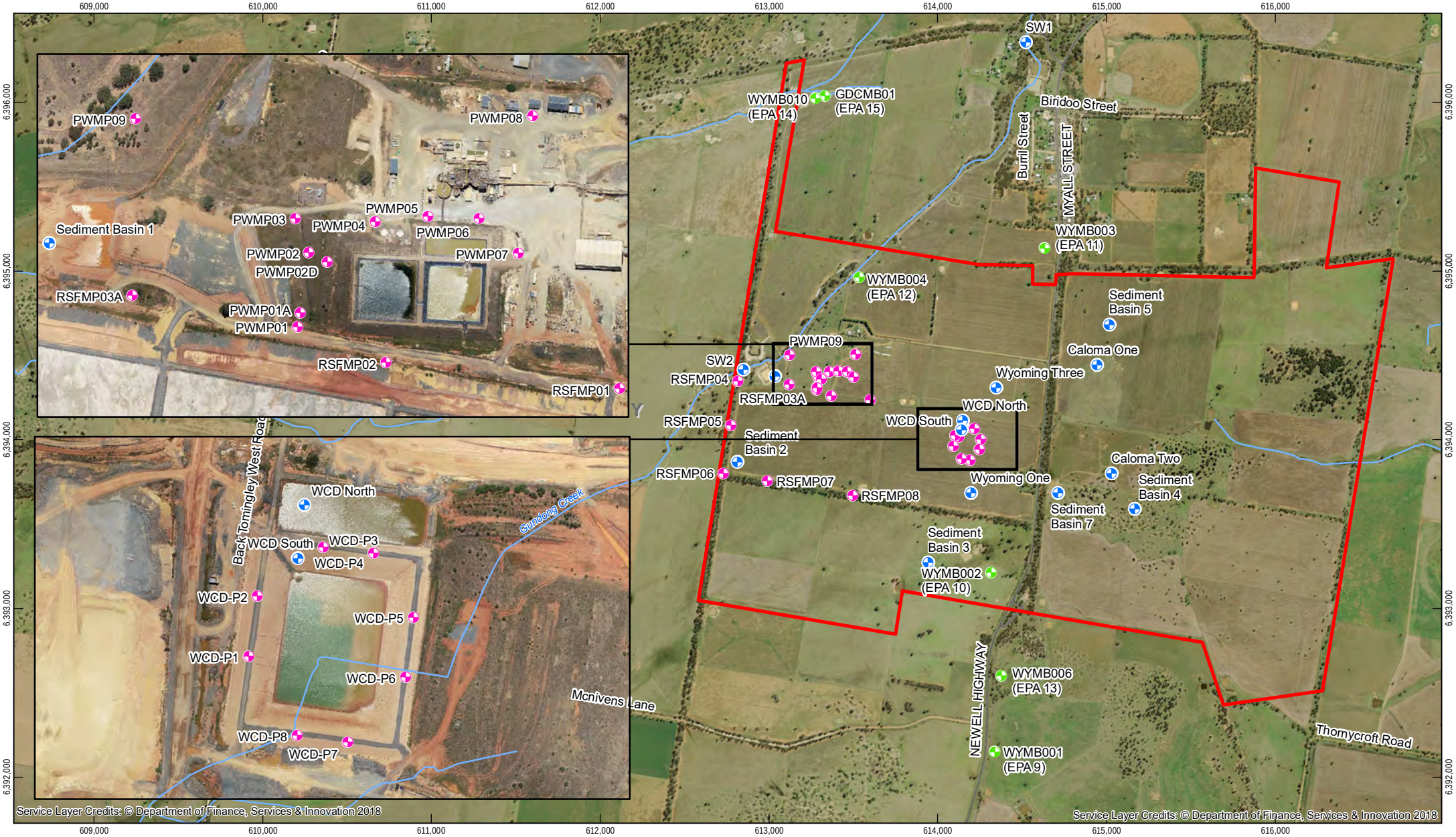
Once dewatering from each open cut pit has ceased monitoring of water level in each pit is required. Monitoring of water levels should continue until water levels stabilise and equilibrium of groundwater levels has occurred.

5.3.3 Monitoring parameters and frequency

The samples collected are to be sent to a NATA accredited laboratory for testing. Sampling frequency and parameters are summarised in Table 5-2. Monitoring locations are shown in Figure 5-1. As part of the construction of RSF2, three additional bores will be established on the southern perimeter and one additional of each on the eastern and western perimeter.

Table 5-2 Groundwater monitoring program

Location	Frequency	Parameter
EPL 20169		
EPA 9 - WYMB01 EPA 10 - WYMB02 EPA 11 - WYMB03 EPA 12 - WYMB04 EPA 13 - WYMB06 EPA 14 - WYMB10 EPA 15 - GDCMB01	Quarterly	Water level
		Alkalinity (as $CaCO_3$), NH_3, As, HCO_3^-, Cd, Ca (dissolved), CO_3^{2-}, Cl^-, Cr, Cu, Cn (free, total and WAD), EC, hardness (as calcium carbonate), Pb, Mg (dissolved), Hg, Ni, NO_3^-, pH, P, K (dissolved), Na (dissolved), SO_4^{2-}, TDS, Fe (total), TSS, Zn
Additional monitoring		
RSFMP01, RSFMP02, RSFMP03A, RSFMP04, RSFMP05, RSFMP06, RSFMP07, RSFMP08, RSFMP11, PWMP01, PWMP01A, PWMP02, PWMP02D, PWMP03, PWMP04, PWMP05, PWMP06, PWMP07, PWMP08, PWMP09 *As part of the construction of RSF2, three additional bores will be established on the southern perimeter and one additional of each on the eastern and western perimeter. Locations to be confirmed during construction of RSF2.*	Monthly	Water level
		Alkalinity (as $CaCO_3$), NH_3, As, HCO_3^-, Cd, Ca (dissolved), CO_3^{2-}, Cl^-, Cr, Cu, Cn (free, total and WAD), EC, hardness (as calcium carbonate), Pb, Mg (dissolved), Hg, Ni, NO_3^-, pH, P, K (dissolved), Na (dissolved), SO_4^{2-}, TDS, Fe (total), TSS, Zn
		Nitrite, nitrate, total nitrogen, total phosphorous, Fe (dissolved),
PWMP02	Monthly	Cyanate, thiocyanate
WCD-P1, WCD-P2, WCD-P3, WCD-P4, WCD-P5, WCD-P6, WCD-P7, WCD-P8	Monthly	Water level
Open cut pits and underground workings	Monthly during dewatering	Dewatering volumes



Paper Size A4

0 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Site boundary
- Watercourse
- EPL 20169
- Groundwater monitoring bore
- Surface water monitoring locations

Tomingley Gold Operations
Water Management Plan - 2021

Job Number	12543651
Revision	0
Date	13 Oct 2021

Monitoring points

Figure 5-1

C:\Users\ttinkler\AppData\Local\Temp\arc9DD0\12543651_WMP005_SWGW_Monitoring_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: Tomingley Gold Operations: Imagery, 2015; LPI: DTDB\Imagery, 2012, 2015. RWC: Site boundary, 2021. Created by:

6. Baseline data

The purpose of this section is to summarise the baseline monitoring data collected as part of the monitoring program. Details of the baseline surface and groundwater environment for TGO are presented in Section 3.

6.1 Surface water

Water quality monitoring within the dirty water system commenced as each sediment pond was constructed. Water quality monitoring of the dirty water systems is undertaken following periods of rainfall, which result in the generation of runoff into the sediment ponds.

The monitoring record for the surface water management system is summarised in Table 6-1 and presented in Appendix B.

Table 6-1 Surface water quality monitoring record

ID	Water management system	Monitoring period
WCD - South	Process	May 2015 to present
WCD - North	Mine	May 2015 to present
Underground dewatering (Wyoming 1 void)	Mine	Once underground operations commence
Caloma 1 void	Mine	May 2015 to present
Caloma 2 void	Mine	Ceased at completion of mining
Wyoming 1 void	Mine	April 2015 to present
Wyoming 3 Pit	Mine	Ceased when backfilling commenced
EPA 4 – SP1	Dirty	October 2013 to present
EPA 5 – SP2	Dirty	October 2013 to present
EPA 6 – SP3	Dirty	October 2013 to present
EPA 7 – SP4	Dirty	October 2013 to present
EPA 8 – SP5	Dirty	March 2014 to present
EPA 16 – SW1	Clean	June 2014 to present
EPA 17 – SW2	Clean	June 2014 to present
EPA 18 – SP7	Dirty	February 2017 to present

6.2 Groundwater

6.2.1 Fractured rock monitoring bores

Groundwater level hydrographs of all fractured rock groundwater monitoring bores have been plotted and compared with the Cumulative Rainfall Departure (CRD) curve. Hydrographs are shown in Appendix D.

The pre-mining groundwater hydrograph at WYMB001 shows a rise in groundwater levels of 7.02 m between April 2007 and November 2012. During operational years there is an increase in groundwater levels during the period June 2016 to June 2017 which corresponds to a period of above average rainfall (CRD above 200 mm). Based on this comparison, WYMB001 appears to be responsive to rainfall recharge. Recent groundwater levels show a gradual decline from 237.8 m AHD in June 2017 to 234.2 m AHD in December 2018, however these levels are still above pre-mining minimum groundwater levels.

The pre-mining groundwater hydrographs for WYMB002, WYMB003 and WYMB004 are generally stable. During operational years WYMB002 shows a slight overall declining trend, below the pre-mining minimum groundwater level. Both WYMB003 and WYMB004 show a gradual increase in groundwater levels during operational years, above the pre-mining maximum groundwater levels. The hydrographs do not show a response to rainfall recharge.

The pre-mining groundwater hydrograph for WYMB006 shows a response to rainfall recharge. The hydrograph shows a sudden rise around January 2008 which follows two months of above average rainfall in November and December 2007. Coffey (2008) attributed this rainfall response to be related to the filling of the McPhail's historical workings. During operational years there is an increase in groundwater levels during the period June 2016 to June 2017 which corresponds to a period of above average rainfall (CRD above 200 mm). Recent groundwater levels show a gradual decline from 241.8 m AHD in February 2017 to 233.7 m AHD in December 2018, however these levels are still above pre-mining minimum groundwater levels.

Groundwater levels at WYMB010 have remained relatively stable over the monitoring period.

Baseline and operational groundwater levels are summarised in Table 6-2.

Table 6-2 Groundwater level summary

Location	Baseline (pre-January 2014) groundwater level (m AHD)		Operational groundwater level (m AHD)	
	Minimum	Maximum	Minimum	Maximum
WYMB001	225.74	233.45	230.42	242.94
WYMB002	208.31	209.17	204.48	214.24
WYMB003	220.19	221.74	220.5	222.37
WYMB004	208.21	208.71	206.91	209.15
WYMB006	231.13	240.31	230.31	243.36
WYMB010	200.44	200.56	196.99	200.90

6.2.2 Shallow bores

There are limited baseline data for the shallow alluvial groundwater monitoring bores. Monitoring commenced at GDCMB01 in November 2011 however monitoring of bores associated with the RSF and the processing area did not begin until after commencement of operations at TGO. Groundwater level hydrographs of all shallow groundwater monitoring bores have been plotted and compared with the CRD curve. Hydrographs are shown in Appendix D.

HARTT (Hydrograph Analysis: Rainfall and Time Trends) regression analysis has been undertaken to establish whether shallow groundwater levels respond to rainfall and to determine any other underlying trends. HARTT analysis was only undertaken for monitoring bores with sufficient groundwater level data and a zero-month delay period was selected for each regression analysis. Regression statistics for each monitoring bore are shown in Table 6-3. Observed and fitted groundwater level hydrographs are plotted with the CRD curve in Appendix D.

Table 6-3 HARTT regression analysis statistics for monitoring bores

Bore	R2	Rainfall Coeff. a (m/mm)	P rain	Time Coeff. b (m/mth)	P Time	Intercept c (m)
RSFMP01	0.1471	-0.0001	0.8430	0.0079	0.0013	258.4
RSFMP03	0.7882	-0.0023	0.1751	0.1696	0.0000	259.1
RSFMP05	0.7581	0.0022	0.0001	0.0494	0.0000	259.2
RSFMP06	0.0902	0.0015	0.0062	0.0031	0.3092	262.8
RSFMP07	0.9089	0.0018	0.0000	0.0377	0.0000	260.3
RSFMP08	0.9444	0.0000	0.8868	0.0254	0.0000	262.2
PWMP01	0.6538	0.0026	0.0540	0.0958	0.0000	259.0
PWMP02	0.5921	0.0103	0.0000	-0.0663	0.0000	266.4
PWMP03	0.0514	-0.0916	0.1491	-0.1826	0.7359	263.4
PWMP04	0.6332	0.0003	0.8805	0.1068	0.0000	257.0
PWMP05	0.3230	0.0045	0.0062	-0.0267	0.0336	265.0
PWMP06	0.3760	0.0105	0.0000	0.0738	0.0000	258.7
PWMP07	0.0262	-0.0006	0.6875	0.0087	0.4472	260.9
PWMP08	0.4329	-0.0002	0.8416	0.0428	0.0002	260.2
GDCMB01	0.3176	0.0015	0.0083	-0.0006	0.8654	271.3

The R^2 value of the HARTT regression line gives a measure of the quality of fit of the non-linear regression line to the observed hydrograph. This value was greater than 0.5 for 7 of the 15 shallow hydrographs analysed, indicating that almost half of the hydrographs can be reasonably modelled by the HARTT variables (rainfall and linear time trends) alone. A lower R^2 value indicates that the hydrograph cannot be adequately modelled by the HARTT variables and that other factors may be affecting groundwater levels.

The p-value for the rainfall and time coefficients indicates the statistical significance of the variable. Where the p-value is less than 0.05, the variable is significant. The p-value for rainfall was significant for 8 of the 15 hydrographs, including PWMP02, PWMP05, PWMP06, GDCMB01, RSFMP05, RSFMP06 and RSFMP07. This indicates that these shallow bore hydrographs are responsive to rainfall recharge. The p-value for the time was significant for all hydrographs except RSFMP06, PWMP03, PWMP07 and GDCMB01.

The pre-mining groundwater hydrograph for GDCMB01 is generally stable. Recent groundwater level measurements show a decline in groundwater levels, however these levels are still above or equal to the pre-mining minimum groundwater levels. The HARTT regression analysis shows that groundwater levels at GDCMB01 respond to rainfall recharge however the R^2 value is only 0.3, suggesting dependence on variables other than rainfall and time trends.

RSFMP02 and RSFMP04 have been dry since installation, however water level measurements have since been obtained at RSFMP04 since mid-2019. There are insufficient data to undertake HARTT analysis at these sites. RSFMP09 has been dry since May 2014 and RSFMP10 was dry between approximately August 2014 and April 2015. Groundwater levels at RSFMP09 and RSFMP10 have not been monitored since mid-2015 as this is when these two bores were decommissioned following expansion of the RSFs. RSFMP11 has generally been dry however groundwater levels increased by approximately 3.2 m between February 2019 and October 2019. Groundwater levels have since decreased and the bore is dry. The groundwater hydrograph for RSFMP06 shows an overall decline in groundwater levels since monitoring began.

RSFMP08 was generally dry until November 2016, and since then recent measurements show a 1.55 m rise in the groundwater level. The HARTT analysis provides a good regression fit for the data. The rainfall p-value is greater than 0.05 and so the groundwater level increase is independent of rainfall at this location. RSFMP01 was generally dry until December 2017, and since then measurements show a 1.5 m rise in the groundwater level to January 2019. The groundwater hydrographs for RSFMP03, RSFMP05, RSFMP06 RSFMP07 show an overall rise in groundwater levels since monitoring began. The HARTT analysis suggests the overall rise in the groundwater level is independent of rainfall at RSFMP01 and RSFMP03, and dependent on rainfall at RSFPB05, RSFMP06 and RSFMP07.

Monitoring bores RSFMP03, RSFMP05, RSFMP07, RSFMP08 and PWMP01 show a statistically significant positive time trend in groundwater levels and are all located near the western end of the RSF. The rising trend in groundwater levels at these monitoring locations may be due to recovery of shallow groundwater levels following completion of construction of the surface facilities area and/or seepage to groundwater from a process water pipeline in the vicinity of PWMP02 (GHD, 2015a).

Monitoring bores PWMP03, PWMP04, PWMP05, PWMP06, PWMP07 and PWMP08 were installed to monitor the rising trend in groundwater in the vicinity of the RSF. The HARTT analysis shows a statistically significant positive time trend in groundwater levels at PMWP04, PMWP05, PMWP06 and PWMP08, however groundwater levels have been declining at PWMP03 since January 2018. The hydrographs for PWMP04, PWMP05 and PWMP07 all show water level variability. The water level at PWMP08 has been increasing since mid-2019.

7. Triggers and response plans

The water management system (refer to Section 4) has been developed to satisfy the requirements of the regulatory requirements identified in Section 2. The environmental performance of TGO is measured against performance indicators. The purpose of this section is to specify the performance indicators, including trigger values for assessment of the results of the monitoring program presented in Section 5. Trigger values have been developed considering the baseline data presented in Section 3 and Section 6. Contingency plans have been developed for the unlikely exceedance of the performance criteria or other unpredicted impacts and are included in Appendix E.

7.1 Water management system

Triggers for the water management system are based on the water performance measures required by PA 09_0155. These performance measures are achieved by the management measures described in this WMP, as summarised in Table 7-1.

Table 7-1 Water management performance measures

Feature	Performance measure	Where addressed
Water management – General	Minimise the use of clean water on site	Section 4.5.5
	Minimise the need for make-up water from external potable water supplies	Section 4.5.5
Construction and operation of infrastructure	Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads	Section 4.6
	Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the: • Guidelines for Controlled Activities on Waterfront Land (DPI 2007), or its latest version • Guidelines for fish habitat conservation and management – Chapter 4 (DPI 2013), or its latest version	Section 4.1.1.3
Clean water diversion & storage infrastructure	Design, install and maintain the clean water system to capture and convey the 100 year average recurrence interval (ARI) flood	Section 4.1.1.1 and Section 4.1.1.2
	Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site	Section 4.1.1.1 and Section 4.1.1.2
Sediment dams	Design, install and maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries	Section 4.1.3.1
	Ensure the capacity of all sediment dams is sufficient to contain rainfall up to a 10 day 90 percentile rain event	Section 4.1.3.1

Feature	Performance measure	Where addressed
Mine water management system, including residue storage facility and associated collection pond	No unlicensed or uncontrolled discharge of mine water off-site (except in accordance with condition 23)	Section 4.5.4
	Ensure that the capacity of the residue storage facilities (RSF1 and RSF2) and associated collection pond are designed to meet the requirements of the Australian National Committee on Large Dams' Guidelines on Tailings Dams – Planning, Design and Construction, Operation and Closure (July 2019) or its latest version, and that the floor and walls are lined to achieve a permeability standard of at least 1 x 10^{-9} m/s and 1 metre depth (or equivalent permeability performance), unless otherwise agreed by the EPA and the Secretary	Section 4.1.5.3
	Maintain adequate freeboard (i.e. minimum 500 mm) in the residue storage facilities (RSF1 and RSF2) at all times	Section 4.1.5.3
	All water storages on site that receive chemical or salt laden water, including the dewatering ponds, raw water dams and process water dams are lined to achieve a permeability standard of at least 1 x 10^{-9} m/s, unless otherwise agreed by the EPA and the Secretary	Section 4.1.5.1
	Maintain adequate freeboard (i.e. minimum 500 mm) in the process water dam and minimum of 200 mm in the raw water dam at all times	Section 4.1.5.1 Section 4.1.2.2
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards	Section 4.3
Gundong Creek	Maintain or improve baseline channel stability	Section 7.2.2
	Develop site-specific water quality trigger levels in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or its latest version	Section 7.2.2

7.2 Surface water

Discharges into Gundong Creek are permitted under EPL 20169 at six LDPs (refer to Section 4.1.3.2), subject to the pollutant concentration limits specified within EPL 20169. However, the site is to be managed as a nil-discharge site, meaning discharges are not expected to occur under normal operating conditions.

Water quality monitoring of Gundong Creek indicates that levels of some pollutants are naturally higher than the default trigger values adopted within EPL 20169. Site specific guideline values (SSGVs) have been developed with historical data at SW1 and reference to default trigger values. Ongoing water quality monitoring of Gundong Creek, at locations upstream and downstream of TGO, in particular during large storm events or extended periods of wet weather, will assist in identifying whether instances of potential pollution within Gundong Creek are the result of discharges from TGO or the result of other processes (natural or human) within the catchment.

Where exceedances of water quality trigger values occur within Gundong Creek that are the result of discharges (uncontrolled or otherwise), TGO will:

- If a controlled discharge, cease to discharge and undertake testing of the discharge water to ensure that it meets the requirements of EPL 20169.
- If an uncontrolled discharge, notify the EPA immediately, and, if safe to do so, commence emergency pumping measures to alternative water storages to minimise the volume of uncontrolled discharges off-site.

Following any exceedance of water quality trigger values, an investigation should be undertaken to identify the likely source of the exceedance as per the Trigger Action Response Plan.

7.2.1 Sediment basin discharge limits

EPL 20169 water quality limits on discharges from the sediment ponds and into the RSF and WCD South are summarised in Table 7-2.

Table 7-2 EPL 20169 pollutant concentration limits

Pollutant	Units	90th percentile	100th percentile
Sediment basins (EPA 4, 5, 6, 7 and 8)			
Arsenic (As)	mg/L	-	0.024
Cadmium (Cd)	mg/L	-	0.0002
Copper (Cu)	mg/L	-	0.0014
EC	µS/cm	-	350
Lead (Pb)	mg/L	-	0.0034
Nickel (Ni)	mg/L	-	0.011
Nitrogen (total) (N)	µg/L	-	250
pH (-)	-	-	6.5 to 8.5
Phosphorous (total) (P)	µg/L	-	20
TSS (a)	mg/L	-	50
Zinc (Zn)	mg/L	-	0.008
RSF and WCD South (EPA 2 and 19)			
Cn (WAD)	µg/L	20	30

(a) EPA has agreed, in principle, that the TSS licence limit may be "turned off" during periods of managed overflows provided that other proposed water management components are implemented. Refer to Appendix B.

7.2.2 Gundong Creek guideline values

SSGVs for Gundong Creek have been derived as summarised in Table 7-3.

EPL 20169 requires that discharges from the sediment ponds do not to exceed the concentration limits summarised in Table 7-2. The EPL limits are intended to protect the receiving environment from pollutant levels that are outside of the range typical of the local environment. The current EPL limits are based on the default water quality thresholds for aquatic ecosystems (ANZECC/ARMCANZ 2000).

ANZECC/ARMCANZ (2000) also includes default water quality thresholds for a range of primary industry uses, including irrigation, stock watering and aquaculture and human consumers of aquatic foods. The trigger values for each of these primary industry uses are summarised in Table 7-3. The trigger values for the various water quality parameters vary considerably depending on the water use. The ephemeral nature of Gundong Creek means it is not a secure water supply either for human consumption or agricultural purposes, however, may provide additional irrigation and stock water. The default water quality thresholds for irrigation and livestock are generally higher than those currently included within the EPL (refer to Table 7-3).

ANZECC/ARMCANZ (2000) provides a method for the development of SSGVs which can be adopted in place of the default trigger values (DTV) for assessment of impact of discharges into receiving waterways. The development of SSGVs requires 24 months of monthly water quality sampling data from a nearby reference site. The upstream monitoring site (SW1) is considered to be a reasonable reference site, however due to the ephemeral nature of Gundong Creek, water quality sampling opportunities are limited. Collection of surface water quality data at SW1 has allowed for the identification of SSGVs. SSGVs have been selected as the higher value of the concentration limits in EPL 20169 or the 80th percentile concentration of historical water quality at SW1 as presented in Table 7-3.

Table 7-3 Site specific guideline values for Gundong Creek

Pollutant	Units	EPL 20169 limit	ANZECC / ARMCANZ (2000)				SW1	Adopted SSGV
			Aquatic ecosystems (upland rivers)	Irrigation and general use	Livestock	Aquaculture & human consumption	80th Percentile	
Arsenic	mg/L	0.024	0.024 [A]	0.1 [B]	0.5	0.05	0.003	0.024
Cadmium	mg/L	0.0002	0.0002 [A]	0.01 [B]	0.01	0.0005	0.0001	0.0002
Copper	mg/L	0.0014	0.0014 [A]	0.2 [B]	0.4 [E]	0.005	0.009	0.009
EC	µS/cm	350	350	650 [C]	3000 [F]	4500 [G]	312.2	350
Lead	mg/L	0.0034	0.0034 [A]	2.0 [B]	0.1	0.007	0.014	0.014
Nickel	mg/L	0.011	0.011 [A]	0.200 [B]	1	0.1	0.008	0.011
Nitrogen (total)	µg/L	250	250	5 [B]	100 [H]	50 [H]	1660	1660
pH (-)	-	6.5 to 8.5	6.5 to 8.0	6.0 to 9.0	-	5.0 to 9.0	7.54 to 8.32	6.5 to 8.5
Phosphorous (total)	µg/L	20	20	50 [B]	-	100 [I]	192	192
TSS	mg/L	50	-	50	-	40	117.2	117.2
Zinc	mg/L	0.008	0.008 [A]	2.0 [B]	20	0.005	0.034	0.034

[A] 95% species protections for freshwater systems
[B] long-term trigger value
[C] guideline value for sensitive crops, assuming light clay soils
[E] guideline value for sheep
[F] adapted from a TDS concentration of 2,000 mg/L
[G] adapted from a TDS concentration of 3,000 mg/L (freshwater production)
[H] total nitrate concentration
[I] phosphates

7.3 Groundwater

The NSW Aquifer Interference Policy requires that potential impacts on groundwater sources, including users and GDEs, be assessed against minimal impact considerations, outlined in Table 1 of the policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered acceptable. The Level 1 minimal impact considerations for Less Productive Fractured Groundwater Sources have been adopted for TGO. The Level 1 minimal impact considerations are as follows:

- A cumulative pressure head decline of not more than 2 m at any water supply work.
- If the predicted pressure head decline is greater than the requirement above, then appropriate studies are required to demonstrate that the decline will not prevent the long-term viability of the affected water source unless make good provisions apply.
- No reduction in beneficial use category beyond 40 m from the activity.
- If the above condition is not met then appropriate studies will need to demonstrate that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

7.3.1 Groundwater level triggers

The majority of shallow bores have been located to provide early detection of leaks from the RSF and processing areas. Therefore, trigger values for shallow monitoring bores are based on a rise in groundwater level. For all shallow monitoring bores (except GDCMBP01) a Stage 1 trigger would be exceeded if groundwater levels rise over three consecutive months. A Stage 1 trigger would result in an investigation to determine if the rise in groundwater level is attributable to mining related activities.

The Stage 1 investigation will include an analysis of groundwater quality monitoring data to identify whether the increases in groundwater levels are attributable to mining related activities. If it is likely that the rise in groundwater levels is the result of mining related activities, temporary modifications to the responsible mining activities will be made until groundwater levels return to normal levels.

A Stage 2 trigger would be exceeded if groundwater levels rise over six consecutive months. The subsequent investigation will also include an analysis of groundwater quality monitoring data to determine whether the increases are the result of mining related activities. If mining related activities are likely to be responsible for the changes to shallow groundwater levels, longer term changes to water management on site will be implemented.

Groundwater level triggers for deeper groundwater monitoring bores have been developed to monitor drawdown in the fractured rock aquifer. All deeper groundwater monitoring bores are within the radius of groundwater drawdown predicted by the Impax Group (2011). Since there is no numerical groundwater model, the extent of drawdown at each of the monitoring bores has not been predicted. Therefore, groundwater level drawdown triggers are based on historical groundwater levels and from any complaints from a surrounding land holder.

The proposed groundwater level Stage 1 trigger is a drop in groundwater level more than 2 m below minimum pre-mining groundwater level or a complaint from a surrounding landholder. The proposed groundwater level Stage 2 trigger is a drop in groundwater level more than 4 m below the pre-mining groundwater level or two complaints from surrounding landholders within a three-month period.

Similar to groundwater monitoring bores in the fractured rock, the groundwater level trigger for GDCMP01 is recommended to be based upon historical groundwater levels. The Stage 1 trigger value for groundwater level at GDCMP01 is proposed to be a groundwater level of 1 m below minimum historical groundwater level. The Stage 2 trigger value for groundwater level at GDCMP01 is proposed to be a groundwater level of 2 m below minimum historical groundwater level.

Groundwater monitoring bores WYMB001 and WYMB006 are located outside of the modelled drawdown area. The potential impact to groundwater levels at these locations due to mining operations at TGO is therefore expected to be negligible.

Groundwater level triggers for EPL monitoring sites are shown in Table 7-4.

If the deeper groundwater levels are drawn down to either the stage 1 and stage 2 trigger level, an investigation will be undertaken to ascertain whether the falling groundwater levels are the result of mining related activities, and the result of external factors (for example over-use of the groundwater source by other licensed water users or extended period of drought). If the investigation identifies that the fall in groundwater levels is the result of mining related activities, compensatory water supplies will be provided to the affected landowners.

Table 7-4 Groundwater level triggers – EPL points

Bore	Stage 1 Trigger		Stage 2 Trigger	
	Level (m AHD)	Trend	Level (m AHD)	Trend
EPL 20169				
EPA 9 - WYMB01	228.40	Groundwater level for three consecutive months	227.40	Groundwater level for six consecutive months
EPA 10 - WYMB02	202.31		200.31	
EPA 11 - WYMB03	218.42		216.42	
EPA 12 - WYMB04	204.91		202.91	
EPA 13 - WYMB06	228.31		226.31	
EPA 14 - WYMB10	194.99		192.99	
EPA 15 - GDCMB01	269.42	-	268.42	-

7.3.2 Groundwater quality triggers

The NSW Aquifer Interference Policy states that the impact on groundwater quality from TGO operations should not reduce the beneficial use category beyond 40 m from the activity.

The review of historical groundwater quality data indicates that EC at deeper groundwater monitoring bores (WYMB02, WYMB03, WYMB04 and WYMB10) is typically around 20,000 µS/cm. Background EC is approximately 12,000 to 13,000 µS/cm for WYMB01 and WYMB06. The very high EC at these locations limits the beneficial use of deep groundwater within the porous and fractured groundwater source to industrial use only. The search for registered groundwater works indicates that there are only two monitoring bores registered as stock or domestic within 10 km of the Mine. Both of these bores are over 8 km from the Mine.

Considering the lack of nearby registered groundwater bores, high groundwater EC, and uneconomically low water yield, the trigger for groundwater quality for deep monitoring bores are based on complaints from surrounding landholders. The Stage 1 trigger for groundwater quality for the deep groundwater aquifer is a complaint from a surrounding landholder regarding groundwater quality.

Analysis of water quality data at GDCMB01 compared groundwater quality to SSGVs. Groundwater quality at GDCMB01 exceeds SSGVs for a number of water quality parameters. Recommended trigger values at GDCMB01 are recommended to be a combination of DTVs and historical water quality. The trigger value adopted is the DTV except where 80th percentile concentration limit of historical data exceeds the DTV. Where the 80th percentile exceeds the DTV then the trigger value is proposed to be the 80th percentile of the historical concentration. Groundwater quality trigger values are summarised in Table 7-5.

Table 7-5 Groundwater quality trigger values – GDCMB01 (EPA 15)

Parameter	Units	Trigger Value	Source
pH	-	6.5 - 9.0	ANZG 2018 – 95% Species Protection
EC	µS/cm	505.8	80th Percentile historical concentration
Arsenic	mg/L	0.013	ANZG 2018 – 95% Species Protection
Cadmium	mg/L	0.0002	ANZG 2018 – 95% Species Protection
Chromium	mg/L	0.024	80th Percentile historical concentration
Copper	mg/L	0.017	80th Percentile historical concentration
Lead	mg/L	0.015	80th Percentile historical concentration
Mercury	mg/L	0.0006	ANZG 2018 – 95% Species Protection
Nickel	mg/L	0.014	80th Percentile historical concentration
Zinc	mg/L	0.08	ANZG 2018 – 95% Species Protection
Iron (dissolved)	mg/L	1.54	80th Percentile historical concentration
Iron (total)	mg/L	21.86	80th Percentile historical concentration
Cyanide (Total, Free and WAD)	mg/L	0.007	ANZG 2018 – 95% Species Protection
Ammonia	mg/L	1.09	ANZG 2018 – 95% Species Protection

Limited groundwater quality data are available at shallow groundwater monitoring locations associated with the RSF and the PWD. This lack of data is due to a number of these locations being dry or almost dry for the majority of monitoring periods.

In order to identify any impacts from the RSF or the PWD the water quality triggers for GDCMB01 are adopted for shallow groundwater monitoring locations associated with the RSF and the processing plant. The exception to this is the trigger for EC, since the shallow groundwater near the site appears to be influenced by the deeper porous and fractured rock aquifer.

The stage 1 trigger for all shallow groundwater monitoring locations is an exceedance of a trigger value for any water quality parameter listed in Table 7-5. The stage 1 trigger for all shallow groundwater monitoring bores is also proposed to be a continuous upward trend in any of the parameters listed in Table 7-5 for three consecutive months. The stage 2 trigger value is proposed to be an exceedance of a trigger value listed in Table 7-5 for three consecutive months for any water quality parameter. The stage 2 trigger for all shallow groundwater monitoring bores is also proposed to be a continuous upward trend in any of the parameters listed in Table 7-5 for six consecutive months.

8. Reporting

8.1 Incident reporting

Following an incident causing or threatening material harm to the environment TGO will:

- Notify the EPA by phone via the Environment Line (phone 131 555)
- Undertake a comprehensive investigation of the event
- Complete an Incident Report as per the TGO Pollution Incident Response Management Plan (PIRMP)
- Provide a copy of the Incident report to DPE and EPA within seven days of the incident

TGO must notify DPE Water and NRAR in writing immediately upon becoming aware of a breach of any conditions set out in WALs held by TGO.

8.2 Monitoring results

In accordance with Section 66(6) of the POEO Act and requirements issued by the EPA, TGO must publish water quality monitoring data that has been collected as a result of EPL 20169 requirements.

EPL 20169 requires that surface and groundwater monitoring results be:

- Made publicly available via the TGO website each month
- Included in the Annual Return
- Held on site

The conditions of the WALs require TGO to record:

- The date and duration during which water is taken
- The volume of water taken
- The water supply work approval number used to take the water
- The purpose for which the water was taken

The records must be kept for at least five years and be produced for inspection when requested by DPE.

8.3 Complaints

EPL 20169 requires that TGO keep a record of any complaint made to TGO or any employee or agent of TGO in relation to pollution arising from any TGO activities.

The record of the complaint must be kept for at least four years and must include the following details:

- The date and time of the complaint
- The method by which the complaint was made
- Any details of the complaint
- The nature of the complaint

Complaints are to be included in the Annual Return under the requirements of EPL 20169.

8.3.1 Compensatory water supply

Following a complaint regarding loss of water supply from a surrounding landholder the appropriate TARP should be followed.

- Investigate groundwater monitoring levels to confirm potential loss of water supply as a result of mining operations.
- If necessary, provide a compensatory water supply to the landholder from existing groundwater licences or from existing surface water storages, within 24 hours of the loss being identified unless otherwise agreed with the landowner.
- Document the results of the investigation and any subsequent actions taken by TGO.

8.4 Annual review

TGO are required to prepare an Annual Review that:

- Reviews the performance of operations at TGO against the requirements of the WMP.
- Provides an overview of environmental management actions taken.
- Summarises the monitoring results and complaints over the 12 month period.

The Annual Review typically includes:

- Any amendments to licencing or statutory approvals.
- An evaluation of any trends in the monitoring results occurring across the site over the life of the Project.
- A comparison of site water balance for each calendar year.
- Any non-compliance recorded during the reporting period and the actions taken to ensure compliance.
- Identification of any discrepancies between the predicted and actual impacts of the operations and an analysis of the potential cause of any significant discrepancies.
- Reporting of the site water balance and water transfers in and out of the site.
- A summary of management actions to be implemented over the next year to improve the environmental performance of the Project.

Management actions identified in the Annual Review relating to the water management system may include:

- Refinements to performance criteria and objectives.
- Changes to monitoring frequency, parameters or locations.
- The initiation of any remedial actions.

9. Roles, responsibilities and training

9.1 Roles and responsibilities

The key roles and responsibilities with respect to the management of surface and groundwater at TGO are provided in Table 9-1.

Table 9-1 Roles and responsibilities

Role	Responsibility
General Manager Operations	Ensure adequate resources are available to enable implementation of the Plan. Accountable for the overall environmental performance of the Operation, including the outcomes of the Plan.
TGO Environment & Community Manager	Ensure the implementation of the Plan, including the reporting of non-compliances with the trigger values, and subsequent implementation of the relevant action plan. Ensure employees are competent through training and awareness programs.
Mobile Equipment/Fixed Plant Operators	Ensure operations are undertaken in accordance with instructions. Ensure appropriate notification and response in the event of an environmental incident. Show due care not to cause environmental harm.
All Personnel	Follow direction provided by the TGO General Manager and TGO Environment & Community Manager. Show due care not to cause environmental harm. Notify Supervisor and Environment Manager immediately of any environmental non-compliance or potential non-compliance.

9.2 Training

All necessary site and contract personnel shall undergo water management awareness training as part of the site inductions. Any additional task specific training will be undertaken on an ‘as needed basis’ in the form of toolbox talks or formal training sessions.

10. Plan review

10.1 WMP revisions

The WMP will be reviewed and revised in accordance with Schedule 5 Condition 5 of Project Approval 09_0155 as reproduced below:

Within three months, unless the Secretary agrees otherwise, of:

a. The submission of an annual review under condition 4;

b. The submission of an incident report under conditions 7 or 7A;

c. The submission of an audit report under conditions 8 to 9A; and

d. The approval of any modification to the conditions of this approval; or

e. A direction of the Secretary under condition 2 of Schedule 2;

The Proponent must review and, if necessary, revise the studies, strategies or plans required under the conditions of approval to the satisfaction of the Secretary.

Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted to the Secretary for approval, unless otherwise agreed with the Secretary.

Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.

In addition to PA requirements TGO will review this plan if the following occur:

- Any significant change to water management practices
- Construction of additional significant surface water storages
- Development of new open cut or underground mining areas
- Continual exceedances of any surface or groundwater trigger values

10.2 Hydrogeological model review

As part of confirming the predictions of the analytical hydrogeological modelling undertaken for the Tomingley Gold Project (Impax, 2008, 2011), verification of the model results is required.

Hydrogeological modelling will be reviewed as required with the development of new underground workings.

The most recent verification and refinement of the groundwater model was undertaken as part of the Water Resources Assessment for MOD3 (GHD 2015b). A review and incorporation of additional baseline data found that:

- During the operational phase at TGO, groundwater levels at monitoring locations have typically remain with the pre-mining range,
- The inferred radius of influence of groundwater interception is lower than predicted in the EIS.
- The refined estimates of groundwater inflows were less than predicted in the EIS

11. References

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Appendices

Appendix A – Conditions of consent and statement of commitments

Table A-1 Schedule 3, Condition 32 - Water management plan requirements

Condition of Consent (09_0155) as modified by Modification 5		Where addressed
32	The Proponent shall prepare and implement a WMP for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with the EPA, DPE Water and Dam Safety NSW, by a suitably qualified and experienced person(s) whose appointment has been approved by the Secretary for approval by the end of January 2013, unless the Secretary agrees to otherwise. In addition to the standard requirements for management plans (see Schedule 5) the WMP must include:	This WMP Section 1.3
	a. a Site Water Balance that:	Section 4.5
	i. includes details of:	Section 4.5.2
	- sources and security of supply water	Section 4.5.3
	- water use on site	Section 4
	- water management on site	Section 4.5.4
	- off-site water discharges, including volume, timing and release point infrastructure	Section 8.4
	- reporting procedures, including comparisons of the site water balance for each calendar year	Section 4.5.5
	ii. describes what methods/measures would be implemented to minimise potable water use on site	This WMP Section 3.2 Section 6.1 Appendix B
	b. a Surface Water Management Plan that includes:	Section 4
	i. detailed baseline data on surface water flows and quality in creeks and other waterbodies that could be affected by the project (including Gundong Creek)	Section 4.1.1.1
	ii. a detailed description of the water management system on site, including:	Section 4.6
	- clean water diversion systems, including the clean water and dirty water separation levee	Section 4.1
	- An erosion and sediment control plan, consistent with the requirements of the Managing Urban Stormwater: Soils and Construction Manual (Landcom 2004, or its latest version); and	Section 4.1.4.1
	- water storages;	Section 4.1.5.3
	iii. detailed plans, including design objectives and performance criteria, for:	Section 4.7
	- design and management of the final voids	
	- design and management of water storages including the residue storage facilities (RSF1 and RSF2) and process water dams, including demonstrating how the decant water pond within RSF1 and RSF2 would be maintained to ensure adequate freeboard for containment of the design rainfall events, and a quality assurance / quality control plan to ensure the RSF2 liner meeting the permeability requirements in Table 8;	
	- control of any potential water pollution from the rehabilitated areas of the site	

Condition of Consent (09_0155) as modified by Modification 5		Where addressed
	iv. A program to monitor:	Section 5.2
	- The effectiveness of the water management system	Section 5.3 Section 5.2
	- Potential leakage or spillage from on-site pipelines	Section 5.3 Section 4.8
	- Surface water flows and quality, stream health and channel stability in Gundong Creek (in so far as it could potentially be affected by the project)	Section 5.1 Section 5.2
	v. A plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project	Section 7
	vi. Reporting procedures for the results of the monitoring program	Section 8.2
	c. A Groundwater Management Plan, that includes:	This WMP
	i. Detailed baseline data on groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the project	Section 3.4 Section 6.2
	ii. Groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts	Section 7.3
	iii. A program to monitor:	Section 5.3.2
	- Groundwater inflows to the open cut and underground mining operations	
	- The impacts of the project on	Section 5.3
	- Alluvial aquifers	
	- Any groundwater bores on privately owned land that could be affected by the project	Section 5.3
	- The seepage/leachate from the residue storage facility, water storages, backfilled voids and the final void	Section 5.3
	- The quality of groundwater to be re-used on the site	Section 5.2
	iv. A program for the on-going verification and refinement of the groundwater model, including the review and incorporation of additional baseline data obtained in accordance with condition 31, within 12 months of the project approval	Section 10.2
	v. A plan to respond to any exceedances of the groundwater assessment criteria	Section 7
	vi. Should geochemical testing reveal a higher risk of acid rock or saline drainage, the Proponent shall prepare an acid mine drainage strategy in consultation with DPI Water and to the satisfaction of the Secretary	Section 7 Appendix E

Condition of Consent (09_0155) as modified by Modification 5		Where addressed
3	1. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	Section 2.6
	a. detailed baseline data;	Section 3.2 Section 3.4 Section 6
	b. a description of:	Section 2
	i. the relevant statutory requirements (including any relevant approval, licence or lease conditions);	
	ii. any relevant limits or performance measures/criteria;	Section 7
	iii. the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 7
	c. a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 4
	d. a program to monitor and report on the:	Section 5
	i. impacts and environmental performance of the project;	Section 8
	ii. effectiveness of any management measures (see c above);	Section 5 Section 8
	e. a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.2.2
	f. a protocol for managing and reporting any:	Section 8.1
	i. incidents;	
	ii. complaints;	Section 8.3
	iii. non-compliances with statutory requirements; and	Section 8.4
	iv. exceedances of the impact assessment criteria and/or performance criteria; and	Section 8.4
	g. a protocol for periodic review of the plan.	Section 10

Table A-2 Other water management consent conditions

Condition of Consent (09_0155) as modified by Modification 5		Where addressed
Schedule 3		
26	The Proponent shall provide a compensatory water supply to any owner on privately-owned land whose water entitlements are adversely impacted (other than an impact that is negligible) as a result of the project, in consultation with DPE Water, and to the satisfaction of the Secretary. The compensatory water supply measures must provide an alternative long term supply of water that is equivalent to the loss attributable to the project. Equivalent water supply should be provided (at least on an interim basis) within 24 hours of the loss being identified, unless otherwise agreed with the landowner. If the Proponent and the affected landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution. If the Proponent is unable to provide an alternative long-term supply of water, then the Proponent shall provide alternate compensation to the satisfaction of the Secretary.	Section 8.3.1
Baseline groundwater monitoring		
31	The Proponent shall obtain at least six months of additional baseline groundwater monitoring within 12 months of the project approval. This monitoring shall: (a) Be sourced from bores WYMB02, WYMB03, WYMB04, WYMB06 and a new bore in the Gundong Creek alluvium to be established in consultation with DPE Water; and (b) Include a minimum of monthly measurements of standing water level and water quality parameters consistent with those monitored in the EA.	Appendix D

Table A-3 Statement of commitments

Desired Outcome	Action		Timing	Where addressed
5. Surface water				
Effective management of the potential contamination and/or reduction in availability of surface water resources.	5.1	Construct and maintain surface water management infrastructure of the Mine in accordance with an approved Water Management Plan (WMP).	Ongoing	Section 4
	5.2	Implement impact mitigation measures in accordance with an approved WMP.	As defined by the WMP	Section
	5.3	Undertake surface water monitoring in accordance an approved WMP.		Section 5.2
Design and construct surface water management structures to prevent the discharge of contaminated (hydrocarbon, cyanide, trace metals etc.) water from the Mine Site	5.4	Ensure that all fuel and reagent storage, delivery and handling areas are appropriately sealed and bunded and that overflow pipes are installed in a manner that would minimise the potential for pollution in the event of overfilling.	Ongoing	Section 4.3
	5.5	Securely store all hydrocarbon and chemical products.	Ongoing	Section 4.3
	5.6	Ensure all hydrocarbon and chemical storage tanks are either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum 110 % of the largest storage tank capacity.	Ongoing	Section 4.3
	5.7	Refuel all equipment within designated areas of the Mine Site, where practicable.	Ongoing	Section 4.3
	5.8	Undertake all maintenance works involving hydrocarbons, where practicable, within designated areas of the Mine Site such as the maintenance workshop.	Ongoing	Section 4.3
	5.9	Direct all water from wash-down areas and workshops to oil/water separators and containment systems.	Ongoing	Section 4.3
	5.10	Construct the RSF in accordance with design specifications and have QA/QC assessment completed.	During site establishment phase (prior to commencement of mining)	Completed
	5.11	Line the RSF and Raw Water Dam with compacted clay to achieve a permeability of 1 x 10^{-9}m/s or less.		Completed
	5.12	Provide for design specific freeboard within the RSF and Raw Water Dam to prevent overtopping.		Completed

Desired Outcome	Action		Timing	Where addressed
6. Groundwater				
Effective management of water dewatered from the open cuts	6.1	Remove water accumulating in the open cuts, transfer to Dewatering Dams and use preferentially for dust suppression activities.	Ongoing	Section 4.1.4
Effective management of the potential contamination and/or reduction in availability of groundwater resources.	6.2	Implement impact mitigation measures in accordance with an approved Water Management Plan (WMP).	As defined by the Water Management Plan	This WMP
	6.3	Undertake the groundwater monitoring in accordance an approved WMP.		Section 5.3
Ensure the availability of groundwater to surrounding users is maintained.	6.4	Implement additional assessment, landowner notification and contingency or compensatory measures in accordance with an approved Site Water Management Plan.		

Appendix B – Consultation

Dear Colleen

I would like to advise you that the Director-General has approved the appointment of:

- James Barrow to prepare the Groundwater Management Plan, which will form part of the broader Surface Water Management Plan for the project; and
- Jodie Benton to prepare the Heritage Management Plan for the project.

Regards
David

>>> Colleen Measday <CMeasday@alkane.com.au> 8/6/2012 3:04 pm >>>

Hello David,

Tomingley Gold Operations seek the endorsement of the Director General for the appointment of the specialists identified in the Letters attached. The specialists will undertake preparation of the management plans associated with Tomingley Gold Project and in accordance with Project Approval (application number 09_0155).

Best Regards

Colleen Measday
Environment Superintendent

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TOMINGLEY
GOLD OPERATIONS PTY LTD
(A wholly owned subsidiary of Alkane Resources Ltd)

Colleen

As the Director-General's delegate, I hereby approve the appointment of Mark Passfield of SEEC to prepare the Surface Water Management Plan for the project.

Regards
David

>>> Colleen Measday <CMeasday@alkane.com.au> 11/23/2012 10:39 am >>>

Department of Planning and Environment

Mr David Pritchard
Environment and Community Manager
Tomingley West Road
TOMINGLEY, NSW, 2869

08/07/2022

Dear Mr Pritchard

Tomingley Gold Project (MP09_0155)
Approval of Experts for Water Management Plan

I refer to your request (MP09_0155-PA-23) for the Planning Secretary's approval of suitably qualified and experienced persons to prepare the Water Management Plan in accordance with Condition 32 of Schedule 3 of the Project Approval (MP09_0155).

Tomingley Gold Operations Pty Ltd (TGO) has nominated Mr Tyler Tinkler, Senior Water Engineer at GHD and Mr Stuart Gray, Technical Director, Hydrogeology at GHD to prepare the Water Management Plan.

The Department has reviewed the nominations and information provided and is satisfied that these experts are suitably qualified and experienced. Consequently, I can advise that the Planning Secretary approves the appointment of Mr Tyler Tinkler and Mr Stuart Gray to prepare the Water Management Plan for the Tomingley Gold Project.

If you wish to discuss the matter further, please contact Emily Murray on 02 8837 6041.

Yours sincerely

Stephen O'Donoghue
Director
Resource Assessments

As nominee of the Planning Secretary

Colleen Measday

To: Tim Baker
Subject: TGO Water Management Plan - Office of Water comments

Dear Tim,

Thank you for forwarding NOW's comments on the TGO Water Management Plan.

We have amended our plan in accordance with the table below.

I have attached the updated copy of the Water Management Plan which will be forwarded to NSW Department of Planning and Infrastructure for Approval.

Best Regards

NOW Comment	TGO Response
Comment 1	Section 7.5.1 has been updated to include your request for resubmission following completion of the 6 months of background monitoring data.
Comment 2	Section 16.1 has been amended to include your comments
Comment 3	Section 2.2 has been included to incorporate your requirements
Comment 4	Section 8.4.3.2 has been amended to include your comments.
Comment 5	TGO will review the trigger data for EC upon completion of the six month groundwater sampling program and amend the EC trigger level to reflect background data.

Colleen Measday
Environment Superintendent

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TOMINGLEY
GOLD OPERATIONS PTY LTD
(A wholly owned subsidiary of Alkane Resources Ltd)

Level 2, 21 Church Street, Dubbo NSW 2830
PO BOX 910 Dubbo NSW 2830

From: Tim Baker [mailto:Tim.Baker@water.nsw.gov.au]
Sent: Wednesday, 30 January 2013 1:30 PM
To: Colleen Measday
Cc: Kane Winwood; Mark Campbell; Mike Sutherland; Richard Wheatley; Vickie Chatfield
Subject: TGO Water Management Plan - Office of Water comments

Hi Colleen,

Please see attached copy of Office of Water's comments to the Tomingley Gold Mine Draft Water Management Plan.

If you have any queries please let me know.

Regards
Tim

Tim Baker
A/Manager
Major Projects, Mines and Assessment
NSW Office of Water
Ph (02) 68417403
Mob 0428162097
Fax (02) 68840096
email - Tim.Baker@water.nsw.gov.au

>>> Colleen Measday <CMeasday@alkane.com.au> 12/4/2012 3:51 pm >>>

Hello Mark and Tim,

Please find attached Revision 1 of TGO?s Water Management Plan.

As per Schedule 3, Condition 32 of TGO?s Project Approval this plan is to be prepared in Consultation with NOW.

We also understand that the Surface Water component of this plan is required to assist you in approving our application for the construction of the western surface water diversion structure.

Please do not hesitate to contact me with any questions or comments regarding this plan

Best Regards

Colleen Measday
Environment Superintendent

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Department of Primary Industries
Office of Water

Contact Tim Baker
Phone 02 6841 7403
Mobile 0428 162 097
Fax 02 6884 0096
Email Tim.Baker@water.nsw.gov.au

Our ref ER20743

Colleen Measday
Alkane Resources Pty Ltd
PO Box 910
DUBBO NSW 2830

Dear Colleen,

Tomingley Gold Mine – Water Management Plan

I refer to your email dated 4th December 2012 requesting comments from the NSW Office of Water on the Draft Water Management Plan for the Tomingley Gold mine. It is recognised this request is in accordance with Schedule 3, Condition 32 of the Tomingley Gold Mine project approval. The NSW Office of Water appreciates the opportunity to comment and recommends the following points be considered and incorporated prior to finalising the document:

- The Office of Water is aware of the project approval requirement for 6 months of consecutive monthly baseline monitoring within 12 months of post project approval. As the WMP is yet to include this data the Office of Water requests the WMP be resubmitted upon completion of the 6 consecutive months of groundwater monitoring and analysis.
- The WMP indicates the volume of groundwater required on the groundwater license will be determined by the volume being intercepted by the open cut and underground workings. The Office of Water advises that licensed entitlement must be held by the proponent prior to intercepting groundwater and that the predictive model is used to determine the required volume. Actual monitoring data and refinement of the groundwater model can then be utilised to inform ongoing licence requirements. No groundwater licences have been lodged, or share component nominated for the three open cuts or underground portal that possibly intercept groundwater and any evaporative losses incurred.
- The Office of Water recommends a new table or an additional column on an existing table is included to indicate where a licence under the *Water Management Act 2000* is required for access to a proposed water source. If that licence has already been obtained then the licence number and entitlement can be listed. It is also requested this table include the predicted groundwater take requirements for the project. It is anticipated this would be included in further detail in the AEMR reports with actual monitoring data and refinement of predictions for future years.
- The WMP states a commitment in the case of all the proposed monitoring bores drying up during mining as a result of dewatering, to further monitoring of the fractured rock aquifer. A similar level of commitment should be made to monitoring the Gundong Creek alluvium if project operations occur in the drying up of the existing monitoring bores.
- The EC trigger level for alluvial groundwater in the Gundong Creek aquifer (GDCMB01) exceeding 2000 μS/cm appears excessive to current baseline data presented. The existing baseline lab and field EC measurements from November 2012 range between 510-705 µS/cm for GDCMB01. The EC review level for the Gundong Creek alluvium should be

assessed and recommended upon the completion of the 6 month consecutive monthly baseline data on ongoing monitoring.

Should you have any further queries in relation to this submission please do not hesitate to contact Tim Baker on (02) 6841 7403.

Yours sincerely

Tim Baker
A/Manager Major Projects, Mines and Assessment
30 January 2013

Colleen Measday

From: Colleen Measday
Sent: Thursday, 6 December 2012 2:43 PM
To: bradley.tanswell@epa.nsw.gov.au
Subject: Tomingley Gold Project - Water Management Plan
Attachments: Water Management Plan R1 06Dec2012.pdf

Hello Brad,
Please find attached Revision 1 of TGP Water Management Plan.
In accordance with Schedule 3, Condition 32 of our Project Approval issued by the NSW Department of Planning and Infrastructure, this plan must be prepared in consultation with EPA.
Please review this plan and provide any feedback to me.

Best Regards

Colleen Measday
Environment Superintendent

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TOMINGLEY
GOLD OPERATIONS PTY LTD
(A wholly owned subsidiary of Alkane Resources Ltd)

Level 2, 21 Church Street, Dubbo NSW 2830
PO BOX 910 Dubbo NSW 2830

Dear Brad,

Thank you for your letter requesting Additional Information to process the Tomingley Gold Operations - Environment Protection Licence.

The table that follows addresses your requests for additional information.

EPA Comment	TGO Reply
<u>Surface Water Structures</u> No calculations to determine the sediment basin sizing were provided in the Water Management Plan. The EPA requires these calculations to confirm the 5 day rainfall event stated equates to 35.6mm.	Calculations for the 5 sediment basins were provided in Appendix 5 of the Tomingley Gold Project – Surface Water Assessment, September 2011, SEEC. (This report is attached to this reply).
The Process Water Dam, Residue Storage Facility and Dewatering Ponds. The WMP provides no information about design rainfall events (or probability of overtopping) that is protected by the freeboards nominated in the WMP. The EPA seeks this information to allow the variation application to be processed.	The Tomingley Gold Project – Surface Water Assessment, September 2011, produced as part of the Environment Assessment for the project details this information. Section 4.8 -Climate And Section 4.8.3 - Rainfall to Evaporation Comparison, details information with respect to anticipated rainfall for the site. This explains that in all cases rainfall is exceeded by evaporation. (This report is attached to this reply).
<u>Surface Water Monitoring Plan</u> The EPA will require initial monitoring of water captured in the sediment basins with analysis to include the analytes listed in Table 6 as well as the full scan of metals and total and WAD Cyanide. The surface water monitoring program should be amended to include initial regular monthly monitoring of the sediment basins including parameters listed in Table 6 plus a full scan of metals and total and WAD cyanide. Once this is established the additional parameters should then be monitored quarterly ensure cyanide and metals are not reaching the sediment basins in levels beyond background levels. Table 8 should be updated to trigger a nominated management response where any metals or cyanide are detected in excess of background	The WMP Table 6 has been updated to include metals and cyanide in line with your comments and to adjust the frequency of monitoring in line with your comments. Section 6.3.4 has also been included to identify the ANZECC trigger levels for the Gundong Creek. Table 8 (now Table 9) has been updated to indicate the TGO response based on trigger levels of cyanide and metals.

EPA Comment	TGO Reply
levels in the sediment basins. The EPA requires the amendments as described above to be placed in the WMP.	
Groundwater Monitoring Program Baseline Monitoring Bore Locations – The EPA requires a relevant map of these locations, depicting the relevant monitoring points to allow the variation application to proceed.	Section 4.6 has been updated to include Figure 2.
Groundwater monitoring frequency – the EPA requires the WMP to provide for quarterly monitoring	Section 7.5.4 has been updated to include quarterly monitoring
Monitoring Parameters Section 7.5.4 states that monitoring will be undertaken for analytes listed in Table 8. This is an incorrect cross reference.	Section 7.5.4 has had reference to Table 8 changed to Table 18.
Groundwater Monitoring for the Residue Storage Facility (RSF) The EPA requires a clear map from the proponent showing the proposed locations of the piezometers.	A new Figure, Figure 3 has been added to the plan to show the location of the 6 piezometers.
The suite of analytes included at Table 18 must include TDS, DO, redox potential, major Cations, anions, alkalinity, TSS, bicarbonate, calcium, chloride and sulphate.	Table 18(now Table 19) has been updated to include the requested parameters
Surface Water Response Plan The EPA requires the addition of triggers for metals and cyanide.	Table 20 updated to include triggers for metals and cyanide
Groundwater Response Plan The EPA requires justification from the proponent for a groundwater EC trigger level of 2000uS/cm for the shallow alluvium.	At the time of writing Revision 2 of the WMP only one round of sampling had been conducted in the new bore located in the shallow alluvium GDCMB01. The groundwater monitoring program has just been completed and the results are to be sent to our groundwater consultant for review. Upon this review the groundwater trigger levels can be updated to be more site specific. The new

EPA Comment	TGO Reply
	revision of the plan will be issued to the EPA.
<u>Residue Storage Facility</u> Section 8.4.4.2 states that the samples will be analysed for parameters listed in Table 9, which includes only EC, TP, TN, pH and TSS. This appears to contradict the commitments in Section 7.5.5 (Table 18) to analyse for a wider range of elements, including heavy metals and cyanide. The EPA requires the proponent to: 1. Analyse samples in the RSF piezometers for the full suite of parameters previously recommended by the EPA until a constant or certain relationship between EC, pH , metals and cyanide can be determined. 2. Set trigger levels for management response to all parameters.	In section 8.4.4.2 the reference to Table 9 has been changed to Table 19 (previously Table 18) which lists the full suite of parameters. Section 8.4.4.2 has been updated to refer to the Trigger Value listed within Table 8.
<u>Groundwater Reuse Procedures</u> The EPA requires, at this time written confirmation from the proponent regarding this limited groundwater re-use.	Section 7.3.6 has been updated to describe the way in which groundwater will be reused on site.

NSW EPA

Our reference : DOC16/290326
Contact: Ramya Gowda, epa.farwest@epa.nsw.gov.au
Date: 5 August 2016

General Manager
Tomingley Gold Operations Pty Ltd
PO Box 910
DUBBO NSW 2830

Attention: Mark Williams

Dear Mr Sutherland,

Thank you for submitting the water balance and Water Management Plan (WMP) to the Environment Protection Authority (EPA) as part of the Tomingley Gold Operations project modification 3.

The EPA has reviewed the amendments to the WMP and has found that the WMP is not adequate and should be revised to address the issues set out below to ensure the WMP remains consistent with current and future licence requirements. The EPA's comments are included in Attachment A and are enclosed.

Should you have any enquiries regarding this matter, please contact Ramya Gowda at the Dubbo Office of EPA by telephoning (02) 6883 5306.

Yours sincerely

BRADLEY TANSWELL
Acting Head Far West Operations
Environment Protection Authority

Encl: Attachment A

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ATTACHMENT A

Discharges from "dirty water" sediment basins

The MOD 3 Environment Assessment (EA) proposed that the site will be a nil discharge site, i.e. only managed overflows will occur in large rainfall events. The WMP does not make it clear that this remains the case or if controlled discharges are now proposed.

The EPA has previously advised that the volume and quality of managed overflows is not fully able to be controlled by the licensee. In these circumstances the EPA cannot reasonably expect a licensee to manage compliance with pollutant concentration and volume limits beyond the design parameters.

The EA stated that:

> *"In the unlikely event of a discharge, it is expected the quality of the water would comply with salinity and pH criteria. While this water could contain elevated concentrations of total suspended sediment the criteria of EPL 20169 is not applicable under these conditions given the rainfall exceeds the design specification of the sediment basins (designed, constructed and managed in accordance with Blue Book standards)." and*
>
> In Section 4.3.4.1.3 Water Quality: *"the water quality criteria for total suspended sediment (TSS) of EPL 20169 should not apply and modification to EPL 20169 is recommended to reflect this.*

The EPA agreed that licence limits for TSS could be turned off for managed overflows provided that the other proposed controls, including increasing the basin size and including pumping to other storages, are implemented.

Turning off licence limits for TSS during managed overflows recognises that the agreed design capacity of sediment basins has been exceeded and that overflows are a function of the weather event and therefore the Licensee is not fully able to control the sediment in the discharge and the volume discharged. It may also result in inappropriate use of flocculants in an attempt to meet the TSS licence limit which may lead to higher risk of flocculants or coagulants being discharged. The EPA can regulate managed overflows by conditions that minimise the environmental impact and ensure that other practical measures are taken.

The EPA and Proponent have agreed to this position through the Planning process (Response to Submission), however, this has not been incorporated into the WMP. The means that the WMP continues to propose and discuss limits for TSS in managed overflows and this may have implications for other elements of the WMP such as appropriate use and management of flocculants and discussion around retention times required for treatment (see further comments below on retention times).

Natural metal levels in receiving waters

As part of the EA process, the EPA stated that the limits for metals should remain on the licence for any controlled discharges and for managed overflows since the design of the sediment basins (i.e. "Blue Book" standards) is based on areas with clean sediment only. The dirty water sediment basins receive runoff from waste rock emplacement areas that may contain metals.

The WMP indicates that monitoring will be conducted to develop site specific trigger values for metals that may naturally occur at concentrations exceeding the limits in EPL 20169. With regard to taking into account natural metal concentrations in waterways, ANZECC (2000) provides specific guidance and methodology including:

- selecting reference sites (e.g. use of slightly disturbed reference sites where the level of protection is slightly to moderately disturbed); and
- specific data requirements for deriving site specific trigger values (24 monthly samples for example).

A key issue that the WMP is not adequately addressing is, if site specific trigger values are proposed to be developed then the use of data from moderately disturbed or highly disturbed sites is not appropriate and site selection should be clearly justified based on the ANZECC reference site methodology in consultation with the EPA. The upstream sites used in the WMP have not been established as slightly disturbed sites for the purposes of developing site specific trigger values.

It is recommended that before any monitoring is conducted to establish site-specific trigger values that the suitability of the reference site is developed in accordance with ANZECC (2000) methodology and the site is agreed by the EPA as a suitable reference site.

Proposed interim trigger values/licence limits

The WMP proposes alternative licence limits in Table 5-5 (Proposed interim water quality trigger values). This is not an acceptable approach as the proposed limits do not make reference to aquatic ecosystem trigger values but are based on other environmental values. The EPA, as part of its licensing functions, are required to consider all of the environmental values of water affected by the activity and the practical measures that could be taken to restore or maintain those environmental values.

It is recommended that:

- ***existing licence limits for metals and salinity are maintained; and***
- ***as an initial basis for revising licence limits, the licensee consider relevant steps in the ANZECC (2000) decision tree for toxicants to modify trigger values for site-specific use and to identify the forms of each metal that have the highest risk to aquatic ecosystem, e.g. sampling of total and dissolved metals in managed overflows.***

Available dilution in receiving waters can be taken into account in revising limits for metals, however, it should be noted that the dilution that EPA takes into account is near-field (initial) dilution in-stream and not dilution from far-field processes.

Dilution of metal levels in the sediment basins and in discharges due to high rainfall conditions has the potential to reduce metal concentrations in discharges which will assist in meeting current licence limits for metals.

Overflow frequency based on revised sizing of sediment basins

The MOD3 EA proposed an internal sediment basin dewatering system would continue to be maintained with pumping rates of 90L/s. The pumping rates should be incorporated into the WMP.

The WMP states that "*The treatment of water within the sediment ponds prior to discharging from the LDPs requires additional residence time, treatment and water quality testing. The additional residence time required to achieve overly-conservative water quality targets has the potential to increase the potential for uncontrolled discharges to occur by reducing the available storage capacity within the sediment ponds (refer to Section 4.1). Uncontrolled discharges are likely to include higher concentrations of pollutants.*"

Based on the above statement, it is not clear how residence time would be increased by trying to achieve "overly conservative" water quality targets or how this may have the potential to increase the potential for uncontrolled discharges to occur by reducing the available storage capacity within the sediment ponds. (Note that it has not been established that the limits are over conservative as

they are based on ANZECC (2000) guidelines and the WMP has not considered any options in ANZECC to reduce any conservative aspects of default trigger values). Further clarification should be provided in the WMP on:

- how consideration of switching off TSS limits would affect the statements about retention times to allow treatment. Where TSS limits are switched off for managed overflow, it is not clear what treatment methods are proposed in the lead up to a potential managed overflow and how these treatments would be managed to ensure that dissolved flocculants are not discharged. Measurement of total and, in particular, dissolved metals at times of overflow may provide appropriate information to consider potential environmental harm; and
- how it is possible to increase the potential for uncontrolled discharges due to the additional residence time required to achieve water quality targets. Managed overflow will occur when the design capacity is exceeded plus all available pumping capacity is exceeded. Treatment periods cannot be extended to allow further treatment unless there is consideration of controlled discharges, however, the site is stated to be a nil discharge site apart from managed overflow.
- measures to address potential elevated metal levels in sediment basins in controlled or managed overflows as the basins are designed to manage sediment and not metals. This may include:
    - further separating areas of higher risk of metal runoff and directing this wastewater to contaminated water basins that do not discharge to the waters except in extreme rainfall events; or
    - appropriately treating metals prior to any discharges via the sediment basins "dirty water" system subject to the assessment of total and dissolved metal levels in discharges.

Based on initial sampling of managed overflows and consideration of all practical measures to address the potential impact of metal levels in overflows, the EPA may consider proposals for alternative discharge limits or conditions for metals in managed overflows that account for the full range of environmental values.

Regulation of pumping from sediment basin to internal storages

The EPA proposes to add conditions to the EPL 20169, in relation to the regulation of pumping to control and minimise overflows as outlined below (and as proposed in the Environmental Assessment). This relates to a requirement to ensure pumping is implemented and maintained to ensure offsite discharges are minimised:

- *The licensee must initiate pumping (with a pumping rate of 90L/s) to move water from the sediment basins to the process water management system (Raw Water Dam, Process Water Dam or Central Wyoming Dam) during heavier or prolonged rainfall events;*
- *The licensee must discharge wastewater to an alternative storage or open cut for temporary storage, if capacity of any of the water storages of the process water management system reaches 90%.*

Residue Storage Facility

Table 1-1 in the WMP refers to "*Conditions of Consent relating to Water*". In the row relating to the permeability of the Residue Storage Facility liner the Consent condition states:

- "*The Proponent shall ensure that the capacity of the RSF and associated collection pond is designed to meet the requirements of the Environmental Guidelines – Management of Tailings Storage Facilities (Vic DPI, 2004) and that the floor and walls are lined to achieve permeability standard of at least 1 x 10^{-9} m/s.*" and notes that:
- "*An alternative permeability standard may be acceptable following the completion of an appropriate risk assessment undertaken in accordance with the abovementioned guidelines, to the satisfaction of the EPA and the Director-General.*"

The comment column states: "*Verification exercises indicate a permeability of 1x10^{-8} m/s. Approval for compaction sought by EPA and DP&E.*" *Section 7.2.2 is referred to, to address this issue.*

Section 7.2.2, however, states that "*In accordance with the Statement of Commitments listed in (Appendix A) the RSF has been constructed over naturally occurring clays that have a permeability of less than 1 x 10^{-9} m/s of depth 900 mm or greater.*" It is not clear what Table 1.1 is referring to. Section 7.2.2 of the WMP indicates an appropriate permeability of the liner and there has not been a risk assessment for any alternative liner standards.

DOC22/55340-2

Alkane Resources Ltd
Returned via the Major Projects Portal

Attention: Mr David Pritchard

14 February 2022

Response to the Draft Water Management Plan for Modification 5 MP09_0155-PA-20 post approval consultation

Dear Mr Pritchard,

Thank you for consulting with the Environment Protection Authority (EPA) on your proposed revision to the Water Management Plan for the Tomingley Gold Mine. A draft copy of the revised plan was provided to the EPA via the Major Projects Portal on 1 February 2022. I understand that it is a condition of the facility's Project Approval (MP09_0155) that the EPA be consulted during the preparation of this plan.

The EPA encourages the development of Environmental Management Plans and Programs to ensure that proponents/licensees have determined how they will meet their statutory obligations and environmental objectives as specified by any Project Approval (or other statutory approval) and/or the conditions of an environment protection licence. However, the EPA does not review these plans and programs (unless in circumstances deemed necessary) as the role of the EPA is to set conditions/criteria for environmental protection and management, not to be directly involved in the development of strategies to comply with such conditions/criteria.

In this instance, the EPA will not be providing any specific comment on the management plan. As a management tool, such plans and programs should assist Tomingley Gold Operations Pty Limited in meeting their commitment to statutory compliance and wider environmental management and, where appropriate, should be integrated with other management plans. The EPA recommends that such plans be audited to an industry standard or certified to the ISO 14001 standard (if applicable) as part of any overall environmental management system.

The EPA also recommends that you contact us directly should you identify any necessary changes to the premises' Environment Protection Licence that may result from the proposed management plan updates.

If you have any questions about this matter, please contact Joshua Loxley on (02) 6883 5326 or by email at info@epa.nsw.gov.au.

Yours sincerely

Nick Feneley
Acting Unit head
Regulatory Operations Regional

Phone 131 555 **TTY** 133 677 PO Box 2111 L1, 48-52 Wingewarra Street **info@epa.nsw.gov.au**
Phone +61 2 6883 5333 **ABN** 43 692 285 758 DUBBO NSW 2830 DUBBO NSW 2830 **www.epa.nsw.gov.au**
Australia Australia

From: DRNSW Dam Safety Information Mailbox <dsnsw.info@damsafety.nsw.gov.au>
Sent: Monday, 14 February 2022 09:59
To: David Pritchard <DPritchard@alkane.com.au>
Subject: Re: Tomingley Gold Operations Draft Water Management Plan Review.

Hi David

Thank you for your email. I have forwarded your email onto the appropriate person in Dams Safety NSW and they will be in touch.

Regards

Dams Safety NSW

From: David Pritchard <DPritchard@alkane.com.au>
Sent: Monday, 14 February 2022 8:56 AM
To: DRNSW Dam Safety Information Mailbox <dsnsw.info@damsafety.nsw.gov.au>
Subject: Tomingley Gold Operations Draft Water Management Plan Review.

Good morning,

Please find attached the latest revision of the Tomingley Gold Operations (TGO) Water Management Plan which has been provided to Dams Safety NSW for review in accordance with the TGO Project Approval prior to submitting the final version to DPE for approval. As Dams Safety NSW are linked to the DPE portal the Management Plan has been supplied directly.

A reply with any comments would be appreciated within 14 days in line with the DPE standard period for consultation with other agencies.

Should you require any clarification on this plan please contact me ion the numbers below.

Regards

David Pritchard

Environment & Community Manager

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TOMINGLEY
GOLD OPERATIONS PTY LTD
(A wholly owned subsidiary of Alkane Resources Ltd)

Mine Site: Tomingley West Road, Tomingley NSW 2869 - PO Box 59, Peak Hill NSW 2869

Department of Planning and Environment

David Pritchard
Environment and Community Manager
Tomingley West Road
Tomingley, NSW, 2869

27/05/2022

Dear Mr Pritchard

Tomingley Gold (MP09_0155)
Water Management Plan - Request for Additional Information

I refer to the Water Management Plan submitted to the Department of Planning and Environment (the Department) as required under the conditions of consent for the Tomingley Gold Project.

After receiving comment from the Department of Planning and Environment – Water (DPE Water), the Department is requesting that you provide additional information as detailed in Attachment A.

You are requested to provide the information, or notification that the information will not be provided, to the Department by Wednesday 15 June 2022. If you are unable to provide the requested information within this timeframe, you are required to provide, and commit to, a timeframe detailing the provision of this information.

If you have any questions, please contact Kristina Robinson, who can be contacted on (02) 9860 1543 or at Kristina.robinson@dpie.nsw.gov.au.

Yours sincerely

W Jones

Wayne Jones
Team Leader - Post Approval
Resource Assessments

Attachments: Attachment A - DPE Water Response

Department of Planning and Environment

Our ref: OUT22/1910

David Pritchard

Email: DPritchard@alkane.com.au

17 May 2022

Subject: **Tomingley Gold - Water Management Plan (WMP) (MP09_0155-PA-20)**

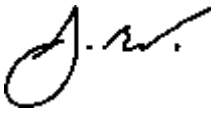
Dear Mr Pritchard,

I refer to your request for advice on 1 February 2022 to the Department of Planning and Environment (DPE) Water about the above matter.

The Department of Planning and Environment- Water (DPE Water) has reviewed the WMP and requests further information on the monitoring of potential leakage from RSF2 and clarification of information provided in the WMP.

Should you have any further queries in relation to this submission please do not hesitate to contact DPE Water Assessments at water.assessments@dpie.nsw.gov.au

Yours sincerely,



Luke McIver
Acting Manager, Assessments, Knowledge Division
Department of Planning and Environment: Water

Attachment A

Detailed advice regarding the Tomingley Gold - Water Management Plan (MP09_0155-PA-20)

1.0 Monitoring around RSF2

1.1 Recommendation

- Construct and monitor shallow monitoring bores around RSF2 and include those bores within the Trigger Action Response Plan (TARP) in consultation with DPE Water.

1.2 Explanation

In terms of revision of the WMP, water quality impact associated with potential leakage from the RSF2 is the additional concern relevant to Modification 5 of the project approval. However, shallow monitoring bores are neither drilled nor proposed for monitoring around RSF2 to monitor potential leakage from RSF2.

2.0 Water balance

2.1 Recommendation

- Clarify the reasons for disparity between inflow and outflow, and zero groundwater inflow in the water balance provided in section 4.5.1.

2.2 Explanation

Water balance (Table 4.4) appears to provide the water budget for the project. It indicates a change in storage of 61 ML/year and zero groundwater inflow. It is not clear why there is a change in storage in the water balance. The WMP (section 4.4.2) states that groundwater encountered in the underground workings is removed by pumps; this contradicts the statement of zero groundwater inflow in the water balance.

3.0 Monitoring bore WYMB01

2.1 Recommendation

- Clarify the reasons for selecting an excessively deeper groundwater level stage 1 trigger for monitoring bore WYMB01 and absence of the hydrograph for the same in the WMP.

2.2 Explanation

The hydrograph of monitoring bore WYMB01 is notably absent, although hydrographs of all other deep monitoring bores were provided in Appendix B. The groundwater level stage 1 trigger is set as approximately 2 m below the historical low groundwater level during TGO operational period since 2014 for all deep monitoring bores. However, groundwater level trigger for WYMB01 is excessively deep at 207.6 m AHD, which is about 18 m deeper than the historical low observed in that bore. The reason for setting a deeper trigger level for WYMB01 is unsubstantiated.

End Attachment A

Department of Planning and Environment

David Pritchard
Environment and Community Manager
Tomingley Gold Operations Pty Ltd
Tomingley West Road
Tomingley, NSW, 2869

04/07/2022

Dear Mr. Pritchard

Tomingley Gold Project (MP09_0155)
Water Management Plan - Request for Additional Information

I refer to the Water Management Plan submitted to the Department of Planning and Environment (the Department) in accordance with Condition 32 of Schedule 3 of the conditions of approval for the Tomingley Gold Project (MP09_0155). After careful consideration, the Department is requesting that you provide additional information.

You are requested to submit a revised document that addresses matters discussed in **Attachment 1**.

If you have any questions, please contact Emily Murray, who can be contacted on 8837 6041.

Yours sincerely

W Jones

Wayne Jones
Team Leader - Post Approval
Resource Assessments

Attachments: Attachment 1 – Feedback Table

Tomingley Gold Project – Water Management Plan
Post Approval Review

Document: Water Management Plan
Revision: 5 Dated June 2022
Reviewed: Emily Murray on 4 July 2022

Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
The Proponent shall prepare Water Management Plan for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with the EPA, DPE Water and Dams Safety NSW by a suitably qualified and experienced person(s) whose appointment has been approved by the Secretary, and submitted to the Secretary for approval by the end of January 2013, unless the Secretary agrees otherwise.	No	References Section 1.3 TGO attempted consultation with Dams Safety but did not receive a response (this information is not in the MP), responses received from EPA and DPE Water but not attached to MP. No evidence of suitably qualified and experienced persons whose appointment was approved by the Secretary provided.	Provide evidence of consultation as an appendix. Add details that Dams Safety NSW did not provide a response. Provide details of person who prepared the WMP and approval from the Secretary. A table in the document would also be good to be able to capture previous consultation (as this is revision 5 and no evidence of previous consultation is attached) – if not, at least consultation undertaken for this revision.	Evidence of consultation has been summarised in Section 1.4 and is included in Appendix B. Evidence of approval of the appointment of suitably qualified and experienced persons is summarised in Section 1.3 and is included in Appendix B.
In addition to the standard requirements for management plans (see Condition 3 of Schedule 5), this plan must include: (a) a Site Water Balance that: (i) includes details of:	Partial	References Section 4.4.2. Incorrect – water balance is Section 4.5.	Reference Section 4.5.	Referencing has been updated.

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Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
• sources and security of water supply;	Partial	References Section 0. Section 4.5.1 describes main water supply at TGO is raw water from Woodlands Borefield and the groundwater is inherently secure. Details entitlement of 1000 ML sufficient for TGO operations. There are two Sections 4.5.1's.	Revise heading number for '4.5.1 – Water supply and security' – this should be 4.5.2. Reference to Table 4.4 and revised section 4.5.2 in Table A-1 in appendices.	Referencing has been updated.
• water use on site;	Partial	References Section 4.4.2. Should be 4.5.2 (or 4.5.3 if headings are fixed). Water use is detailed in Table 4-4 and describes that main water use at the mine is processing ore, with majority of water use lost through evaporation in tailings.	Update references in Table A-1 and heading numbers.	Referencing has been updated.
• water management on site;	Yes	References Section 4. Section 4 describes water management system. Details include surface water management system and details of capacity of all water storages, figures provided of water management (diagram) and on-site management which includes the new RSF2 (MOD5) and extended project area.	Update headings. Remove references to 'proposed' RSF2 and describe it as the RSF2 as this has been approved.	Section 4.1.5 has been updated to refer to RSF2 as approved following approval of MOD5.

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		Details of clean water, raw water, mine water and dirty water provided. Reference is to the 'proposed RSF2' – RSF2 has been approved and proposed should be removed. Groundwater management system detailed, water balance, erosion and sediment control.		
• off-site water discharges, including volume, timing and release point infrastructure requirements;	Yes	References Section 4.5.3 – offsite discharges. Discharges would account for less than 1% of water outputs and only occur via Licensed Discharge Points LDPs identified Section 4.1.3.2 due to rainfall events. Concentration limits in 7.2.1 Table 7-2 a) claims EPA approval for turning off TSS licence limits.	Please provide evidence of EPA approval to "turn off" TSS limits during managed overflows.	Evidence of EPA agreement in principle to wet weather discharge conditions is provided in Appendix B, subject to implementation of other proposed water management components. A future variation to EPL 20169 would be required to reflect this agreement.
• reporting procedures, including comparisons of the site water balance for each calendar year; and	Yes	References Section 8.4 Annual site water balance is included in annual review.	Include that annual review should include comparisons of site water balance for each calendar year.	Section 8.4 has been updated to include the requirement of comparisons of the site water balance for each calendar year
(ii) describe what measures would be implemented to minimise potable water use on site;	Partial	References Section 4.4.2 – Underground water management.	Revise referencing in Appendix.	Referencing has been updated.

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Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
		Section 4.5.4 references potable water use and describes that municipal potable water use is not available.		
(b) a Surface Water Management Plan that includes: (i) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could be affected by the project (including Gundong Creek);	Partial	References Section 3.2 – Hydrology and waterways. Section identifies catchment (Figure 3-5). Section 3.4 describes groundwater quality but surface water quality in creeks is not mentioned. Baseline data is provided in Section 6, with Section 6.1 describing surface water including quality.	Reference to Sections 6.1, Table 6-1, Appendix B in the appendix.	Referencing has been updated.
(ii) a detailed description of the water management system on site, including: • clean water diversion systems, including the clean water and dirty water separation levee; • an erosion and sediment control plan, consistent with the requirements of the Managing Urban Stormwater: Soils and Construction Manual (Landcom 2004, or its latest version); and • water storages;	Yes	References Section 4 (water management system) – from previous condition this looks adequate. Clean water diversions – references 4.1.1.1, clean water diversions could be included in the figure. Erosion and sediment control plans – references to Section 4.6 – Erosion and sediment control, includes reference to	No action	No action

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Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
		correct guideline, details risks based on rainfall and months, includes details of erosion and sediment controls. Water storages – references Section 4.1 – Table 4-1 includes details of all water storages.		
(iii) detailed plans, including design objectives and performance criteria, for: • design and management of the final voids; • design and management of water storages including the residue storage facilities (RSF1 and RSF2) and process water dams, including demonstrating how the decant water pond within RSF1 and RSF2 would be maintained to ensure adequate freeboard for containment of the design rainfall events, and a quality assurance/ quality control plan to ensure the RSF2 liner meets the permeability requirements in Table 8; • control of any potential water pollution from the rehabilitated areas of the site;	No	References Section 4.1.4.1, final voids – details pits are dewatered or used for dirty water management. Should also reference Section 4.1.4.2 – Final voids. Details that objectives are in the MOP – as of July this will need to change to a Rehab Management Plan, given timing of RSF2 construction works this should be revised in the next revision of the Management Plan. Refers to Section 4.1.5.3 – Residue Storage Facilities. Performance criteria is provided, no demonstration of how the decant pond would be maintained or any quality assurance/control plan provided. Figures would be useful.	Reference to Section 4.1.4.2. Include details of the quality assurance /quality control plan to form a low permeability layer (of less than 1 x 10-9 m/s) referred to in Section 4.1.5.3. Detail rehabilitated areas within the site (completed) and to be completed and measures that would be implemented to control potential water pollution.	Noted. The next revision of the WMP will include an updated reference to the relevant aspects of the Rehabilitation Management Plan that address the relevant conditions of the WMP. Section 4.1.5.3 has been updated to include additional details on the management of water levels in decant pond. Adequate freeboard is maintained by continuous monitoring of water levels in the decant pond by the site supervisory control and data acquisition (SCADA) system and decant pumps to transfer excess decant water is

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		Rehabilitation – references Section 7.2. Only section that mentions rehabilitated areas is Section 4.7. Describes that monitoring program will continue during rehabilitation. WRE1 and WRE2 (rehabilitated areas) are not mentioned and no measures to control any potential pollution from rehabilitated areas is provided.		transferred to the WCD – South for storage. Section 4.1.5.3 has been updated to include additional details on the quality assurance /quality control plan to form a low permeability layer including the the material specifications for the construction of RSF2 requirement for a minimum permeability test frequency of once every 5 000m3 and per 10 000m3 of volume placed. Section 4.7 includes details of the rehabilitated areas on site. The final landform surface is designed to minimise the potential for pollution from rehabilitated areas. No pollution from rehabilitated areas of the site have been identified. The surface existing monitoring program will continue during rehabilitation to identify any potential water pollution from the

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				rehabilitated areas of the site. The measures to control potential water pollution from rehabilitated areas will reviewed following the approval of the Rehabilitation Management Plan.
(iv) a program to monitor: • the effectiveness of the water management system; • potential leakage or spillage from on-site pipelines; • surface water flows and quality, stream health and channel stability in Gundong Creek (in so far as it could potentially be affected by the project);	Partial	References Section 5.2 and 5.3 and potentially 4.8. Could reference Section 5 'Monitoring Requirements', Section 5.1 describes inspections undertaken. Potential leakage or spillage is referenced in Section 48. Surface water flows references Section 5.2, channel stability not detailed as a monitoring parameter.	Include monitoring channel stability of Gundong Creek in parameters in Section 5.2.	Condition 32(b)(iv)(3) requires a program to monitor surface water flows and quality, stream health and channel stability in Gundong Creek (in so far as it could potentially be affected by the project). Infrequent discharges due rainfall in excess of the design criteria from the site have the potential to affect surface water flows and quality, but are unlikely to affect stream health and channel stability. No routine monitoring of stream health and channel stability are proposed as part of the surface water monitoring program.

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(v) a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project; and	Partial	References Section 6.2.2. Section 6.2.2 is 'shallow bores'. Does not describe plans to respond to exceedances of the performance criteria. Should references Section 7 – Triggers and response plans. Also Table 7-1 provides details of performance measures and where addressed – some references are to 'Section 0'. Refers to the Trigger Action Response Plan – not sure where this is? TARP is in Appendix C but there is no reference to the appendix in the document.	Revise reference to Section 7 and refer to Appendix C in the text (when referencing the TARP).	Referencing has been updated.
(vi) reporting procedures for the results of the monitoring program; and	Yes	References Section 8.2 – Monitoring results. Monitoring results will be published in accordance with the POEO Act.	No action.	No action
(c) a Groundwater Management Plan, that includes: (i) detailed baseline data on groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the project; (ii) groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	No	i) References Section 3.4 and 6.2. Details of groundwater quality provided in Section 3.4, GDE's, 22 bores withing 10km of the site, including public bores (4). Section 6.2 is baseline data for	Provide details of the quality of groundwater to be re-used on site. Provide details of on-going verification and refinement against the baseline data as required to be completed	Condition 32(c)(iii)(5) requires a program to monitor the quality of groundwater to be re-used on the site. Groundwater is not reused directly at TGO. Section 5.2 has been

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Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
(iii) a program to monitor: • groundwater inflows to the open cut and underground mining operations; • the impacts of the project on: - alluvial aquifers; and - any groundwater bores on privately-owned land that could be affected by the project; • the seepage/leachate from the residue storage facilities (RSF1 and RSF2), water storages, backfilled voids and the final void; and • the quality of groundwater to be re-used on the site; (iv) a program for the on-going verification and refinement of the groundwater model, including the review and incorporation of additional baseline data obtained in accordance with condition 31, within 12 months of the project approval; and (v) a plan to respond to any exceedances of the groundwater assessment criteria; and (vi) should geochemical testing reveal a higher risk of acid rock or saline drainage, the Proponent shall prepare an acid mine drainage strategy in consultation with DPE Water and to the satisfaction of the Secretary.		groundwater. Should also reference groundwater triggers in Section 7.3. ii) References Section 7.3 – groundwater triggers. Details of triggers provided iii) References 5.3.2, and 5.3. 5.3.2 describes dewatering from open cut pits. Describes additional 3 bores will be established in the southern perimeter of the RSF2 – to be confirmed during RSF2. No details of groundwater re-use in this section. iv) References Section 10.2. No details of the program being completed within 12 months of project approval. Condition iv) also does not reference the full condition requirement. v) References Section 6.2.2 – shallow bores. Should reference to Section 6.3 – Groundwater (triggers) and Appendix C. vi) References Section 6.2.2. No references to geochemical testing of acid rock or saline rock provided. No details of	within 12 months of project approval. Revise referencing where required. Provide details of management procedures for when geochemical testing reveals higher risk of acid rock or saline drainage (including that TGO must prepare an acid mine drainage strategy).	updated to clarify that any groundwater intercepted during mining is dewatered to a surface water storage where it may mix with surface water prior to reuse. The quality of this water is monitored at the surface water storage prior to reuse. A formal verification and refinement of the groundwater model was not completed with 12 months of the project approval. Section 10.2 has been updated to summarise the most recent verification and refinement of the groundwater model undertaken as part of the Water Resources Assessment for MOD3 (GHD 2015b). A review and incorporation of additional baseline data found that: — During the operational phase at TGO, groundwater levels at monitoring locations

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		proposed management should this be identified.		have typically remain with the pre-mining range, — The inferred radius of influence of groundwater interception is lower than predicted in the EIS. — The refined estimates of groundwater inflows were less than predicted in the EIS The surface water TARP in Appendix E has been updated to include details of the management procedures if geochemical testing reveals higher risk of acid rock or saline drainage (including that TGO must prepare an acid mine drainage strategy).
32A. The Proponent must prepare a revised Water Management Plan to the satisfaction of the Secretary prior to commencement of construction of RSF2.	Partial	RSF2 pre-construction works commenced, waiting on approval of this management plan.	Do not commence construction until WMP is prepared and approved.	Noted.
32B. The Proponent must implement the approved Water Management Plan.	Partial	No reference to statement that the proponent will implement condition.	Add statement that proponent will implement condition.	Condition 32B is not a requirement of the Water Management Plan required by Condition 32. Nonetheless, Section 1.3 has been updated to

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Schedule 3 Clause 32 Water Management Plan	**Sufficient (Yes/No/Partial)**	**Document reference and comment**	**Action Required**	**Applicant Response**
				include a commitment to implementing the approved Water Management Plan.
32C. The Proponent must notify Dams Safety NSW of its intention to construct RSF2 prior to commencing construction of RSF2.	Partial	No reference to notification requirements.	Include intention / notification to Dams Safety NSW.	Condition 32B is not a requirement of the Water Management Plan required by Condition 32. Nonetheless, Section 1.4 has been updated to include this requirement.
General			**Action Required**	
Heading numbers are incorrect.			Ensure all headings, numbers, pages, table of content errors are revised.	References have been updated.
The Department is 'Department of Planning and Environment' (DPE) and DPE – Water.			Revise.	References have been updated..
Table A-1 and A-3 Section referencing requires updating.			Revise.	References have been updated.
There are two appendices labelled "Appendix B".			Revise.	References have been updated.
Suggest removing phrases such as "should consider" / "should be" and replace with a commitment e.g. "include".			Revise.	Noted. Use of "should consider" / "should be" have been reviewed and revised as appropriate..
MOD 5 referenced as most up to date.			Given MP is a June 2022 revision it should include reference to MOD6 instead of MOD5.	References have been updated.

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Other Agency Comments – DPE Water			
Recommendation	**Explanation**	**Tomingley Response**	**Consideration**
Monitoring around RSF2: Construct and monitor shallow monitoring bores around RSF2 and include those bores within the Trigger Action Response Plan (TARP) in consultation with DPE Water.	In terms of revision of the WMP, water quality impact associated with potential leakage from the RSF2 is the additional concern relevant to Modification 5 of the project approval. However, shallow monitoring bores are neither drilled nor proposed for monitoring around RSF2 to monitor potential leakage from RSF2.	Section 4.4.1 has been updated reflect the commitment of TGO to "as part of the construction of RSF2, three additional bores will be established on the southern perimeter and one additional of each on the eastern and western perimeter." The exact locations will be determined during the construction of RSF2 and reflected in a future version of the WMP. Table 5-2 has been updated to include these future monitoring locations in the monitoring program once constructed.	Accepted.
Water Balance: Clarify the reasons for disparity between inflow and outflow, and zero groundwater inflow in the water balance provided in section 4.5.1	Water balance (Table 4.4) appears to provide the water budget for the project. It indicates a change in storage of 61 ML/year and zero groundwater inflow. It is not clear why there is a change in storage in the water balance. The WMP (section 4.4.2) states that groundwater encountered in the underground workings is removed by pumps; this contradicts the statement of zero groundwater inflow in the water balance.	Section 4.5 has been updated to provide clarification on the 'change in storage' modelling result. Table 4-4 shows an average annual increase in water inventory of 61ML. This minor increase (less than 5% of overage total average annual inflows) corresponds to the below average rainfall observed in the 2020 calendar year compared to the average of the range of potential rainfall in the future. Section 4.5.1 states that "Groundwater intercepted by mine working available for reuse has been considered negligible and is not relied on as a secure water supply." Section 4.4.2 states "Groundwater encountered within the underground working is removed by pumping into the mine water management system." These statements are not contradictory, the first relates to water security in the context of the overall site water balance, the second relates to physical infrastructure.	
Monitoring bore WYMB01: Clarify the reasons for selecting an excessively deeper groundwater level	The hydrograph of monitoring bore WYMB01 is notably absent, although hydrographs of all other deep monitoring bores were provided in Appendix B. The groundwater	The omission if hydrograph for monitoring bore WYMB01 has been corrected. The stage 1 and stage 2 trigger were erroneously based on likely measurement errors now identified on the	

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stage 1 trigger for monitoring bore WYMB01 and absence of the hydrograph for the same in the WMP.	level stage 1 trigger is set as approximately 2 m below the historical low groundwater level during TGO operational period since 2014 for all deep monitoring bores. However, groundwater level trigger for WYMB01 is excessively deep at 207.6 m AHD, which is about 18 m deeper than the historical low observed in that bore. The reason for setting a deeper trigger level for WYMB01 is unsubstantiated.	hydrograph. The stage 1 and stage 2 trigger values have been corrected to be consistent with the triggers for groundwater level.	

Comment	Response
DPE Water – 27 May 2022	
Monitoring around RSF2: Construct and monitor shallow monitoring bores around RSF2 and include those bores within the Trigger Action Response Plan (TARP) in consultation with DPE Water. In terms of revision of the WMP, water quality impact associated with potential leakage from the RSF2 is the additional concern relevant to Modification 5 of the project approval. However, shallow monitoring bores are neither drilled nor proposed for monitoring around RSF2 to monitor potential leakage from RSF2.	Section 4.4.1 has been updated reflect the commitment of TGO to "as part of the construction of RSF2, three additional bores will be established on the southern perimeter and one additional of each on the eastern and western perimeter." The exact locations will be determined during the construction of RSF2 and reflected in a future version of the WMP. Table 5-2 has been updated to include these future monitoring locations in the monitoring program once constructed.
Water Balance: Clarify the reasons for disparity between inflow and outflow, and zero groundwater inflow in the water balance provided in section 4.5.1 Water balance (Table 4.4) appears to provide the water budget for the project. It indicates a change in storage of 61 ML/year and zero groundwater inflow. It is not clear why there is a change in storage in the water balance. The WMP (section 4.4.2) states that groundwater encountered in the underground workings is removed by pumps; this contradicts the statement of zero groundwater inflow in the water balance.	Section 4.5 has been updated to provide clarification on the 'change in storage' modelling result. Table 4-4 shows an average annual increase in water inventory of 61ML. This minor increase (less than 5% of overage total average annual inflows) corresponds to the below average rainfall observed in the 2020 calendar year compared to the average of the range of potential rainfall in the future. Section 4.5.1 states that "Groundwater intercepted by mine working available for reuse has been considered negligible and is not relied on as a secure water supply." Section 4.4.2 states "Groundwater encountered within the underground working is removed by pumping into the mine water management system." These statements are not contradictory, the first relates to water security in the context of the overall site water balance, the second relates to physical infrastructure.
Monitoring bore WYMB01: Clarify the reasons for selecting an excessively deeper groundwater level stage 1 trigger for monitoring bore WYMB01 and absence of the hydrograph for the same in the WMP. The hydrograph of monitoring bore WYMB01 is notably absent, although hydrographs of all other deep monitoring bores were provided in Appendix B. The groundwater level stage 1 trigger is set as approximately 2 m below the historical low groundwater level during TGO operational period since 2014 for all deep monitoring bores. However, groundwater level trigger for WYMB01 is excessively deep at 207.6 m AHD, which is about 18 m deeper than the historical low observed in that bore.	The omission if hydrograph for monitoring bore WYMB01 has been corrected. The stage 1 and stage 2 trigger were erroneously based on likely measurement errors now identified on the hydrograph. The stage 1 and stage 2 trigger values have been corrected to be consistent with the triggers for groundwater level.

Comment	Response
The reason for setting a deeper trigger level for WYMB01 is unsubstantiated.	
Department of Planning and Environment – 4 July 2022	
TGO attempted consultation with Dams Safety but did not receive a response (this information is not in the MP), responses received from EPA and DPE Water but not attached to MP. Provide evidence of consultation as an appendix. Add details that Dams Safety NSW did not provide a response. A table in the document would also be good to be able to capture previous consultation (as this is revision 5 and no evidence of previous consultation is attached) – if not, at least consultation undertaken for this revision.	Evidence of consultation has been summarised in Section 1.4 and is included in Appendix B.
No evidence of suitably qualified and experienced persons whose appointment was approved by the Secretary provided. Provide evidence of consultation as an appendix. Add details that Dams Safety NSW did not provide a response.	Evidence of approval of the appointment of suitably qualified and experienced persons is summarised in Section 1.3 and is included in Appendix B.
Section 4 describes water management system. Details include surface water management system and details of capacity of all water storages, figures provided of water management (diagram) and on-site management which includes the new RSF2 (MOD5) and extended project area. Details of clean water, raw water, mine water and dirty water provided. Reference is to the 'proposed RSF2' – RSF2 has been approved and proposed should be removed. Remove references to 'proposed' RSF2 and describe it as the RSF2 as this has been approved.	Section 4.1.5 has been updated to refer to RSF2 as approved following approval of MOD5.
Discharges would account for less than 1% of water outputs and only occur via Licensed Discharge Points LDPs identified Section 4.1.3.2 due to rainfall events. Concentration limits in 7.2.1 Table 7-2 a) claims EPA approval for turning off TSS licence limits. Please provide evidence of EPA approval to "turn off" TSS limits during managed overflows.	Evidence of EPA agreement in principle to wet weather discharge conditions is provided in Appendix B, subject to implementation of other proposed water management components. A future variation to EPL 20169 would be required to reflect this agreement.
Annual site water balance is included in annual review. Include that annual review should include comparisons of site water balance for each calendar year.	Section 8.4 has been updated to include the requirement of comparisons of the site water balance for each calendar year

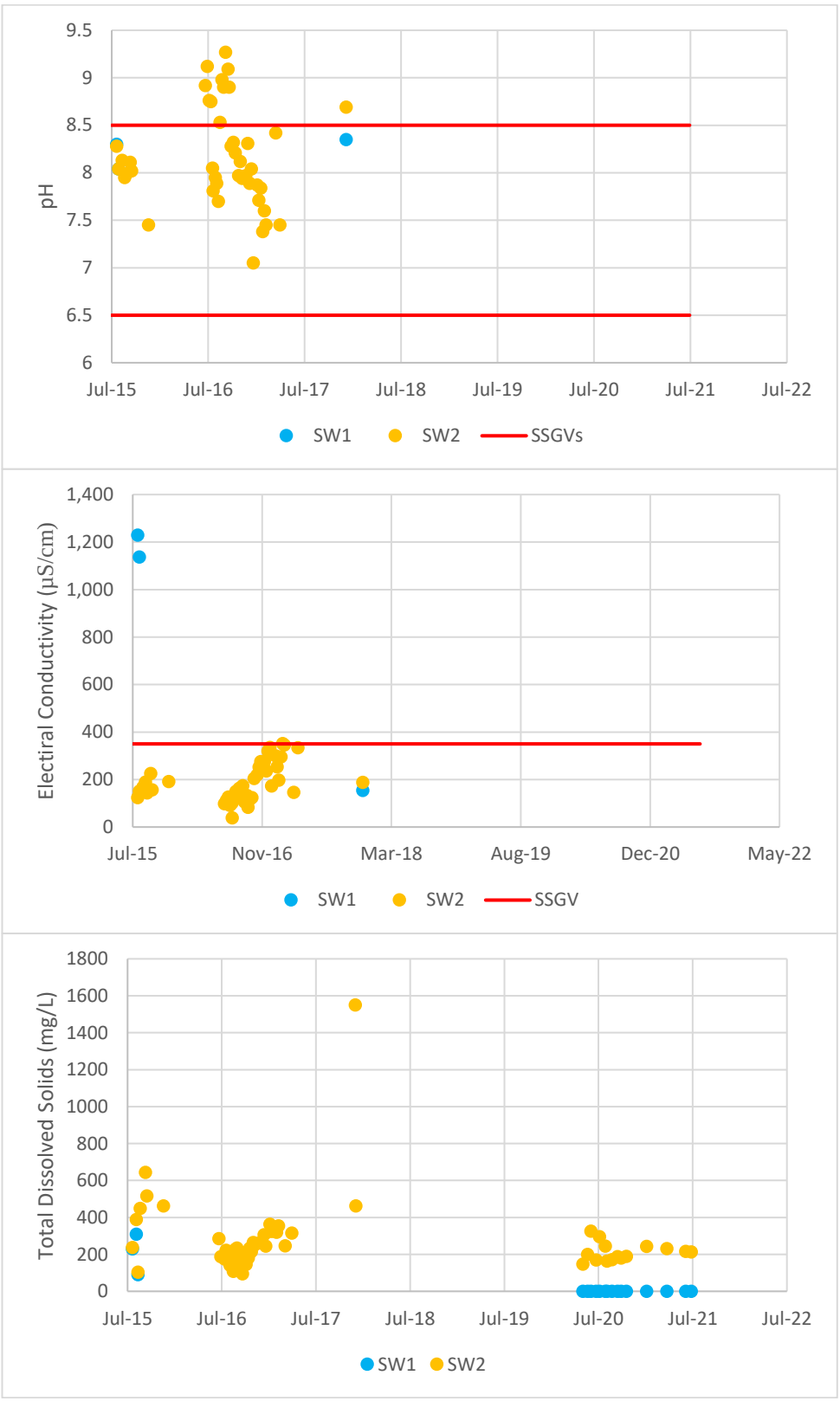
Comment	Response
Section 4.1.4.1, final voids – details pits are dewatered or used for dirty water management. Should also reference Section 4.1.4.2 – Final voids. Details that objectives are in the MOP – as of July this will need to change to a Rehab Management Plan, given timing of RSF2 construction works this should be revised in the next revision of the Management Plan.	Noted. The next revision of the WMP will include an updated reference to the relevant aspects of the Rehabilitation Management Plan that address the relevant conditions of the WMP.
Refers to Section 4.1.5.3 – Residue Storage Facilities. Performance criteria is provided, no demonstration of how the decant pond would be maintained or any quality assurance/control plan provided. Figures would be useful. Include details of the quality assurance /quality control plan to form a low permeability layer (of less than 1 x 10-9 m/s) referred to in Section 4.1.5.3.	Section 4.1.5.3 has been updated to include additional details on the management of water levels in decant pond. Adequate freeboard is maintained by continuous monitoring of water levels in the decant pond by the site supervisory control and data acquisition (SCADA) system and decant pumps to transfer excess decant water is transferred to the WCD – South for storage. Section 4.1.5.3 has been updated to include additional details on the quality assurance /quality control plan to form a low permeability layer including the the material specifications for the construction of RSF2 requirement for a minimum permeability test frequency of once every 5 000m^3 and per 10 000m^3 of volume placed.
Rehabilitation – references Section 7.2. Only section that mentions rehabilitated areas is Section 4.7. Describes that monitoring program will continue during rehabilitation. WRE1 and WRE2 (rehabilitated areas) are not mentioned and no measures to control any potential pollution from rehabilitated areas is provided. Detail rehabilitated areas within the site (completed) and to be completed and measures that would be implemented to control potential water pollution.	Section 4.7 includes details of the rehabilitated areas on site. The final landform surface is designed to minimise the potential for pollution from rehabilitated areas. No pollution from rehabilitated areas of the site have been identified. The surface existing monitoring program will continue during rehabilitation to identify any potential water pollution from the rehabilitated areas of the site. The measures to control potential water pollution from rehabilitated areas will reviewed following the approval of the Rehabilitation Management Plan.
Surface water flows references Section 5.2, channel stability not detailed as a monitoring parameter. Include monitoring channel stability of Gundong Creek in parameters in Section 5.2.	Condition 32(b)(iv)(3) requires a program to monitor surface water flows and quality, stream health and channel stability in Gundong Creek (in so far as it could potentially be affected by the project). Infrequent discharges due rainfall in excess of the design criteria from the site have the potential to affect surface water flows and quality, but are unlikely to affect stream health and channel stability. No routine monitoring of stream health and channel stability are proposed as part of the surface water monitoring program.
iii) References 5.3.2, and 5.3. 5.3.2 describes dewatering from open cut pits.	Condition 32(c)(iii)(5) requires a program to monitor the quality of groundwater to be re-used on the site. Groundwater is not reused directly at TGO. Section 5.2 has been updated to clarify that any groundwater intercepted during mining is dewatered to a surface water storage where it

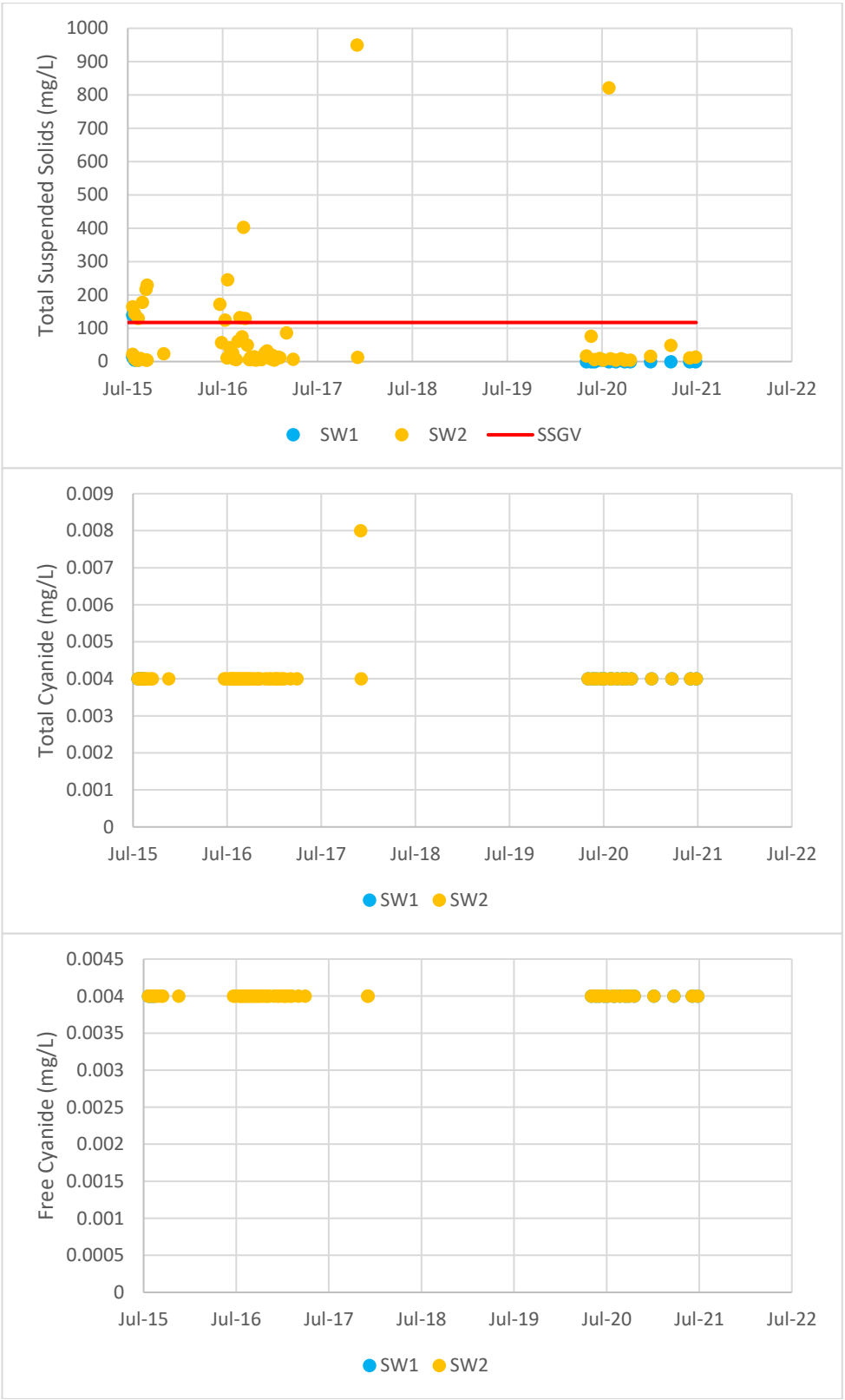
Comment	Response
Describes additional 3 bores will be established in the southern perimeter of the RSF2 – to be confirmed during RSF2. No details of groundwater re-use in this section. Provide details of the quality of groundwater to be re-used on site.	may mix with surface water prior to reuse. The quality of this water is monitored at the surface water storage prior to reuse.
iv) References Section 10.2. No details of the program being completed within 12 months of project approval. Condition iv) also does not reference the full condition requirement. Provide details of on-going verification and refinement against the baseline data as required to be completed within 12 months of project approval.	A formal verification and refinement of the groundwater model was not completed with 12 months of the project approval. Section 10.2 has been updated to summarise the most recent verification and refinement of the groundwater model undertaken as part of the Water Resources Assessment for MOD3 (GHD 2015b). A review and incorporation of additional baseline data found that: — During the operational phase at TGO, groundwater levels at monitoring locations have typically remain with the pre-mining range, — The inferred radius of influence of groundwater interception is lower than predicted in the EIS. — The refined estimates of groundwater inflows were less than predicted in the EIS
vi) References Section 6.2.2. No references to geochemical testing of acid rock or saline rock provided. No details of proposed management should this be identified. Provide details of management procedures for when geochemical testing reveals higher risk of acid rock or saline drainage (including that TGO must prepare an acid mine drainage strategy).	The surface water TARP in Appendix E has been updated to include details of the management procedures if geochemical testing reveals higher risk of acid rock or saline drainage (including that TGO must prepare an acid mine drainage strategy).
RSF2 pre-construction works commenced, waiting on approval of this management plan. Do not commence construction until WMP is prepared and approved.	Noted.
No reference to [Condition 32B] that the proponent will implement condition. Add statement that proponent will implement condition.	Condition 32B is not a requirement of the Water Management Plan required by Condition 32. Nonetheless, Section 1.3 has been updated to include a commitment to implementing the approved Water Management Plan.
No reference to notification requirements. Include intention / notification to Dams Safety NSW.	Condition 32B is not a requirement of the Water Management Plan required by Condition 32. Nonetheless, Section 1.4 has been updated to include this requirement.
Heading numbers are incorrect. Ensure all headings, numbers, pages, table of content errors are revised.	References have been revised throughout the plan.

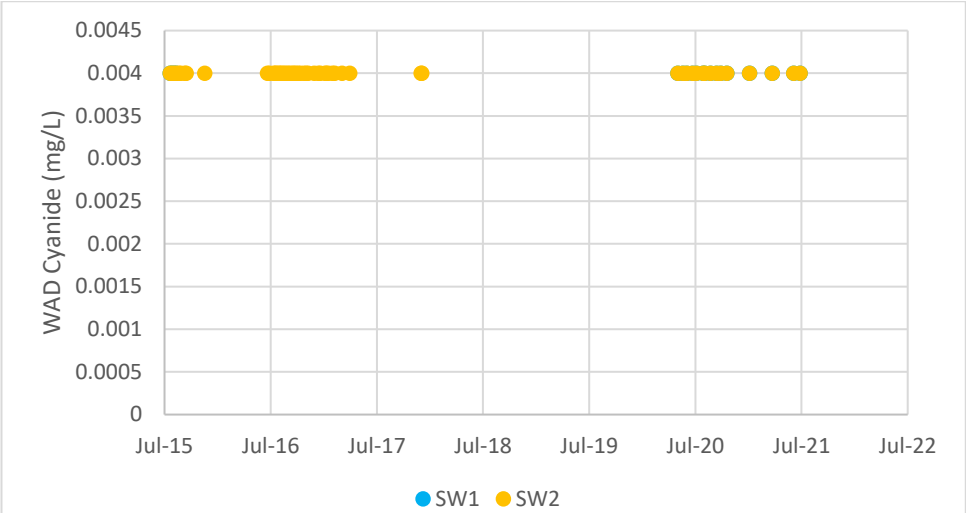
Comment	Response
The Department is ‘Department of Planning and Environment’ (DPE) and DPE – Water.	References to DPE and DPE Water have been revised throughout the plan.
Table A-1 and A-3 Section referencing requires updating. There are two appendices labelled “Appendix B”.	References have been revised throughout the plan.
Suggest removing phrases such as “should consider” / “should be” and replace with a commitment e.g. “include”.	Noted. Use of “should consider” / “should be” have been reviewed and revised as appropriate.
MOD 5 referenced as most up to date. Given MP is a June 2022 revision it should include reference to MOD6 instead of MOD5.	Section 1.2 has been updated to reflect the approval of MOD6.

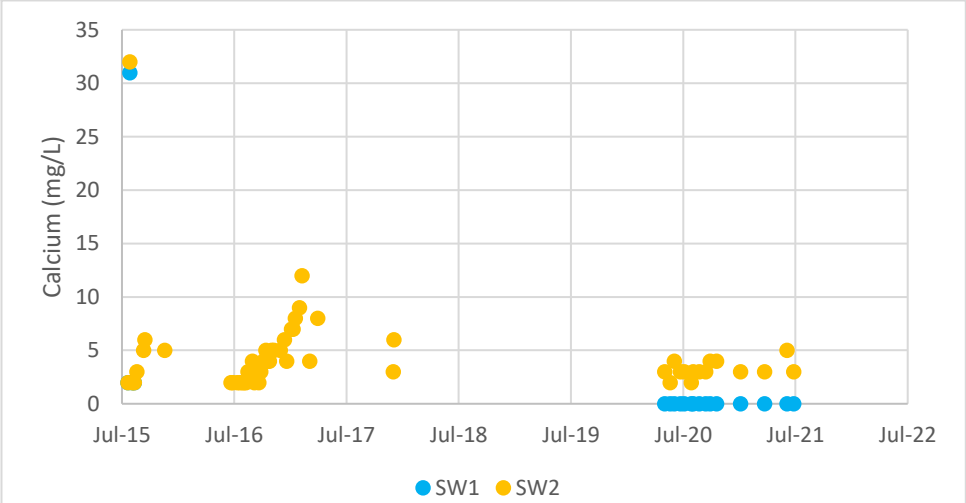
Appendix C – Surface water quality data

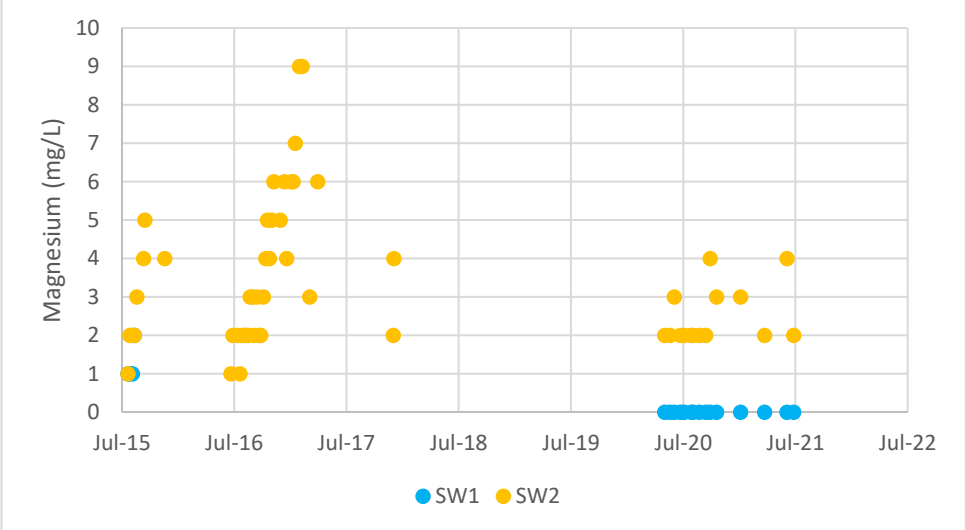
Gundong Creek

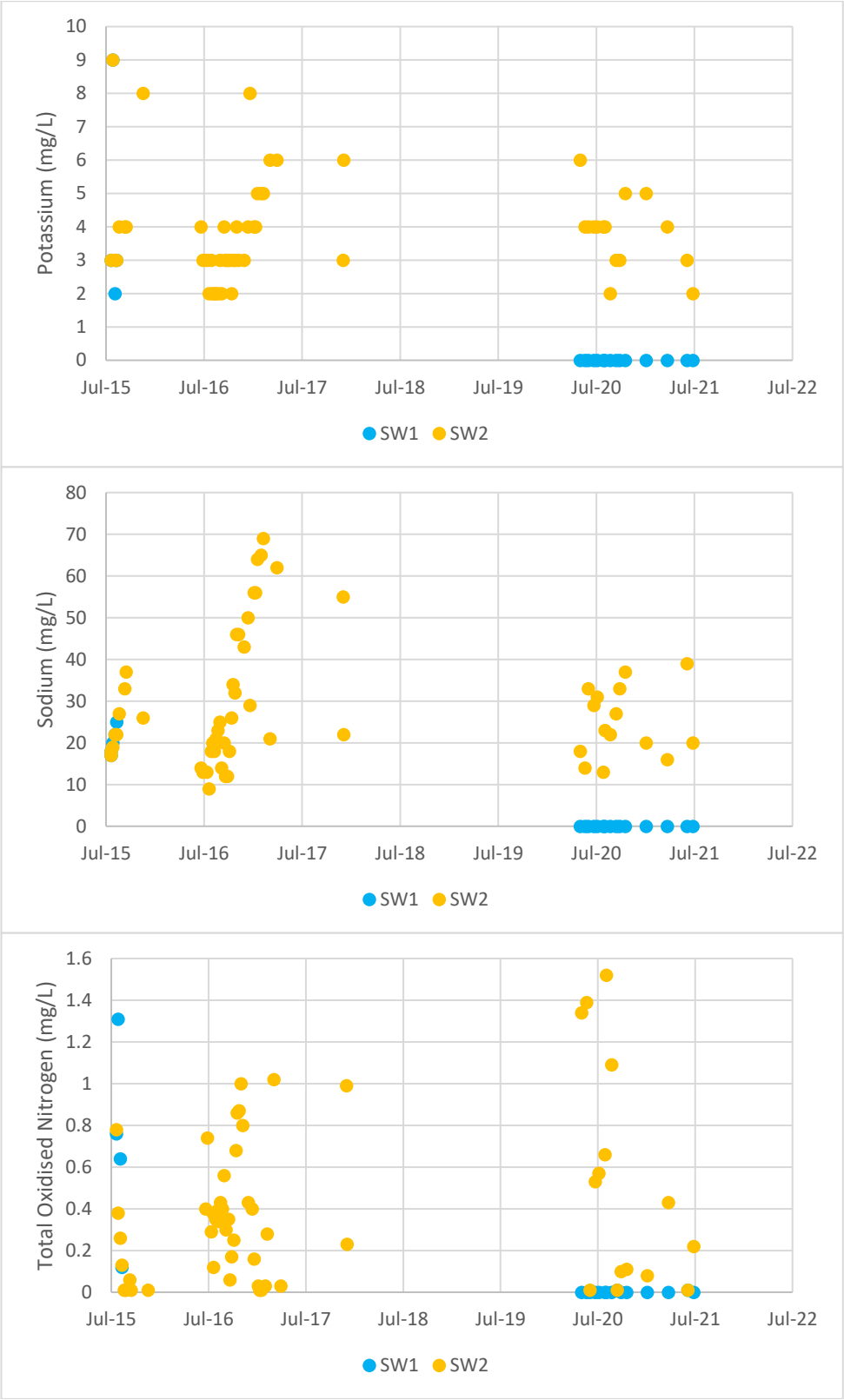


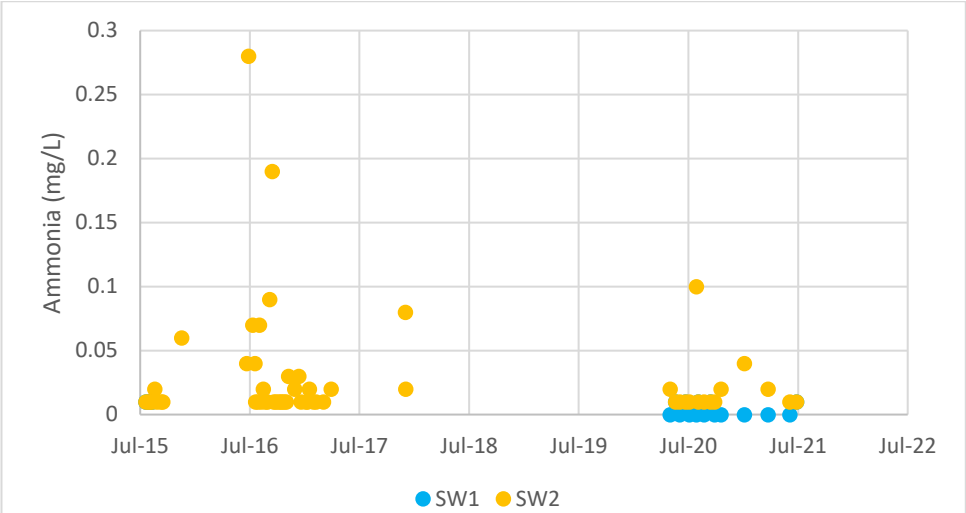

Total Suspended Solids (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV
Total Cyanide (mg/L)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
Free Cyanide (mg/L)
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

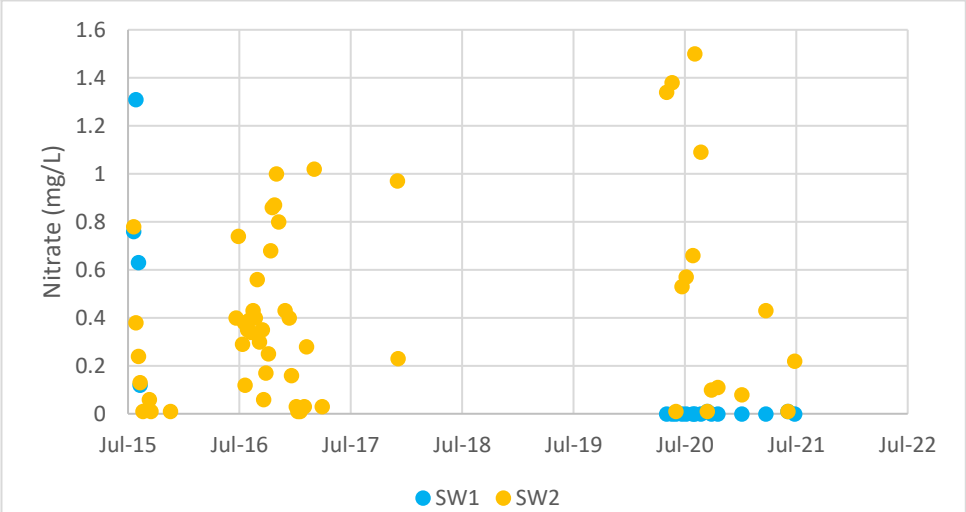

0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
WAD Cyanide (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

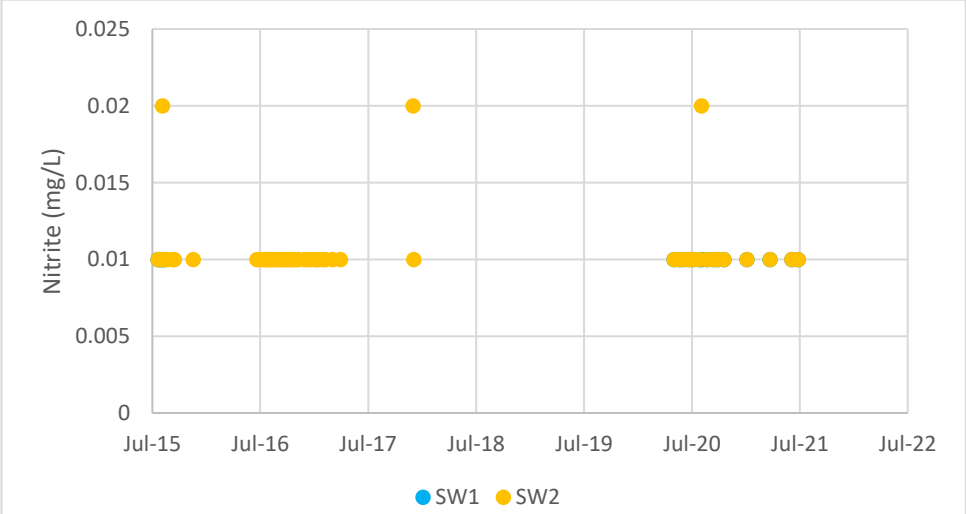

35
30
25
20
15
10
5
0
Calcium (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

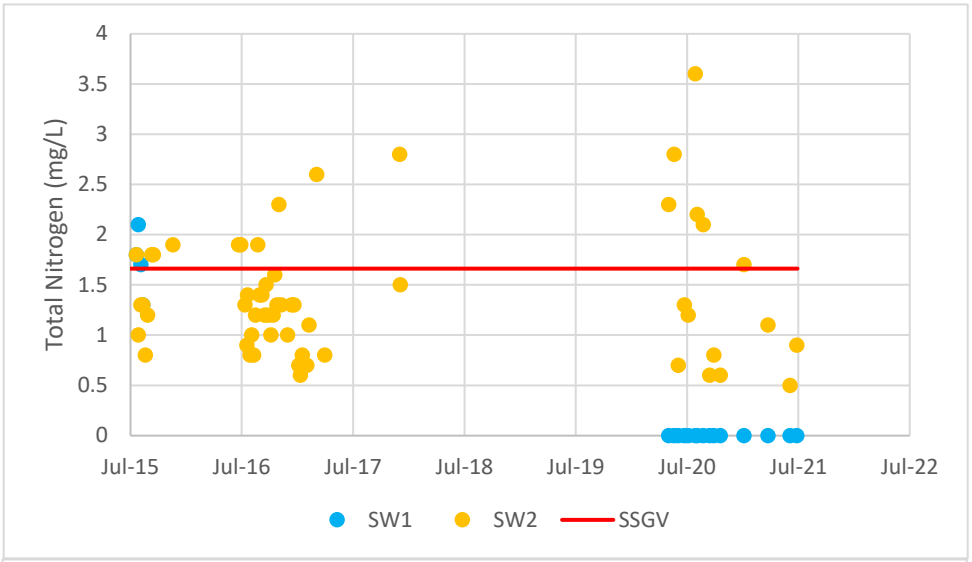

10
9
8
7
6
5
4
3
2
1
0
Magnesium (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

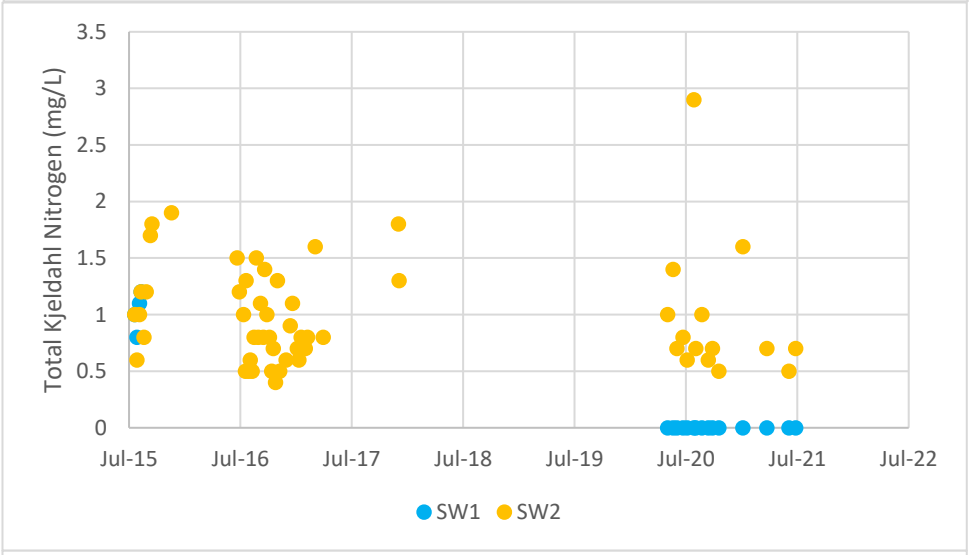

Potassium (mg/L)
10
9
8
7
6
5
4
3
2
1
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
Sodium (mg/L)
80
70
60
50
40
30
20
10
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
Total Oxidised Nitrogen (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

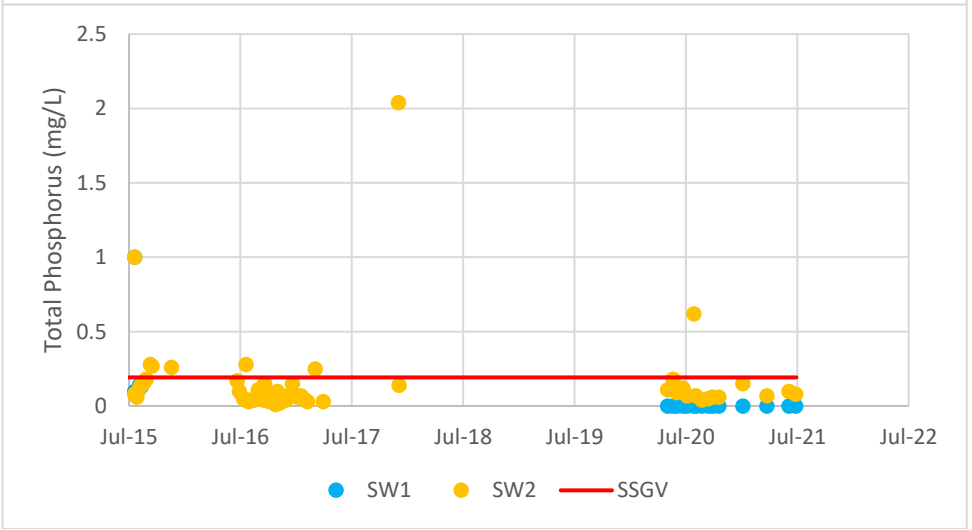

Ammonia (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

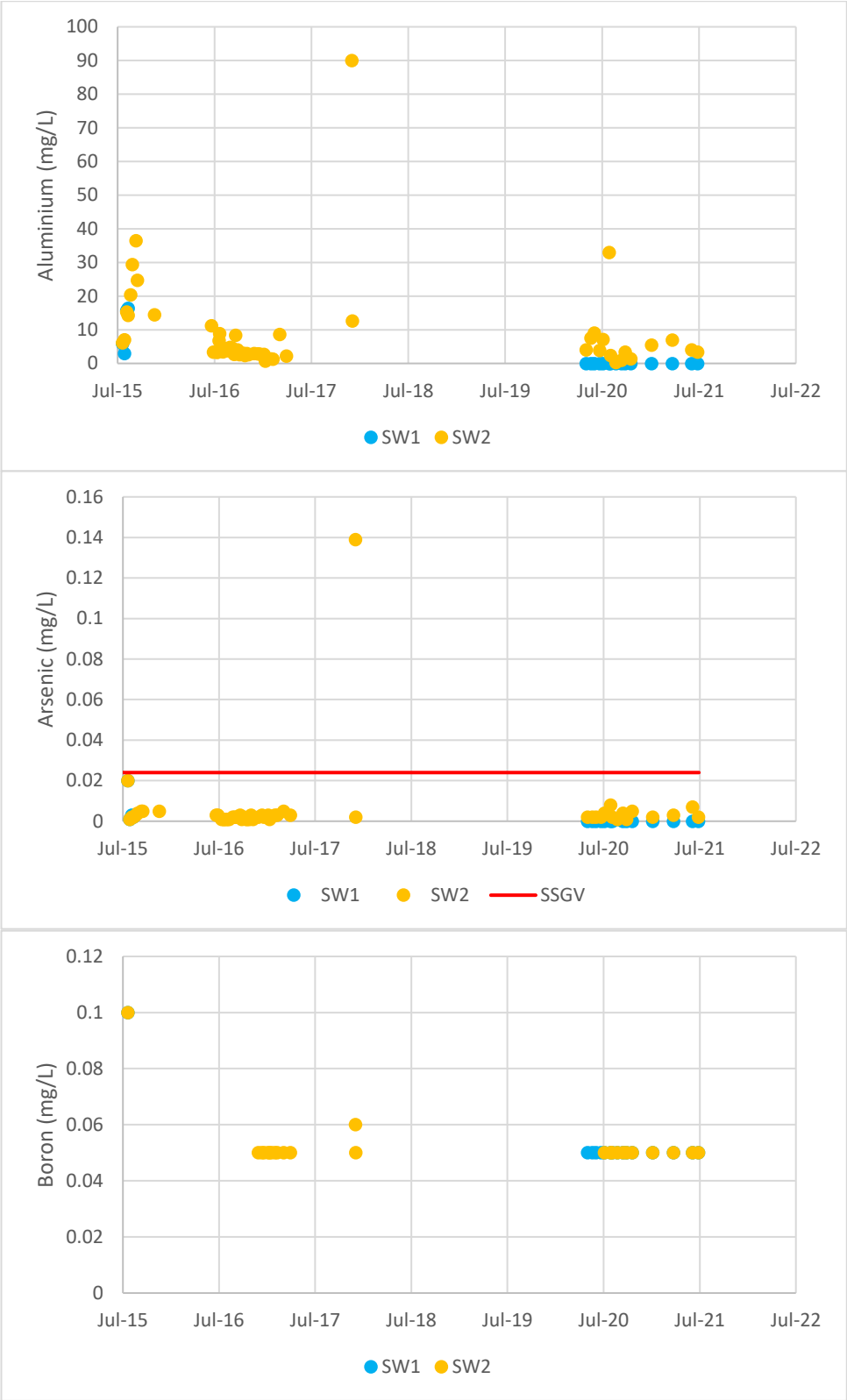

Nitrate (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

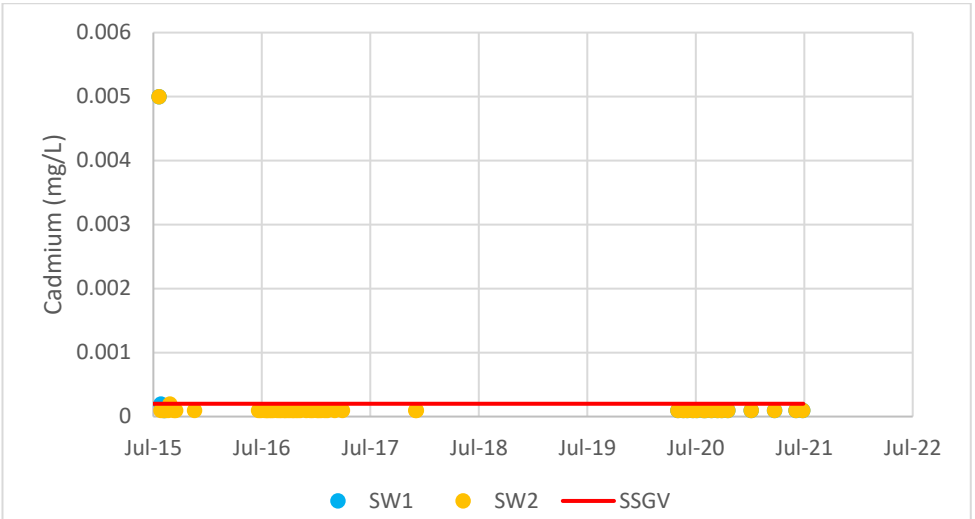

Nitrite (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

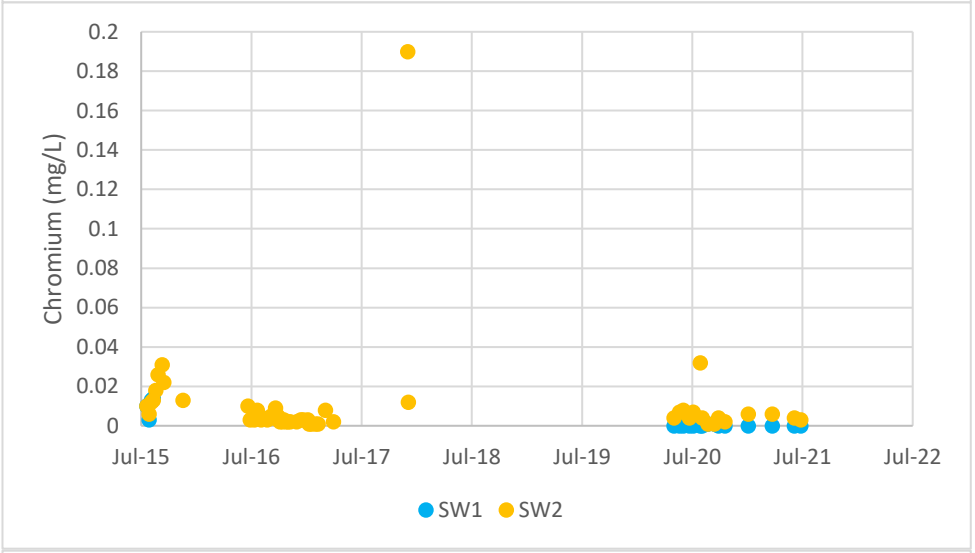

Total Nitrogen (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV

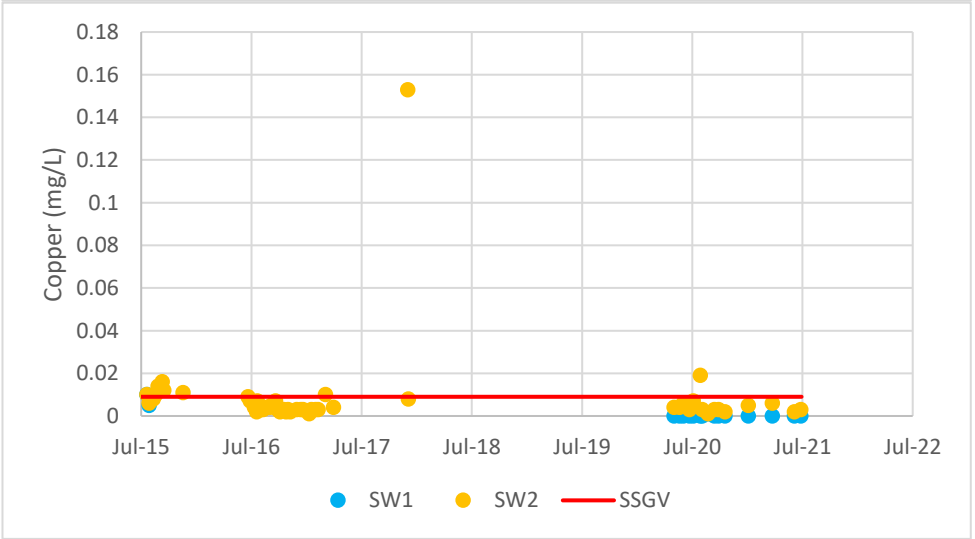

Total Kjeldahl Nitrogen (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

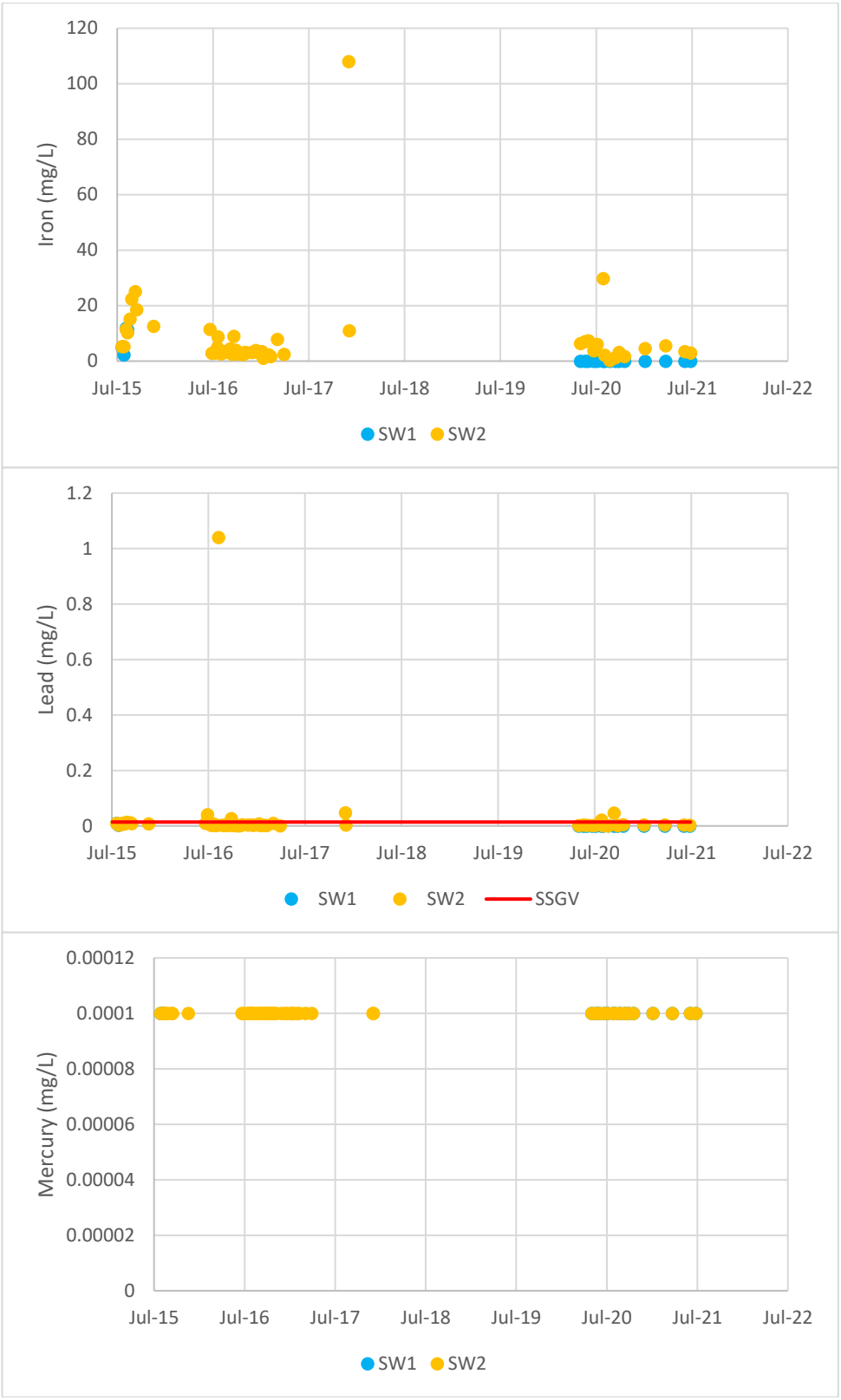

Total Phosphorus (mg/L)
2.5
2
1.5
1
0.5
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV

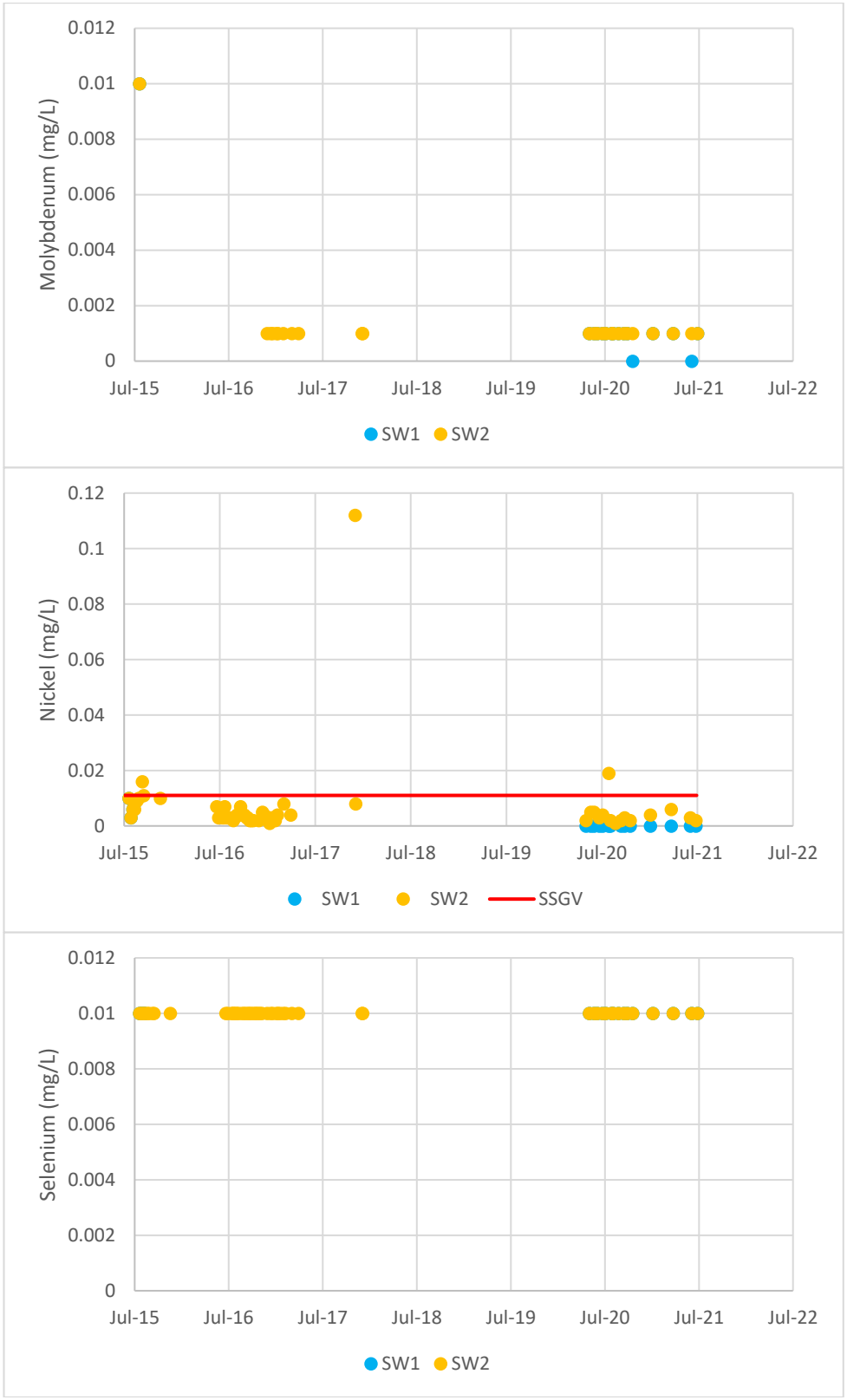

Aluminium (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
Arsenic (mg/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV
Boron (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

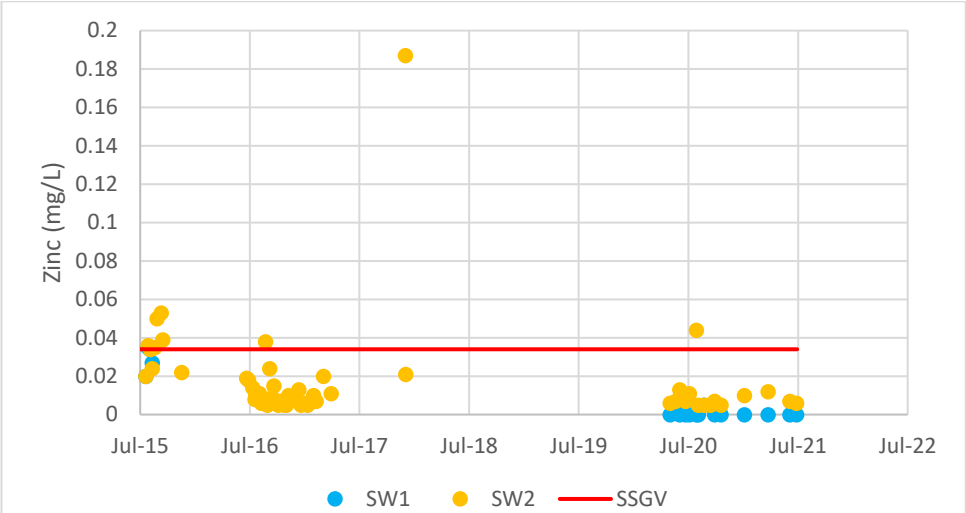

0.006
0.005
0.004
0.003
0.002
0.001
0
Cadmium (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV

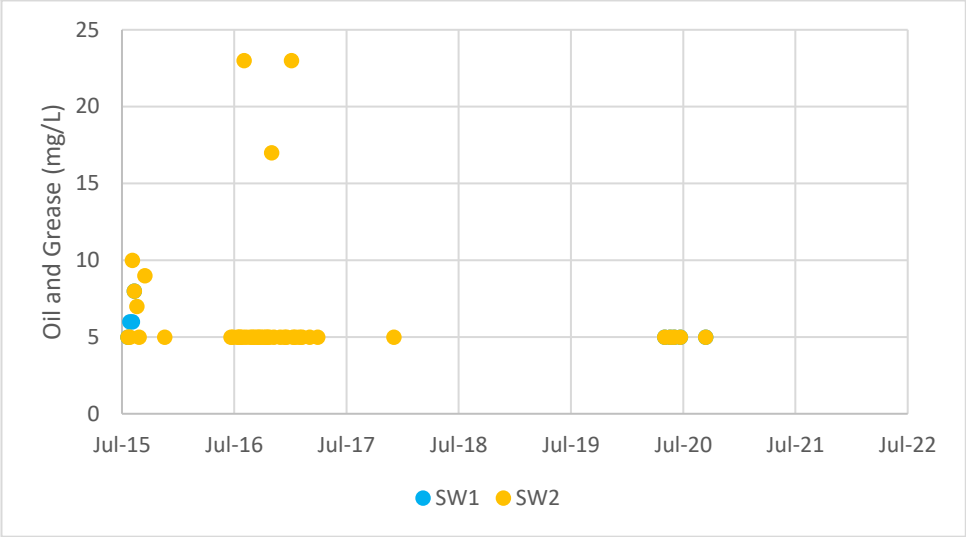

0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Chromium (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2


0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Copper (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV

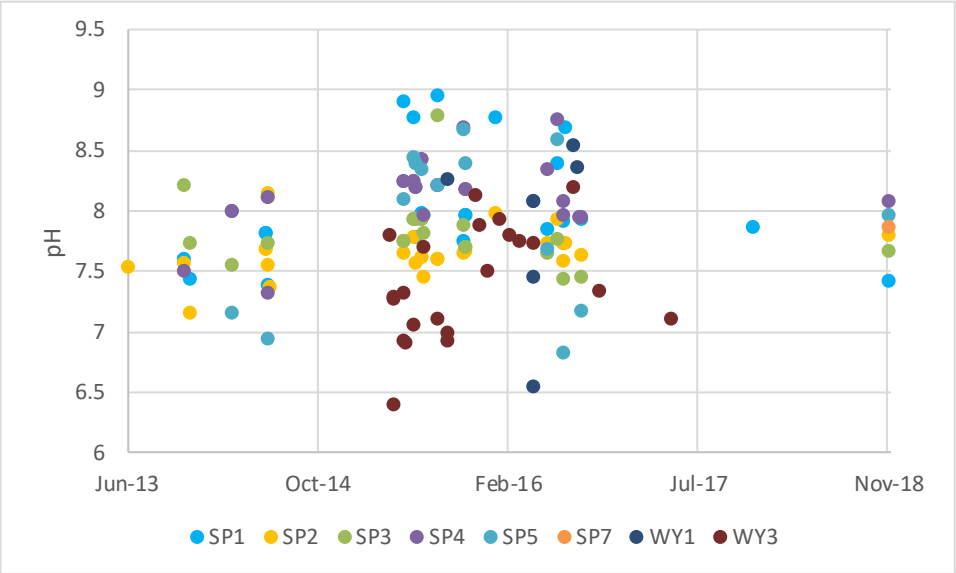

120
100
80
60
40
20
0
Iron (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
1.2
1
0.8
0.6
0.4
0.2
0
Lead (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Mercury (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

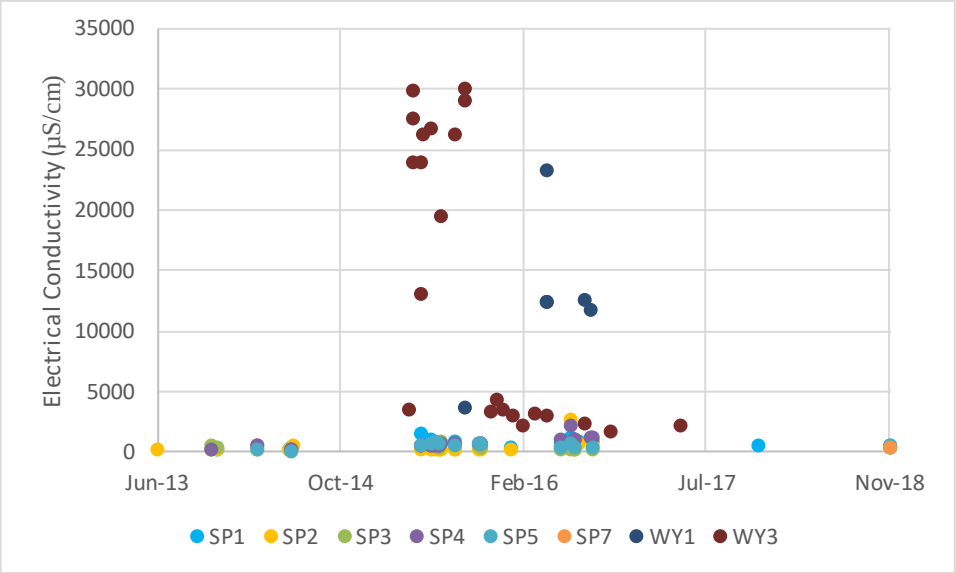

Molybdenum (mg/L)
0.012
0.01
0.008
0.006
0.004
0.002
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
Nickel (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV
Selenium (mg/L)
0.012
0.01
0.008
0.006
0.004
0.002
0
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

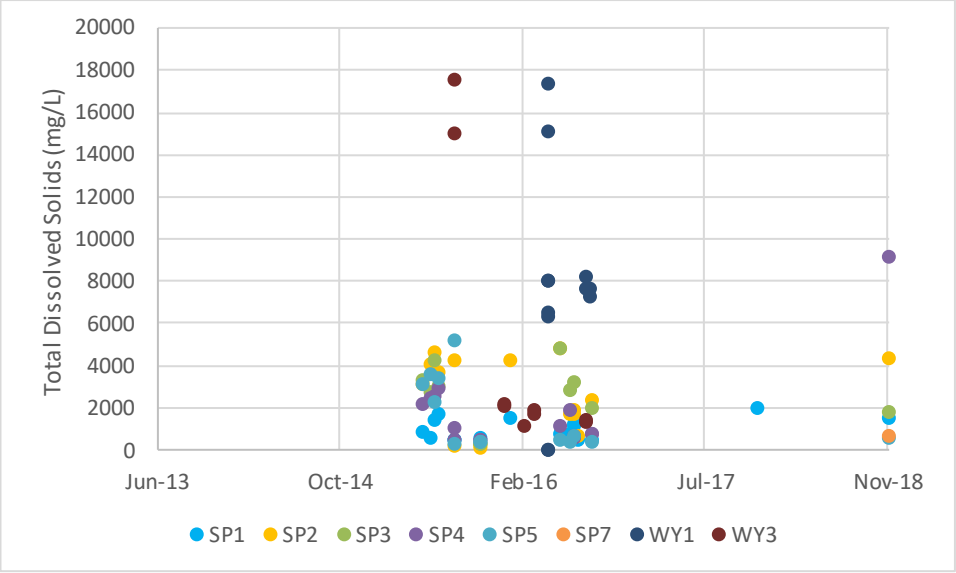

0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Zinc (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2
SSGV

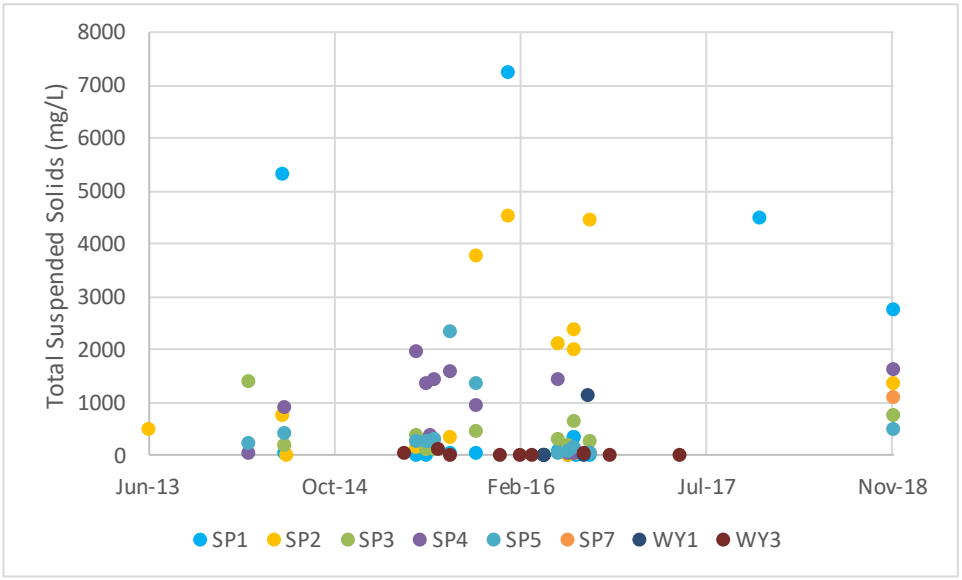

25
20
15
10
5
0
Oil and Grease (mg/L)
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
SW1
SW2

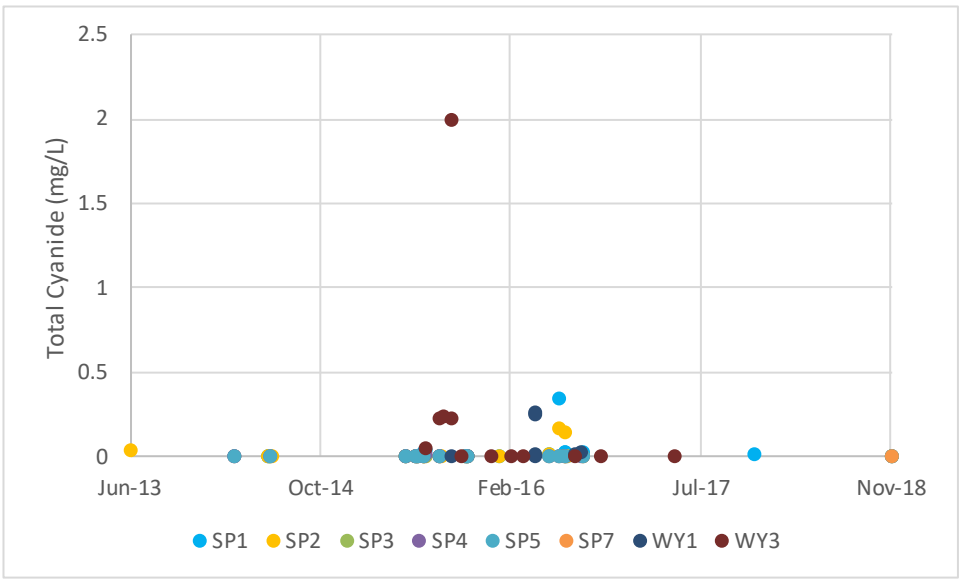
Surface water storages

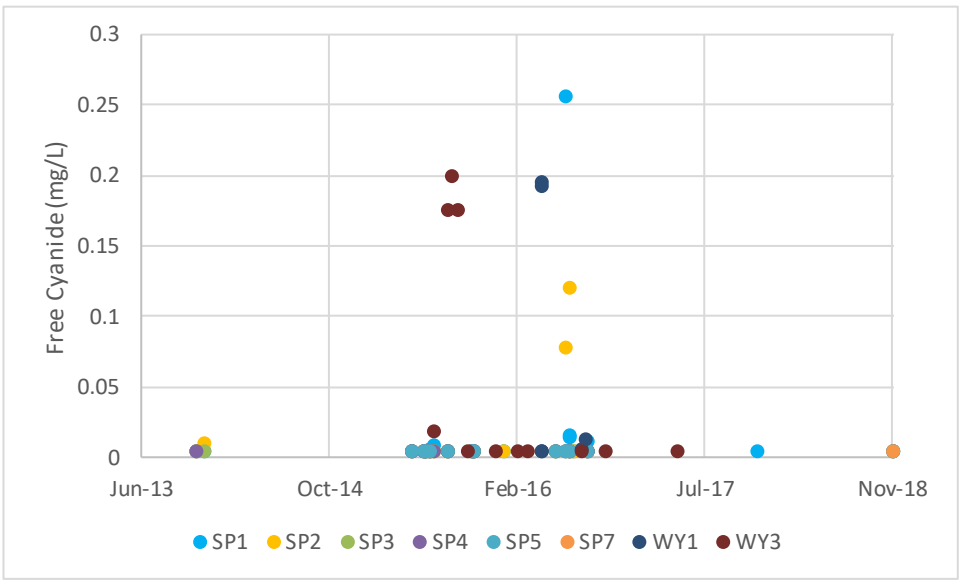


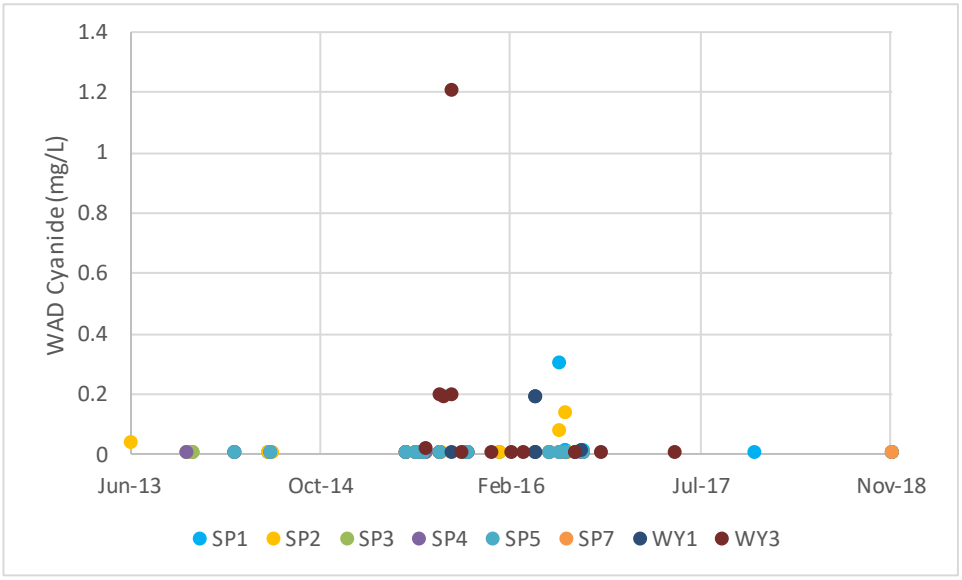


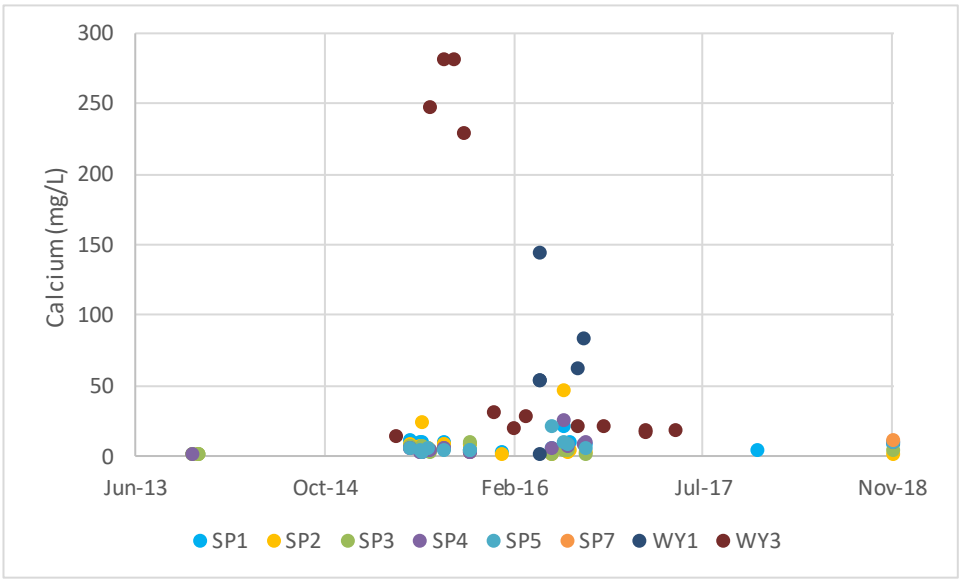


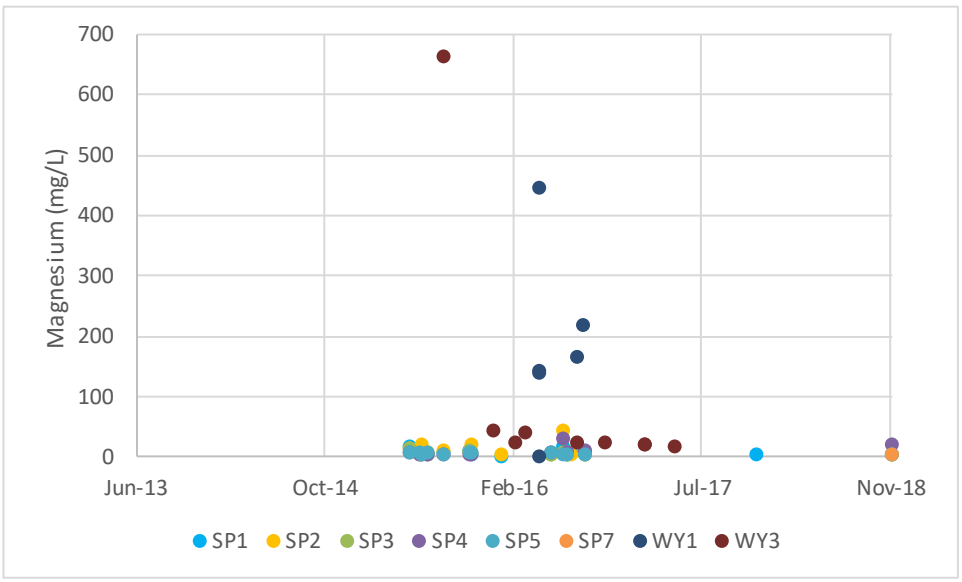

Total Suspended Solids (mg/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

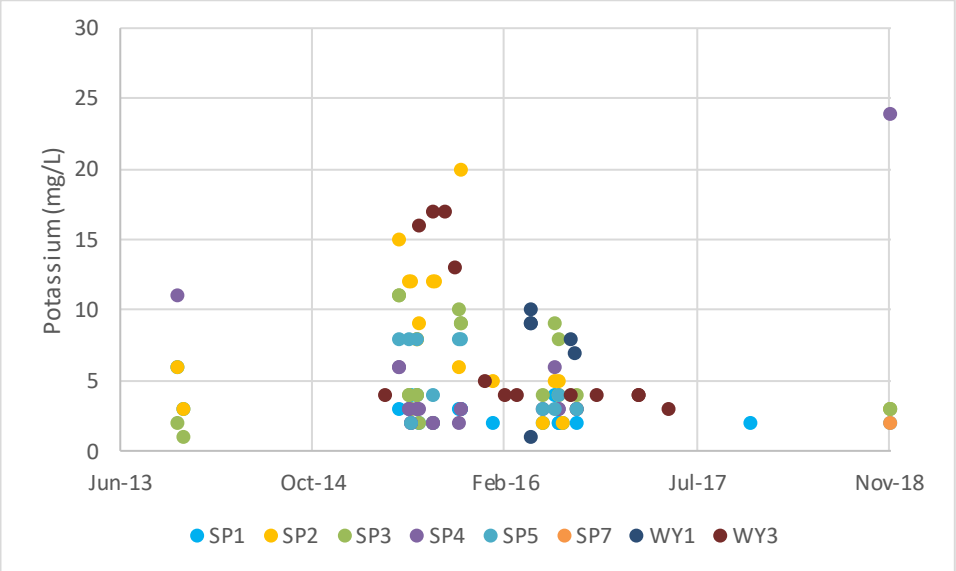

Total Cyanide (mg/L)
2.5
2
1.5
1
0.5
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

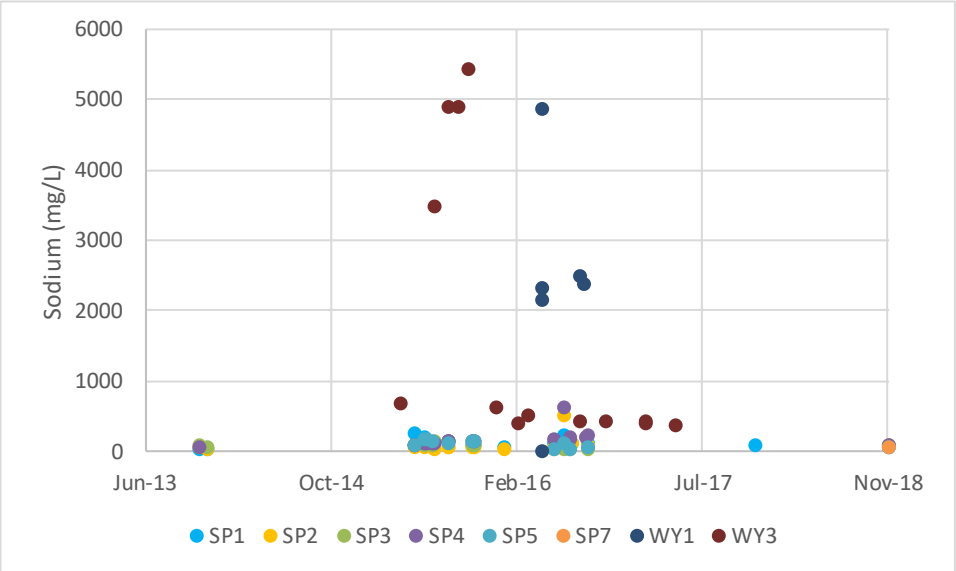

Free Cyanide (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

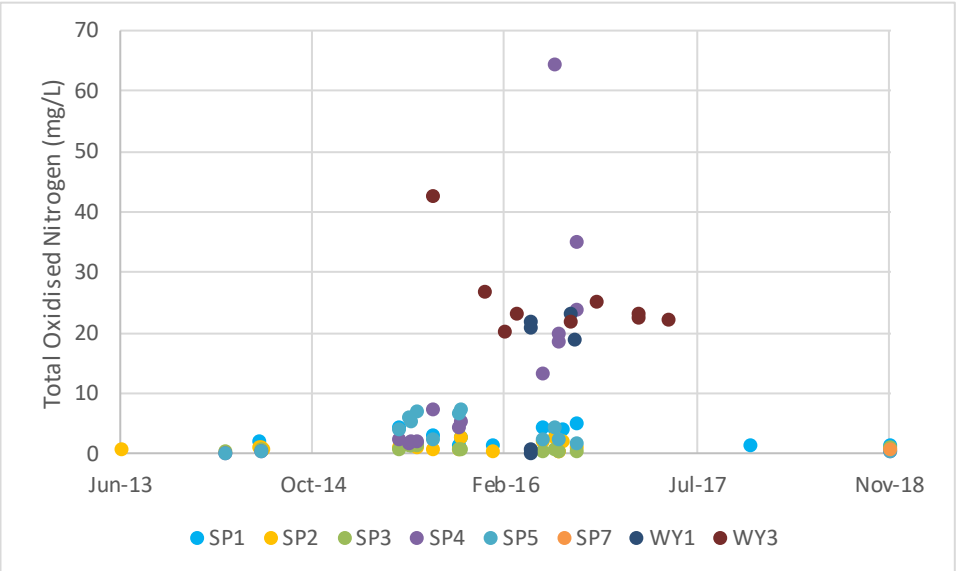

WAD Cyanide (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

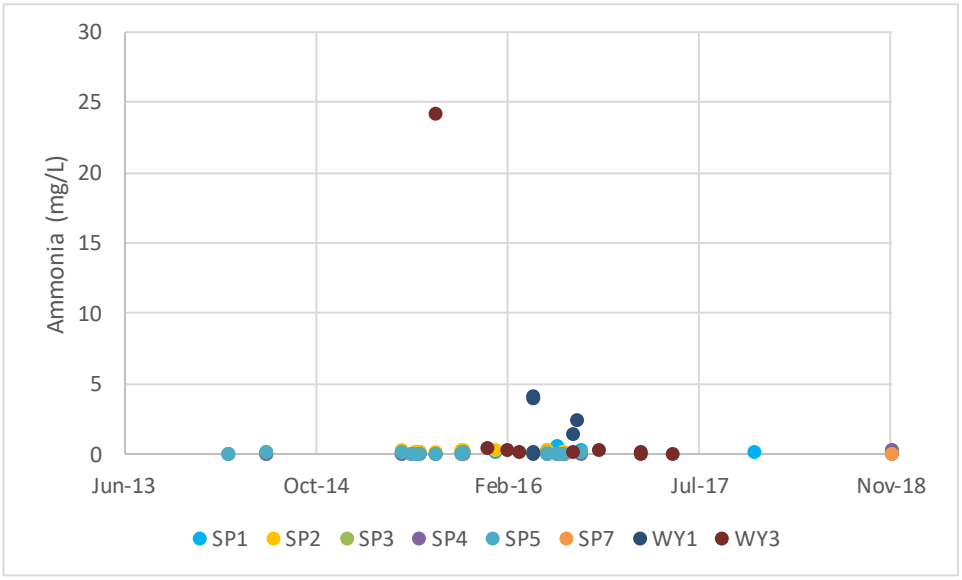

Calcium (mg/L)
300
250
200
150
100
50
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

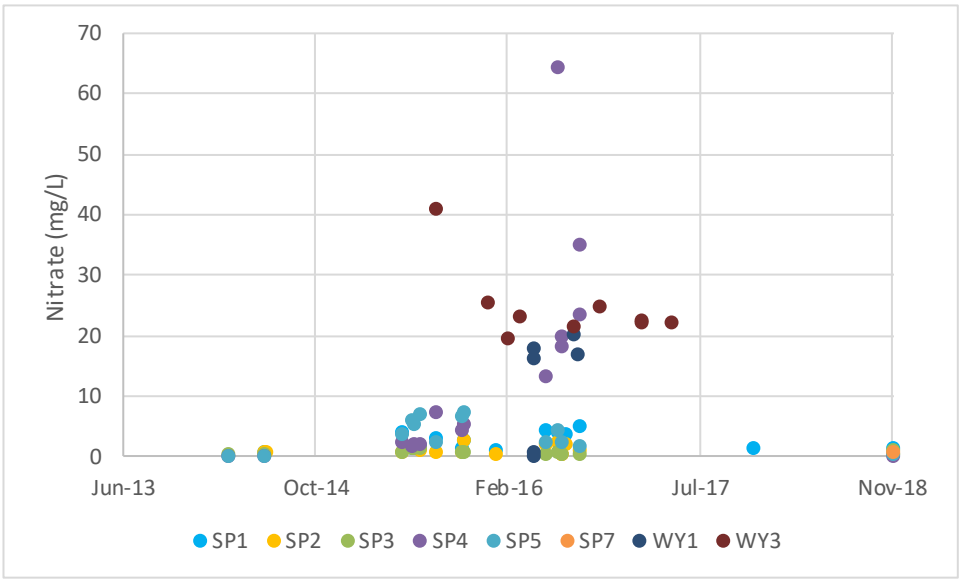

Magnesium (mg/L)
700
600
500
400
300
200
100
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

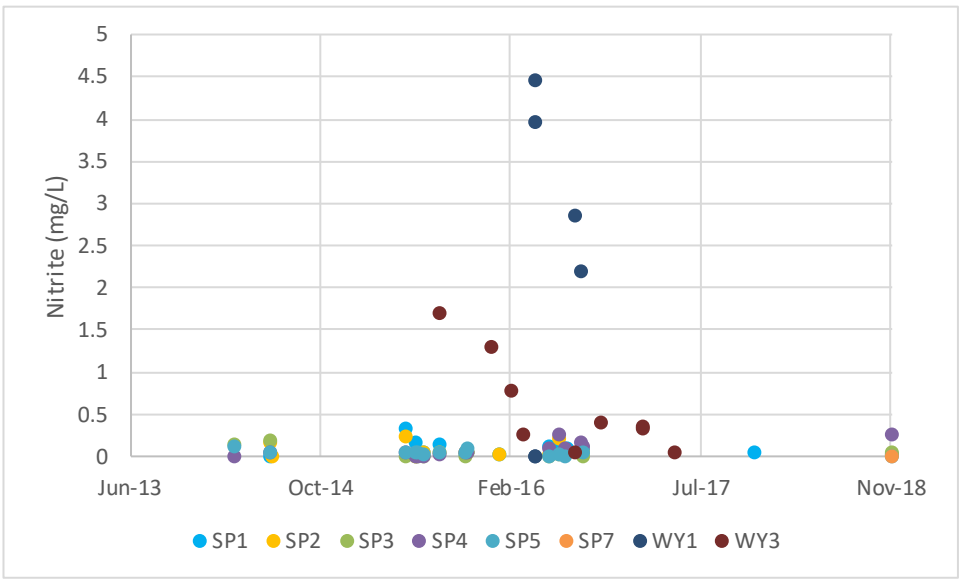

Potassium (mg/L)
30
25
20
15
10
5
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

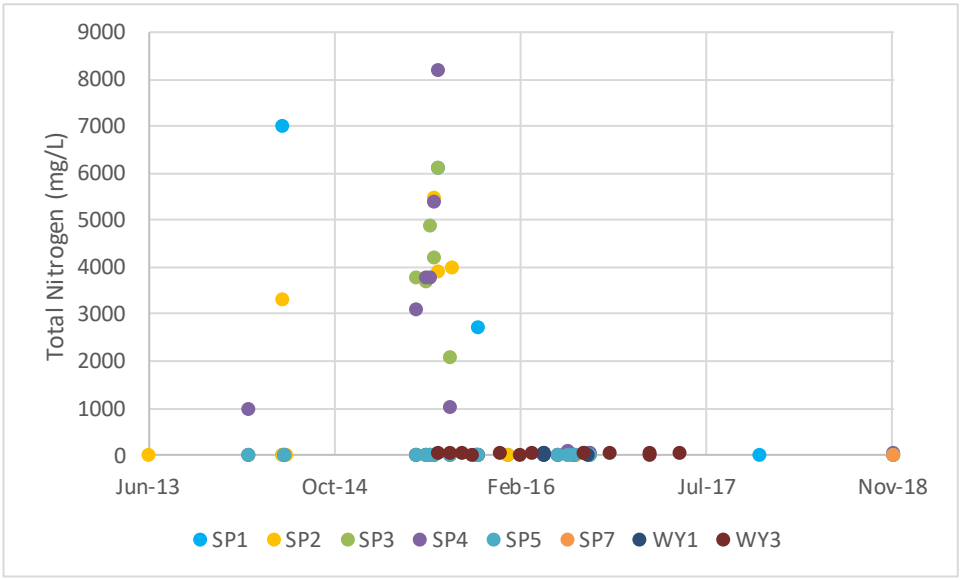

Sodium (mg/L)
6000
5000
4000
3000
2000
1000
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

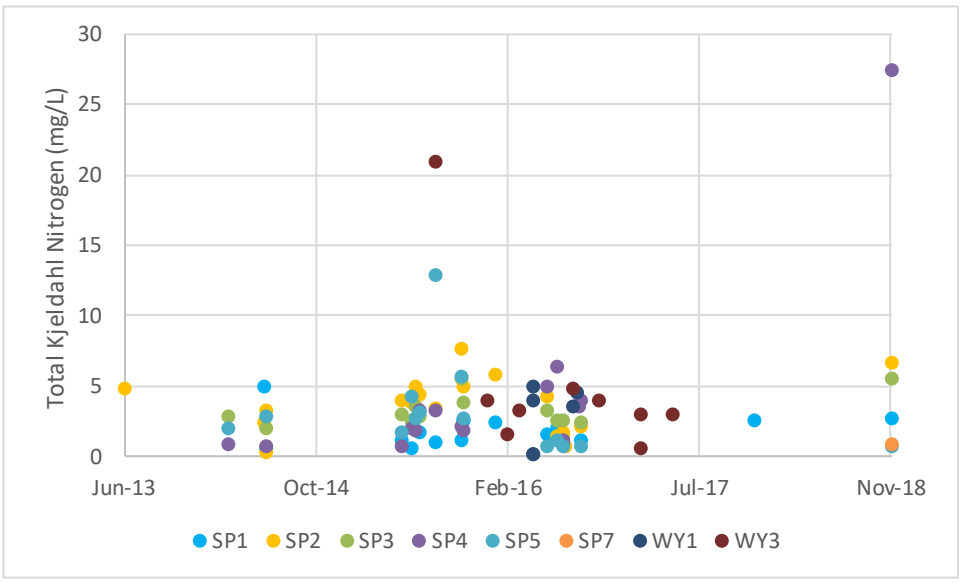

Total Oxidised Nitrogen (mg/L)
70
60
50
40
30
20
10
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

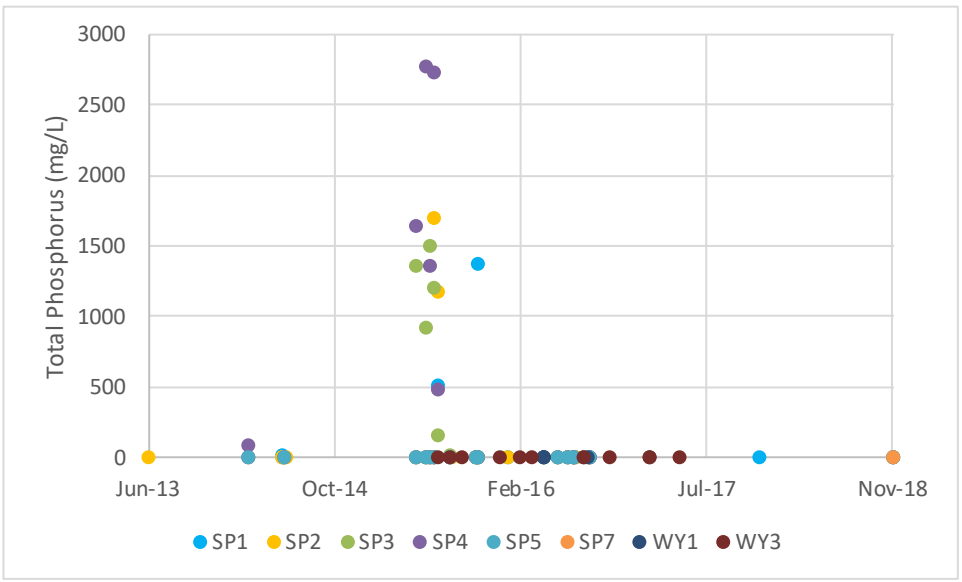

Ammonia (mg/L)
30
25
20
15
10
5
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

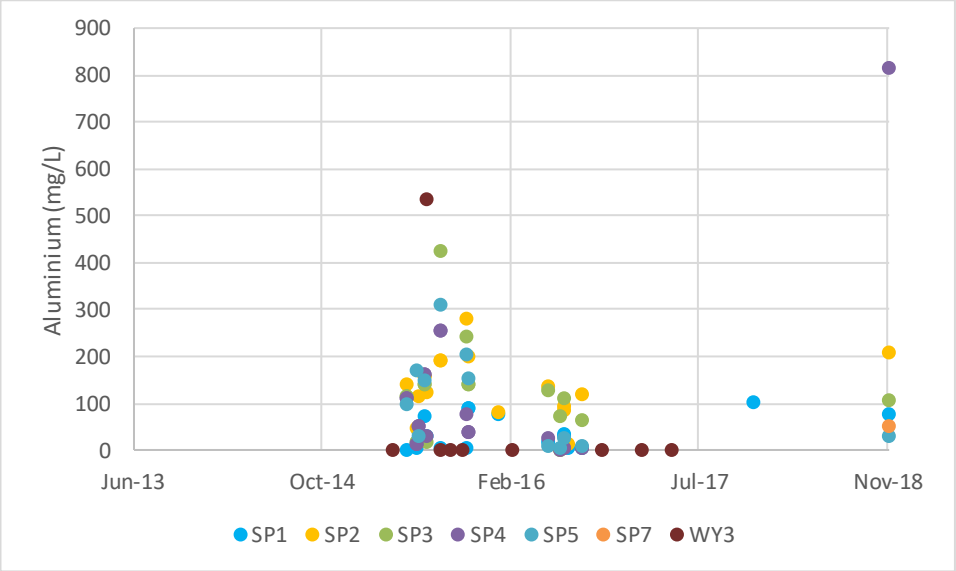

Nitrate (mg/L)
70
60
50
40
30
20
10
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

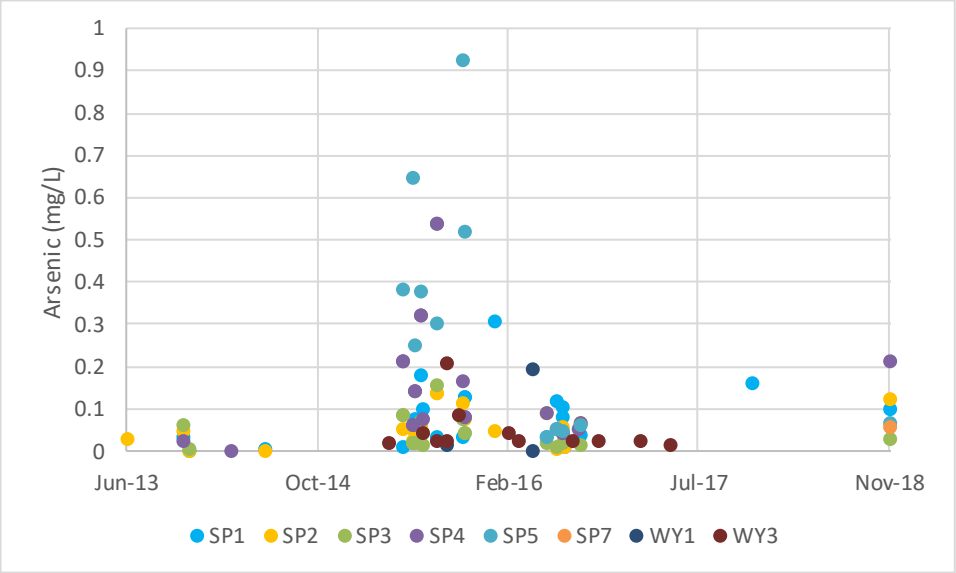

Nitrite (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

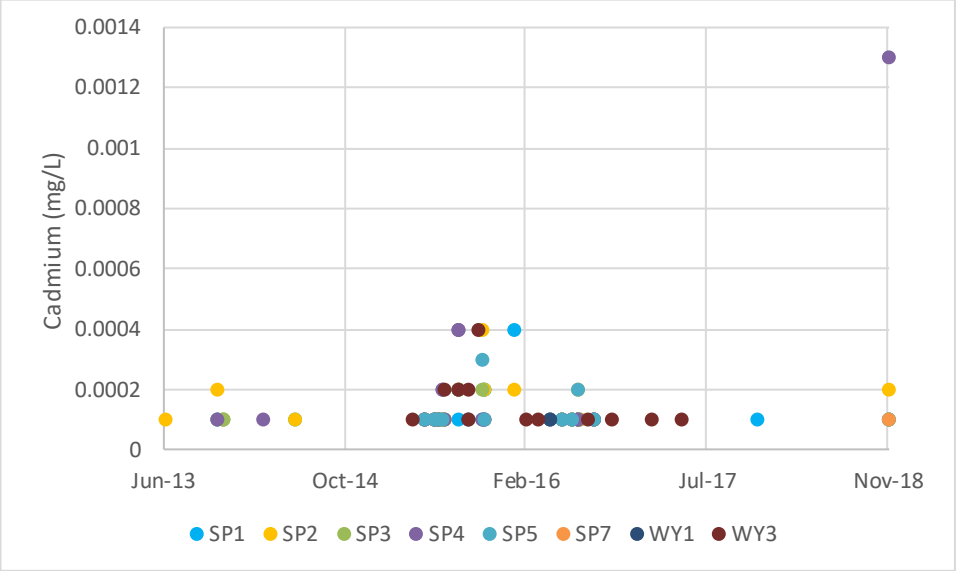

Total Nitrogen (mg/L)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

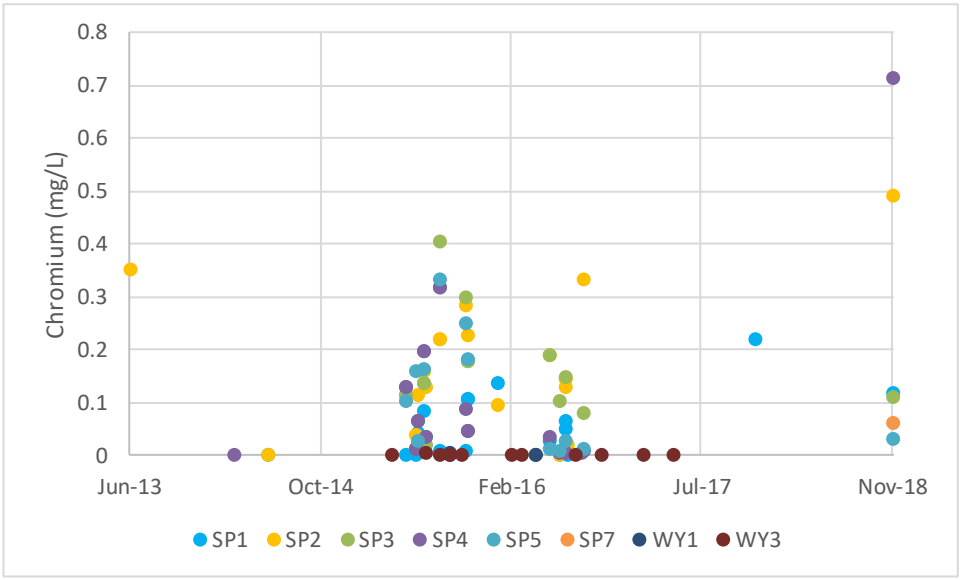

Total Kjeldahl Nitrogen (mg/L)
30
25
20
15
10
5
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

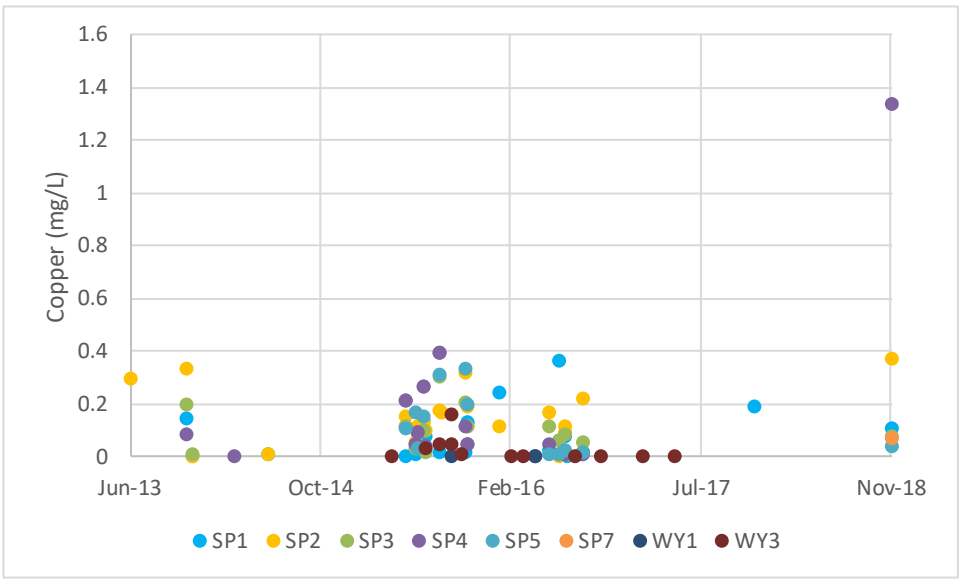

Total Phosphorus (mg/L)
3000
2500
2000
1500
1000
500
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

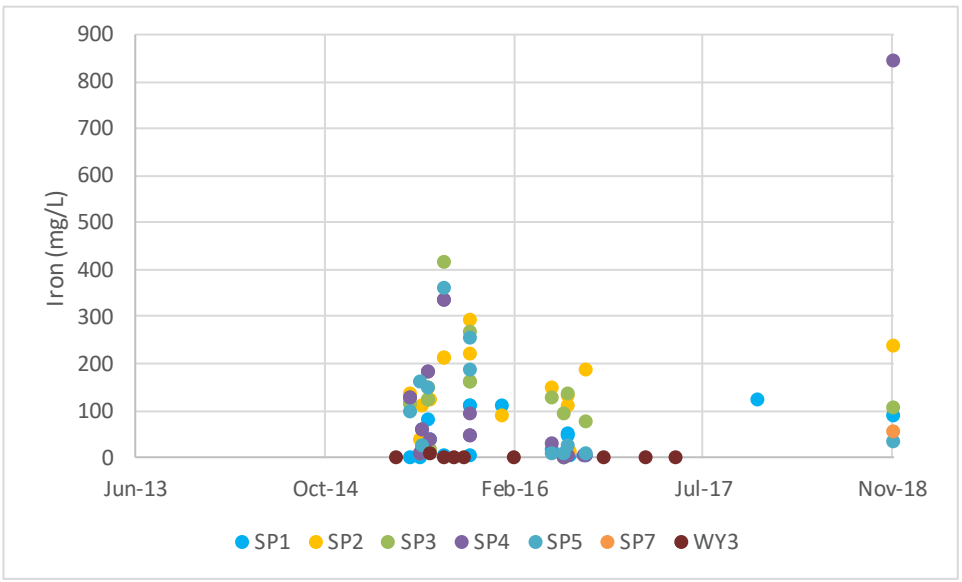

Aluminium (mg/L)
900
800
700
600
500
400
300
200
100
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY3

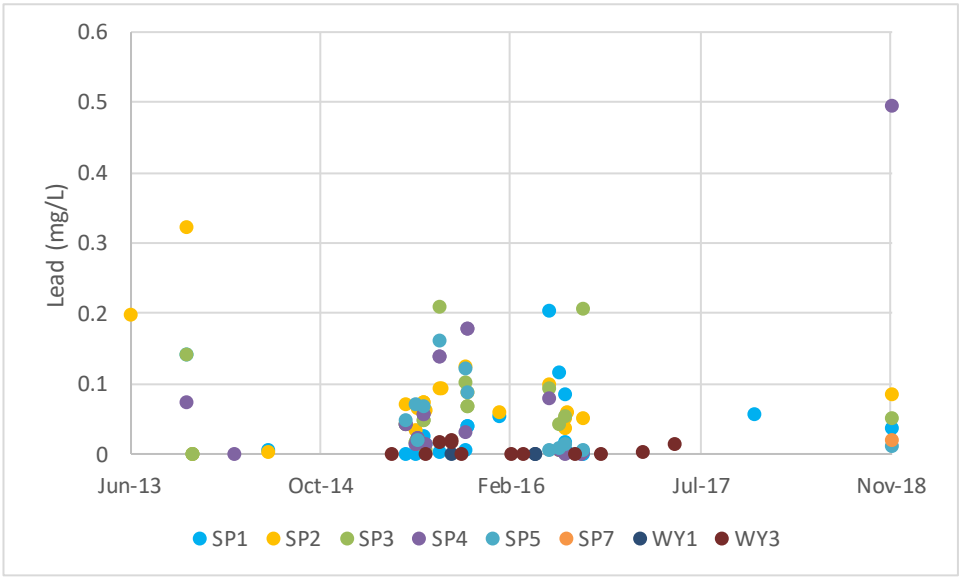

Arsenic (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

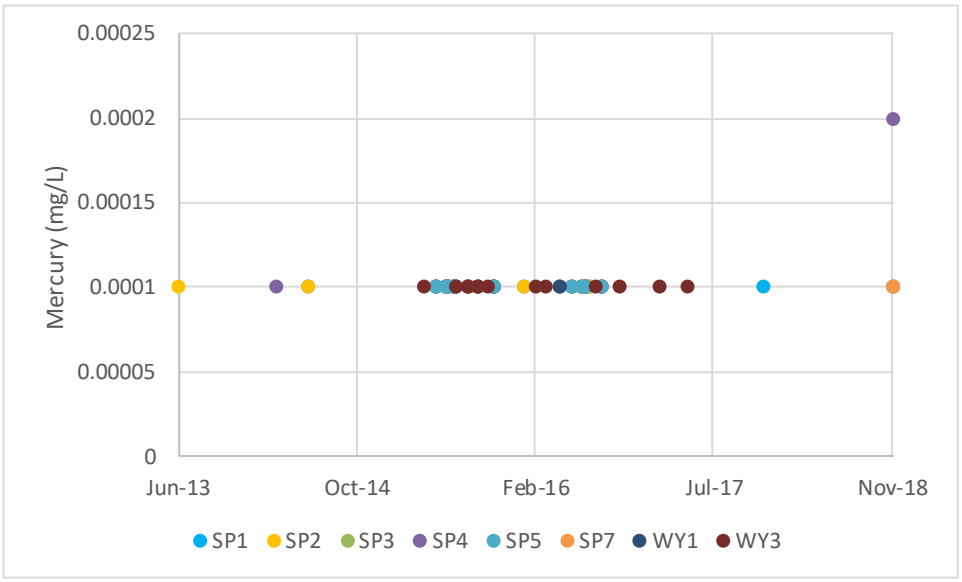

Cadmium (mg/L)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

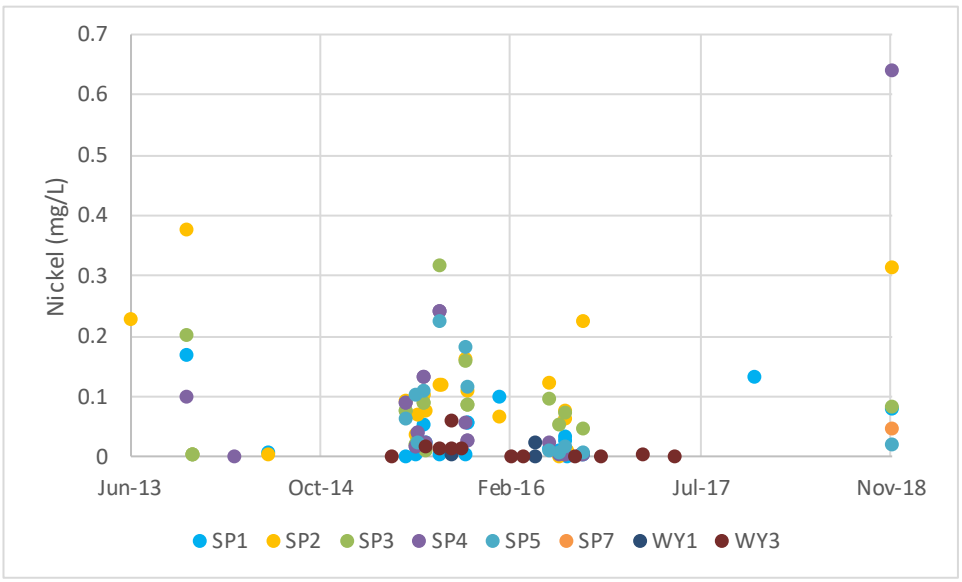

Chromium (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

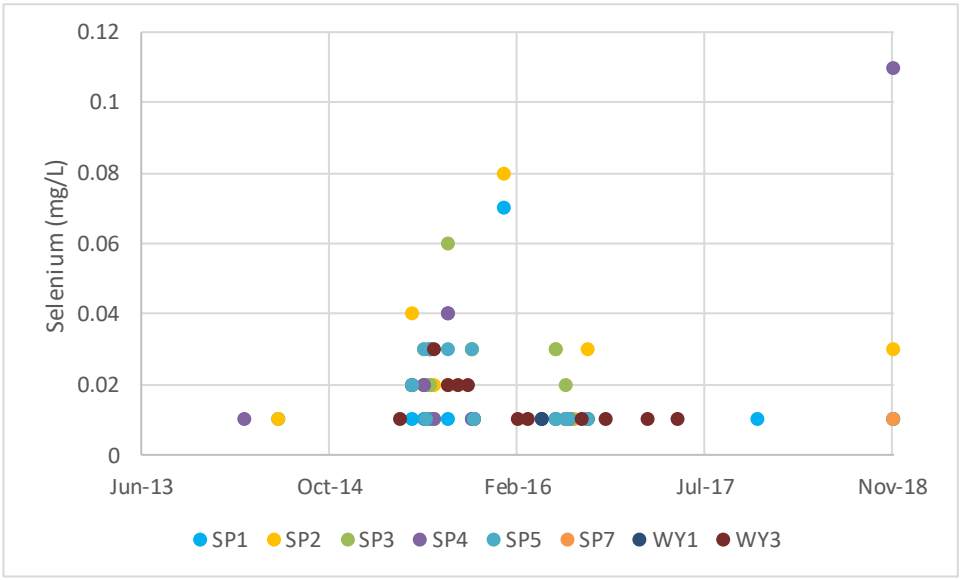

Copper (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

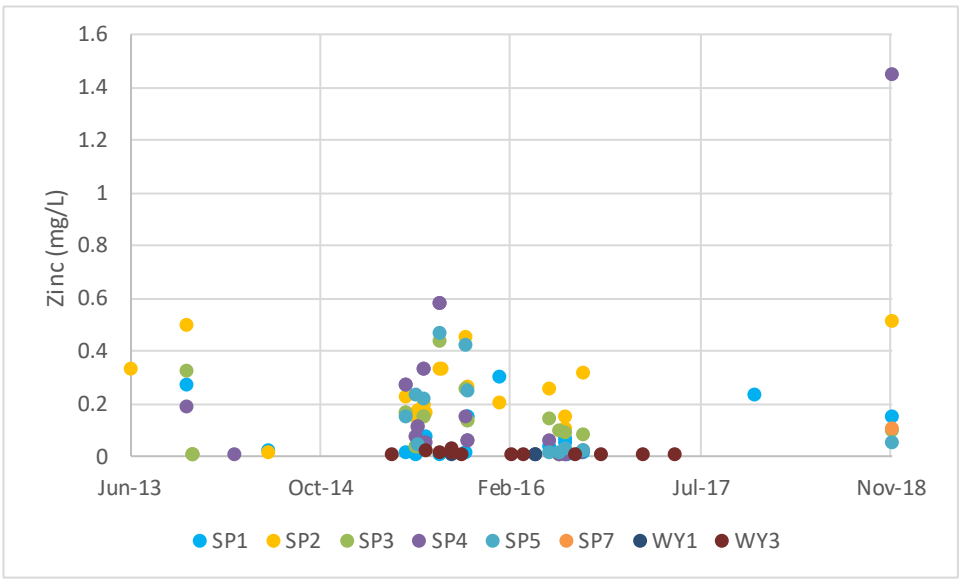

Iron (mg/L)
900
800
700
600
500
400
300
200
100
0
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY3

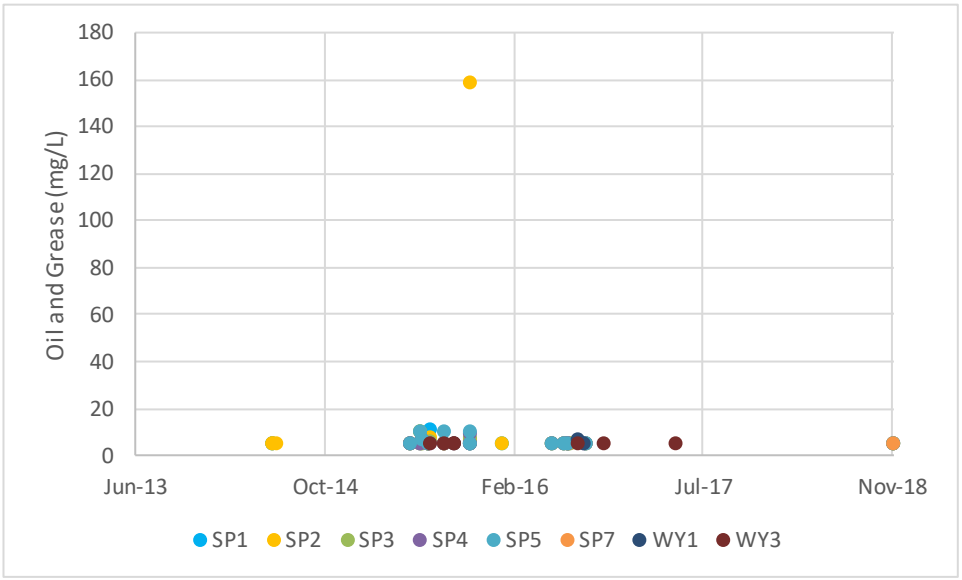

0.6
0.5
0.4
0.3
0.2
0.1
0
Lead (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3


0.00025
0.0002
0.00015
0.0001
0.00005
0
Mercury (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Nickel (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3


0.12
0.1
0.08
0.06
0.04
0.02
0
Selenium (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3


1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Zinc (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3


180
160
140
120
100
80
60
40
20
0
Oil and Grease (mg/L)
Jun-13
Oct-14
Feb-16
Jul-17
Nov-18
SP1 SP2 SP3 SP4 SP5 SP7 WY1 WY3

Appendix D – Baseline groundwater data

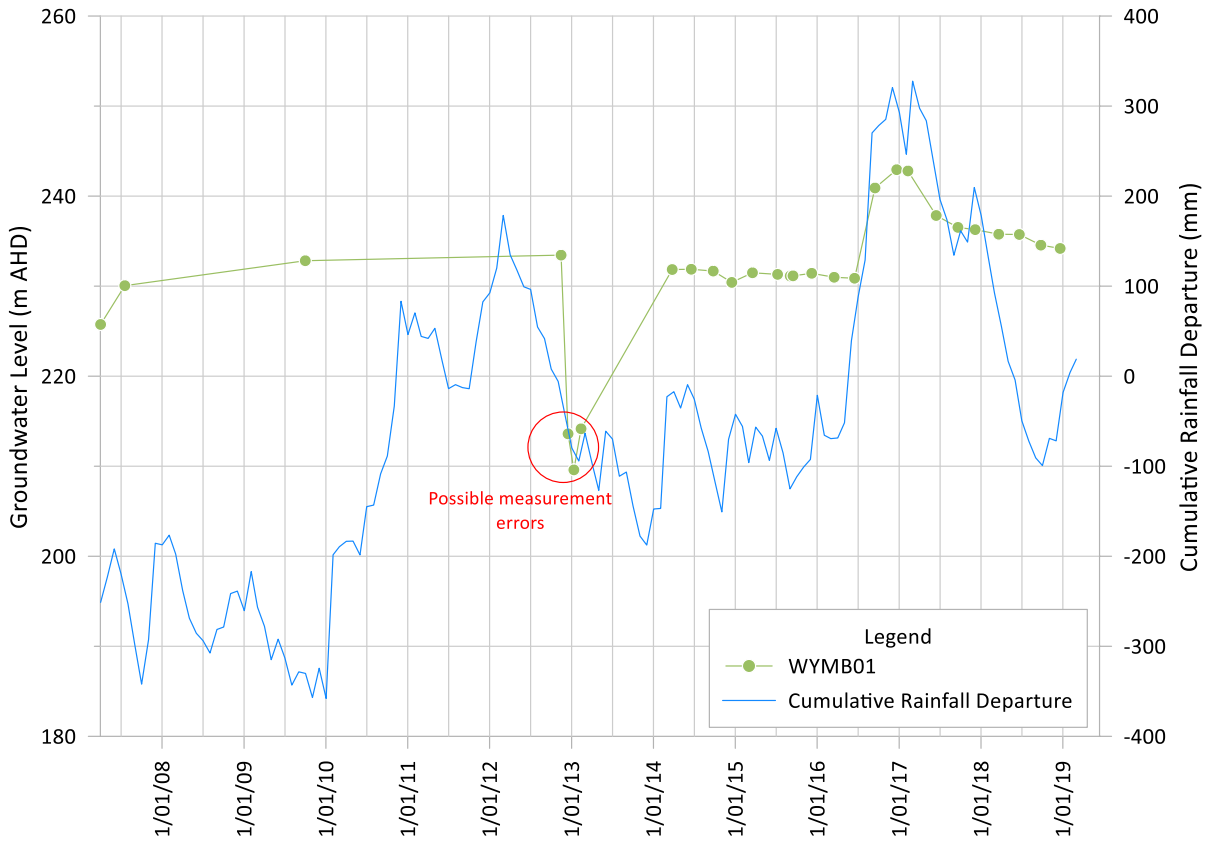
Table D-1 Registered bore details - TGO

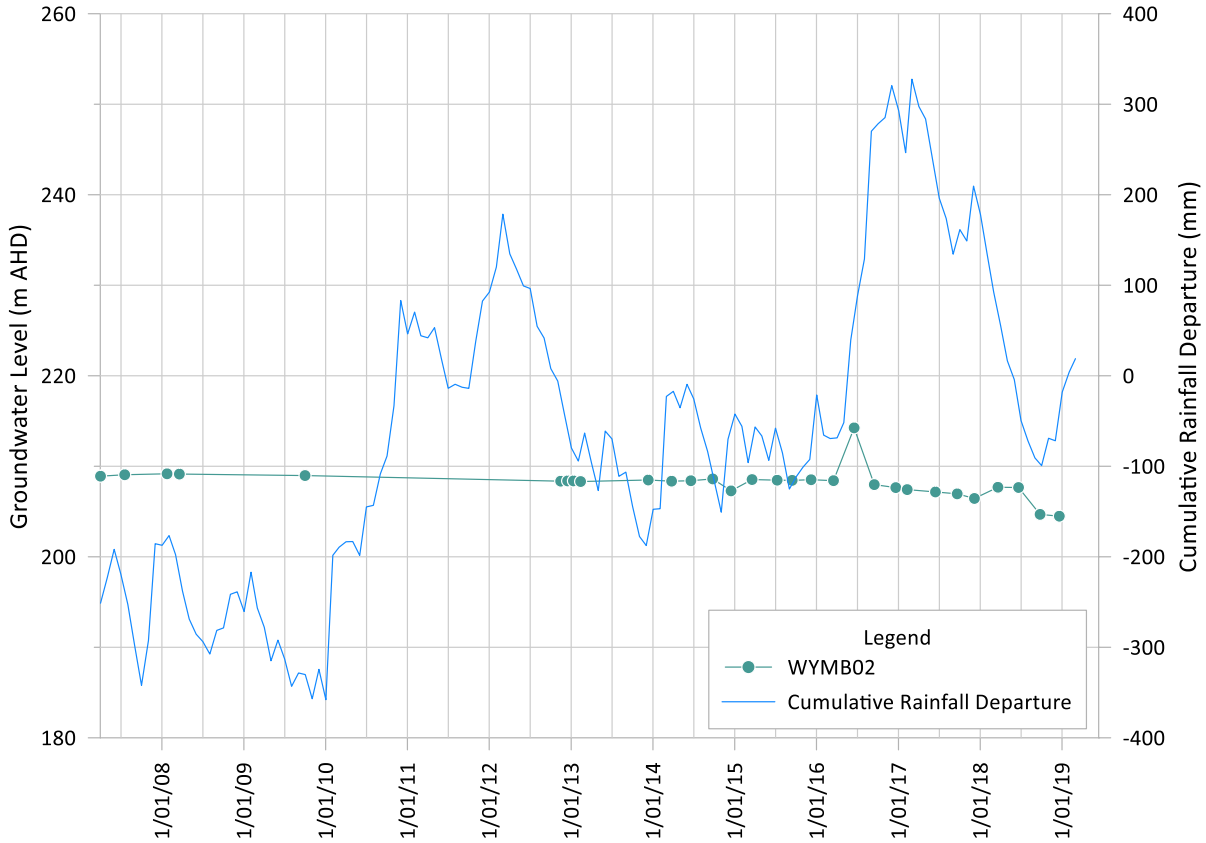
Bore	Depth	Authorised Purpose	Intended Purpose	Easting	Northing	Licence	Licence Status	WBZ	Aquifer	SWL	Yield	Salinity
GW012385	44.1		Groundwater Exploration	605497	6399909	-	-	19.5-19.8, 33.5-35	Gravelly Clay	9.1, 7.3	1.14	-
GW034897	1.8	Stock, Domestic	Stock, Domestic	612967	6398380	80BL028144	Converted	1.8	-	-	-	-
GW066562	73	Test Bore	Test Bore	617276	6387642	80BL141280	Cancelled					
GW054594	61.6	Stock, Domestic	Stock, Domestic	617018	6383487	80BL116653	Converted	-	-	-	-	-
GW045134	18.3	Test Bore	Public/ Municipal	614748	6396758	80BL105282	Cancelled	-	-	-	-	-
GW045135	3.7	Test Bore	Public/ Municipal	617605	6397956	80BL105283	Cancelled	3	Clay white sandy	0.9	0.76	-
GW045136	5.2	Test Bore	Public/ Municipal	617792	6398324	80BL105284	Cancelled	4.6-5.2	Unconsolidated Sandy Clay	-	-	-
GW045137	12.2	Test Bore	Public/Municipal	615448	6396318	80BL105285	Cancelled	-	-	-	-	-
GW800177	113.88	Test Bore	Test Bore	619322	6400284	80BL237099	Cancelled	2-4.5	Sand	1	0.32	Good
GW801568	81	Domestic, Stock	Domestic, Stock	619013	6385184	80BL239686	Converted	-	-	-	-	-
GW800178	80	Test Bore	Test Bore	619329	6400277	80BL237099	Cancelled	-	-	-	-	-
GW068651	97	-	Mining	616478	6383302	-	-	82-82.1, 94-94.1	Fresh siltstone	-	-	-
GW037395	4.5	Irrigation	Irrigation	616510	6397938	80BL030552	Converted	3.6-4.5	Unconsolidated Sandy Clay	2.1	1.26	-
GW802834	77	Test Bore	Test Bore	617229	6383531	80BL237359	Lapsed	54-77	Shale and siltstone	42	1.5	3900 mg/L

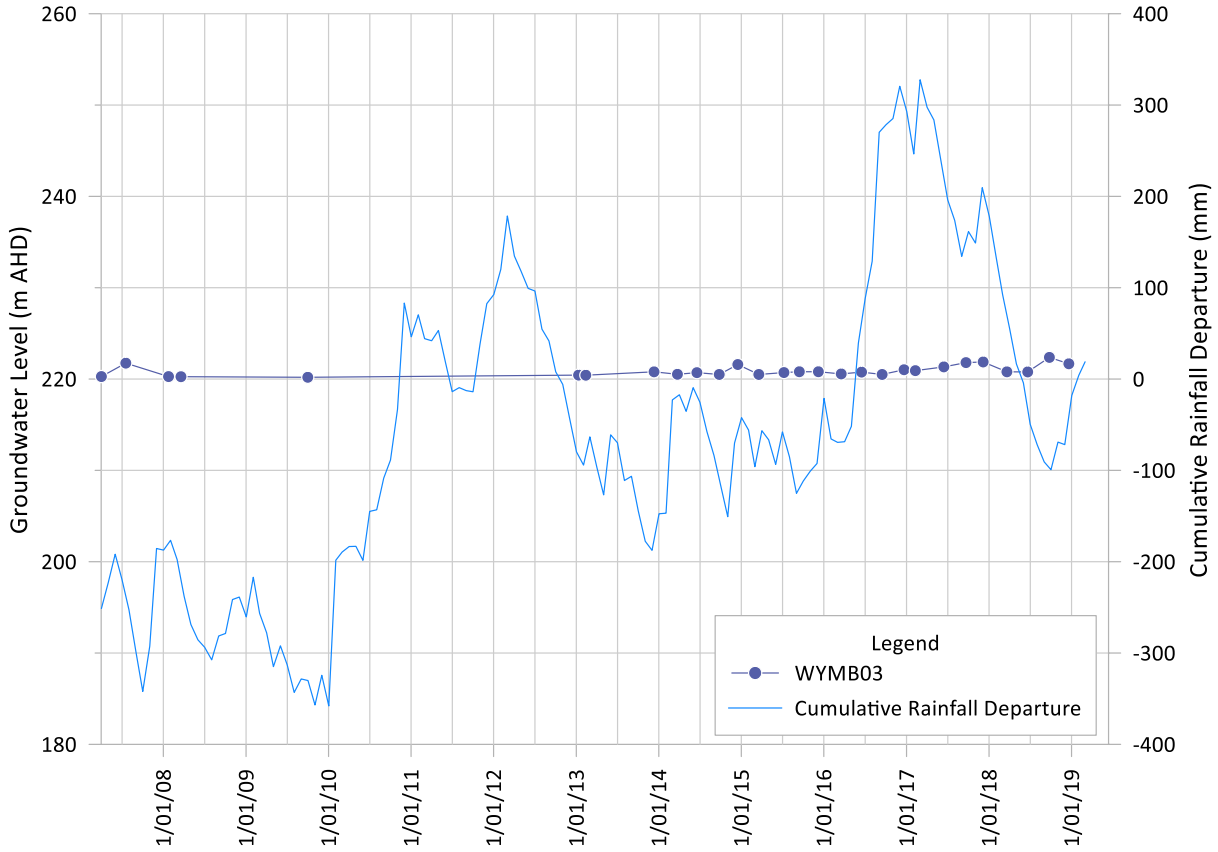
Bore	Depth	Authorised Purpose	Intended Purpose	Easting	Northing	Licence	Licence Status	WBZ	Aquifer	SWL	Yield	Salinity
GW803148	5.8	Town Water Supply	Town Water Supply	617498	6397966	80BL242918	Converted	-	-	4.4	1	-
GW803681	3.5	Monitoring Bore	-	614686	6395749	80BL245013	Active	-	Weathered shale	-	-	-
GW803678	4	Monitoring Bore	-	614695	6395743	80BL245013	Active	-	Claystone	-	-	-
GW803682	3.5	Monitoring Bore	-	614688	6395758	80BL245013	Active	-	Weathered shale	-	-	-
GW803680	4.5	Monitoring Bore	-	614685	6395767	80BL245013	Active	-	Sandy Clay/Clay	-	-	-
GW803679	4	Monitoring Bore	-	614680	6395761	80BL245013	Active	-	Claystone/ Shale	-	-	-
GW804130	69	-	Test Bore	604604	6388873	-	Abandoned	-	-	-	-	-
GW804137	64	-	Test Bore	603562	6395423	-	-	-	-	-	-	-

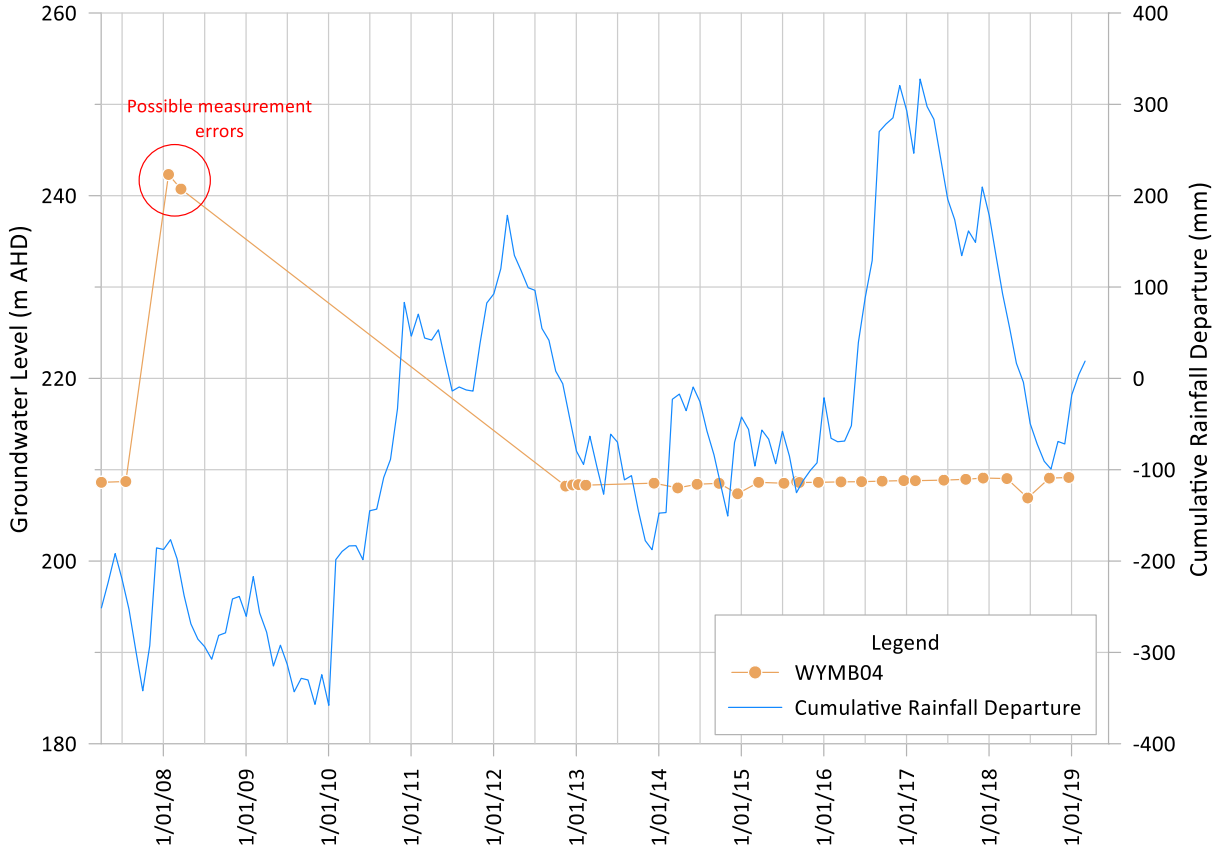
Groundwater hydrographs

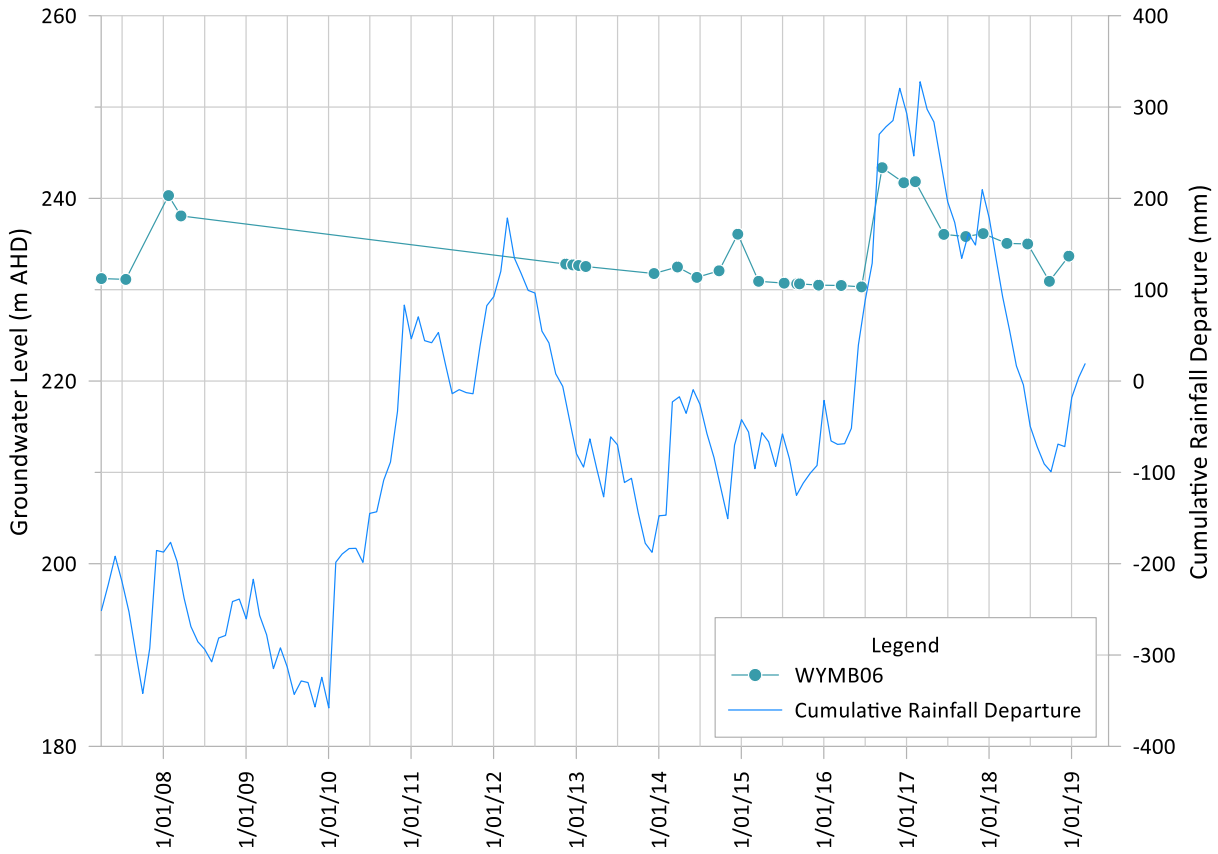
Fractured rock bores

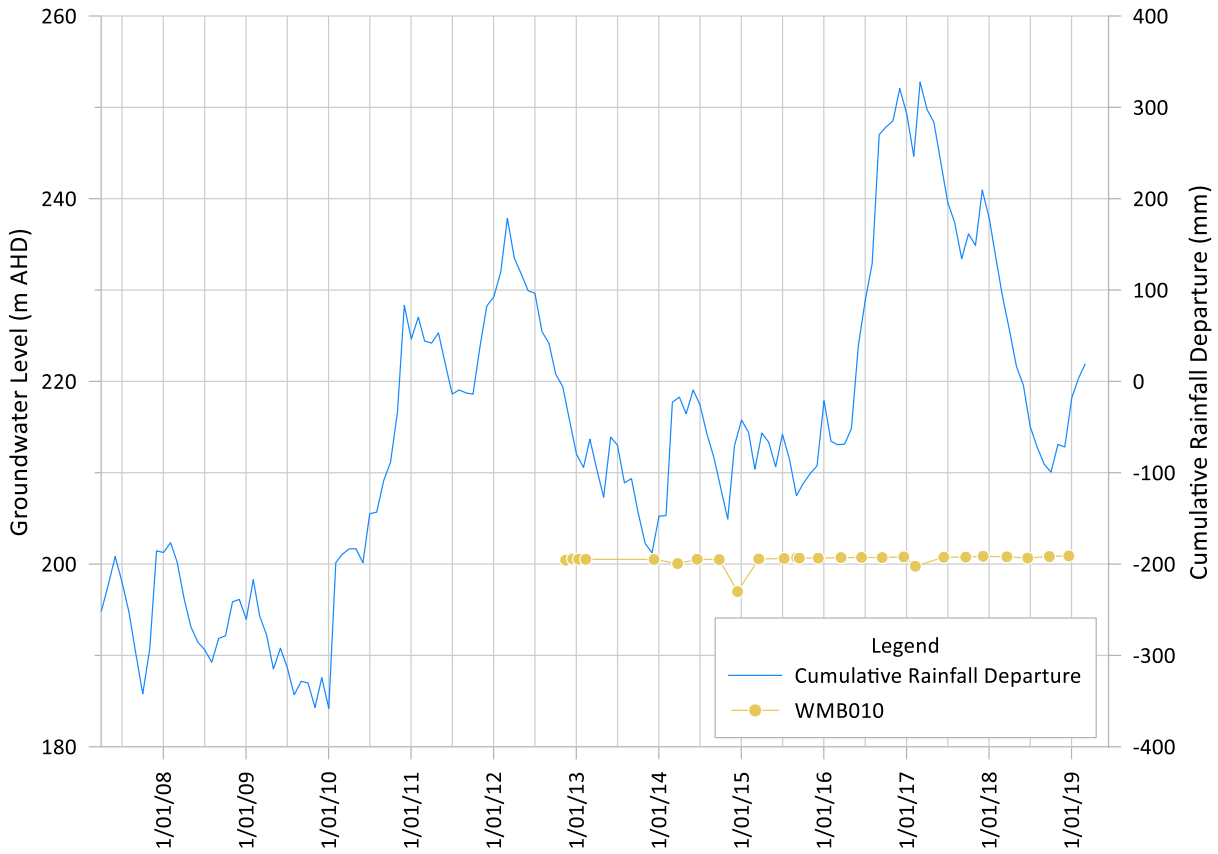




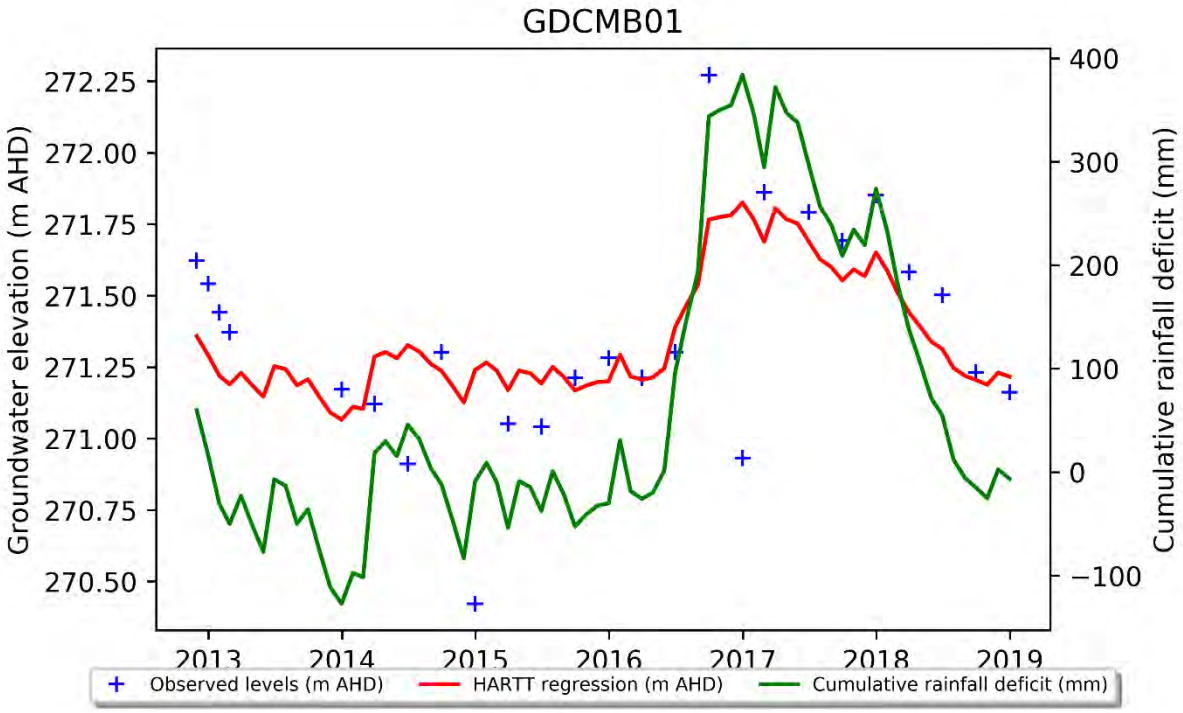

Groundwater Level (m AHD)
Cumulative Rainfall Departure (mm)
260
240
220
200
180
400
300
200
100
0
-100
-200
-300
-400
1/01/08
1/01/09
1/01/10
1/01/11
1/01/12
1/01/13
1/01/14
1/01/15
1/01/16
1/01/17
1/01/18
1/01/19
Legend
WYMB03
Cumulative Rainfall Departure

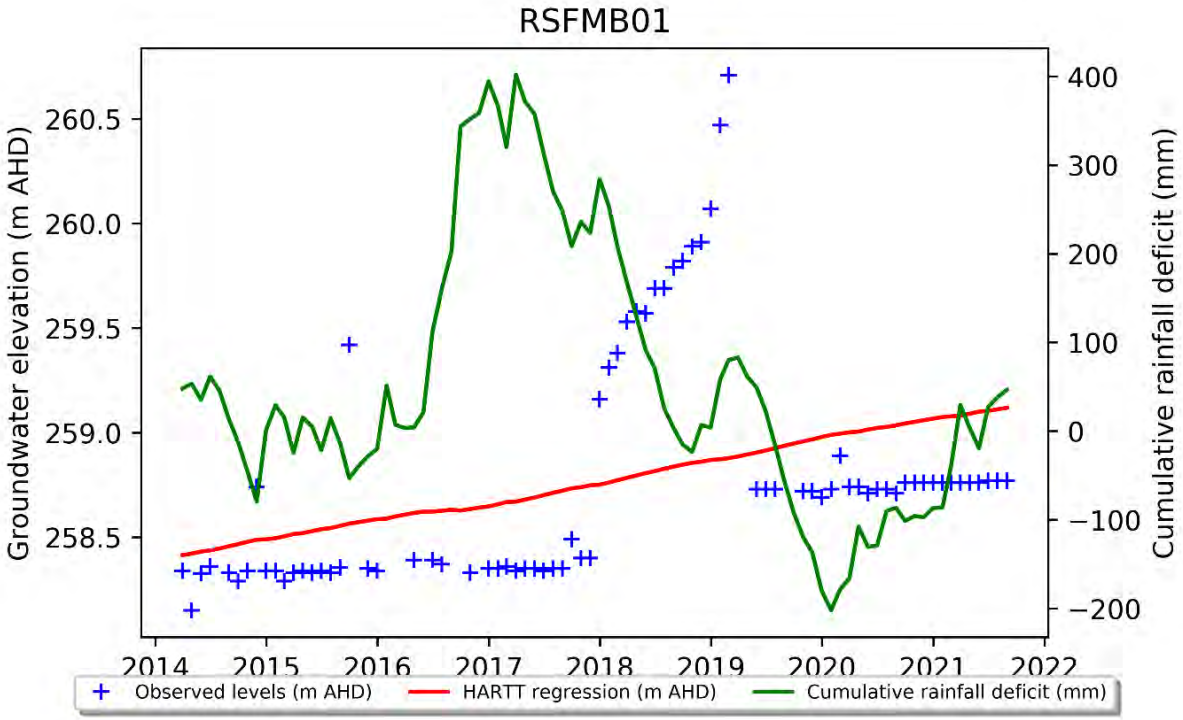

Possible measurement errors
Groundwater Level (m AHD)
Cumulative Rainfall Departure (mm)
260
240
220
200
180
400
300
200
100
0
-100
-200
-300
-400
1/01/08
1/01/09
1/01/10
1/01/11
1/01/12
1/01/13
1/01/14
1/01/15
1/01/16
1/01/17
1/01/18
1/01/19
Legend
WYMB04
Cumulative Rainfall Departure

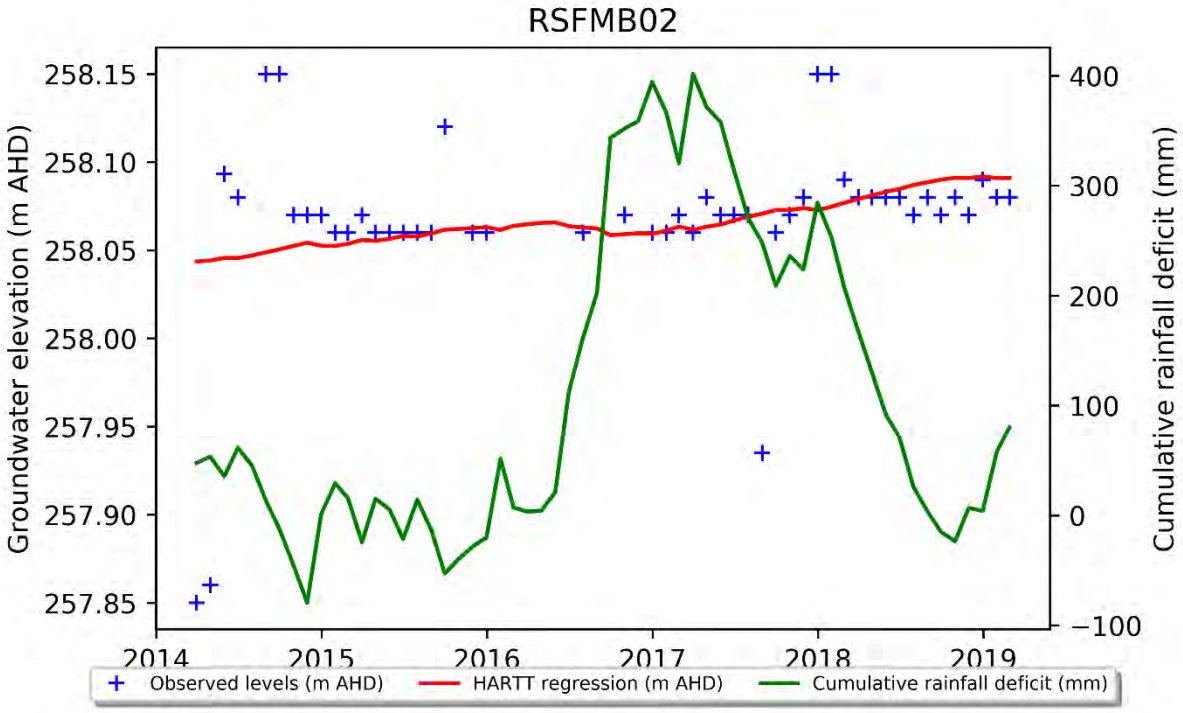

Groundwater Level (m AHD)
Cumulative Rainfall Departure (mm)
260
240
220
200
180
400
300
200
100
0
-100
-200
-300
-400
1/01/08
1/01/09
1/01/10
1/01/11
1/01/12
1/01/13
1/01/14
1/01/15
1/01/16
1/01/17
1/01/18
1/01/19
Legend
WYMB06
Cumulative Rainfall Departure

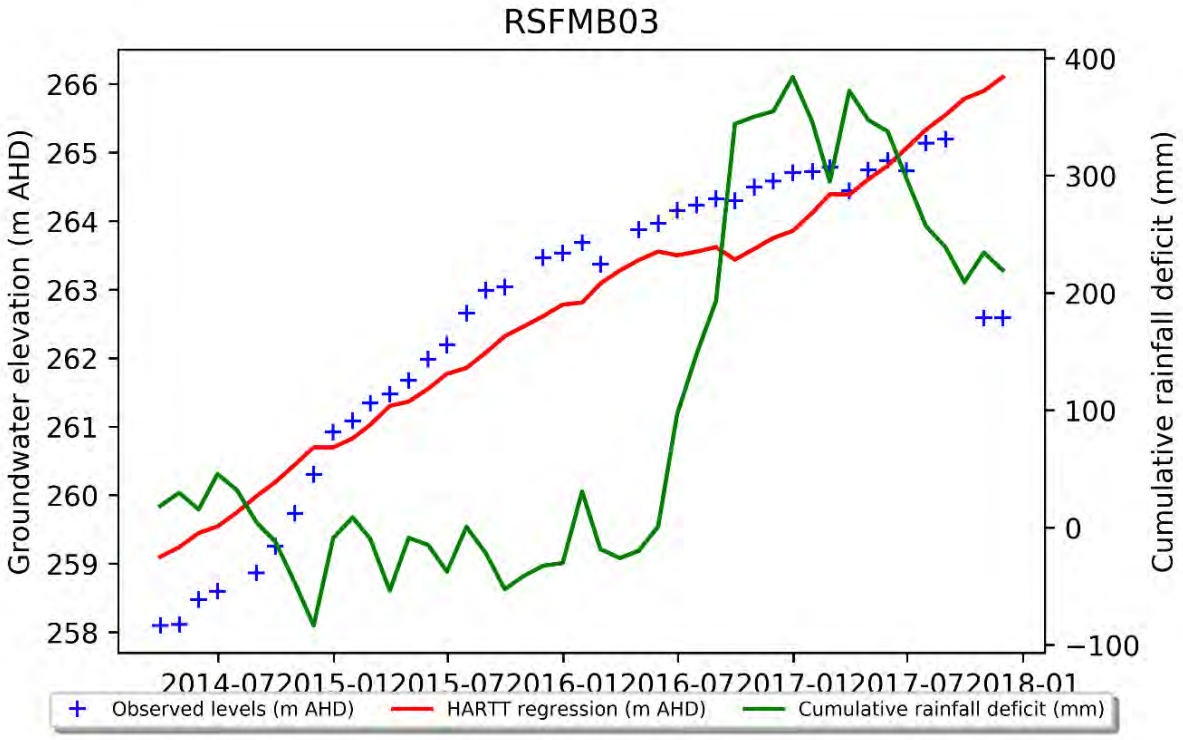

Groundwater Level (m AHD)
Cumulative Rainfall Departure (mm)
260
240
220
200
180
400
300
200
100
0
-100
-200
-300
-400
1/01/08
1/01/09
1/01/10
1/01/11
1/01/12
1/01/13
1/01/14
1/01/15
1/01/16
1/01/17
1/01/18
1/01/19
Legend
Cumulative Rainfall Departure
WMB010

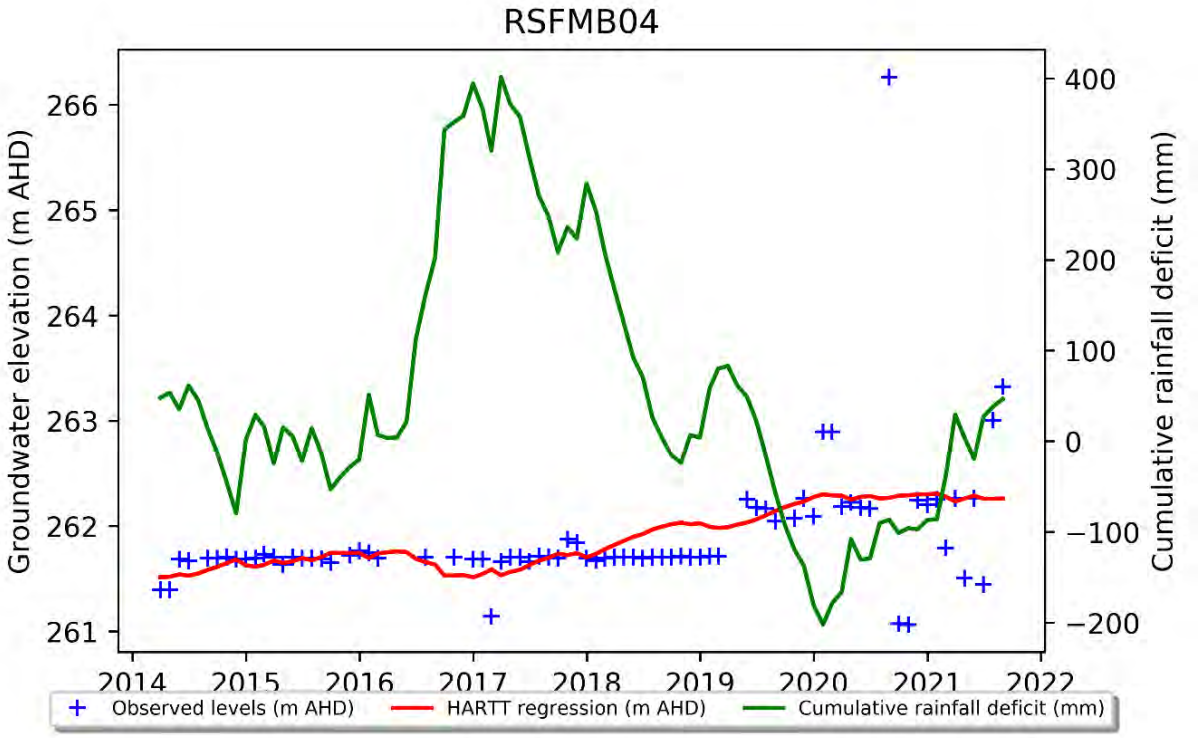
Shallow bores

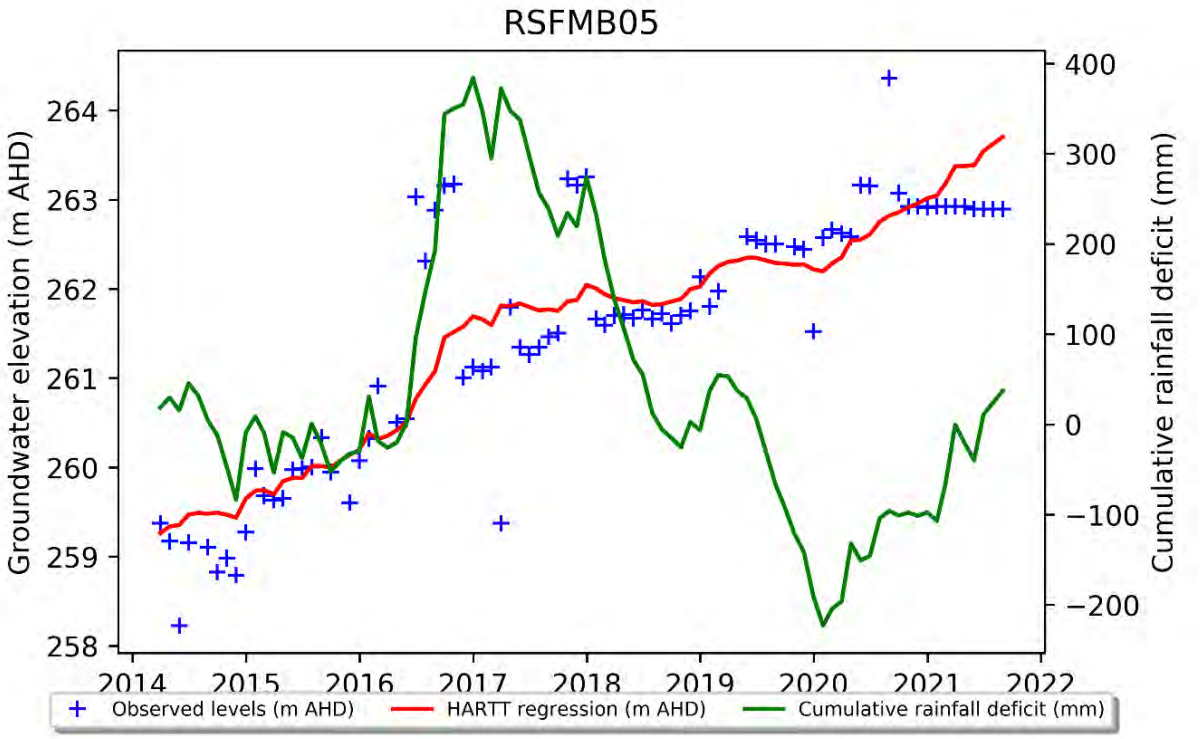


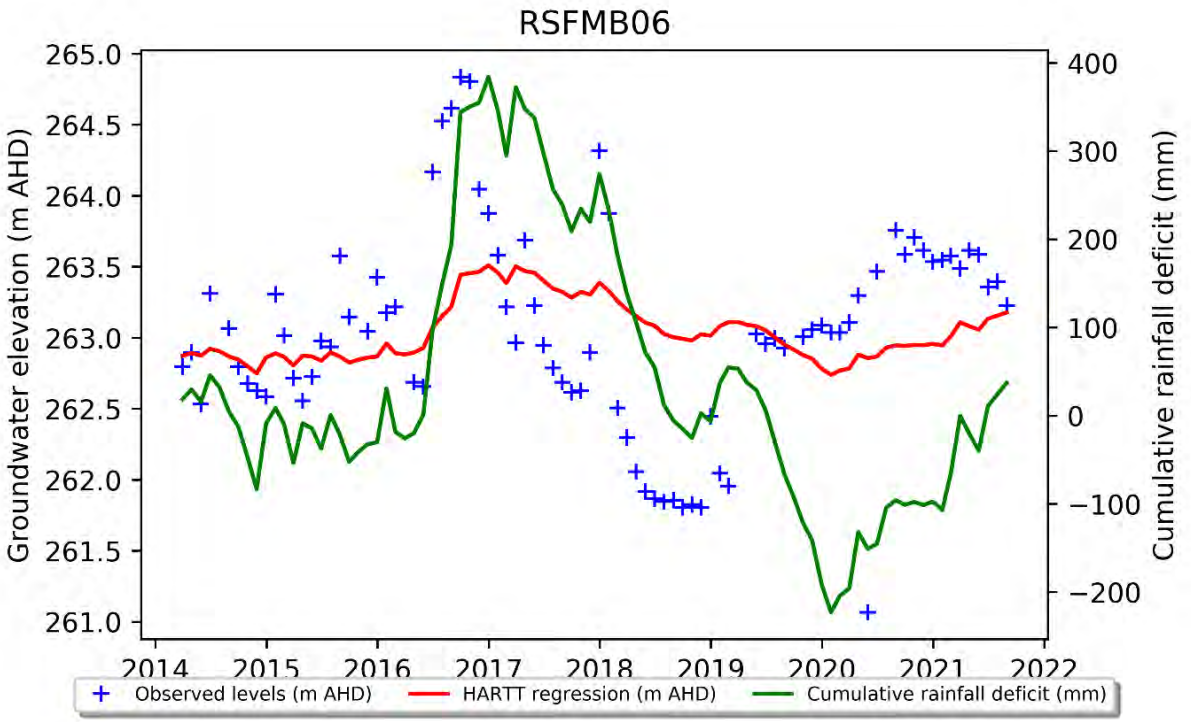


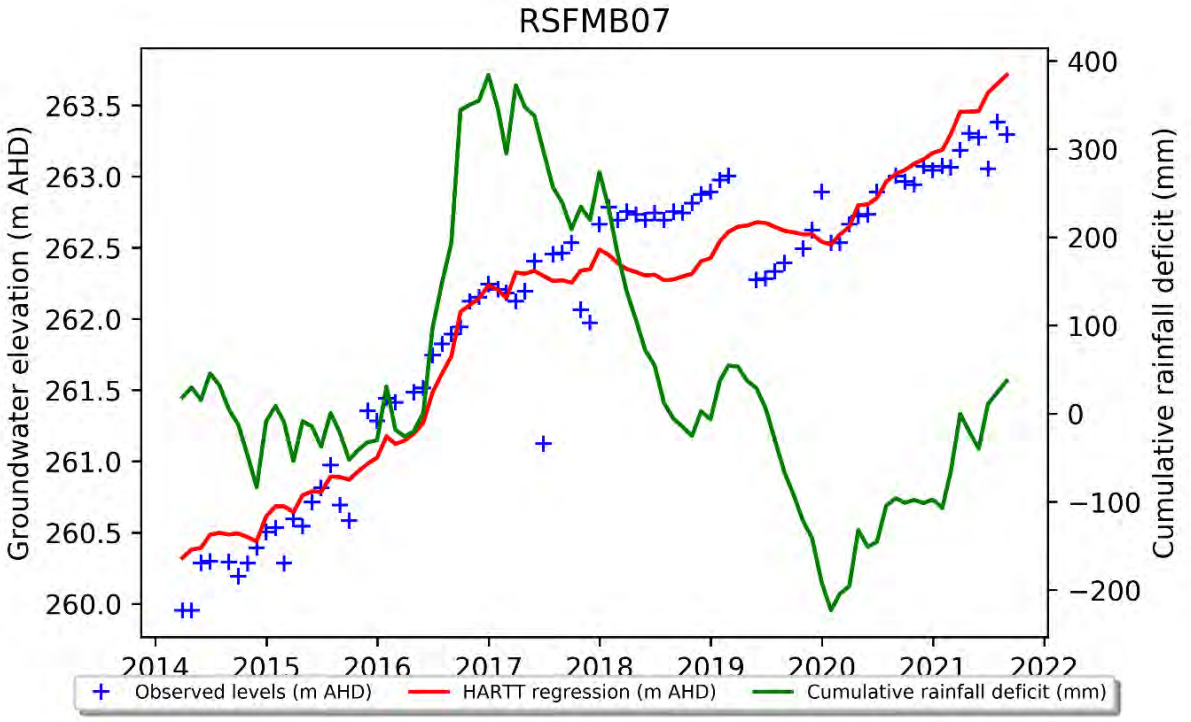

RSFMB02
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
258.15
258.10
258.05
258.00
257.95
257.90
257.85
400
300
200
100
0
−100
2014
2015
2016
2017
2018
2019
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

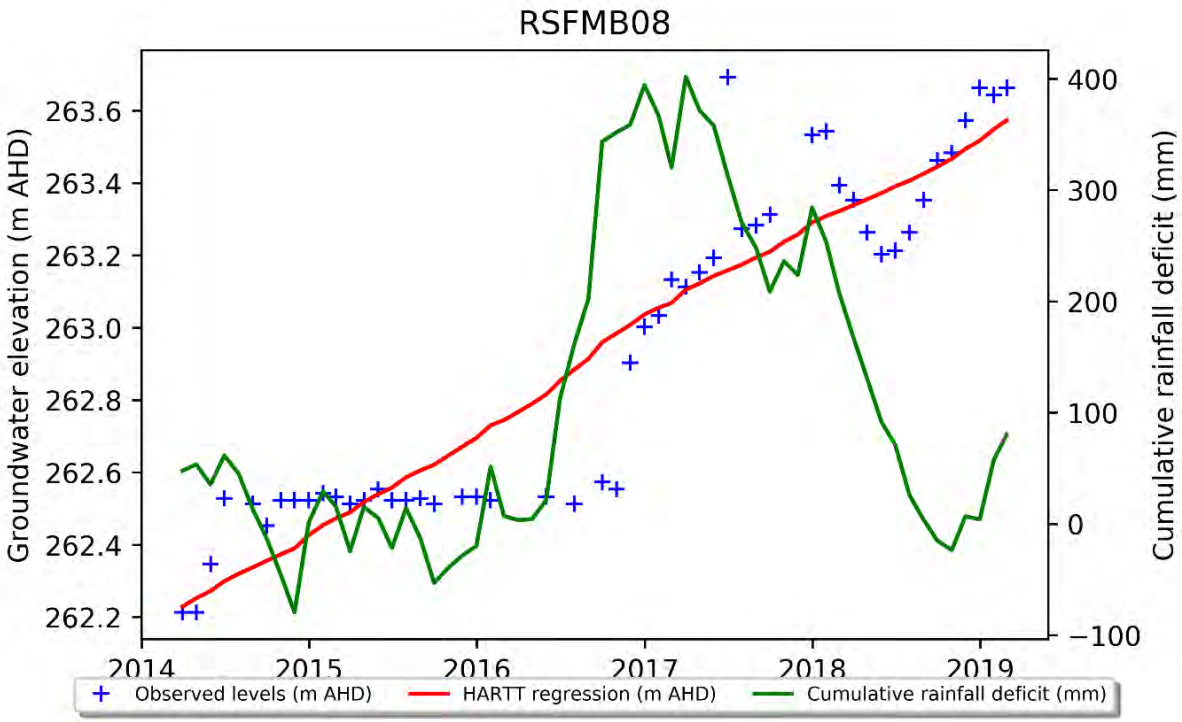

RSFMB03
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
266
265
264
263
262
261
260
259
258
400
300
200
100
0
−100
2014-07
2015-01
2015-07
2016-01
2016-07
2017-01
2017-07
2018-01
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

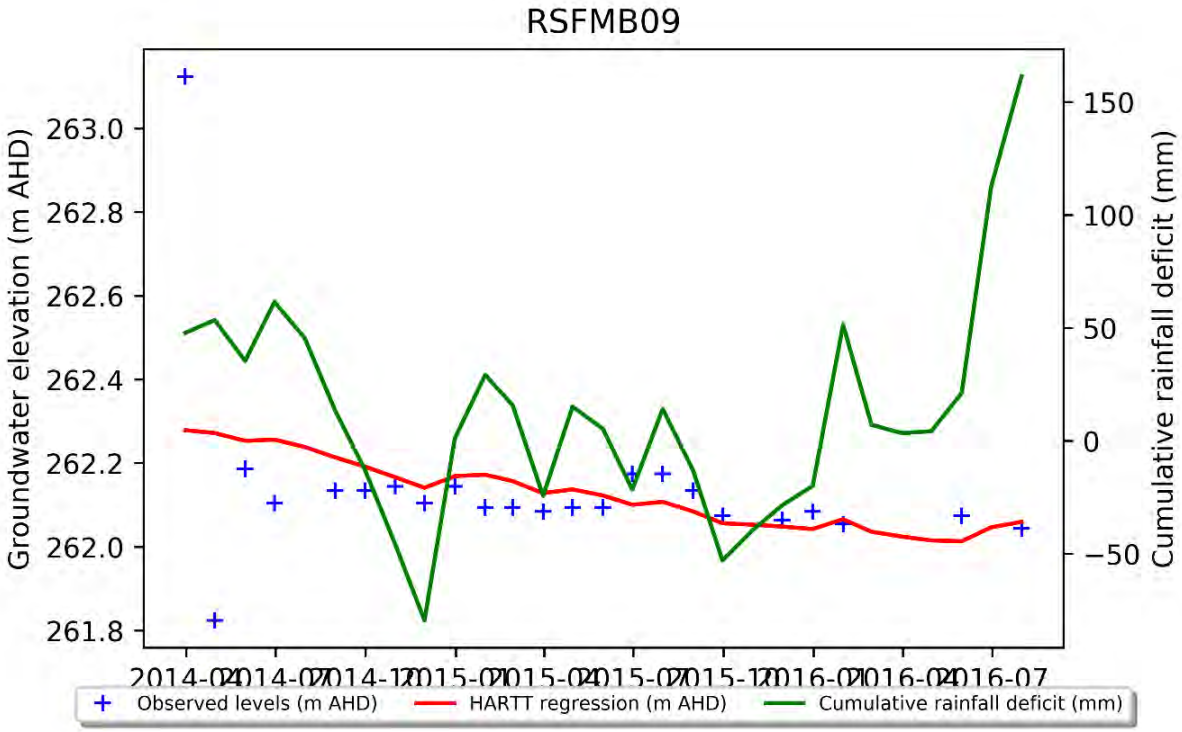

RSFMB04
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
266
265
264
263
262
261
400
300
200
100
0
−100
−200
2014
2015
2016
2017
2018
2019
2020
2021
2022
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

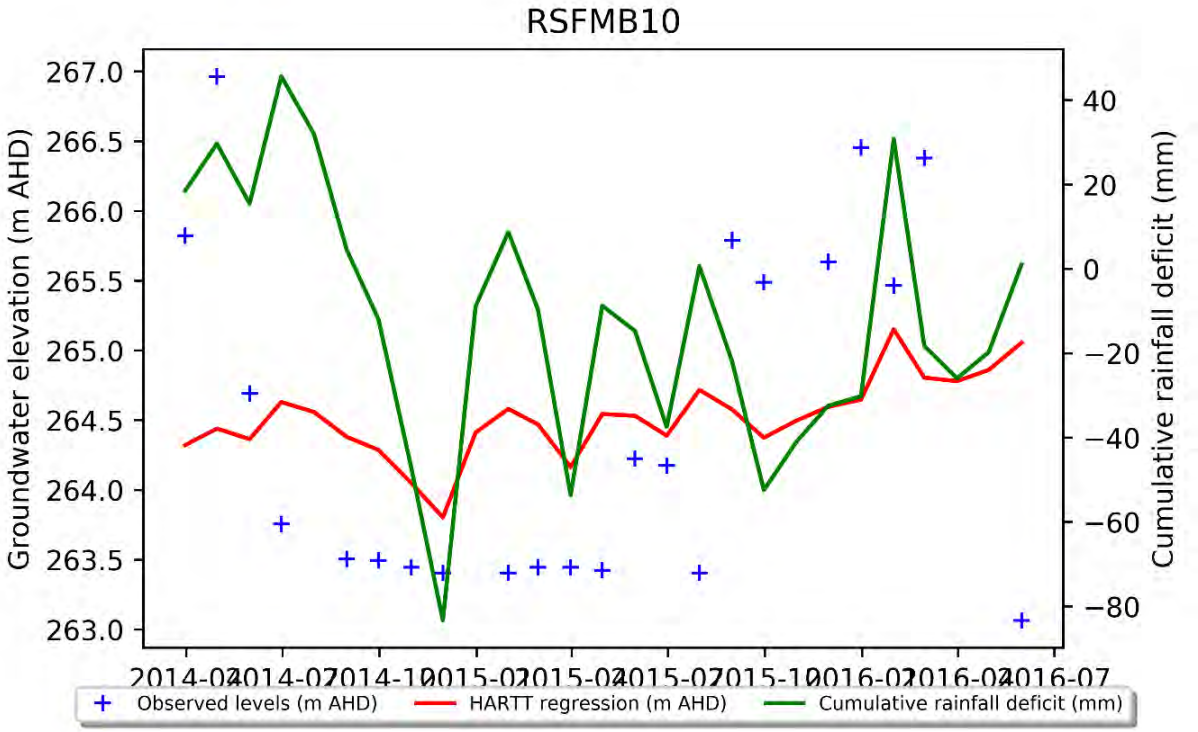

RSFMB05
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
264
263
262
261
260
259
258
400
300
200
100
0
−100
−200
2014
2015
2016
2017
2018
2019
2020
2021
2022
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

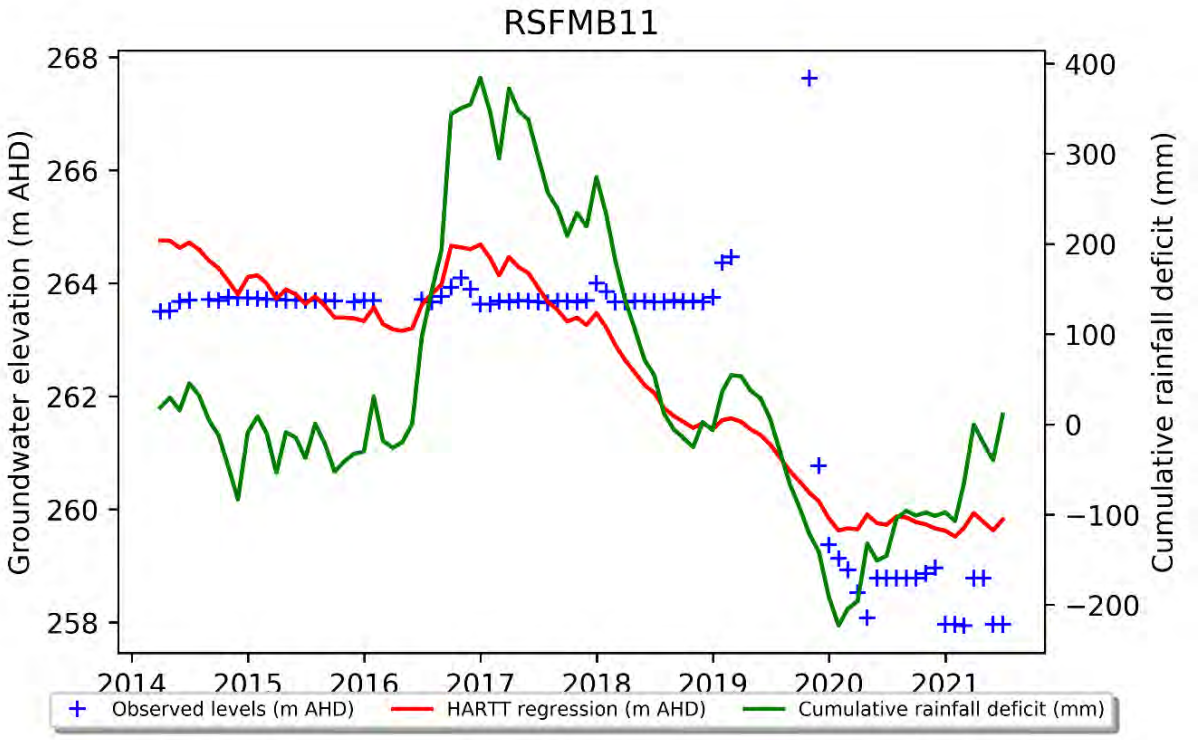

RSFMB06
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
265.0
264.5
264.0
263.5
263.0
262.5
262.0
261.5
261.0
400
300
200
100
0
−100
−200
2014
2015
2016
2017
2018
2019
2020
2021
2022
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

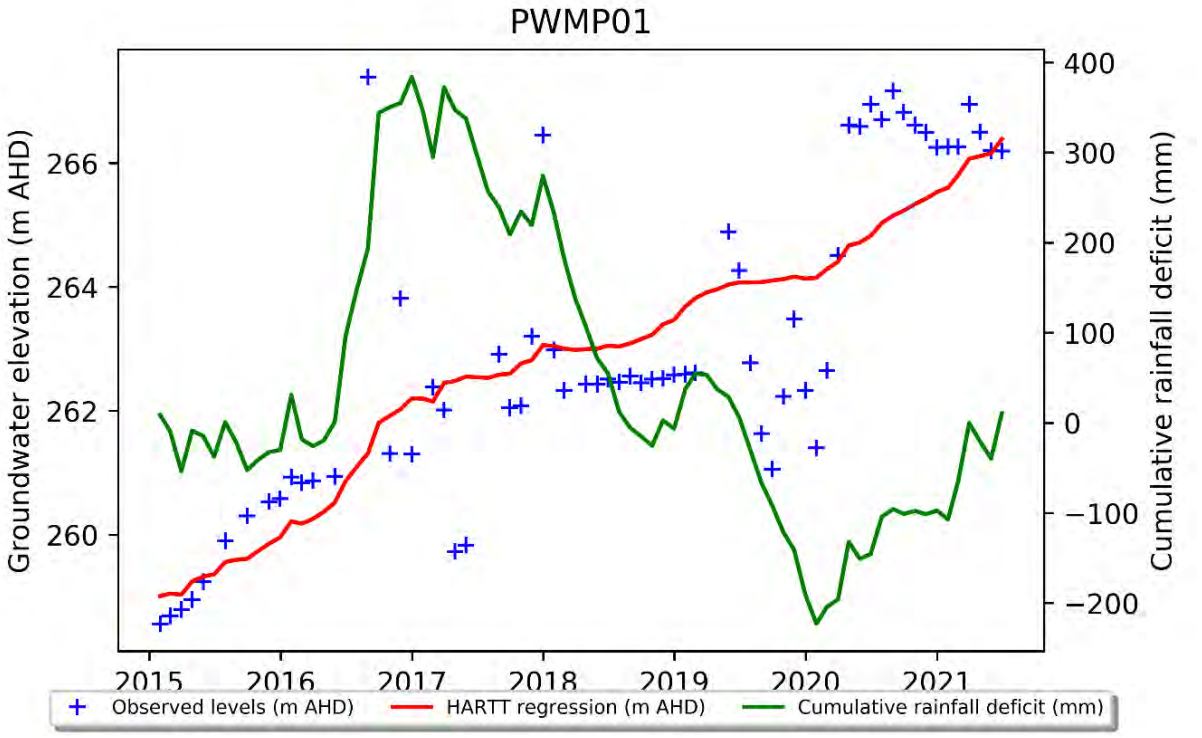

RSFMB07
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
263.5
263.0
262.5
262.0
261.5
261.0
260.5
260.0
400
300
200
100
0
−100
−200
2014
2015
2016
2017
2018
2019
2020
2021
2022
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

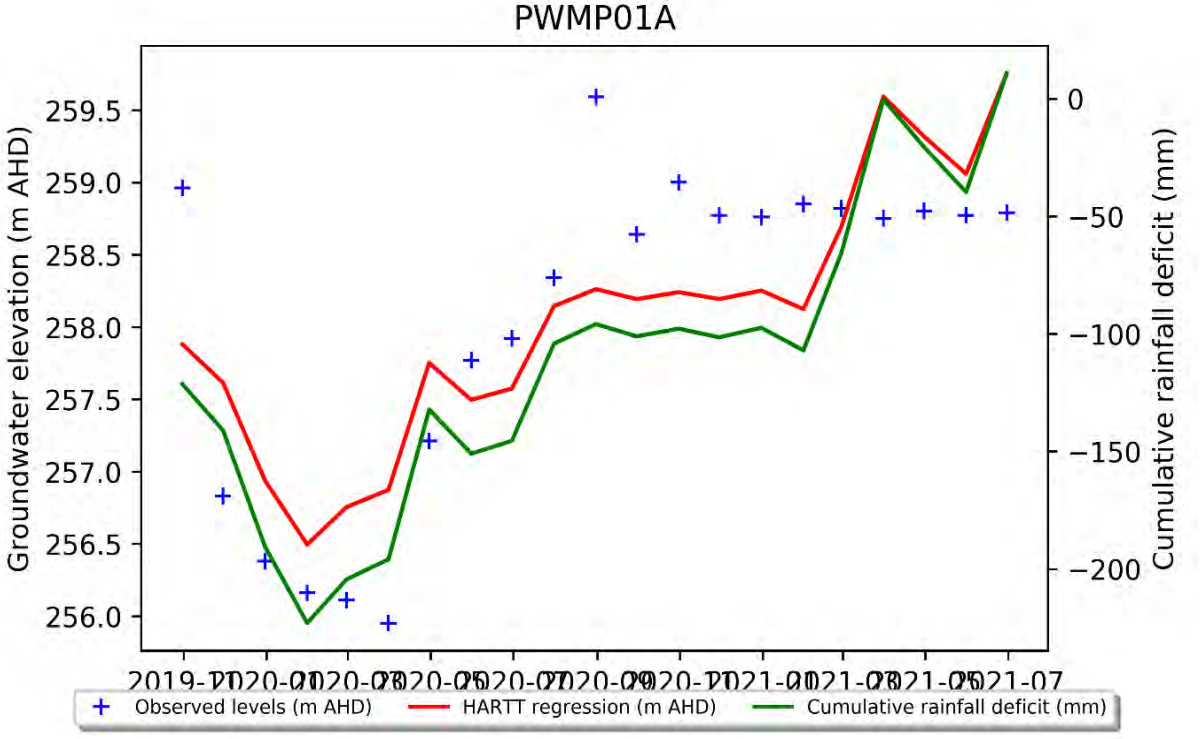

RSFMB08
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
263.6
263.4
263.2
263.0
262.8
262.6
262.4
262.2
400
300
200
100
0
−100
2014
2015
2016
2017
2018
2019
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

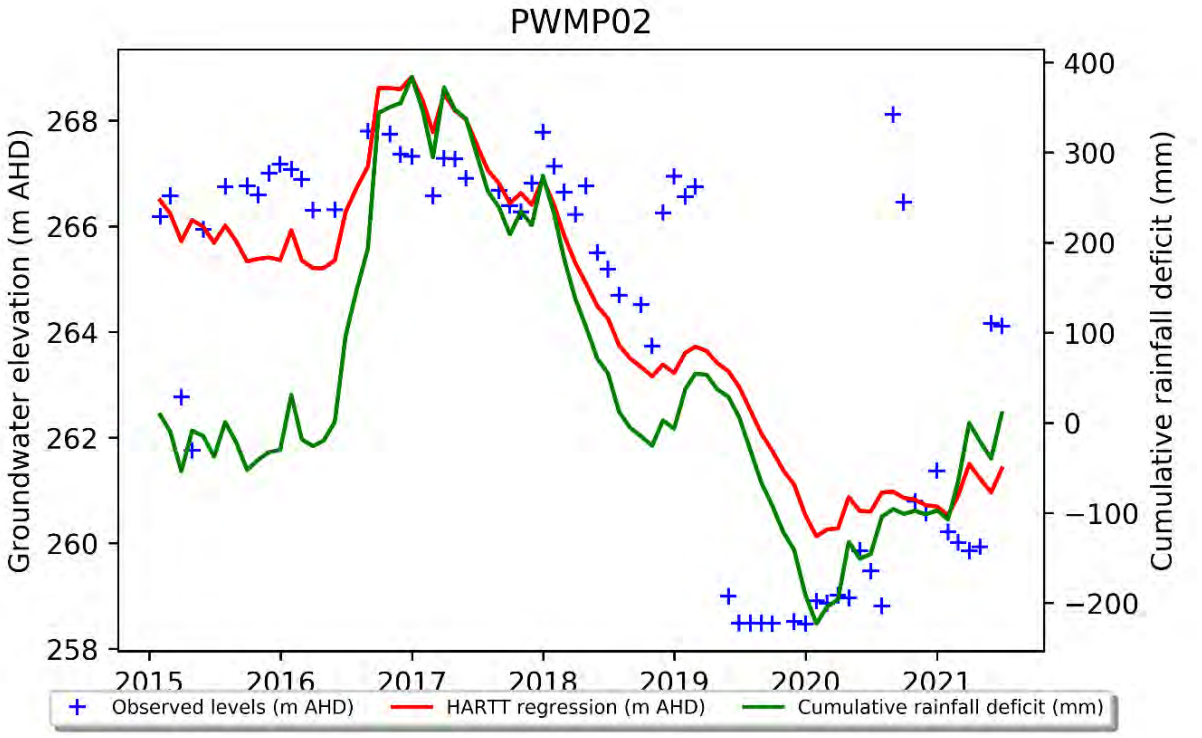

RSFMB09
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
263.0
262.8
262.6
262.4
262.2
262.0
261.8
150
100
50
0
−50
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

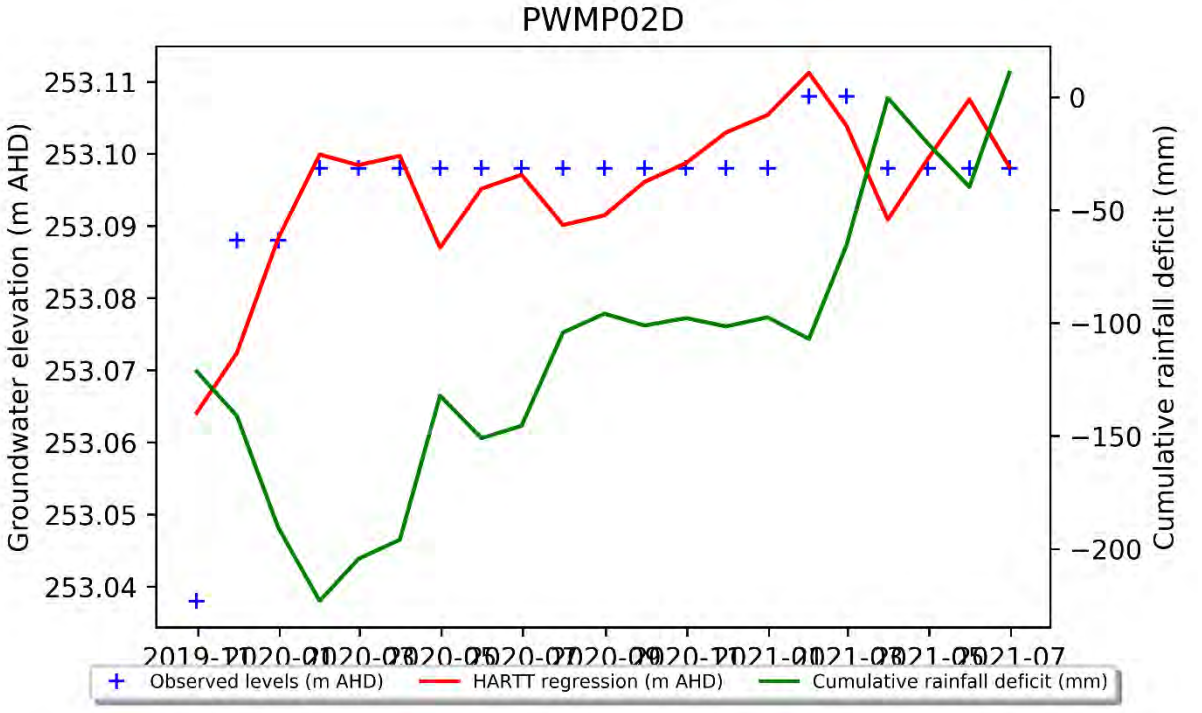

RSFMB10
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
267.0
266.5
266.0
265.5
265.0
264.5
264.0
263.5
263.0
40
20
0
−20
−40
−60
−80
2014-04
2014-07
2014-10
2015-01
2015-04
2015-07
2015-10
2016-01
2016-04
2016-07
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

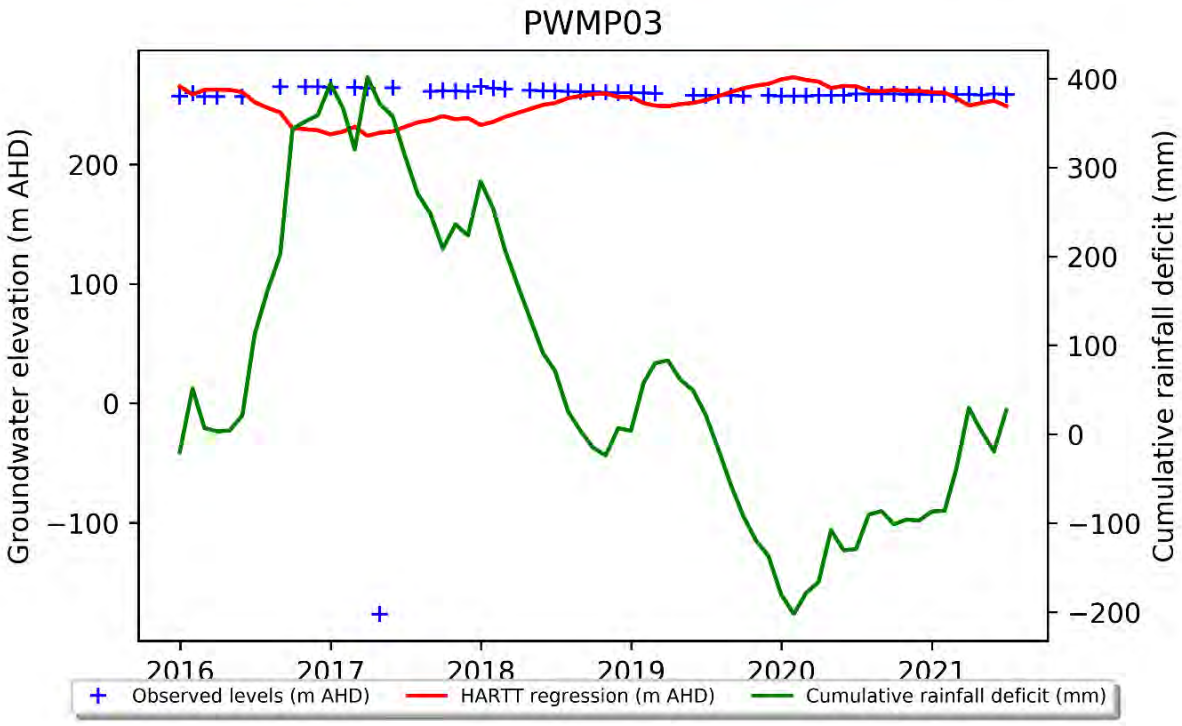

RSFMB11
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
268
266
264
262
260
258
400
300
200
100
0
−100
−200
2014
2015
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

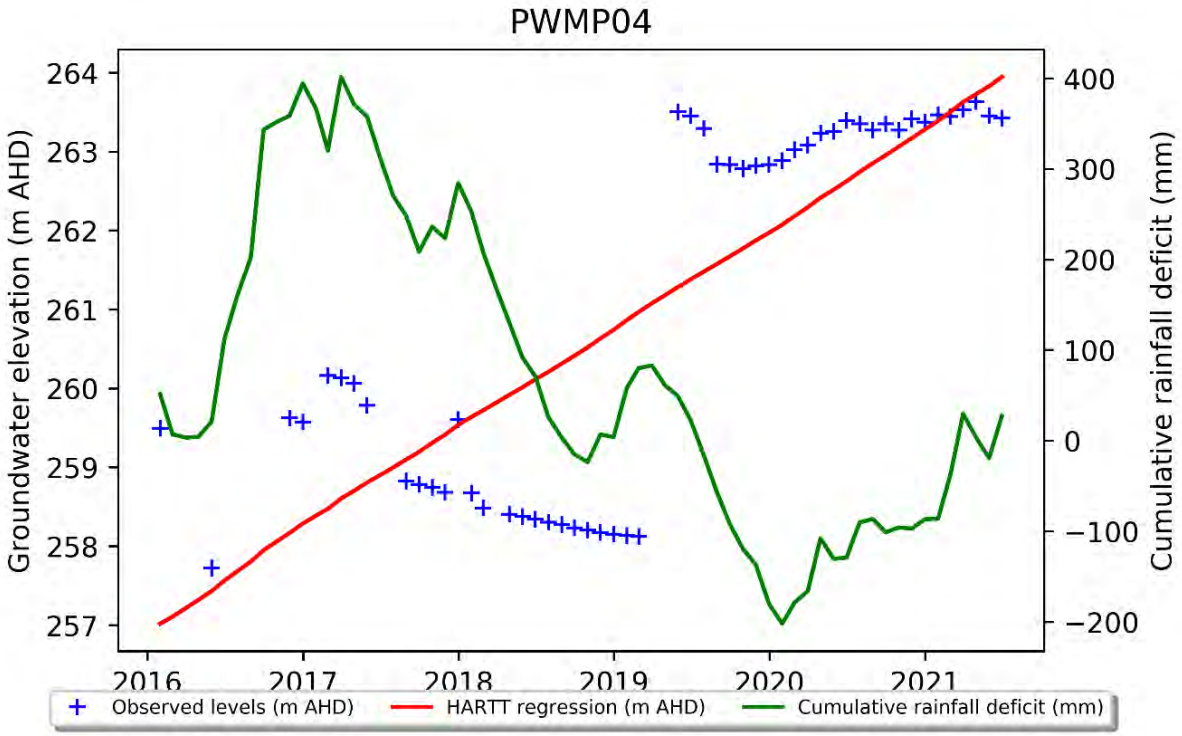

PWMP01
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
266
264
262
260
400
300
200
100
0
−100
−200
2015
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

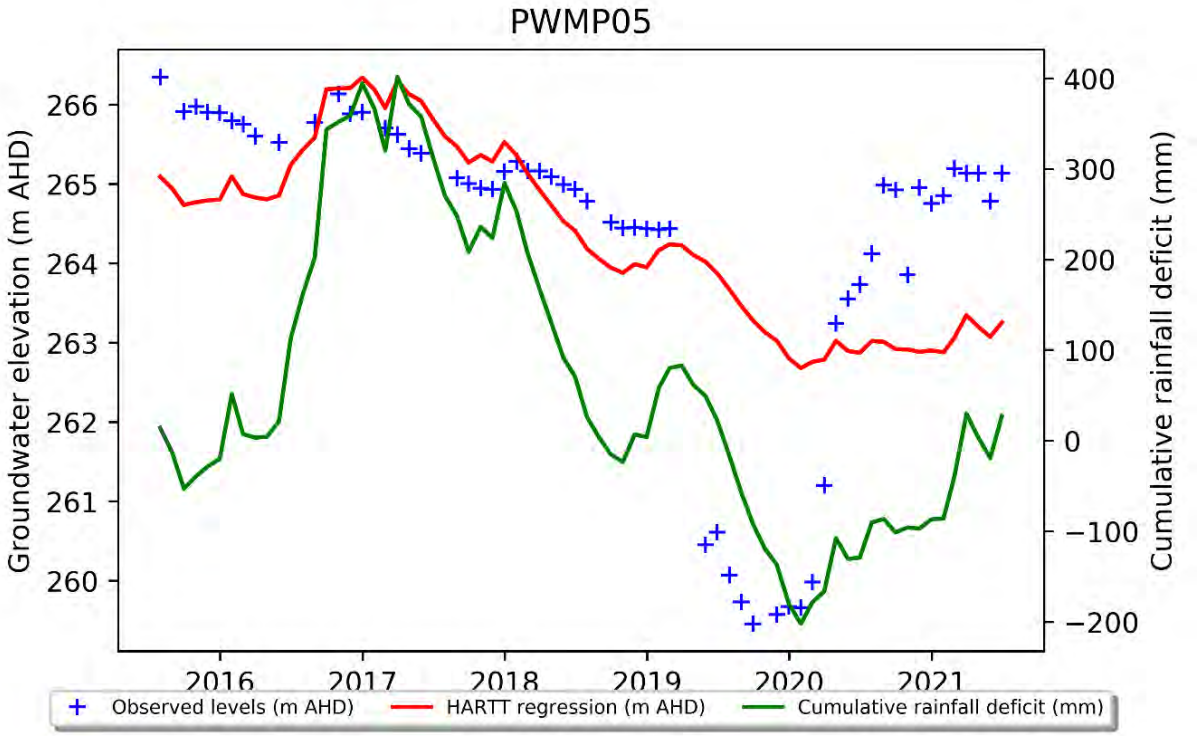

PWMP01A
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
259.5
259.0
258.5
258.0
257.5
257.0
256.5
256.0
0
−50
−100
−150
−200
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

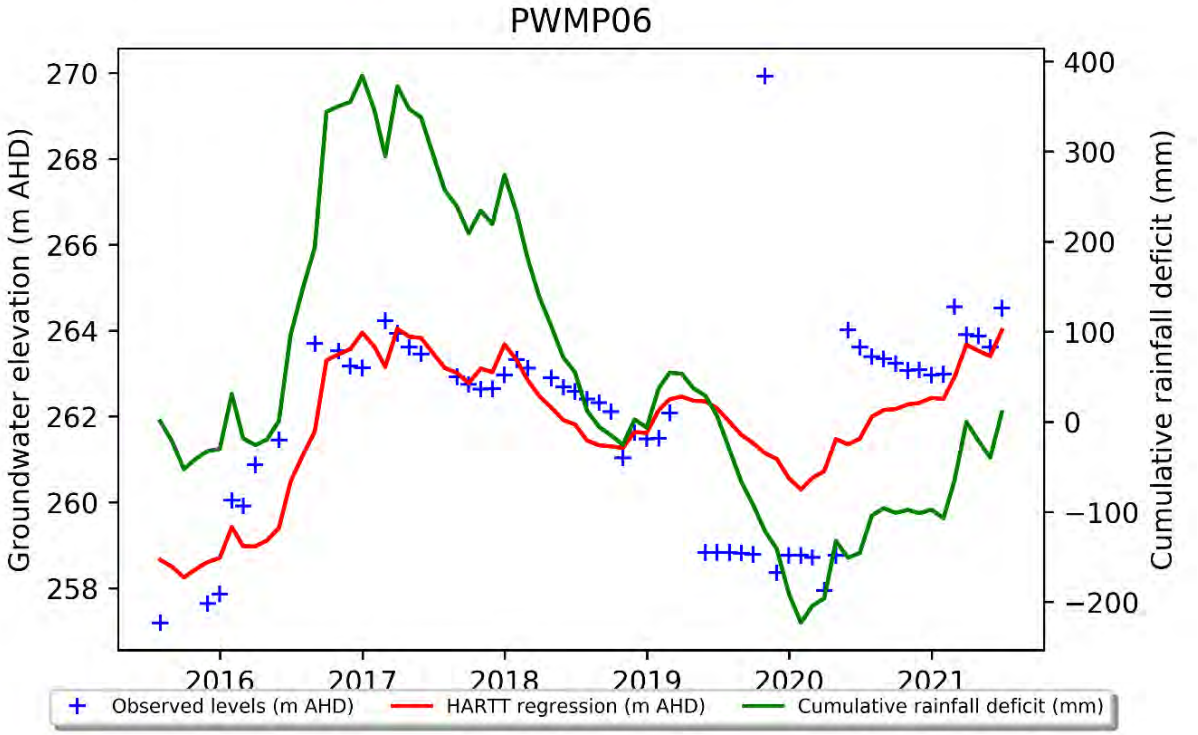

PWMP02
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
268
266
264
262
260
258
400
300
200
100
0
−100
−200
2015
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

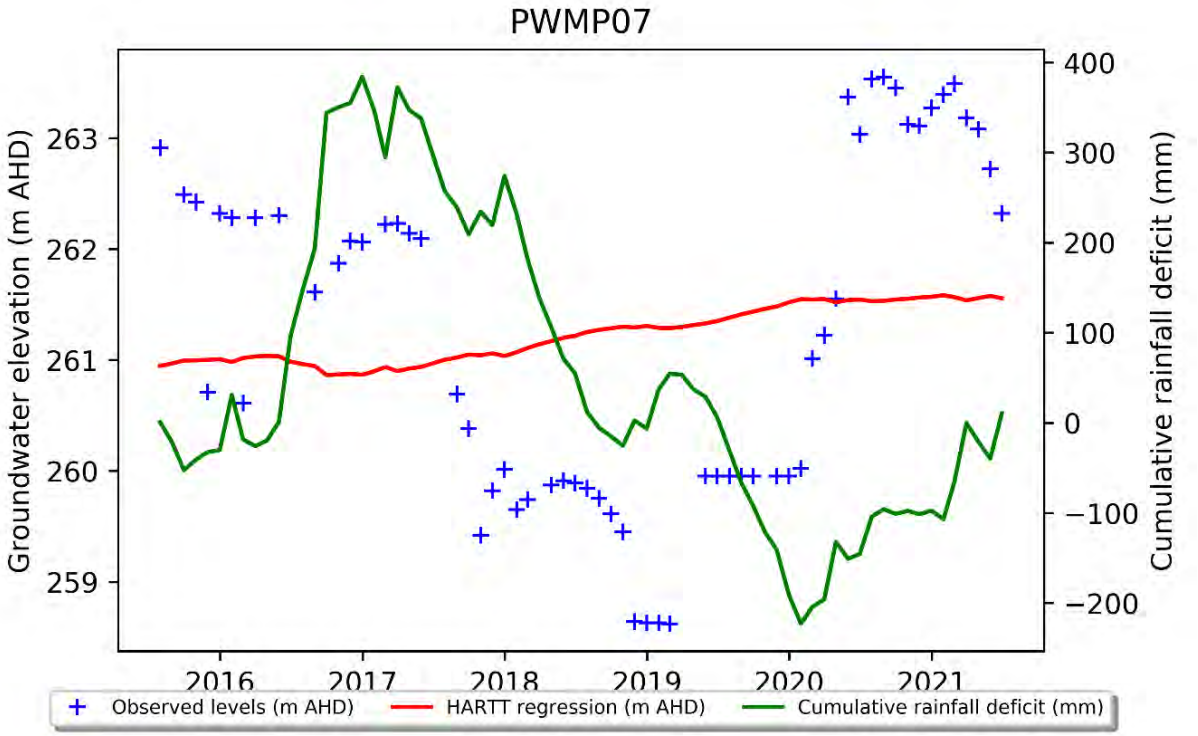

PWMP02D
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
253.11
253.10
253.09
253.08
253.07
253.06
253.05
253.04
0
−50
−100
−150
−200
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

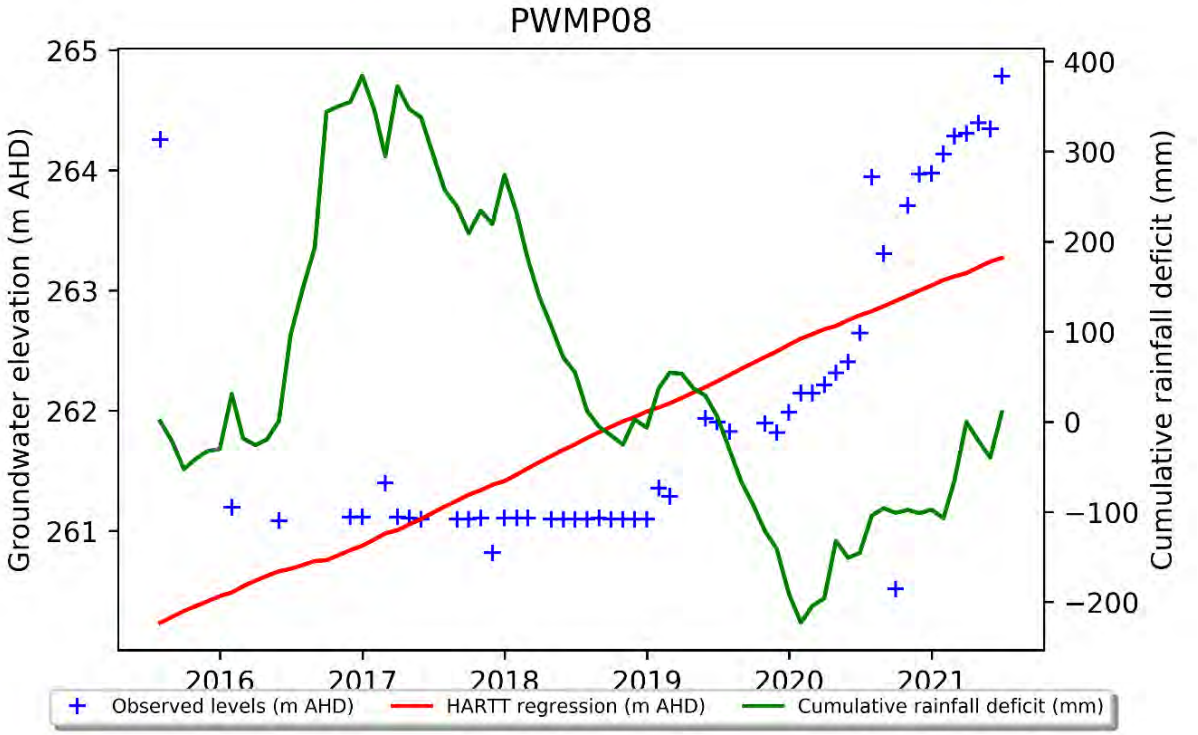

PWMP03
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
400
300
200
100
0
−100
−200
200
100
0
−100
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

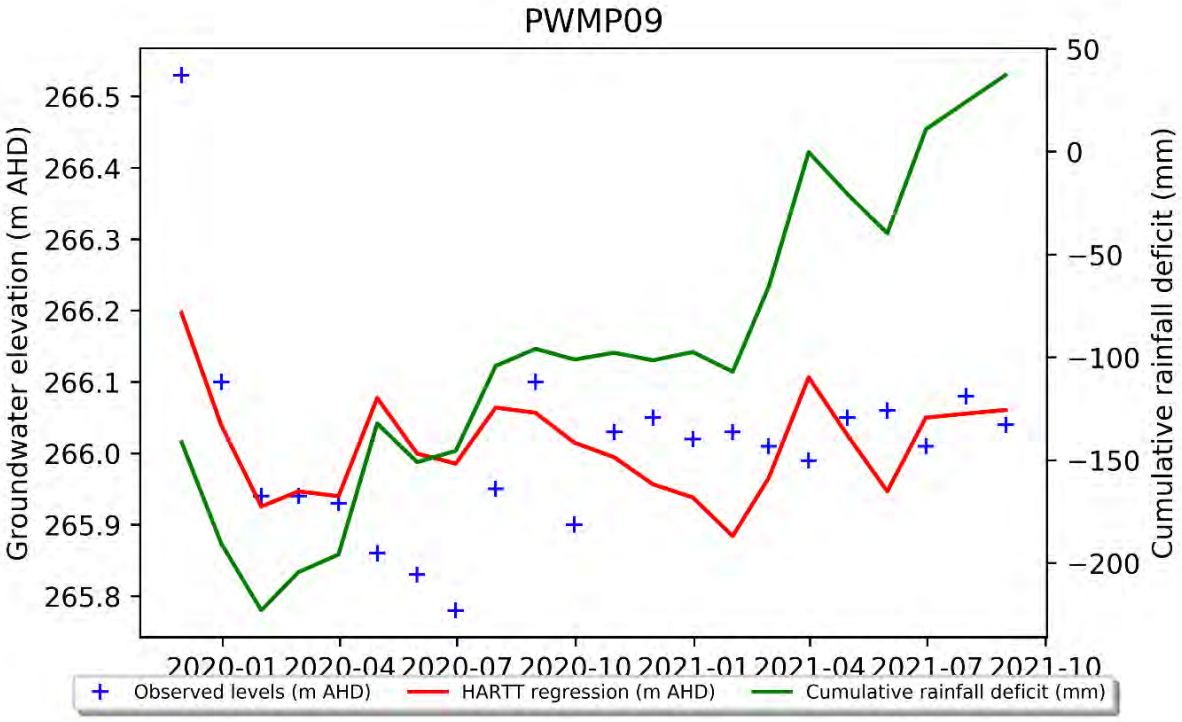

PWMP04
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
264
263
262
261
260
259
258
257
400
300
200
100
0
−100
−200
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)


PWMP05
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
266
265
264
263
262
261
260
400
300
200
100
0
−100
−200
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

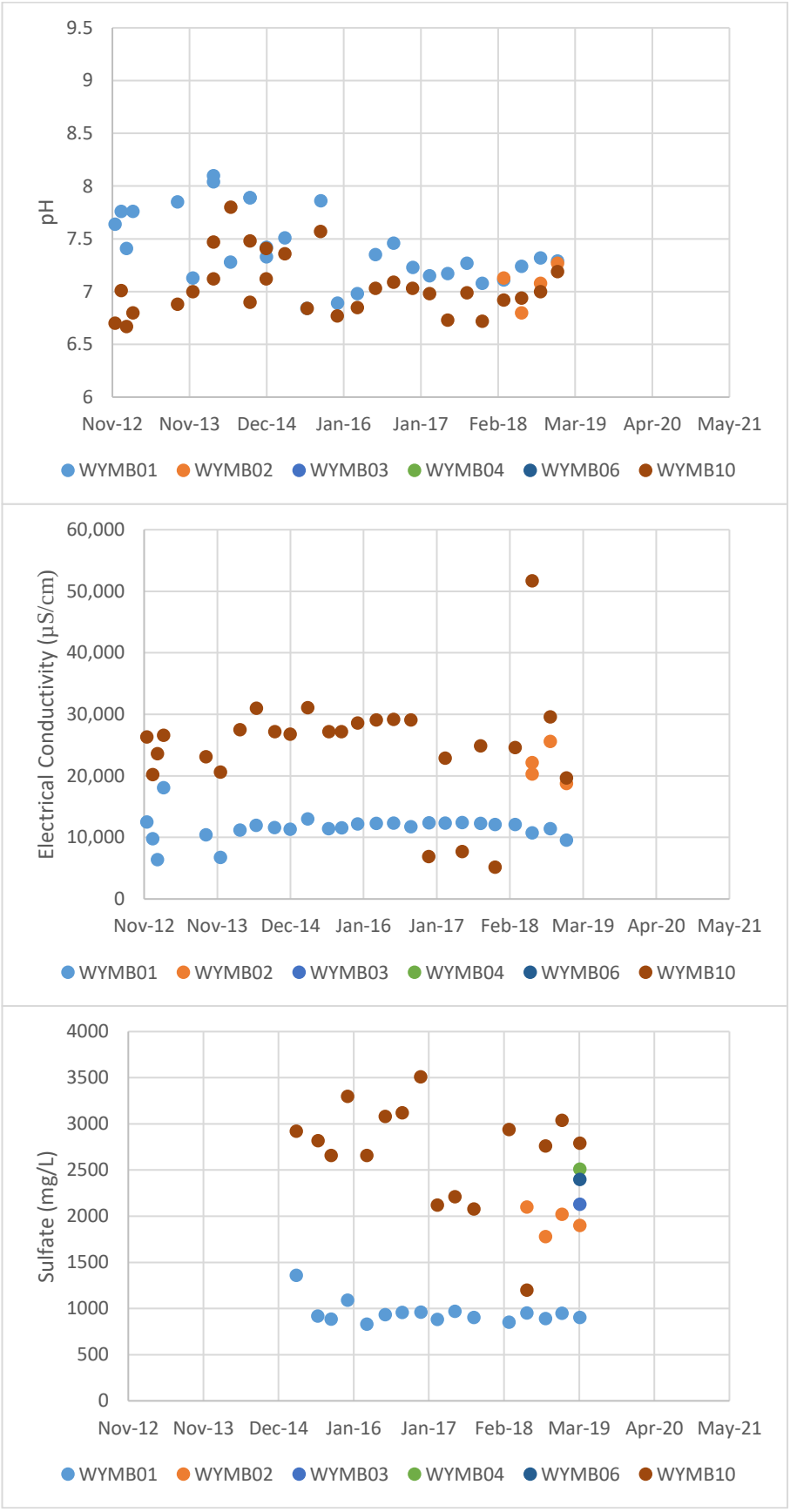

PWMP06
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
270
268
266
264
262
260
258
400
300
200
100
0
−100
−200
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

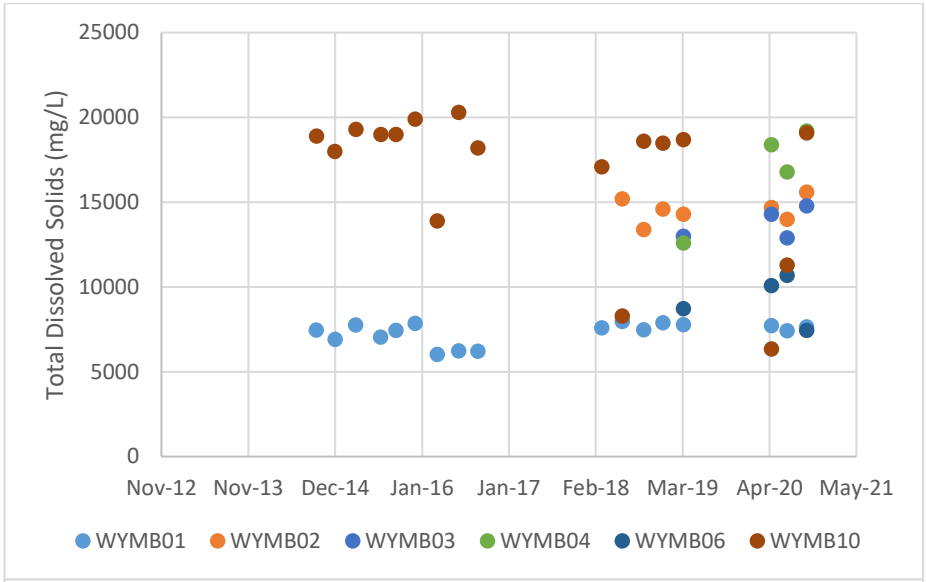

PWMP07
Groundwater elevation (m AHD)
263
262
261
260
259
Cumulative rainfall deficit (mm)
400
300
200
100
0
−100
−200
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

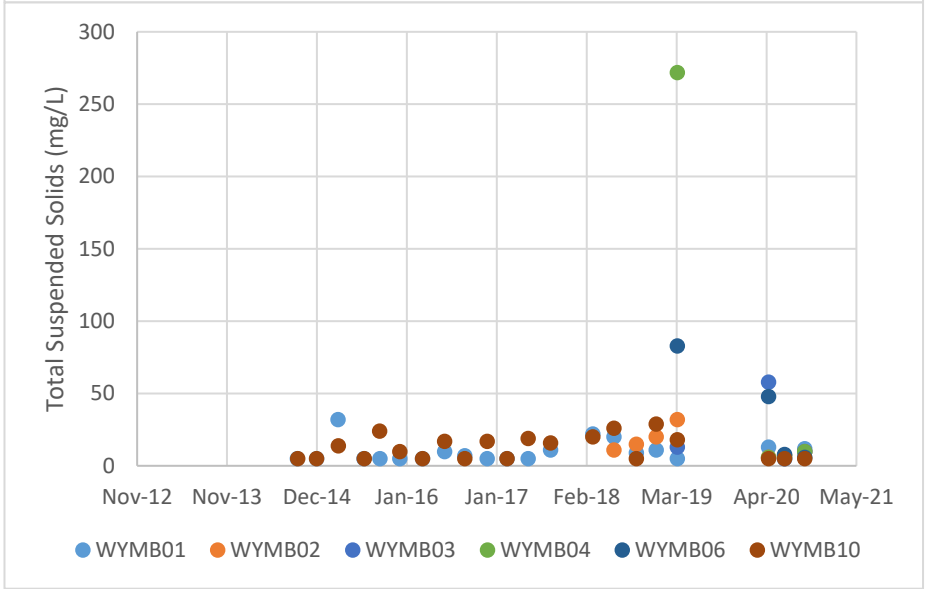

PWMP08
Groundwater elevation (m AHD)
265
264
263
262
261
Cumulative rainfall deficit (mm)
400
300
200
100
0
−100
−200
2016
2017
2018
2019
2020
2021
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

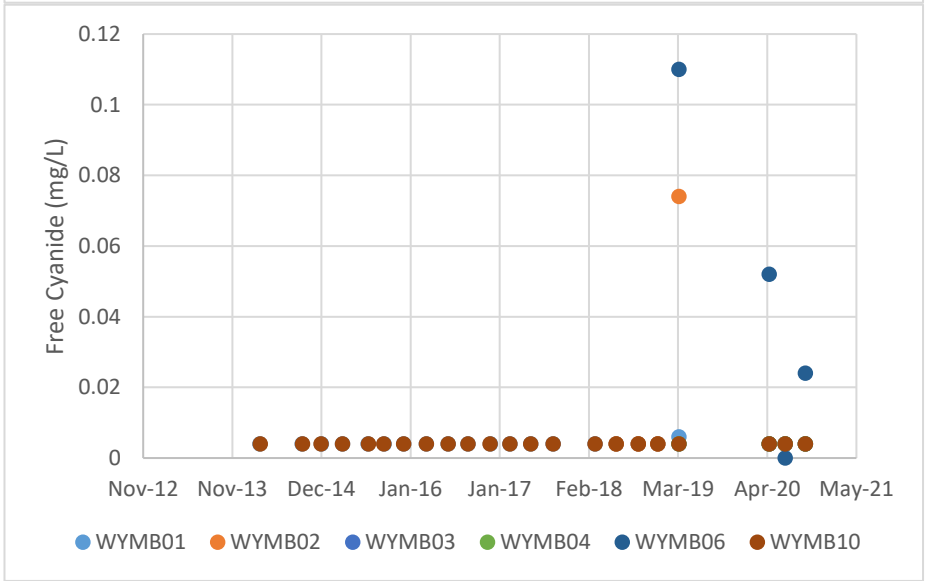

PWMP09
Groundwater elevation (m AHD)
Cumulative rainfall deficit (mm)
266.5
266.4
266.3
266.2
266.1
266.0
265.9
265.8
50
0
−50
−100
−150
−200
2020-01
2020-04
2020-07
2020-10
2021-01
2021-04
2021-07
2021-10
Observed levels (m AHD)
HARTT regression (m AHD)
Cumulative rainfall deficit (mm)

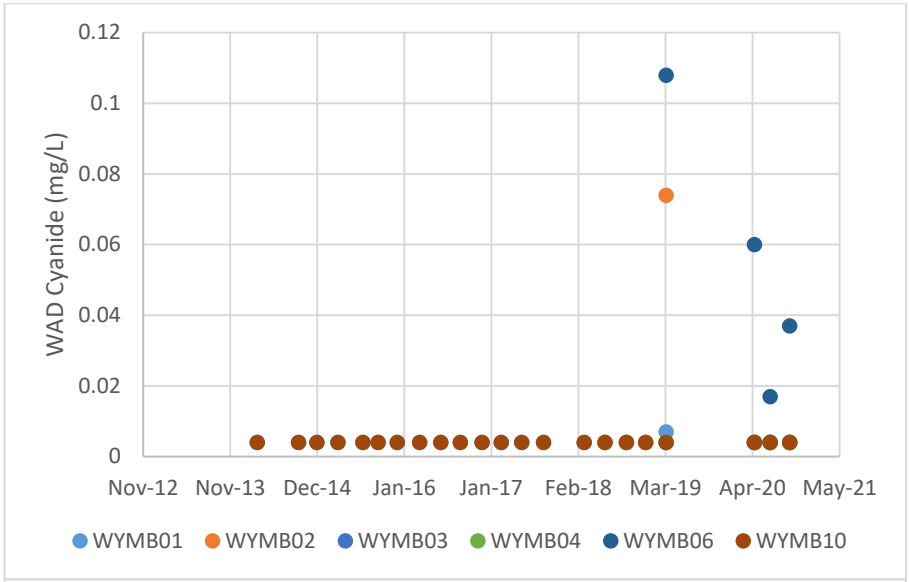
Fractured rock bores

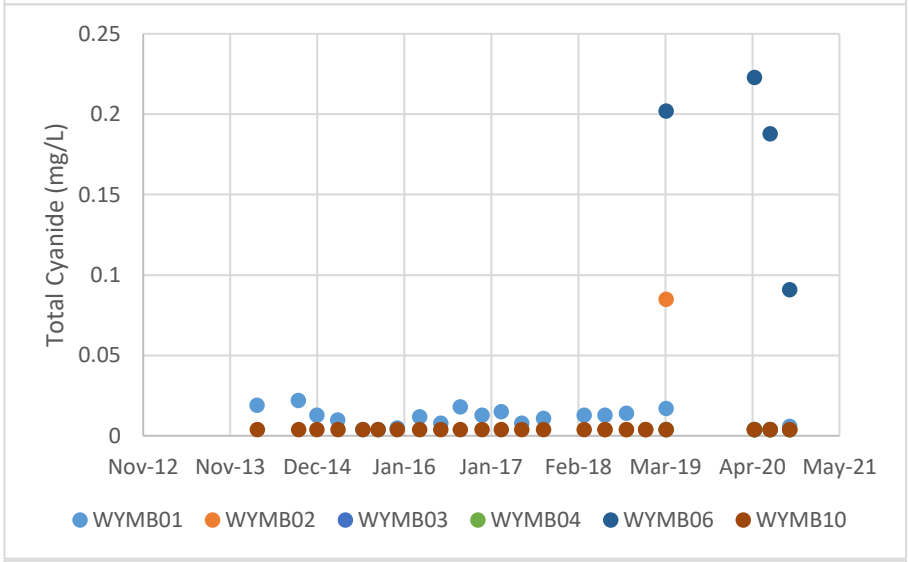


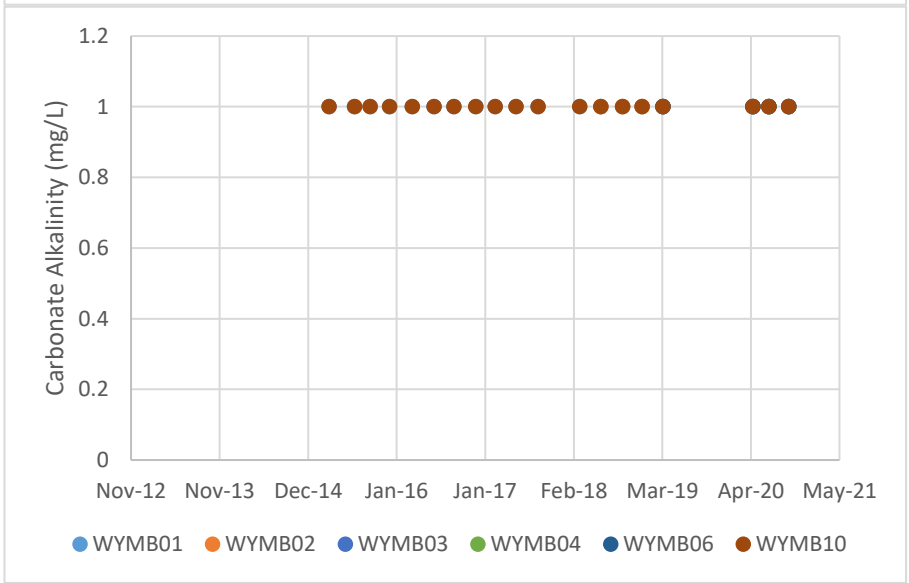

25000
20000
15000
10000
5000
0
Total Dissolved Solids (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

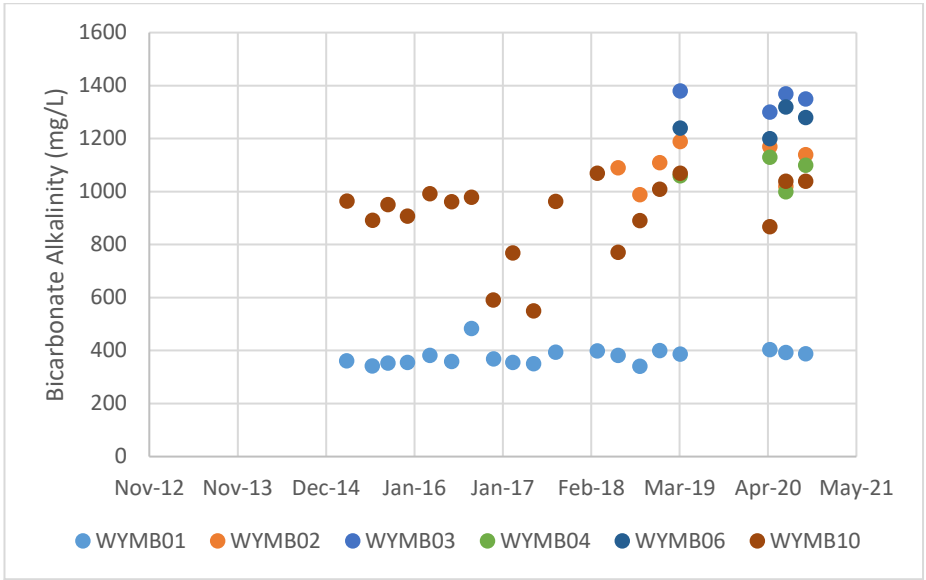

300
250
200
150
100
50
0
Total Suspended Solids (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

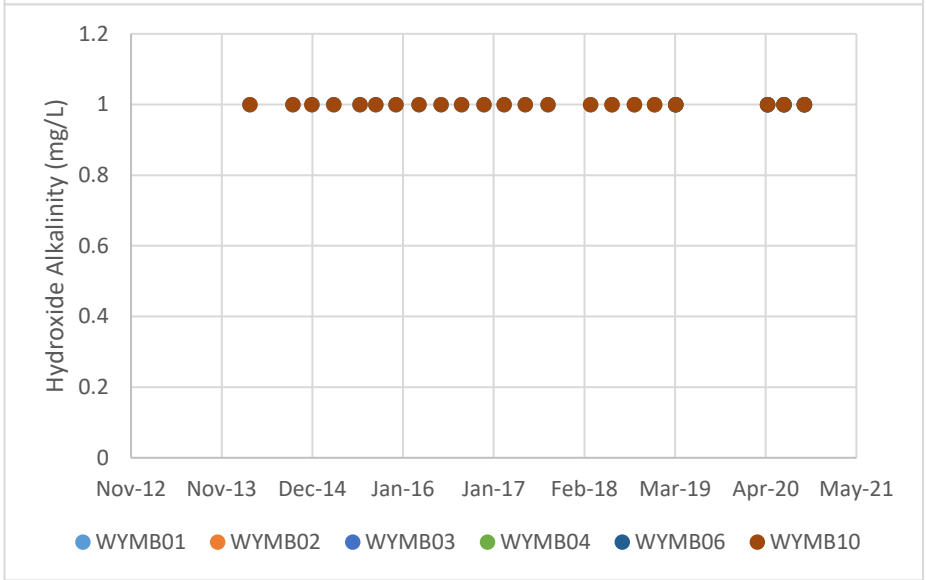

0.12
0.1
0.08
0.06
0.04
0.02
0
Free Cyanide (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

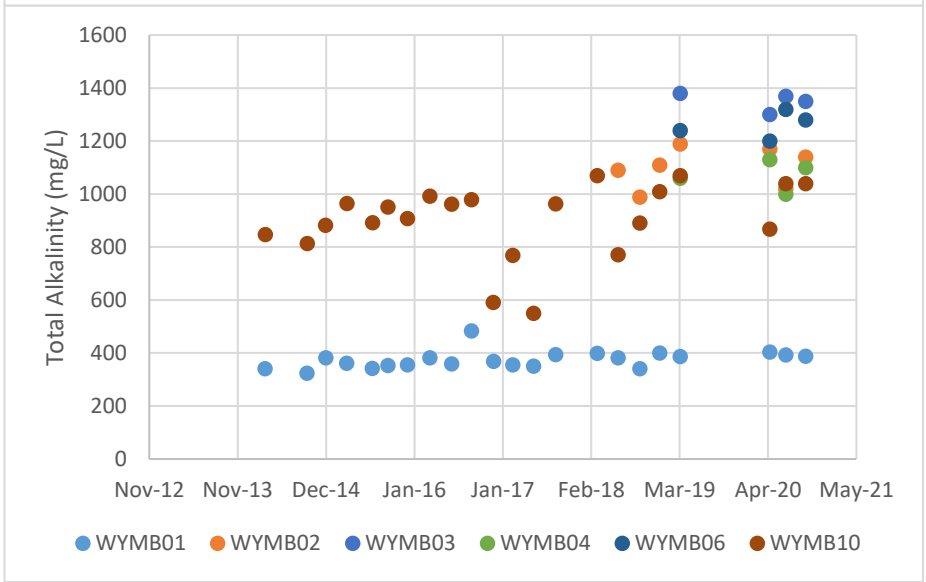

0.12
0.1
0.08
0.06
0.04
0.02
0
WAD Cyanide (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

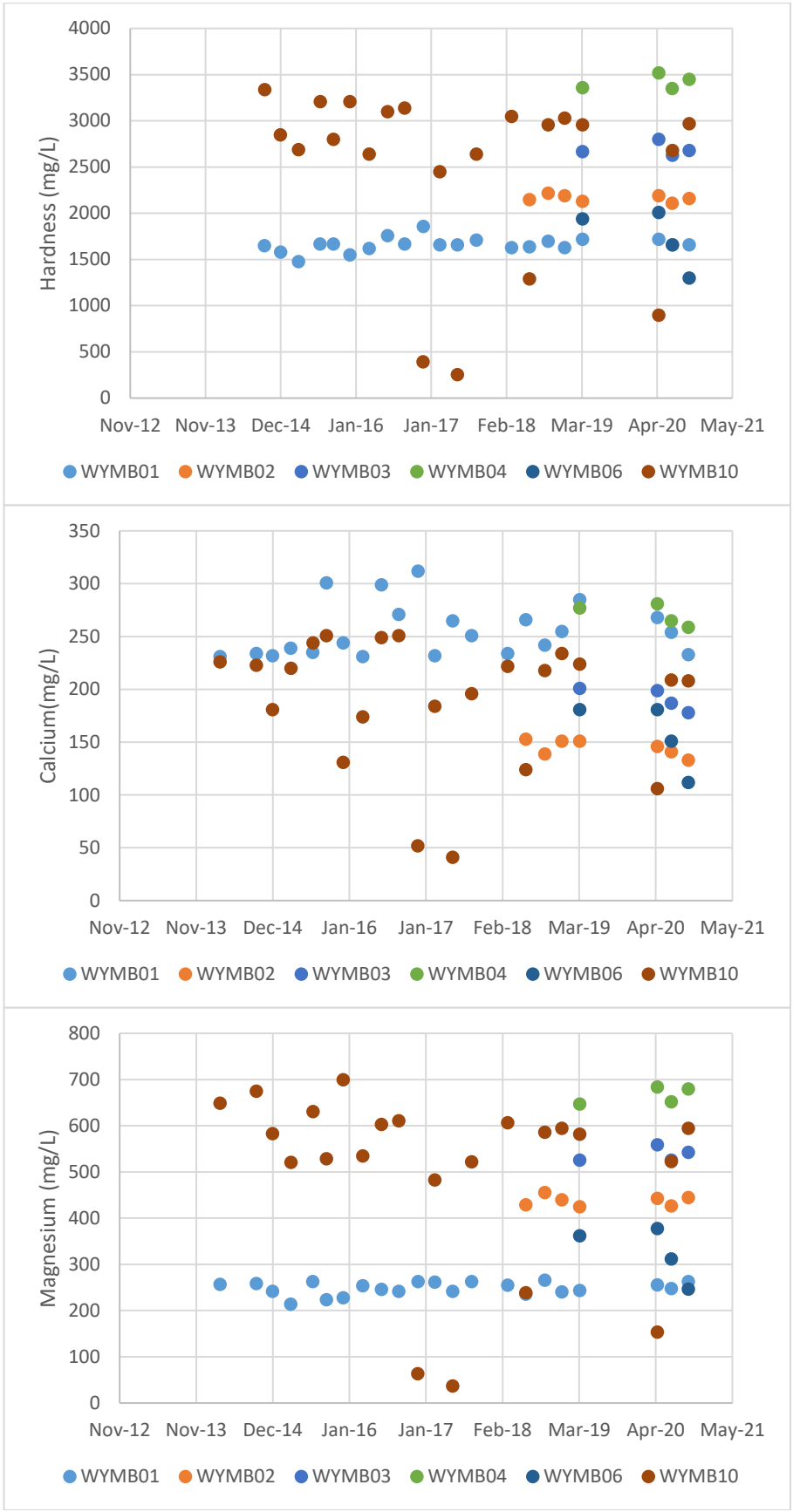

0.25
0.2
0.15
0.1
0.05
0
Total Cyanide (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

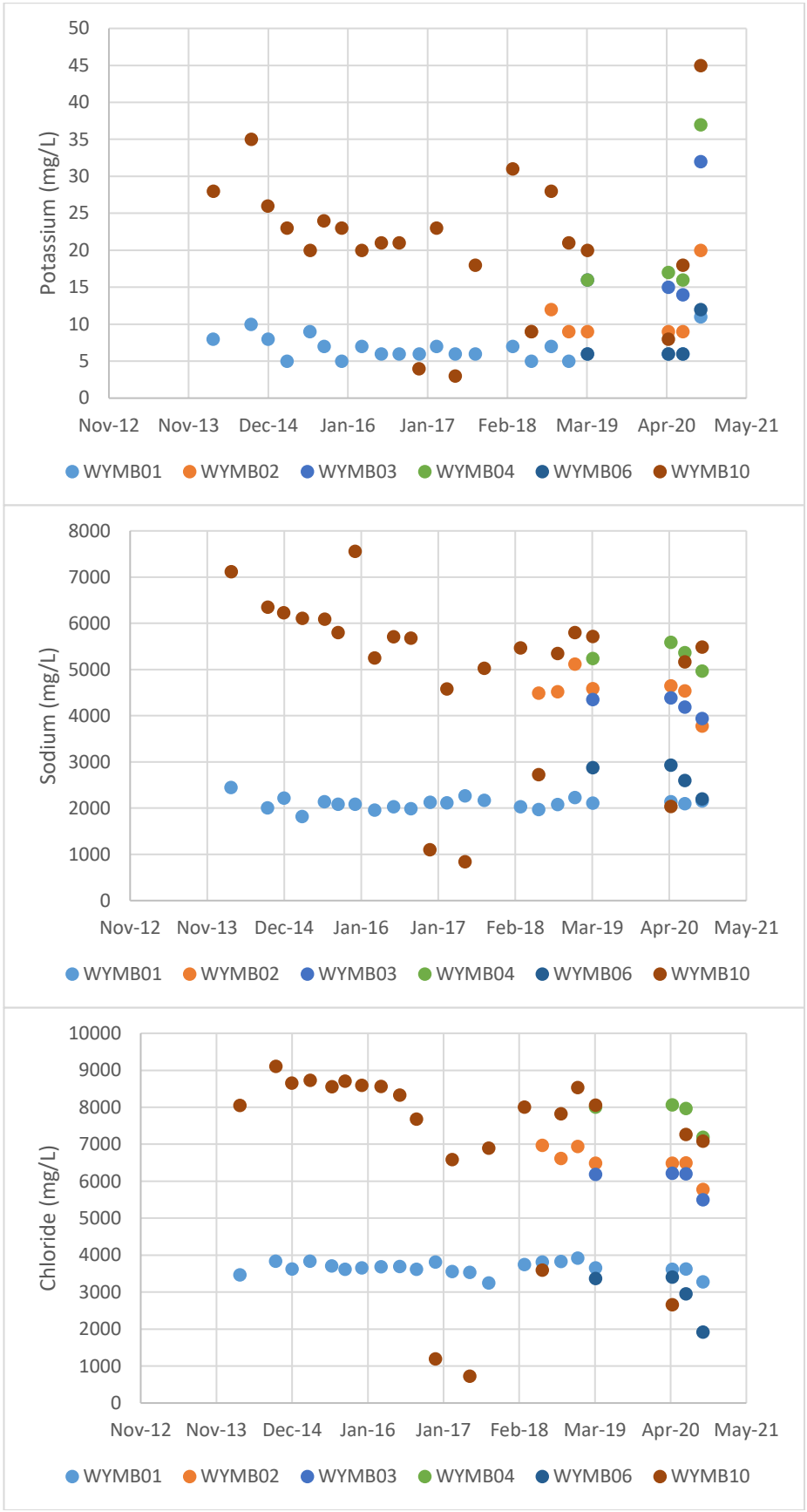

1.2
1
0.8
0.6
0.4
0.2
0
Carbonate Alkalinity (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

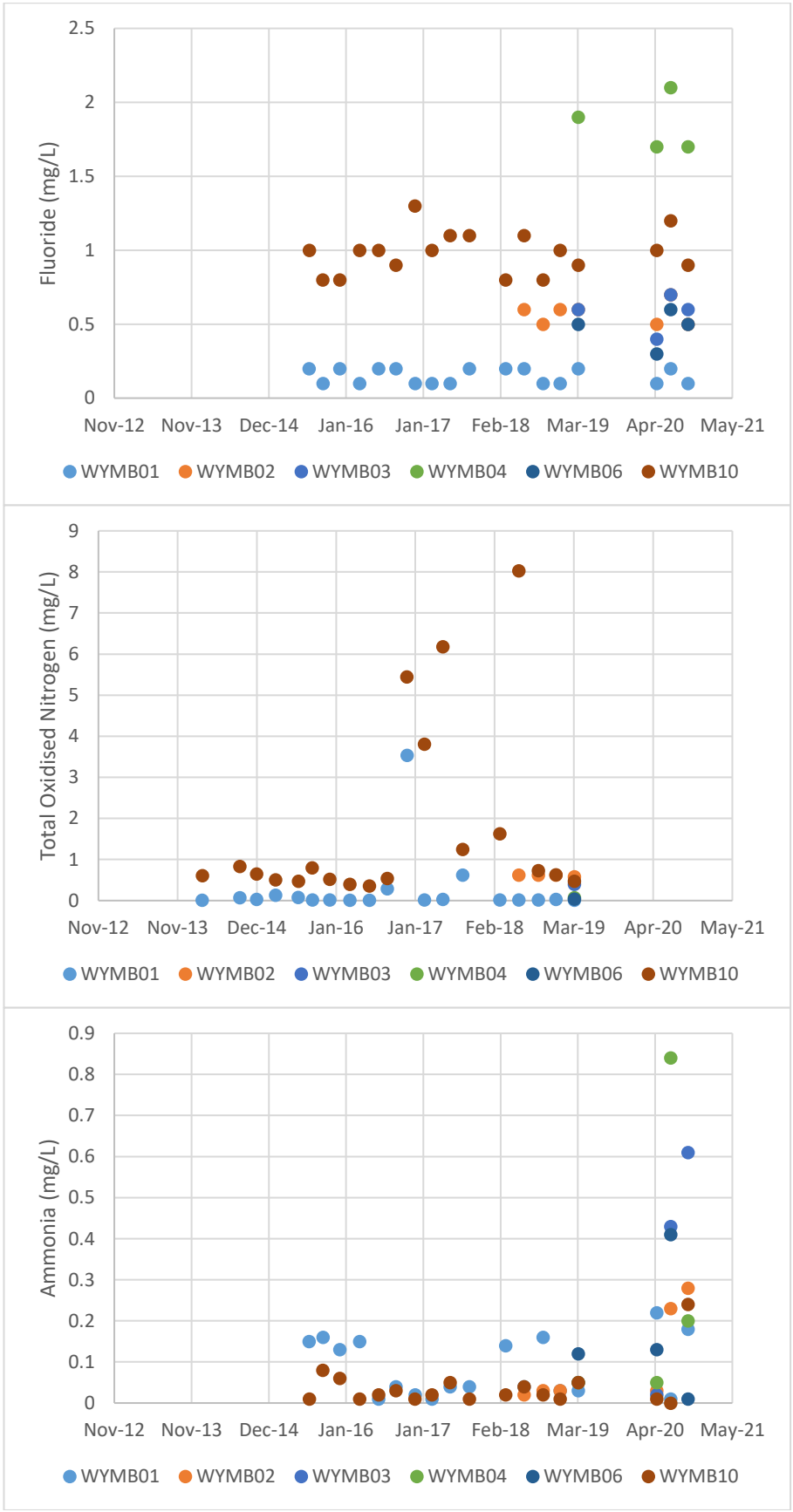

Bicarbonate Alkalinity (mg/L)
1600
1400
1200
1000
800
600
400
200
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

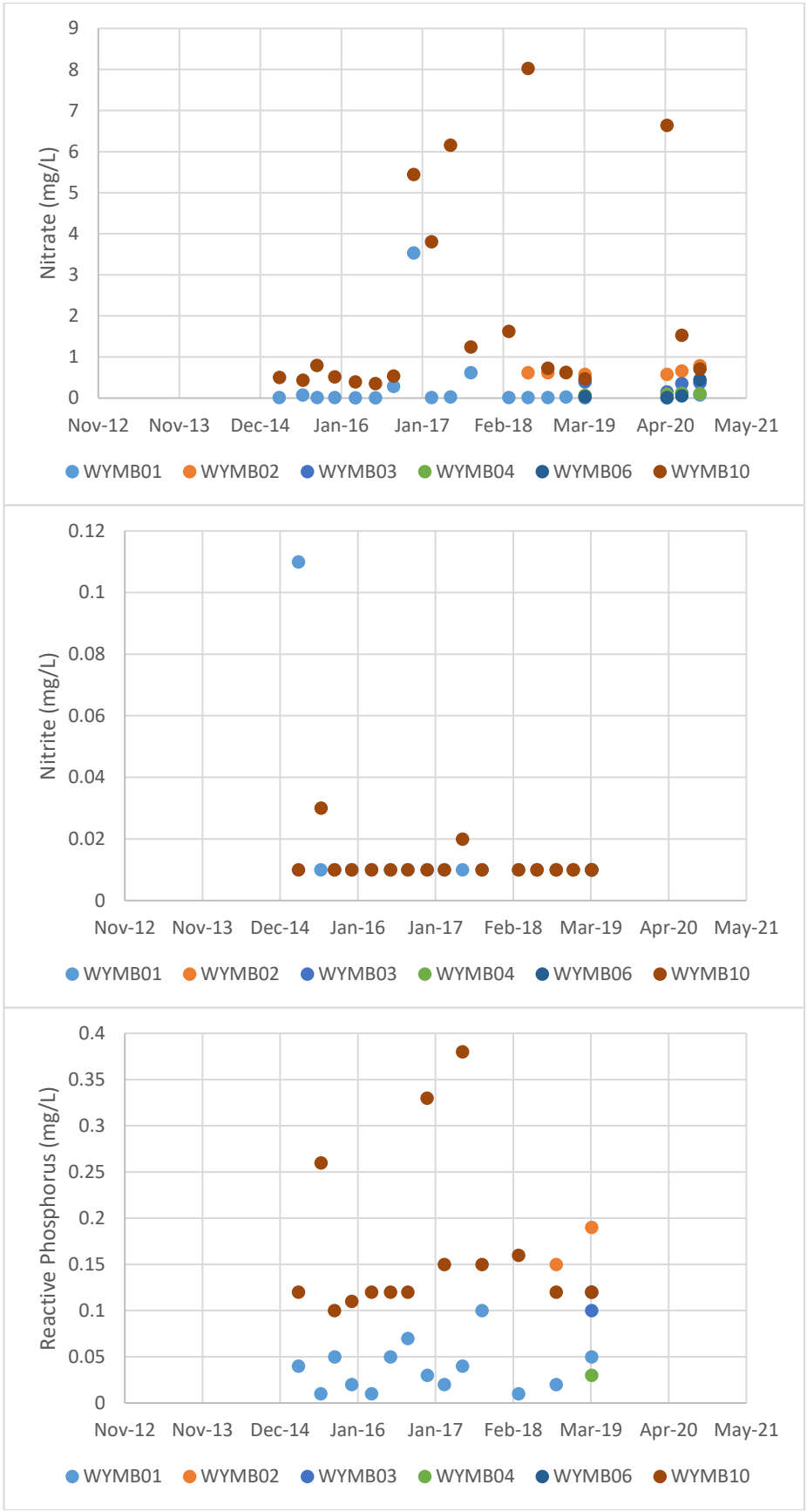

Hydroxide Alkalinity (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

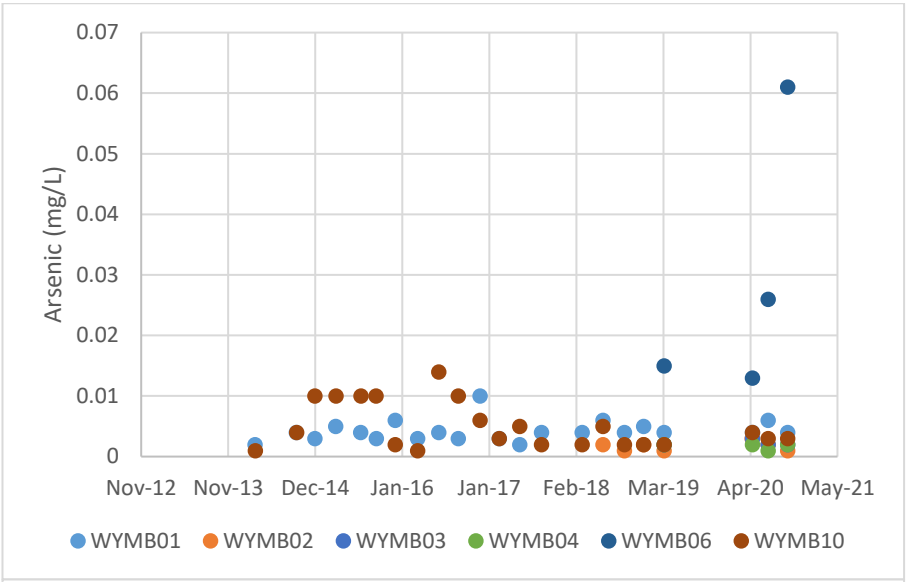

Total Alkalinity (mg/L)
1600
1400
1200
1000
800
600
400
200
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

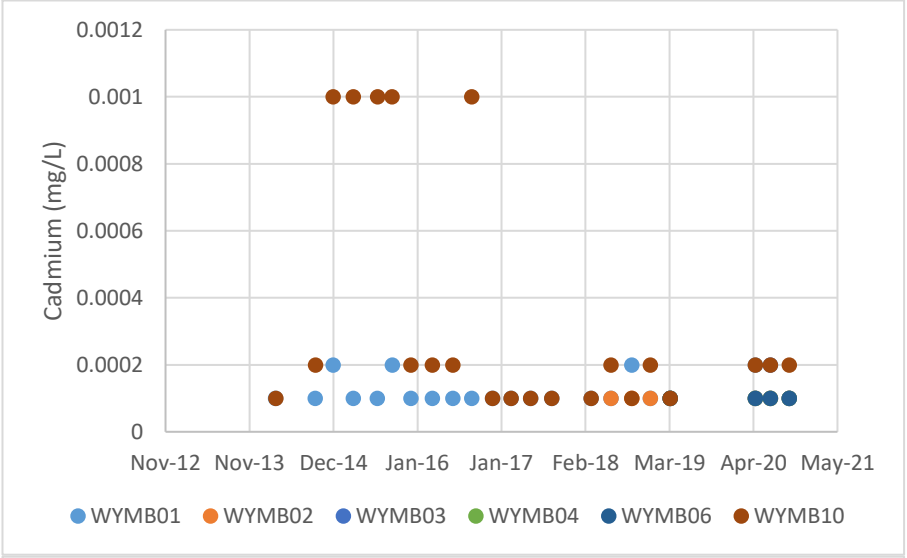

Hardness (mg/L)
4000
3500
3000
2500
2000
1500
1000
500
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Calcium(mg/L)
350
300
250
200
150
100
50
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Magnesium (mg/L)
800
700
600
500
400
300
200
100
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

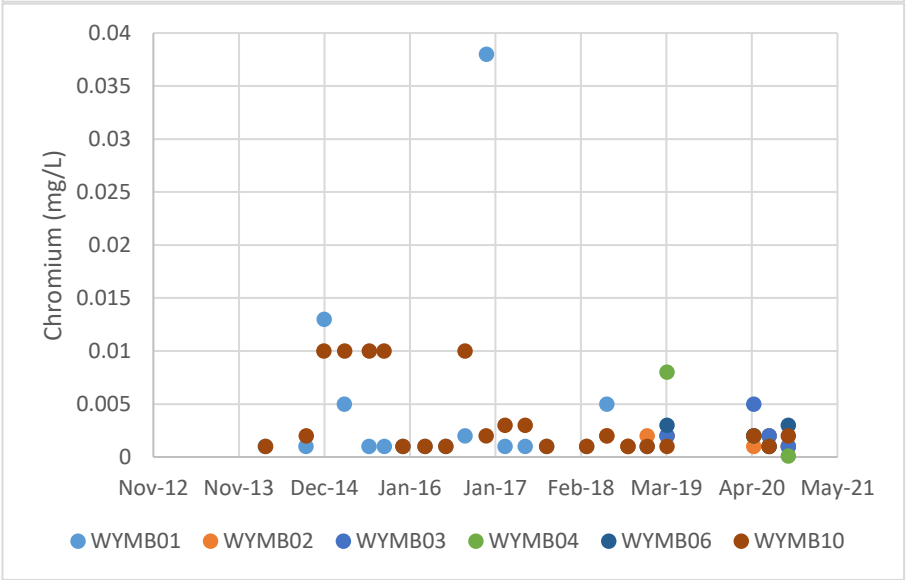

Potassium (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Sodium (mg/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Chloride (mg/L)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

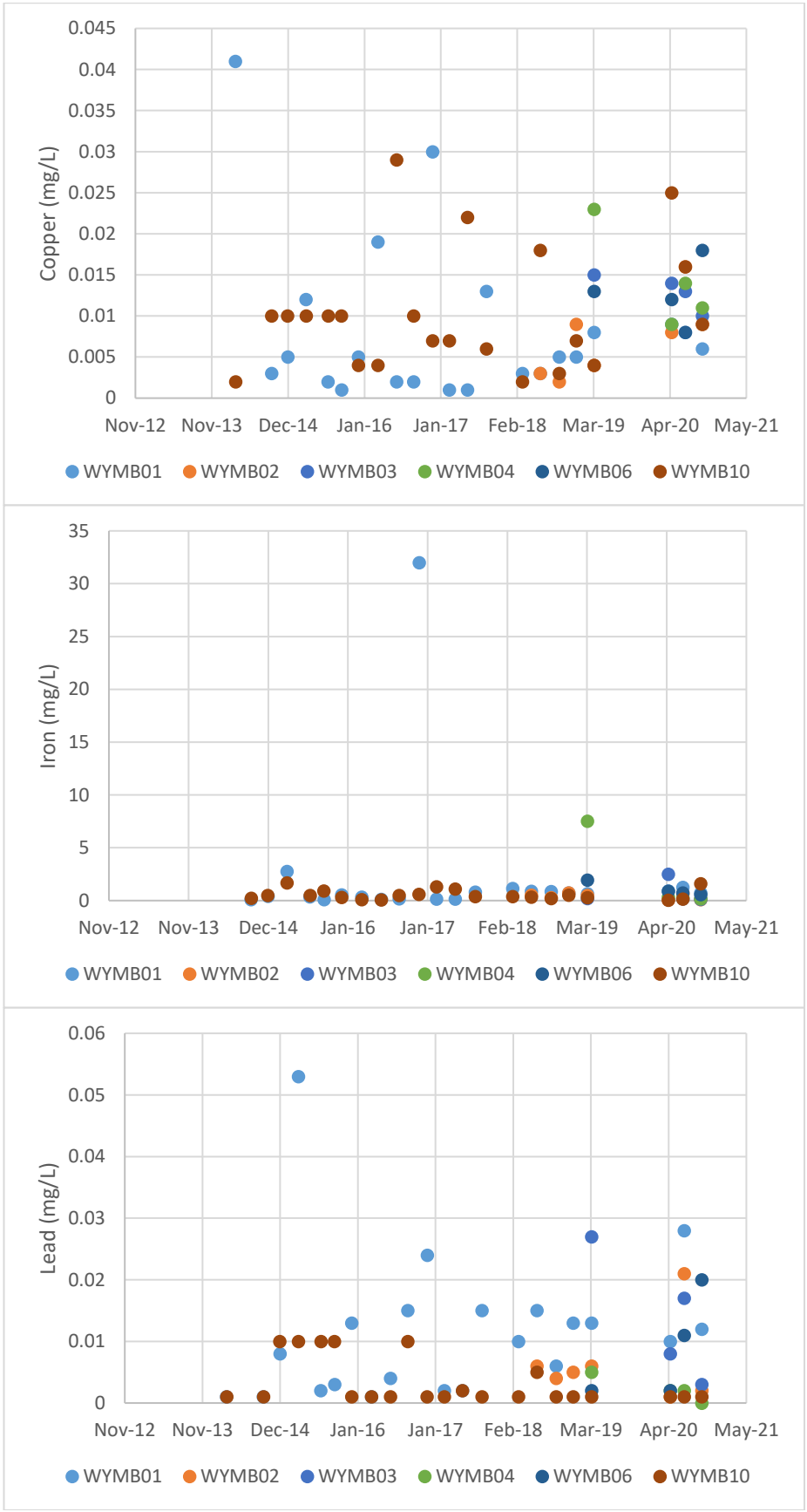

Fluoride (mg/L)
2.5
2
1.5
1
0.5
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Total Oxidised Nitrogen (mg/L)
9
8
7
6
5
4
3
2
1
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10
Ammonia (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

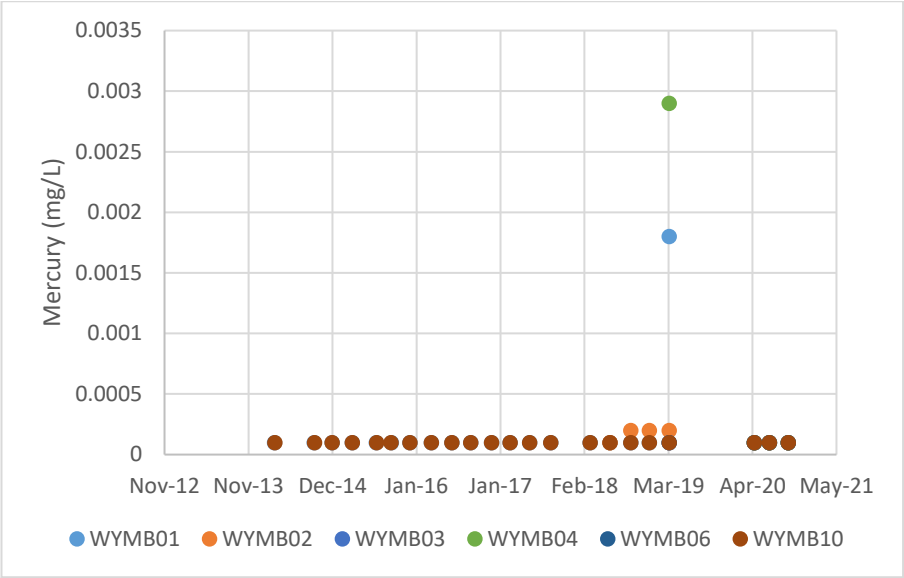

Nitrate (mg/L)
9
8
7
6
5
4
3
2
1
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10
Nitrite (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10
Reactive Phosphorus (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

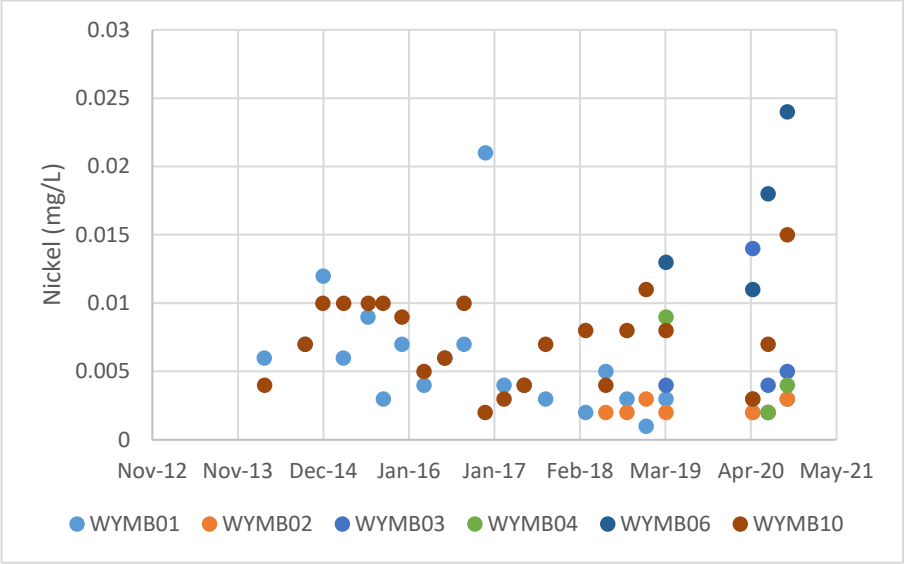

0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Arsenic (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

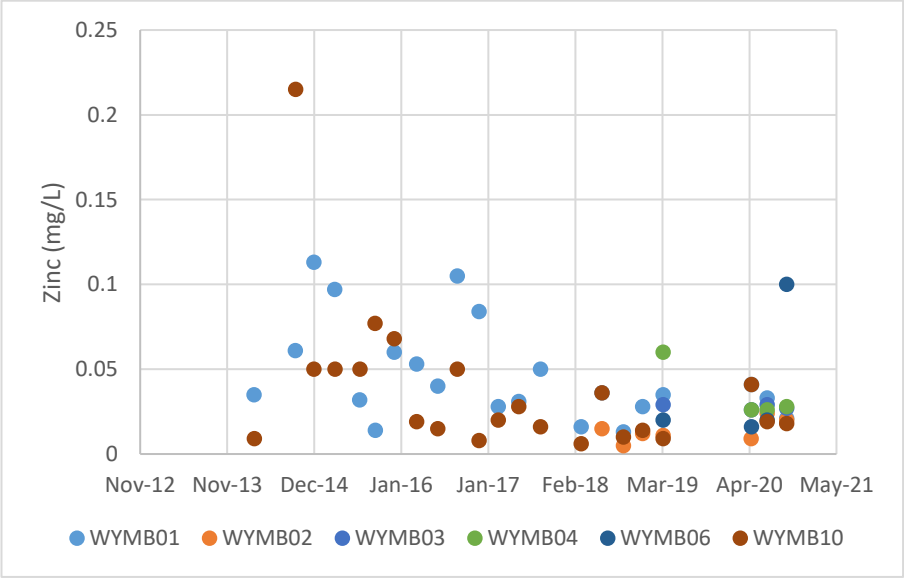

0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Cadmium (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10


0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Chromium (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

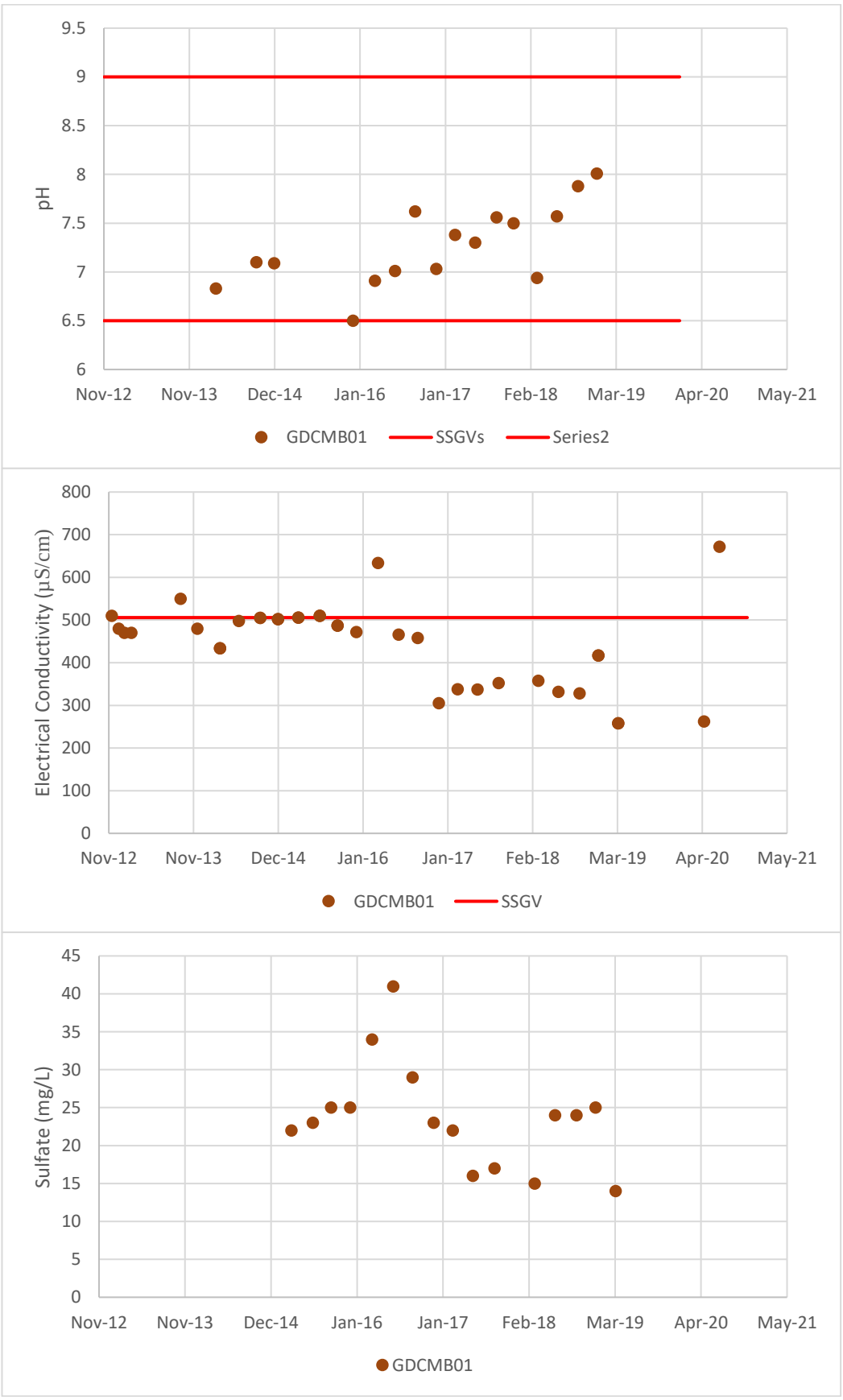

0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Copper (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10
35
30
25
20
15
10
5
0
Iron (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10
0.06
0.05
0.04
0.03
0.02
0.01
0
Lead (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
WYMB01
WYMB02
WYMB03
WYMB04
WYMB06
WYMB10

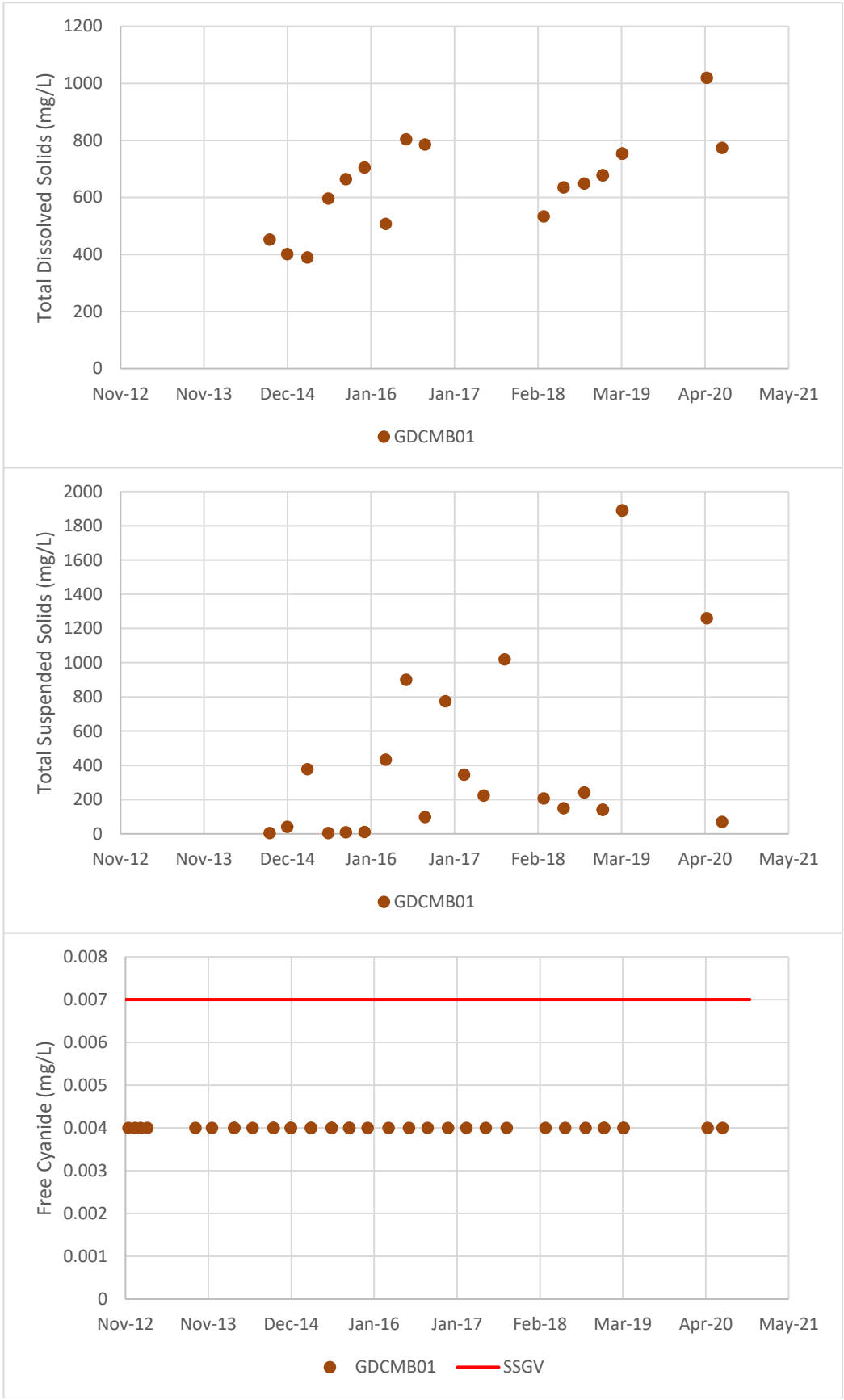

0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
Mercury (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

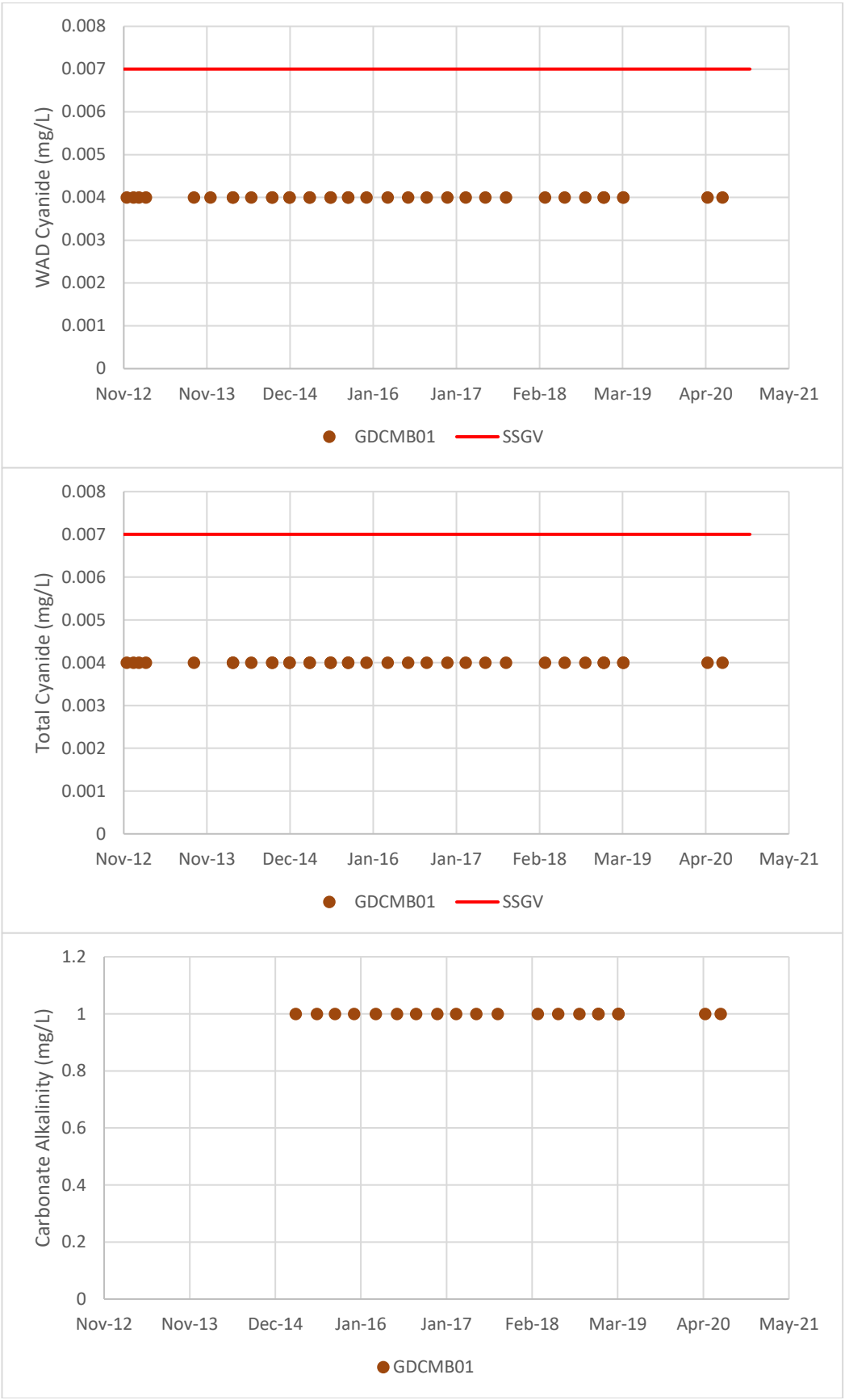

0.03
0.025
0.02
0.015
0.01
0.005
0
Nickel (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

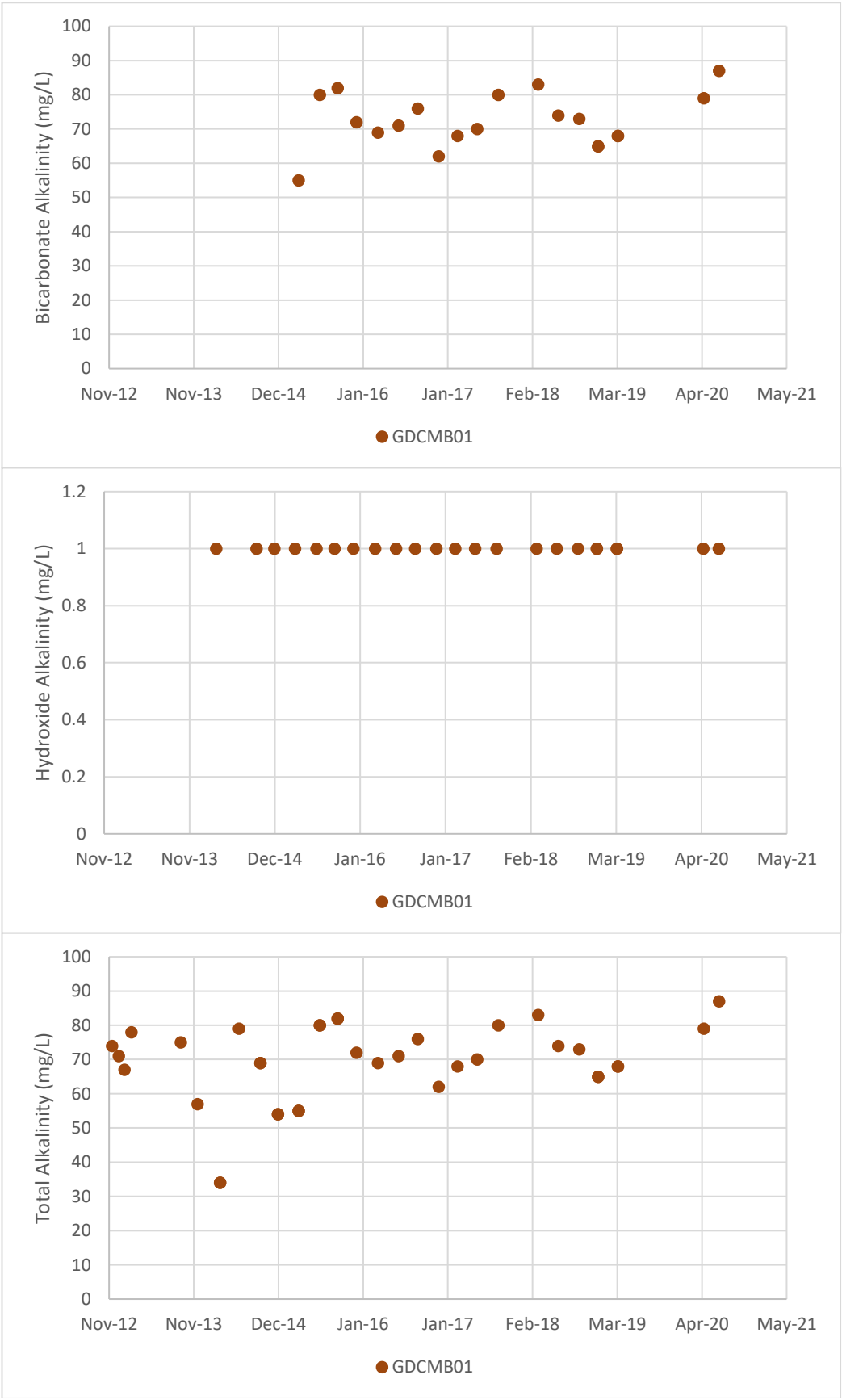

0.25
0.2
0.15
0.1
0.05
0
Zinc (mg/L)
Nov-12 Nov-13 Dec-14 Jan-16 Jan-17 Feb-18 Mar-19 Apr-20 May-21
WYMB01 WYMB02 WYMB03 WYMB04 WYMB06 WYMB10

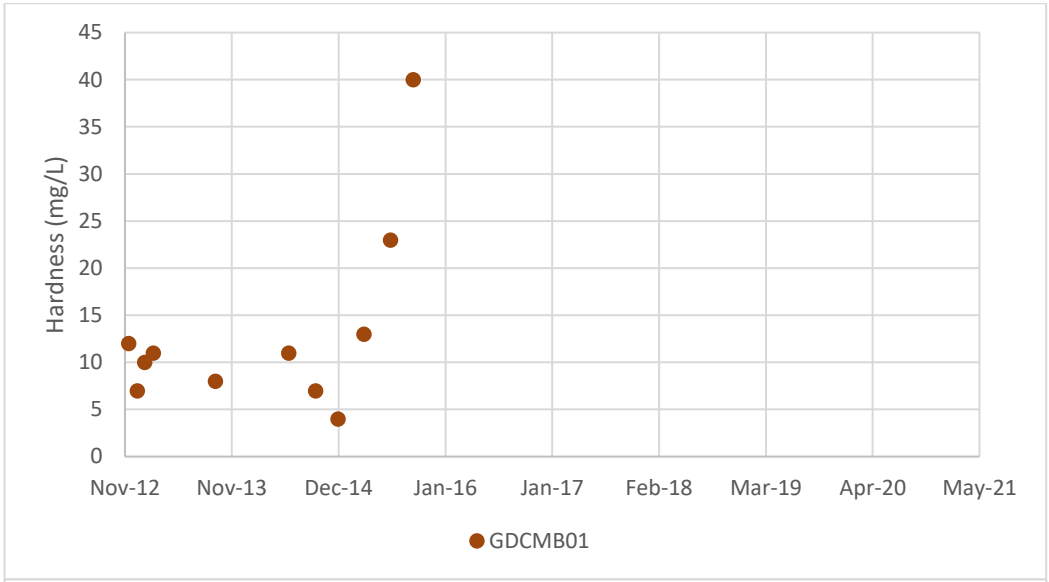
Shallow bores

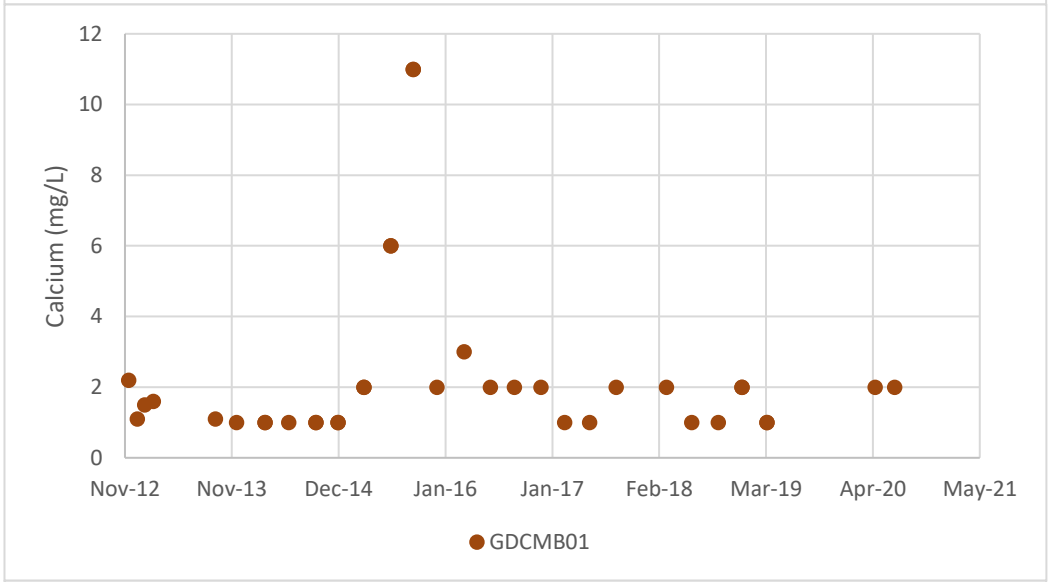


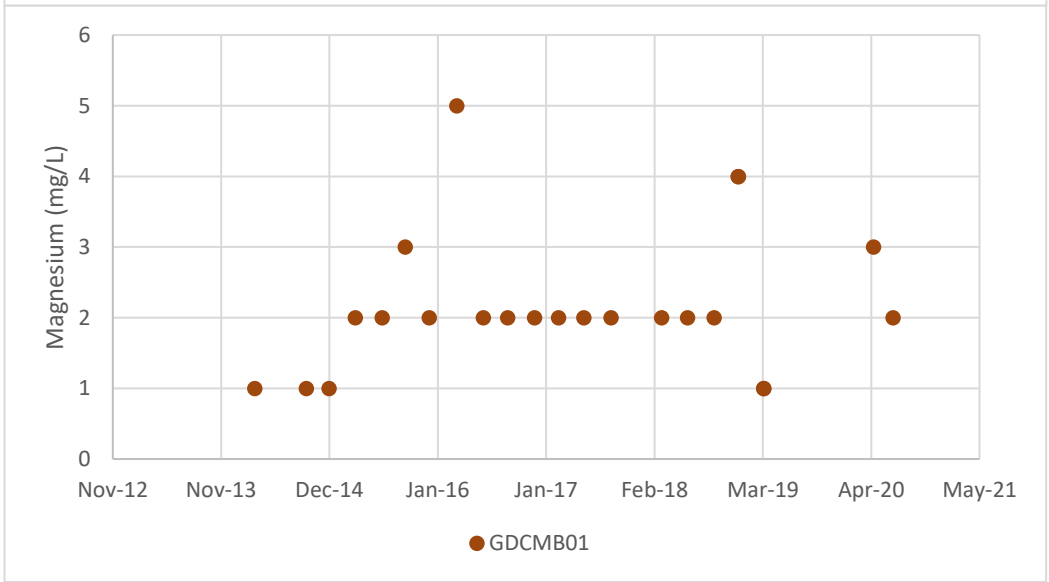

Total Dissolved Solids (mg/L)
1200
1000
800
600
400
200
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Total Suspended Solids (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Free Cyanide (mg/L)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV

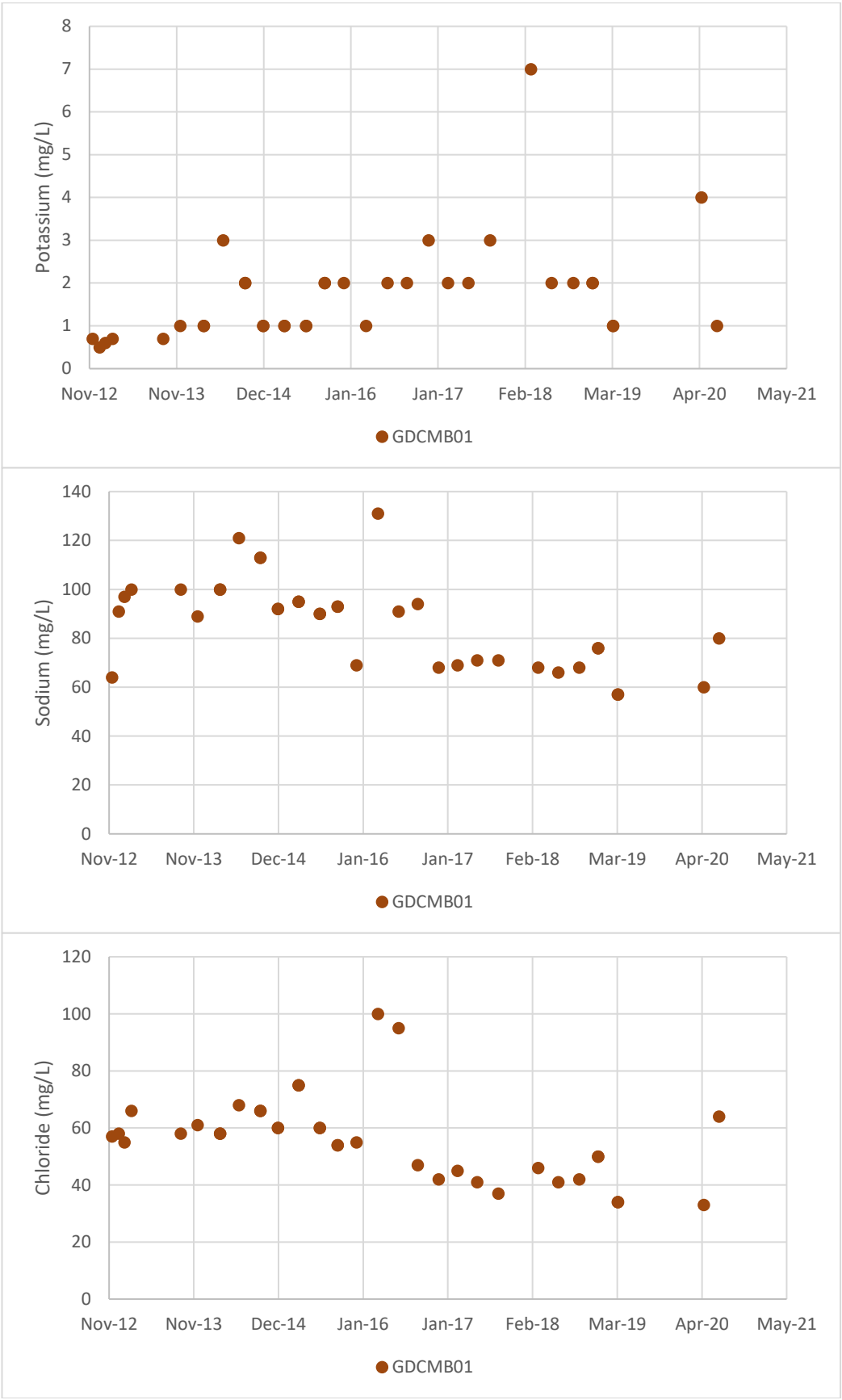

0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
WAD Cyanide (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Total Cyanide (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
1.2
1
0.8
0.6
0.4
0.2
0
Carbonate Alkalinity (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

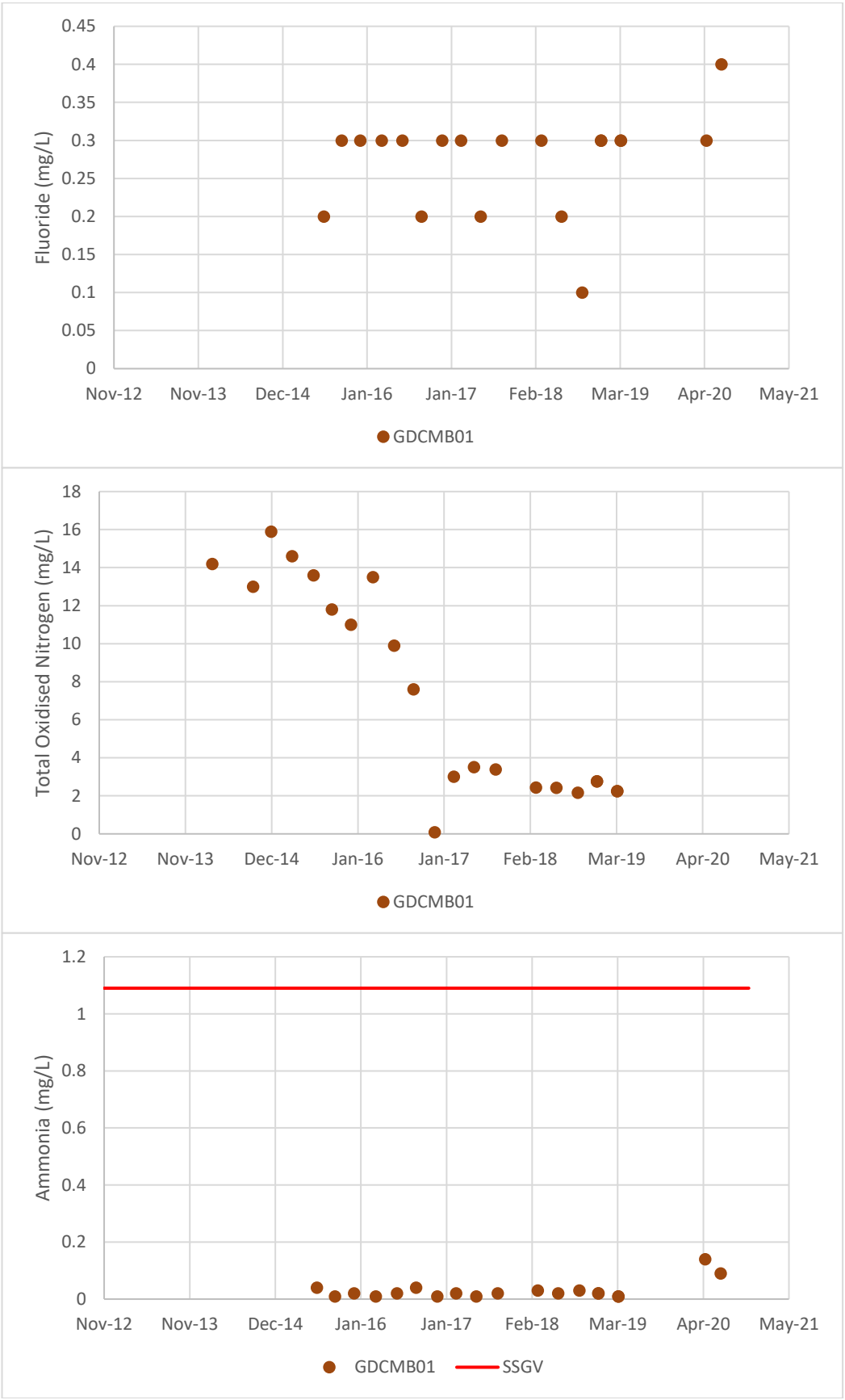

Bicarbonate Alkalinity (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Hydroxide Alkalinity (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Total Alkalinity (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

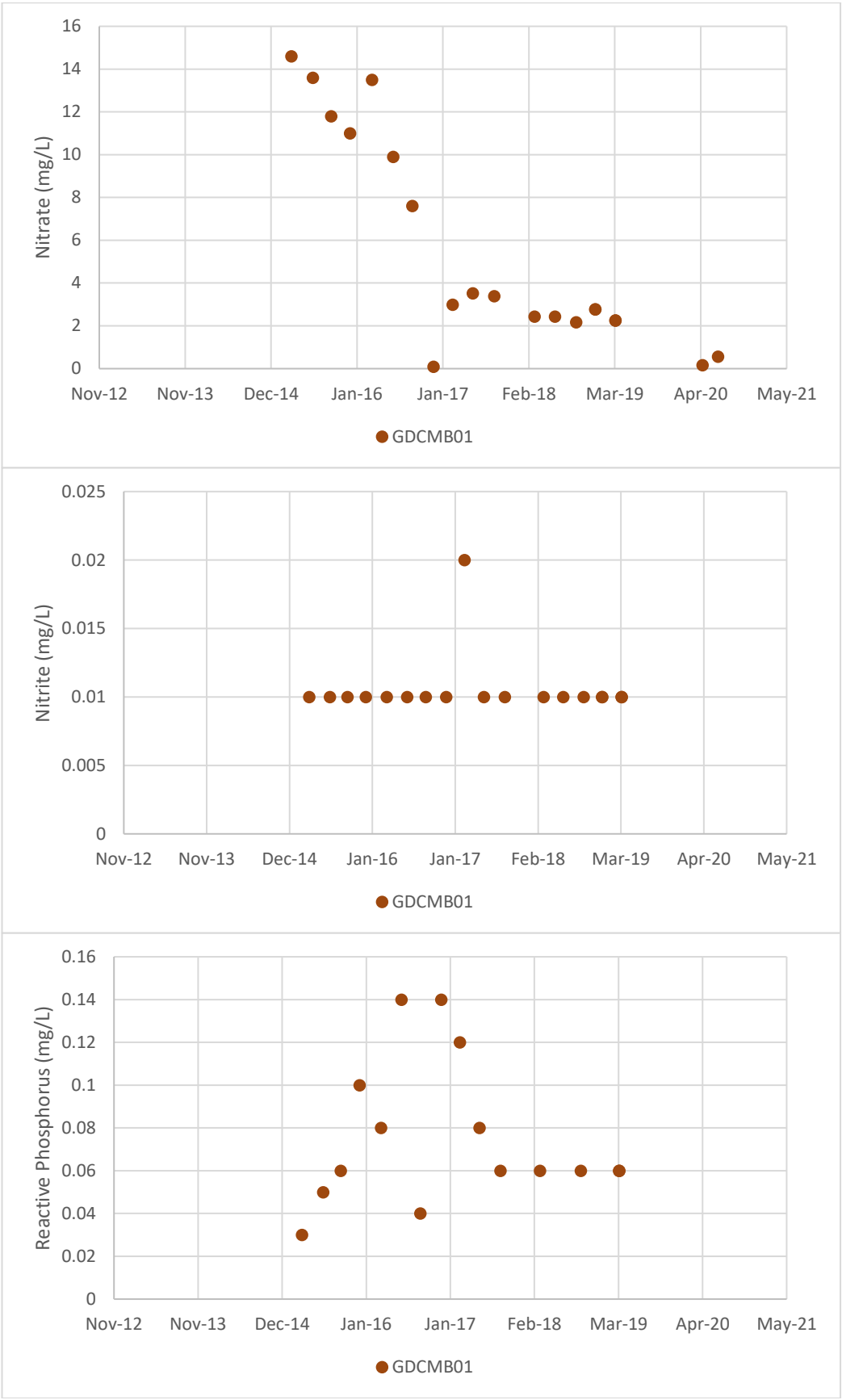

Hardness (mg/L)
45
40
35
30
25
20
15
10
5
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

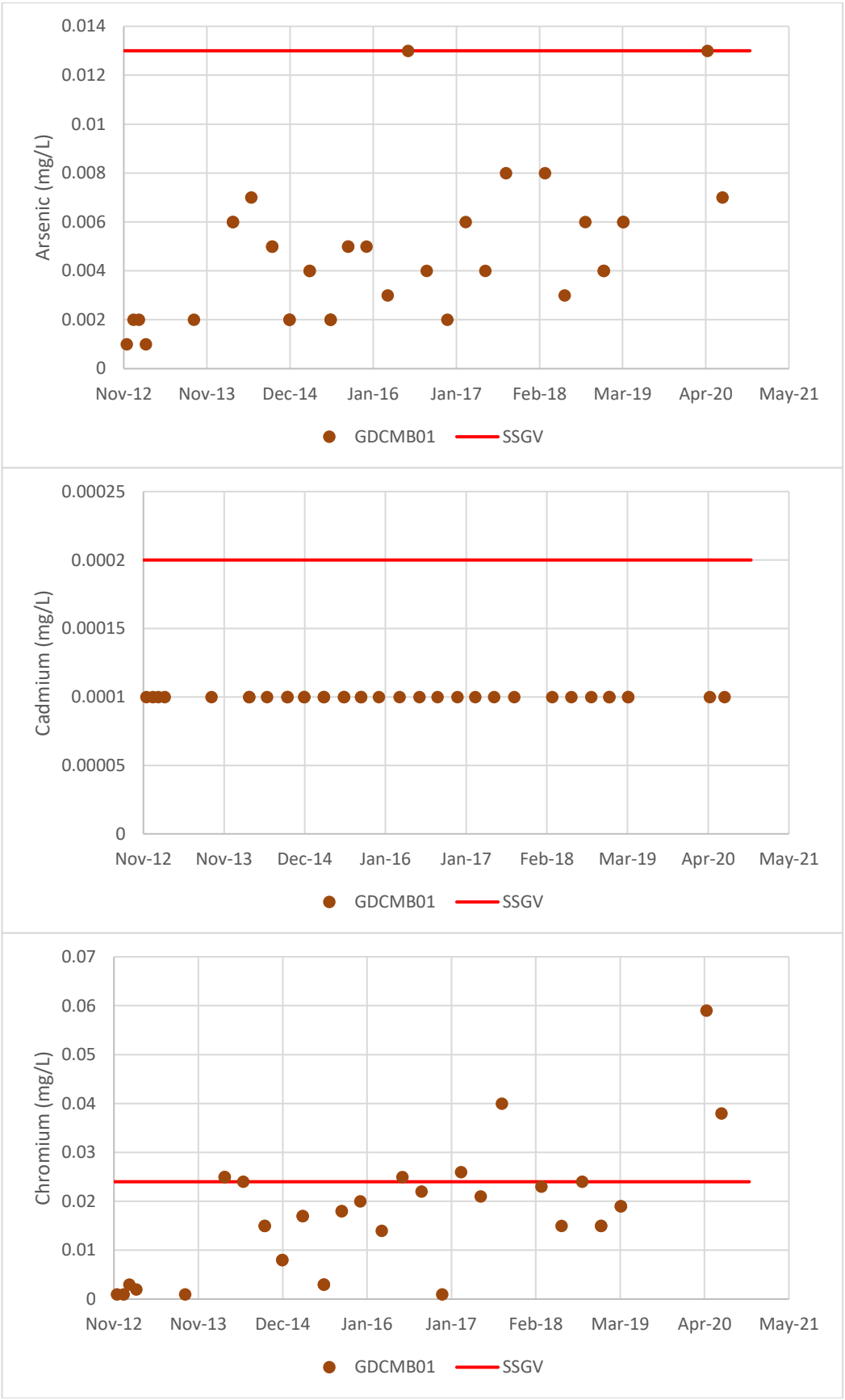

Calcium (mg/L)
12
10
8
6
4
2
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

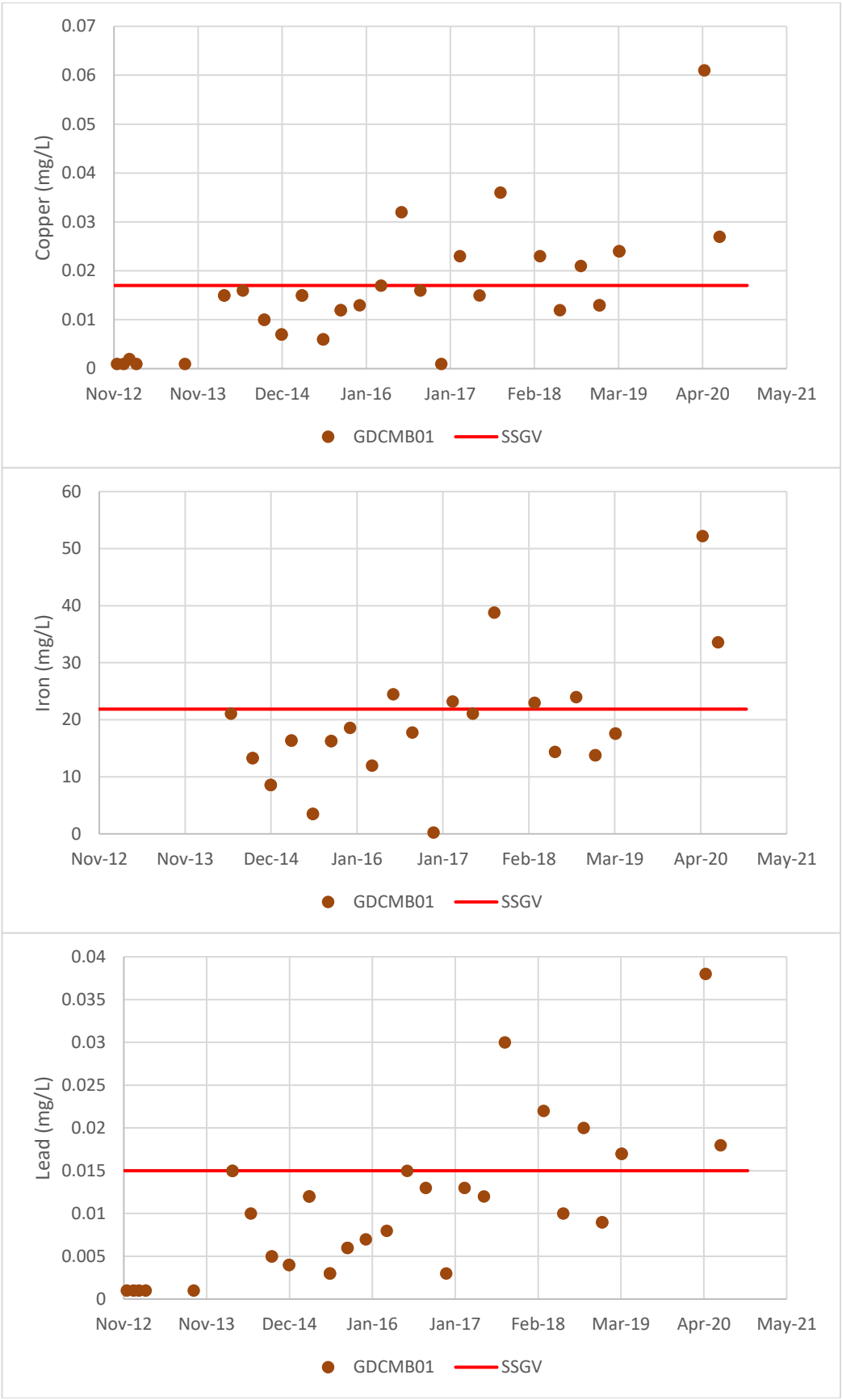

Magnesium (mg/L)
6
5
4
3
2
1
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

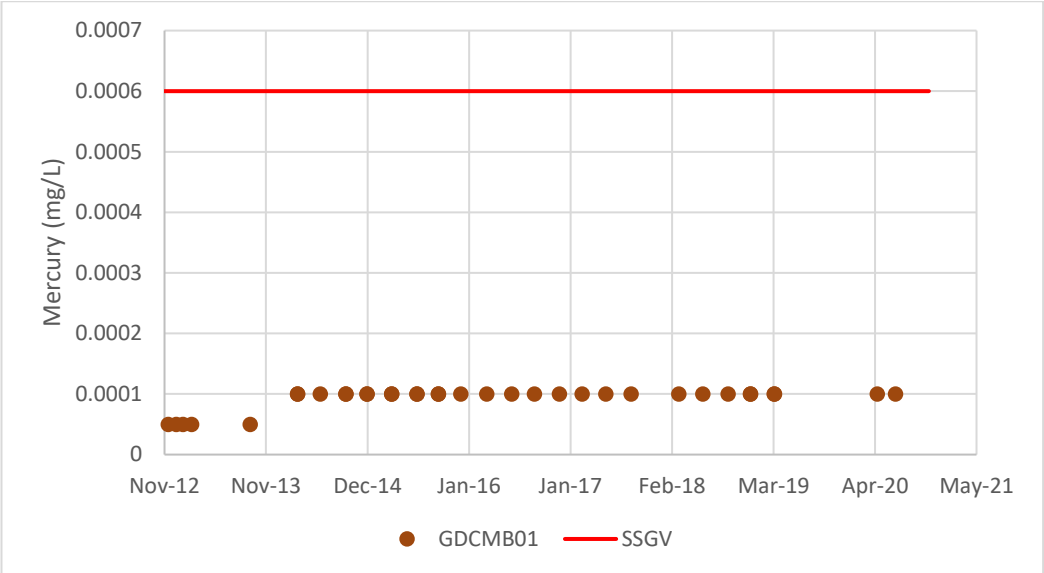

Potassium (mg/L)
8
7
6
5
4
3
2
1
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Sodium (mg/L)
140
120
100
80
60
40
20
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Chloride (mg/L)
120
100
80
60
40
20
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01

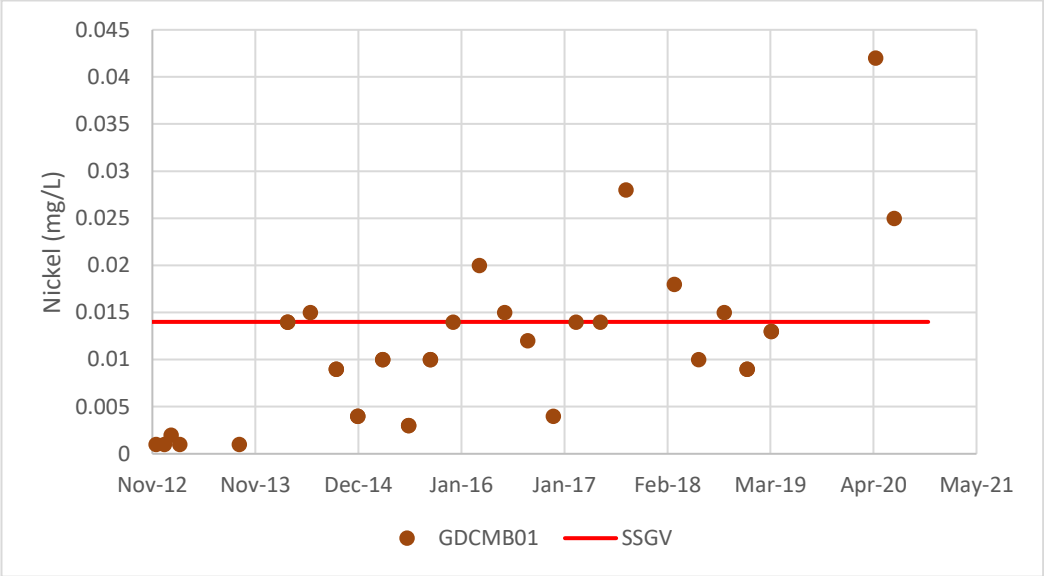

Fluoride (mg/L)
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Total Oxidised Nitrogen (mg/L)
18
16
14
12
10
8
6
4
2
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Ammonia (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV

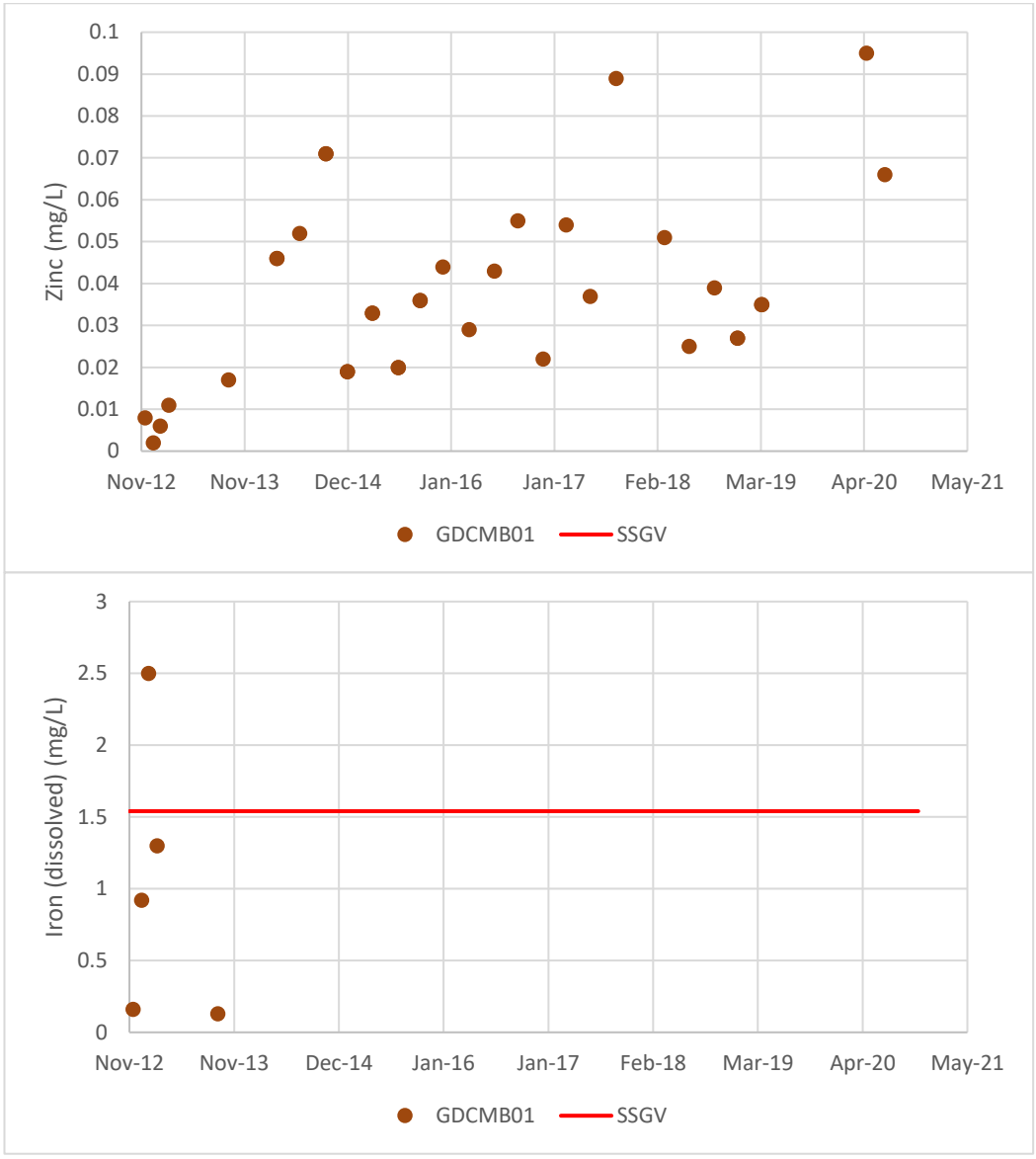

Nitrate (mg/L)
16
14
12
10
8
6
4
2
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Nitrite (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
Reactive Phosphorus (mg/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01


Arsenic (mg/L)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
Cadmium (mg/L)
0.00025
0.0002
0.00015
0.0001
0.00005
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
Chromium (mg/L)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV


Copper (mg/L)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
Iron (mg/L)
60
50
40
30
20
10
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
Lead (mg/L)
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV


0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
Mercury (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV


0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Nickel (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV


0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Zinc (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV
3
2.5
2
1.5
1
0.5
0
Iron (dissolved) (mg/L)
Nov-12
Nov-13
Dec-14
Jan-16
Jan-17
Feb-18
Mar-19
Apr-20
May-21
GDCMB01
SSGV

Appendix E – Trigger Action Response Plans

Surface water quality

	Trigger	Action	Response
Normal		-	Continue to monitor in accordance with a frequency specified in Table 5-2.
Surface water quality			
Stage 1	Surface quality parameters exceed triggers (Section 7.2)	1. Alert site manager.	1. Investigate if change in surface water quality is due to any spill, seepage or leachate.
Stage 1	Upward trend in any of the water quality parameters for three consecutive months.	1. Alert site manager.	1. Investigate if change in surface water quality is due to any spill, seepage or leachate.
Stage 2	Investigation results show that site operations are resulting in adverse surface water impacts	1. Alert site manager.	1. Design and construct appropriate engineering controls to mitigate impacts. 2. If recommended by investigation, conduct geochemical testing to assess risk of acid rock or saline drainage. If assessed as higher risk, prepare an acid mine drainage strategy
Complaints			
Stage 1	Complaint from a surrounding landholder	1. Alert site manager. 2. Investigate if change in surface water quality is due to mining related activities.	1. Document results and outcomes of investigation.

Flooding

	Trigger	Action	Response
Normal	-	1. Maintain water storage level within open cut pit sumps.	-
Stage 1	7 day rainfall forecast includes >50 % chance of at least 50 mm in 24 hours	1. Inspect levees and diversions, and repair as necessary. 2. Dewater open cut pit sumps.	-
Stage 2	Minor flood warning issued	1. Alert person in charge (PIC). 2. Monitor BOM radar and warnings. 3. Dewater open cut pit sumps.	-
Stage 3	Flows observed in the clean water diversions	1. Alert PIC. 2. Monitor BOM radar and warnings. 3. Minimise traffic on haul road to WRE 3. 4. Monitor flows in Central Clean Water Drain (CCD).	1. Inspect clean water diversions and levees for damage, repair as necessary.
Stage 4	Major flood warning issued	1. Alert PIC. 2. Monitor BOM radar and warnings. 3. All mobile plant and personnel to evacuate underground. 4. Relocate personnel and mobile plant to higher bench. 5. Remove all dump trucks from open cut pits. 6. Prepare mobile plant for evacuation.	-
Stage 5	Flows in CCD at or above haul road culvert obvert	1. Alert PIC. 2. All mobile plant and personnel to evacuate open cut pits. 3. Monitor BOM radar and warnings.	1. Inspect clean water diversions and levees for damage, repair as necessary.

Sediment basins

Level	Trigger	Action	Response
Normal	-	1. Dewater sediment basins to Wyoming Three, as required.	-
Stage 1	7 day rainfall forecast includes >50 % chance of at least 25 mm in 24 hours	1. Inspect sediment basins. 2. Dewater sediment basins to provide minimum freeboard. 3. Flocculate storage (TSS < 50 mg/L). 4. Prepare for discharges from LDPs.	-
Stage 2	Minor flood warning issued	1. Alert person in charge (PIC). 2. Monitor BOM radar and warnings.	-
Stage 3	Storage volume is greater than 30 % of capacity	1. Dewater sediment basins to Wyoming Three.	-
Stage 4	Storage volume is greater than 90% of capacity	1. Alert site manager. 2. Increase pump rate or add additional pumps. 3. Flocculate storage (TSS < 50 mg/L). 4. Prepare for discharges from LDPs.	
Stage 5	Overflows to receiving environment occur from one or more Sediment Basins	1. Alert site manager.	1. Notify EPA. 2. Undertake water quality sampling of both the storage and downstream environment.

RSF operation

	Trigger	Action	Response
Level			
Normal	-	1. Captured water is decanted back to Process Water Dam.	-
Stage 1	Volume of water on RSF surface is above normal operating level	1. Increase pump rate of transfers to Process Water Dam or transfer water to WCD - South.	1. Increase inspection frequency. 2. Undertake a round of groundwater monitoring.
Stage 2	Volume of water on RSF surface is above high operating level	1. Alert Mine and Operations manager. 2. Dewatering to any suitable open cut pit or available storage.	1. Undertake round of water quality assessment. 2. Increase inspection frequency. 3. Undertake a round of groundwater monitoring.
Quality			
Normal	-	1. Captured water is decanted back to Process Water Dam.	-
Stage 1	One quality sample records cyanide (WAD) above 90th percentile EPL limit	1. Investigate potential sources. 2. Record results and resample.	-
Stage 3	One quality sample records cyanide (WAD) above 100th percentile EPL limit.	1. Alert Mine and Operations manager. 2. Notify EPA.	1. Investigate potential sources. 2. Record results and resample.
	Multiple samples record cyanide (WAD) above 90th percentile EPL limit	1. Alert Mine and Operations manager. 2. Notify EPA.	1. Investigate potential sources. 2. Record results and resample.

Water security

	Trigger	Action	Response
Dust suppression			
Normal		-	-
Stage 1	WCD - North volume < 25 % of capacity	1. Supply raw water to WCD - North from borefield. 2. Review annual allocations and record transfer.	-
Stage 2	Allocation from bore is exhausted	1. Alert mine and operations manager. 2. Arrange for external transfers to be trucked in.	-
Process water			
Normal		-	-
Stage 1	Raw Water Dam capacity is less than 9774 m^3	1. Supply raw water to Raw Water Dam and Process Water Dam. 2. Review annual allocations and record transfer.	-
	Process Water Dam capacity is less than 8925 m^3	1. Supply raw water to Raw Water Dam and Process Water Dam. 2. Review annual allocations and record transfer.	-
Stage 2	Allocation from bore is exceeded	1. Alert mine and operations manager. 2. Arrange for external transfers to be trucked in.	-

Groundwater levels

	Trigger	Action	Response
Normal		-	Continue to monitor in accordance with a frequency specified in Table 5-2.
Groundwater monitoring bores			
Stage 1	Groundwater elevation falls below Stage 1 Trigger (Table 7-4).	1. Alert site manager. 2. Investigate if change in groundwater level is due to mine related activity.	1. Investigate if change in groundwater level is due to mining related activity.
Stage 2	Groundwater elevation falls below Stage 2 Trigger (Table 7-4).	1. Alert site manager. 2. Investigate if change in groundwater level is due to mine related activity.	1. Investigate if change in groundwater level is due to mining related activity.
Shallow monitoring bores (except GDCMP01)			
Stage 1	Groundwater levels rise over three consecutive months.	1. Alert site manager. 2. Investigate if change in groundwater level is due to mine related activity.	1. Document results and outcomes of investigation.
Stage 2	Groundwater levels rise over six consecutive months	1. Alert site manager. 2. Investigate if change in groundwater level is due to mine related activity.	1. Investigate and implement mitigation measures.
Complaints			
Stage 1	Complaint from a surrounding landholder	1. Alert site manager. 2. Investigate if change in groundwater level is due to mining related activities. 3. Provide compensatory water supply as needed.	1. Document results and outcomes of investigation.

Groundwater quality

	Trigger	Action	Response
Normal		-	Continue to monitor in accordance with a frequency specified in Table 5-2.
Shallow monitoring bores (except RSFMP03)			
Stage 1	Groundwater quality parameters exceed triggers	1. Alert site manager.	1. Investigate if change in groundwater level is due to any spill, seepage or leachate.
	Upward trend in any of the water quality parameters listed for three consecutive months.	1. Alert site manager.	1. Investigate if change in groundwater level is due to any spill, seepage or leachate.
Stage 2	Groundwater quality parameters exceed triggers for three consecutive months	1. Alert site manager.	1. Investigate if change in groundwater level is due to any spill, seepage or leachate. 2. Investigate and implement mitigation measures.
	Upward trend in any of the water quality parameters listed in for six consecutive months.	1. Alert site manager.	1. Investigate if change in groundwater level is due to any spill, seepage or leachate. 2. Investigate and implement mitigation measures.
Complaints			
Stage 1	Complaint from a surrounding landholder	1. Alert site manager. 2. Investigate if change in groundwater level is due to mining related activities. 3. Provide compensatory water supply as needed.	1. Document results and outcomes of investigation.