Dalyellup Annual Environmental Report - 2021

(From Dalyellup TSF Site Revegetation Monitoring Report November 2021)

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Table of Contents

List of Tables

List of Figures

List of Appendices

Summary

This report documents the environmental review of the Dalyellup Treated Solid Residue (TSR) disposal facility managed by Tronox Pigments Bunbury Ltd (Tronox). The report is submitted to satisfy the reporting requirements for the period January – December 2021 in accordance with:

- Closure Notice for Licence 6130/1989/12 (Appendix A) issued by the Department of Water and Environmental Regulation (DWER) under Part V of the *Environmental Protection Act 1986* (EP Act), which commenced 14 May 2013; and
- Ministerial Conditions (Appendix B) imposed under Part IV of the EP Act.

The key findings of this review are:

- Assessment of monitoring data indicates that the rehabilitation of the historical TSR facility results in minimal environmental impacts.
- Radiation levels measured at the site boundaries and in groundwater are consistent with previous years and remain at background levels. The Radiological Council of Western Australia (RCWA) have reiterated that the radiological risk to the community is low and does not require a buffer zone to the east of the site.
- No significant levels of dioxins and furans were found in the ground water samples. An anomalous sample in a background bore observed last year was confirmed as that with the measurement recorded in 2021 returning to low levels.
- Background bore MB4 which had been previously damaged, was recommissioned in 2019 to facilitate ongoing sampling. The bore was vandalised again during 2020 and samples were not able to be collected after the January 2020 monitoring event. The bore is located outside of the TSR disposal facility in a publically accessible area. This limits Tronox's ability to continuously maintain the security/integrity of this bore.
- The Yarragadee aquifer remains unaffected by the site.
- Stage 2 Rehabilitation Plans are progressing with ponds capped, area seeded and seedlings planted. Weed and pest control and infill planting was undertaken during 2021. Monitoring of the rehabilitation area continued throughout the year. General plant health during the Spring 2021 monitoring event was noted to be in very good condition with signs of new growth and seed production across a number of species.

Since the operation ceased in 2013, monitoring bores down-gradient of the leachate plume are generally trending to lower concentrations of contaminants. The observed trends indicate that leachate generation is declining following closure of the facility. The facility continues to present minimal environmental impact and with natural attenuation contaminant concentrations are returning to background levels.

1.0 INTRODUCTION

1.1 Background of Operations and Purpose

Tronox Mineral Holdings Australia Pty Ltd (Tronox) acquired the global titanium dioxide business of The National Titanium Dioxide Company Ltd (known as Cristal) on 10 April 2019. On 25 July 2019 Cristal Pigment Australia Ltd changed its name to Tronox Pigment Bunbury Ltd (Tronox).

Tronox is one of the world's leading producers of high-quality titanium products, including titanium dioxide pigment, specialty-grade titanium dioxide products and high-purity titanium chemicals; and zircon. Tronox mines titanium-bearing mineral sands and operates upgrading facilities that produce high-grade titanium feedstock materials, pig iron and other minerals. Tronox has two manufacturing facilities in the south west region near Bunbury (see Figure 1). They are the Kemerton processing plant and the Australind finishing plant. Combined, the two plants produce nominally 110,000 tonnes of finished pigment each year. Tronox also operated a Treated Solid Residue (TSR) disposal facility at Dalyellup, 8 km south of Bunbury until 1 March 2013. Since 2013, the TSR has been sent to Cleanaway's Banksia Road Facility at Dardanup.

A Closure Notice was issued in May 2013 by the Department of Water and Environmental Regulation (DWER) and amended in August 2013. This report documents the ongoing monitoring of the TSR disposal facility as required by the Closure Notice.

Figure 1 – Site Location

1.2 Source of Treated Solid Residue (TSR)

The vast majority of TSR sent to Dalyellup was from the Kemerton Processing plant (~ 95%). The plant utilises the chloride process to produce TiO_2. The chloride process is based on the production of titanium tetrachloride (TiCl4) from the chlorination of titanium bearing ore. The purified $TiCl_4$ is subsequently oxidised, yielding titanium dioxide and allowing recycling of chlorine (Cl_2).

Titanium-rich ore, together with a supply of carbon (petroleum coke), is fed into a chlorinating vessel, which operates at approximately 900 to 1100°C. Chlorine entering the vessel reacts with the TiO_2 and some of the ore impurities to form $TiCl_4$, metal chlorides as well as carbon monoxide (CO) and carbon dioxide (CO_2). The reaction is as follows:

$$3\ TiO_2 + MOx + 4\ C + 6\ Cl_2 \longrightarrow 3\ TiCl_4 + 2\ CO + 2\ CO_2 + MClx$$

In the purification process, solid and liquid impurities are separated from the hot gas. The gas is condensed and then distilled to produce pure titanium tetrachloride as an intermediate product.

The solid residue separated from the gas stream typically consists of metal chlorides, oxides, various silicates, unreacted ore and coke. Most of the ore and coke is recovered and separated prior to being reused in the production process. A neutralisation process is used to treat the remaining solid residue from the chlorinated gas stream. Lime is added to each of a series of tanks to raise the pH and precipitate the contaminants as hydroxides.

$$MCl_x + Ca(OH)_2 \longrightarrow CaCl_2 + M(OH)_x$$

Metal chlorides + lime ⟶ calcium chloride + metal hydroxides

The slurry is then sent to a clarifier where the solids settle and are separated. The solids are filtered by a vacuum filter and washed to remove a large proportion of the soluble salts. The waste was transferred as a ~ 20% solid slurry by tankers to the disposal site at Dalyellup.

The Australind residue contributed approximately 2 to 6% of the total residue sent to Dalyellup. The Australind finishing plant receives TiO_2 slurry from Kemerton via road tanker where it then undergoes surface treatment, washing, filtering, drying, final milling and packaging. Any process wastewater is captured in the drain system which is transferred to the neutralisation plant. The neutralisation process is the same as Kemerton and slurry was transported to Dalyellup in the same manner. The dried residue is an inert, insoluble, non-toxic, clay-like material.

2.0 SITE INFORMATION

2.1 Site History and Location

The disposal site is adjacent to and set within the buffer zone of the No.2 Bunbury Sewage Treatment Works and is approximately 200 m from the ocean. The disposal site is situated in the swale between the vegetated linear primary dunes and the parabolic secondary dunes, which have a maximum elevation of approximately 45 m Australian Height Datum (m AHD).

Disposal at the site commenced in March 1989 under a five-year agreement with the Shire of Capel. DWER, however, agreed to the use of the site for three years, conditional upon satisfactory environmental performance. In June 1991, the company submitted a proposal to the DWER for a two-year extension of its disposal facilities. This was consistent with the original agreement made with the Shire of Capel. In response, DWER called for a Consultative Environmental Review (CER).

The CER was released in September 1991 and, following the public review and assessment period, approval for the project to proceed was received from the Minister for the Environment on 23 January 1992. The extension, approved under Ministerial Statement No. 213, expired on 4 March 1994.

In August 1993 Tronox submitted a proposal to the DWER for continued use of the disposal site. Pursuant to section 46(1) of the EP Act, the Minister for the Environment requested DWER to inquire into and report on the proposed change to Environmental Condition M1.

The Section 46 amendment was approved in Ministerial Statement No. 332, published on 9 December 1993. Further Ministerial Conditions were set on the project (see Section 5). The extension, for the “Life of the Site”, is subject to the licensing requirements of the EP Act. Tronox was granted approval to operate this site until March 2010.

The site was registered in May 2007 as a Contaminated Site, as required under the *Contaminated Sites Act 2003* (CS Act). The registration was accompanied by copies of the licence, the Annual Environmental Reports (AERs) from previous years, and other studies and reports. The site has been classified by the DWER Contaminated Sites Branch as ‘Possibly Contaminated’ and suitable for its then current use.

In 2008 Tronox commenced community consultation for the issue of a new licence to operate the site from 2010 to 2013. The extension was requested as the facility would not be fully utilised until 2013. This was due to Tronox implementing waste reduction and recycling programs at the Kemerton facility.

During 2009, the Shire of Capel, WA Planning Commission, Radiological Council of Western Australia (RCWA) and Environmental Protection Authority (EPA) approved continued use of the site. An assessment by the DWER followed and a licence was issued on the 25th January 2010 to operate the site until March 2013, at which time the site ceased to operate.

In 2009-2010, studies on the impact of leachate to the near shore, concluded that there was no evidence of metal, chromium VI, dioxin or furan contamination found in the sediment, sediment elutriates or marine water adjacent to the Dalyellup waste disposal site, and on the basis of the results, ground water discharge adjacent to the site posed negligible risk to the marine environment and had a negligible impact on recreational uses on the beach and waters adjacent to the site.

Disposal ceased on 1 March 2013 and the Closure Notice, issued in May 2013 by DWER, details the ongoing monitoring requirements. The remaining TSR ponds were covered with 3-4 m of clean fill in September 2013. The site was classified as "Remediated for Restricted Use" in 2018 as it is considered to be remediated such that it is suitable for passive recreational use as endemic bushland.

Two rehabilitation options were considered in detail: redevelopment to sporting fields; and rehabilitation back to native vegetation. In May 2017, the Shire of Capel formally communicated that they were not committing to the sporting field option in the near future, and works commenced to extend previous successful revegetation efforts at the south of the site to the rest of the facility. In 2018, seeding and planting of seedlings in Stage 2 was undertaken. Weed and pest control and infill planting was undertaken during 2020 and 2021. Monitoring of the rehabilitation area continued throughout the year. General health of the plants has continued to improve over 2021 and there was evidence of natural seed distribution from the initial and infill plantings.

In 2015, the OEPA was satisfied that ministerial conditions related to the closure had been met. The Mandatory Auditor's Report, prepared by a DWER accredited independent auditor, was sent to DWER's Contaminated Sites Branch in July 2015 and reviewed by DWER, Department of Health, Capel Shire and RCWA. The Site Management Plan (SMP) was updated and submitted to DWER in October 2019 for review.

In October 2017 a member of the general public reported to DWER that the proposed Greenpatch development (located to the east of the historical TSR facility) was suspected to be contaminated under the CS Act from chromium and zinc present in the groundwater and TSR beneath the site. Soil validation of the suspected areas found no evidence of TSR beneath the site. The site was reported again in 2018 due to the suspected presence of TSR associated with operations historically undertaken at the former TSR disposal site.

Two hydrogeological studies have confirmed the groundwater flow is from east to west, i.e. towards the sea rather than from the TSR disposal site towards Greenpatch. Background bores located to the south west and within the Yarragadee Aquifer (which is a source of drinking water) show no contamination. It has been eight years since the operation closed and monitoring bores down hydraulic gradient (down-gradient) of any leachate plume are trending lower concentrations of contaminants.

There is however, limited groundwater data available to Tronox from monitoring bores to east and south-east of the Tronox site. The Department of Biodiversity, Conservation and Attractions (DBCA) advised[1] that there are no mapped geomorphic wetlands of any management category on the Greenpatch development site. The two water bodies present have been described as a man-made 'sump' or 'dam'. These water bodies are located up hydraulic gradient (up-gradient) of the Tronox site, therefore groundwater flows from these water bodies towards the Tronox site.

The Contaminated Sites Committee considered appeals against the classification of Lots 8019, 9076 and 9105. The Committee made its decision in respect of this Appeal against the classification on 20 October 2020 and decided the site be reclassified to *'possibly contaminated – investigation required'*. The Greenpatch developers, Satterley, engaged RPS to prepare a Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) for the site for submission to an accredited CS auditor.

[1] Hansard, Legislative Council, 29 Nov 2018

The main findings of the DSI included the following:

- With the exception of isolated exceedances of metals (Mg, Ni) and radionuclides (Th) in two of 24 locations (TP14 and TP18), soils typically complied with adopted guidelines. All guideline exceedances were observed in a dark brown clayey silt layer visually distinct from natural soils and the capping layer within Lot 9109. Based on investigation results impacted soils are suspected to be a blend (1:9 ratio TSR to sand) of TSR and sands and not straight TSR. Impacted soils at TP14 and TP18 were not considered a risk to human health in their current condition. However, soils may present a risk during the proposed development of Lot 9109 if the material is exposed during earthworks. On this basis removal of the impacted material from Lot 9109 is recommended.
- No TSR was observed elsewhere onsite based upon the site walkover and review of historical aerials. The blended TSR would also pose significantly lower radiation risk then straight TSR due to the lower concentrations of radionuclides.
- Exceedances of ecological guidelines in groundwater were observed for metals (Cr(VI) and Fe) and nutrients. With the exception of hexavalent chromium, dissolved metal concentrations are relatively consistent across the site and of those in the Perth's superficial aquifer. However, with the exception of Cr(VI) in one bore (DM9S) groundwater quality entering and exiting the site were comparable.
- Lot 9109 was deemed to pose low risk to the human health and local ecology based upon the current site use, i.e. public open space natural bushland, and future proposed residential use, however ongoing management is required to ensure the potential risks to human health are minimised.
- Lot 9076 and 8019 were deemed to present no risk to human health or the local ecology based on the current and future site use.

The DSI stated that to manage the potential increased risk to human health should impacted soils at TP14 and TP18 be exposed during development or groundwater abstracted RPS recommends:

- Impacted soils at and adjacent to TP14 and TP18 are excavated and disposed of at an appropriate landfill.
- A moratorium on groundwater abstraction from the shallow aquifer is acquired to prevent potable / nonpotable groundwater use.

The DSI recommended Lot 9076 and Lot 8019 can be reclassified as "not contaminated – unrestricted use" under the Contaminated Site Act 2003, without any remedial action. After remediation, it is recommended that Lot 9109 is classified as "Decontaminated" under the Contaminated Site Act 2003 and suitable for the proposed land end use as residential and open space.

2.2 Site Hydrogeology

2.2.1 Superficial Formations

The sediments below the site area are calcareous, fine to medium grained sands. They range in depth from 10 to 20 m. Limestone, sand and sandy clays occur in the area at depths between 10 to 30 m. Below these sediments are dark grey, silty, micaceous clays. Some heavy minerals and silty organic matter occur throughout the profile. The secondary dunes are overlain by about 0.5 to 1.0 m of topsoil.

The area is underlain by superficial formations, which range in depth from sea level to about 10 m AHD above sea level. The superficial formations form an anisotropic unconfined aquifer, comprising sand and limestone, with a basal section of less permeable silty sand and sandy clay. The depth to the water table is about 10 m beneath the base of the tailings storage lagoons and varies with topographic elevation and mounding effects. Seasonal fluctuation is estimated to be 1 to 1.5 m.

The superficial aquifer has a saturated thickness at about 10 m beneath the disposal site. Groundwater flow through the superficial formation is towards the ocean where discharge occurs across a seawater interface. The hydraulic gradient is about 1:100. Baseline studies, prior to commissioning the site, recorded electrical conductivities in the order of 1,350 µS/cm, equivalent to about 800 mg/L TDS. Figure 2 shows a hydrogeological conceptual model of the site.

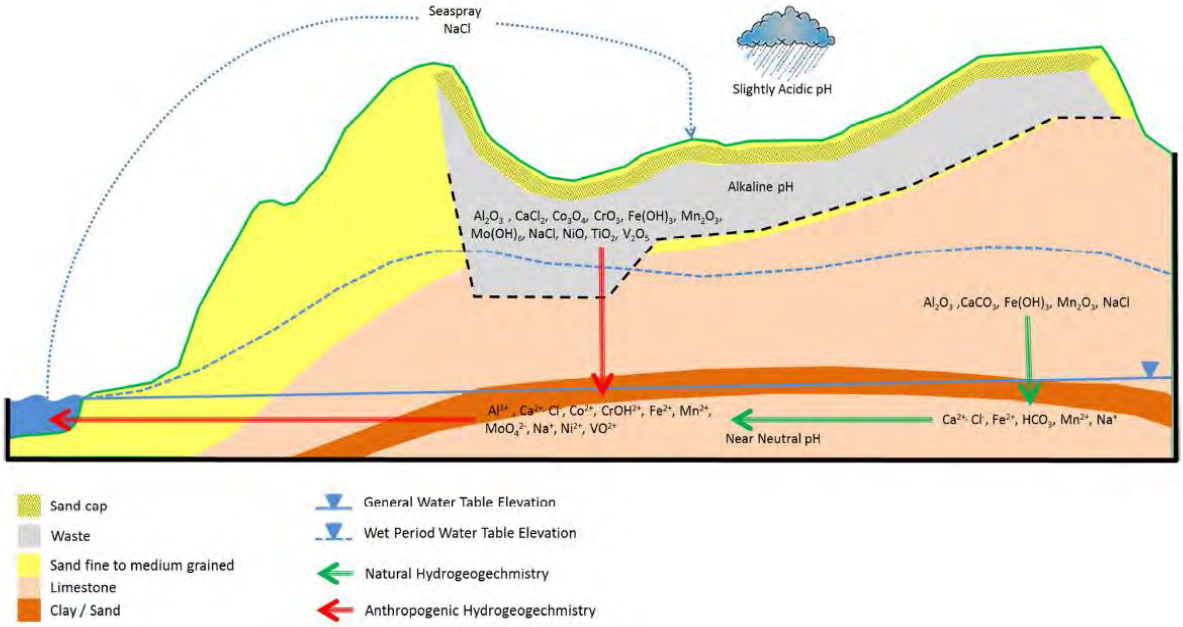


Figure 2 – Conceptual Model of the Site[2]

2.2.2 Yarragadee Formation

The Yarragadee formation directly underlies the superficial formation in this area and forms a confined multi layered aquifer, comprising interbedded sandstone, siltstone and shale. In 1996 it was determined that the potentiometric head in the confined aquifer was about 1 m higher than in the superficial formations. Consequently, there is upward recharge into the superficial formations. This upward head prevents leachate entering the Yarragadee Aquifer. Regional groundwater flow in the Yarragadee formation is in a North West direction and discharge is via the superficial formation into the ocean. Beneath the disposal site, the groundwater salinity in the Yarragadee formation ranges between 600 and 1,000 mg/L TDS.

[2] Dalyellup Waste Residue Facility – Hydrogeological Assessment, GHD, April 2015

3.0 GROUNDWATER MONITORING

3.1 Monitoring Bore Network

Fifteen monitoring bores have been installed around the Dalyellup disposal facility (see Figure 3) including a bore to monitor the Yarragadee (YB).

The monitoring bores on the site are cased with Class 9 PVC, ranging in size from 50 to 100mm. Construction details of the monitoring bores are given in Appendix C. The bores can be divided into two main groups, background monitoring bores and site monitoring bores.

- The background monitoring bores are constructed of 100mm PVC and are slotted against the entire aquifer thickness. These are designated by the MB (monitoring bore) prefix.
- The site monitoring bores are located in pairs, one deep (A) and one shallow (C); these are designated by the DM (Dalyellup monitoring) prefix e.g. DM2A and DM2C. Monitoring at two depths in the aquifer is conducted to identify any stratification that may be occurring in the leachate plume. DM1R and DM9R are up hydraulic gradient of the historical TSR ponds and are considered to be representative of background conditions.

Figure 3 - Monitoring Bore Locations

Bores range in depth from around 15 to 50 m below ground level and monitor groundwater in the Superficial Formations (quaternary aged shallow aquifer system). Since the monitoring bore network was constructed in 1989, several bores have been replaced. Bores DM1(R) and DM4(R) were replaced in 1992 and 1996 respectively as part of earth works on the site. MB1, MB2 and MB3 were replaced in February 2001 due to earthworks associated with the Dalyellup residential sub-division, which borders the southern boundary of the disposal area. In May 2004, MB1 and MB2 were decommissioned due to further earthworks. This was discussed with DWER at the time and the licence was amended to reflect the changes in July 2005.

The southern ponds were rehabilitated in 2002. DM3A and DM3C were located in the southern ponds and have now been decommissioned. Some sand was also removed from the southwest part of the central pond to help build a separating wall in the pond. This unintentionally created some erosion around bores DM5A and DM5C and made sampling of these bores unsafe. These bores were subsequently decommissioned.

Background monitoring bore, MB4, has been damaged a number of times since 1989. The bore was vandalised in 2018 and recommissioned in 2019 to enable recommencement of the sampling program. The bore was vandalised again during 2020 and samples were not able to be collected after the January 2020 monitoring event. The bore is on the beach's high water mark outside of the TSR disposal site boundary and is subject to both storm damage and acts of vandalism which restricts Tronox's ability to maintain integrity of this bore.

3.2 Superficial Aquifer Monitoring Bores

As required by Section 1.3 of the Closure Notice, a report was prepared on the groundwater beneath the site for the period 4 March 2013 to 4 March 2015 [2]. The full report was provided in the 2015, 2016 and 2017 AER's.

Groundwater discharges directly into the nearby Indian Ocean. As such, ANZECC 2000 Marine Water 95% species protection criteria (Marine Criteria) was adopted for the assessment. In summary the report concluded:

a) Geology underlying the Site comprised calcareous, fine to medium grained sands, ranging in depth from 10 to 20 m. Limestone, sand and sandy clays occur in the area at depths between 10 to 50 m. Below these sediments are dark grey, silty, micaceous clays. The clays appear from 20 to 40 m, and occasionally occur above or within the sandy limestone layers.

b) Groundwater standing water level (SWL) resides in the superficial formation between 0.8 to 2.5 m AHD. Yarragadee aquifer SWL level resides between 1.5 to 2.5 m AHD.

c) The monitoring network incorporating 15 bores was sufficient to complete the hydrogeological review;

d) Groundwater quality investigations reported exceedances of select trace metals. Of these, it was concluded that lead, cobalt, copper and zinc are likely to be due to natural background conditions.

e) Chromium and vanadium were the only two detected trace metals that appear to be linked to the TSR as their concentration shows an increase between the up and down-gradient bores.

f) Mobility of hexavalent chromium and vanadium is dependent on anionic sorption processes with the main anion attracting sites being ferric hydroxide minerals. Therefore, dissolution of these metals is dependent on pH. The pulsed nature of mobility would likely result in very slow transport velocities with these metals only migrating during periods when the pH is in a narrow window where sorption and precipitation are not occurring.

g) The TSR is generating saline leachate that is increasing the TDS of the superficial groundwater along the flow path.

h) The most likely mineral responsible for the majority of the observed effect on the major ion composition of the groundwater is calcium chloride. The source of this mineral is considered to be anthropogenic and probably associated with the TSR.

i) The hydro-geochemical character at the down-gradient bore (DM4(4R)) is influenced by mixing of fresh groundwater discharge, impacted by leachate from the TSR and seawater interface, which would be anticipated, given the position of the bore near the beach.

The report recommended that Tronox:

a) Maintain the monitoring program as currently described in the Closure Notice.

b) Periodically re-evaluate the hydro-geochemical data to establish that conditions remain stable and provide a series of actions and measures to be adopted should any future monitoring identify potential changes in hydro-geochemical conditions and / or risk profile of the TSR to the environment.

c) Store and manage data in a program which can be updated and analysed easily.

Data (refer to Appendices D and E) is transferred into an environmental database (ESDAT), which is Tronox's site tool for storing and managing the data.

As reported in the 2018 AER, Tronox undertook an evaluation of the dataset to identify statistically significant changes using the Mann-Kendall test. From this test Tronox was able to identify whether there had been an upward or downward trends in the analytical suite over the 10 year period from 2008-2018.

The 2018 AER identified a number of "trends of interest" relating to individual bores and the associated suite of analytes. The 2021 analytical data has been compared against the "trends of interest" and reported in Table 1.

Table 1 – Trends of Interest

BORE	ATTRIBUTE	COMMENT (Refer to graphs in Appendix D and bore locations in Figure 3.)
DM1A	Pb	Deep bore NE corner. This bore is up hydraulic gradient of the historical TSR ponds. Spike in August 2012. Concentrations were below level of detection in 2021. These values are considered to be reflective of ambient groundwater conditions. Action: No further action.
DM1C	EC, TDS	Shallow bore NE corner. This bore is up hydraulic gradient of the historical TSR ponds. Levels returned to previous high levels in June 2021 before dropping to longer term average value in October 2021. EC and TDS levels indicate that there has not been any impact resulting from saline TSR leachate on this bore confirming that this bore is up hydraulic gradient of the historical ponds. Action: No further action.
	Fe	Peaked in 2015-2016. 2021 levels significantly less than the peak values recorded in 2015-2016. These values are considered to be reflective of ambient groundwater conditions. Action: No further action.
	Pb	Peaked in 2012 -2016 with seasonal fluctuations. The concentrations over the last four years' were significantly below the peak values recorded and levels have been below ANZECC marine water quality guideline (95% trigger) from 2019. Action: No further action.
	Mn	Peaked in 2012 -2018 with seasonal fluctuations. The concentrations over the last three years' were significantly below the peak values recorded. Action: No further action.
	Na/Cl	Results over the last four years were around 1 indicating no impact from the Cl leachate from the TSR. Action: No further action.
	Mg, Na, SO_4	Major constituents (Mg, SO_4, Na) fluctuated over 2021 however were generally within historical values with the exception of SO_4 which peaked in June 2021 before returning to longer term average value in October 2021. Action: No further action.
DM2A	Cr(VI)	Deep bore on NW corner of the historical TSR facility. Levels peaked in 2014. 2019 levels increased to similar peak value before decreasing in 2020. Levels have fluctuated over 2021 and were above ANZECC marine quality water guidelines (95% trigger). Action: Refer to Section 3.2 (f). Action: Continue to monitor.
	Pb	Peaked in 2012 -2016 with seasonal fluctuations. Levels stabilised below the ANZECC marine water quality guidelines (95% trigger). Action: No further action.
	Mn	Peaked in 2014. Levels have stabilised and generally decreasing over the last few years. Action: No further action.

BORE	ATTRIBUTE	COMMENT (Refer to graphs in Appendix D and bore locations in Figure 3.)
	Ni	Spike in April 2014. However, levels have remained below the ANZECC marine water quality guidelines (95% trigger) and have stabilised well below the maximum concentration recorded. Action: No further action.
	V	Spike in April 2014. Levels stabilised below the ANZECC marine water quality guidelines (95% trigger). Action: No further action.
DM2C	Cl	Shallow bore on NW corner down-gradient of tailings. Levels have varied over the monitoring period from 1988 in response to the when TSR was deposited in the historical ponds closest to this bore. Levels have gradually declined from the last peak recorded in 2015. Action: Continue to monitor.
	Cr(VI)	Spike in April 2014 and again in October 2020. Levels have decreased from the latest peak however are above ANZECC marine quality water guidelines (95% trigger). Action: Refer to Section 3.2 (f). Action: Continue to monitor.
	Fe, Ni, Pb, Mn, V	Spike in May 2017. Levels returned to be within ANZECC marine quality water guidelines (95% trigger). Refer to Section 3.2 (f). All parameters are trending down and have stabilised at low levels. Action: Refer to Section 3.2 (f). Action: Continue to monitor.
	Na/Cl EC	2021 ratio remains low (up to 0.26) with natural Na/Cl ratio (0.7 to1.0). EC relatively high, indicating leachate plume impacting this bore with chlorides still present, however is trending down. Action: Continue to monitor.
	Redox	Oxidising conditions recorded over 2021 and within historical values. Action: No further action.
	SO_4	Levels recorded during 2020and 2021 were lower than the peak value recorded in 2010. SO_4 is indicative of oxidation of sulphur in the TSR. Action: Continue to monitor.
DM7A	Pb	Deep bore near the SW boundary. Spike in April 2018. Levels have continued to decrease from 2019. Levels less than limit of reporting in 2021 and well below ANZECC marine quality water guidelines (95% trigger). Action: No further action.
DM7C	Mn	Maximum value (2.0 mg/L) recorded in 1996. 2021 levels were significantly less than the historical maximum. Action: No further action.
	Mo	Levels have decreased from values recorded in 2018 and remain similar to concentrations recorded in background bores. Action: No further action.
	Ra^{226}	A spike in 2015. 2021 levels were significantly below historic maximum and well below radiological trigger (500 mBq/L). Refer to Appendix F. Action: No further action.

BORE	ATTRIBUTE	COMMENT (Refer to graphs in Appendix D and bore locations in Figure 3.)
	V	Levels have remained well below the ANZECC marine quality water guidelines (95% trigger) since 2007. Action: No further action.
DM8A	Fe, pH, Mn	Deep bore on the western site boundary directly down-gradient of the last filled tailings dams. The pH has stabilised to a more neutral level. Iron and manganese levels were within historical ranges. Levels do not pose a significant ecological risk. Action: No further action.
DM8C	Mo	Shallow bore on the western site boundary directly down-gradient of the last filled tailings dams. Levels remained low in 2020 and 2021 after fluctuating levels from 2017-2019. Action: No further action.
	Redox	Returned to reducing conditions in 2021 following oxidising conditions recorded in 2020. Considered to be reflective of ambient groundwater conditions. Action: No further action.
DM9A	Cl, Na	Deep bore on eastern side of the historical TSR disposal ponds. Values recorded during 2021 were within historical ranges. Considered to be reflective of background conditions. These levels indicate that there has not been any impact resulting from saline TSR leachate on this bore confirming that this bore is up hydraulic gradient of the historical ponds. Action: No further action.
	Fe	Levels fluctuate over the past ten years. This bore is up hydraulic gradient of the historical TSR ponds and this increase is likely a result of off-site influences. Refer to Section 3.2 (f). Action: No further action.
	Mn, SO_4, pH	Slight increases SO_4 and pH levels over the period to their highest historical values. Mn values decreased to well below historical values. This bore is up hydraulic gradient of the historical TSR ponds and these values are considered to be reflective of ambient groundwater conditions. Action: No further action.
DM9C	Cr(VI)	Shallow bore on eastern side of the historical TSR disposal ponds. This bore is up hydraulic gradient of the historical TSR ponds. Levels peaked in 2012-14 and 2016. 2021 results were below LOR. The DSI completed for this lot states that the elevated hexavalent chromium concentrations at this location may be associated with an isolated remnant layer of TSR blend that was identified in a test pit during investigations. Action: Continue to monitor.
	EC	EC (Field) decreased slightly to below historical values over 2021, however, considered to be reflective of natural variation in ambient groundwater conditions. Action: No further action.
	Fe	Spike in 2010. Levels spiked again in 2021. This bore is up hydraulic gradient of the historical TSR ponds and this increase is likely a result of off-site influences. Action: No further action.

BORE	ATTRIBUTE	COMMENT (Refer to graphs in Appendix D and bore locations in Figure 3.)
	SO_4	Values recorded during 2021 decreased from the slightly elevated values recorded in 2020. This bore is up hydraulic gradient of the historical TSR ponds and these values are considered to be reflective of ambient groundwater conditions. No further action.
MB3		Background bore SW of site. Action: Continue to monitor as a reference.
MB4	Fe, Na/Cl, Mn, Pb, V	Background bore on the beach's high water mark. Vandalised in second half of 2018. Repaired bore in 2019 however was vandalised again in 2020. Natural variation. Action: Consider seeking approval to discontinue use of this location as the well has been consistently vandalised over the past few years. There is over 30 years of monitoring data available from this background monitoring location.
YB	Na/Cl, Cl, EC, Mg, V, SO_4	Deep aquifer supplying town water. Natural variation in levels over time. There is no evidence of any impact of TSR leachate on the Yarragadee aquifer. Action: Continue to monitor.

Concentrations were within the ANZECC marine quality water guidelines (95% trigger) with the exception of the following:

- All monitoring locations were conservatively assumed to exceed the guideline for hexavalent chromium (0.0044 mg/L) as the limit of reporting was 0.01 mg/L. Of these, only three bores (DM2C (up to 0.32 mg/L)), DM2A (up to 0.32 mg/L) and DM9A (up to 0.16 mg/L)) recorded values that exceeded the LOR;
- DM2C (up to 0.03 mg/L) exceeded the guideline for trivalent chromium (0.0274 mg/L);
- DM4A (0.0022 mg/L) exceeded the guideline for cobalt (0.001 mg/L); and
- DM1C (up to 0.0029 mg/L), DM1A (up to 0.002 mg/L), DM2C (up to 0.0028 mg/L), DM2A (up to 0.0047 mg/L), DM7C (up to 0.0097 mg/L), DM8A (up to 0.0014 mg/L), DM9C (up to 0.0146 mg/L), DM9A (up to 0.0025 mg/L) and MB3 (up to 0.002 mg/L) exceeded the guideline for copper (0.0013 mg/L).

Data is provided in Appendices D and E.

The Hydrogeological Assessment (GHD 2015) concluded that reported exceedances of select metals including lead, cobalt, copper and zinc are likely to be due to natural background conditions encountered at the time of sampling. Chromium and vanadium were the only two trace metals that appear to be linked to the TSR as their concentration shows an increase between the up and down-gradient wells.

Points of note from the 2021 SWL dataset for the superficial aquifer are:

- There were no notable short-term trends in SWL's.
- Longer term trends for SWL's indicate an overall decrease in level in response to a decrease in annual average rainfall (Figure 4) and cessation of operations.

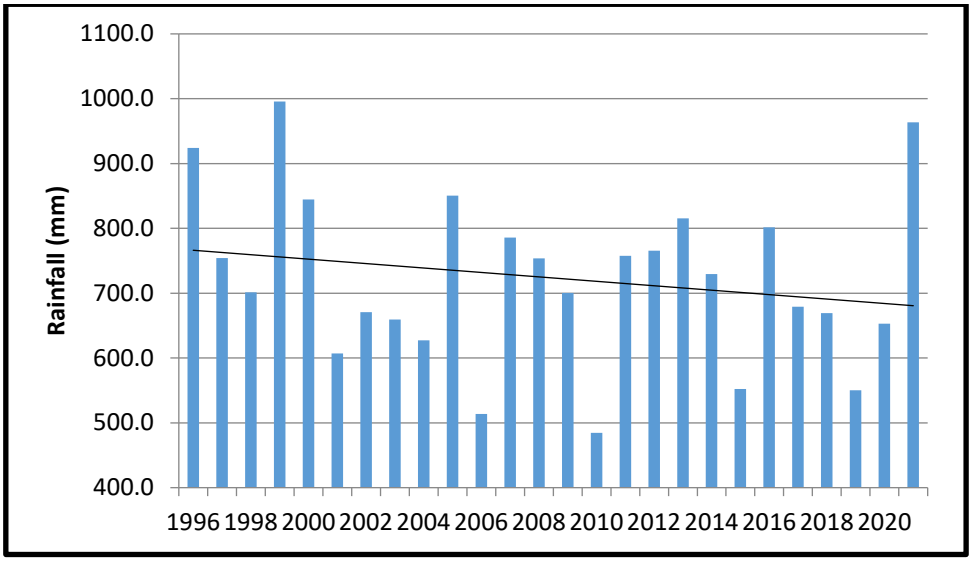


Figure 4 - Total Annual Rainfall at Bunbury (data from BOM (2021))

The monitoring of the molar Na/Cl ratio in groundwater over time assists in determining the position of the TSR salt plume. TSR is rich in soluble chlorides, in particular calcium chloride. As a guide, in nature the molar Na/Cl ratio of waters, be it strongly saline or dilute concentration, approaches 1. Therefore, the TSR salt plume, enriched with chlorides, which moves west to the ocean, will have a low molar Na/Cl ratio (0.2). As the plume is displaced and / or diffused by fresh groundwater flow the molar Na/Cl ratio will approach 1. Refer to graphs in Appendix D. Those monitoring bores up hydraulic gradient of the site, DM1A/C and DM9A/C, show no salt plume, whilst the plume persists in down hydraulic gradient bores of the last filled ponds, DM2A/C, DM4A/C, DM8A/C. DM7A/C, bores down hydraulic of southern ponds, have rising ratios showing the return to background conditions. The southern ponds were decommissioned in 2001 which indicates Na/Cl ratio levels will naturally attenuate after the site ceased operation.

EC and TDS concentrations are also an indicator of the saline leachate plume. These parameters have been declining in all site bores indicating that the generation of saline leachate is reducing since the closure of the facility.

3.3 Yarragadee Bore

The Yarragadee Bore (YB) was sampled quarterly for SWL, pH, electrical conductivity, chloride, sodium, redox potential and radionuclides, and annually for dioxins and furans (see Section 3.4). This data is provided in Appendices D, E and I. Results from 2021 monitoring indicate:

- The Yarragadee aquifer SWL remains between 1.5 to 2.4 m AHD.
- Salinity remains within the ‘marginal’ salinity threshold category of 500 to 1000 mg/L. The long term trend observed regionally is that the aquifer is becoming more saline which corresponds with the lowering rainfall.
- Na/Cl ratio values in the Yarragadee monitoring bore (YB) continue to be aligned with historical values of around 0.7 indicating that connectivity with the shallow contaminated aquifer is minimal and there has been no impact associated with leachate generation from the TSR disposal ponds.

3.4 Dioxins and Furans

A requirement of the Closure Notice is to monitor dioxins and furans annually in bores YB, MB3 and DM8. Refer to Appendix I. Tables (2-4) report the lower, middle and upper boundaries of the data on toxicity

equivalent (TEQ) basis. Variability can be expected at these very low levels and boundaries provide a potential range within each sample.

There were no measureable dioxins or furans (1, 2,3,7,8 PECDD) in the groundwater samples from the monitoring bores (YB, MB3 or DM8A). In 2021 reported values for all congeners were generally reported as less than the level of detection. OCDD in YB in 2020 was higher than historically recorded with a value of 24 pg/kg. However, OCDD is the least toxic of the congeners and the overall sum of the congeners was still low. There has been no evidence of there being any impact from the TSR leachate on the Yarragadee aquifer and this elevated result may be from contamination during the sampling event. 2021 results support this with a value less than the LOR (0.5 pg/L) recorded.

Table 2 - Yarragadee Bore

Sampled YB	Lower Bound pg TEQ/L	Middle Bound pg TEQ/L	Upper Bound pg TEQ/L	OCDD pg/L
Aug 2010	0.00	3.08	6.16	< 9.29
Feb 2011	0.00	3.94	7.89	< 9.29
Aug 2011	0.00	3.00	6.00	< 7.20
Feb 2012	0.00	2.72	5.44	< 4.37
Sept 2012	0.00	2.13	4.26	< 7.34
Feb 2013	0.00	1.95	3.90	< 1.69
Apr 2014	0.00	1.50	3.10	< 9
Apr 2015	0.00	2.70	5.30	< 2
Apr 2016	0.01	0.77	1.5	< 1
Apr 2017	0.00	0.39	0.78	< 0.3
Apr 2018	0.00	0.88	1.8	< 0.5
Apr 2019	0.00	1.1	2.1	< 1.0
Apr 2020	0.022	0.78	1.5	24
Aug 2021	0.00	0.34	0.68	< 0.5

Table 3 - Superficial Groundwater Background Bore

Sampled MB3	Lower Bound pg TEQ/L	Middle Bound pg TEQ/L	Upper Bound pg TEQ/L	1,2,3,7,8 PeCDD pg/L
Aug 2010	0.00	2.54	5.08	< 1.63
Feb 2011	0.00	2.55	5.09	< 1.40
Aug 2011	0.00	2.95	5.90	< 1.82
Feb 2012	0.00	2.19	4.38	< 3.95
Sept 2012	0.00	1.99	3.98	< 1.90
Feb 2013	0.00	2.59	5.19	< 4.51
Apr 2014	0.00	1.2	1.4	< 0.9
Apr 2015	0.00	1.5	3.1	< 1
Apr 2016	0.00	0.72	1.4	< 0.4
Apr 2017	0.00	0.33	0.67	< 0.2
Apr 2018	0.00	0.52	1.0	< 1
Apr 2019	0.011	1.3	2.7	< 0.8
Apr 2020	0	1.3	2.7	< 1
Jun 2021	0.0053	0.42	0.83	< 0.4

Table 4 – Down-gradient Superficial Groundwater Bore (Deep) of the Ponds

Sampled DM8A	Lower Bound pg TEQ/L	Middle Bound pg TEQ/L	Upper Bound pg TEQ/L	1,2,3,7,8 PeCDD pg/L
Aug 2010	0.00	1.86	3.71	< 1.28
Feb 2011	0.00	3.15	6.29	< 1.59
Aug 2011	0.00	2.16	4.33	< 1.44
Feb 2012	0.00	2.52	5.03	< 1.88
Sept 2012	1.32	3.00	4.68	1.32
Feb 2013	0.00	2.57	5.13	< 1.46
Apr 2014	0.00	1.6	3.1	< 0.7
Apr 2015	0.00	2.5	5.0	< 1
Apr 2016	0.00	0.79	1.6	< 0.5
Apr 2017	0.00	0.35	0.88	< 0.3
Apr 2018	0.00	0.7	1.4	< 0.5
Apr 2019	0.00	1.1	2.1	< 0.8
Apr 2020	0.00	0.57	1.1	< 0.3
Aug 2021	0.00	0.61	1.2	< 0.5

3.5 Radiological Monitoring

Independent consultants, Radiation Professionals, conduct an annual survey of the site. A RCWA approved radiation monitoring program has been implemented by Tronox. The annual report (Appendix F) relates to monitoring undertaken during 2021.

The approved radiation monitoring program includes periodic radiation surveys to ensure that the site is returned to natural background radiation levels for the area.

Based on the most recent gamma dose rate-in-air, the results clearly show that the gamma radiation levels are consistent with the natural background gamma radiation levels expected in the area and pose no radiological health issues to the public or the environment.

The average gamma dose rate for the rehabilitated area was 0.15 µGy/h. The results are comparable to last years' results and are typical for the background gamma dose rate levels for the Perth Coastal Plain.

For the period from October 2020 to August 2021, all radon results are less than Minimum Analysis Level (MAL), i.e. <15 to <30 Bq/m^3 with one exception for the January to May 2021 period at location 7 (RM5) of 24 ± 10 Bq/m^3. The thoron results are also less than the MAL, with two exceptions:

- for the January to May 2021 period at location 13 (RM3) of 70 ± 22 Bq/m^3
- for the May to August 2021 period at location 7 (RM5) of 43 ± 22 Bq/m^3.

The three measurements of activity concentrations that were greater than MDL have large measurement errors, and the measured activity concentrations are only slightly above the MDL.
The data do not provide an indication of long-term elevation in the radon and thoron levels for the Dalyellup Rehabilitation area. The results for 2020-2021 indicate that radon and thoron activity concentration levels are low and would pose no radiological health issues to the public (Radiation Professionals 2021).

The groundwater sampling results for 2021 are comparable to previous years and they continue to remain below the National Drinking Water Guidelines recommended screening concentration for gross alpha activity or gross beta activity of 0.5 Bq/L (500mBq/L) (Radiation Professionals 2021).

The highest recorded activity concentration for Ra-226 in 2021 was 0.14 Bq/L for bores DM9C. The highest recorded activity concentration for Ra-228 in 2021 was 0.8 Bq/L for bore DM9C and all other measurements were less than the MDL of 0.18 Bq/L.

Data gathered during the groundwater monitoring program for 2021 suggests that there is no leaching of radionuclides into the surrounding areas (Radiation Professionals 2021).

The RCWA have reiterated that the radiological risk to the community is low and does not support a buffer zone to the east of the site.

4.0 LICENCE COMPLIANCE & INCIDENTS

4.1 Operating Licence

The site operated under Closure Notice for Licence 6130/1989/12. The degree of compliance is summarised in Table 5. All groundwater monitoring results for monitoring required by the Closure Notice were recorded in Tronox's environmental database ESDAT, and provided in Appendix D.

Background monitoring bore, MB4, was vandalised during late 2018. This bore had been refurbished and sampling recommenced in 2019. The bore was vandalised again during 2020 and samples were not able to be collected after the January 2020 monitoring event. The bore is located outside of the TSR disposal facility in a publically accessible area. This limits Tronox's ability to continuously maintain the security/integrity of this bore. The bore is on the beach's high water mark and subject to interference. There have been five instances of the bore being vandalised since 1989.

4.2 Incidents

There were no environmental incidents or community complaints recorded for the Dalyellup site during the 2021 reporting period.

Table 5 - Compliance with Closure Notice

	Licence Requirement	Comment	Compliance
1.1.1	The Person to Whom this Notice is Given shall undertake the monitoring in Table 1.1.1 according to the specifications of that Table.	Monitoring of the required parameters was undertaken at the intervals outlined in Table 1.1.1.	✓
1.1.2	The Person to Whom this Notice is Given shall ensure that: (a) All samples required by Table 1 are collected and preserved in accordance with AS/NZS 5667.1; (b) All sampling required by Table 1 is conducted in accordance with AS/NZS 5667.11; (c) All samples are submitted to a laboratory with current NATA accreditation for the parameters to be analysed; (d) The limit of detection of analysis for all samples is: (i) One order of magnitude below the relevant ANZECC guideline; or (ii) Where the laboratory cannot routinely achieve a limit of detection one order of magnitude below the relevant ANZECC guideline, the lowest limit of detection; (e) Quarterly monitoring is undertaken at least 45 days apart, with the first round of sampling to commence in Q3 2013 (i.e. 1 July to 30 September 2013); (f) Six monthly monitoring is undertaken at least 5 months apart, with the first round of sampling to commence between 1 July and 31 December 2013; and (g) Annual monitoring is undertaken at least 9 months apart, with the first round of sampling to commence prior to 1 July 2014.	As above. See Appendix G Site Management Plan detailing the groundwater sampling requirements the consultant implements. All samples sent to ALS, ChemCentre (WA) and Western Radiation Services. Analysis is to the lowest detection limits possible. See Appendix D. Quarterly sampling taken on 26 January, 7-11 June, 12-19 August and 18-21 October 2021. Bi-annual sampling taken on 7-11 June and 18-21 October 2021. Dioxins and Furans sampling completed April 2018, 2019 and 2020 and August 2021.	✓
1.2.1	The Person to Whom this Notice is Given shall prepare a biennial hydrogeological report on groundwater beneath the Premises, covering the period 4 March 2013 to 4 March 2015.	Refer to AER 2015, 2016 and 2017 Appendix G.	✓
1.2.2	The Person to Whom this Notice is Given shall ensure the hydrogeological report referred to in paragraph 1.2.1 of this Notice includes:	Refer to AER 2015, 2016 and 2017 Appendix G.	✓

	Licence Requirement	Comment	Compliance
	(a) Assessment of groundwater quality below and down, gradient from the Premises and compared to background groundwater quality; (b) Assessment of any contaminant plume size, movement and distribution of contaminant concentrations from below the disposal ponds to the near shore groundwater discharge zone; and (c) A characterisation of the interaction between the treated solid residue and the groundwater, more specifically being: (I) The geochemical interactions between leachate, underlying soils and groundwater; (ii) Contaminant transport rates; and (iii) Contaminant migration pathways.		
1.2.3	The Person to Whom this Notice is Given shall submit the hydrogeological report referred to in paragraph 1.2.1 of this Notice to DWER at the Contact Address by 5pm on 1 July 2015.	Accompanied the Annual Report that was delivered to the DWER offices in Bunbury before the due date.	✓
2.1.1	The Person to Whom this Notice is Given shall undertake the monitoring in Table 2.1.1 according to the specifications of that Table whilst the ponds remain uncovered.	Dust monitoring not required during 2021 as the ponds were covered in September 2013.	✓
2.1.2	The Person to Whom this Notice is Given shall ensure dust sampling equipment is co-located and sited in compliance with AS/NZS 3580.1.1 :2007.	Dust monitoring not required during 2021 as the ponds were covered in September 2013.	✓
3.1.1	3.1.1 The Person to Whom this Notice is Given shall submit to DWER at the Contact Address an annual report on the implementation of the requirements of this Notice by 30 June 2014, and by 30 June in each subsequent year.	Compliant with this condition. Annual report submitted before 30 June.	✓
3.1.2	The report referred to in paragraph 3.1.1 of this Notice shall include: (a) Annual monitoring data and other collected data required by any clause in this Notice; and (b) Interpretation and appraisal of the annual monitoring results against: (i) background water quality below and down-gradient from the Premises and compared against background groundwater quality found up gradient of the Premises and against relevant ANZECC	Contained in Appendices D, E and I. See AER 2017 Appendix G.	✓

	Licence Requirement	Comment	Compliance
	guidelines for water quality, historical data, the surrounding environment and other beneficial users; and		
	(ii) NEPM standard of 50 µg/m^3 for PM_{10} (24-hour average) and WHO Guideline of 120 µg/m^3 for TSP (24-hour average).The Licensee shall take representative samples of the TSR solid and TSR filtrate prior to the waste being brought to the Premises for disposal at quarterly intervals.	Not required. See condition 2.1.1.	

5.0 MINISTERIAL CONDITIONS & COMPANY COMMITMENTS

TRONOX operates its Dalyellup solid waste disposal facility in accordance with Company Commitments and Ministerial Statements 213 and 332. Compliance with these conditions and commitments is discussed below (Table 6 and Table 7).

Table 6 - Compliance with Ministerial Conditions

Commitment		Action Taken	Outcome
332:M1 Commitments	Fulfil the commitments (which are not inconsistent with the conditions or procedures contained in the Minister's statement)	Tronox has undertaken the requirements that currently apply.	Full compliance.
332:M2:1 Implementation	Adhere to the proposal as amended (via Statement 332) in accordance with any designs, specifications, plans or other technical material submitted by the proponent to the DWER.	Tronox has implemented the proposal as submitted.	Site operated effectively.
332:M2:2 Minor amendments	Seek approval for modifications to the proposal by detailing changes to design, specifications, plans or technical material.	Tronox to notify DWER of any changes. Closure plans sent to OEPA and other key stakeholders. OEPA satisfied with Closure Plan in February 2015. Closure Plan was updated in July 2018 and sent to OEPA once the sport fields' option was not part of the Shire of Capel's short term plans.	Remaining ponds covered with clean fill. Final end use confirmed. Revised Closure Plan waiting for Radiological Council to respond to OEPA's request for comment.
213:M3 Compliance Audit Report	Prepare "Annual Compliance Report"	Contained in this report	Fully compliant. Refer to Table 5.
332:M4:1 Rehabilitation	Prepare a final rehabilitation programme.	Tronox submitted a staged rehabilitation management program in October 2001. The DWER, Radiological Council and Shire of Capel approved the plan. Preliminary plan was submitted in September 2012. A Final Closure Rehabilitation Plan was sent June 2013 and updated in July 2018.	Final Closure Rehabilitation Plan requires the completion of the Contaminated Sites risk assessment which was progressed further in 2015. OEPA approved Final Closure Rehabilitation Plan in February 2015.

Commitment		Action Taken	Outcome
332:M4:2 Rehabilitation	Implement the rehabilitation programme	Tronox has implemented the first stage of the program as specified in the Staged Rehabilitation Management Program. Final Closure Rehabilitation Plan is being implemented.	Vegetation surveys and dune subsidence surveys conducted in 2003 and 2004. 2009 visual inspections revealed continued success in rates of plant growth. The remaining ponds were covered with clean fill in September 2013. Native rehabilitation has been selected as a post-closure land use in consultation with Capel Shire and DWER. Revegetation of the remaining ponds commenced in 2018 with seeding occurring in 2018. Further infill planting and seeding has since been undertaken.
213:M5 Proponent	Seek approval for transfer of proponent	Although Tronox has acquired Cristal Pigment Australia Ltd the ABN remains unchanged.	Tronox will comply, when or if appropriate.
332:M6:1 Site management	Operate and maintain the waste disposal site to protect the environment from unacceptable environmental impacts	Tronox complies with this condition through regular groundwater and radiation monitoring, dust, geochemical and geotechnical research and by following operational control procedures documented in the SMP and Radiation Management Plan, DWER licence and Closure Notice	Refer to 2021 Annual Environmental Report and future AERs for ongoing monitoring and assessment.
332:M6:2 Site management	Extent of disposal. Ensure that disposal occurs within the existing lease boundary and does not encroach on the primary dunes and is limited to a fill height of no more than RL24.	Design for disposal ponds show only areas to the east of the primary dunes will be utilised. Tronox will comply with fill height of RL24.	Validation report on the rehabilitated site in January 2014 has confirmed, from core logs, that the fill coverage on top of the mud is 3-4 m and mud level is below the RL24 mark across the site.
332:M6:3 Site management	Only dispose of waste from own operations	Only TSR produced at Tronox was disposed at the site.	Full compliance.

Table 7 - Compliance with Company Commitments

Commitment		Action Taken	Outcome
P1	The groundwater monitoring and reporting program will continue. This will be combined with ongoing investigations, including solute transport modelling to improve the understanding of the disposal technique.	Groundwater monitoring, radiation monitoring was conducted to schedule in 2021. Reporting as required. Biennial Hydrogeological Report submitted to DWER in June 2015.	Whilst the plume persists in down hydraulic gradient bores of the last filled ponds, DM2A/C, DM4A/C, DM8A/C. DM7A/C, bores down hydraulic of southern ponds, have rising Na/Cl ratios showing the return to background conditions. The southern ponds were decommissioned in 2001 which indicates Na/Cl ratio levels are naturally attenuating. EC and TDS concentrations are declining in all bores down hydraulic gradient of the ponds.
P2	Existing topsoil removal practices will be continued to ensure that windblown dust remains under control.	Stockpiled topsoil is appropriately located and germinating seed in the soil alleviates dust problems. "Hydromulch" paper mulch and grass seed was sprayed onto the stockpile at various times (last time in November 2013).	Full compliance. No dust issue at the site. No community complaints relating to dust since project inception.
P3	Radiation monitoring and reporting program will continue.	Radiation monitoring program carried out by Radiation Professionals.	Full compliance. Refer 2021 Annual Radiation Monitoring Report (Appendix F).

Commitment		Action Taken	Outcome
P4	At the end of the disposal period the proponent will cause the disposal site to be rehabilitated to the satisfaction of the Shire of Capel and the DWER.	Tronox submitted a staged rehabilitation management program in October 2001. The DWER, Radiological Council and Shire of Capel approved the plan. Preliminary plan was submitted in September 2012. A Closure Rehabilitation Plan was sent June 2013 and approved by Shire, RCWA, DWER, and OEPA. Shire of Capel in May 2017 formally endorsed the rehabilitation back to natural vegetation on the remaining part of the site. An updated Closure Rehabilitation Plan was then sent to OEPA in July 2018.	First stage of the programme completed in 2002 with the successful rehabilitation of the southern ponds. The remaining ponds were covered with clean fill in September 2013. Native rehabilitation has been selected as a post-closure land use in consultation with Capel Shire and DWER. Revegetation of the remaining ponds commenced in 2018 with seeding occurring in 2018. Further infill planting and seeding has since been undertaken.
P5	The proponent will continue Research and Development Studies into methods of waste minimisation and modification including further salinity reductions. This will include further studies of the materials properties and possible uses.	A waste minimisation plant was commissioned in December 1992. This has substantially reduced the quantity of residue solids. A system for washing the solids prior to disposal was also developed. Tronox has investigated the solid waste as a soil condition capping and road base material and bricks. Also HCl (nominally 15,000 tonnes/year) which is a by-product in the manufacturing process has been sold commercially rather than neutralised with lime. New Facility at Cleanaway's Banksia Road site at Dardanup has a leachate recovery circuit with leachate now returned to Tronox's Kemerton plant for further waste treatment.	Tronox has actively pursued co-product developments with external parties, however no economically viable options were found. Ceased operations at the site in 2013. Continue to run the waste minimisation plant at Kemerton. Feasibility study to extract minerals of value by third parties to be pursued.
P6	The proponent will continue actively pursuing alternative methods of waste disposal.	Tronox has found an alternative residue disposal site. The site is fully lined and has a leachate recovery circuit.	Full compliance.

Appendix A
Closure Notice

Government of **Western Australia**
Department of **Environment Regulation**

Your ref: L6130/1989/12
Our ref: 2013/000411
Enquiries: Daniel Hartnup
Phone: 9724 6124
Fax: 9725 4300
Email: daniel.hartnup@der.wa.gov.au

The Manager
Cristal Pigment Australia Ltd
Locked Bag 245
BUNBURY WA 6230

ATTN: Mr Peter Allen

Dear Mr Allen

***ENVIRONMENTAL PROTECTION ACT 1986* – CLOSURE NOTICE**

Dalyellup Waste Residue Disposal Facility
Lot 9077 on Plan 60716
DALYELLUP WA 6230
Lic No. 6130/1989/12

The Department of Environment Regulation (DER) hereby serves a Closure Notice on the Dalyellup Waste Residue Disposal Facility on Thursday, 1 August 2013, which supersedes the Notice served on facility on Thursday, 9 May 2013.

A copy of the Closure Notice is attached.

The premises in question is described as:

Whole of Lot 9077 on Deposited Plan 60716 – Certificate of Title Volume 2717 and Folio 207.

Pursuant to Section 68A(10) of the *Environmental Protection Act 1986*, I have delivered copies of this Notice to the Western Australian Planning Commission and the Western Australian Land Information Authority for registration.

Please be advised this Notice will be reviewed by DER after 1 October 2015.

Yours sincerely

Alan Sands
Director Environmental Regulation Division
Department of Environment Regulation

Thursday, 1 August 2013

Environmental Protection Act 1986

Section 68A

CLOSURE NOTICE

The Authorisation to which this Notice relates:

Licence number 6130/1989/12 issued on 21 January 2010 and which expired on 3 March 2013.

("the Authorisation")

The Person to Whom this Notice is Given:

(Being the person who held the Authorisation in relation to the Premises described below)

Cristal Pigment Australia Ltd
(ACN: 008 683 627)
4 Old Coast Road
AUSTRALIND in the state of Western Australia

("Person to Whom This Notice is Given")

Premises to which this Notice relates:

The Dalyellup waste residue disposal site located on Lot 9077 on Plan 60716, Maidment Parade, Dalyellup in Western Australia and being more particularly described as:

Lot 9077 on Plan 60716 – Certificate of Title Volume 2717 and Folio 207, being the area defined in the Premises Map in Schedule 1 of this notice."

("the Premises")

Reason for which this Notice is served:

This notice is issued as a result of something that has happened at the Premises before the expiry of the Authorisation, namely, the disposal of treated solid residue from the production of titanium dioxide pigment, before the expiry of the Authorisation. Ongoing monitoring is required at the Premises following the expiry of the Authorisation.

Requirements of this Notice:

1.1 Groundwater monitoring

1.1.1 The Person to Whom this Notice is Given shall undertake the monitoring in Table 1.1.1 according to the specifications of that Table.

Table 1.1.1: Monitoring of groundwater			
Monitoring point reference and location on Map of Monitoring Points in Schedule 1	**Parameter**	**Units**	**Frequency**
YB	standing water level	m (AHD)	Quarterly
	pH	pH unit	
	electrical conductivity	µS/cm	
	chloride	mg/L	
	sodium	mg/L	
	redox potential	mV	
	radionuclides	Bq/L	
MB3, MB4, DM1A(R), DM1C(R), DM2A DM2C, DM4A(R), DM4C(R), DM7A(R), DM7C, DM8A, DM8C(R), DM9A, DM9C	standing water level	m (AHD)	Six monthly
	pH	pH unit	
	electrical conductivity	µS/cm	
	total dissolved solids, bicarbonate, boron, calcium, cadmium, carbonate, chromium, chromium (III)[1], chromium (VI), cobalt, copper, chloride, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, nitrate-nitrogen, potassium, sodium, sulphate, vanadium	mg/L	
	radionuclides	Bq/L	
YB, MB3, DM8	dioxins and furans	pg/L	Annually

Note 1: Can be reported as the difference between Cr and Cr(VI)

1.1.2 The Person to Whom this Notice is Given shall ensure that:

(a) all samples required by Table 1 are collected and preserved in accordance with AS/NZS 5667.1;

(b) all sampling required by Table 1 is conducted in accordance with AS/NZS 5667.11;

(c) all samples are submitted to a laboratory with current NATA accreditation for the parameters to be analysed;

(d) the limit of detection of analysis for all samples is:

(i) one order of magnitude below the relevant ANZECC guideline; or

(ii) where the laboratory cannot routinely achieve a limit of detection one order of magnitude below the relevant ANZECC guideline, the lowest limit of detection;

(e) quarterly monitoring is undertaken at least 45 days apart, with the first round of sampling to commence in Q3 2013 (i.e. 1 July to 30 September 2013);

(f) six monthly monitoring is undertaken at least 5 months apart, with the first round of sampling to commence between 1 July and 31 December 2013; and

(g) annual monitoring is undertaken at least 9 months apart, with the first round of sampling to commence prior to 1 July 2014.

1.2 Hydrogeological report

1.2.1 The Person to Whom this Notice is Given shall prepare a biennial hydrogeological report on groundwater beneath the Premises, covering the period 4 March 2013 to 4 March 2015.

1.2.2 The Person to Whom this Notice is Given shall ensure the hydrogeological report referred to in paragraph 1.2.1 of this Notice includes:

(a) assessment of groundwater quality below and down gradient from the Premises and compared to background groundwater quality;

(b) assessment of any contaminant plume size, movement and distribution of contaminant concentrations from below the disposal ponds to the near shore groundwater discharge zone; and

(c) a characterisation of the interaction between the treated solid residue and the groundwater, more specifically being:

(i) the geochemical interactions between leachate, underlying soils and groundwater;

(ii) contaminant transport rates; and
(iii) contaminant migration pathways.

1.2.3 The Person to Whom this Notice is Given shall submit the hydrogeological report referred to in paragraph 1.2.1 of this Notice to DER at the Contact Address by 5pm on **1 July 2015**.

2.1 Dust monitoring

2.1.1 The Person to Whom this Notice is Given shall undertake the monitoring in Table 2.1.1 according to the specifications of that Table whilst the ponds remain uncovered.

Table 2.1.1: Monitoring of dust emissions

Monitoring point reference	Parameter	Standard	Frequency
D1, D2	TSP	AS/NZS 3580.9.3:2003	One 24-hour sample taken every 6 days starting October 2013 and subsequently 1 October to 31 March, inclusive
	PM_{10}	AS/NZS 3580.9.6:2003	

2.1.2 The Person to Whom this Notice is Given shall ensure dust sampling equipment is co-located and sited in compliance with AS/NZS 3580.1.1:2007.

3.1 Reporting

3.1.1 The Person to Whom this Notice is Given shall submit to DER at the Contact Address an annual report on the implementation of the requirements of this Notice by 30 June 2014, and by **30 June** in each subsequent year.

3.1.2 The report referred to in paragraph 3.1.1 of this Notice shall include:
(a) annual monitoring data and other collected data required by any clause in this Notice; and
(b) interpretation and appraisal of the annual monitoring results against:
(i) background water quality below and down gradient from the Premises and compared against background groundwater quality found up gradient of the Premises and against relevant ANZECC guidelines for water quality, historical data, the surrounding environment and other beneficial users; and
(ii) NEPM standard of 50 $\mu g/m^3$ for PM_{10} (24-hour average) and WHO guideline of 120 $\mu g/m^3$ for TSP (24-hour average).

4.1 Interpretation

4.1.1 In this Notice, definitions from the *Environmental Protection Act 1986* apply unless the contrary intention appears.

4.1.2 For the purposes of this Notice, unless the contrary intention appears:

"AHD" means the Australian height datum;

"annual" means the inclusive period from 1 April until 31 March in the following year;

"AS 3580.9.3" means the Australian Standard AS 3580.9.3 *Methods for sampling and analysis of ambient air - Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method;*

"AS 3580.9.6" means the Australian Standard AS 3580.9.6 *Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM_{10} high volume sampler with size - selective inlet – Gravimetric method;*

"AS/NZS 5667.1" means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance of the Design of sampling programs, sampling techniques and the preservation and handling of samples;*

"AS/NZS 5667.11" means the Australian Standard AS/NZS 5667.11 *Water Quality – Sampling – Guidance on sampling of groundwaters;*

"ANZECC" means the Australian and New Zealand Environment Conservation Council (ANZECC) which was a Ministerial Council operating between 1991 and 2001 and which provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues; ANZECC issued a series of Guidelines such as the ANZECC Guidelines for Fresh and Marine Water Quality 2000;

"Bq/L" means becquerel per litre;

"Contact Address" for the purpose of correspondence and advice means:
Regional Leader, South West Region
Department of Environment Regulation
PO Box 1693
BUNBURY WA 6231
Telephone: (08) 9725 4300
Facsimile: (08) 9725 4351
Email: southwestregion.industryregulation@der.wa.gov.au;

"NATA" means the National Association of Testing Authorities, Australia;

"NATA accredited" means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis;

"pg/L" means picogram per litre;

"PM" means total particulate matter including both solid fragments of material and miniscule droplets of liquid;

"PM_{10}" means particles with an aerodynamic diameter of less or equal to 10 µm;

"quarterly" means the 4 inclusive periods from 1 January to 31 March, 1 April to 30 June, 1 July to 30 September and 1 October to 31 December in the same year;

"six monthly" means the 2 inclusive periods from 1 January to 30 June and 1 July to 31 December in the same year;

"spot sample" means a discrete sample representative at the time and place at which the sample is taken;

"TSP" means total suspended particles each having an equivalent aerodynamic diameter of less than 50 micrometres; and

"µS/cm" means microsiemens per centimetre.

.....
Alan Sands
Director Environmental Regulation Division
Department of Environment Regulation

1 August 2013

IMPORTANT NOTE: **A PERSON WHO IS BOUND BY THIS NOTICE AND WHO DOES NOT COMPLY WITH THIS NOTICE COMMITS AN OFFENCE.**

A person who is aggrieved by a requirement contained in this Notice may within 21 days of being given this Notice

lodge with the Minister for Environment an appeal in writing setting out the grounds of that appeal.

Any other person who disagrees with a requirement contained in this Notice may within 21 days of the making of that requirement lodge with the Minister for Environment an appeal in writing setting out the grounds of that appeal.

PENDING THE DETERMINATION OF AN APPEAL REFERRED TO ABOVE THE RELEVANT REQUIREMENTS CONTAINED IN THIS NOTICE CONTINUE TO HAVE EFFECT.

Schedule 1: Maps

Premises Map and Map of Monitoring Locations

The Premises and the locations of the monitoring points defined in Tables 1.1.1 and 2.1.1 is shown in the map below. The red line depicts the Premises Boundary. The green and blue dots depict the groundwater and dust monitoring locations, respectively.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

FILE No.

TO: REGISTRAR OF TITLES
REGISTRAR OF DEEDS AND TRANSFERS

NOTIFICATION

ENVIRONMENTAL PROTECTION ACT 1986 (EPA)

~~**ENVIRONMENTAL PROTECTION NOTICE (EPA Sec 65);**~~

CLOSURE NOTICE (EPA Sec 68A); or

~~**VEGETATION CONSERVATION NOTICE (EPA Sec 70)**~~

(Delete notices that are not applicable by putting a single line through them)

DESCRIPTION OF LAND	EXTENT	VOLUME	FOLIO
Lot 9077 on Deposited Plan 60716	Whole	2717	207

REGISTERED PROPRIETOR OF LAND

Cristal Pigment Australia Ltd (ACN: 008 683 627)

NOTICE GIVEN TO REGISTERED PROPRIETOR

I certify that the notice attached to this Notification is a true copy of:

~~An Environmental Protection Notice given to the Registered Proprietor pursuant to EPA Sec 65;~~

A Closure Notice given to the Registered Proprietor pursuant to EPA Sec 68A;

~~A vegetation Notice given to the Registered Proprietor pursuant to EPA Sec 70.~~

(Delete the sections which are not applicable by putting a single line through them)

DATED THIS FIRST DAY OF AUGUST 20 13

SIGNED BY:

Signature

ALAN DONALD SANDS

Print Full Name:

DELEGATE OF
THE CHIEF EXECUTIVE OFFICER
UNDER SECTION 20 OF THE *ENVIRONMENTAL PROTECTION ACT 1986*

OFFICE USE ONLY

NOTIFICATION

ENVIRONMENTAL PROTECTION ACT 1986

LODGED BY: Alan Sands

ADDRESS: The Atrium, Level 4
168 St Georges Tce
PERTH WA 6000

PHONE No. 6467 5300

FAX No. 6467 5562

PREPARED BY:
Daniel Hartnup, South West Region

INSTRUCT IF ANY DOCUMENTS ARE TO ISSUE TO OTHER THAN LODGING PARTY

Nil

TITLES, LEASES, DECLARATIONS ETC LODGED HEREWITH

1. _____ Received Items
2. _____
3. _____ Nos.
4. _____
5. _____ Receiving Clerk
6. _____

EXAMINED

Registered/Lodged pursuant to the provisions of the *TRANSFER OF LAND ACT 1893* as amended on the day and time shown above and particulars entered in the Register.

Landgate

THE GOVERNMENT OF WESTERN AUSTRALIA

Appendix B
Ministerial Statements

Ass # 625

Bull # 589

State # 213

WESTERN AUSTRALIA

MINISTER FOR THE ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

CONTINUED USE OF SCM SOLID RESIDUE DISPOSAL SITE AT DALYELLUP, FROM MARCH 1992 TO MARCH 1994 (625)

SCM CHEMICALS LTD

This proposal may be implemented subject to the following conditions:

1. In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review, September 1991 (A copy of the commitments is attached).

2. Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3. Prior to 30 June each year, the proponent shall prepare and submit an audit report which addresses the following:
   1. environmental performance of the existing site;
   2. progress towards finding an alternative; and
   3. compliance with the conditions of this statement,

   to the satisfaction of the Environmental Protection Authority.

4. The proponent shall be responsible for decommissioning and removal of the plant and installations and rehabilitating the site and its environs, to the satisfaction of the Environmental Protection Authority. At least six months prior to decommissioning, the proponent shall prepare and subsequently implement a decommissioning and rehabilitation plan, to the satisfaction of the Environmental Protection Authority.

5. No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

Published on

23 JAN 1992

18th FLOOR, ALLENDALE SQUARE, 77 ST GEORGE'S TERRACE, PERTH, W.A. 6000 TELEPHONE 325 9422 FAX. 325 5621

Procedure

The operation of this site is currently subject to conditions of a licence issued under the provisions of Part V of the Environmental Protection Act. The continued operation of this site will be subject to the licensing requirements of the Environmental Protection Act.

Bob Pearce, MLA
MINISTER FOR THE ENVIRONMENT

22 JAN 1992

COMMITMENTS:

The proponent has made the following commitments in relation to this proposal.

1. The existing groundwater monitoring and reporting programme will continue. This will be combined with ongoing investigations, including solute transport modelling to improve understanding of the disposal technique.

2. Existing topsoil removal practices will be continued to ensure that wind blown dust remains under control.

3. The existing radiation monitoring and reporting programme will continue.

4. At the end of the disposal period the proponent will cause the disposal site to be rehabilitated to the satisfaction of the Shire of Capel and the EPA.

5. The proponent will continue Research and Development studies into methods of waste minimisation and modification including further salinity reductions. This will include further studies of the materials properties and possible uses.

6. The proponent will continue actively pursuing alternative methods of waste disposal.

WESTERN AUSTRALIA

MINISTER FOR THE ENVIRONMENT

STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL (PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE ENVIRONMENTAL PROTECTION ACT 1986)

PROPOSAL: CONTINUED USE OF SCM SOLID RESIDUE DISPOSAL SITE AT DALYELLUP, FROM MARCH 1992 TO MARCH 1994 (625/824)

CURRENT PROPONENT: SCM CHEMICALS LTD

CONDITIONS SET ON: 22 JANUARY 1992

Conditions 1, 2 and 4 are amended to read as follows:

1 Proponent Commitments

In implementing the proposal, including the proposed amendment to continue using the site beyond March 1994 as reported on in Environmental Protection Authority Bulletin 706, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review, September 1991. (A copy of the commitments is attached.)

2 Implementation

Subject to the conditions in this amended statement, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

4 Rehabilitation

The satisfactory rehabilitation of the site is the responsibility of the proponent.

4-1 At least six months prior to any planned decommissioning of the site, the proponent shall prepare a final rehabilitation programme to the requirements of the Radiological Council and the Environmental Protection Authority on advice of the Shire of Capel.

4-2 The proponent shall implement the programme required by condition 4-1.

Published on

-9 DEC 1993

12th FLOOR DUMAS HOUSE 2 HAVELOCK STREET WEST PERTH 6005 TELEPHONE (09) 321 2222 FAX (09) 322 1598

The following condition is inserted following condition 5:

6 Management of the Site

6-1 The proponent shall operate and maintain the waste disposal site to protect the environment from unacceptable environmental impacts.

6-2 The proponent shall ensure that disposal occurs within the existing lease boundary, does not encroach on the primary dune system, and is limited to a fill height of no more than RL 24.

6-3 The proponent shall only dispose of waste from its own operations.

The procedure is amended to read as follows:

Procedure

1 The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other government agency.

2 If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

3 The operation of this site is currently subject to conditions of a licence issued under the provisions of Part V of the Environmental Protection Act. The continued operation of this site will be subject to the licensing requirements of the Environmental Protection Act.

Kevin Minson MLA
MINISTER FOR THE ENVIRONMENT

8 DEC 199

PROPONENT'S COMMITMENTS

CONTINUED USE OF SCM SOLID RESIDUE DISPOSAL SITE AT DALYELLUP (625/824)

SCM CHEMICALS LTD

COMMITMENTS

The proponent has made the following commitments in relation to this proposal.

1. The existing groundwater monitoring and reporting programme will continue. This will be combined with ongoing investigations, including solute transport modelling to improve understanding of the disposal technique.

2. Existing topsoil removal practices will be continued to ensure that wind blown dust remains under control.

3. The existing radiation monitoring and reporting programme will continue.

4. At the end of the disposal period the proponent will cause the disposal site to be rehabilitated to the satisfaction of the Shire of Capel and the EPA.

5. The proponent will continue Research and Development studies into methods of waste minimisation and modification including further salinity reductions. This will include further studies of the materials properties and possible uses.

6. The proponent will continue actively pursuing alternative methods of waste disposal.

Appendix C
Monitoring Bore Construction Data

Bore	Date Drilled	ELEVATION		COMPLETION DETAILS					CO-ORDINATES (MGA)	
		Ground Level (m AHD)	Top Casing (m AHD)	Depth Drilled (m bns)	Drilled Diameter (mm)	Casing ID (mm)	Slotted Intervals (m bns)	Decommiss	Eastings	Northings
MB1	03.11.88	28.74	29.57	31	127	50	24.8 – 30.8	Feb-01		
MB2	04.11.88	23.8	24.67	32.5	127	50	20.5 – 32.3	Feb-01		
MB3	06.11.88	14.19	14.99	26	127	50	16.7 – 25.7	Feb-01		
MB4	10.11.88	3.57	**5.13	16.2	127	50	2.2 – 16.2		370245.4	6303905.3
MB1(R)	23.11.00	26.11	24.12	33	155	100	27.0 – 33.0	May-04	370669.9	6303957.3
MB2(R)	23.11.00	25.85	24.06	32	155	100	25.5 – 31.5	May-04	370578.8	6303984.0
MB3(R)	22.11.00	27.23	25.9	34.5	155	100	28.0 – 34.0		370416.8	6304040.3
DM1A(R)	15.12.92	40.05	40.75	50	168	80	45.0 – 48.0		370835.2	6304509.4
DM1C(R)	15.12.92	40.06	40.71	43	168	80	39.0 – 42.0		370835.0	6304508.1
DM2A	27.02.89	24.489	25.217	35.3	168	100	27.0 – 30.0		370522.2	6304510.7
DM2C	27.02.89	24.614	25.305	26.5	168	100	23.5 – 25.5			
DM3A*	03.03.89	22.53	22.83	32.1	168	100	25.0 – 28.0	May-02		
DM3C*	03.03.89	22.685	22.915	25.5	168	100	21.5 – 24.5	May-02		
DM4A(R)	13.02.89	3.643	4.444	12.5	168	100	9.5 – 12.5		370365.0	6304364.7
DM4C®	13.02.89	3.698	4.497	7	168	100	3.0 – 6.0		370365.2	6304365.9
DM5A	14.05.91	20.473	21.123	30.68	168	100	25.0 – 28.0	May-03	370534.6	6304241.2
DM5C	14.05.91	20.321	21.021	21.8	168	100	18.8 – 20.8	May-03	370535.4	6304242.4
DM7A	26.05.92	20.497	21.347	30.8	168	100	26.0 – 29.0		370479.8	6304180.9
DM7C	27.05.92	20.473	21.323	23	168	100	19.0 – 22.0		370479.7	6304182.4
DM8A	23.7.96	25.7	26.19	36		100	32-36		370506.7	6304411.8
DM8C	23.7.96	25.7	26.19	28		100	24-28		370506.9	6304410.2
DM9A	23.7.96	33.8	34.35	46		100	42-46		370766.3	6304210.4
DM9C	23.7.96	33.8	34.28	28		100	24-28		370765.8	6304209.1
PB1+	14.03.89	23.935	24.188	72.1	254	155	63.14 – 72.10			
YB	24.3.05		27.2	72		100	66 - 72		370516	6304473

Note: m bns - metres below natural surface

* - 1m of casing cut off for access January 1994

** - top of casing level, prior to surface casing being re-set

\+ - bore decommissioned and cement grouted to surface

				Alkalinity by PC Titrator	Inorganic		Nitrite and Nitrate as N (NOx)	Sulfate (Turbidimetric) as SO4	Field			Inorganics															Lead	Metals																					Radionuclides	
			Carbonate as CaCO3	Carbonate Alkalinity as CaCO3	Na:Cl molar ratio	Na:Cl molar ratio (Filtered)	Nitrite + Nitrate as N	Sulfate as SO4 - Turbidimetric (Filtered)	EC (field)	pH (Field)	Temp (field)	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Anions Total	Alkalinity (Bicarbonate as CaCO3)	Cations Total	Chloride	Ionic Balance	Nitrate (as N)	Nitrite (as N)	Redox Potential	Sodium	Sodium (Filtered)	Sulphate	TDS (evap)	Thorium (Filtered)	Lead Total (Filtered)	Arsenic (Filtered)	Boron (Filtered)	Cadmium (Filtered)	Calcium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium Total (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)	Cobalt (Filtered)	Copper Total (Filtered)	Iron (Filtered)	Magnesium (Filtered)	Manganese (Filtered)	Mercury	Mercury (Filtered)	Molybdenum (Filtered)	Nickel (Filtered)	Potassium (Filtered)	Uranium (Filtered)	Vanadium Total (Filtered)	Radium-226	Radium-228
			mg/L	mg/L	ratio	ratio	mg/L	mg/L	µS/cm	pH	oC	µg/L	mg/L	meq/L	mg/L	meq/L	mg/L	%	mg/L	mg/L	mV	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mBq/L	mBq/L
EQL			1	1		0.1	0.01	1				1000	1	0.01	1	0.01	1	0.01	0.01	0.01		1	0.1	1	10	0.1	0.0001	0.0002	0.005	0.00005	0.1	0.001	0.01	0.0002	0.001	0.01	0.0001	0.0001	0.002	0.1	0.0001	0.00005	0.000005	0.0001	0.0005	0.1	0.05	0.0001		
ANZECC 2000 MW 95%																											0.0044			0.0055		0.0044	0.0044		0.0274	0.0274	0.001	0.0013				0.0004	0.0004		0.07			0.1		
LocCode	Sampled_Date-Time	WellCode																																																
DM1R	7/06/2021	s	-	-	-	-	-	-	2621	7.15	18.2	-	-	-	-	-	-	-	-	-	27.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM1R	8/06/2021	s	-	-	0.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
DM1R	8/06/2021	s	-	<1	-	-	1.73	219	-	-	-	<1000	384	30.2	384	25.8	637	7.92	1.73	<0.01	-	-	324	-	1750	<0.1	0.0003	0.0153	0.097	<0.00005	140	-	<0.01	0.0016 - 0.002	-	<0.01	0.0006	0.0029	0.24	52	0.282	-	0.000005	0.0011	0.0033	16	0.88	0.0018	-	-
DM1R	11/06/2021	d	-	-	0.94	-	-	-	2665	7.07	18	-	-	-	-	-	-	-	-	-	86.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
DM1R	11/06/2021	d	-	<1	-	-	1.96	227	-	-	-	<1000	371	29.5	371	29.8	617	0.44	1.96	<0.01	-	-	376	-	1730	<0.1	<0.0001	0.0026	0.118	<0.00005	163	-	<0.01	0.001 - 0.0012	-	<0.01	0.0002	0.002	0.004	59	0.0102	-	<0.000005	0.0013	0.0011	18	1.01	0.001	-	-
DM1R	21/10/2021	d	-	-	0.98	-	-	-	2710	7.34	19.3	-	-	-	-	-	-	-	-	-	68.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10
DM1R	21/10/2021	s	-	-	1.01	-	-	-	1328	7.22	19.6	-	-	-	-	-	-	-	-	-	-61.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM1R	21/10/2021	d	-	<1	-	-	2.17	235	-	-	-	<1000	365	29.8	365	30.9	623	1.88	2.17	<0.01	-	-	394	-	1710	<0.1	<0.0001	0.0033	0.104	<0.00005	166	-	<0.01	0.0016 - 0.002	-	<0.01	0.0001	0.0008	0.009	61	0.0052	-	<0.000005	0.001	0.0013	18	0.89	0.001	-	-
DM1R	21/10/2021	s	-	<1	-	-	0.17	55	-	-	-	<1000	348	15.2	348	14.9	253	1.02	0.17	<0.01	-	-	165	-	788	<0.1	<0.0001	0.0118	0.055	<0.00005	105	-	<0.01	<0.0002	-	<0.01	<0.0001	0.0006	2.46	28	0.101	-	<0.000005	0.0006	0.0009	8	<0.05	<0.0002	-	-
DM2R	8/06/2021	d	-	-	0.28	-	-	-	3323	6.92	17.4	-	-	-	-	-	-	-	-	-	40.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM2R	8/06/2021	s	-	-	0.2	-	-	-	3871	7.01	16	-	-	-	-	-	-	-	-	-	37.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM2R	8/06/2021	s	-	<1	-	-	5.25	253	-	-	-	<1000	250	46.9	250	48	1300	1.18	5.25	<0.01	-	-	166	-	3300	<0.1	<0.0001	0.0005	0.212	<0.00005	425	-	0.32	0.344	-	0.02	0.0003	0.0028	0.012	235	0.0032	-	<0.000005	0.0019	0.0009	11	1.54	0.0158	-	-
DM2R	8/06/2021	d	-	<1	-	-	1.1	185	-	-	-	<1000	286	38.3	286	39.1	1020	1	1.08	0.02	-	-	182	-	2790	<0.1	<0.0001	0.0011	0.156	<0.00005	426	-	0.02	0.029 - 0.03	-	<0.01	0.0001	0.0047	0.005	117	0.0034	-	<0.000005	0.0034	0.001	12	1.06	0.0014	-	-
DM2R	19/10/2021	s	-	-	0.26	-	-	-	4343	7.12	19.7	-	-	-	-	-	-	-	-	-	55.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM2R	19/10/2021	s	-	<1	-	-	2.62	412	-	-	-	<1000	280	46.9	280	51.4	1160	4.56	2.61	0.01	-	-	198	-	3780	<0.1	<0.0001	0.0006	0.142	<0.00005	509	-	0.24	0.273	-	0.03	0.0004	0.001	0.003	207	0.018	-	<0.000005	0.002	<0.0005	13	1.9	0.0043	-	-
DM2R	20/10/2021	d	-	-	0.25	-	-	-	3738	7.07	19	-	-	-	-	-	-	-	-	-	117.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM2R	20/10/2021	d	-	<1	-	-	2.4	237	-	-	-	<1000	280	41	280	43.3	1080	2.72	2.37	0.03	-	-	176	-	3200	<0.1	<0.0001	0.0009	0.168	<0.00005	423	-	0.32	0.307	-	<0.01	0.0002	0.0013	0.009	173	0.005	-	<0.000005	0.003	0.0007	11	0.91	0.0014	-	-
DM4R	26/01/2021	s	<1	-	-	0.2	-	-	8080	6.44	22	-	-	-	250	-	2540	-	<0.01	-	133	-	293	570	5500	-	<0.0001	-	0.24	<0.0001	515	<0.001	-	0.002	0.002	-	<0.0001	<0.0001	3.2	619	0.15	<0.00005	-	0.003	<0.001	13.3	-	0.0001	64	<180
DM4R	9/06/2021	s	-	-	0.17	-	-	-	7196	6.91	19.4	-	-	-	-	-	-	-	-	-	-73.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
DM4R	9/06/2021	s	-	<1	-	-	<0.01	576	-	-	-	<1000	250	86.9	250	85.5	2480	0.82	<0.01	<0.01	-	-	274	-	7000	<0.1	<0.0001	0.0116	0.169	<0.00005	549	-	<0.01	<0.0002	-	<0.01	<0.0001	0.0008	6.07	558	0.12	-	<0.000005	0.0034	<0.0005	11	<0.05	<0.0002	-	-
DM4R	18/10/2021	d	-	-	0.19	-	-	-	6675	6.95	20.2	-	-	-	-	-	-	-	-	-	-41.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
DM4R	18/10/2021	s	-	-	0.21	-	-	-	7741	7.6	20.6	-	-	-	-	-	-	-	-	-	-71.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
DM4R	18/10/2021	s	-	<1	-	-	0.02	543	-	-	-	<1000	265	72.7	265	80.9	1990	5.3	0.02	<0.01	-	-	270	-	6430	<0.1	<0.0001	0.0097	0.135	<0.00005	544	-	<0.01	<0.0002	-	<0.01	<0.0001	0.0012	3.99	507	0.0942	-	<0.000005	0.0032	<0.0005	10	<0.05	<0.0002	-	-
DM4R	18/10/2021	d	-	<1	-	-	0.01	420	-	-	-	<1000	85	60.9	85	67.5	1790	5.12	0.01	<0.01	-	-	217	-	5440	<0.1	<0.0001	0.0171	0.041	<0.00005	543	-	<0.01	<0.0002	-	<0.01	0.0022	0.0007	22.2	373	0.73	-	<0.000005	0.0004	0.003	11	<0.05	<0.0002	-	-
DM7R	10/06/2021	d	-	-	-	-	-	-	1345	7.05	20.1	-	-	-	-	-	-	-	-	-	-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM7R	10/06/2021	s	-	-	-	-	-	-	1161	6.93	20.5	-	-	-	-	-	-	-	-	-	65.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM7R	11/06/2021	d	-	-	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
DM7R	11/06/2021	s	-	-	0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
DM7R	11/06/2021	d	-	<1	-	-	0.18	56	-	-	-	<1000	372	15	372	14.7	226	0.8	0.16	0.02	-	-	115	-	770	<0.1	<0.0001	0.013	0.076	<0.00005	109	-	<0.01	<0.0002	-	<0.01	0.0003	<0.0005	2.07	50	0.0995	-	<0.000005	0.0009	0.0007	7	<0.05	0.0005	-	-
DM7R	11/06/2021	s	-	<1	-	-	0.78	62	-	-	-	<1000	344	12.4	344	13	150	2.29	0.78	<0.01	-	-	63	-	674	<0.1	0.0007	0.0013	0.068	<0.00005	130	-	<0.01	0.0009 - 0.001	-	<0.01	0.0001	0.0097	0.004	44	0.0416	-	<0.000005	0.012	0.0024	5	0.77	0.004	-	-
DM7R	18/10/2021	d	-	-	0.83	-	-	-	1387	7.25	20.3	-	-	-	-	-	-	-	-	-	-96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM7R	18/10/2021	s	-	-	0.48	-	-	-	1336	7.17	20.9	-	-	-	-	-	-	-	-	-	106.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
DM7R	18/10/2021	s	-	<1	-	-	1.03	65	-	-	-	<1000	348	14.5	348	14.5	219	0.08	1.02	0.01	-	-	68	-	895	<0.1	<0.0001	0.0014	0.028	<0.00005	146	-	<0.01	<0.001 - 0.0005	-	<0.01	0.0001	0.0017	0.002	50	0.0634	-	<0.000005	0.0112	0.0006	4	0.75	0.0034	-	-
DM7R	18/10/2021	d	-	<1	-	-	0.5	52	-	-	-	<1000	383	15	383	14.6	224	1.4	0.5	<0.01	-	-	121	-	780	<0.1	<0.0001	0.0112	0.05	<0.00005	99	-	<0.01	<0.0002	-	<0.01	0.0001	<0.0005	2.41	52	0.106	-	<0.000005	0.0007	<0.0005	6	<0.05	0.0004	-	-
DM8R	8/06/2021	d	-	-	0.16	-	-	-	8227	6.84	19.2	-	-	-	-	-	-	-	-	-	-69.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<80
DM8R	8/06/2021	s	-	-	0.17	-	-	-	7743	6.99	18.9	-	-	-	-	-	-	-	-	-	-83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
DM8R	8/06/2021	s	-	<1	-	-	<0.01	641	-	-	-	<1000	285	95.5	285	95.6	2710	0.04	<0.01	<0.01	-	-	299	-	8320	<0.1	<0.0001	0.0043	0.187	<0.00005	628	-	<0.01	0.0009 - 0.001	-	<0.01	<0.0001	0.0006	2.8	619	0.0864	-	<0.000005	0.0149	0.0008	11	0.33	0.0005	-	-
DM8R	8/06/2021	d	-	<1	-	-	<0.01	584	-	-	-	<1000	196	99.3	196	97.1	2950	1.1	<0.01	<0.01	-	-	300	-	8940	<0.1	<0.0001	0.0087	0.124	<0.00005	694	-	<0.01	<0.0002	-	<0.01	0.0002	0.0014	9.61	597	1.61	-	<0.000005	0.0018	0.0007	12	0.26	<0.0002	-	-
DM8R	19/08/2021	d	-	-	-	-	-	-	7872	6.75	19.3	-	-	-	-	-	-	-	-	-	-51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM8R	19/08/2021	s	-	-	-	-	-	-	6683	7	19	-	-	-	-	-	-	-	-	-	-126.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM8R	19/10/2021	d	-	-	0.19	-	-	-	7961	6.92	19	-	-	-	-	-	-	-	-	-	-94.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
DM8R	19/10/2021	s	-	-	0.24	-	-	-	6882	7.04	18.8	-	-	-	-	-	-	-	-	-	-66.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
DM8R	19/10/2021	s	-	<1	-	-	0.02	539	-	-	-	<1000	302	69.2	302	80.8	1840	7.77	0.02	<0.01	-	-	288	-	6320	<0.1	<0.0001	0.0069	0.174	<0.00005	514	-	<0.01	<0.001 - 0.0007	-	<0.01	<0.0001	<0.0005	1.74	515	0.0634	-	<0.000005	0.02	0.0008	10	0.79	0.0005	-	-
DM8R	19/10/2021	d	-	<1	-	-	0.01	573	-	-	-	<1000	223	90	223	92.7	2610	1.47	<0.02	<0.02	-	-	318	-	7110	<0.1	<0.0001	0.0085	0.08	<0.00005	644	-	<0.01	<0.0002	-	<0.01	<0.0001	0.001	12.8	564	0.997	-	<0.000005	0.0029	<0.0005	12	0.08	<0.0002	-	-
DM9R	10/06/2021	d	-	-	0.81	-	-	-	1221	7.91	19	-	-	-	-	-	-	-	-	-	61.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
DM9R	10/06/2021	s	-	-	0.69	-	-	-	1071	6.59	19.5	-	-	-	-	-	-	-	-	-	-65.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	140	80
DM9R	10/06/2021	s	-	<1	-	-	0.02	44	-	-	-	<1000	110	11.4	110	10.7	294	3.2	0.02	<0.01	-	-	132	-	738	<0.1	<0.0001	0.0036	0.01	<0.00005	70	-	<0.01	<0.0002	-	<0.01	0.0003	0.0009	17.2	15	0.104	-	<0.000005	0.0004	0.0014	9	<0.05	<0.0002	-	-
DM9R	10/06/2021	d	-	<1	-	-	1.83	85	-	-	-	<1000	275	13.8	275	14.8	230	3.53	1.83	<0.01	-	-	120	-	744	<0.1	<0.0001	0.0025	0.049	<0.00005	121	-	0.16	0.181	-	0.02	<0.0001	0.0007	0.048	41	0.0037	-	<0.000005	0.0002	<0.0005	5	0.47	0.0012	-	-
DM9R	21/10/2021	d	-	-	0.92	-	-	-	1231	7.41	19.5	-	-	-	-	-	-	-	-	-	134.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
DM9R	21/10/2021	s	-	-	0.75	-	-	-	947	6.64	19.4	-	-	-	-	-	-	-	-	-	154.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	<80
DM9R	21/10/2021	s	-	<1	-	-	0.34	37	-	-	-	<1000	121	10.1	121	9.88	246	1.23	0.34	<0.01	-	-	119	-	590	<0.1	0.0012	<0.0002	0.017	0.00027	63	-	<0.01	0.001	-	<0.01	0.0003	0.0146	<0.002	14	0.0677	-	<0.000005	0.0007	0.0086	16	<0.05	<0.0002	-	-
DM9R	21/10/2021	d	-	<1	-	-	1.25	98	-	-	-	<1000	317	14.1	317	14.3	202	0.84	1.25	<0.01	-	-	120	-	749	<0.1	0.0001	0.0023	0.048	<0.00005	112	-	0.06	0.0674 - 0.072	-	0.01	<0.0001	0.0025	<0.002	41	0.0029	-	<0.000005	0.0001	0.0014	5	0.38	0.0011	-	-
MB3	12/08/2021		-	<1	-	-	7.05	58	-	-	-	<1000	345	11.6	345	12.6	123	4.4	7.05	<0.01	-	-	77	-	630	<0.1	<0.0001	0.0019	0.032	<0.00005	138	-	<0.01	<0.001 - 0.0007	-	<0.01	<0.0001	0.002	0.004	27	0.0022	-	<0.000005	0.0013	0.0007	7	1.28	0.0011	-	-
MB3R	9/06/2021	d	-	-	-	-	-	-	972	7.3	18.3	-	-	-	-	-	-	-	-	-	40.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB3R	12/08/2021	d	-	-	0.97	-	-	-	998	8.78	18.4	-	-	-	-	-	-	-	-	-	55.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<80
MB3R	21/10/2021	d	-	-	0.88	-	-	-	1157	7.16	20.3	-	-	-	-	-	-	-	-	-	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB3R	21/10/2021		-	<1	-	-	6.25	64	-	-	-	<1000	386	13	386	13.5	140	1.8	6.25	<0.01	-	-	80	-	704	<0.1	<0.0001	0.0021	0.061	<0.00005	145	-	<0.01	<0.001 - 0.0007	-	<0.01	<0.0001	<0.0005	0.002	31	0.0005	-	<0.000005	0.0013	<0.0005	8	1.5	0.0011	-	-
YB	26/01/2021	d	-	-	-	0.7	-	-	784	6.29	22.3	-	-	-	-	-	205	-	-	-	119	-	94.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	<160
YB	9/06/2021	d	-	-	0.61	-	-	-	783	6.3	18.5	-	-	-	-	-	-	-	-	-	-42.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
YB	9/06/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	227	-	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/08/2021	d	-	-	0.59	-	-	-	826	6.7	19	-	-	-	-	-	-	-	-	-	-17.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
YB	12/08/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	232	-	-	-	-	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/10/2021	d	-	-	0.56	-	-	-	801	6.42	18.9	-	-	-	-	-	-	-	-	-	-22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
YB	20/10/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	242	-	-	-	-	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

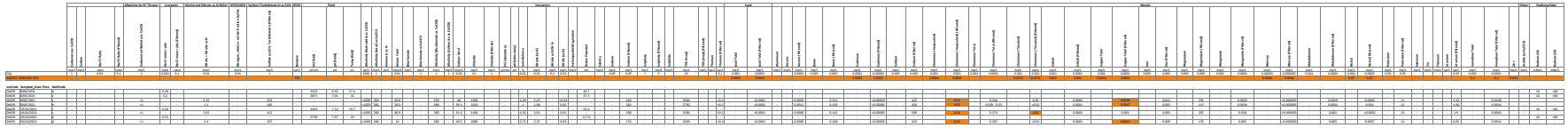
	Inorganic		Field			Inorganics				Radionuclides	
	Na:Cl molar ratio	Na:Cl molar ratio (Filtered)	EC (field)	pH (Field)	Temp (field)	Chloride	Redox Potential	Sodium	Sodium (Filtered)	Radium-226	Radium-228
	ratio	ratio	µS/cm	pH	oC	mg/L	mV	mg/L	mg/L	mBq/L	mBq/L
EQL		0.1				1		1	0.1		
ADWG 2011 Aesthetic								180	180		
ADWG 2011 Health											

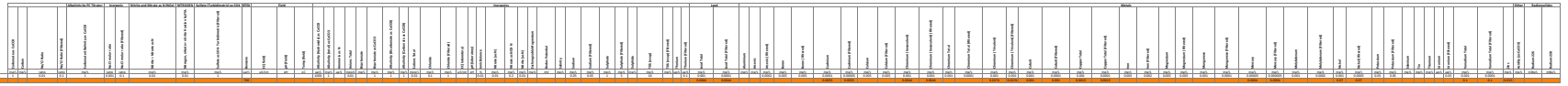
LocCode	Sampled_Date-Time	WellCode											
YB	26/01/2021	d	-	0.7	784	6.29	22.3	205	119	-	94.4	71	<160
YB	9/06/2021	d	0.61	-	783	6.3	18.5	-	-42.5	-	-	20	<80
YB	9/06/2021	d	-	-	-	-	-	227	-	90	-	-	-
YB	12/08/2021	d	0.59	-	826	6.7	19	-	-17.4	-	-	20	<80
YB	12/08/2021		-	-	-	-	-	232	-	89	-	-	-
YB	20/10/2021	d	0.56	-	801	6.42	18.9	-	-22.5	-	-	30	<80
YB	20/10/2021		-	-	-	-	-	242	-	88	-	-	-

[Sampled_Date-Time] >= #26 Jan 2021# And [Sampled_Date-Time] <= #21 Oct 2021 15:01:00# AND

LocCode = 'YB'

			Carbonate as CaCO3	Carbon	Na/Cl Ratio	Na/Cl Ratio (Filtered)	Carbonate Alkalinity as CaCO3	Na:Cl molar ratio	Na:Cl molar ratio (Filtered)	Nitrite + Nitrate as N	Nitrogen, nitrate + nitrite fraction by FIA.	Sulfate as SO4 - Turbidimetric (Filtered)	Benzene	EC (Field)	pH (Field)
			mg/L	mg/L	ratio	ratio	mg/L	ratio	ratio	mg/L	mg/L	mg/L	µg/L	µS/cm	pH
EQL			1		0.01	0.1	1	0.001	0.1	0.01	0.01	1			
ANZECC 2000 MW 95%													700		
LocCode	Sampled_Date-Time	WellCode													
DM1R	1/03/1989	d	-	-	1.017	-	-	-	-	-	-	-	-	1680	7.8
DM1R	1/03/1989	s	-	-	1.021	-	-	-	-	-	-	-	-	1680	7.7
DM1R	1/11/1989	d	-	-	0.9305	-	-	-	-	-	-	-	-	1460	7.45
DM1R	1/11/1989	s	-	-	0.9509	-	-	-	-	-	-	-	-	1520	7.1
DM1R	1/06/1990	d	-	-	0.8773	-	-	-	-	-	-	-	-	1450	7.05
DM1R	1/06/1990	s	-	-	0.771	-	-	-	-	-	-	-	-	950	7.45
DM1R	1/10/1990	d	-	-	0.9959	-	-	-	-	-	-	-	-	1600	7
DM1R	1/10/1990	s	-	-	0.9786	-	-	-	-	-	-	-	-	1660	7
DM1R	1/06/1991	d	-	-	1.127	-	-	-	-	-	-	-	-	1660	7
DM1R	1/06/1991	s	-	-	1.071	-	-	-	-	-	-	-	-	1290	7.2
DM1R	1/09/1991	d	-	-	0.8915	-	-	-	-	-	-	-	-	1630	7.5
DM1R	1/09/1991	s	-	-	0.8738	-	-	-	-	-	-	-	-	1610	7.6
DM1R	1/12/1991	s	-	-	0.8481	-	-	-	-	-	-	-	-	1560	-
DM1R	1/07/1992	d	-	-	1.028	-	-	-	-	-	-	-	-	1550	6.85
DM1R	1/07/1992	s	-	-	1.079	-	-	-	-	-	-	-	-	1520	6.9
DM1R	1/10/1992	d	-	-	1.046	-	-	-	-	-	-	-	-	1550	7.1
DM1R	1/10/1992	s	-	-	0.9637	-	-	-	-	-	-	-	-	1510	7.3
DM1R	1/01/1993	d	-	-	0.8261	-	-	-	-	-	-	-	-	930	7.6
DM1R	1/01/1993	s	-	-	0.9579	-	-	-	-	-	-	-	-	1570	7.95
DM1R	1/07/1993	d	-	-	0.9039	-	-	-	-	-	-	-	-	1040	6.95
DM1R	1/07/1993	s	-	-	0.4785	-	-	-	-	-	-	-	-	1690	6.7
DM1R	1/10/1993	d	-	-	0.8303	-	-	-	-	-	-	-	-	1020	6.8
DM1R	1/10/1993	s	-	-	0.8285	-	-	-	-	-	-	-	-	1650	6.7
DM1R	1/01/1994	d	-	-	0.8545	-	-	-	-	-	-	-	-	920	7.4
DM1R	1/01/1994	s	-	-	0.9396	-	-	-	-	-	-	-	-	1590	7.1
DM1R	1/07/1994	d	-	-	0.7058	-	-	-	-	-	-	-	-	930	8.2
DM1R	1/07/1994	s	-	-	0.9813	-	-	-	-	-	-	-	-	1690	8.1
DM1R	1/10/1994	d	-	-	0.8352	-	-	-	-	-	-	-	-	885	7.9
DM1R	1/10/1994	s	-	-	0.9878	-	-	-	-	-	-	-	-	1650	7.65
DM1R	1/01/1995	d	-	-	0.8866	-	-	-	-	-	-	-	-	830	7.55
DM1R	1/01/1995	s	-	-	0.9345	-	-	-	-	-	-	-	-	1600	7.5
DM1R	1/07/1995	d	-	-	0.771	-	-	-	-	-	-	-	-	970	7.7
DM1R	1/07/1995	s	-	-	0.9766	-	-	-	-	-	-	-	-	1600	7.4
DM1R	1/10/1995	d	-	-	-	-	-	-	-	-	-	-	-	-	7.7
DM1R	1/10/1995	s	-	-	0.9948	-	-	-	-	-	-	-	-	1700	7.6
DM1R	1/01/1996	d	-	-	0.771	-	-	-	-	-	-	-	-	930	8.3
DM1R	1/01/1996	s	-	-	0.7918	-	-	-	-	-	-	-	-	1800	7.9
DM1R	1/07/1996	s	-	-	1.063	-	-	-	-	-	-	-	-	1600	7.6

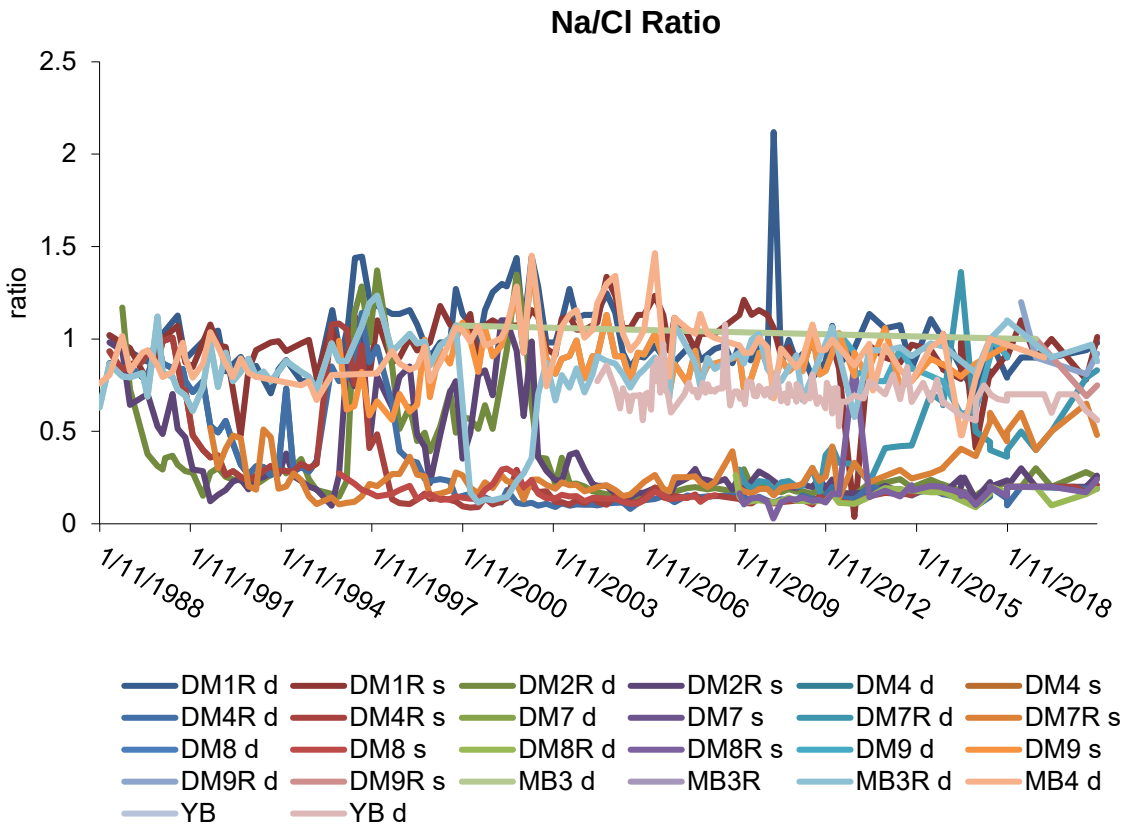


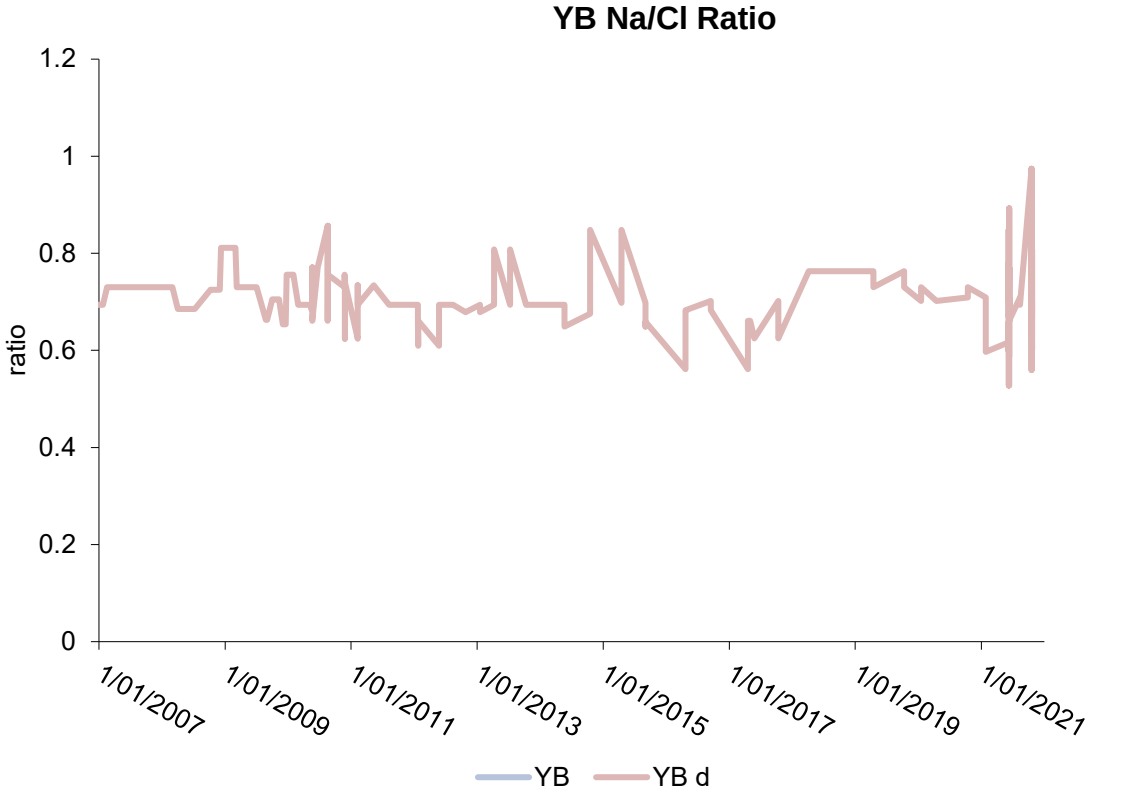


							Inorganic		NITROGEN	Field			Inorganics								
			Carbonate as CaCO3	Carbon	Na/Cl Ratio	Na/Cl Ratio (Filtered)	Na:Cl molar ratio	Na:Cl molar ratio (Filtered)	Nitrogen, nitrate + nitrite fraction by FIA.	EC (field)	pH (Field)	Temp (field)	Ammonia as N	Bicarbonate	Bicarbonate as CaCO3	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Chloride	Chloride (Filtered)	Nitrate (as N)	Nitrate as NO3-N
			mg/L	mg/L	ratio	ratio	ratio	ratio	mg/L	µS/cm	pH	oC	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			1		0.01	0.1	0.001	0.1	0.01						1	1	1	0.1	1	0.01	0.2
ADWG 2011 Aesthetic																					
ADWG 2011 Health																					
LocCode	Sampled_Date-Time	WellCode																			
YB	15/04/2005	d	-	-	0.771	-	-	-	-	-	-	-	-	91	-	-	-	200	-	0.2	-
YB	1/08/2005	d	-	-	-	-	-	-	-	875	6.6	-	-	0	-	-	-	0	-	-	-
YB	2/08/2005	d	-	-	0.8567	-	-	-	-	797	6.6	-	-	100	-	-	-	180	-	0.2	-
YB	14/11/2005	d	-	-	0.7304	-	-	-	-	862	6.4	-	-	-	-	-	-	190	-	0.02	-
YB	11/01/2006	d	-	-	0.6241	-	-	-	-	762	6.3	-	-	0	-	-	-	210	-	-	-
YB	15/02/2006	d	-	-	0.7343	-	-	-	-	819	6.3	-	-	73	-	-	-	210	-	0.2	-
YB	11/03/2006	d	-	-	0.6939	-	-	-	-	818	6.3	-	-	0	-	-	-	200	-	-	-
YB	13/04/2006	d	-	-	0.6939	-	-	-	-	814	6.2	-	-	0	-	-	-	200	-	-	-
YB	10/05/2006	d	-	-	0.6094	-	-	-	-	819	6.2	-	-	0	-	-	-	210	-	-	-
YB	16/06/2006	d	-	-	0.6939	-	-	-	-	826	6.3	-	-	0	-	-	-	200	-	0	-
YB	13/07/2006	d	-	-	0.6939	-	-	-	-	824	6.6	-	-	0	-	-	-	200	-	0	-
YB	9/08/2006	d	-	-	0.6939	-	-	-	-	826	6.5	-	-	0	-	-	-	200	-	0	-
YB	13/09/2006	d	-	-	0.6976	-	-	-	-	792	6.6	-	-	0	-	-	-	210	-	0	-
YB	13/10/2006	d	-	-	0.5613	-	-	-	-	802	6.2	-	-	0	-	-	-	250	-	0	-
YB	13/11/2006	d	-	-	0.7016	-	-	-	-	792	6.3	-	-	0	-	-	-	200	-	0	-
YB	13/12/2006	d	-	2	0.7093	-	-	-	-	831	6.3	-	-	0	-	-	-	200	-	0	-
YB	23/01/2007	d	-	0	0.6168	-	-	-	-	814	6.4	-	-	0	-	-	-	200	-	0	-
YB	16/02/2007	d	-	0	0.8481	-	-	-	-	827	6.5	-	-	0	-	-	-	200	-	0	-
YB	15/03/2007	d	-	-	0.771	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	11/04/2007	d	-	0	0.8927	-	-	-	-	817	6.4	-	-	0	-	-	-	190	-	0	-
YB	16/05/2007	d	-	-	0.7093	-	-	-	-	823	6.3	-	-	-	-	-	-	200	-	-	-
YB	19/06/2007	d	-	-	0.9739	-	-	-	-	820	6.6	-	-	61	-	-	-	190	-	0.2	-
YB	13/07/2007	d	-	0	0.7304	-	-	-	-	818	6.5	-	-	0	-	-	-	190	-	0	-
YB	15/08/2007	d	-	0	0.7016	-	-	-	-	810	6.2	-	-	0	-	-	-	200	-	0	-
YB	17/09/2007	d	-	0	0.6014	-	-	-	-	877	6.4	-	-	0	-	-	-	200	-	0	-
YB	16/10/2007	d	-	0	-	-	-	-	-	785	6.4	-	-	0	-	-	-	200	-	0	-
YB	19/11/2007	d	-	-	-	-	-	-	-	868	6.1	-	-	-	-	-	-	-	-	-	-
YB	13/12/2007	d	-	-	-	-	-	-	-	870	6.1	-	-	-	-	-	-	-	-	-	-
YB	1/03/2008	d	-	-	0.7016	-	-	-	-	846	6.6	-	-	58	-	-	-	200	-	1	-
YB	21/04/2008	d	-	-	0.7633	-	-	-	-	855	6.1	-	-	-	-	-	-	200	-	-	-
YB	8/05/2008	d	-	-	0.7401	-	-	-	-	822	6.2	-	-	-	-	-	-	200	-	-	-
YB	8/06/2008	d	-	-	0.717	-	-	-	-	793	6.3	-	-	-	-	-	-	200	-	-	-
YB	8/07/2008	d	-	-	0.7247	-	-	-	-	800	6.3	-	-	-	-	-	-	200	-	-	-
YB	8/08/2008	d	-	-	0.6829	-	-	-	-	785	6.4	-	-	72	-	-	-	210	-	0.2	-
YB	8/09/2008	d	-	-	0.717	-	-	-	-	795	6.5	-	-	-	-	-	-	200	-	-	-
YB	8/10/2008	d	-	-	0.7633	-	-	-	-	770	6.4	-	-	58	-	-	-	200	-	0.2	-
YB	8/11/2008	d	-	-	0.7093	-	-	-	-	791	6.5	-	-	-	-	-	-	200	-	-	-
YB	8/12/2008	d	-	-	0.7548	-	-	-	-	817	6.3	-	-	56	-	-	-	190	-	0.2	-
YB	9/01/2009	d	-	-	0.717	-	-	-	-	793	6.3	-	-	-	-	-	-	200	-	-	-
YB	1/02/2009	d	-	-	0.7247	-	-	-	-	799	6.4	-	-	-	-	-	-	200	-	-	-
YB	1/03/2009	d	-	-	0.7142	-	-	-	-	792	6.6	-	-	55	-	-	-	190	-	0.2	-
YB	1/04/2009	d	-	-	0.7324	-	-	-	-	791	6.5	-	-	-	-	-	-	200	-	-	-
YB	1/05/2009	d	-	-	0.7324	-	-	-	-	780	6.5	-	-	-	-	-	-	200	-	-	-
YB	1/06/2009	d	-	-	0.7324	-	-	-	-	740	6.4	-	-	-	-	-	-	200	-	-	-
YB	1/07/2009	d	-	-	1.079	-	-	-	-	785	6.3	-	-	59	-	-	-	200	-	0.2	-
YB	1/08/2009	d	-	-	0.7898	-	-	-	-	782	6	-	-	-	-	-	-	205	-	-	-
YB	1/09/2009	d	-	-	0.6394	-	-	-	-	782	6.5	-	-	61	-	-	-	205	-	0.2	-
YB	1/10/2009	d	-	-	0.692	-	-	-	-	783	6.1	-	-	-	-	-	-	205	-	-	-
YB	1/11/2009	d	-	-	0.717	-	-	-	-	790	6.2	-	-	-	-	-	-	200	-	-	-
YB	1/12/2009	d	-	-	0.717	-	-	-	-	816	6.5	-	-	53	-	-	-	200	-	0.2	-
YB	1/01/2010	d	-	-	0.677	-	-	-	-	827	6	-	-	-	-	-	-	205	-	-	-
YB	8/01/2010	d	-	-	0.6853	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-
YB	1/02/2010	d	-	-	0.7093	-	-	-	-	640	6.3	-	-	74	-	-	-	200	-	0.2	-
YB	1/03/2010	d	-	-	0.6476	-	-	-	-	867	6.4	-	-	70	-	-	-	200	-	0.2	-
YB	1/04/2010	d	-	-	0.771	-	-	-	-	870	6.3	-	-	93	-	-	-	190	-	0.2	-
YB	20/05/2010	d	-	-	0.7629	-	-	-	-	798.9	6.9	-	-	54	-	-	-	190	-	0.2	-
YB	21/06/2010	d	-	-	0.692	-	-	-	-	-	6.2	-	-	-	-	-	-	205	-	-	-
YB	22/07/2010	d	-	-	0.6912	-	-	-	-	-	6.3	-	-	-	-	-	-	203	-	-	-
YB	17/08/2010	d	-	-	0.7466	-	-	-	-	875	6.4	-	-	-	-	-	-	190	-	-	-
YB	20/08/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/09/2010	d	-	-	0.7304	-	-	-	-	850	6.3	-	-	-	-	-	-	190	-	-	-
YB	26/10/2010	d	-	-	0.6939	-	-	-	-	830	6.2	-	-	-	-	-	-	200	-	-	-
YB	22/11/2010	d	-	-	0.7304	-	-	-	-	-	6.3	-	-	-	-	-	-	190	-	-	-
YB	15/12/2010	d	-	-	0.7304	-	-	-	-	870	6.3	-	-	-	-	-	-	190	-	-	-
YB	5/01/2011	d	-	-	0.6853	-	-	-	-	882	-	-	-	-	-	-	-	180	-	-	-
YB	9/02/2011	d	-	-	0.7247	-	-	-	-	880	6.5	-	-	57	-	-	-	200	-	0.2	-
YB	22/03/2011	d	-	-	0.8116	-	-	-	-	910	-	-	-	-	-	-	-	190	-	-	-
YB	14/04/2011	d	-	-	0.7304	-	-	-	-	875	6.7	-	-	-	-	-	-	190	-	-	-
YB	11/05/2011	d	-	-	0.663	-	-	-	-	-	6.9	-	-	-	-	-	-	200	-	-	-
YB	21/06/2011	d	-	-	0.7049	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	26/07/2011	d	-	-	0.6535	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	9/08/2011	d	-	-	0.7556	-	-	-	-	-	6.5	-	-	-	-	-	-	200	-	-	-
YB	10/08/2011	d	-	-	-	-	-	-	-	883	6.5	-	-	-	-	-	-	-	-	-	-
YB	13/09/2011	d	-	-	0.6939	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	14/09/2011	d	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-	-	-	-	-	-
YB	6/10/2011	d	-	-	0.6939	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	31/10/2011	d	-	-	0.6862	-	-	-	-	-	6.2	-	-	-	-	-	-	200	-	-	-
YB	1/11/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	10/11/2011	d	-	-	0.6608	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	11/11/2011	d	-	-	0.7556	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	15/12/2011	d	-	-	0.7401	-	-	-	-	-	6.3	-	-	-	-	-	-	200	-	-	-
YB	17/01/2012	d	-	-	0.6939	-	-	-	-	-	6.3	-	-	-	-	-	-	200	-	-	-
YB	23/01/2012	d	-	-	-	-	-	-	-	840	6.5	-	-	-	-	-	-	-	-	-	-
YB	16/02/2012	d	-	-	0.6608	-	-	-	-	-	6.2	-	-	-	-	-	-	210	-	-	-
YB	15/03/2012	d	-	-	0.6939	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	20/04/2012	d	-	-	0.6785	-	-	-	-	-	-	-	-	-	-	-	-	250	-	-	-
YB	24/05/2012	d	-	-	0.8077	-	-	-	-	990	6.8	-	-	59	-	-	-	210	-	-	-
YB	26/06/2012	d	-	-	0.6939	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	17/07/2012	d	-	-	0.6493	-	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-
YB	14/08/2012	d	-	-	0.6829	-	-	-	-	909	6.76	-	-	60	-	-	-	210	-	-	-
YB	24/09/2012	d	-	-	0.6608	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	26/10/2012	d	-	-	0.6245	-	-	-	-	872	6.41	-	-	50	-	-	-	200	-	-	-
YB	13/11/2012	d	-	-	0.7633	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	11/12/2012	d	-	-	0.7304	-	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-
YB	8/01/2013	d	-	-	0.7304	-	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-
YB	16/01/2013	d	-	-	0.5967	-	-	-	-	880	6.62	20.5	-	52	-	-	-	230	-	0.2	-
YB	16/02/2013	d	-	-	0.7343	-	-	-	-	880	6.3	22.2	-	-	-	-	-	210	-	-	-
YB	20/03/2013	d	-	-	0.7343	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	9/04/2013	d	-	-	0.5278	-	-	-	-	876	6.67	20.6	-	52	-	-	-	260	-	0.2	-
YB	6/05/2013	d	-	-	0.6608	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	11/07/2013	d	-	-	0.6608	-	-	-	-	884	5.92	19.2	-	88	-	-	-	210	-	0.2	-
YB	10/10/2013	d	-	-	0.6939	-	-	-	-	900	7.4	21.2	<1000	69	69	-	-	200	-	<0.2	-
YB	29/01/2014	d	-	-	0.6785	-	-	-	-	883	6.55	20.3	-	-	-	-	-	250	-	-	-
YB	9/04/2014	d	<1	-	0.771	-	-	-	-	970	7.47	19.4	-	79	79	-	-	220	-	<0.2	-
YB	16/07/2014	d	-	-	-	-	-	-	-	908	6.4	19	-	-	-	-	-	-	-	-	-
YB	16/10/2014	d	<1	-	0.7016	-	-	-	-	870	6.77	20.4	-	-	77	-	-	200	-	-	<0.2
YB	22/01/2015	d	-	-	-	-	-	-	-	843	5.78	21.8	-	-	-	-	-	-	-	-	-
YB	23/01/2015	d	-	-	0.8077	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
YB	16/04/2015	d	<1	-	0.6755	-	-	-	-	584 - 854	6.68	21.8	-	-	84	-	-	210	-	-	<0.2
YB	9/07/2015	d	-	-	0.8481	-	-	-	-	873	6.55	19	-	-	-	-	-	200	-	-	-
YB	3/09/2015	d	<1	-	0.6588	-	-	-	-	897	6.72	19.9	-	-	75	75	<1	220	-	<0.2	<0.2
YB	4/09/2015	d	-	-	-	-	-	-	-	897	6.72	19.9	-	-	-	-	-	-	-	-	-
YB	20/01/2016		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-
YB	20/01/2016	d	-	-	0.7633	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/01/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/04/2016	d	-	-	-	-	-	-	-	854	6.68	21.8	-	-	-	-	-	-	-	-	-
YB	21/04/2016	d	-	-	0.6682	-	-	-	-	-	-	-	-	-	-	57	<1	210	-	<0.2	-
YB	22/04/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	7/07/2016	d	-	-	0.771 - 0.78	-	-	-	-	854	5.89	18.9	-	-	-	-	-	200	-	-	-
YB	8/07/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/09/2016	d	-	-	0.65 - 0.6608	-	-	-	-	867	8.12	19.1	-	-	-	73	<1	210	-	<0.2	-
YB	23/01/2017	d	-	-	-	-	-	-	-	876	5.86	20.4	-	-	-	-	-	-	-	-	-
YB	18/04/2017	d	<1	-	-	-	-	-	-	-	-	-	-	-	-	53	-	-	210	<0.2	-
YB	18/04/2017	d	-	-	0.5874	-	-	-	-	905	7.03	20.2	-	-	-	-	-	-	-	-	-
YB	27/07/2017	d	-	-	-	-	-	-	-	828	6.7	19.8	-	-	-	-	-	-	-	-	-
YB	28/07/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/10/2017	d	-	-	0.5593	0.6	-	-	-	844	6.89	20	-	-	-	-	-	-	220	-	-
YB	16/10/2017	d	-	-	0.6704	-	-	-	-	-	-	-	-	-	-	-	-	230	-	-	-
YB	11/01/2018	d	-	-	-	-	-	-	-	889	6.72	20.4	-	-	-	-	-	-	-	-	-
YB	24/01/2018		-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	200	-	-
YB	24/01/2018	d	-	-	0.7486	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/02/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/04/2018	d	<1	-	-	-	-	0.7	-	-	-	-	-	-	-	55	-	-	210	<0.01 - 0.03	-
YB	6/04/2018	d	-	-	0.7061	-	-	-	-	1214	7.46	20.9	-	-	-	-	-	-	-	-	-
YB	7/04/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	3/07/2018	d	-	-	-	-	-	-	-	904	6.4	18.9	-	-	-	-	-	-	-	-	-
YB	6/07/2018		-	-	-	-	0.44	-	-	-	-	-	-	-	-	-	-	215	-	-	-
YB	6/07/2018	d	-	-	0.6756	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/07/2018	d	-	-	0.6756	-	-	-	-	-	-	-	-	-	-	-	-	215	-	-	-
YB	29/10/2018	d	<1	-	0.6656	-	-	0.7	-	900	6.82	20.1	-	-	-	57	-	221	-	0.03	-
YB	17/01/2019	d	-	-	-	-	-	-	-	892	6.65	20.5	-	-	-	-	-	-	-	-	-
YB	5/02/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/04/2019	d	-	-	-	-	-	0.7	-	900	6.74	-	-	-	-	-	-	210	-	0.02	-
YB	23/07/2019		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208	-	-	-
YB	5/08/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/09/2019	d	-	-	-	-	-	-	-	881	6.45	19.9	-	-	-	-	-	-	-	-	-
YB	10/10/2019	d	-	-	-	-	-	0.7	-	841	6.66	20.2	-	-	-	-	-	206	-	<0.01	-
YB	17/01/2020	d	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	209	-	-	-
YB	27/01/2020	d	-	-	-	-	-	-	-	790	6.02	-	-	-	-	-	-	-	-	-	-
YB	15/04/2020	d	<1	-	-	-	-	0.6	0.02	792	6.93	-	-	-	-	59	-	219	-	-	-
YB	15/07/2020	d	-	-	-	-	-	0.7	-	784	6.3	-	-	-	-	-	-	209	-	-	-
YB	16/07/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/10/2020	d	<1	-	-	-	-	-	-	715	6.44	-	-	-	-	51	-	208	-	<0.01	-
YB	26/01/2021	d	-	-	-	-	-	0.7	-	784	6.29	22.3	-	-	-	-	-	205	-	-	-
YB	9/06/2021	d	-	-	-	-	0.61	-	-	783	6.3	18.5	-	-	-	-	-	-	-	-	-
YB	9/06/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	227	-	-	-
YB	12/08/2021	d	-	-	-	-	0.59	-	-	826	6.7	19	-	-	-	-	-	-	-	-	-
YB	12/08/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	232	-	-	-
YB	20/10/2021	d	-	-	-	-	0.56	-	-	801	6.42	18.9	-	-	-	-	-	-	-	-	-
YB	20/10/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	242	-	-	-
YB	18/03/2022	d	-	-	-	-	-	-	-	805	6.2	20.8	-	-	-	-	-	-	-	-	-
YB	18/03/2022		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	211	-	-	-

			Inorganics								Lead		Metals																	
			Exchangeable Magnesium	Redox Potential	Salinity	Sodium	Sodium (Filtered)	Sulphate	Sulphate (Filtered)	TDS (evap)	Lead Total	Lead Total (Filtered)	Aluminium	Arsenic	Boron	Boron (Filtered)	Cadmium	Cadmium (Filtered)	Calcium	Calcium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium Total	Chromium Total (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)	Cobalt	Cobalt (Filtered)	Copper Total	Copper Total (Filtered)
			mg/L	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL						0.05	0.05	1	5	10	0.001	0.0001			0.005	0.005	0.0001	0.0001	0.005	0.005	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.0001	0.001	0.0001
ADWG 2011 Aesthetic						180	180	250	250	600			0.2																1	1
ADWG 2011 Health								500	500		0.01	0.01		0.01	4	4	0.002	0.002			0.05	0.05							2	2
LocCode	Sampled_Date-Time	WellCode																												
YB	15/04/2005	d	-	-	-	100	-	18	-	450	-	-	-	-	0.019	-	-	-	45	-	-	-	0.001	-	-	-	-	-	-	-
YB	1/08/2005	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-
YB	2/08/2005	d	-	-	-	100	-	7	-	500	-	-	-	-	0.028	-	-	-	50	-	-	-	0.001	-	-	-	-	-	-	-
YB	14/11/2005	d	-	-	-	90	-	12	-	470	-	-	-	-	0.033	-	-	-	40	-	-	-	0.001	-	-	-	-	-	-	-
YB	11/01/2006	d	-	-	-	85	-	0	-	0	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-
YB	15/02/2006	d	-	-	-	100	-	14	-	540	0.001	-	0.03	-	0.031	-	0.0001	-	40	-	-	-	0.001	-	-	-	-	-	0.001	-
YB	11/03/2006	d	-	-	-	90	-	15	-	0	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-
YB	13/04/2006	d	-	-	-	90	-	14	-	0	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-
YB	10/05/2006	d	-	-	-	83	-	15	-	0	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-
YB	16/06/2006	d	-	-	-	90	-	12	-	0	0	-	-	-	0	-	0	-	0	-	-	-	0	-	-	-	-	-	0	-
YB	13/07/2006	d	-	-	-	90	-	12	-	0	0	-	-	-	0	-	0	-	0	-	-	-	0	-	-	-	-	-	0	-
YB	9/08/2006	d	-	-	-	90	-	12	-	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	-	-	-	-	0	-
YB	13/09/2006	d	-	-	-	95	-	14	-	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	-	-	-	-	0	-
YB	13/10/2006	d	-	-	-	91	-	19	-	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	-	-	-	-	0	-
YB	13/11/2006	d	-	-	-	91	-	16	-	0	0.001	-	0.026	0.001	0	-	0.0001	-	34	-	0.02	-	0.001	-	-	-	0.001	-	0.001	-
YB	13/12/2006	d	-	-	-	92	-	14	-	0	0.001	-	0.019	0.001	0	-	0.0001	-	33	-	0.005	-	0.001	-	-	-	0.001	-	0.001	-
YB	23/01/2007	d	-	-	-	80	-	16	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	16/02/2007	d	-	-	-	110	-	16	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	15/03/2007	d	-	-	-	100	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/04/2007	d	-	-	-	110	-	15	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	16/05/2007	d	-	-	-	92	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	19/06/2007	d	-	-	-	120	-	21	-	480	0.001	-	0	0	0.041	-	0.0017	-	37	-	0	-	0.001	-	-	-	0.001	-	0.001	-
YB	13/07/2007	d	-	-	-	90	-	14	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	15/08/2007	d	-	-	-	91	-	15	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	17/09/2007	d	-	-	-	78	-	18	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	16/10/2007	d	-	-	-	-	-	18	-	0	0	-	0	0	0	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-
YB	19/11/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	13/12/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/03/2008	d	-	-	-	91	-	15	-	450	0.001	-	-	-	0.022	-	0.0001	-	35	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	21/04/2008	d	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/05/2008	d	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/06/2008	d	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/07/2008	d	-	-	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/08/2008	d	-	-	-	93	-	15	-	480	0.001	-	-	-	0.032	-	0.0001	-	35	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	8/09/2008	d	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/10/2008	d	-	-	-	99	-	17	-	420	0.001	-	-	-	0.022	-	0.0001	-	36	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	8/11/2008	d	-	-	-	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/12/2008	d	-	-	-	93	-	20	-	430	0.001	-	-	-	0.023	-	0.0001	-	35	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	9/01/2009	d	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/02/2009	d	-	-	-	94	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/03/2009	d	-	-	-	88	-	15	-	470	0.001	-	-	-	0.025	-	0.0001	-	34	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/04/2009	d	-	-	-	95	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/05/2009	d	-	-	-	95	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/06/2009	d	-	-	-	95	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/07/2009	d	-	-	-	140	-	17	-	780	0.001	-	-	-	0.016	-	0.0001	-	37	-	0.005	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/08/2009	d	-	-	-	105	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/09/2009	d	-	-	-	85	-	16	-	460	0.001	-	-	-	0.12	-	0.0001	-	34	-	0.005	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/10/2009	d	-	-	-	92	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/11/2009	d	-	-	-	93	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/12/2009	d	-	-	-	93	-	13	-	460	0.001	-	-	-	0.011	-	0.0001	-	34	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/01/2010	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/01/2010	d	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/02/2010	d	-	-	-	92	-	16	-	400	0.001	-	-	-	0.02	-	0.0001	-	38	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/03/2010	d	-	-	-	84	-	17	-	460	0.001	-	-	-	0.005	-	0.0001	-	-	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	1/04/2010	d	-	-	-	95	-	17	-	510	-	-	-	-	0.011	-	-	-	35	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	20/05/2010	d	-	-	-	94	-	18	-	490	0.001	-	-	-	0.02	-	0.0001	-	35	-	-	-	0.001	-	-	-	0.001	-	0.001	-
YB	21/06/2010	d	-	-	-	92	-	22	-	-	0.001	-	0.15	0.001	0.026	-	0.0001	-	35	-	-	-	0.001	-	-	-	-	-	0.001	-
YB	22/07/2010	d	-	-	-	91	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/08/2010	d	-	-	-	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/08/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/09/2010	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/10/2010	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	22/11/2010	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/12/2010	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
YB	5/01/2011	d	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/02/2011	d	-	-	-	94	-	17	-	570	0.001	-	-	-	0.026	-	0.0001	-	34	-	0.001	-	0.001	-	-	-	0.001	-	0.001	-
YB	22/03/2011	d	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/04/2011	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/05/2011	d	-	-	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/06/2011	d	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/07/2011	d	-	-	-	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/08/2011	d	-	-	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	10/08/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	13/09/2011	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/09/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/10/2011	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	31/10/2011	d	-	-	-	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/11/2011	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	10/11/2011	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/11/2011	d	-	-	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/12/2011	d	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/01/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	23/01/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/02/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/03/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/04/2012	d	-	-	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/05/2012	d	-	-	-	110	-	19	-	520	-	-	-	-	0.032	-	-	-	50	-	-	-	0.001	-	-	-	-	-	0.024	-
YB	26/06/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/07/2012	d	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/08/2012	d	-	-	-	93	-	19	-	500	-	-	-	-	0.032	-	-	-	35	-	-	-	-	-	-	-	-	-	-	-
YB	24/09/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/10/2012	d	-	-	-	81	-	16	-	510	-	-	-	-	0.037	-	-	-	35	-	-	-	0.0017	-	-	-	-	-	-	-
YB	13/11/2012	d	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/12/2012	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/01/2013	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/01/2013	d	-	-97	-	89	-	23	-	570	0.001	-	-	-	0.039	-	0.0001	-	41	-	0.001	-	0.001	-	-	-	0.001	-	0.001	-
YB	16/02/2013	d	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/03/2013	d	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/04/2013	d	-	-112	-	89	-	12	-	610	0.001	-	-	-	0.029	-	0.0001	-	42	-	0.001	-	0.001	-	-	-	0.001	-	0.001	-
YB	6/05/2013	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/07/2013	d	-	-41	-	90	-	15	-	480	0.001	-	-	-	0.019	-	0.0001	-	33	-	0.001	-	0.001	-	-	-	0.001	-	0.002	-
YB	10/10/2013	d	-	-54	-	90	-	22	-	450	<0.001	-	-	0.001	0.026	-	<0.0001	-	33	-	<0.001	-	0.003	-	-	-	<0.001	-	0.001	-
YB	29/01/2014	d	-	253	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/04/2014	d	13	-43.3	-	110	-	17	-	500	0.005	-	-	-	0.025	-	<0.0001	-	53	-	0.002	-	0.005	-	0.003	-	0.001	-	0.003	-
YB	16/07/2014	d	-	164	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/10/2014	d	-	-	-	91	-	16	-	820	<0.001	-	-	-	0.026	-	<0.0001	-	38	-	<0.001	<0.001	<0.001	-	<0.001	<0.001	0.001	-	<0.001	-
YB	22/01/2015	d	-	-12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	23/01/2015	d	-	-	-	-	110	-	-	480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/04/2015	d	-	-64.2	-	92	-	22	-	600	<0.001	-	-	-	0.01	-	<0.0001	-	40	-	-	<0.001	<0.001	-	-	<0.001	<0.001	-	<0.001	-
YB	9/07/2015	d	-	-2.1	-	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	3/09/2015	d	-	-15	-	94	-	19	-	480	<0.001	-	-	-	0.02	-	<0.0001	-	37	-	-	<0.001	<0.001	-	-	<0.001	<0.001	-	<0.001	-
YB	4/09/2015	d	-	-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/01/2016		-	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/01/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/01/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/04/2016	d	-	-64.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/04/2016	d	-	-	-	91	-	16	-	480	0.002	-	-	-	0.065	-	<0.0001	-	41	-	-	<0.001	0.007	-	-	<0.001	<0.001	-	0.005	-
YB	22/04/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	7/07/2016	d	-	261	-	-	100	-	-	427	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/07/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/09/2016	d	-	-4	-	-	90	19	-	433 - 510	-	0.001	-	-	-	0.035	-	<0.0001	-	38	-	<0.001	-	0.002	-	0.002	-	<0.001	-	<0.001
YB	23/01/2017	d	-	17	-	-	-	-	-	437	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	18/04/2017	d	-	-	-	80	-	-	18	440	<0.001	-	-	-	0.036	-	<0.0001	-	38	-	<0.001	-	0.004	-	0.004	-	<0.001	-	0.002	-
YB	18/04/2017	d	-	-27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	27/07/2017	d	-	-31	-	-	-	-	-	414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	28/07/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/10/2017	d	-	-45	-	-	79.8	-	-	422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/10/2017	d	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/01/2018	d	-	-35	444	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/01/2018		-	-	-	-	97.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/01/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/02/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/04/2018	d	-	-	-	-	95.8 - 96.5	-	19	459 - 474	-	0.0009 - 0.0016	-	-	-	0.025 - 0.026	-	<0.0001	-	38.4 - 40.4	<0.001 - 0.001	-	-	<0.001 - 0.001	<0.001	-	-	0.0003 - 0.0012	-	0.0016 - 0.0035
YB	6/04/2018	d	-	-119	587	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	7/04/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	3/07/2018	d	-	33	452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/07/2018		-	-	-	-	94.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/07/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/07/2018	d	-	-	-	94.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	29/10/2018	d	-	-109	450	-	95.4	20	-	460	-	0.0006	-	-	-	0.022	-	<0.0001	-	37	<0.001	-	-	0.0013	<0.001	-	-	0.0003	-	0.0015
YB	17/01/2019	d	-	-52	-	-	-	-	-	447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	5/02/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/04/2019	d	-	-96	-	-	95.7	19	-	450 - 480	-	0.001	-	-	-	0.02	-	<0.0001	-	37.5	<0.001	-	-	0.0064	0.004	-	-	0.0001	-	0.0026
YB	23/07/2019		-	-	-	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	5/08/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/09/2019	d	-	0	-	-	-	-	-	440	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	10/10/2019	d	-	-128	-	-	93	18	-	421 - 450	-	0.0007	-	-	-	0.034	-	<0.0001	-	37.3	<0.001	-	-	0.003	0.002	-	-	0.0001	-	0.0027
YB	17/01/2020	d	-	-	-	-	92.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	27/01/2020	d	-	-17	-	-	-	-	-	395	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/04/2020	d	-	-140	-	-	87.1	18	-	396 - 510	-	0.0005	-	-	-	<0.02	-	<0.0001	-	35	<0.001	-	-	<0.001	<0.001	-	-	<0.0001	-	0.0027
YB	15/07/2020	d	-	112	-	-	89.9	-	-	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/07/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/10/2020	d	-	34	-	-	91.2	19	-	358 - 500	-	0.0002	-	-	-	0.028	-	<0.0001	-	35.5	<0.001	-	-	<0.001	<0.001	-	-	<0.0001	-	0.0012
YB	26/01/2021	d	-	119	-	-	94.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/06/2021	d	-	-42.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/06/2021	d	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/08/2021	d	-	-17.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/08/2021		-	-	-	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/10/2021	d	-	-22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/10/2021		-	-	-	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	18/03/2022	d	-	-29.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	18/03/2022		-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			Metals																	Other	Radionuclides	
			Iron	Iron (Filtered)	Magnesium	Magnesium (Filtered)	Manganese	Manganese (Filtered)	Mercury	Mercury (Filtered)	Molybdenum	Molybdenum (Filtered)	Nickel	Nickel (Filtered)	Potassium	Potassium (Filtered)	Selenium	Vanadium Total	Vanadium Total (Filtered)	Zinc	Acidity (as CaCO3)	Radium-226	Radium-228
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mBq/L	mBq/L
EQL			0.005	0.005	0.005	0.005	0.001	0.0001	0.00005	0.00001	0.001	0.0001	0.001	0.0005	0.05	0.05		0.001	0.0001				
ADWG 2011 Aesthetic			0.3	0.3			0.1	0.1												3			
ADWG 2011 Health							0.5	0.5	0.001	0.001	0.05	0.05	0.02	0.02			0.01						
LocCode	Sampled_Date-Time	WellCode																					
YB	15/04/2005	d	25	-	11	-	0.1	-	-	-	-	-	-	-	9	-	-	0.0015	-	-	-	32	100
YB	1/08/2005	d	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	2/08/2005	d	19	-	13	-	0.23	-	-	-	-	-	-	-	9	-	-	0.001	-	-	1	41	315
YB	14/11/2005	d	18	-	11	-	0.17	-	-	-	-	-	-	-	7	-	-	0.001	-	-	1	30	567
YB	11/01/2006	d	0	-	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
YB	15/02/2006	d	24	-	11	-	0.15	-	-	-	-	-	0.001	-	0	-	-	0.001	-	-	1	35	432
YB	11/03/2006	d	0	-	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
YB	13/04/2006	d	0	-	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
YB	10/05/2006	d	0	-	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
YB	16/06/2006	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	13/07/2006	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	9/08/2006	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	13/09/2006	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	13/10/2006	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	13/11/2006	d	25	-	0	-	0	-	0.0001	-	-	-	0.001	-	9.1	-	-	0.001	-	-	0	-	-
YB	13/12/2006	d	24	-	9.9	-	0	-	0.0001	-	-	-	0.001	-	7.7	-	-	0.001	-	-	0	-	-
YB	23/01/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	16/02/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	15/03/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/04/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	16/05/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	19/06/2007	d	0	-	12	-	0	-	0.0001	-	-	-	0.001	-	9.3	-	-	0.001	-	-	1	-	-
YB	13/07/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	15/08/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	17/09/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	16/10/2007	d	0	-	0	-	0	-	0	-	-	-	0	-	0	-	-	0	-	-	0	-	-
YB	19/11/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	13/12/2007	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/03/2008	d	27	-	11	-	0.1	-	0.0001	-	-	-	0.001	-	5.8	-	-	0.001	-	-	1	33	100
YB	21/04/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/05/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/06/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/07/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	480	100
YB	8/08/2008	d	28	-	11	-	0.12	-	0.0001	-	-	-	0.001	-	7.4	-	-	0.001	-	-	1	-	-
YB	8/09/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/10/2008	d	24	-	12	-	0.098	-	0.0001	-	-	-	0.001	-	6.4	-	-	0.001	-	-	1	100	100
YB	8/11/2008	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/12/2008	d	24	-	11	-	0.11	-	0.0001	-	-	-	0.001	-	6.3	-	-	0.001	-	-	1	-	-
YB	9/01/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	100
YB	1/02/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/03/2009	d	26	-	11	-	0.11	-	0.0001	-	-	-	0.001	-	7.5	-	-	0.001	-	-	1	40	100
YB	1/04/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/05/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/06/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/07/2009	d	24	-	9.9	-	0.088	-	0.0001	-	-	-	0.001	-	-	-	-	0.001	-	-	1	71	327
YB	1/08/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/09/2009	d	21	-	11	-	0.085	-	0.0001	-	-	-	0.001	-	6.6	-	-	0.001	-	-	1	-	-
YB	1/10/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/11/2009	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/12/2009	d	26	-	11	-	0.096	-	0.0001	-	-	-	0.001	-	8.4	-	-	0.001	-	-	1	79	102
YB	1/01/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/01/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/02/2010	d	22	-	15	-	0.086	-	0.0001	-	-	-	0.001	-	7.4	-	-	0.001	-	-	1	32	200
YB	1/03/2010	d	22	-	9.8	-	0.083	-	0.0001	-	-	-	0.001	-	7	-	-	0.001	-	-	-	-	-
YB	1/04/2010	d	26	-	11	-	0.097	-	0.0001	-	-	-	0.001	-	7.2	-	-	0.001	-	-	1	-	-
YB	20/05/2010	d	24	-	11	-	0.08	-	0.0001	-	-	-	0.009	-	7.9	-	-	0.002	-	-	-	642	523
YB	21/06/2010	d	25	-	11	-	0.097	-	-	-	-	-	0.001	-	8.2	-	-	0.001	-	-	-	-	-
YB	22/07/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/08/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/08/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	304
YB	17/09/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/10/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	22/11/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/12/2010	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	5/01/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/02/2011	d	25	-	11	-	0.094	-	0.0001	-	-	-	0.001	-	8.3	-	-	0.001	-	-	-	76	100
YB	22/03/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/04/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/05/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	463	100
YB	21/06/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/07/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/08/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	158
YB	10/08/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	13/09/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/09/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/10/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	100
YB	31/10/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	1/11/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-	-
YB	10/11/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/11/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63	100
YB	15/12/2011	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/01/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	121
YB	23/01/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/02/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/03/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/04/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/05/2012	d	26	-	17	-	0.096	-	-	-	0.0013	-	-	-	7.9	-	-	0.0012	-	-	-	38	100
YB	26/06/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	17/07/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	14/08/2012	d	25	-	11	-	0.09	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	39	114
YB	24/09/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	26/10/2012	d	24	-	11	-	0.089	-	-	-	-	-	-	-	8.2	-	-	-	-	-	-	40	100
YB	13/11/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/12/2012	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/01/2013	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/01/2013	d	24	-	19	-	0.09	-	0.0001	-	-	-	0.001	-	8.1	-	-	0.001	-	-	-	36	100
YB	16/02/2013	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/03/2013	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	9/04/2013	d	12	-	18	-	0.11	-	0.0001	-	-	-	0.001	-	5.8	-	-	0.001	-	-	-	56	100
YB	6/05/2013	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/07/2013	d	24	-	-	-	0.099	-	0.0001	-	-	-	0.001	-	8	-	-	0.001	-	-	-	56	100
YB	10/10/2013	d	24	-	12	-	0.1	-	<0.0001	-	<0.001	-	<0.001	-	8	-	<0.001	0.002	-	0.003	-	64	<100
YB	29/01/2014	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	100
YB	9/04/2014	d	29	-	13	-	0.17	-	<0.0001	-	<0.001	-	0.001	-	8.3	-	-	0.008	-	-	-	74	100
YB	16/07/2014	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/10/2014	d	24	-	12	-	0.1	-	<0.0001	-	<0.001	-	<0.001	-	10	-	-	<0.001	-	-	-	66	100
YB	22/01/2015	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	177	<100
YB	23/01/2015	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/04/2015	d	23	-	13	-	0.1	-	<0.0001	-	<0.001	-	<0.001	-	8.7	-	-	<0.001	-	-	-	61	100
YB	9/07/2015	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	<100
YB	3/09/2015	d	15	-	12	-	0.12	-	<0.0001	-	<0.001	-	<0.001	-	10	-	-	<0.001	-	-	-	-	-
YB	4/09/2015	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	<100
YB	20/01/2016		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/01/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/01/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	<100
YB	15/04/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	21/04/2016	d	26	-	12	-	0.2	-	<0.0001	-	<0.001	-	0.002	-	10	-	-	0.017	-	-	-	-	-
YB	22/04/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	533	192
YB	7/07/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/07/2016	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	232	<100
YB	15/09/2016	d	-	23	-	12	-	0.13	-	<0.0001	-	<0.001	-	<0.001	-	8.4	-	-	0.007	-	-	<100	<100
YB	23/01/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	114
YB	18/04/2017	d	23	-	12	-	0.1	-	<0.0001	-	<0.001	-	<0.001	-	7.4	-	-	0.003	-	-	-	-	-
YB	18/04/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44	76
YB	27/07/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	28/07/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	68
YB	12/10/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	71
YB	16/10/2017	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	11/01/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/01/2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	24/01/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	8/02/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	141
YB	6/04/2018	d	-	20 - 22	-	12 - 13.9	-	0.094 - 0.12	<0.0001	-	-	0.0002 - 0.0008	-	0.0008 - 0.0017	-	8.2 - 8.5	-	-	0.0014 - 0.005	-	-	-	-
YB	6/04/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45 - 47	130
YB	7/04/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	130
YB	3/07/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/07/2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	6/07/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	100
YB	9/07/2018	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	100
YB	29/10/2018	d	-	21	-	12.2	-	0.11	<0.00005	-	-	<0.0001	-	0.0006	-	8.9	-	-	0.0034	-	-	<100	38
YB	17/01/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	5/02/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	80
YB	16/04/2019	d	-	25	-	12.5	-	0.099	<0.00005	-	-	<0.001	-	<0.001	-	8.3	-	-	0.0028	-	-	44	<150
YB	23/07/2019		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	5/08/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	71
YB	11/09/2019	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	10/10/2019	d	-	24	-	12.4	-	0.13	<0.00005	-	-	<0.001	-	<0.001	-	8.4	-	-	0.0023	-	-	-	-
YB	17/01/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	<82
YB	27/01/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	15/04/2020	d	-	24	-	10.5	-	0.11	<0.00005	-	-	<0.001	-	<0.001	-	7.8	-	-	0.0008	-	-	<69	<110
YB	15/07/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	16/07/2020	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<64	83
YB	14/10/2020	d	-	20	-	11.7	-	0.1	<0.00005	-	-	<0.001	-	<0.001	-	7.9	-	-	0.0002	-	-	64	<150
YB	26/01/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	<160
YB	9/06/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
YB	9/06/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	12/08/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	<80
YB	12/08/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	20/10/2021	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	<80
YB	20/10/2021		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	18/03/2022	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
YB	18/03/2022		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-





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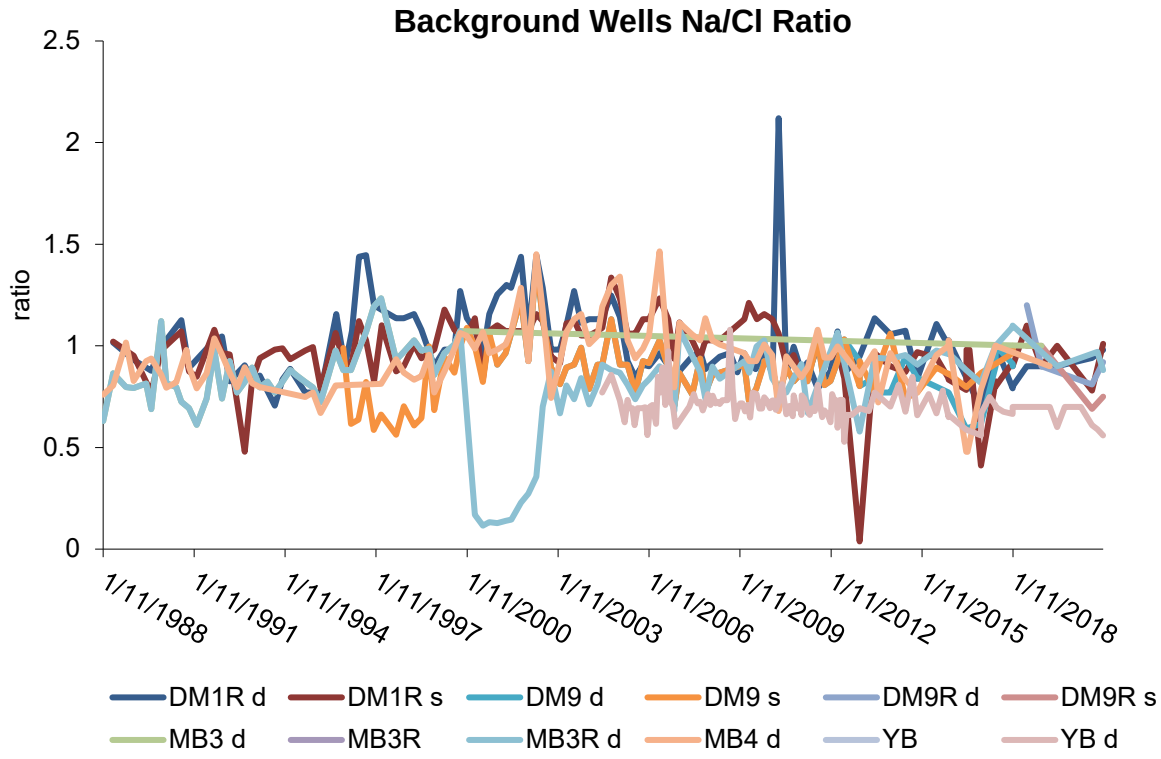

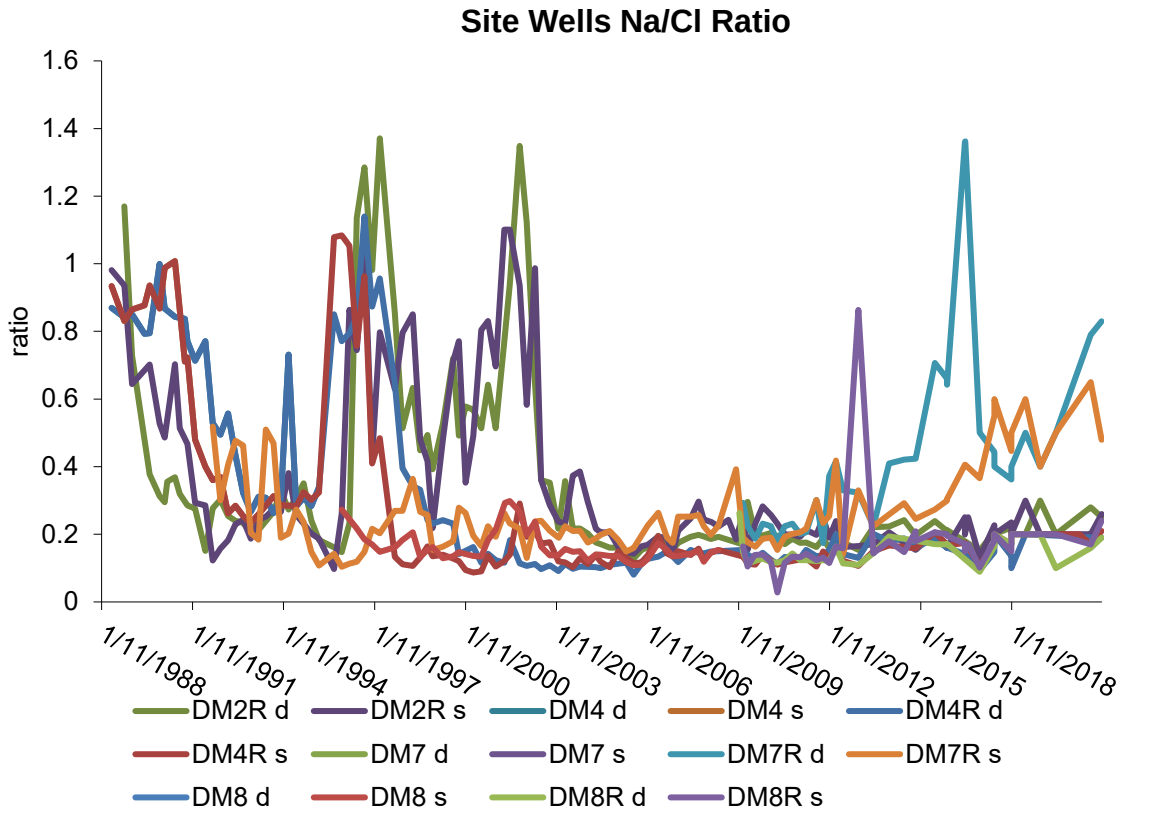

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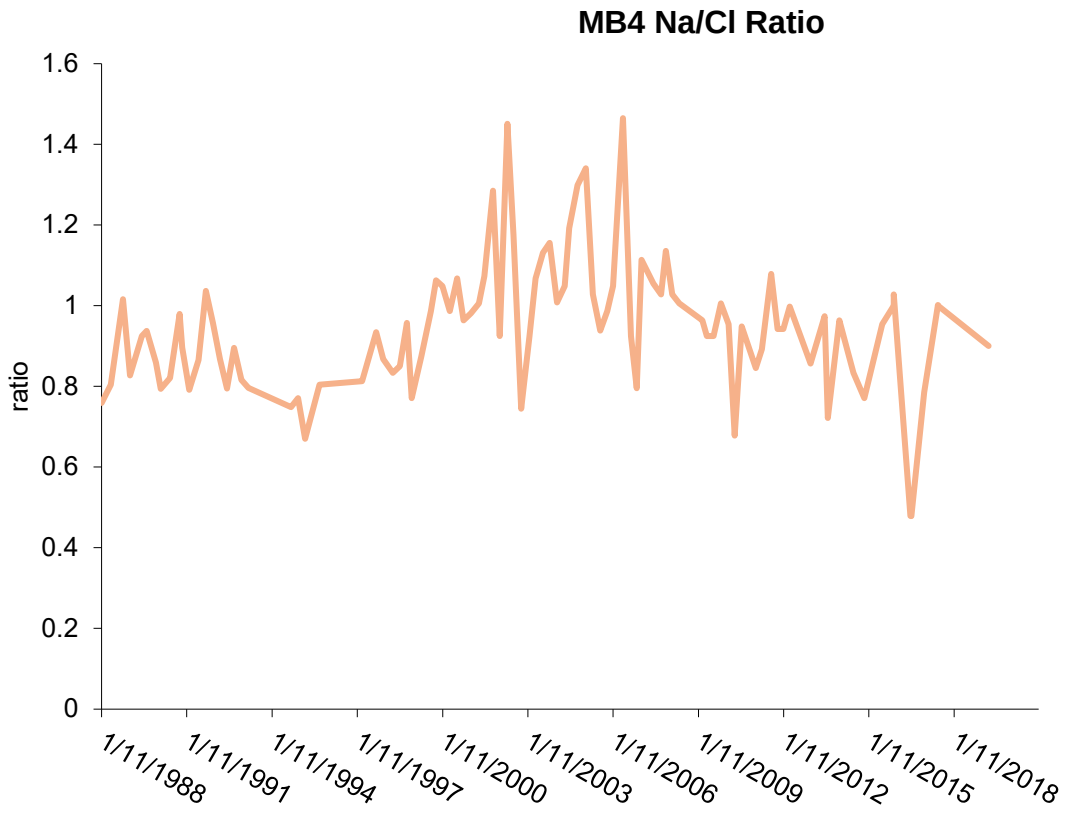

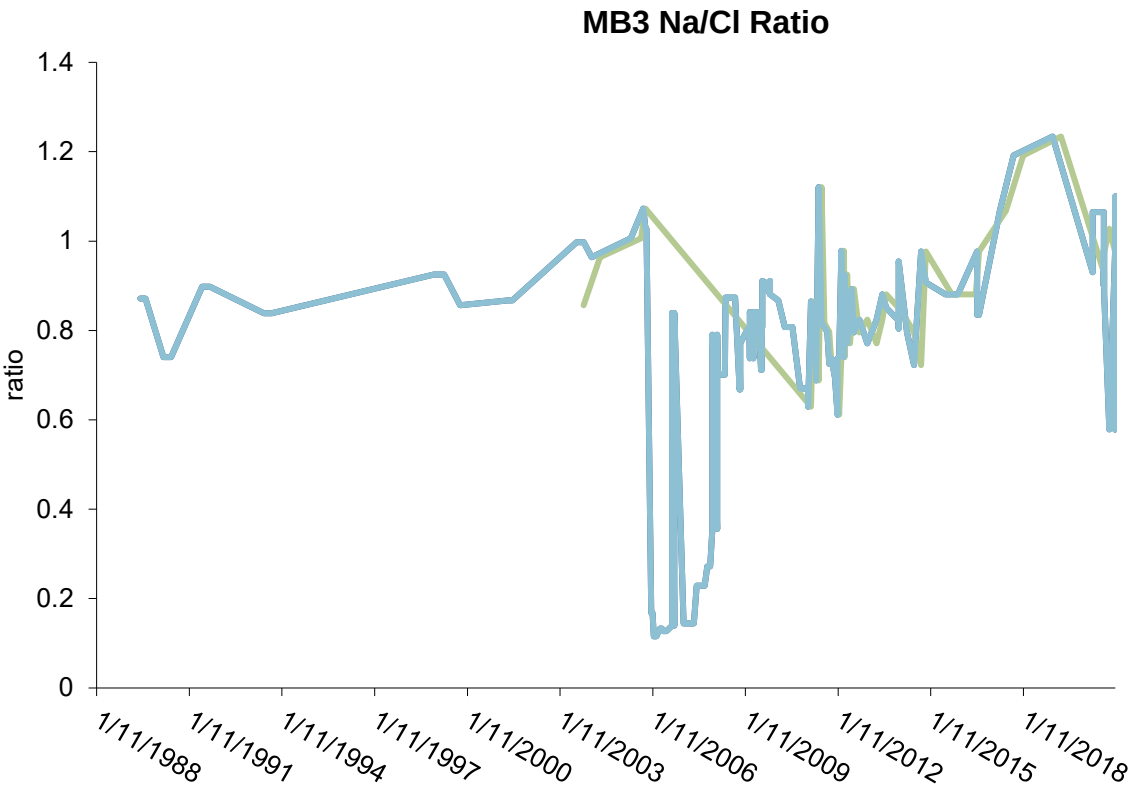

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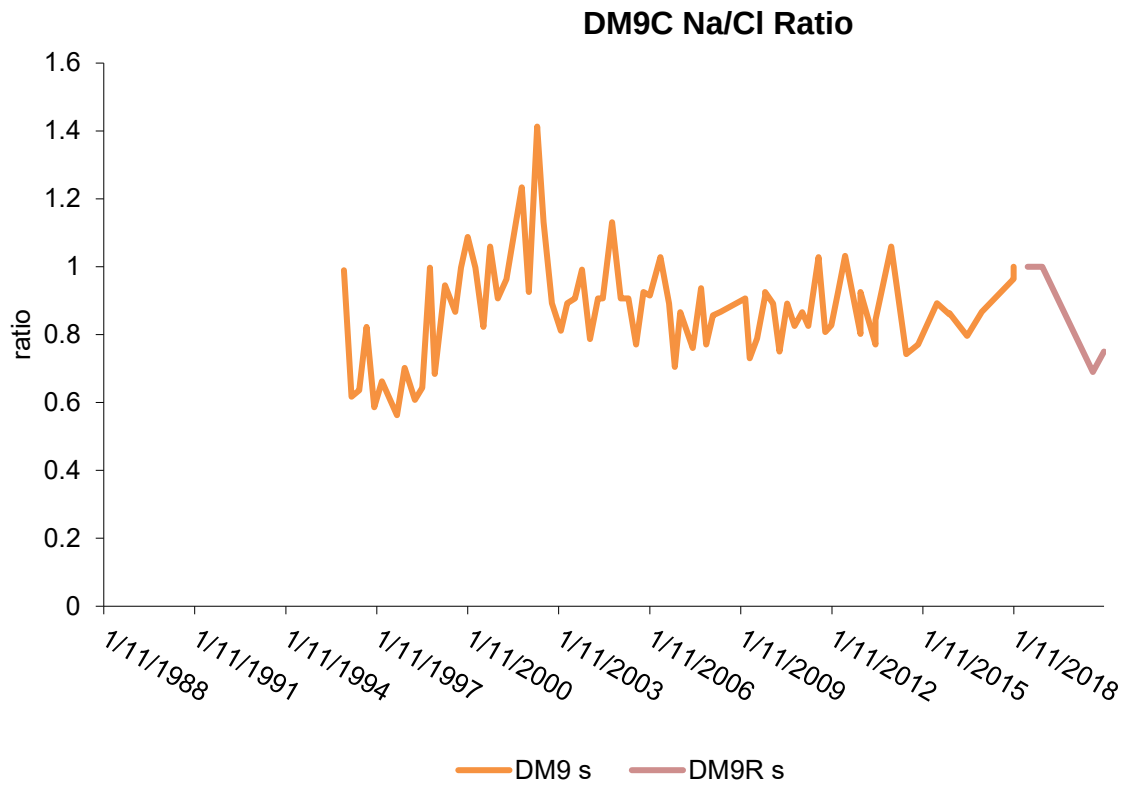

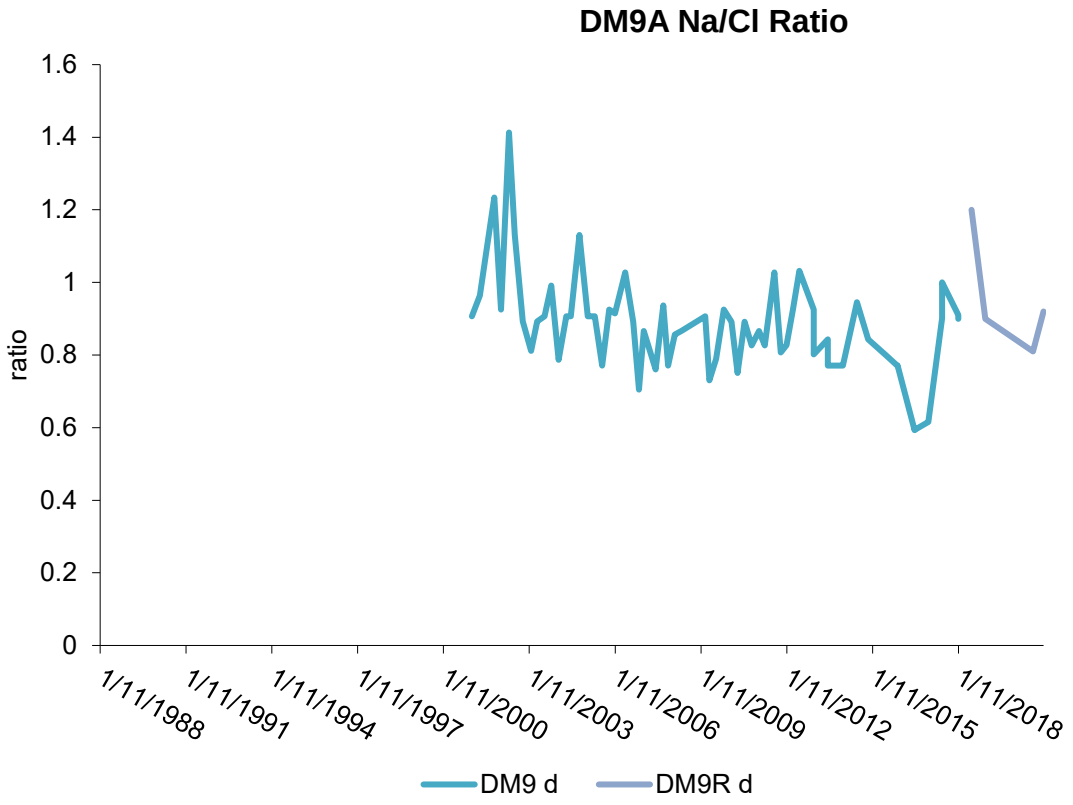

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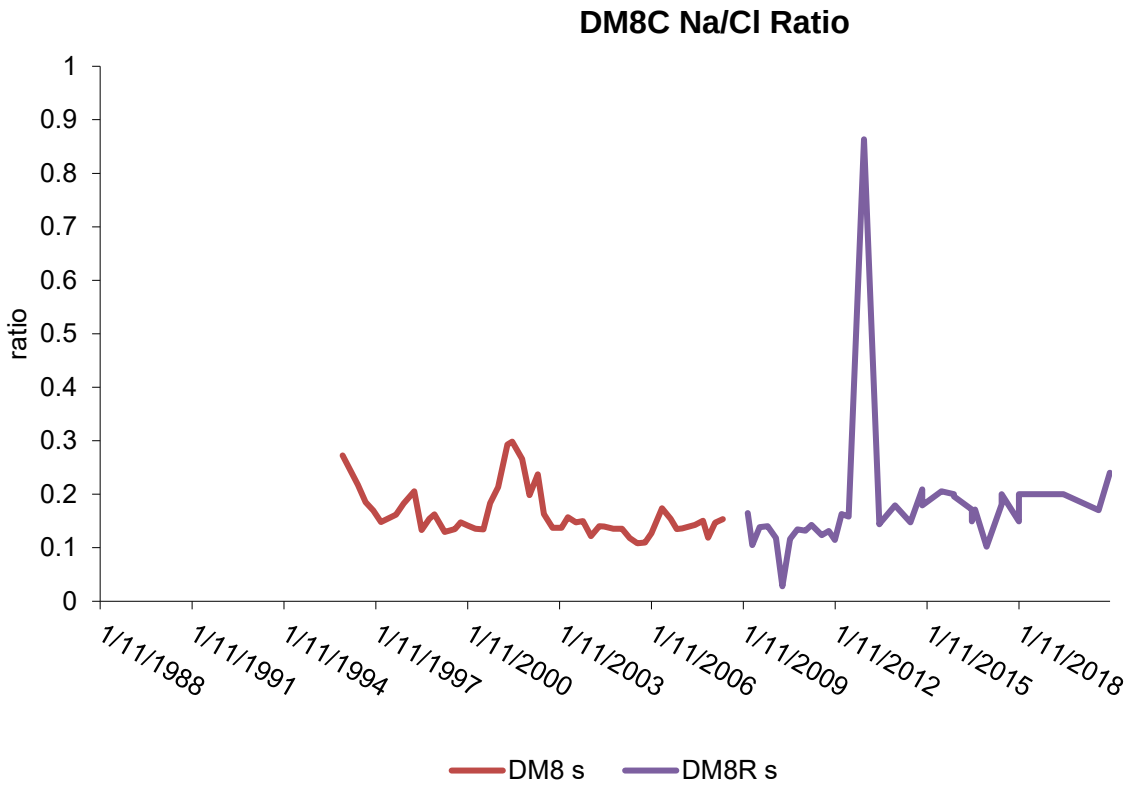

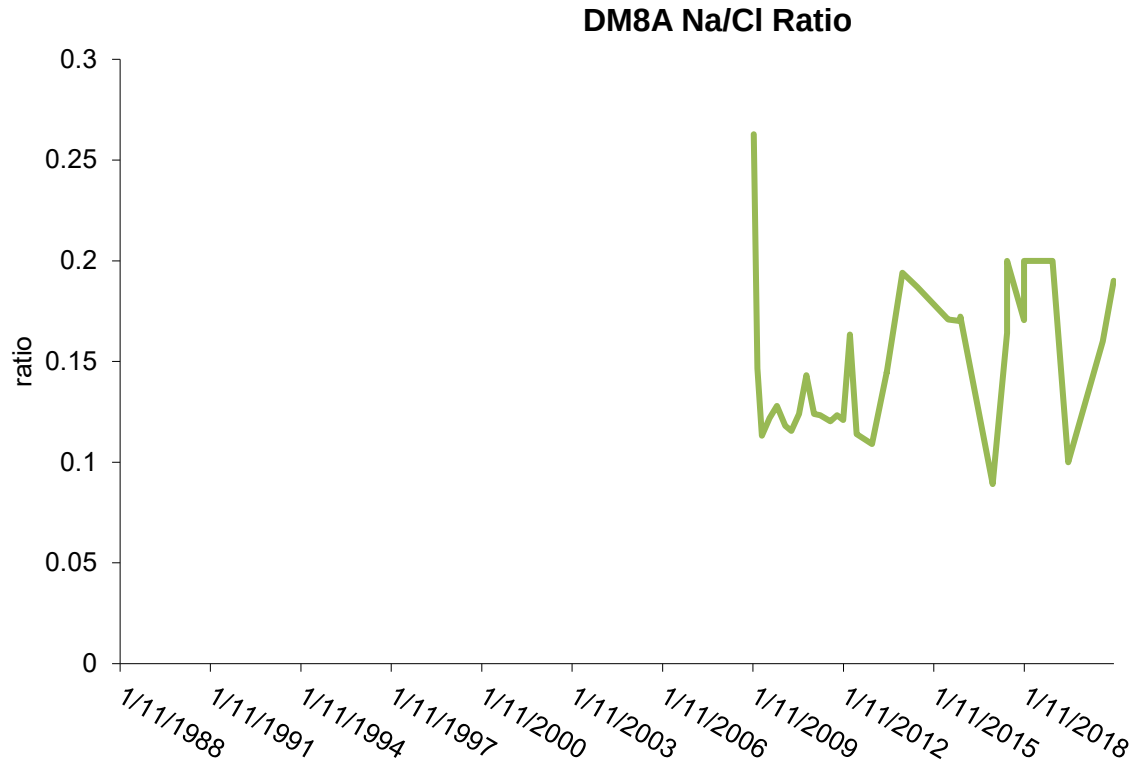

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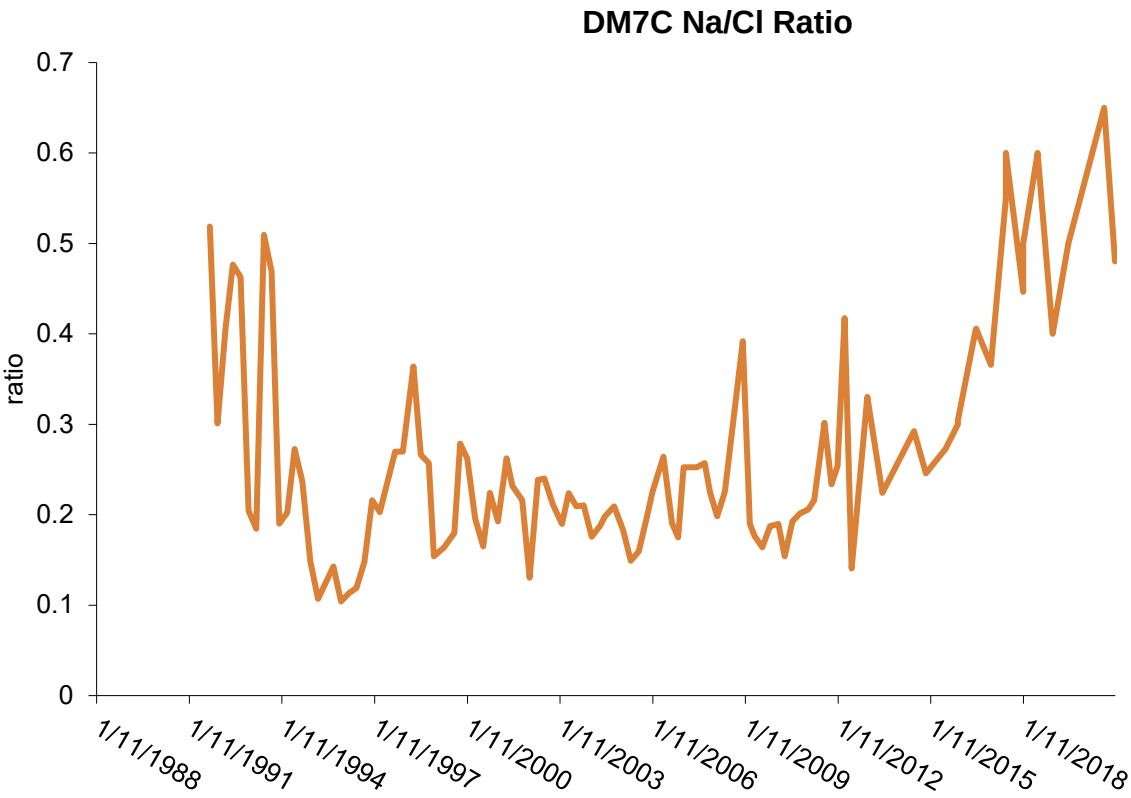

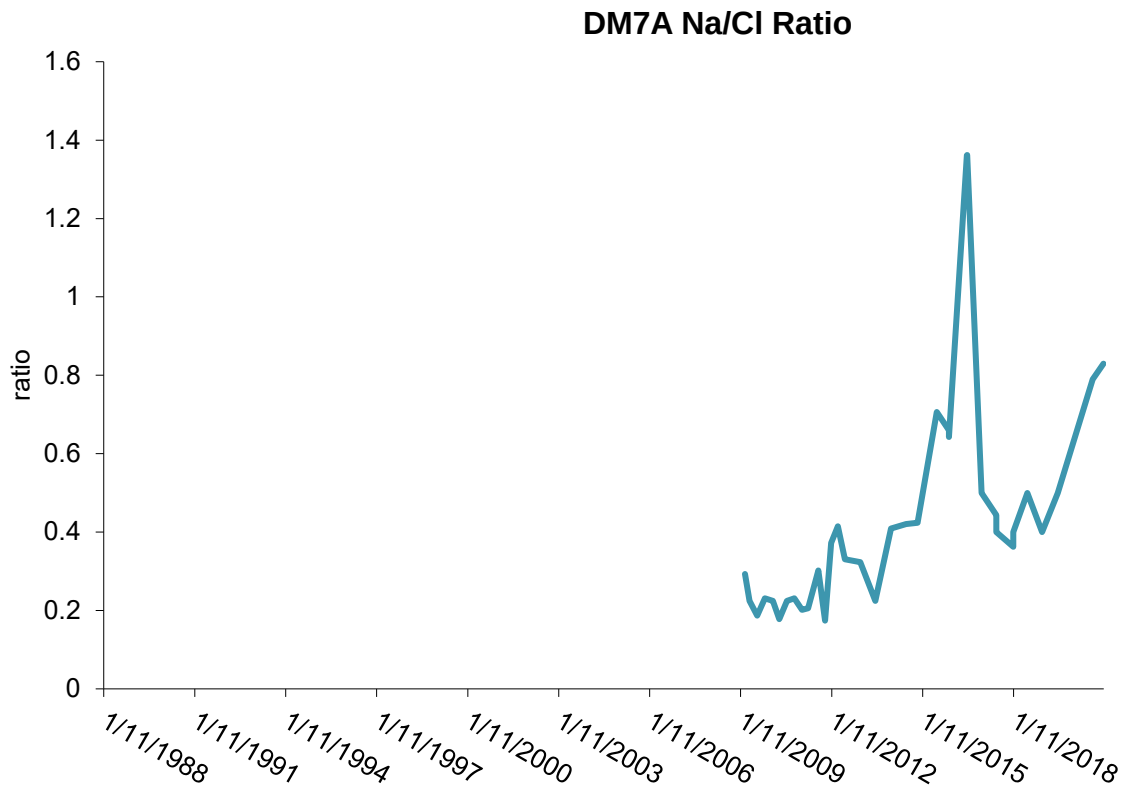

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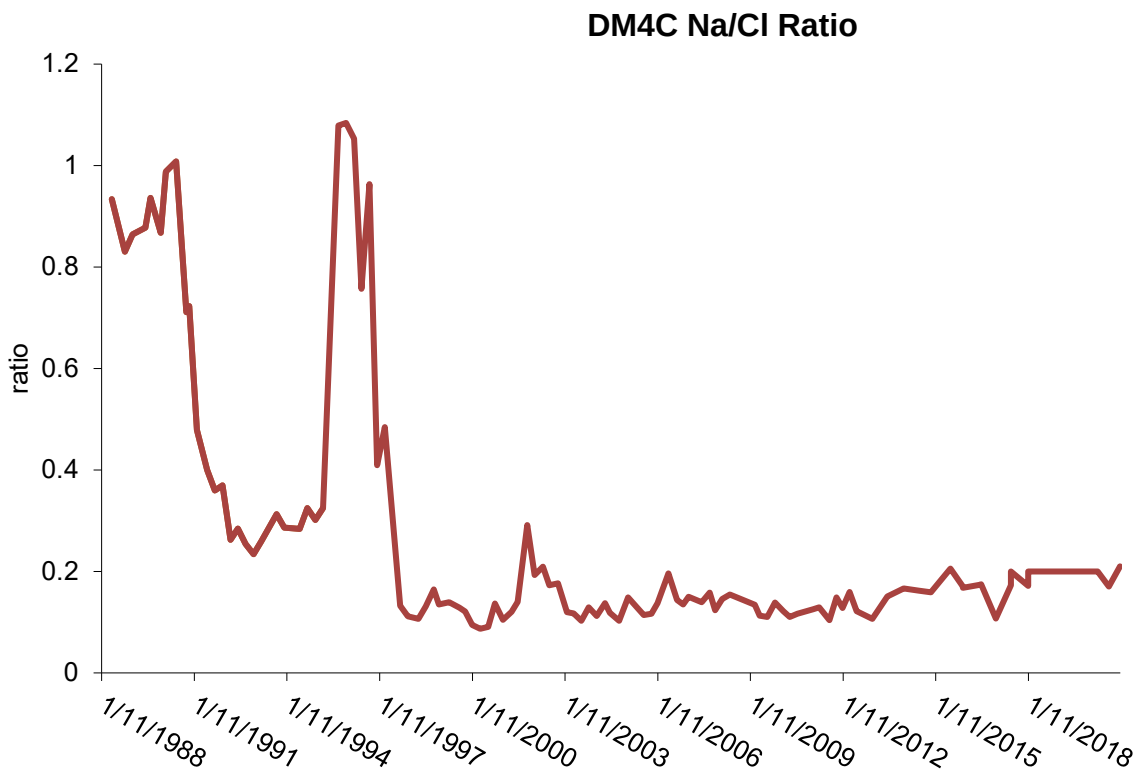

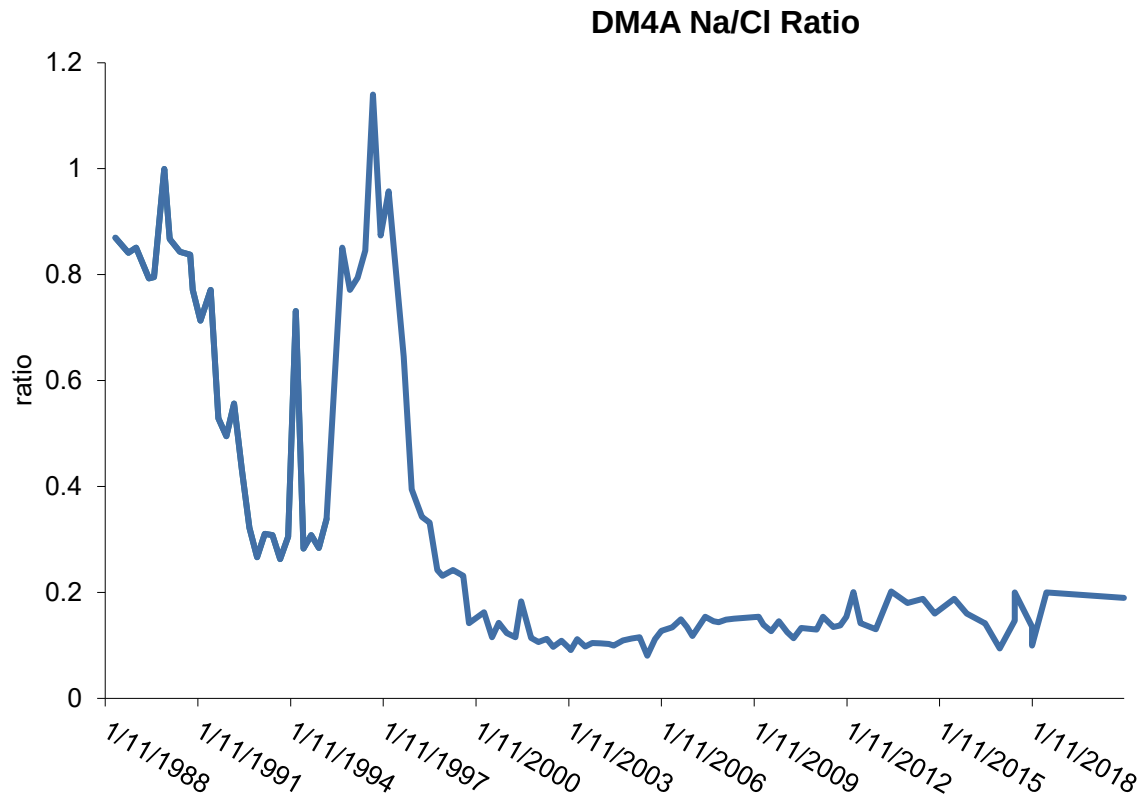

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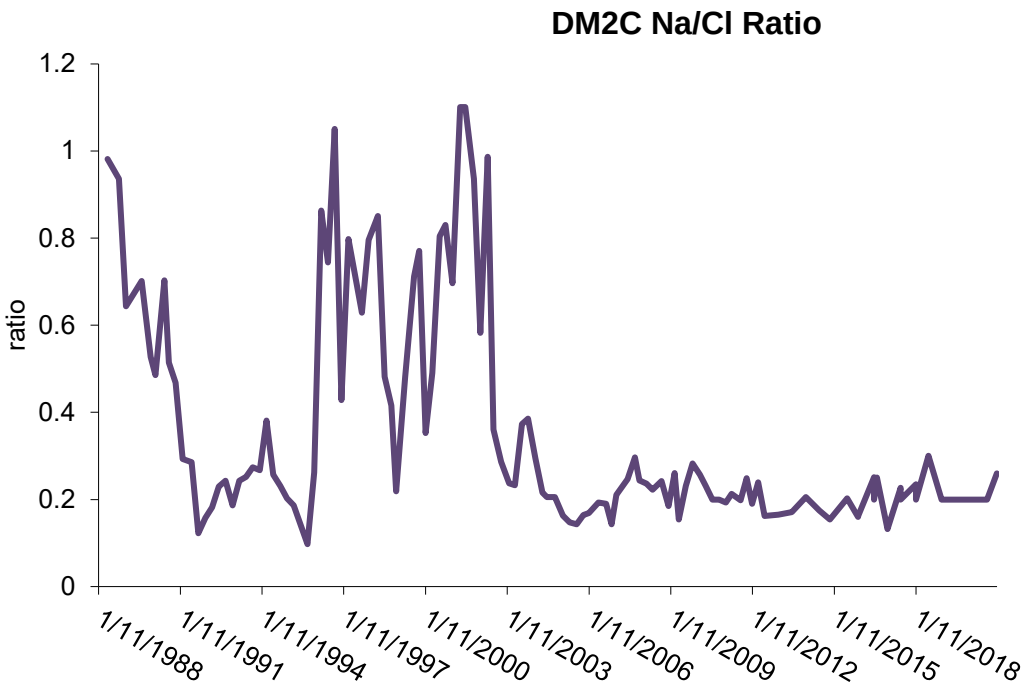

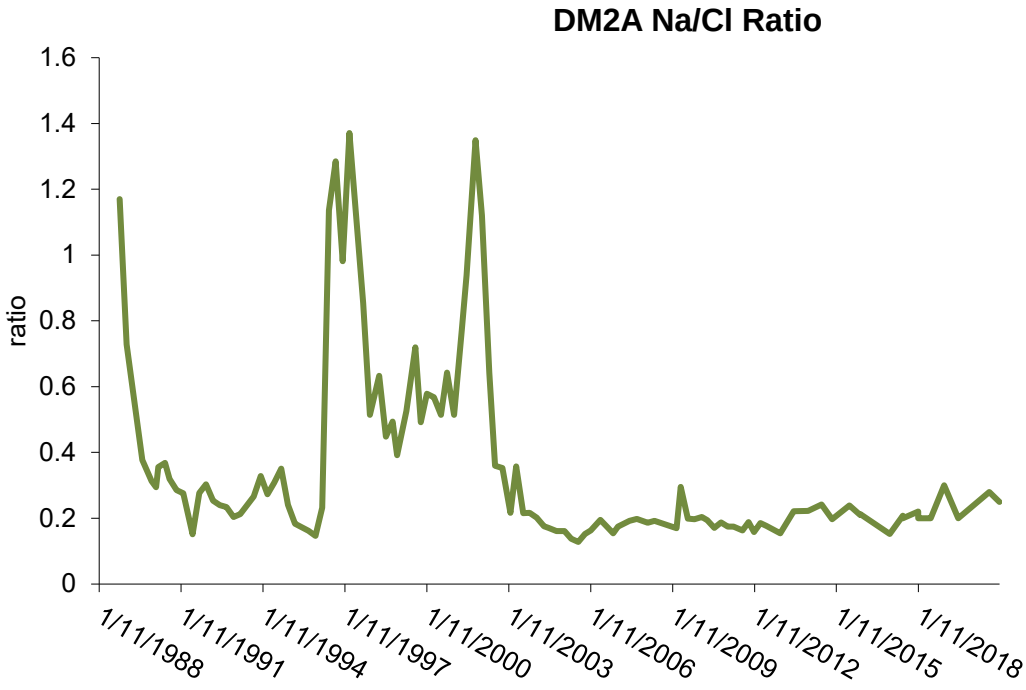

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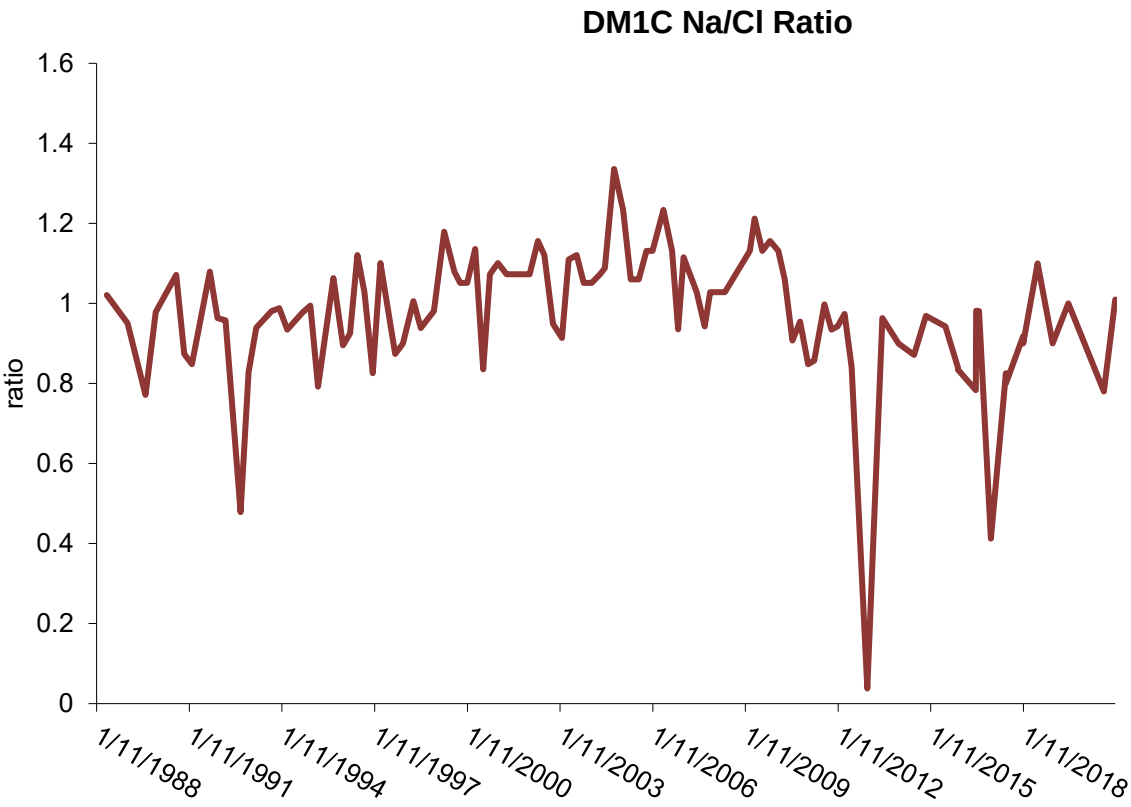

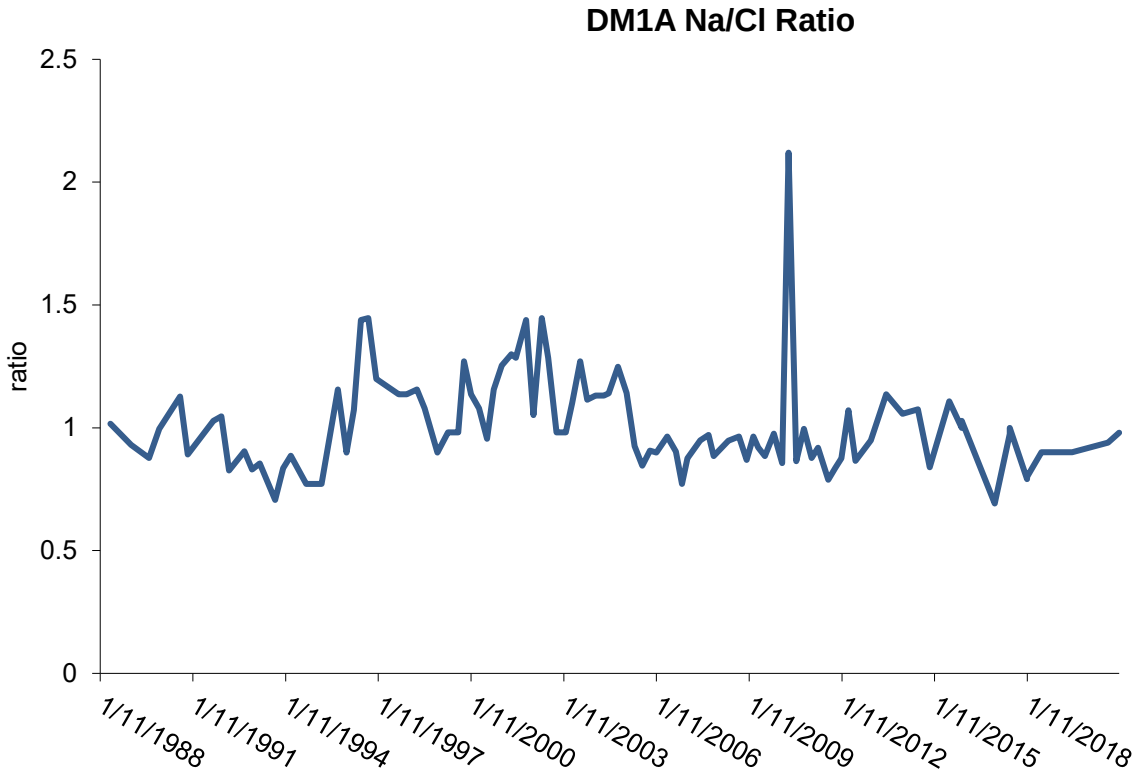

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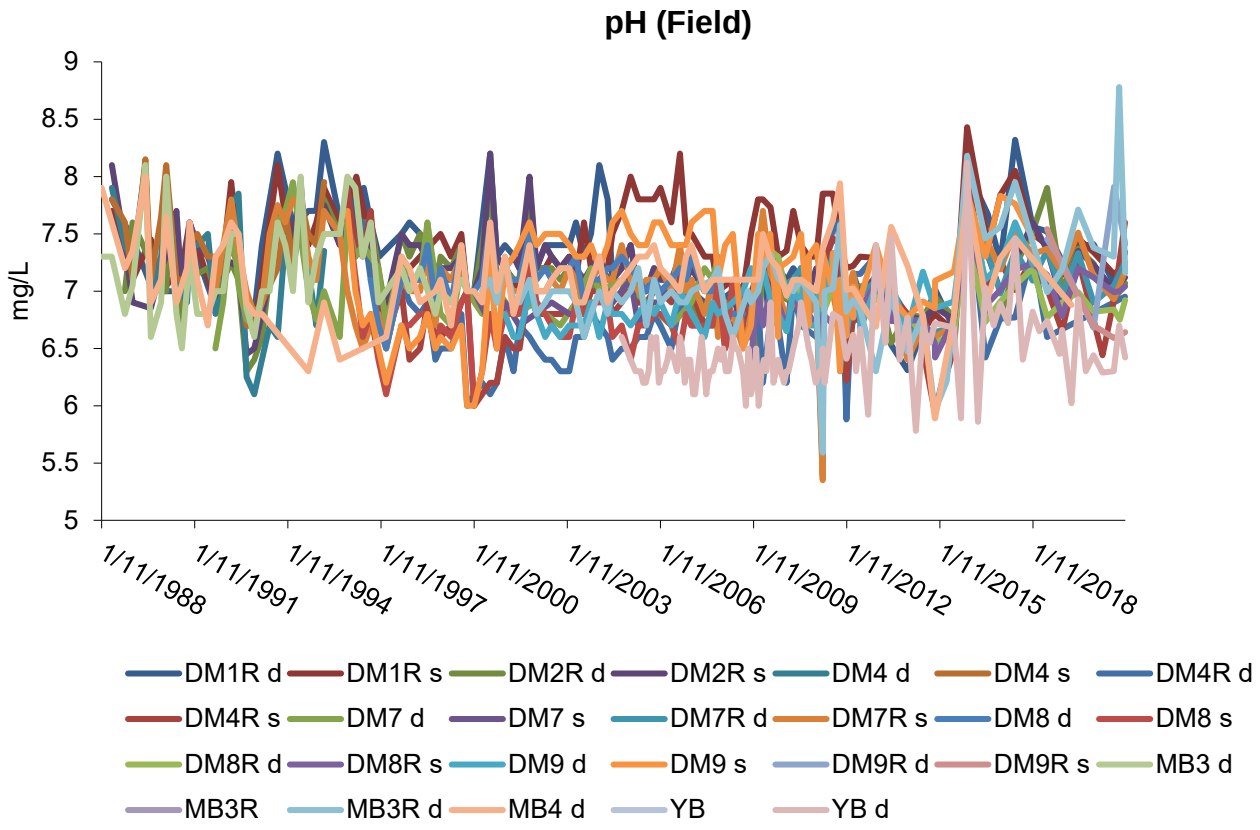

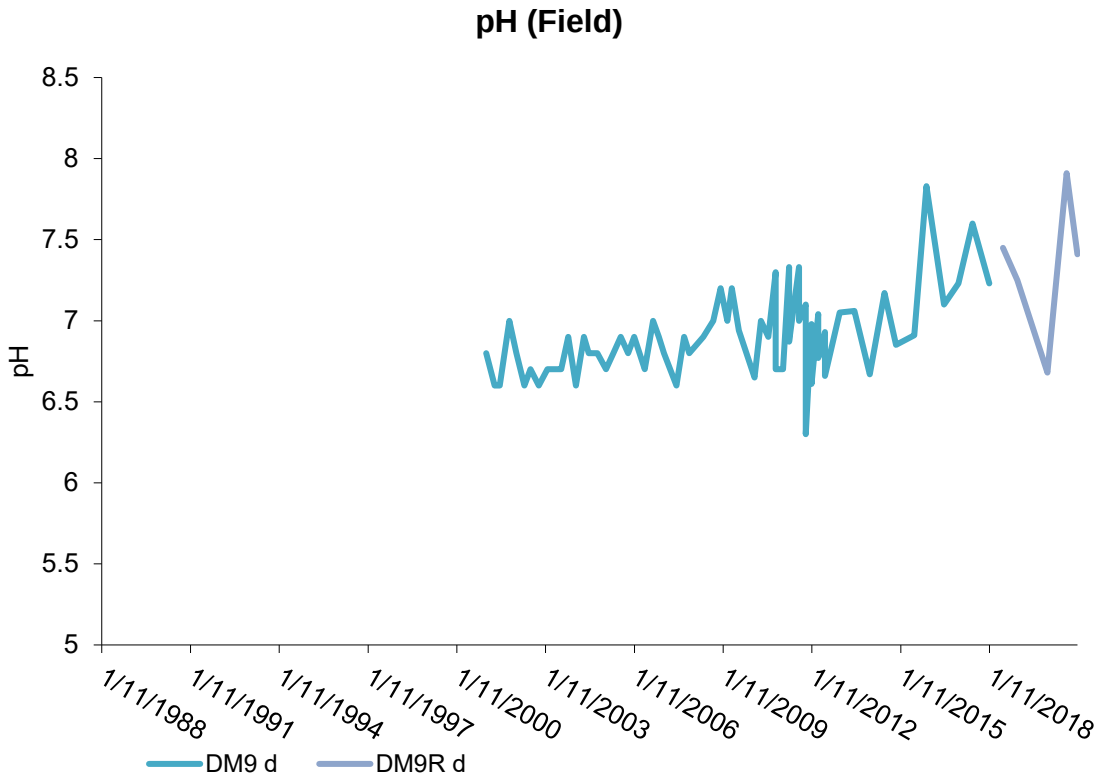

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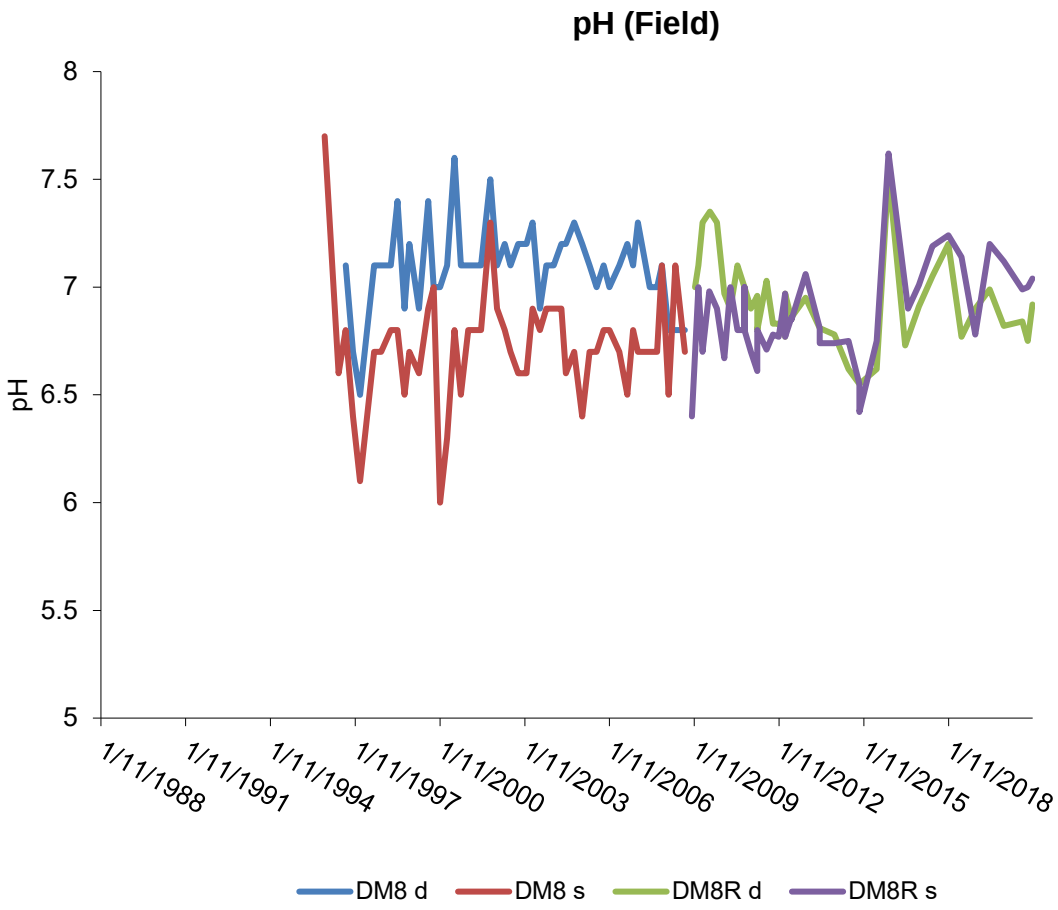

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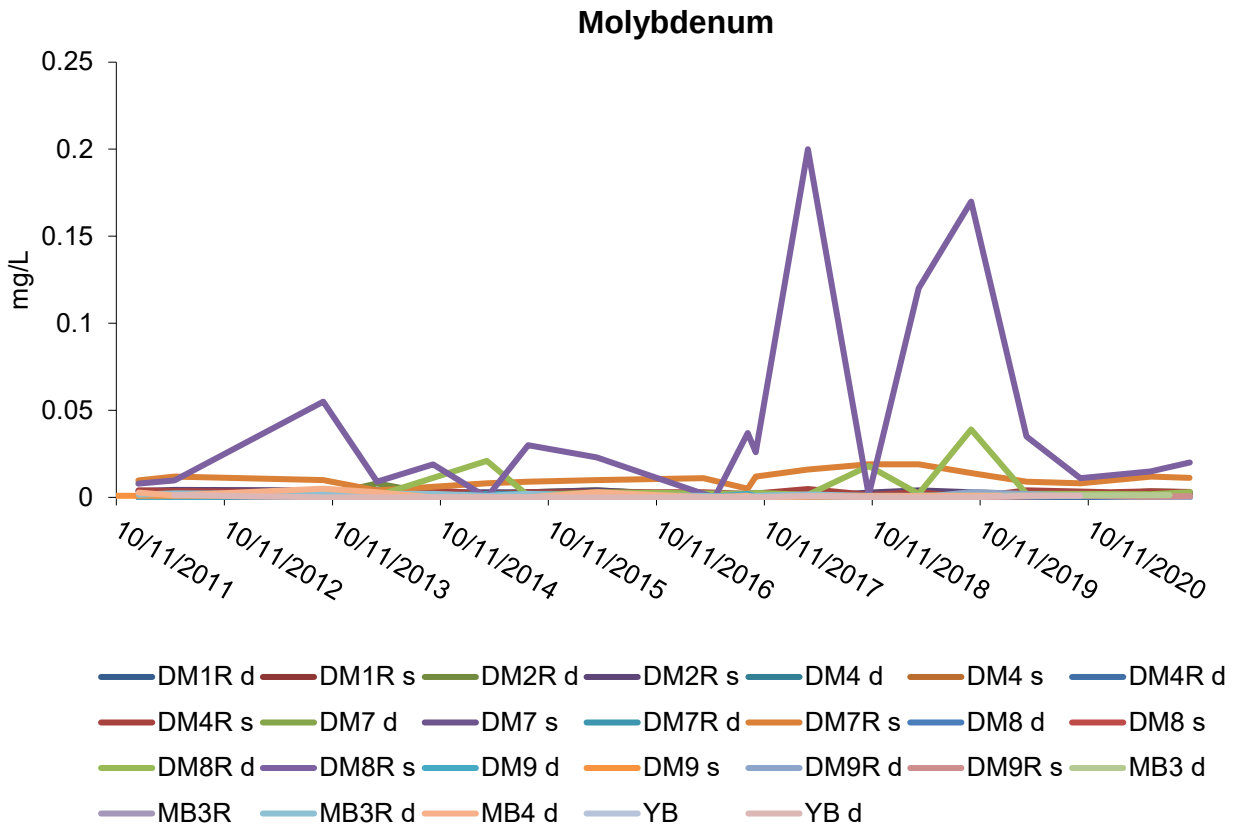

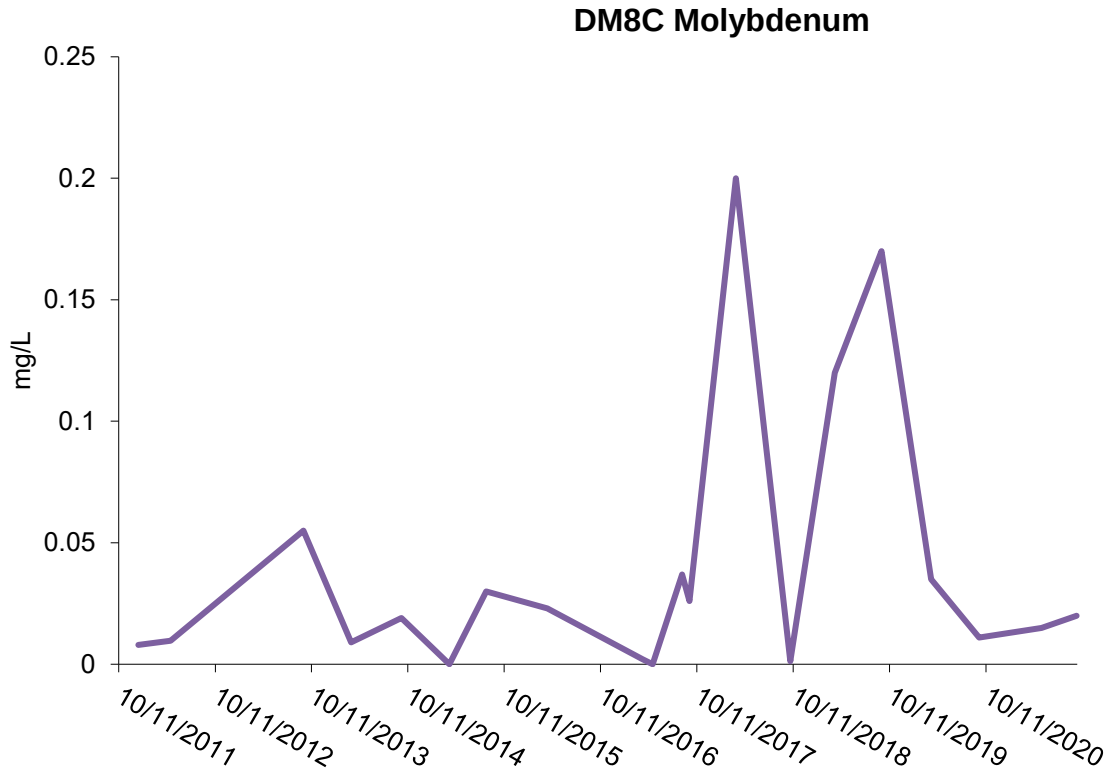

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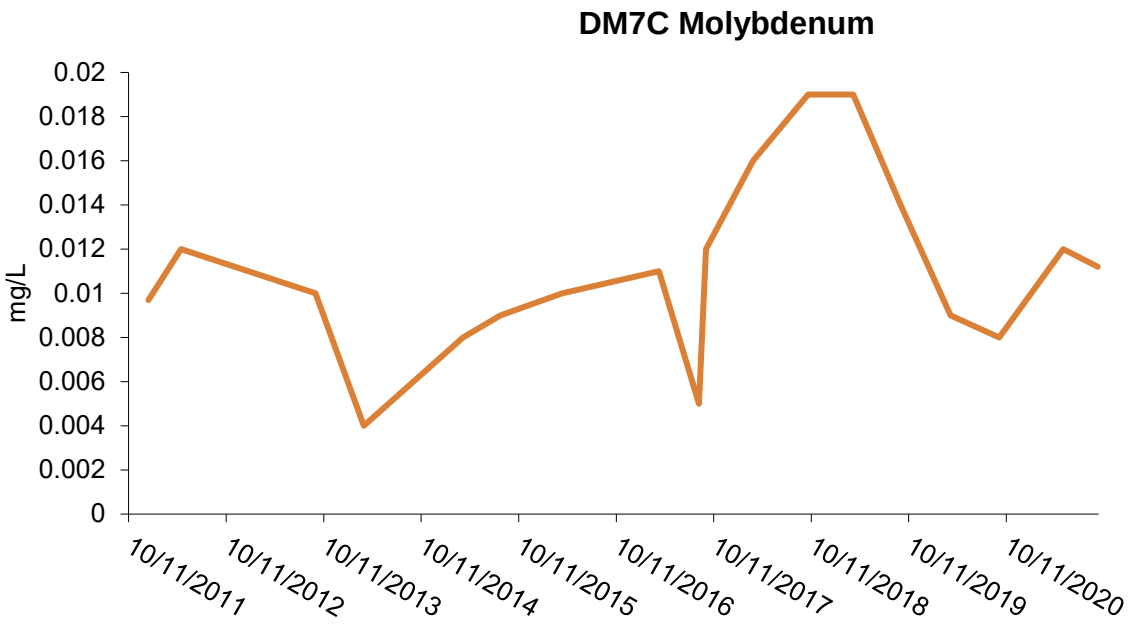

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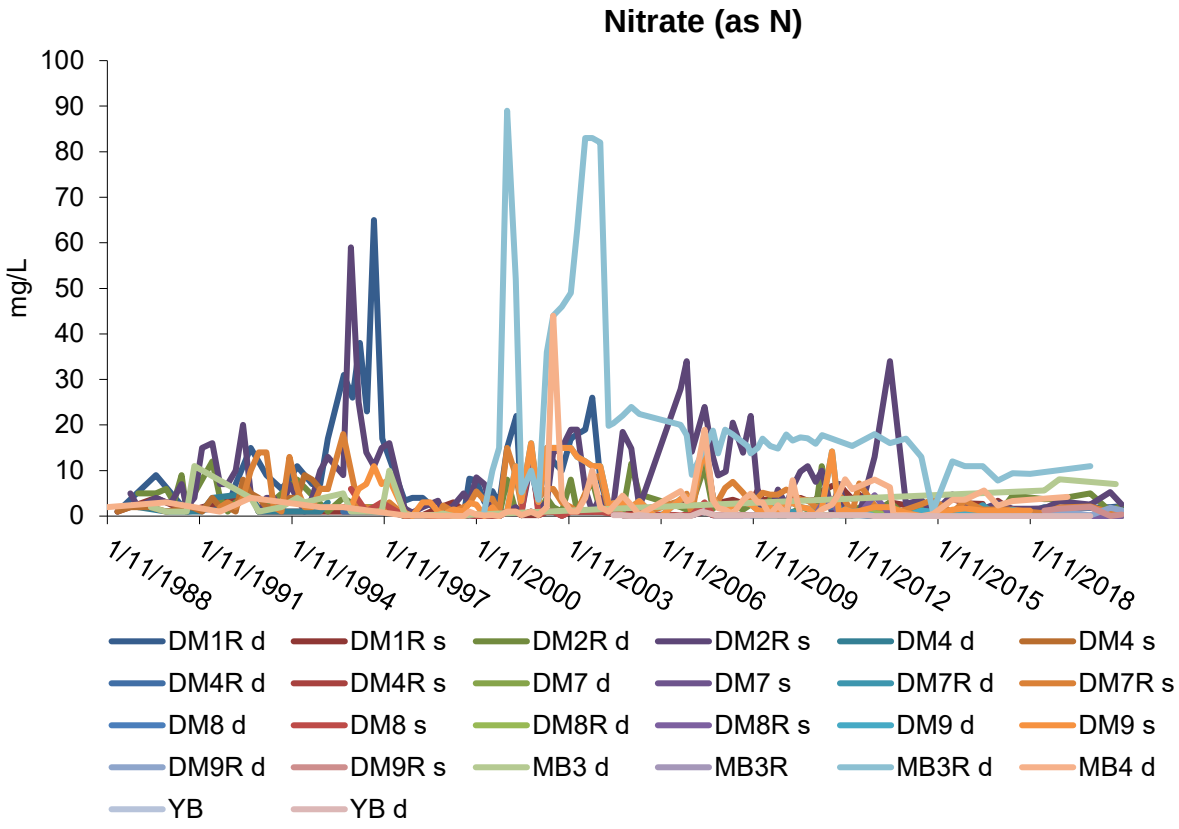

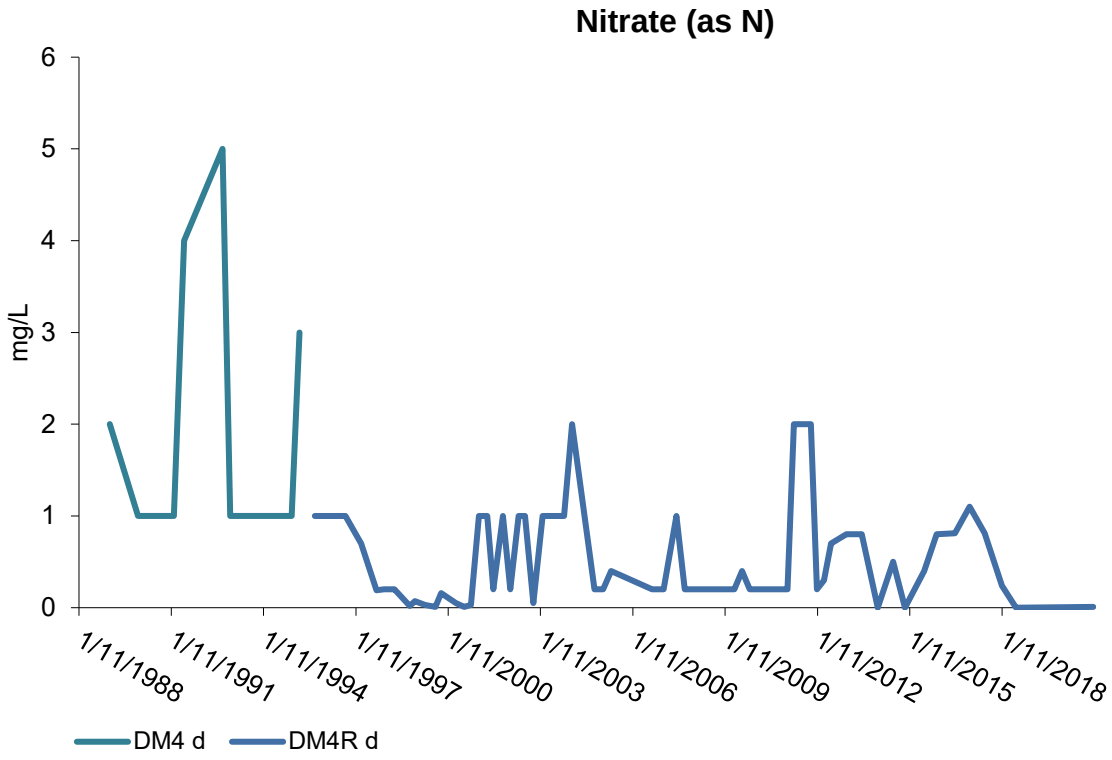

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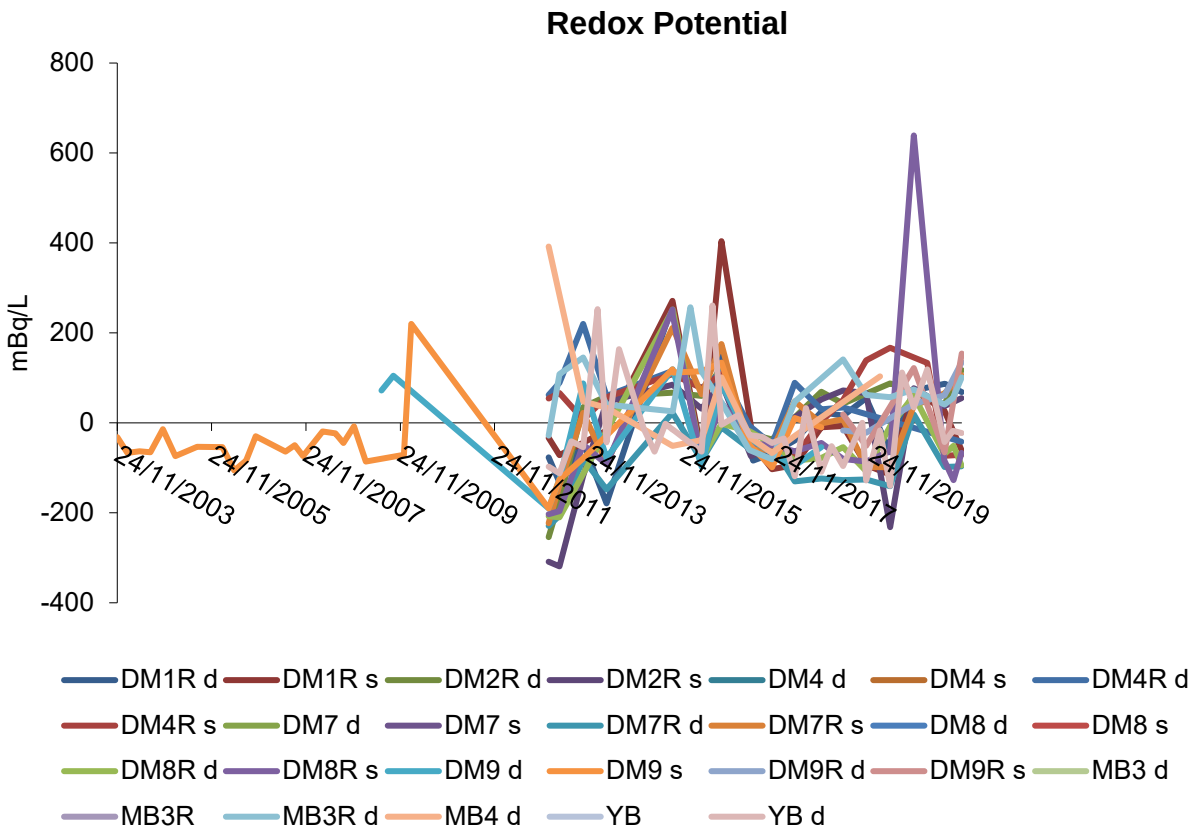

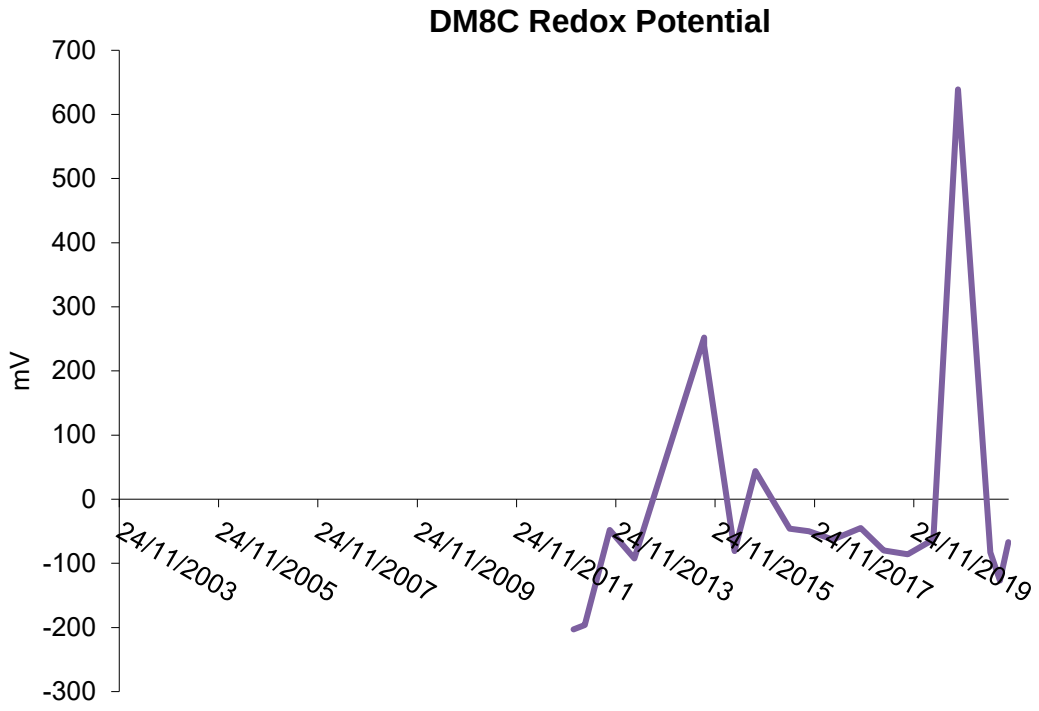

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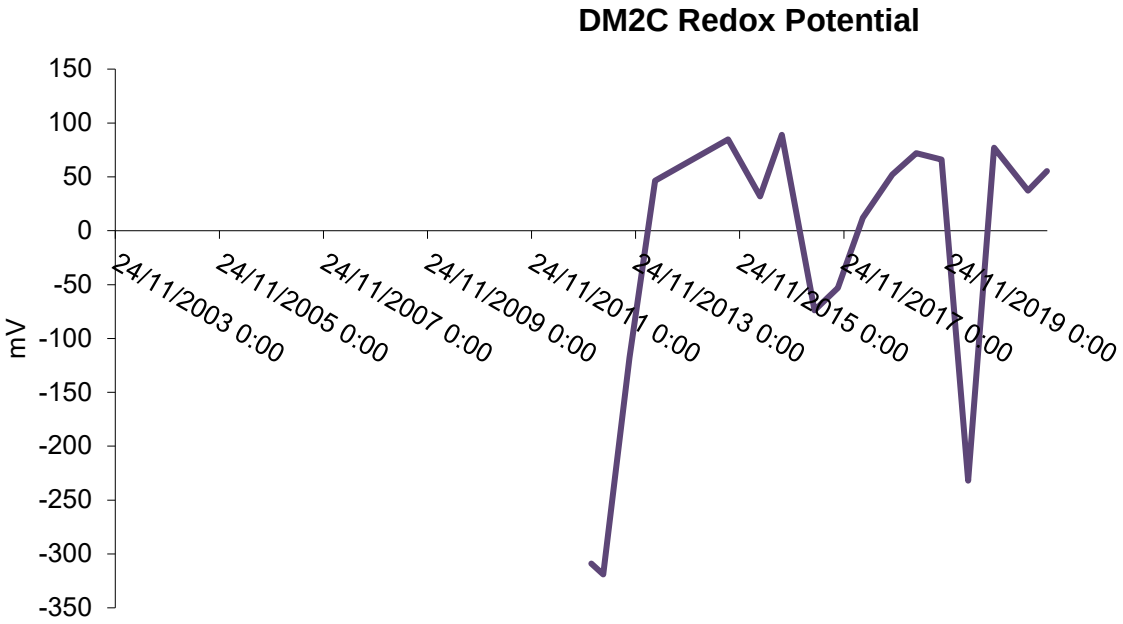

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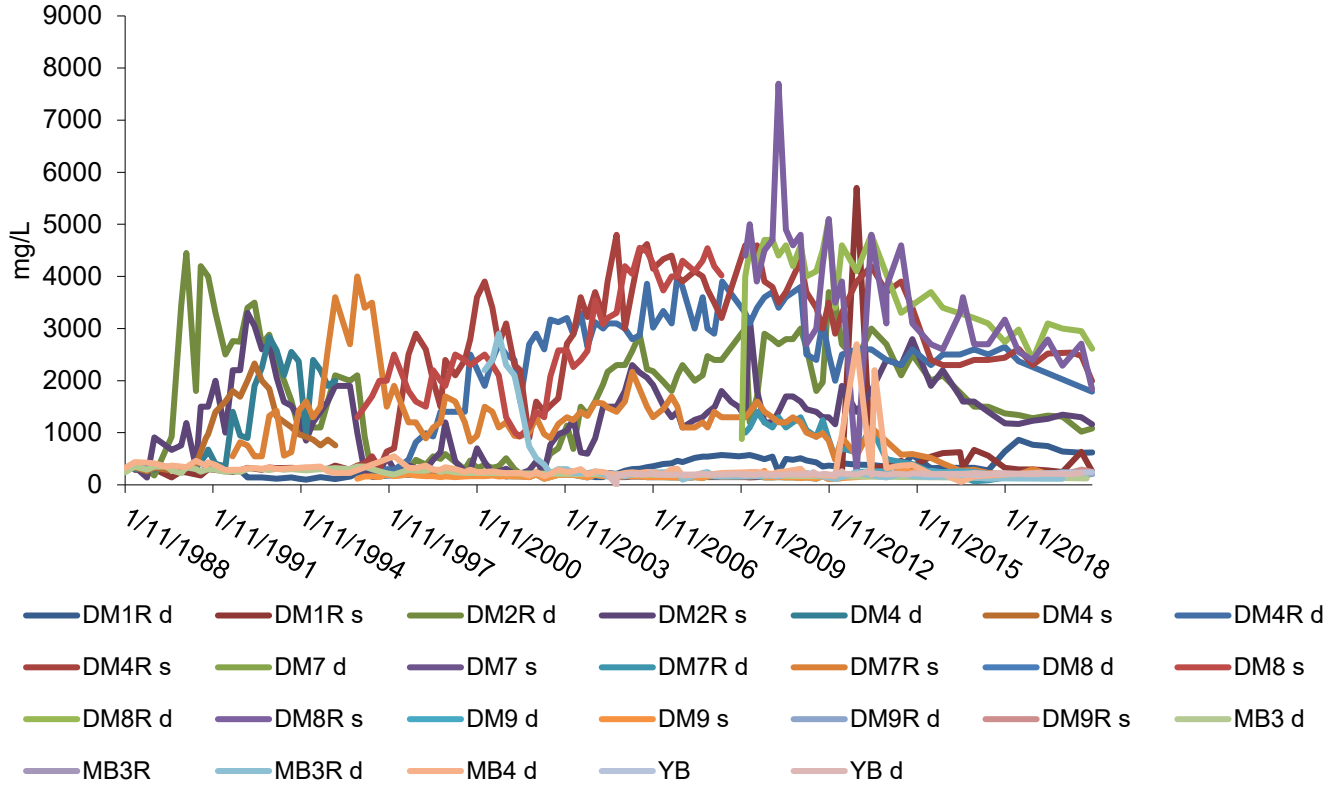
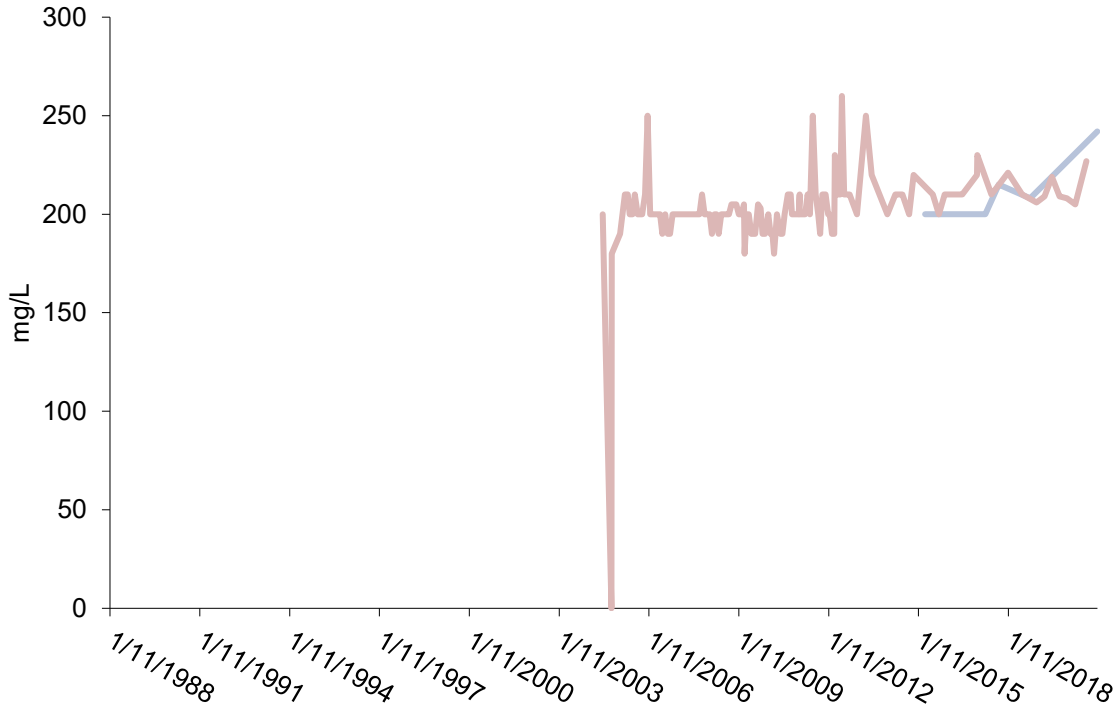


YB Chloride



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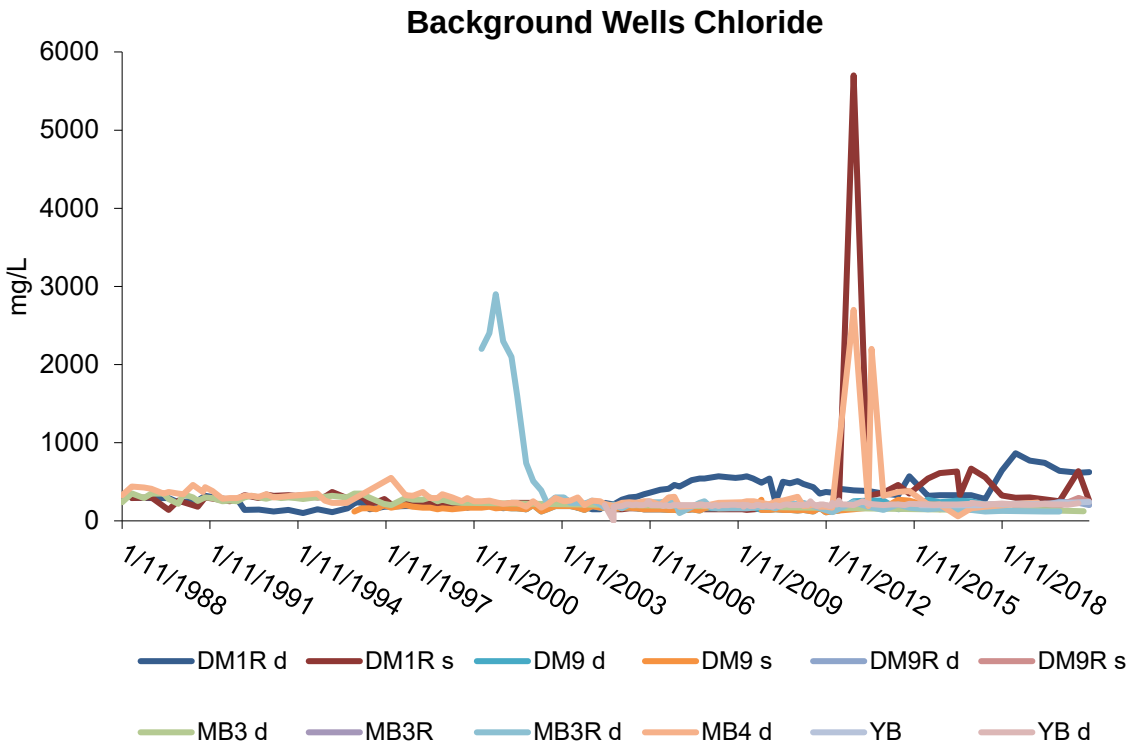

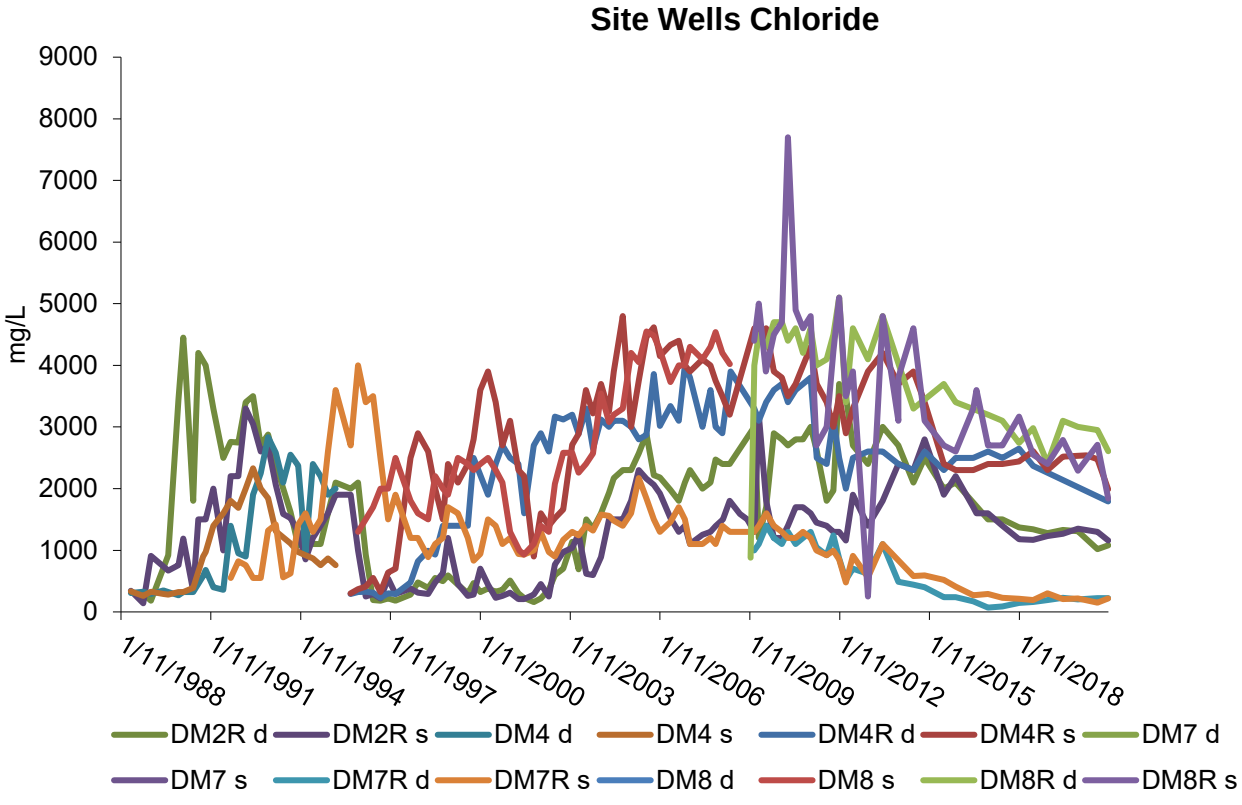

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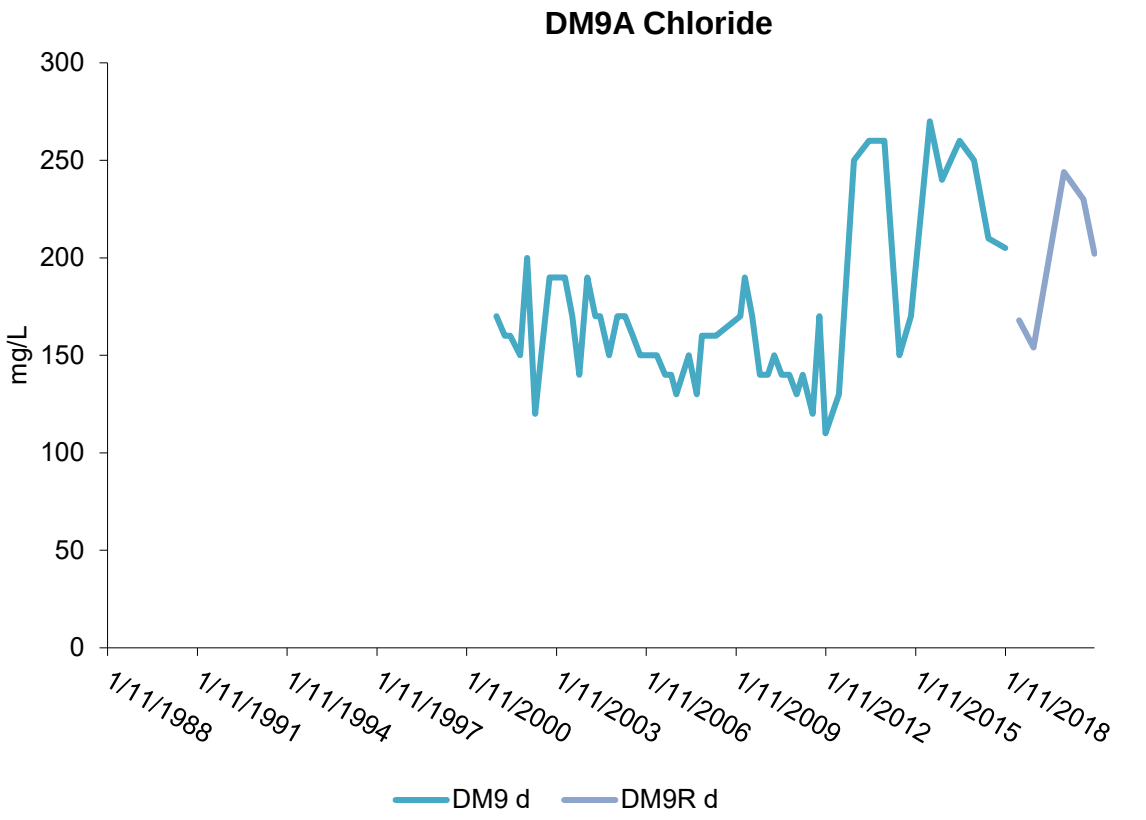

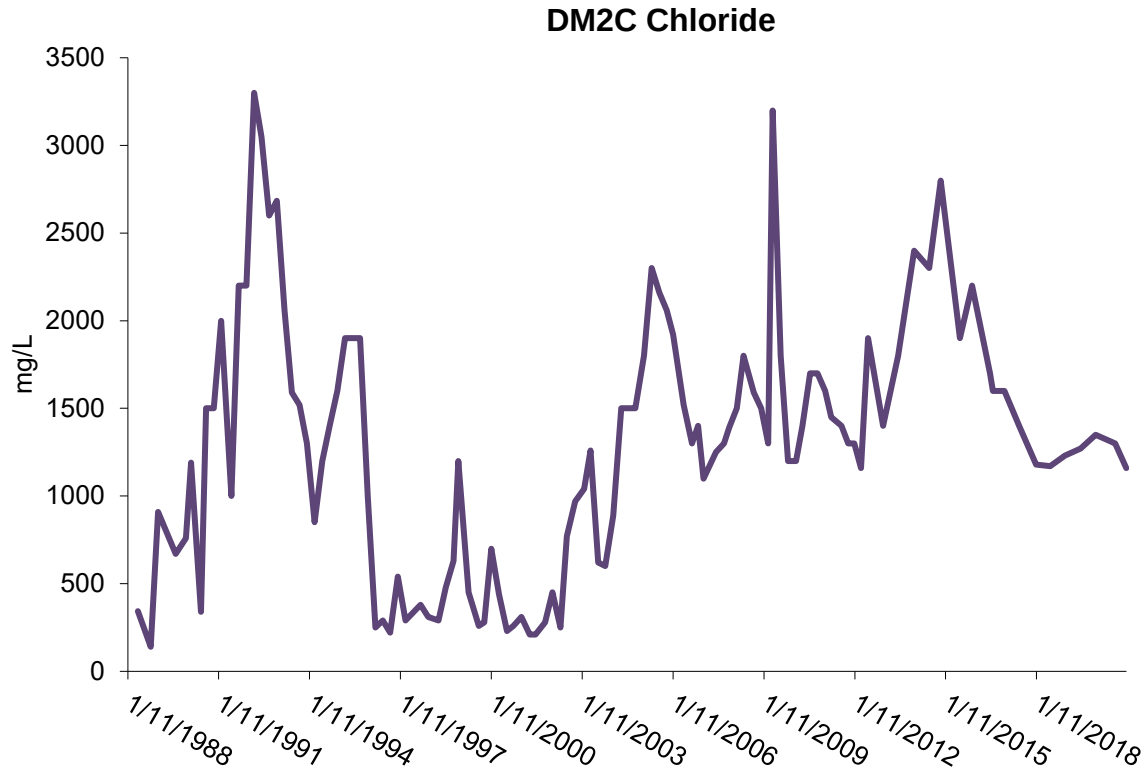

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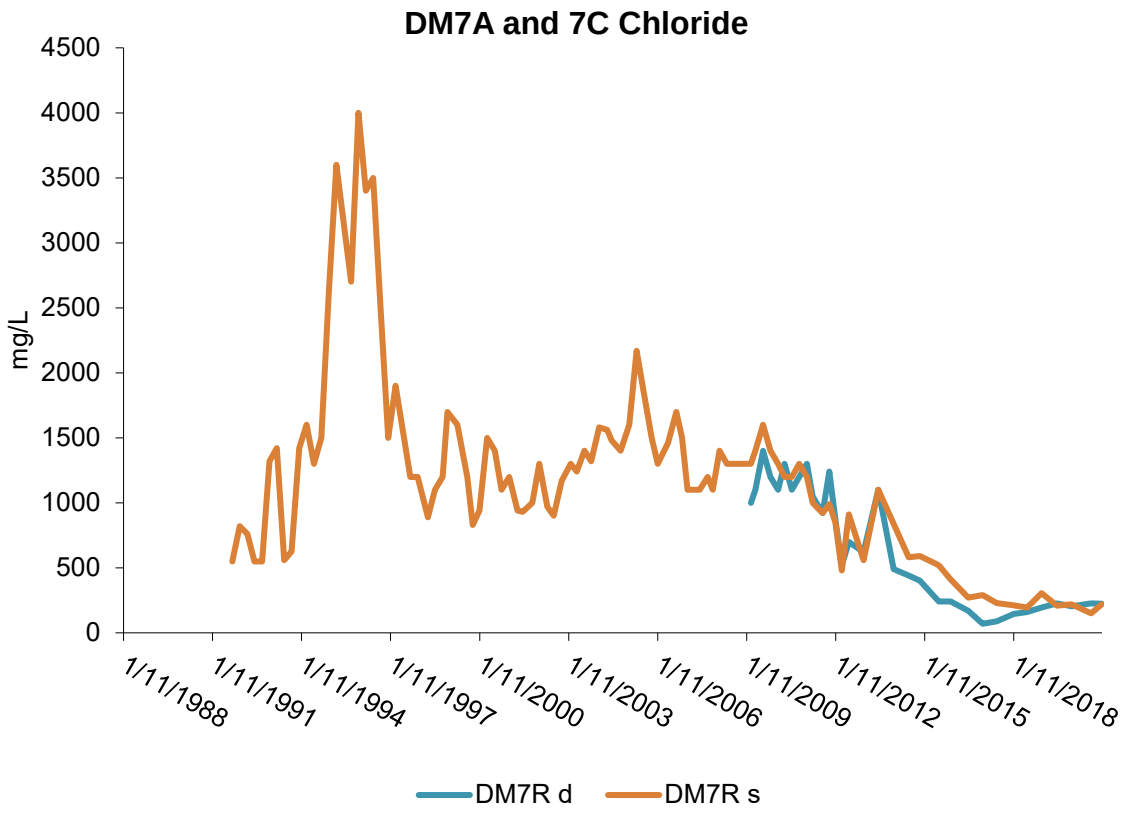

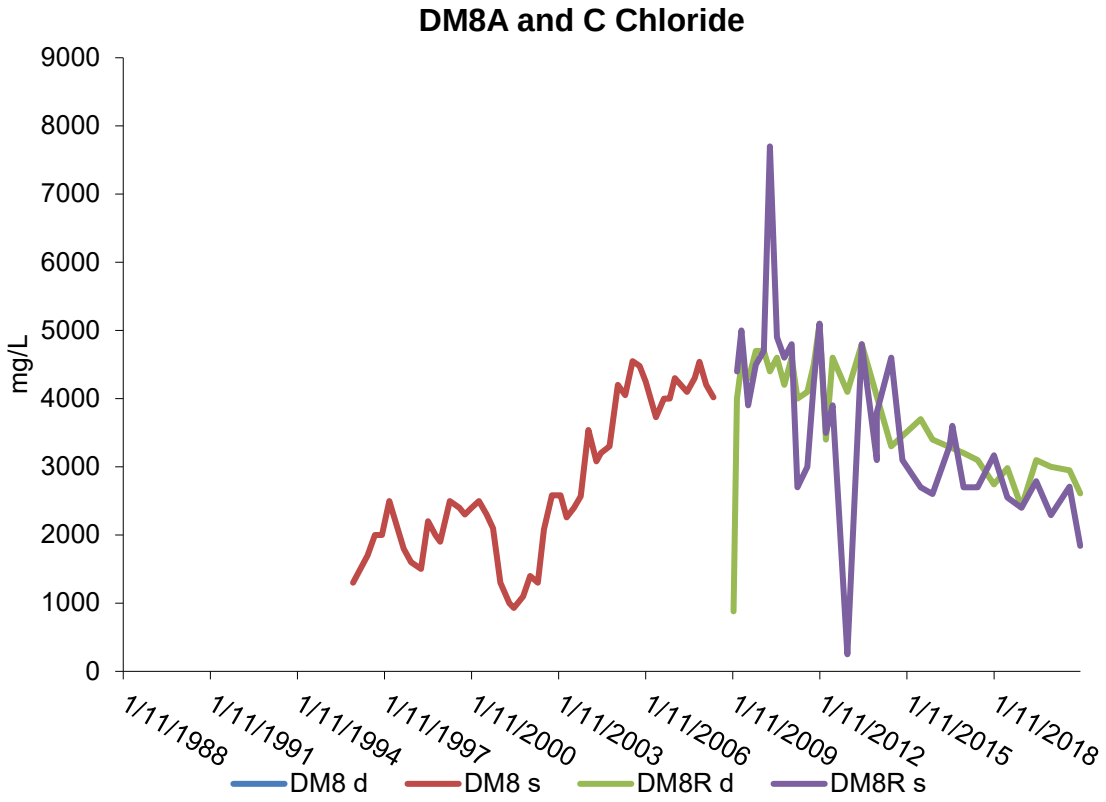

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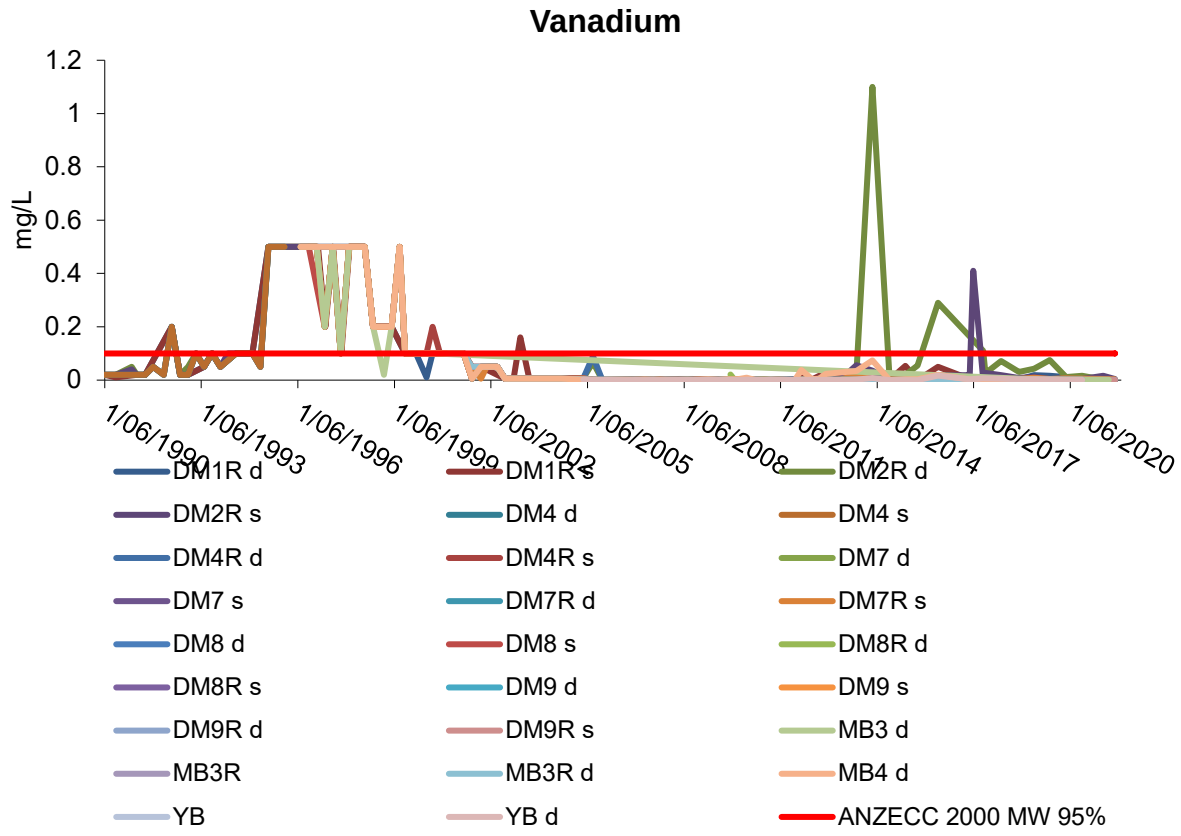

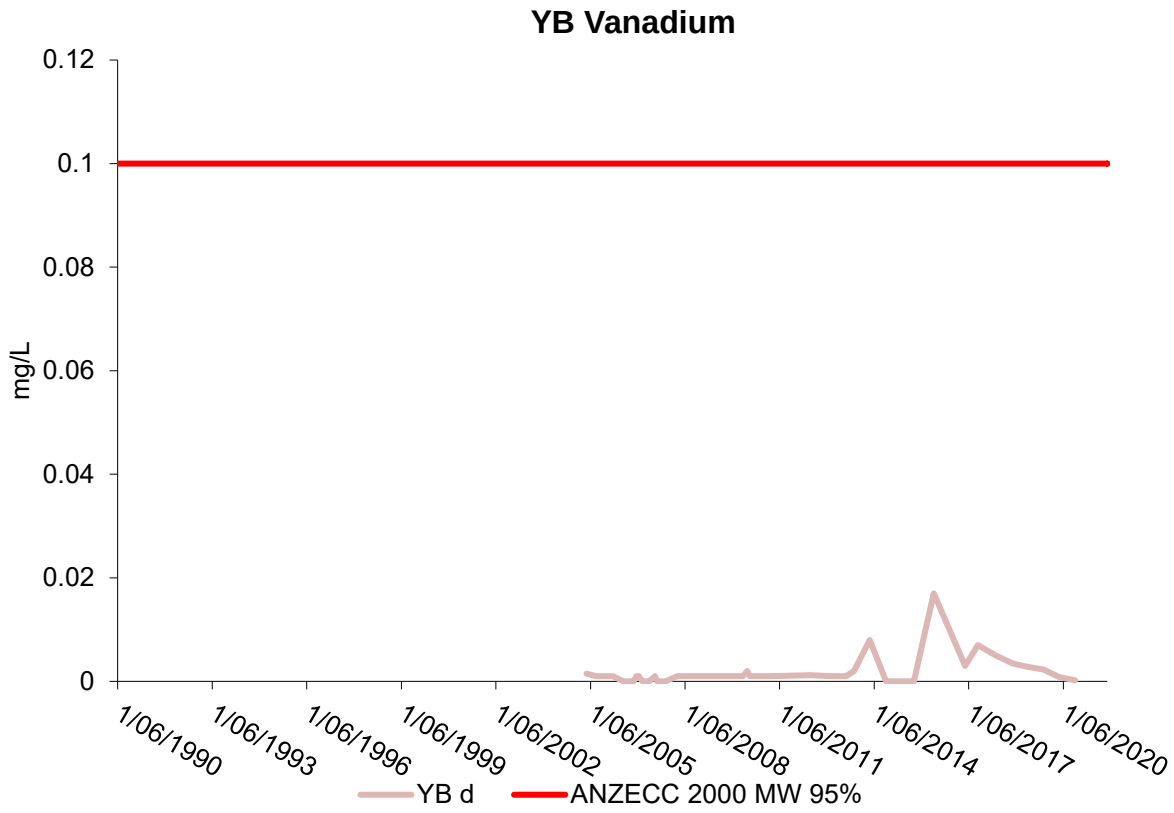

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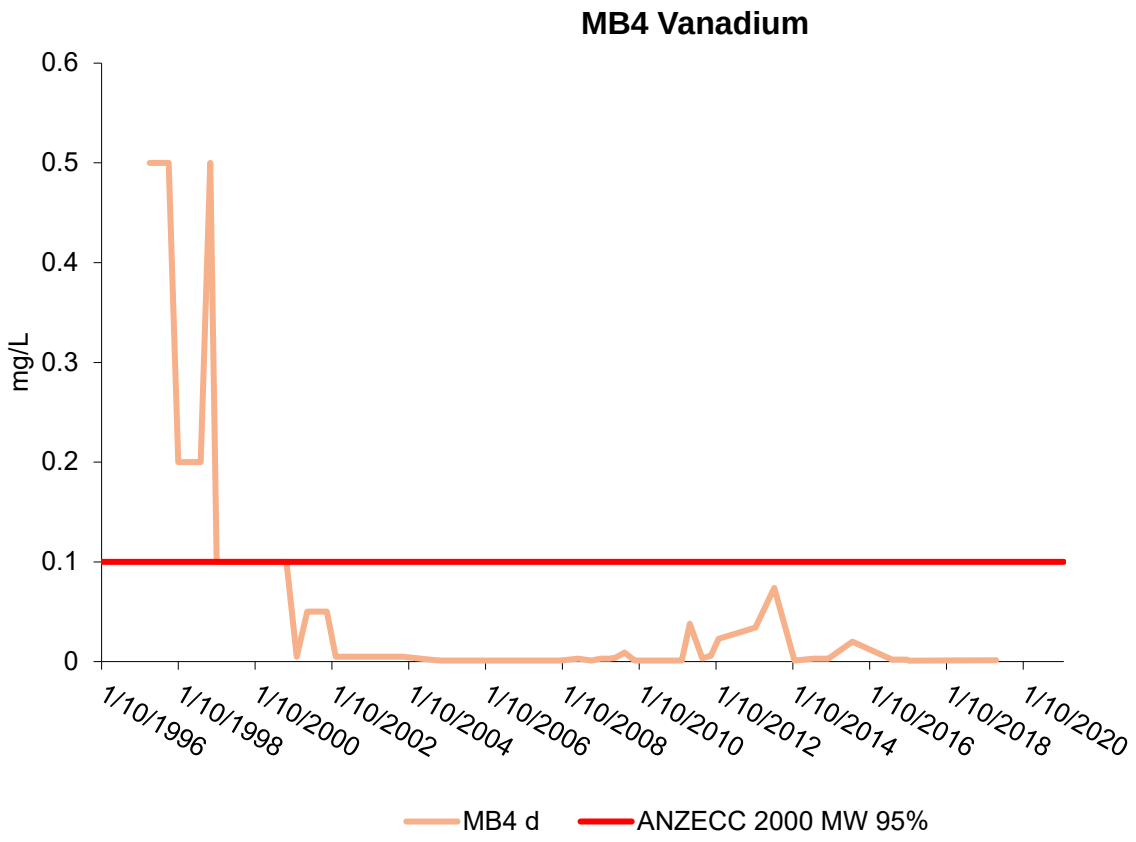

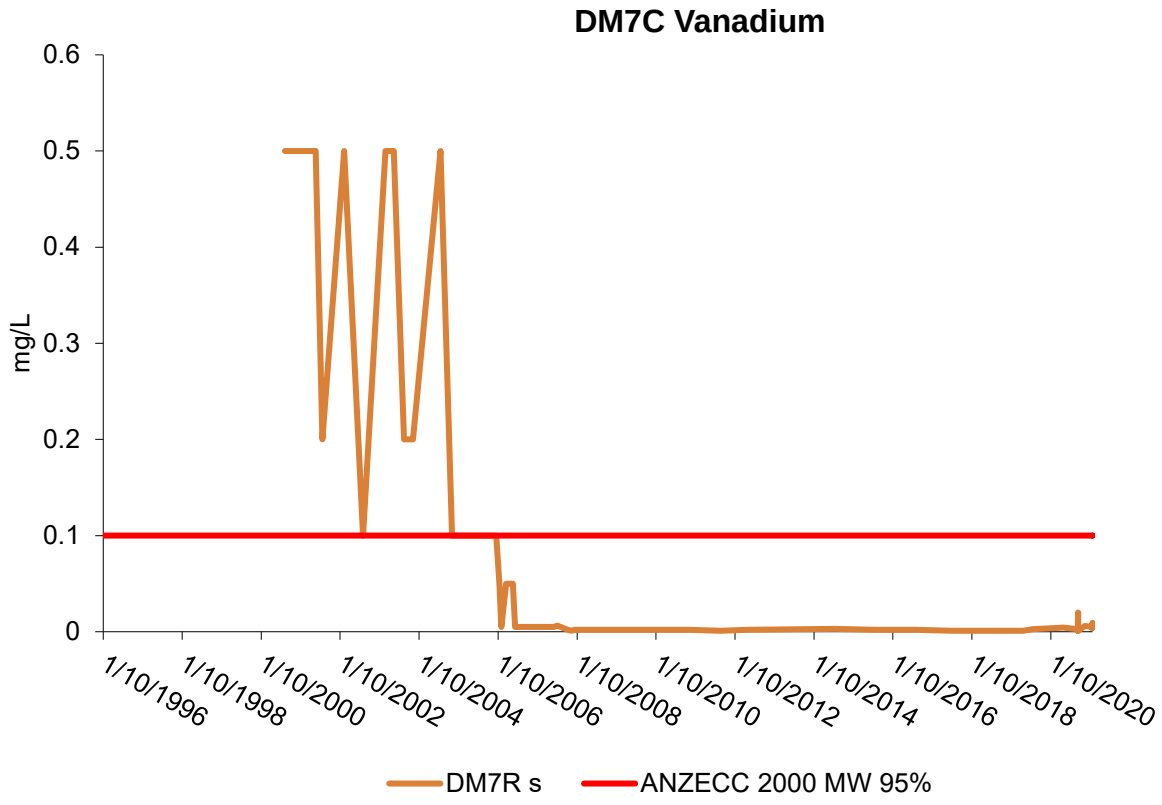

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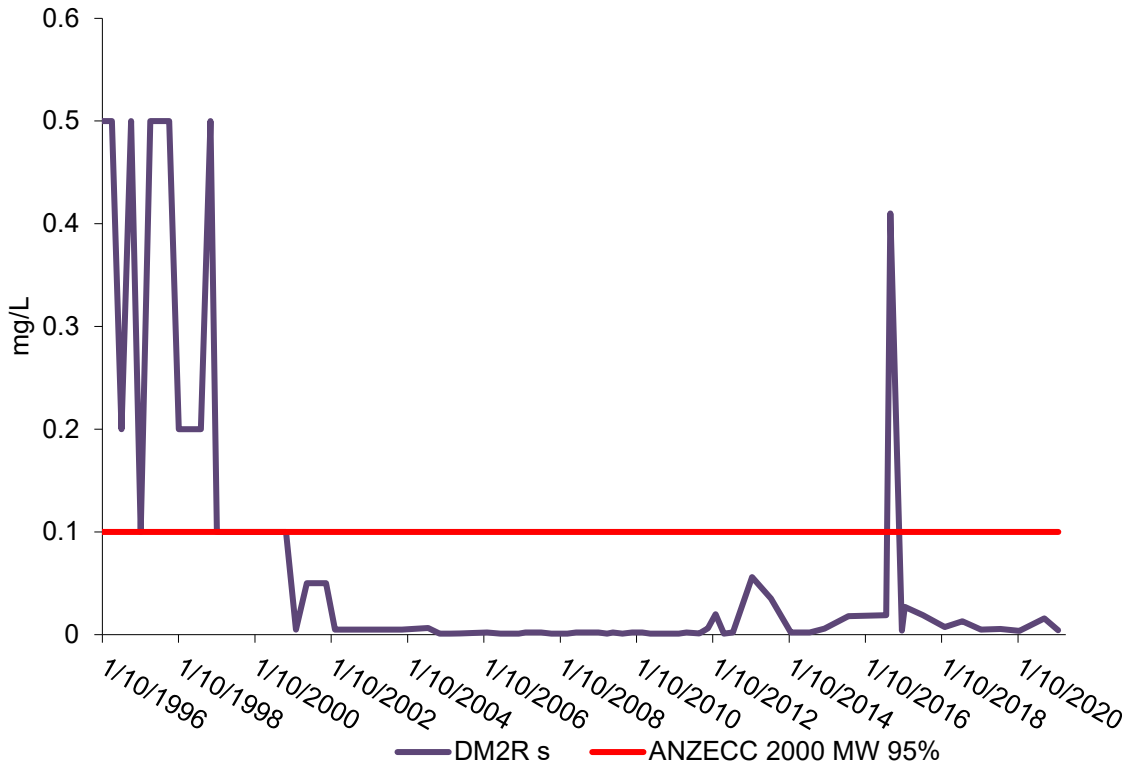
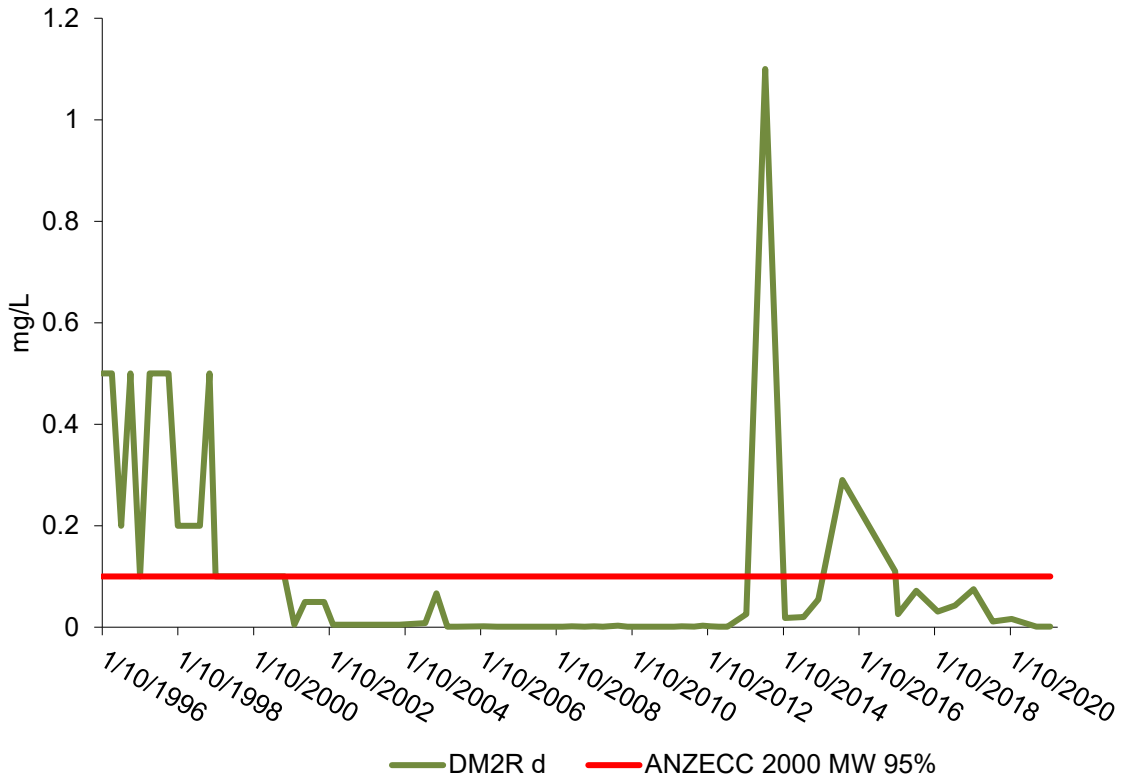
TRONOX

DM2C Vanadium



DM2A Vanadium



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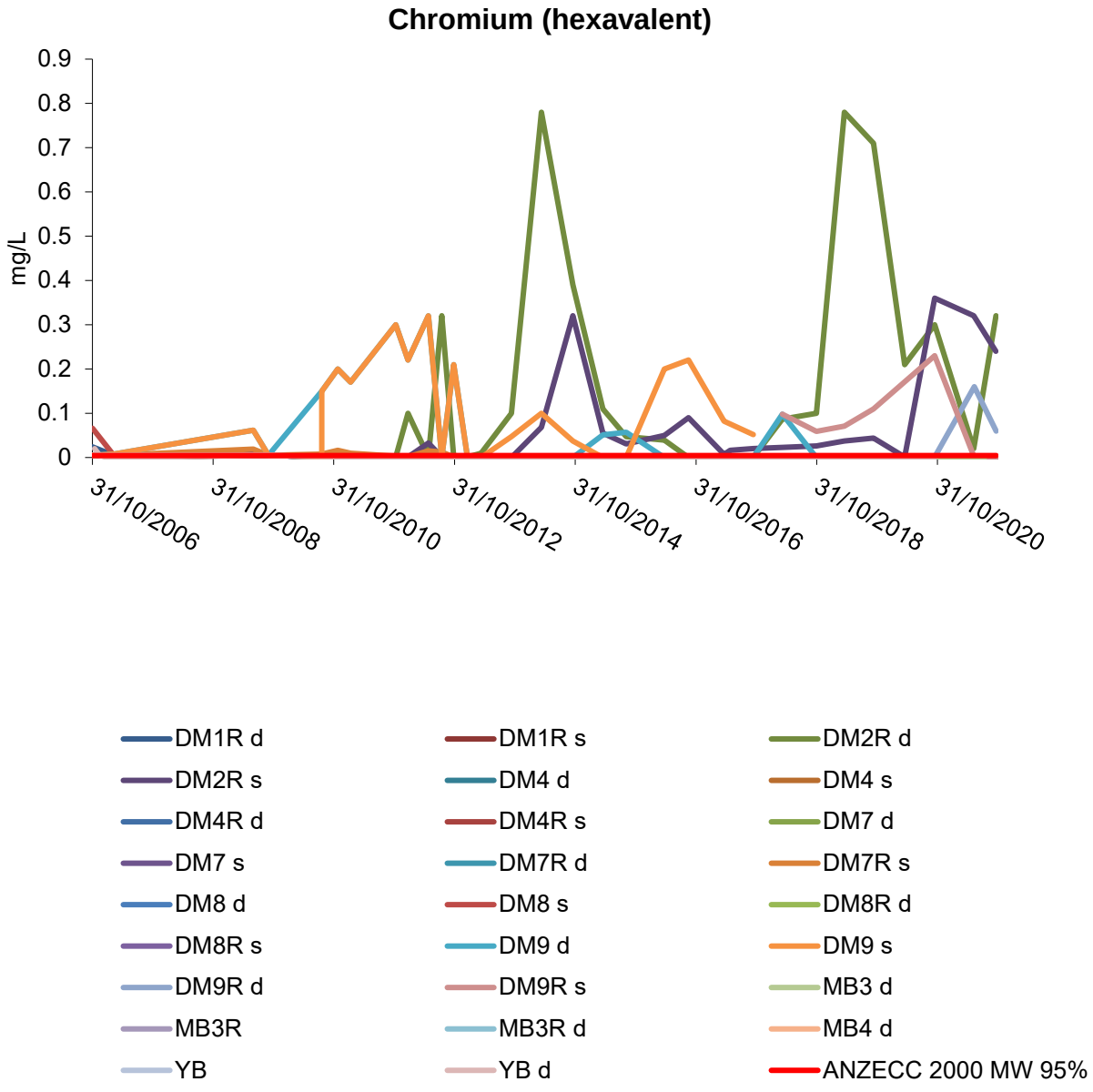

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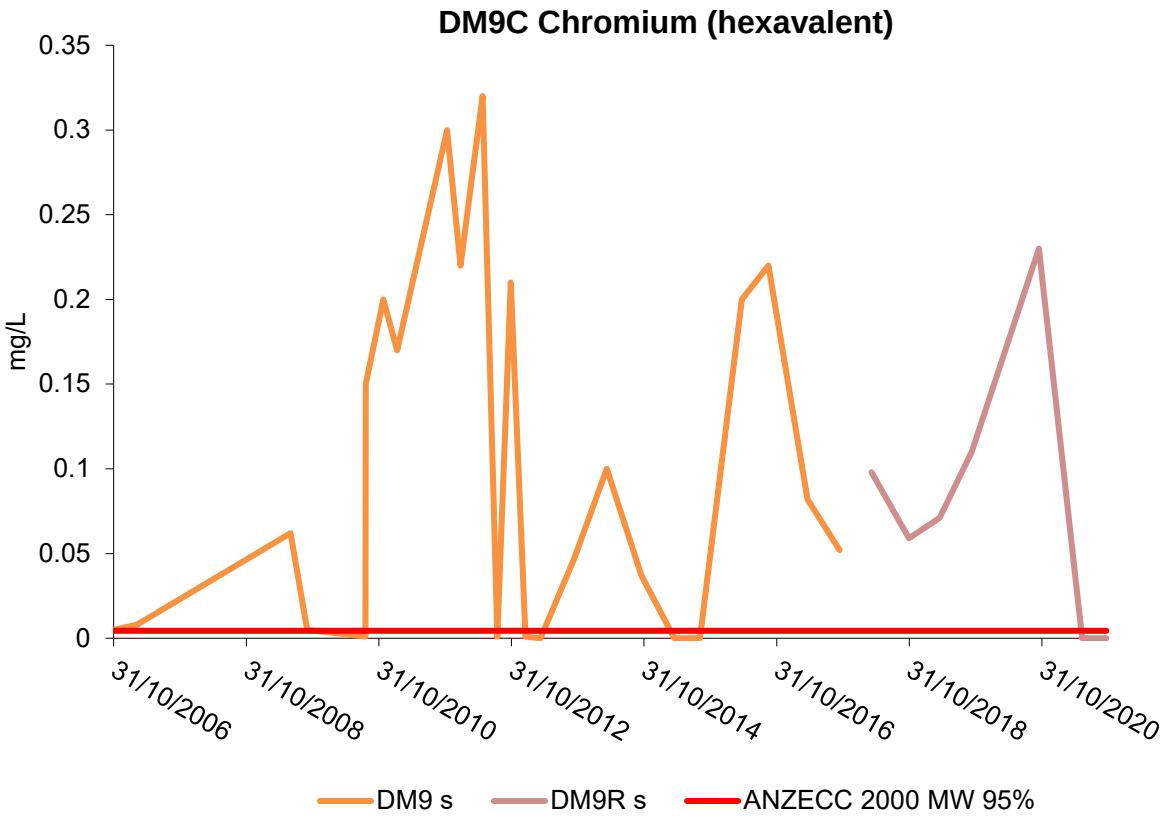

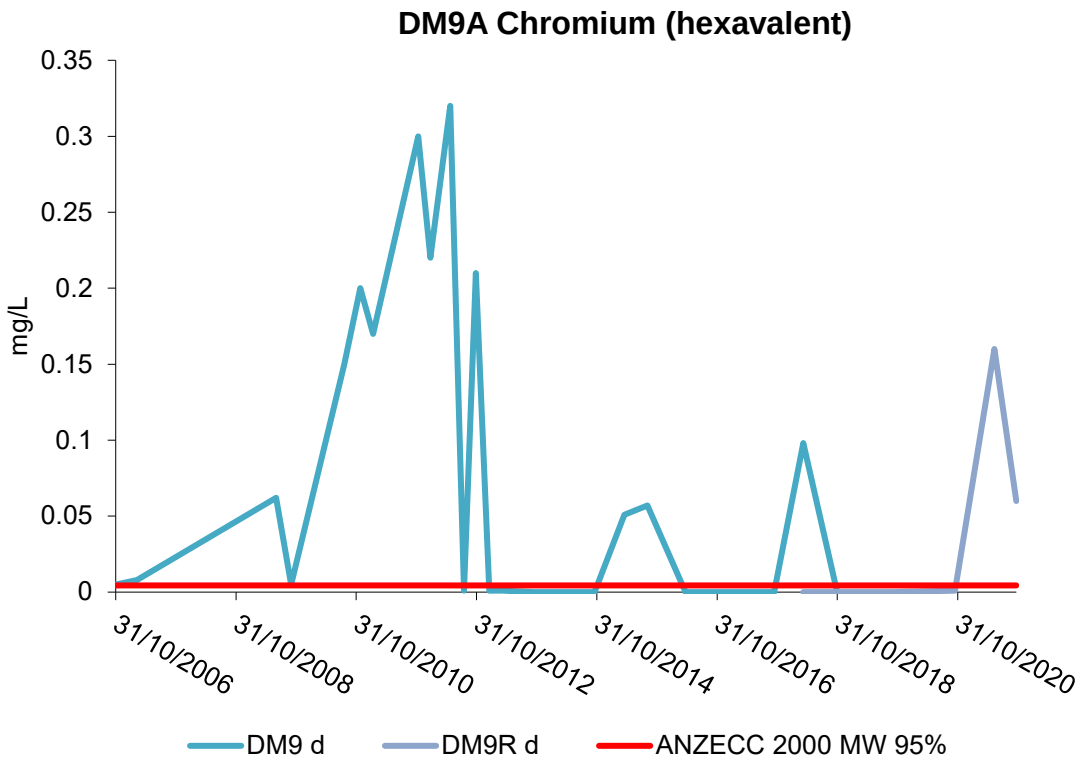

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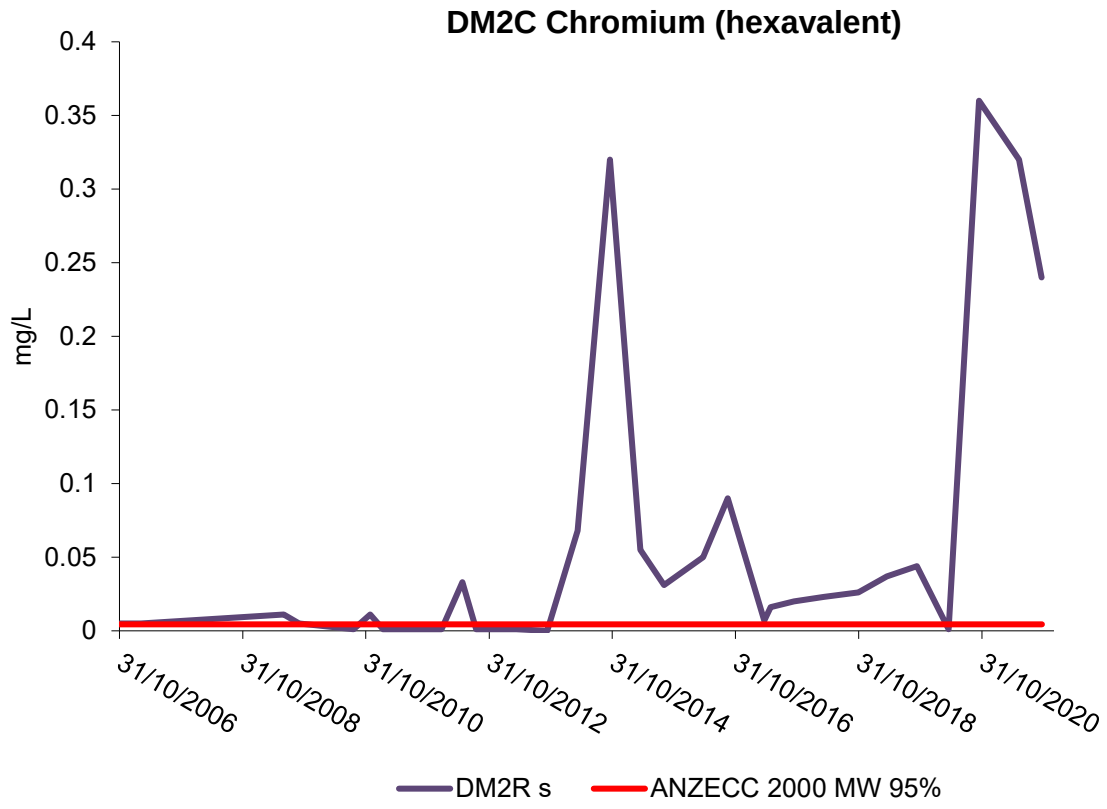

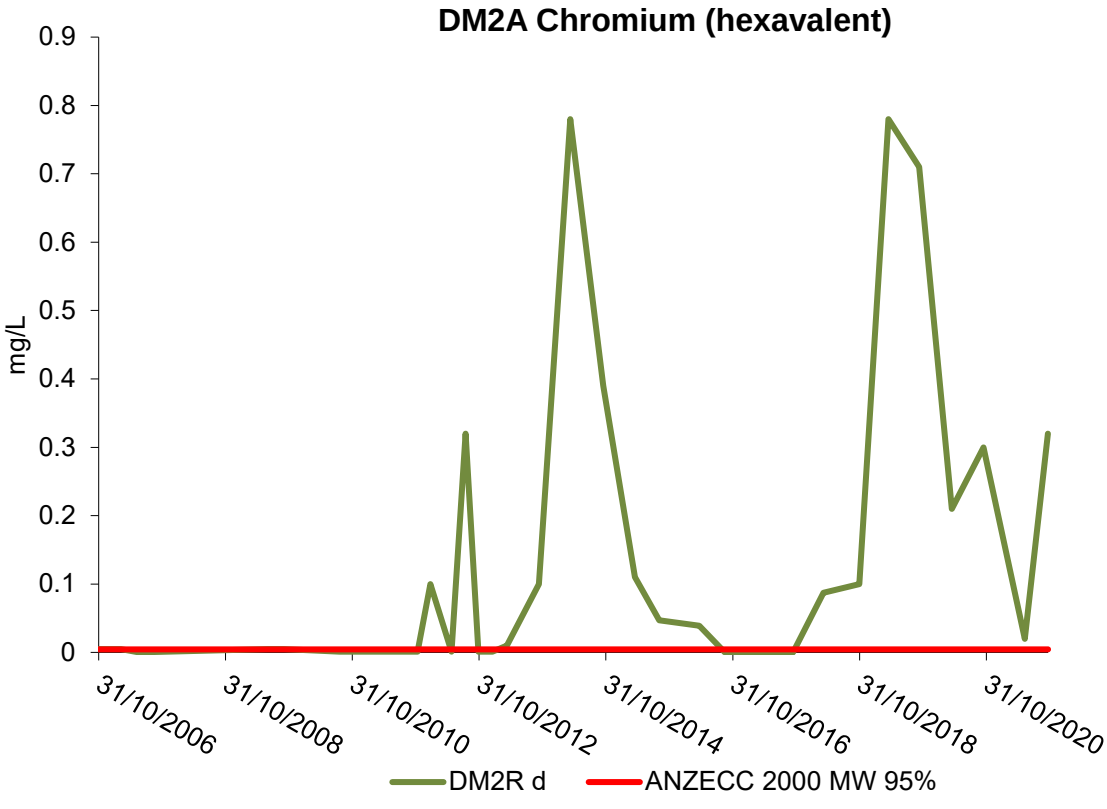

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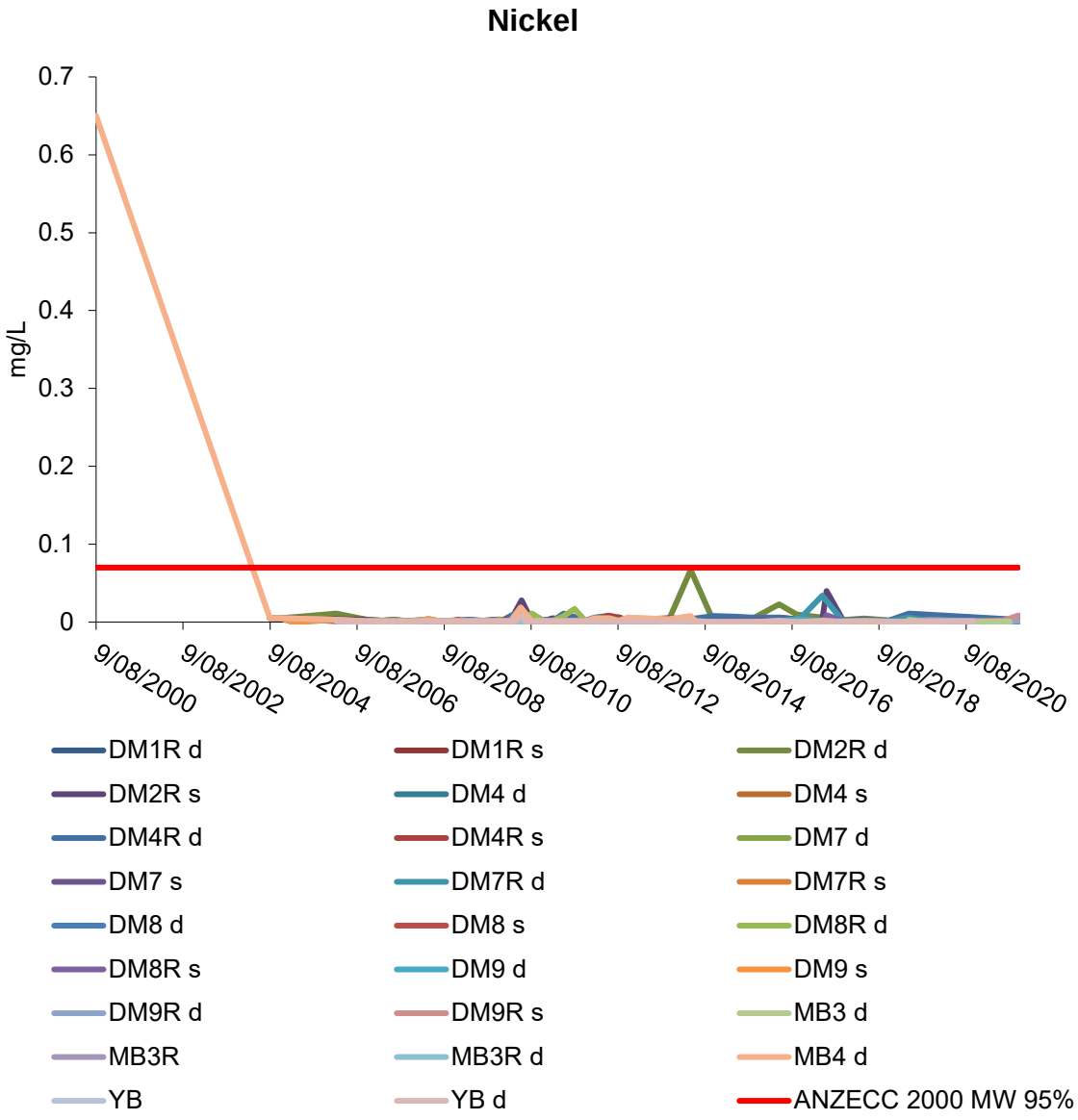

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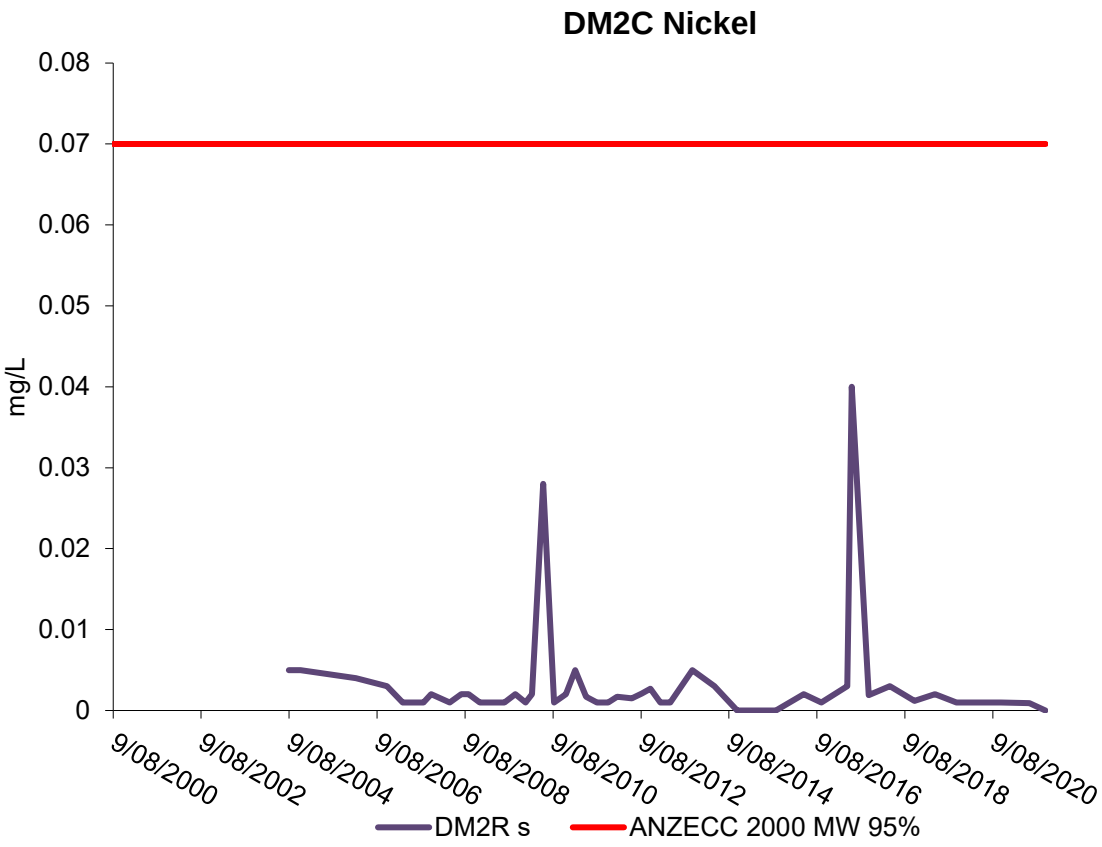

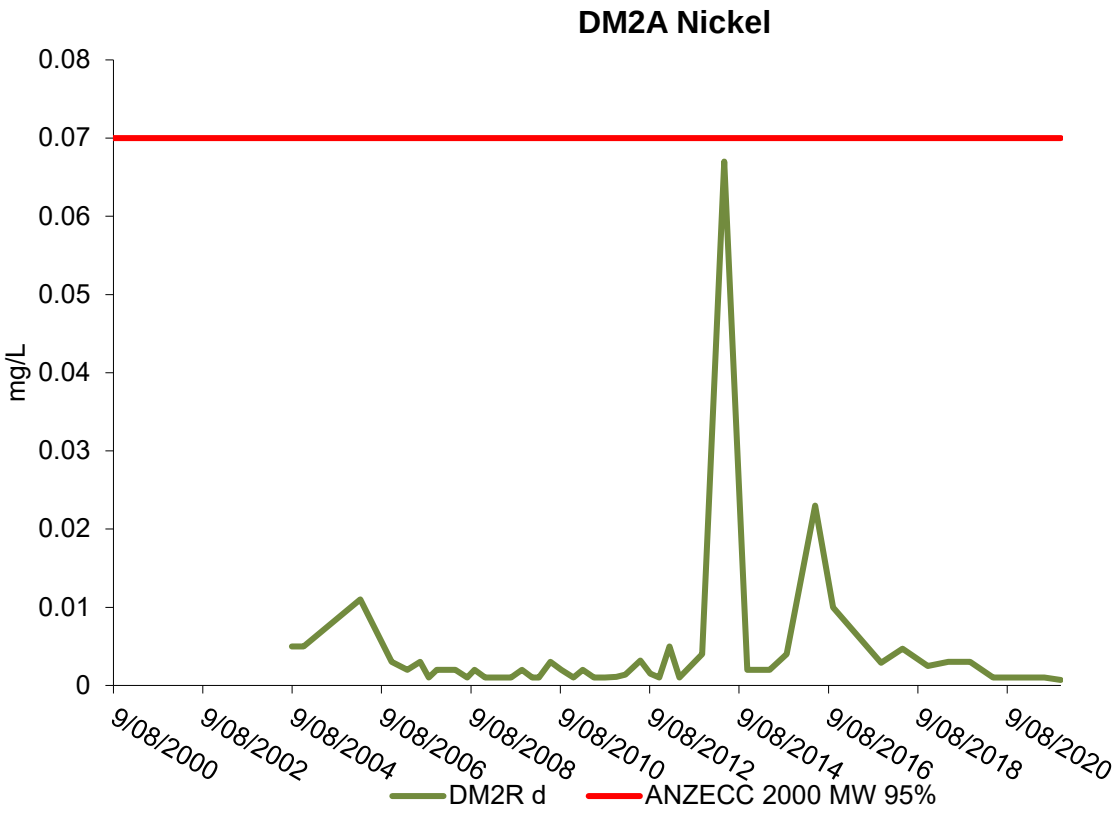

Figure

Dalyellup Monitoring

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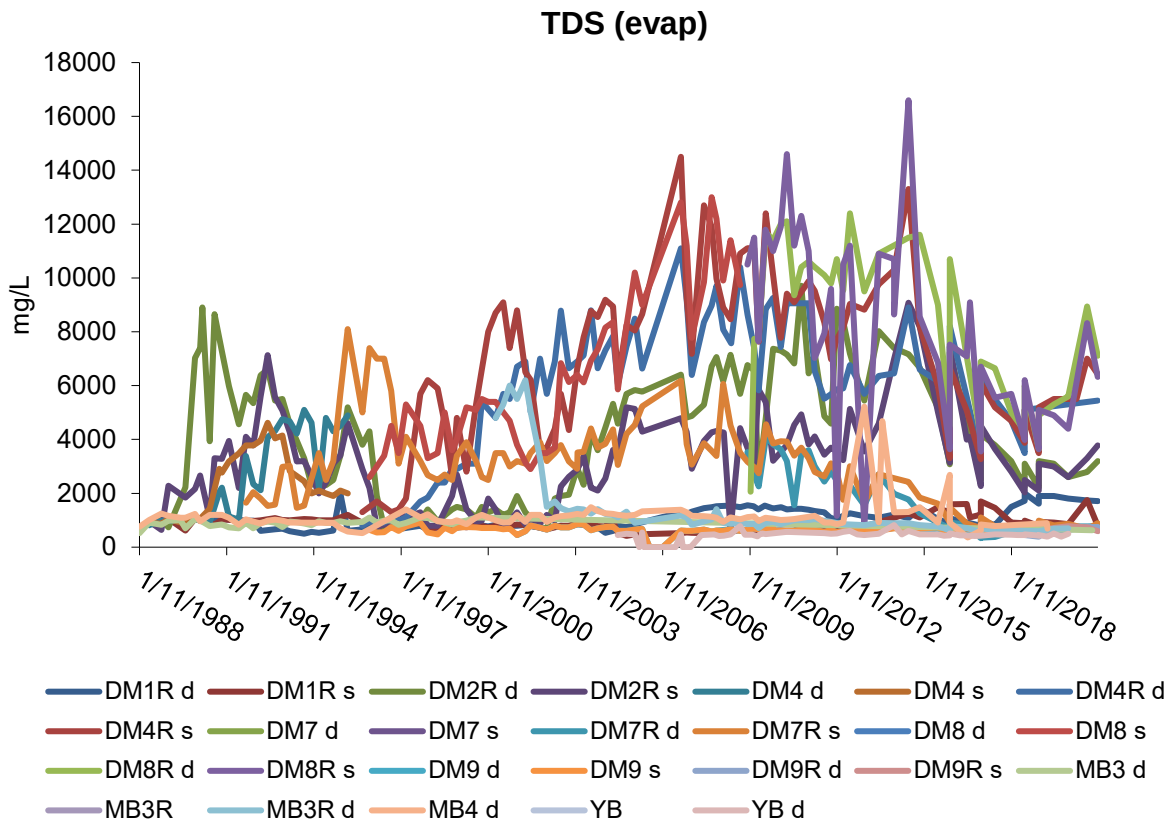

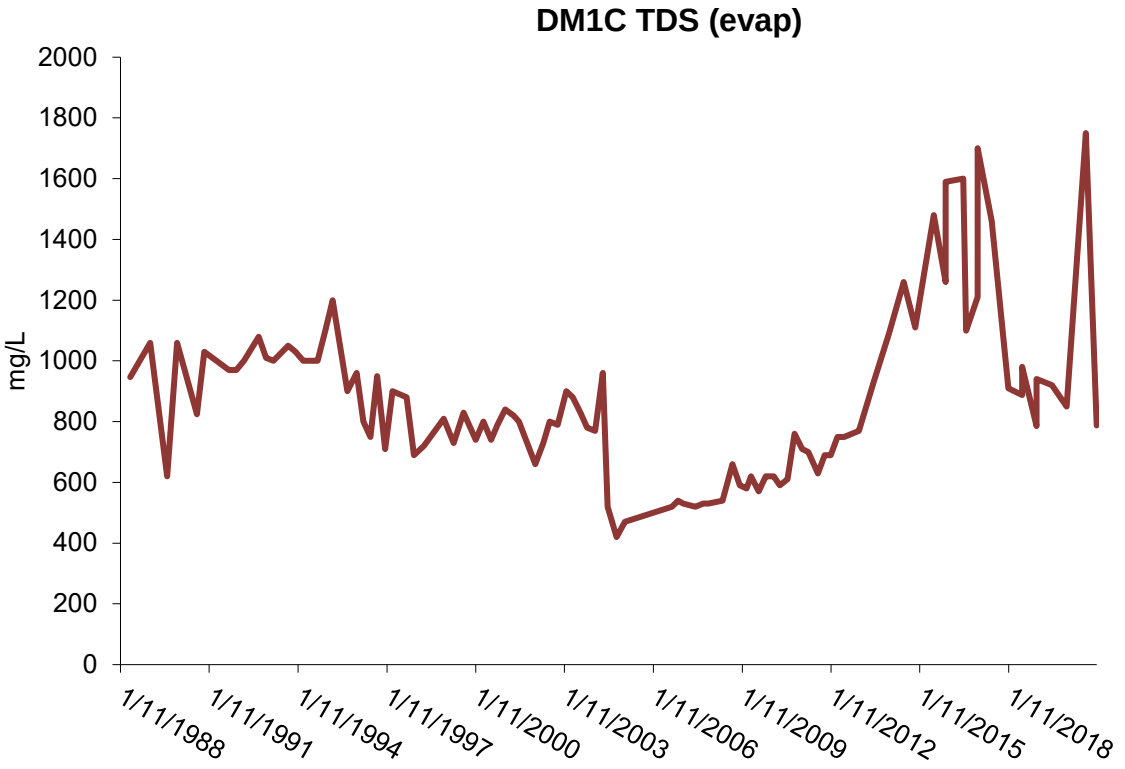

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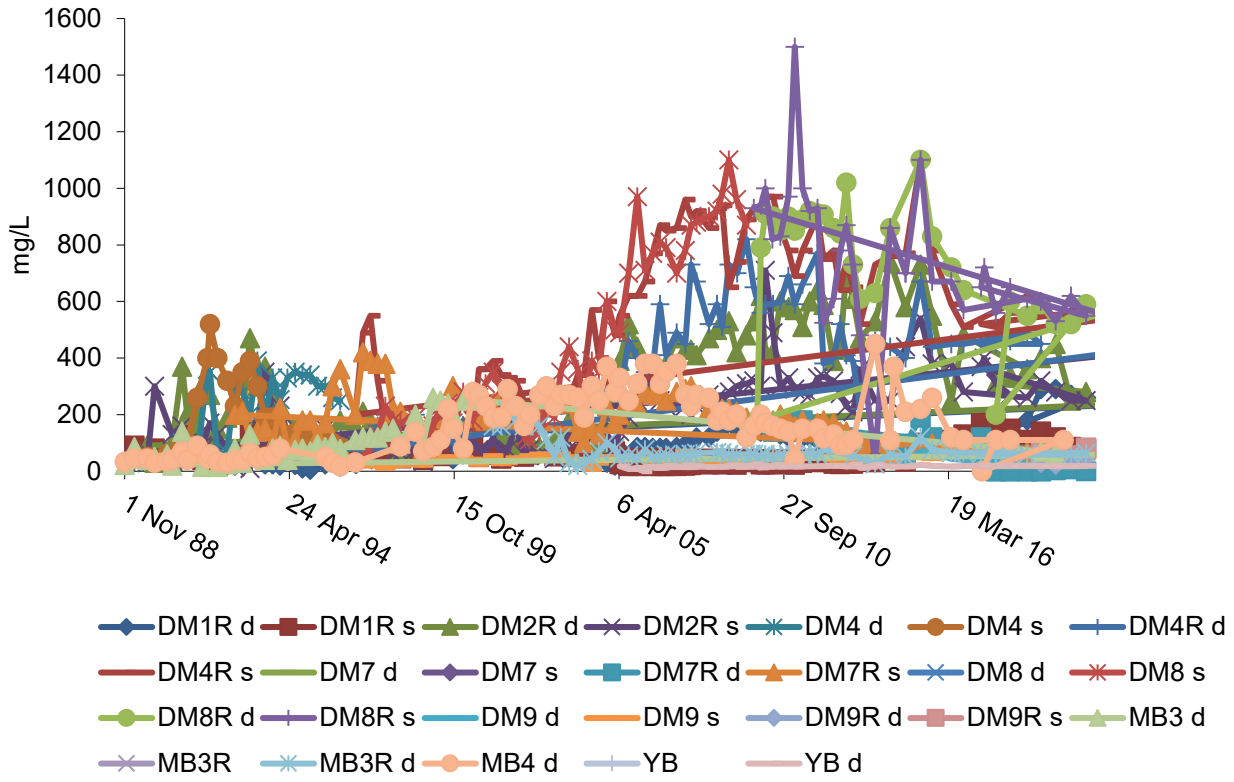
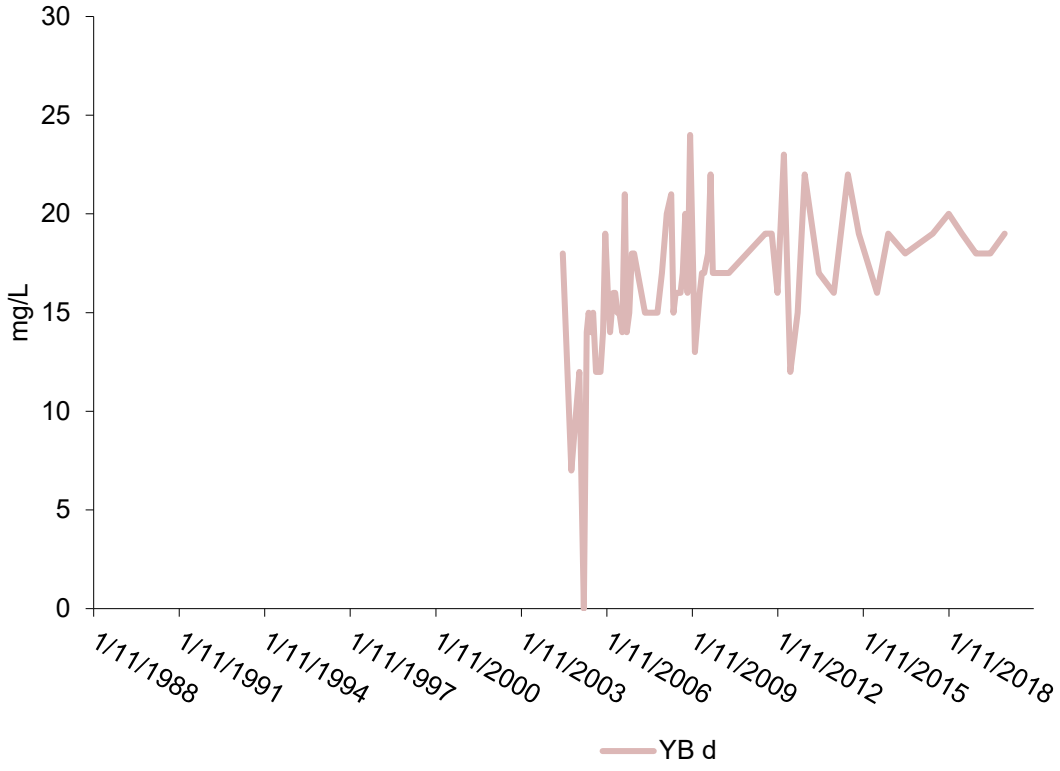
Sulphate



YBSulphate



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Dalyellup Monitoring

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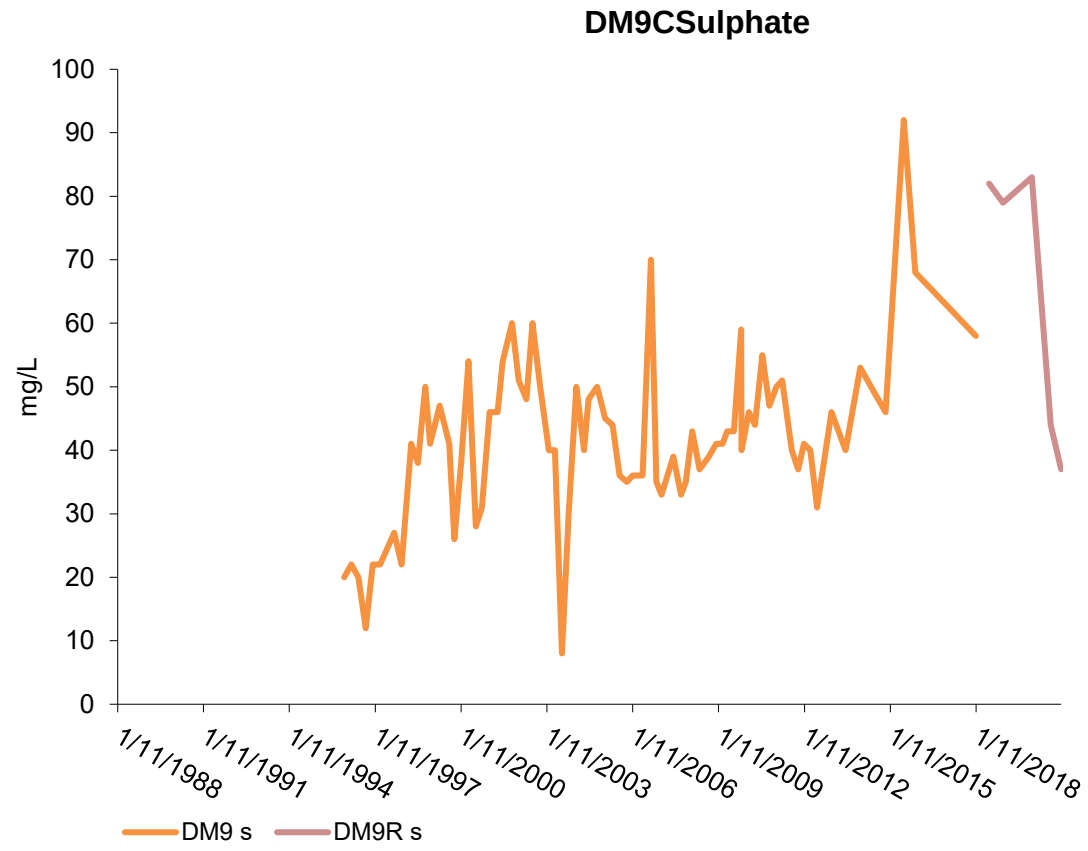

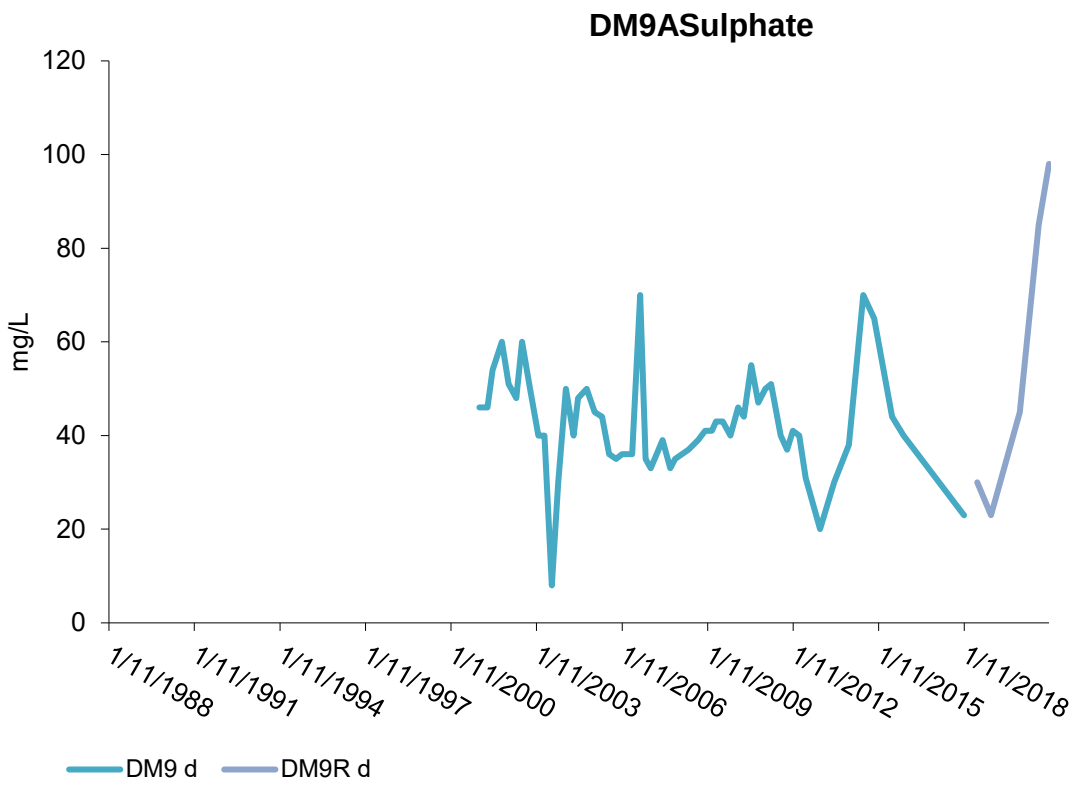

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Dalyellup Monitoring

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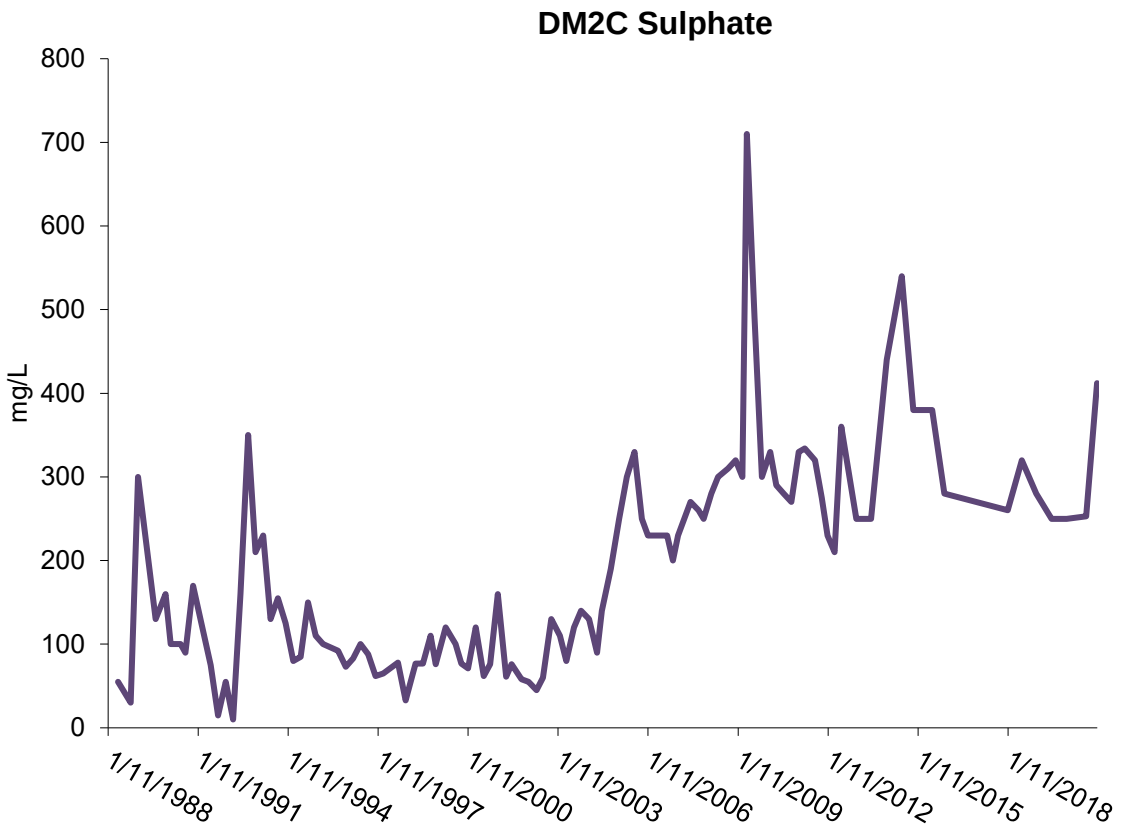

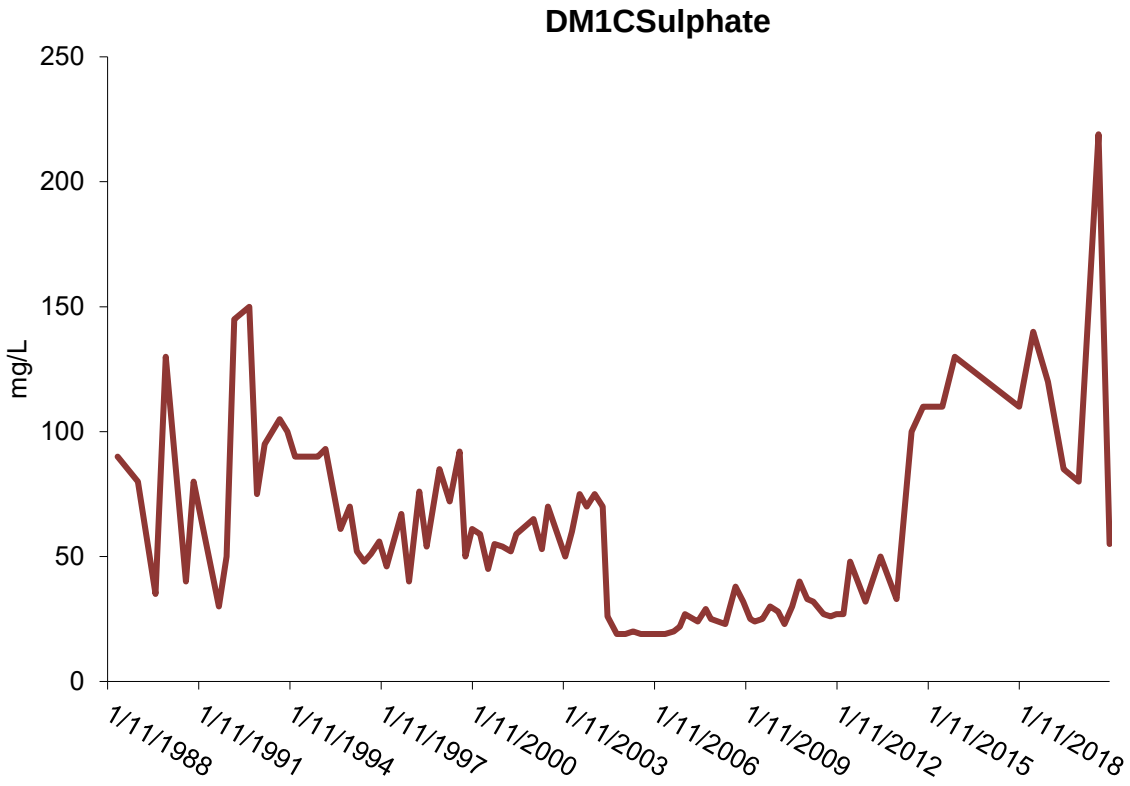

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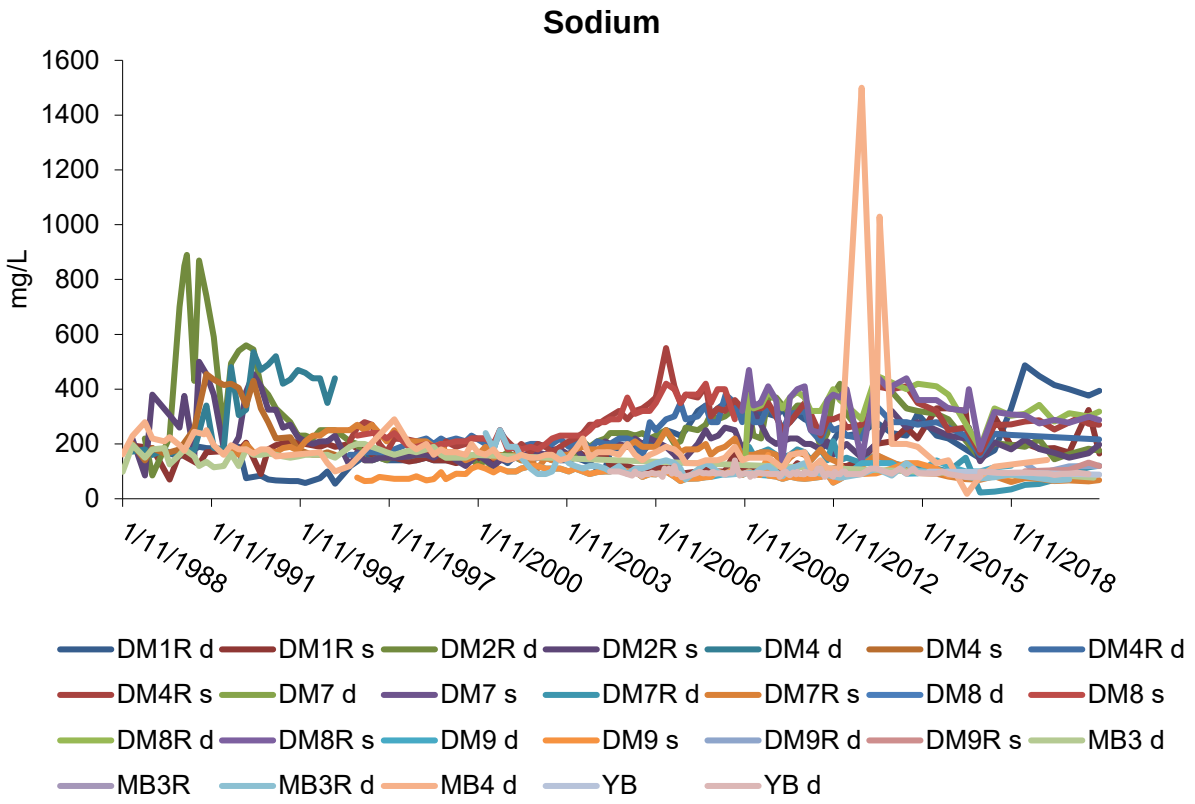

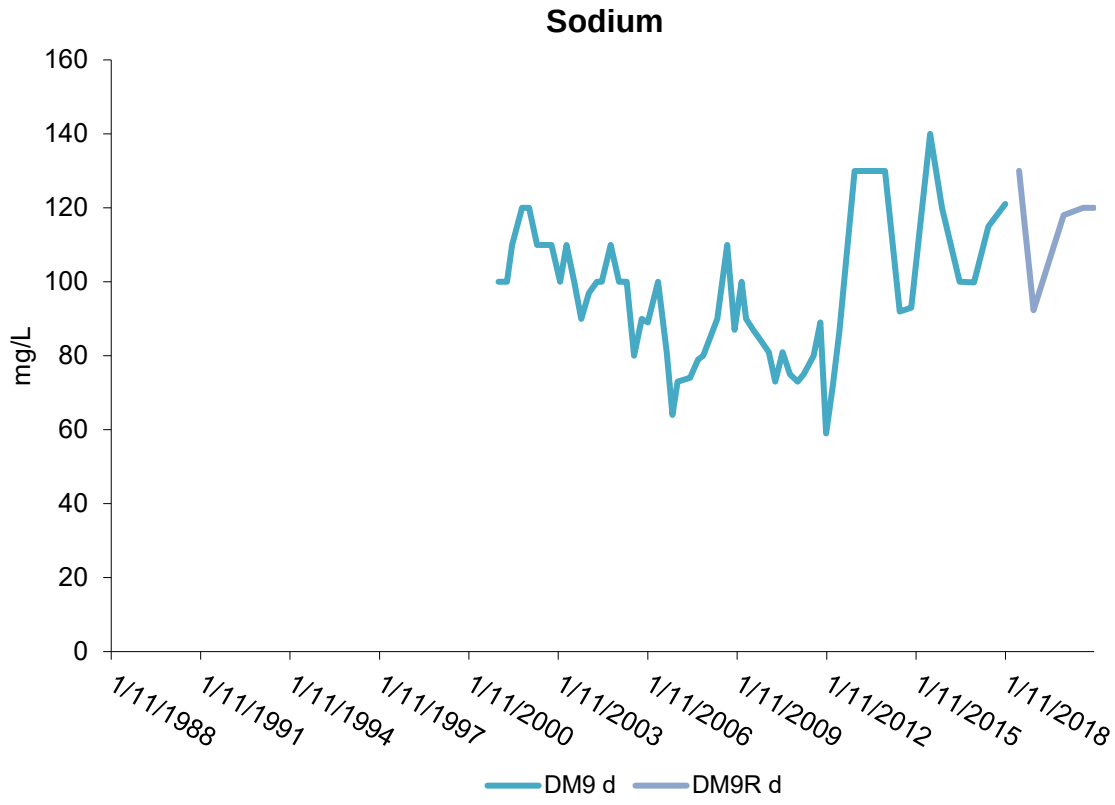

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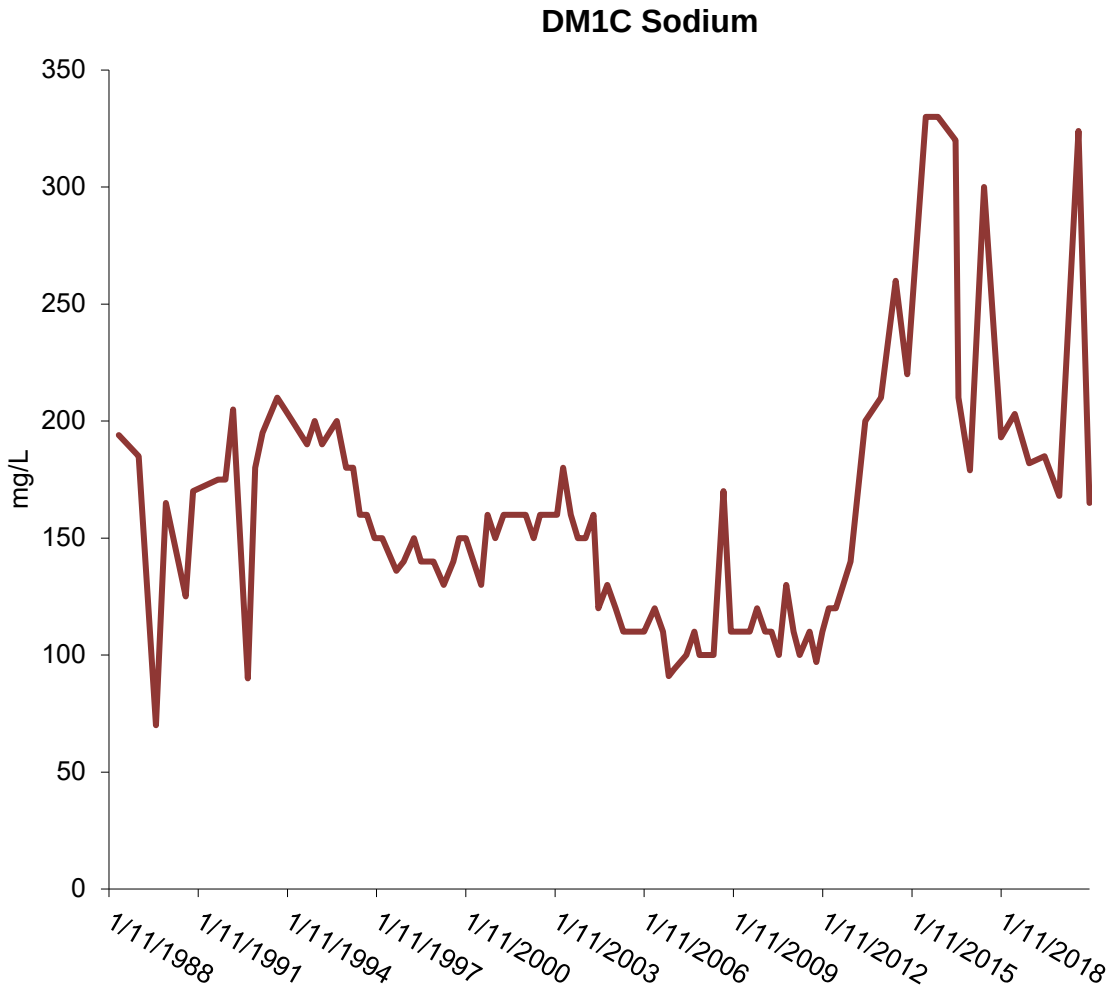

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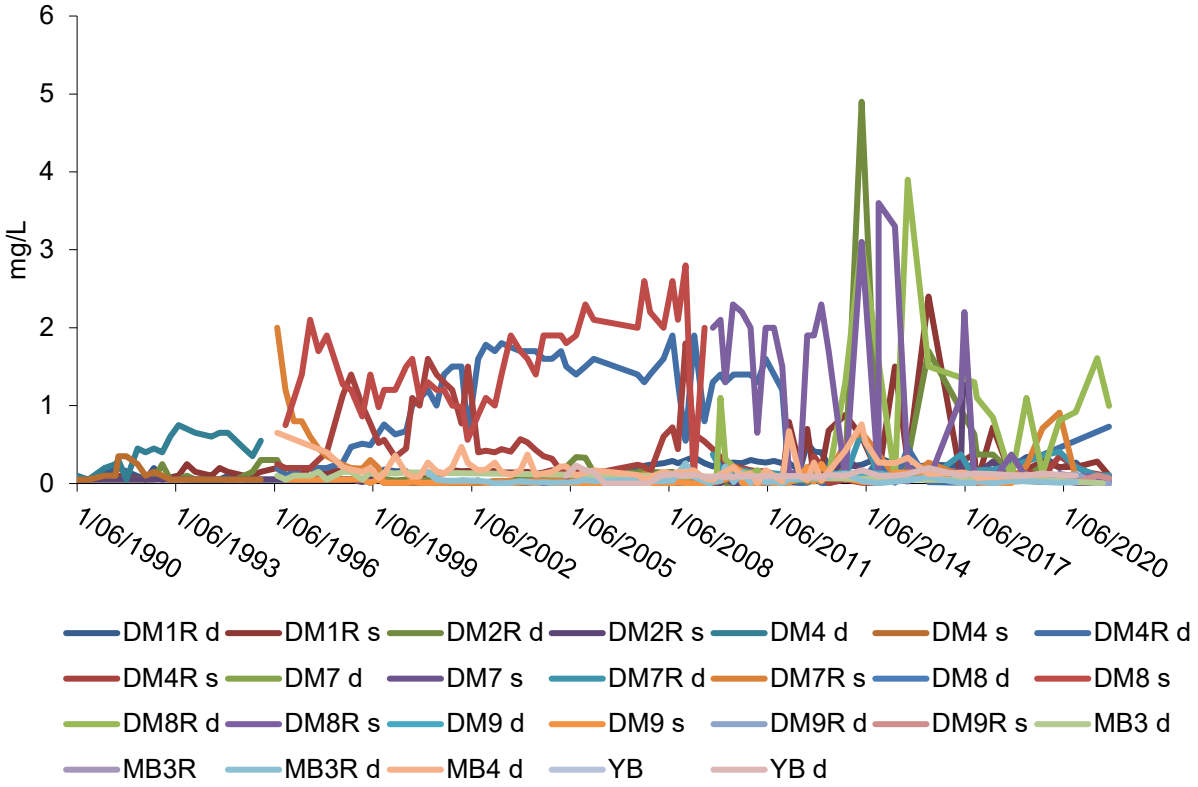
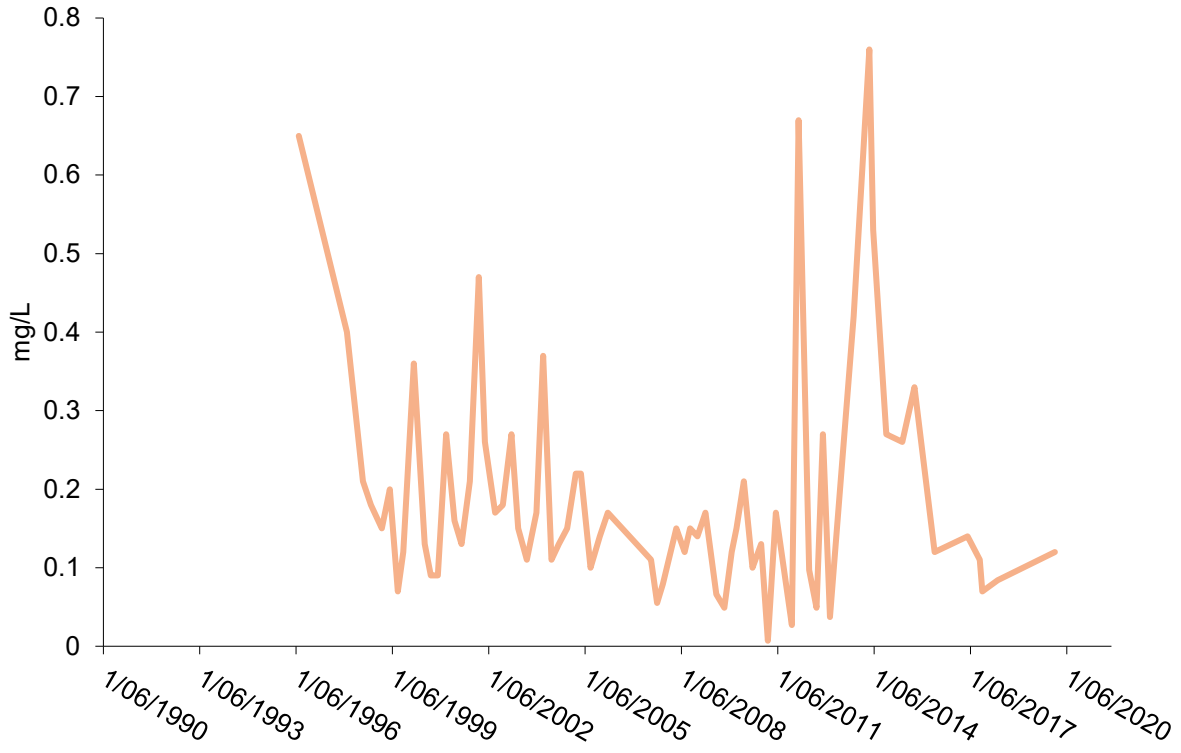
TRONOX

Manganese



MB4 Manganese



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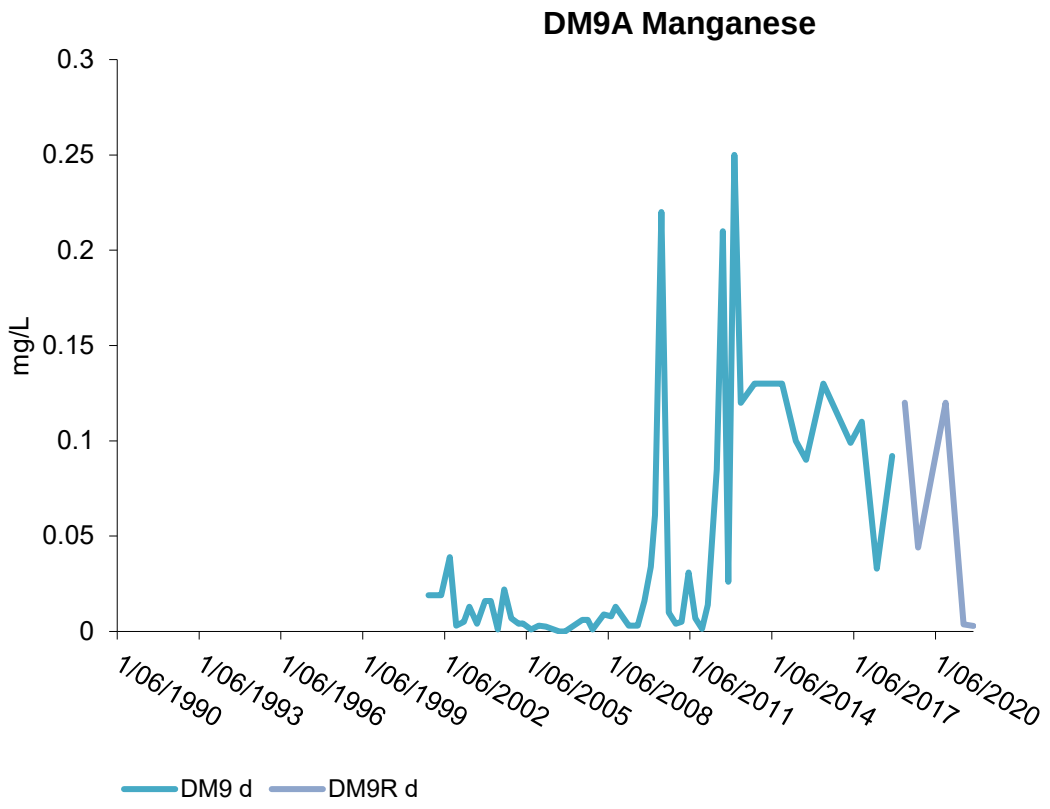

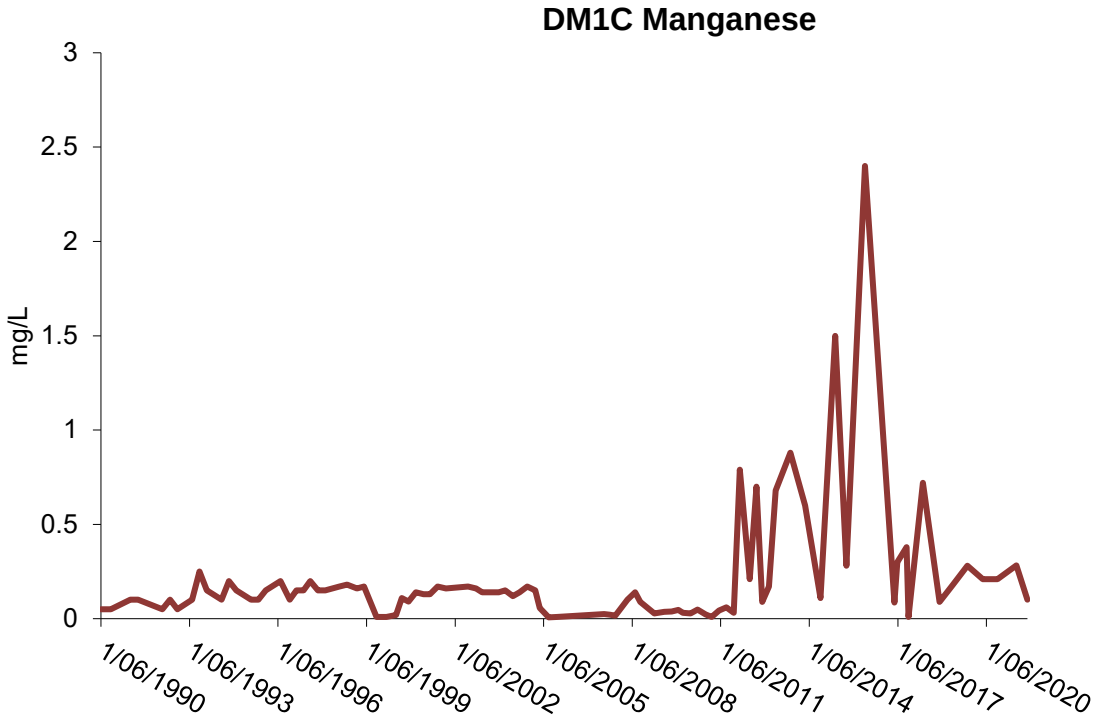

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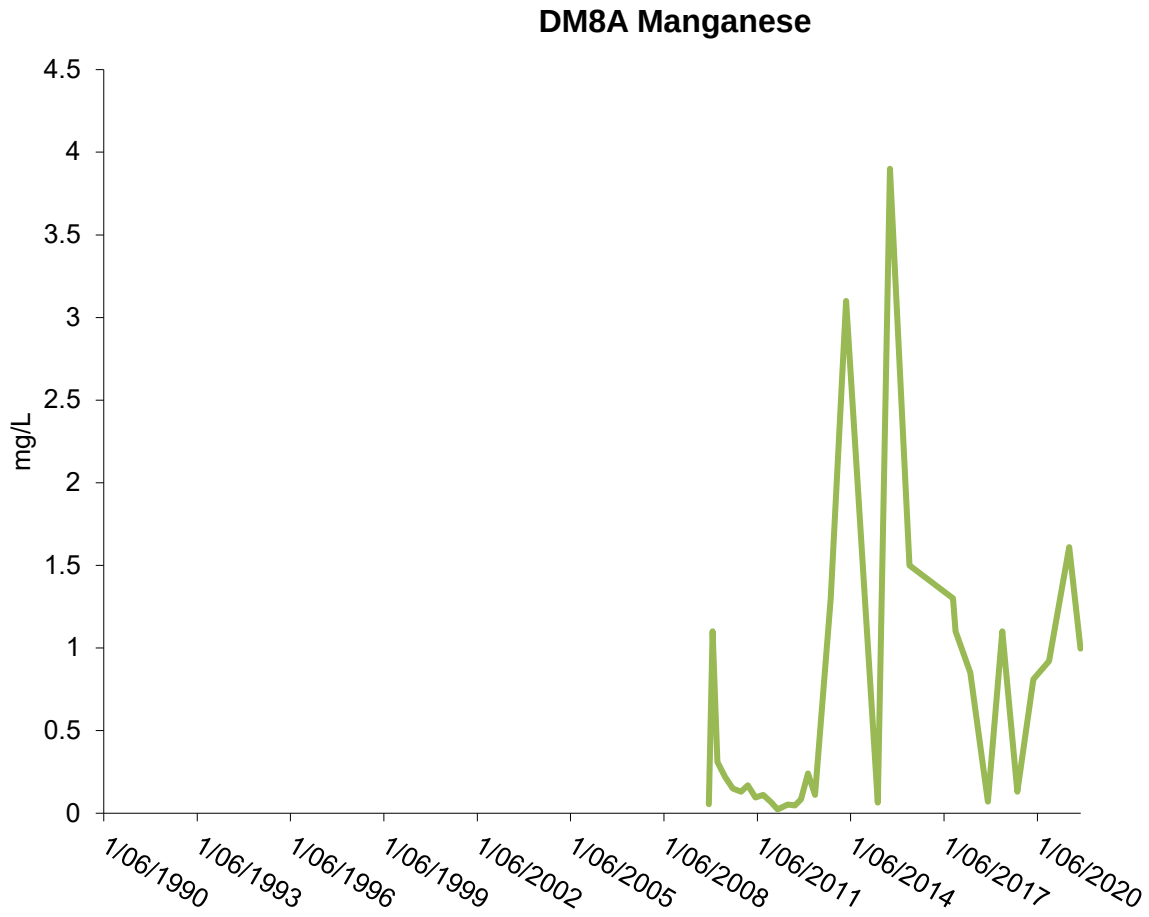

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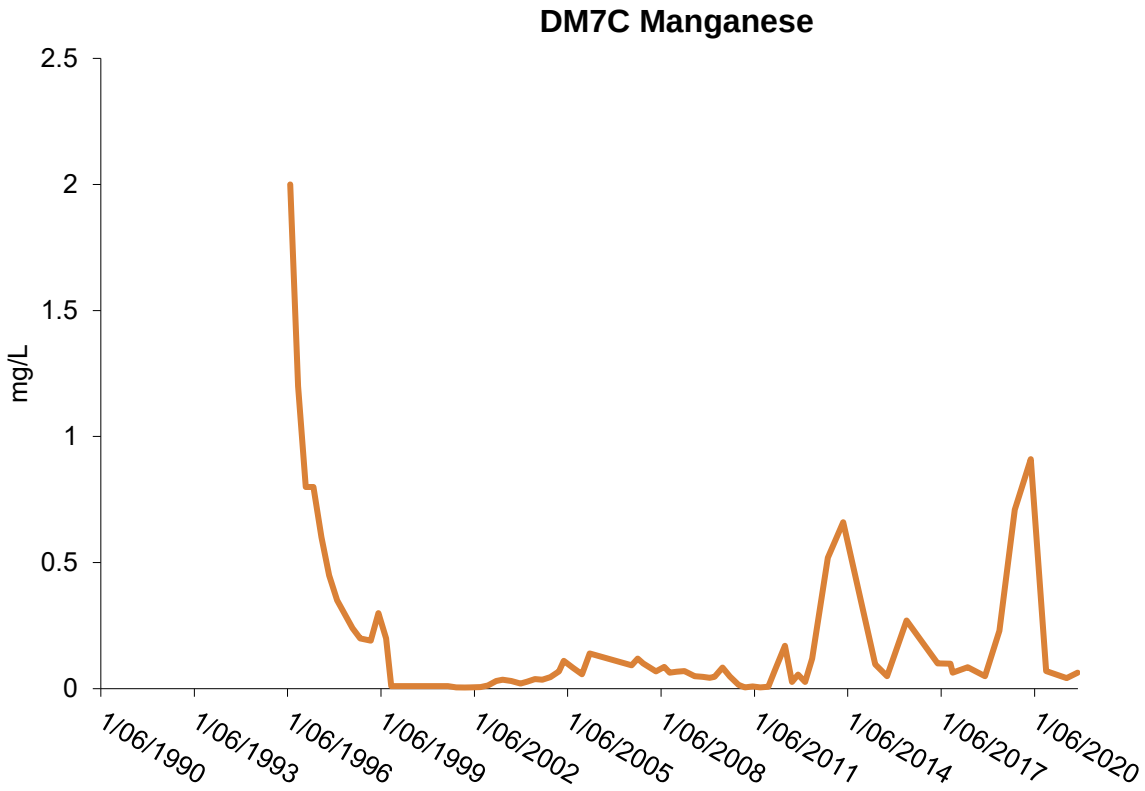

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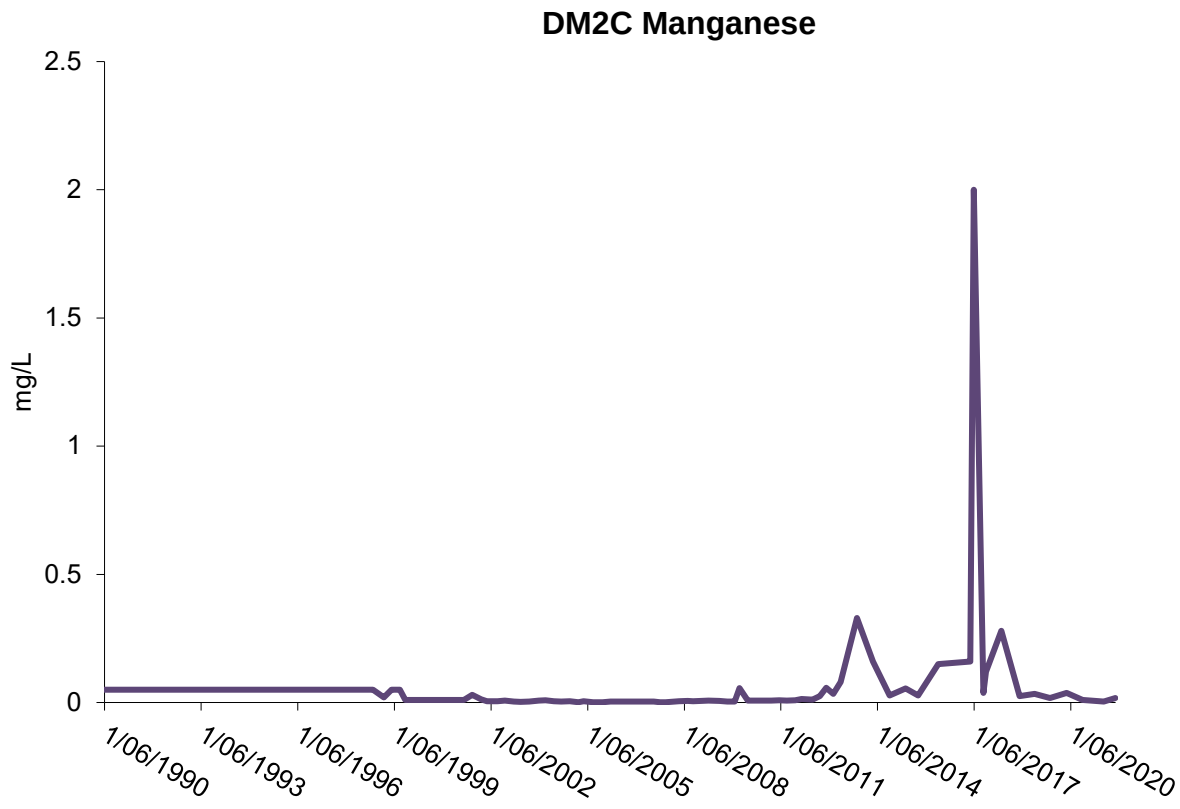

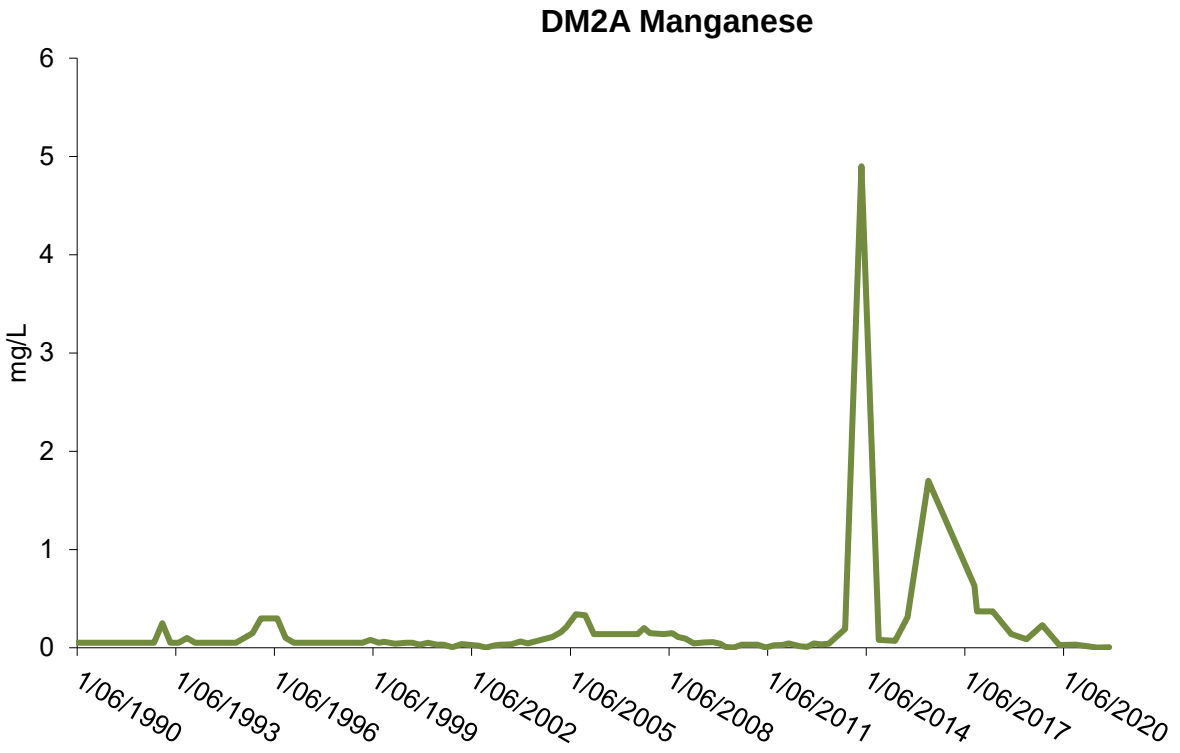

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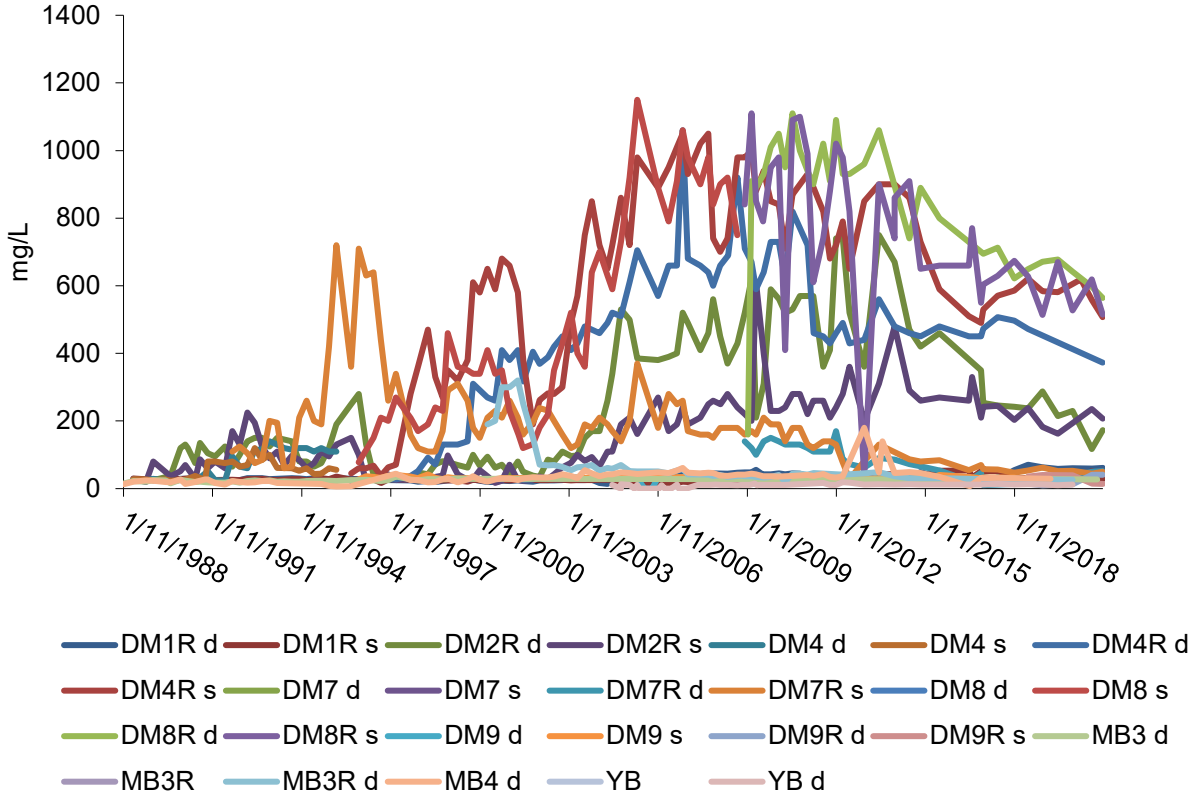
Magnesium



YB Magnesium

Figure

Dalyellup Monitoring

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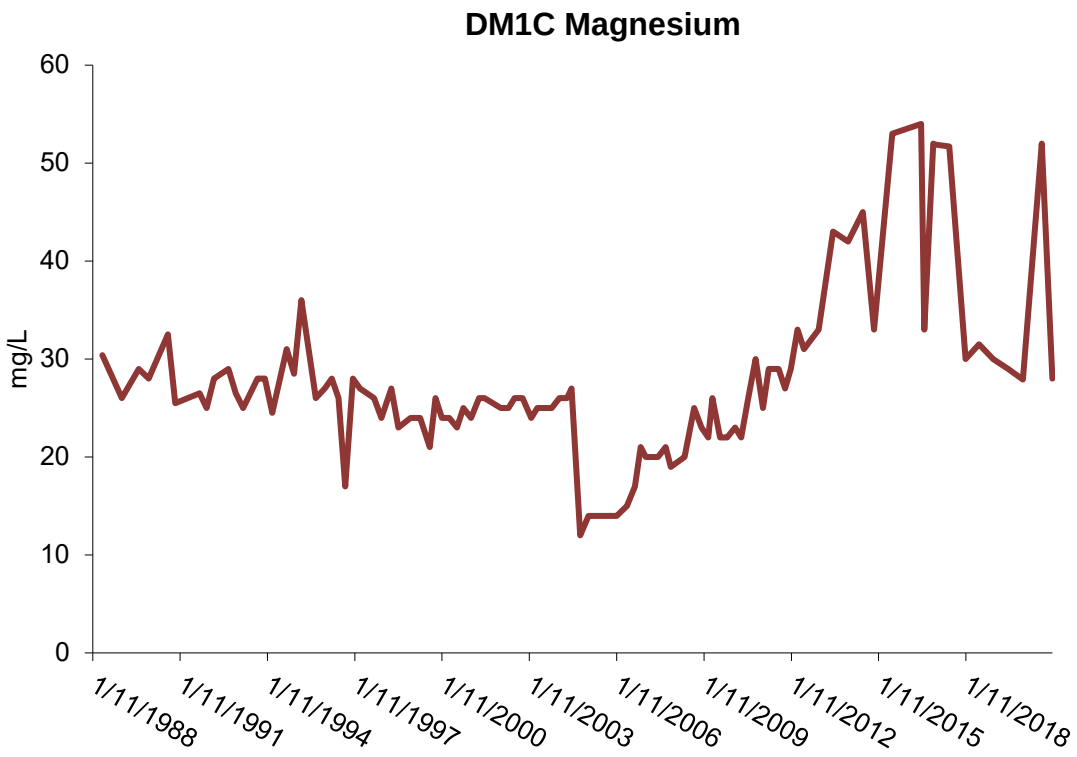

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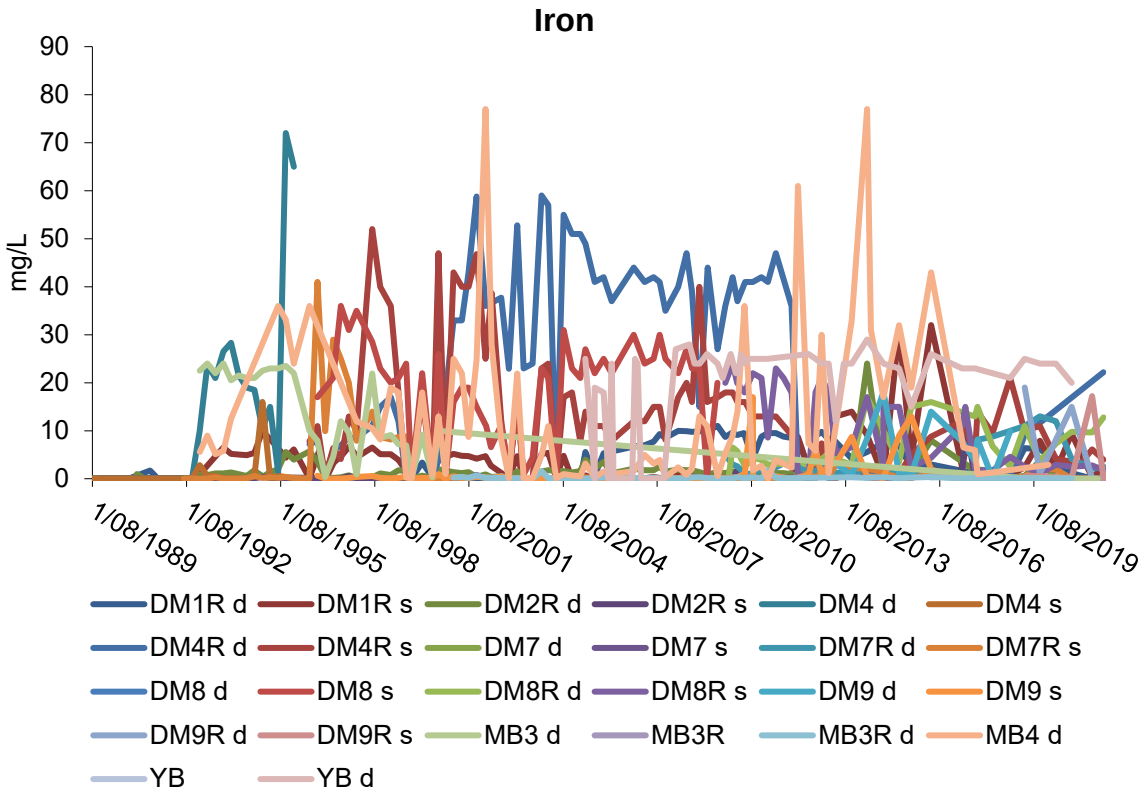

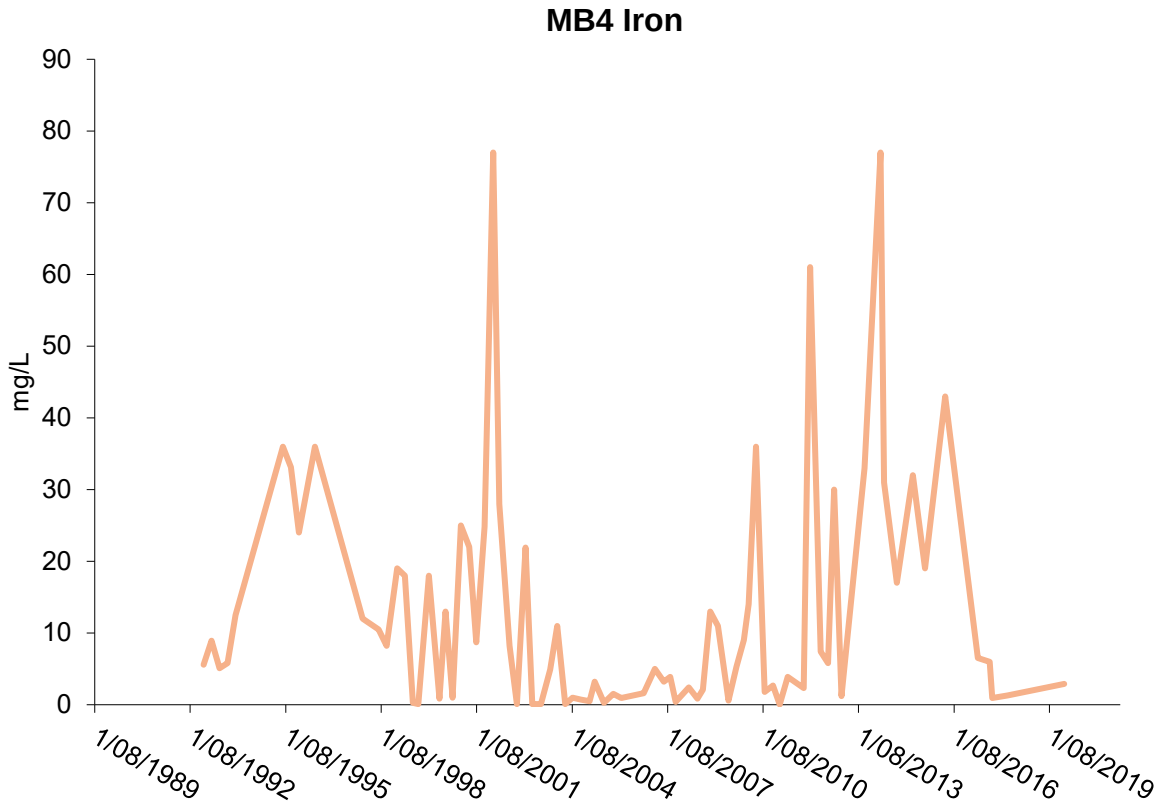

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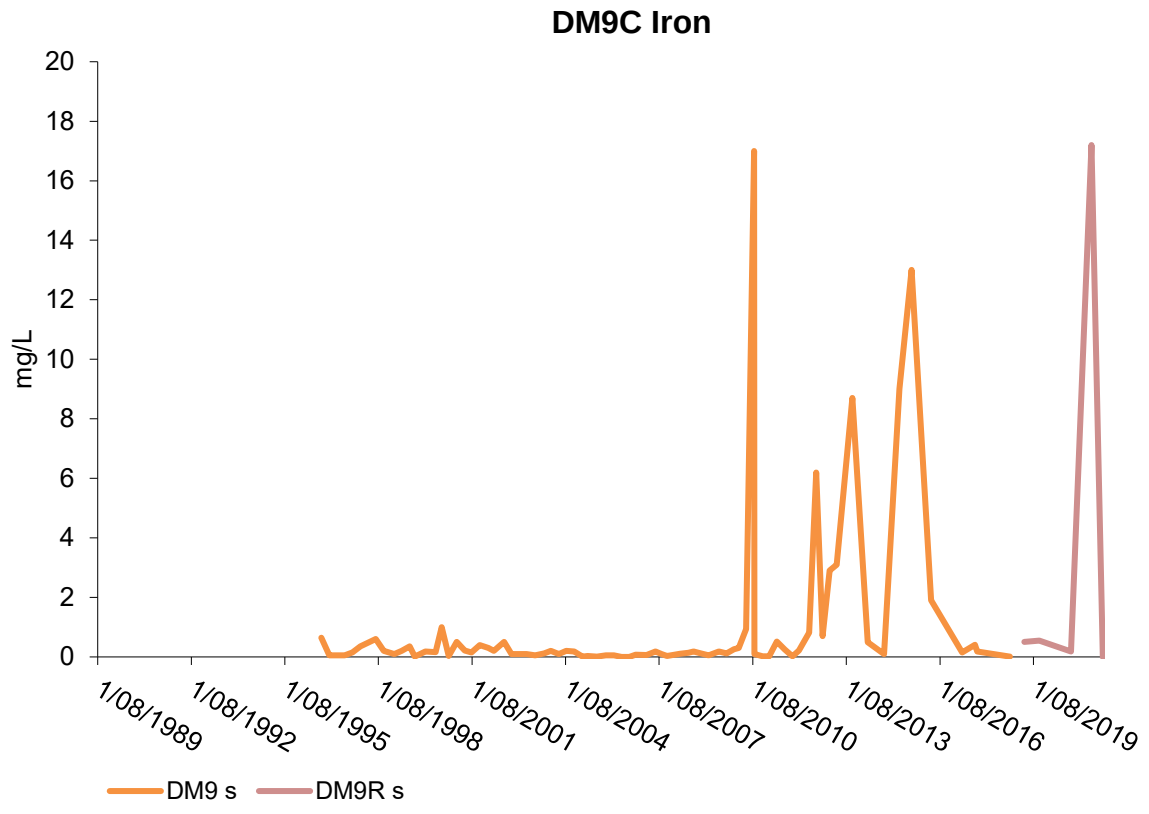

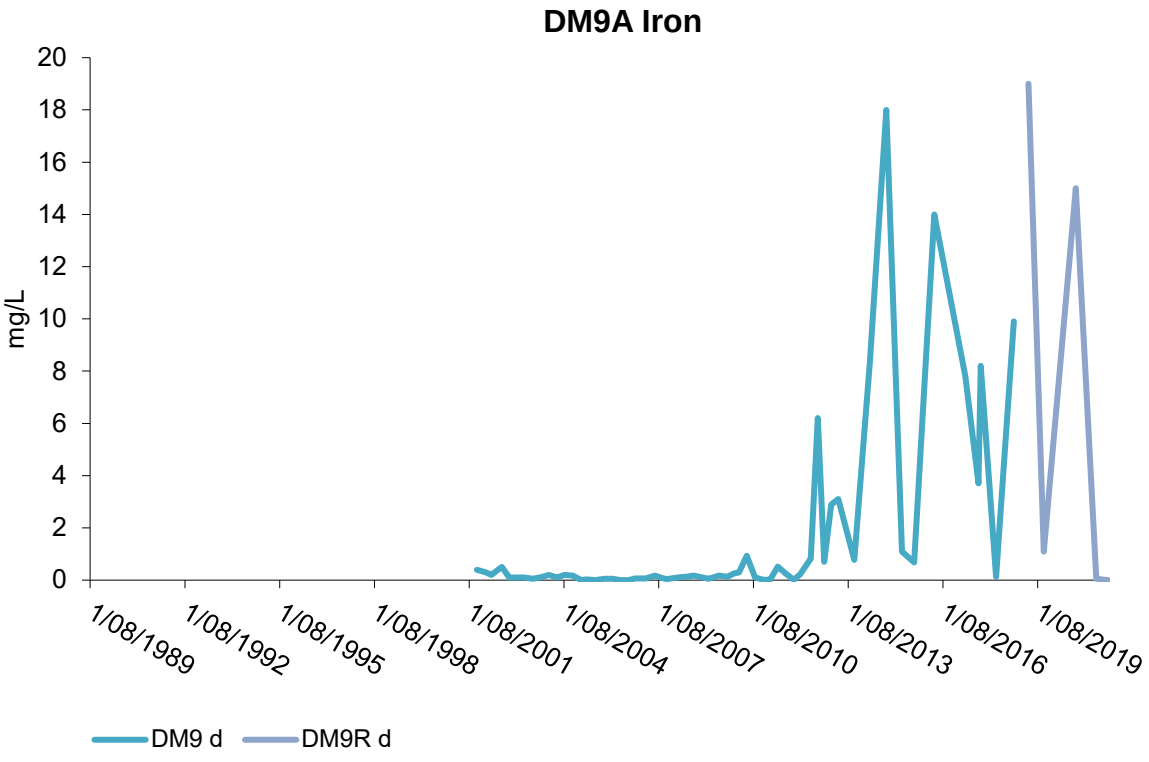

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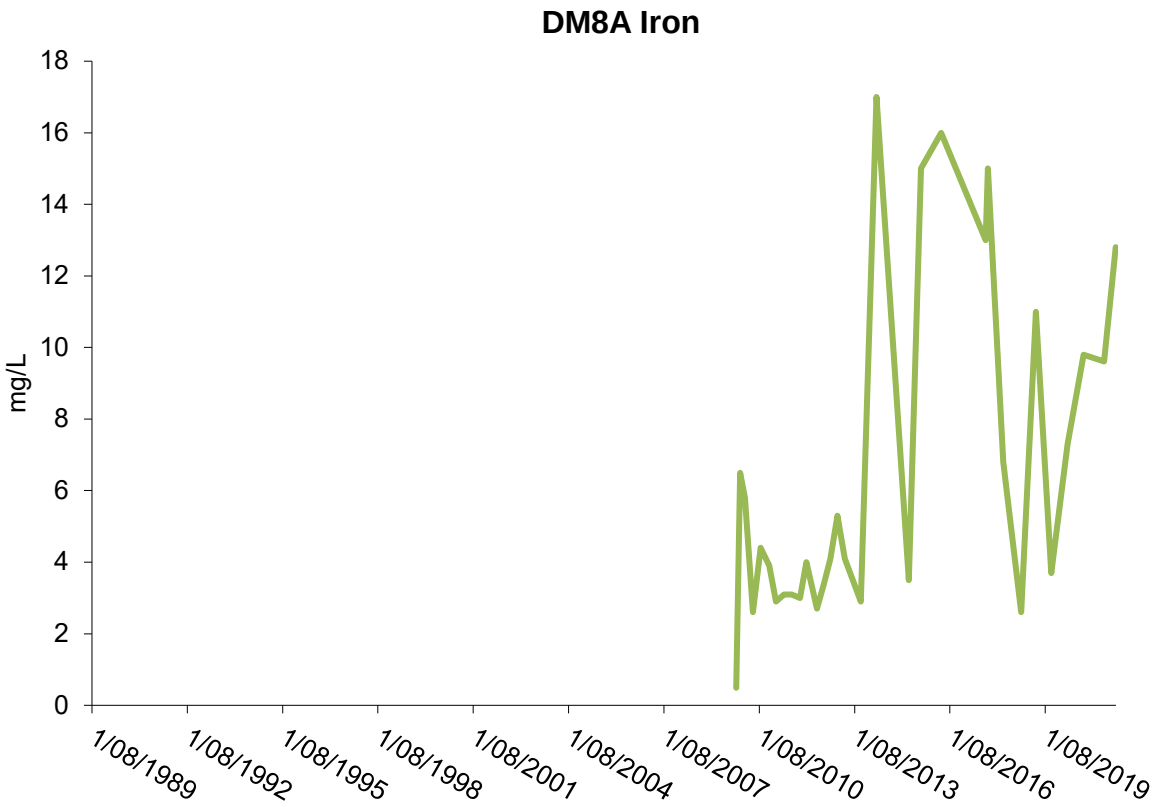

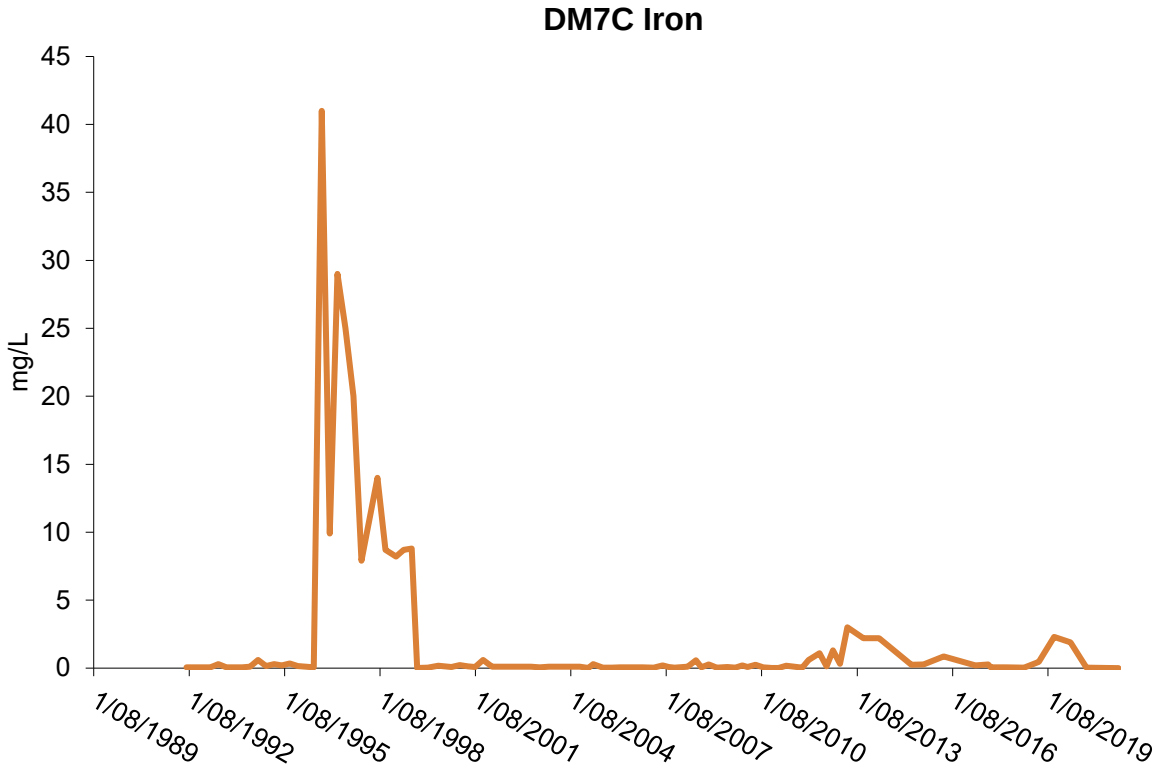

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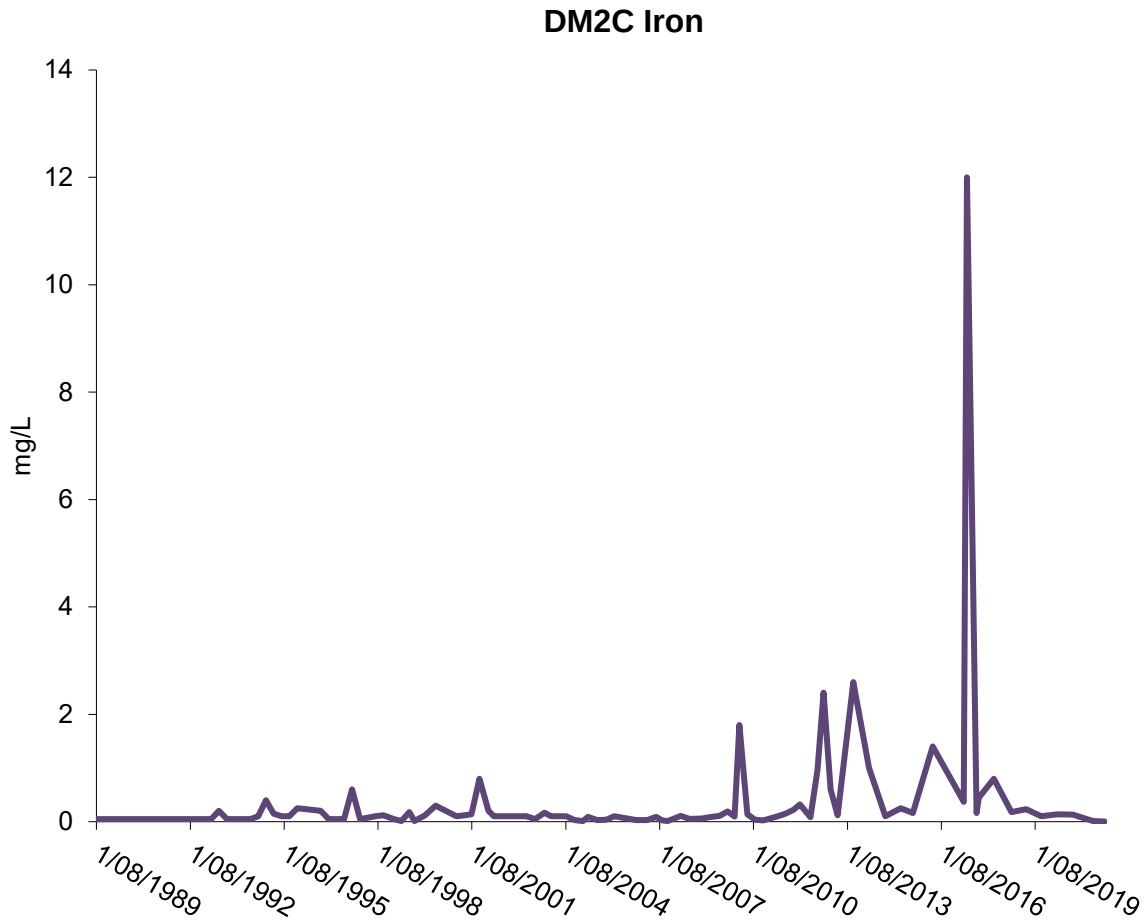

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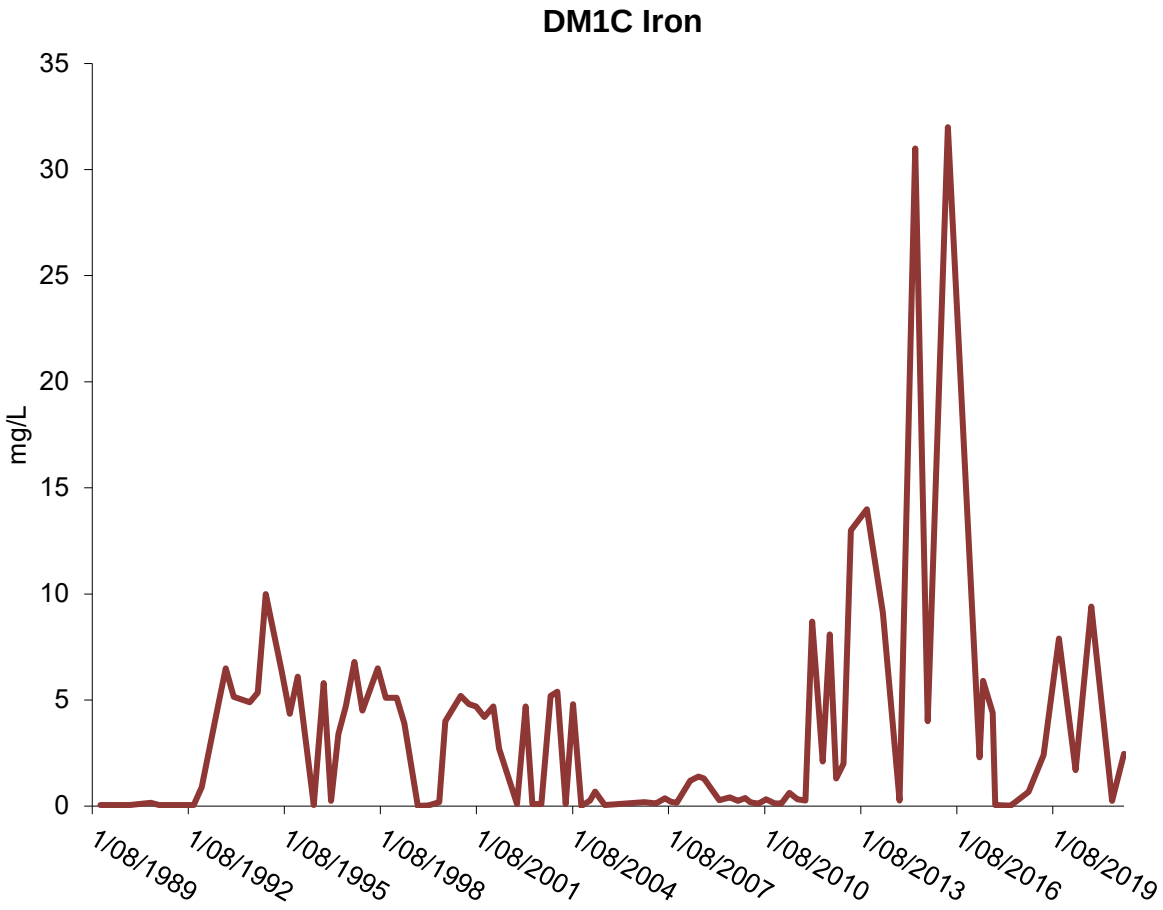

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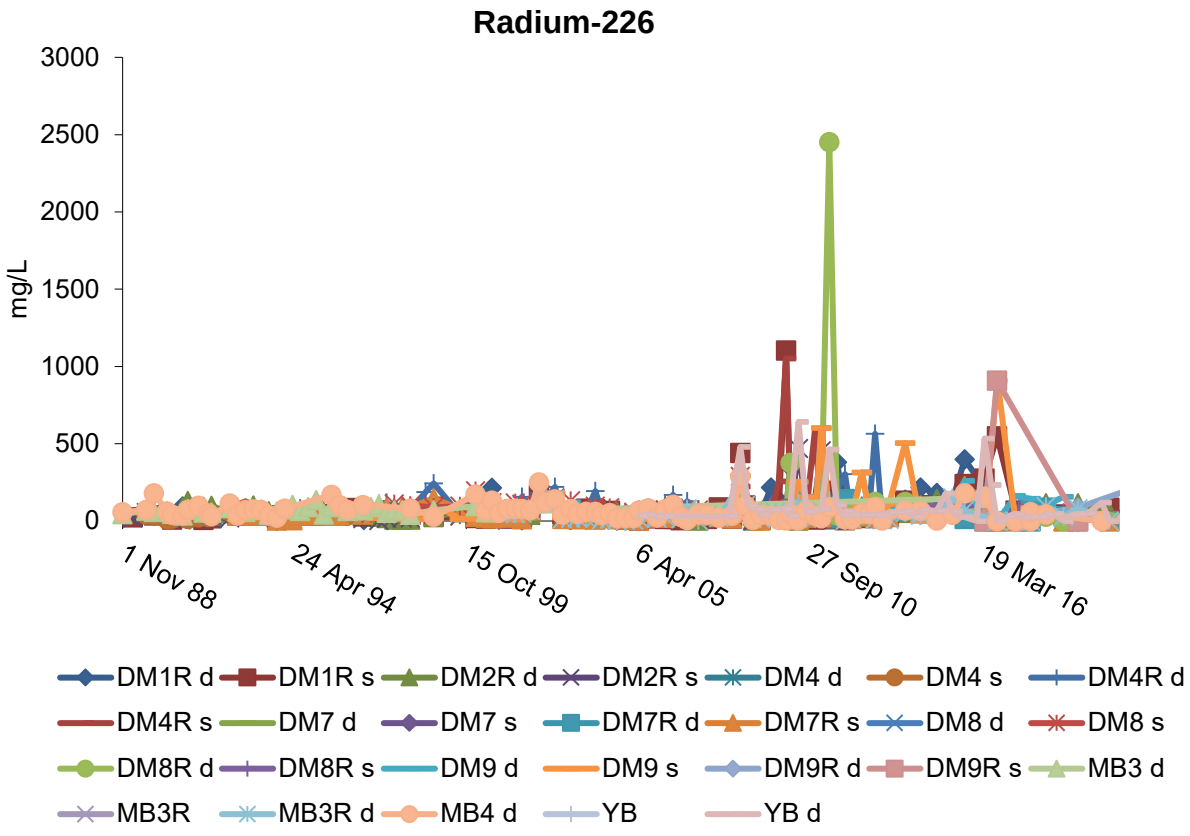

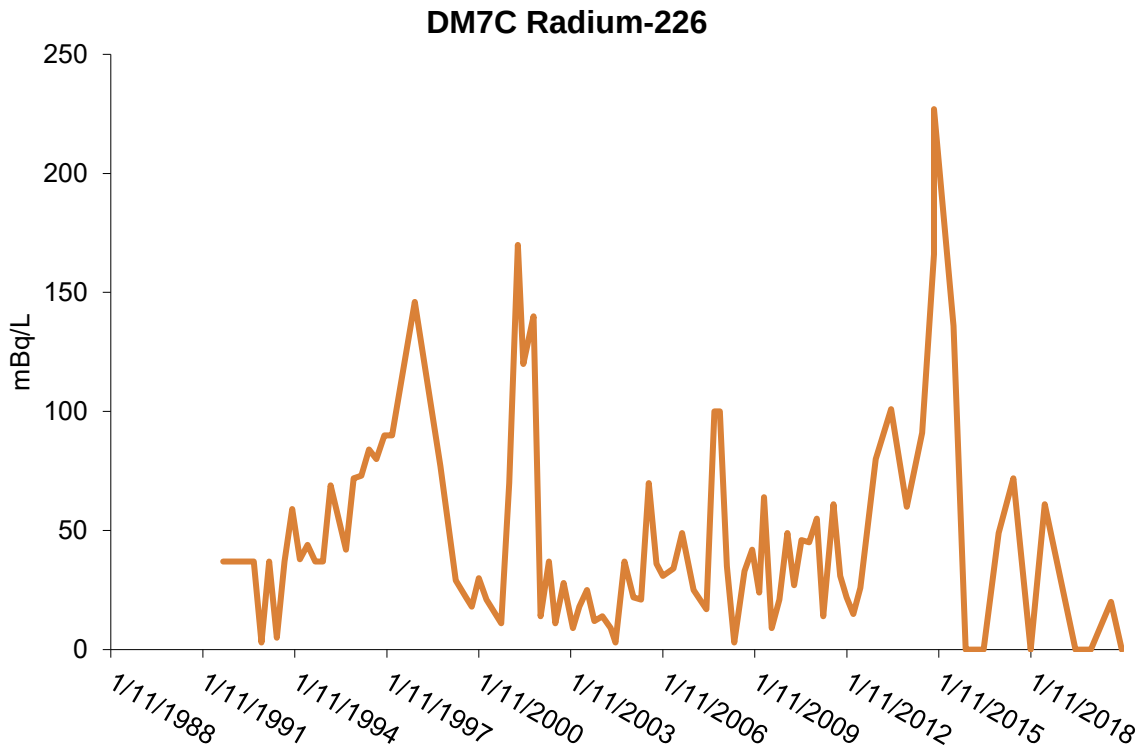

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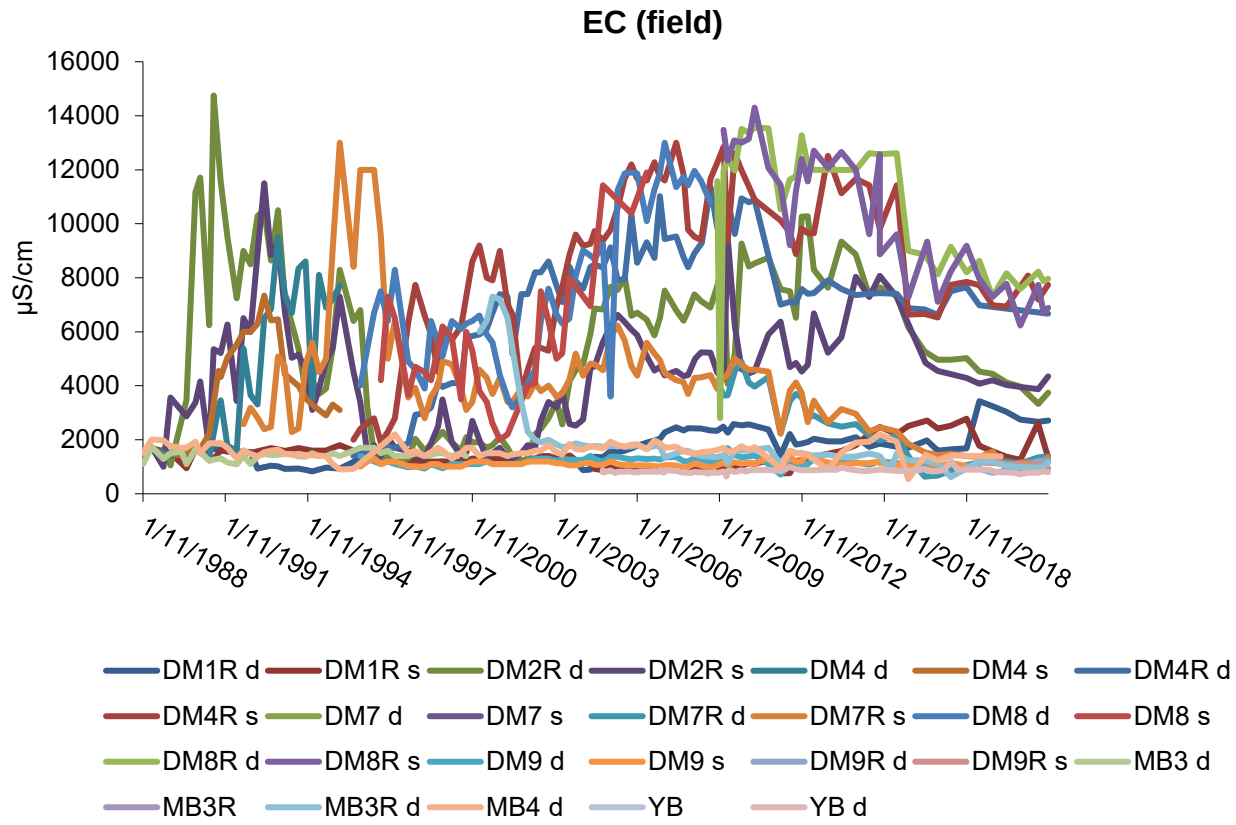

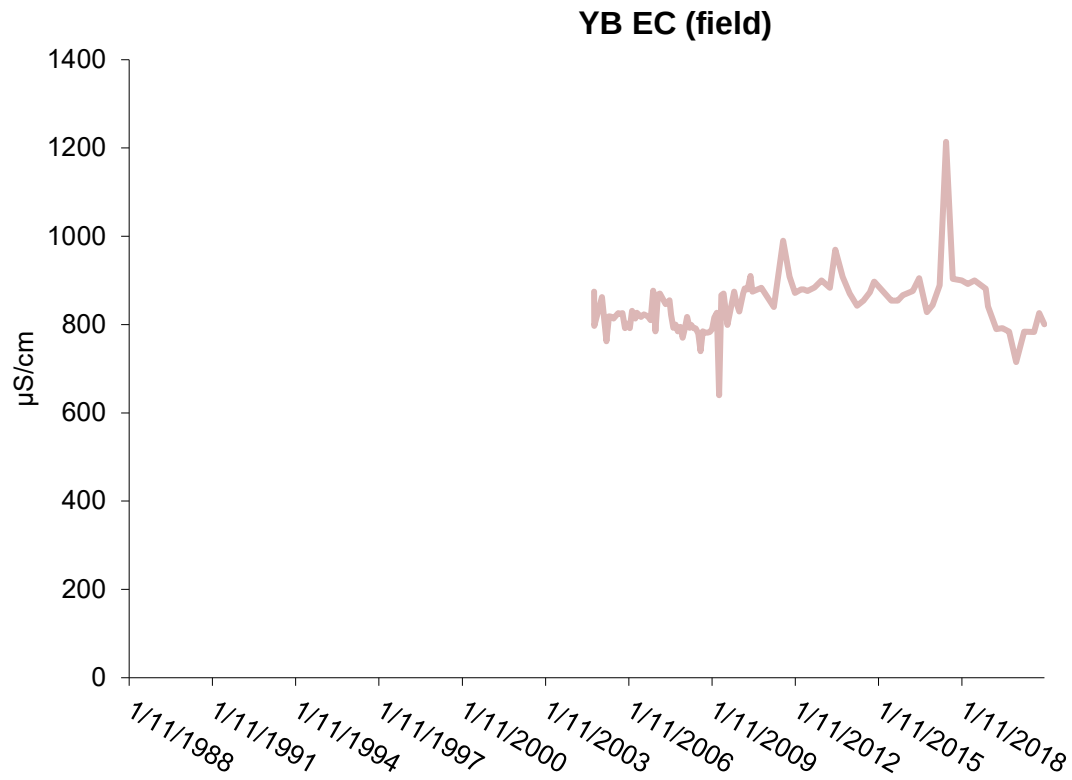

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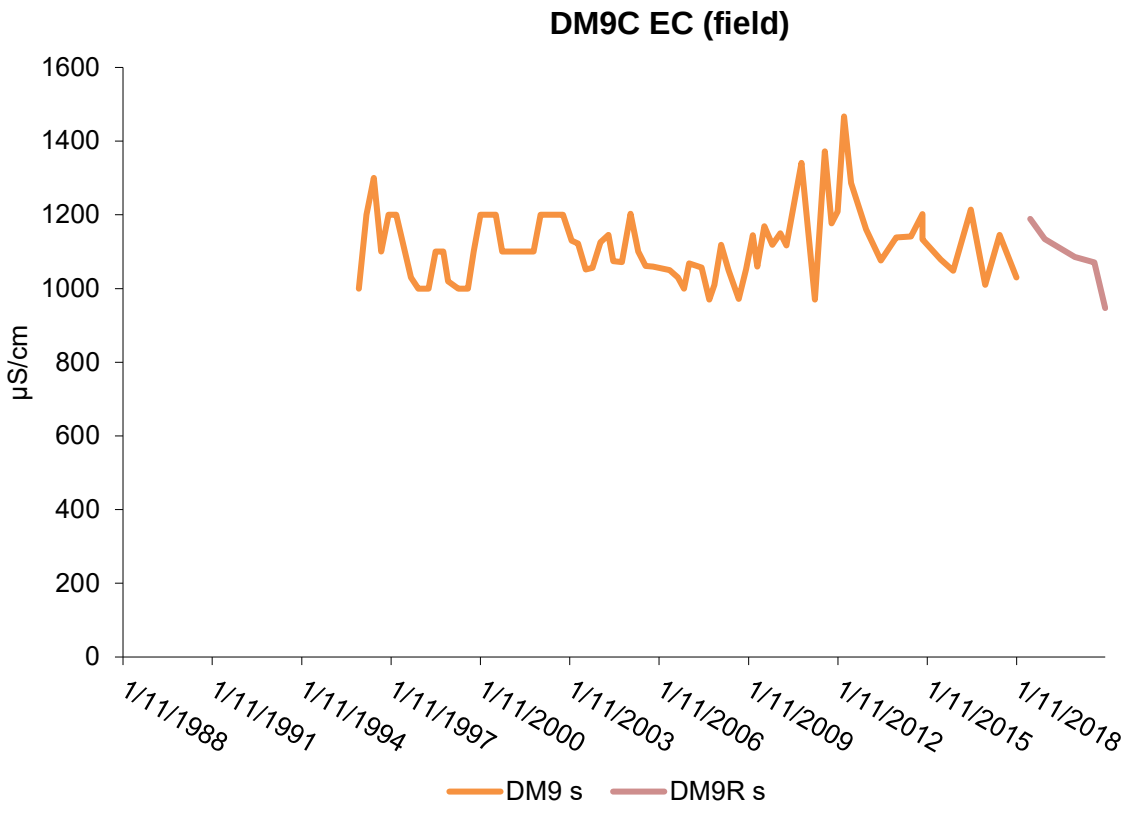

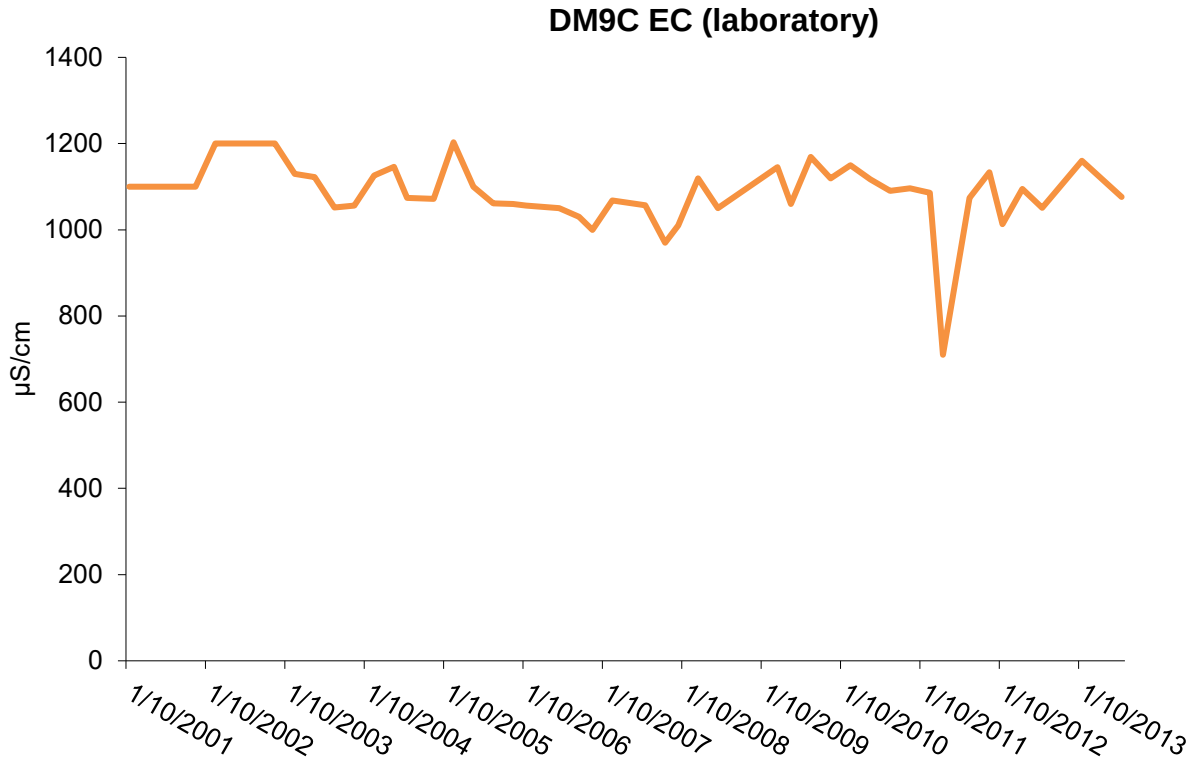

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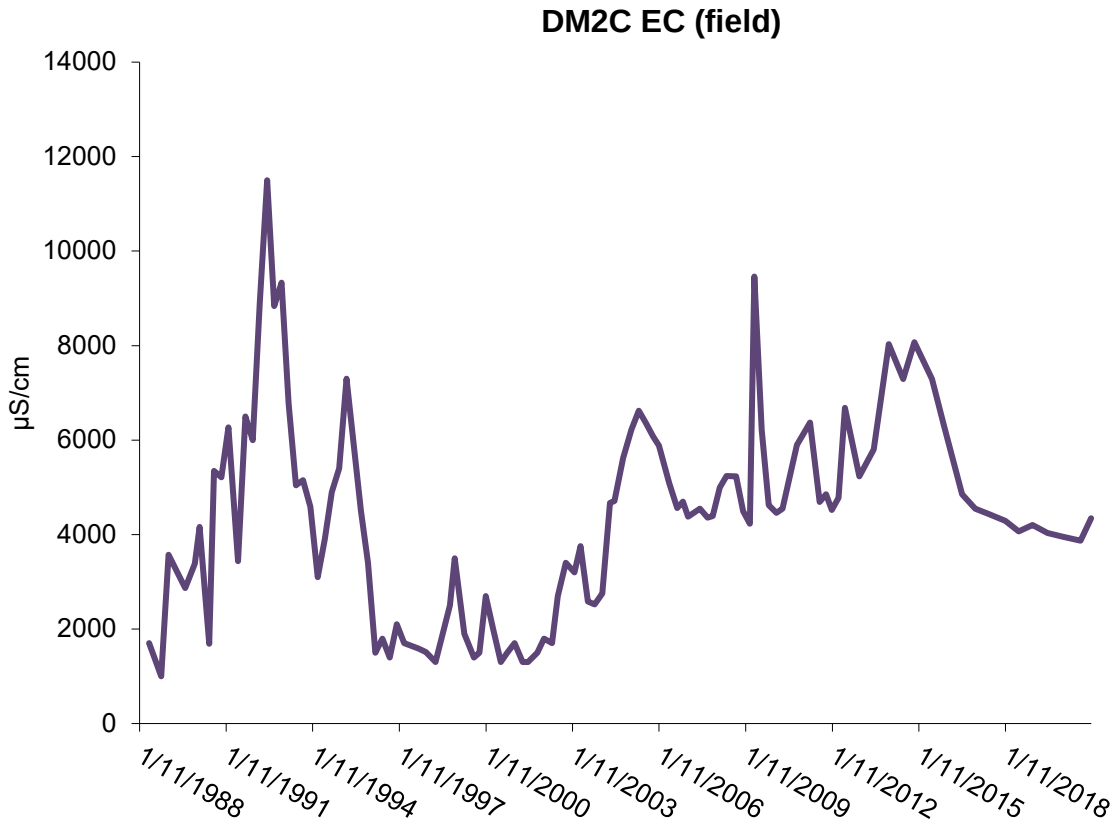

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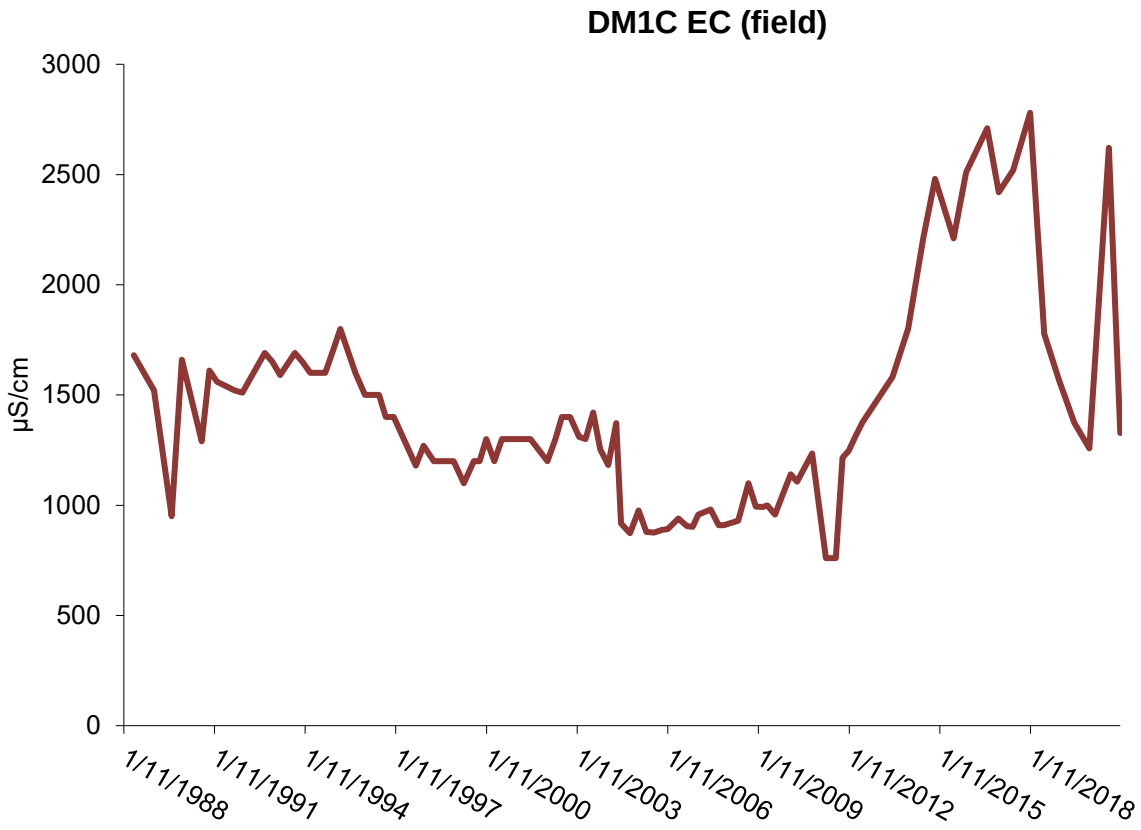

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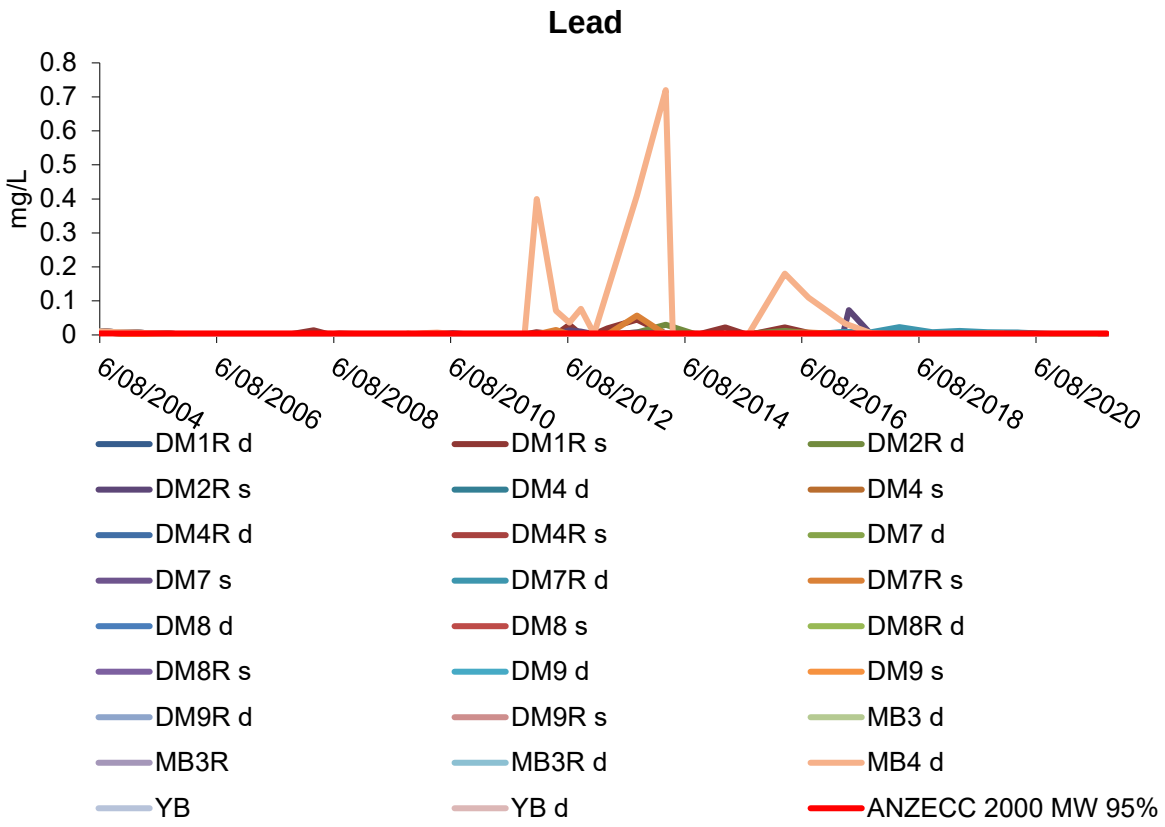

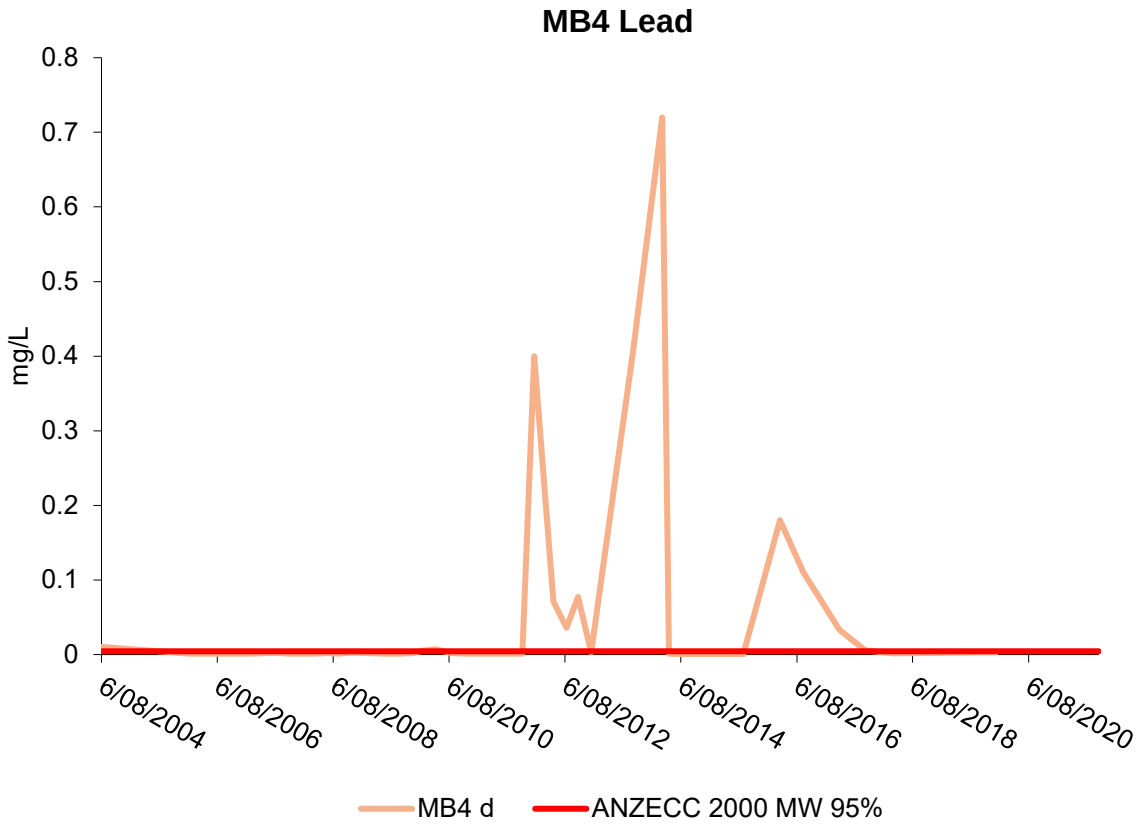

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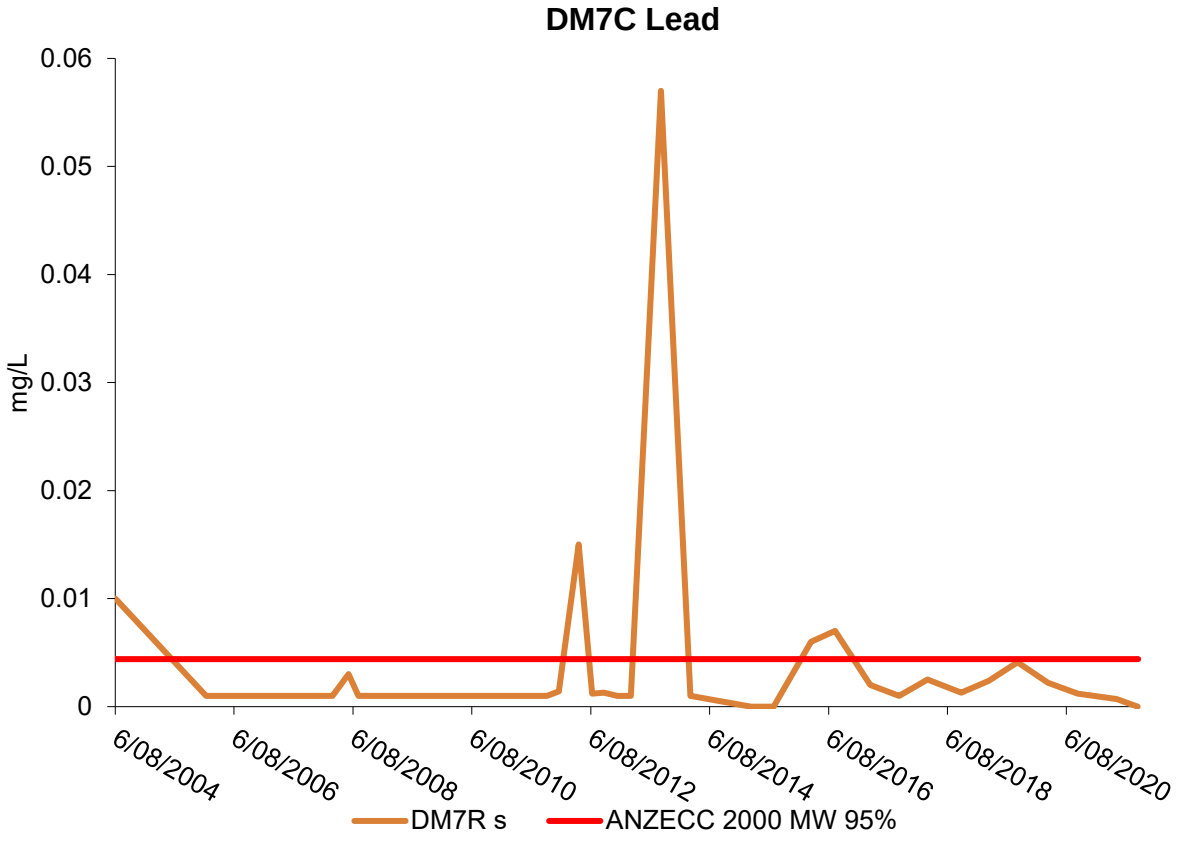

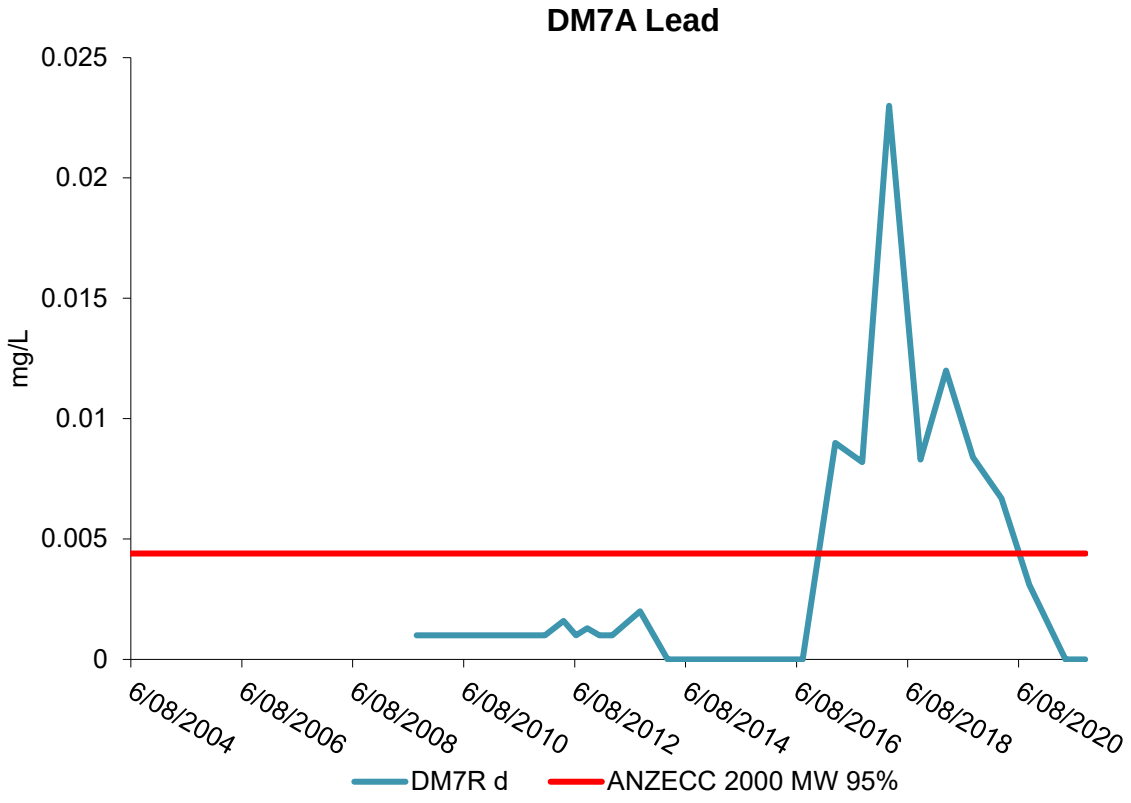

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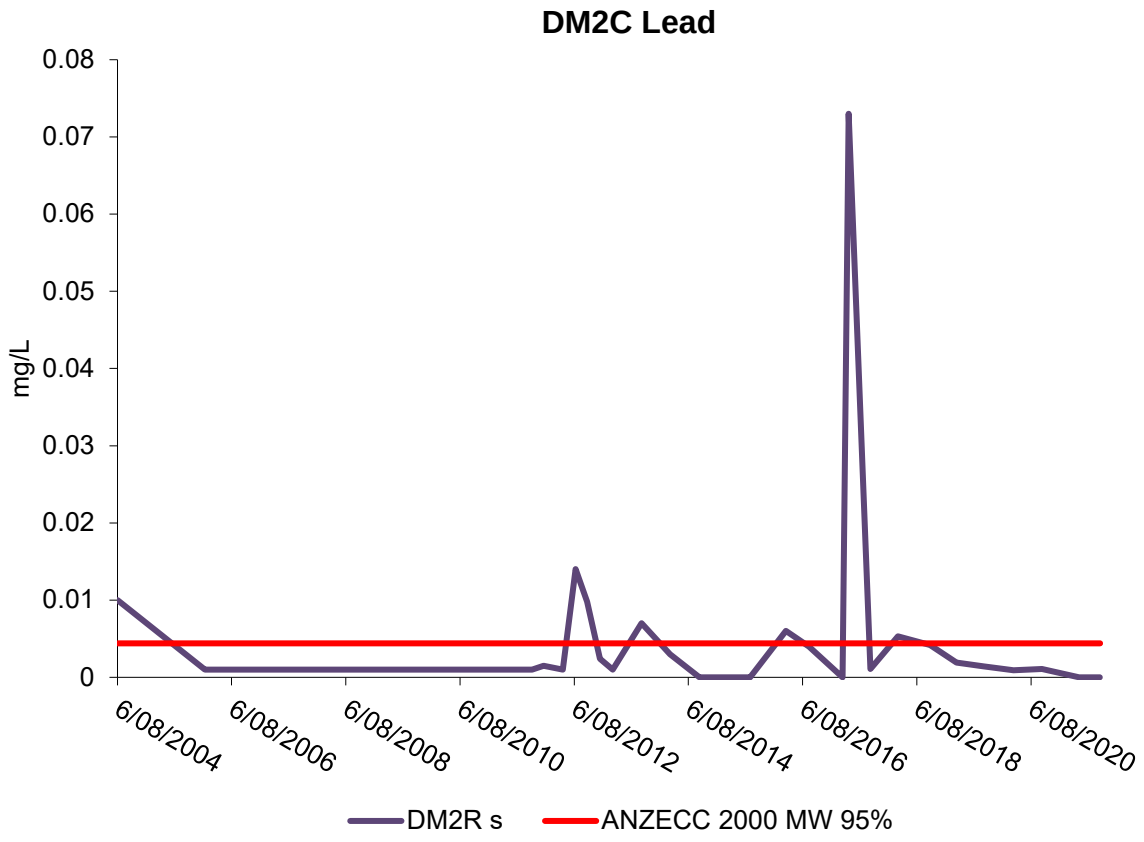

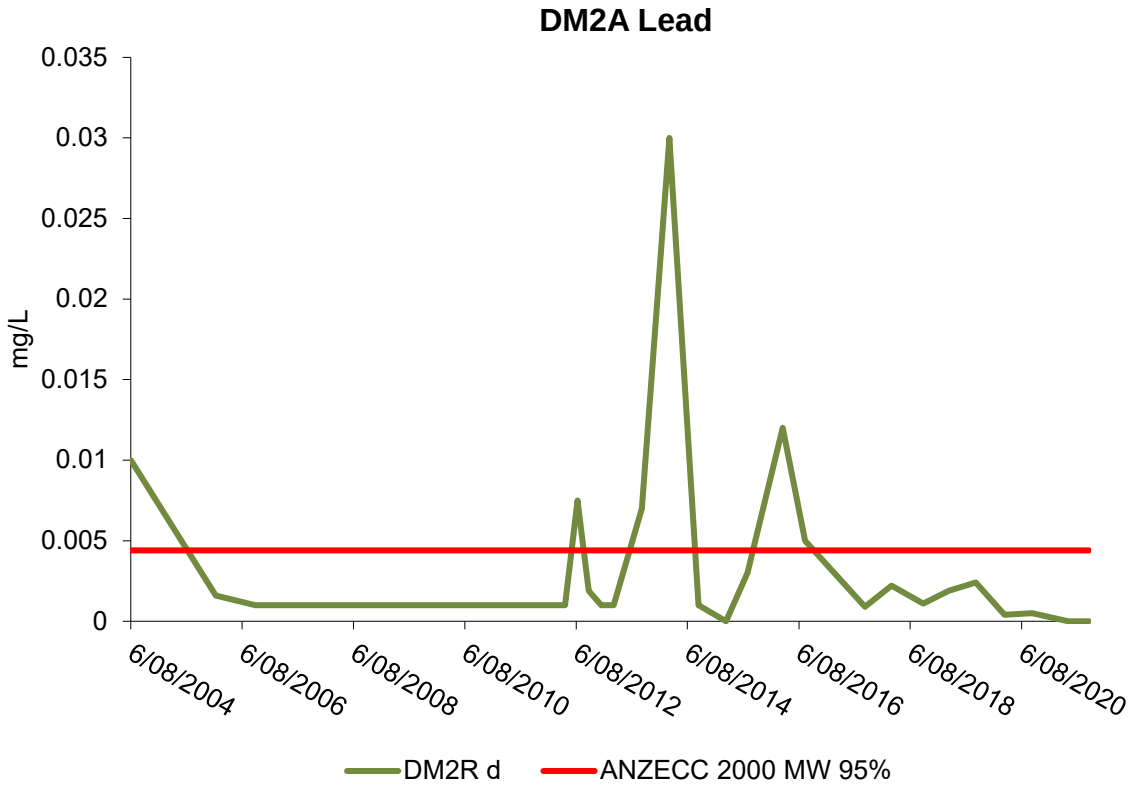

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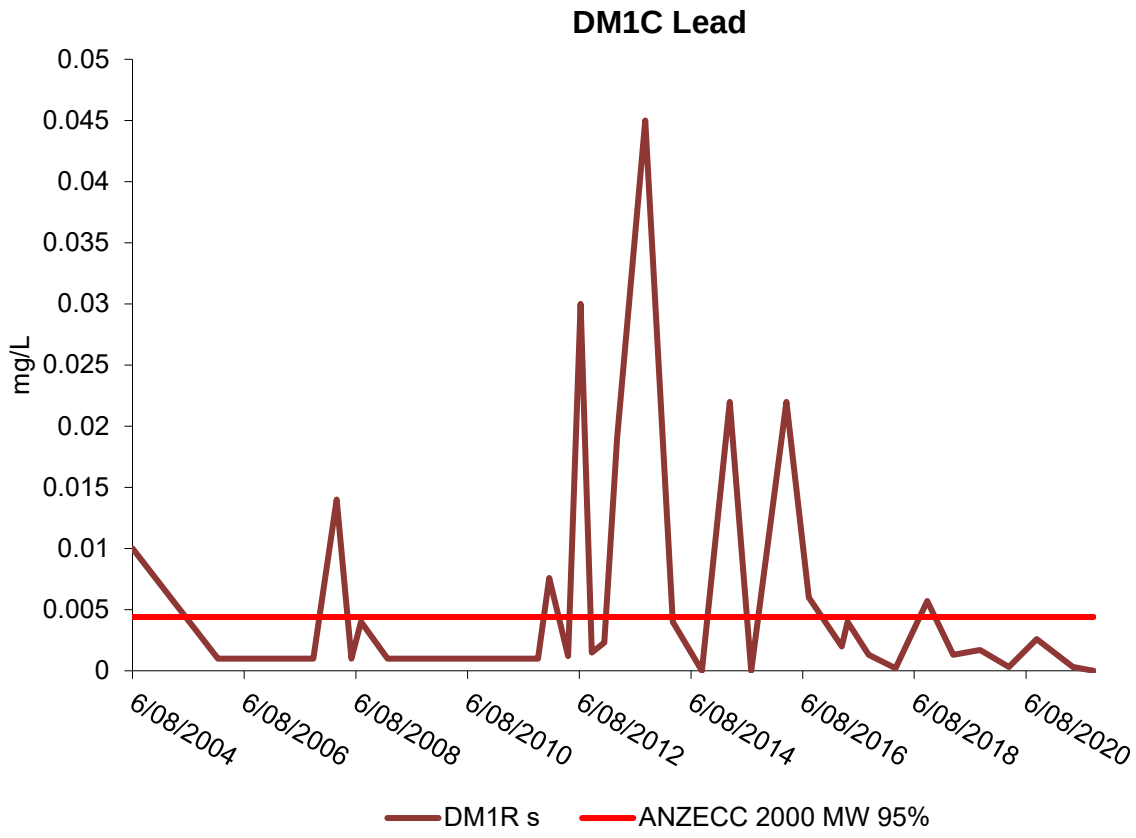

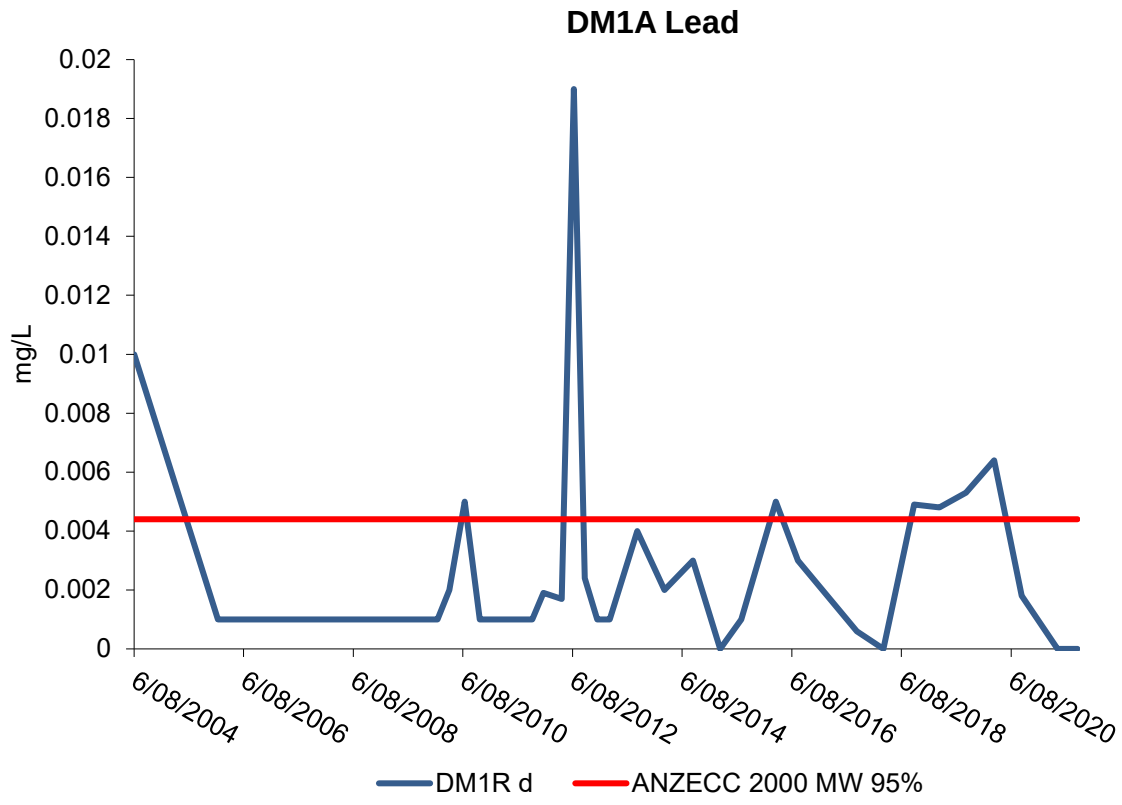

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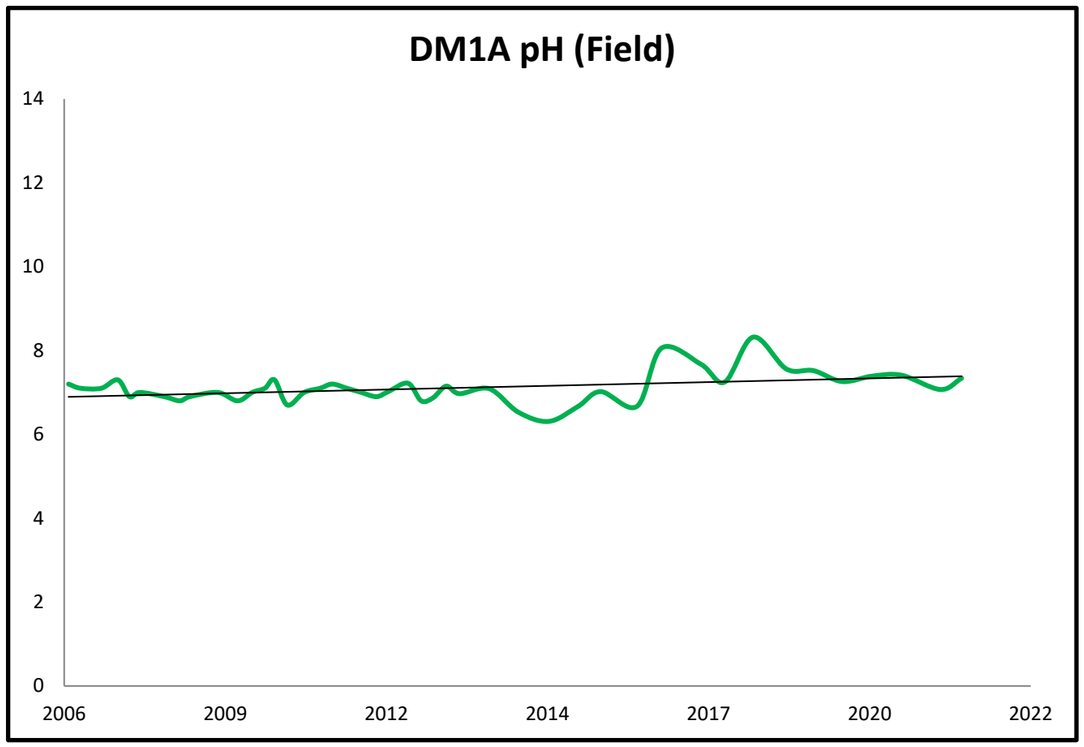
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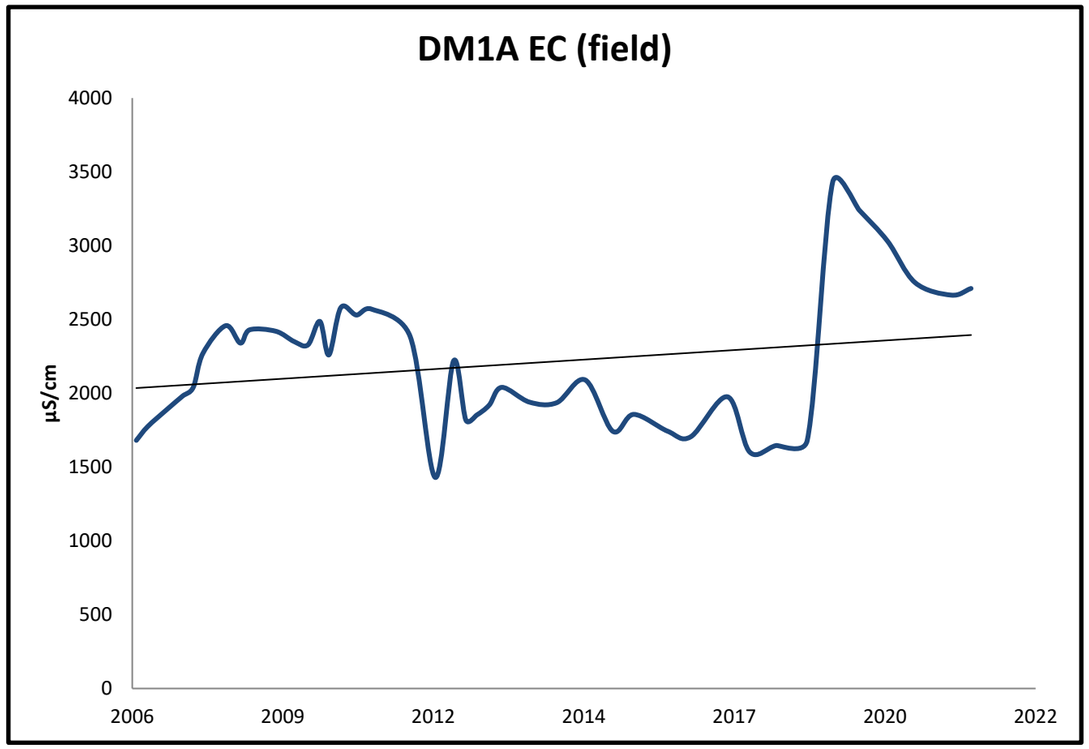
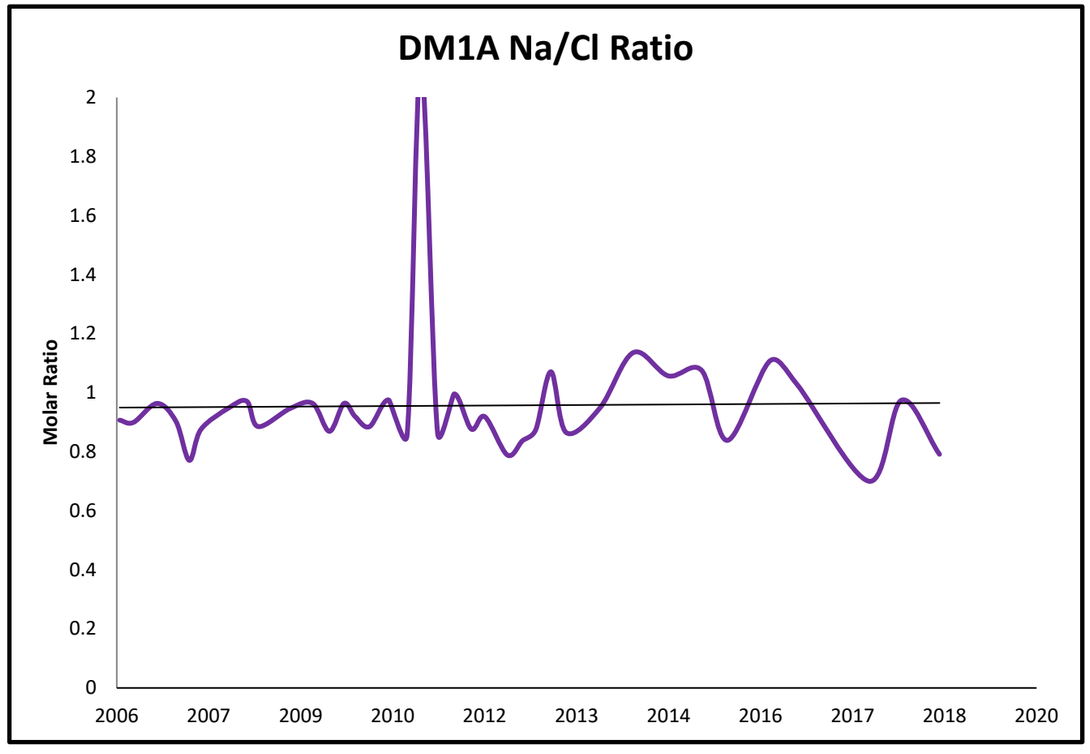
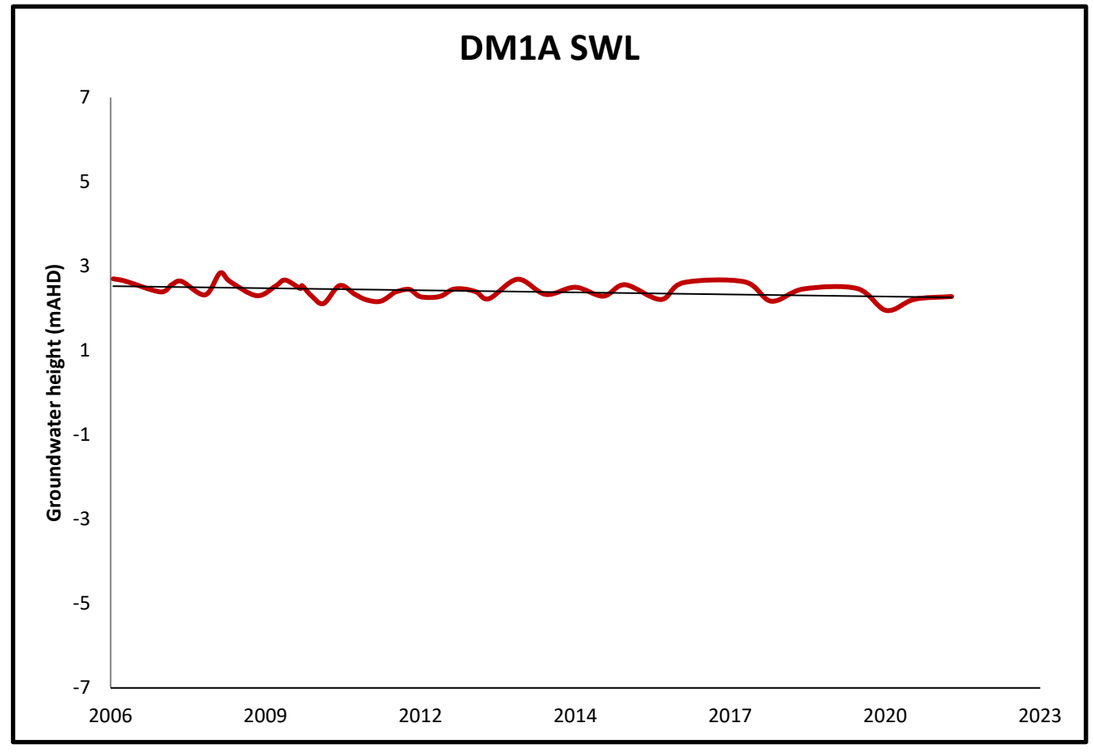
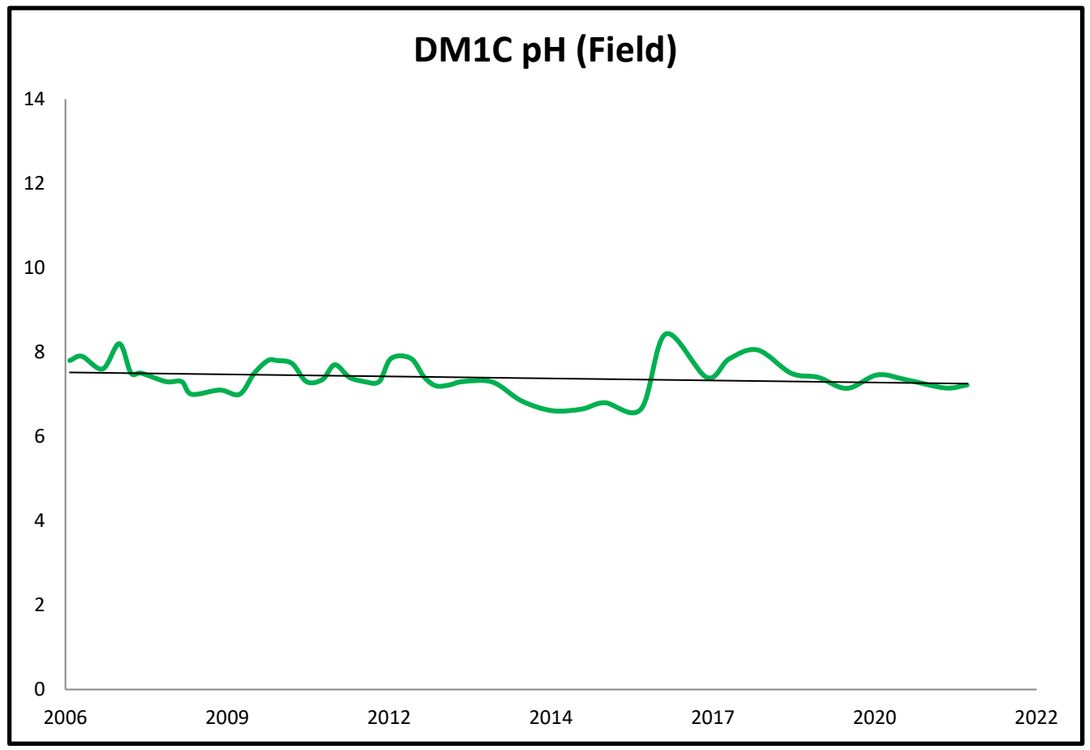
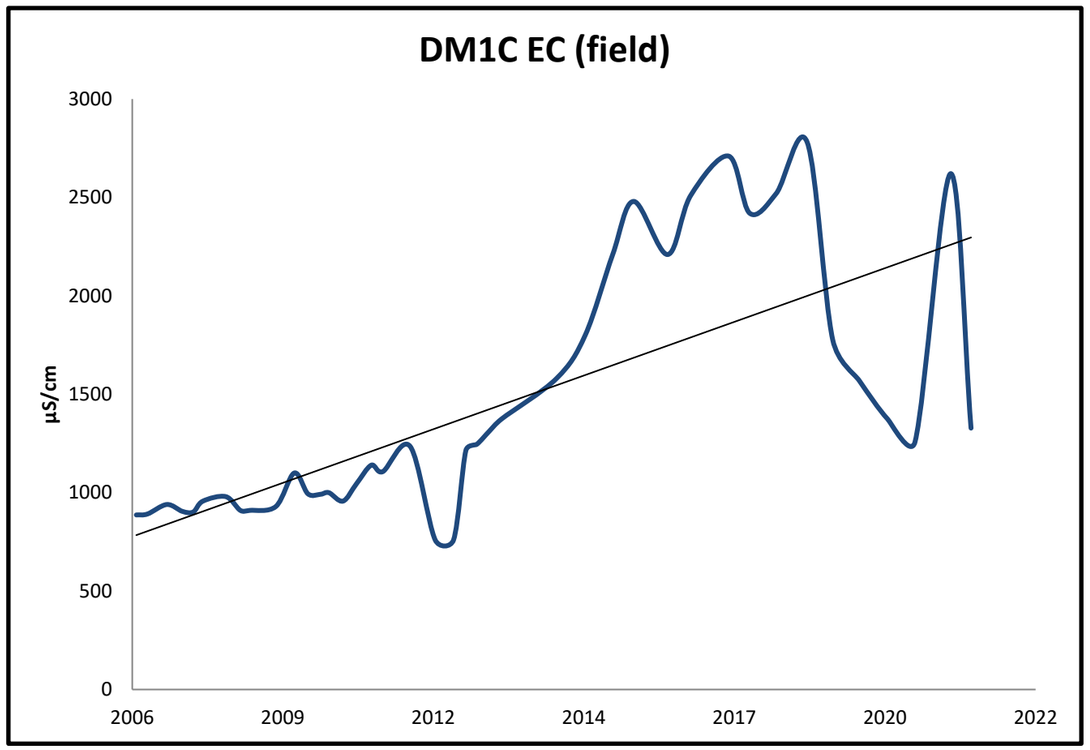
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

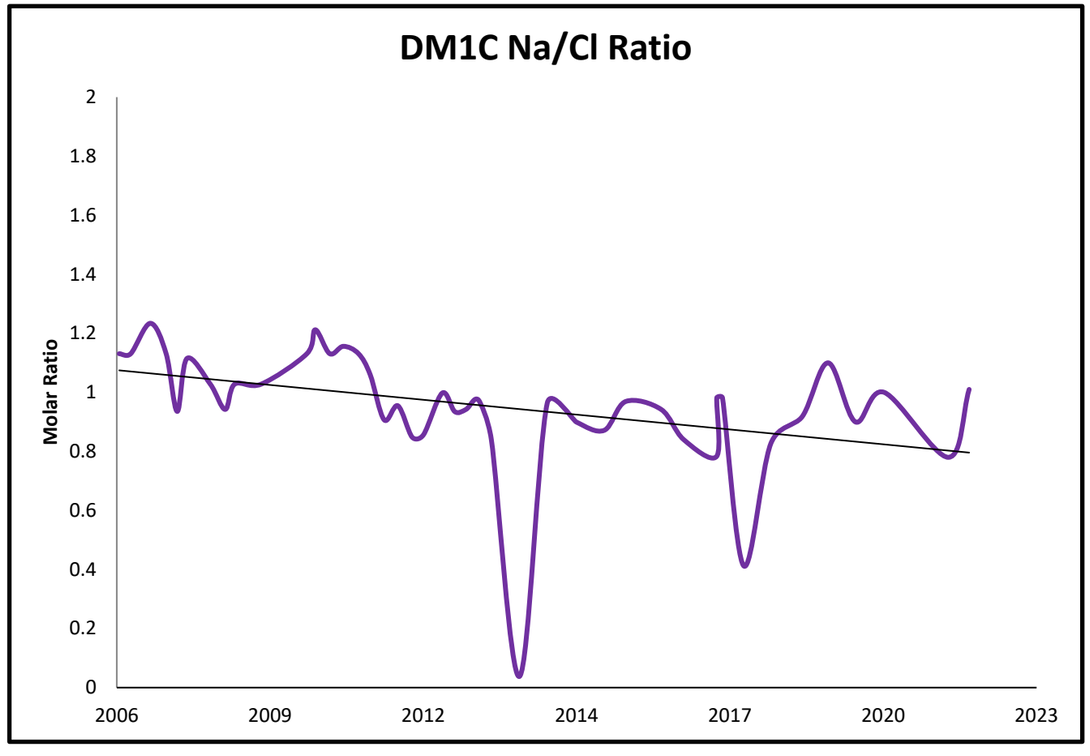

DM1A EC (field)
µS/cm
4000
3500
3000
2500
2000
1500
1000
500
0
2006
2009
2012
2014
2017
2020
2022

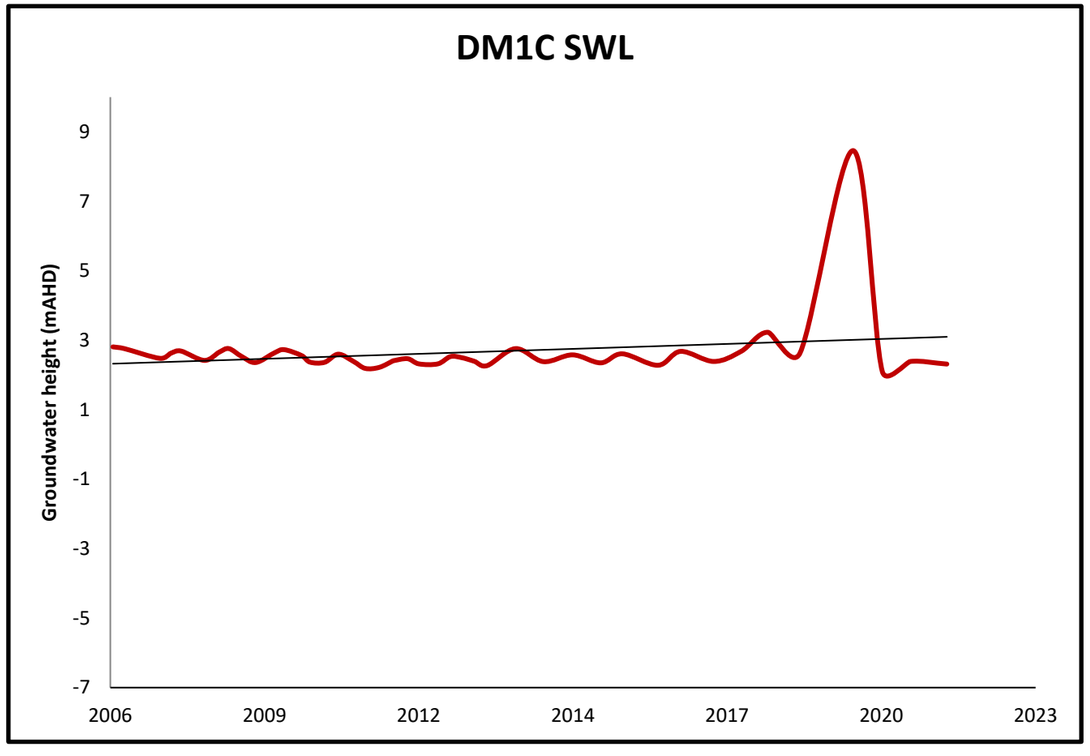

DM1A Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2007
2009
2010
2012
2013
2014
2016
2017
2018
2020

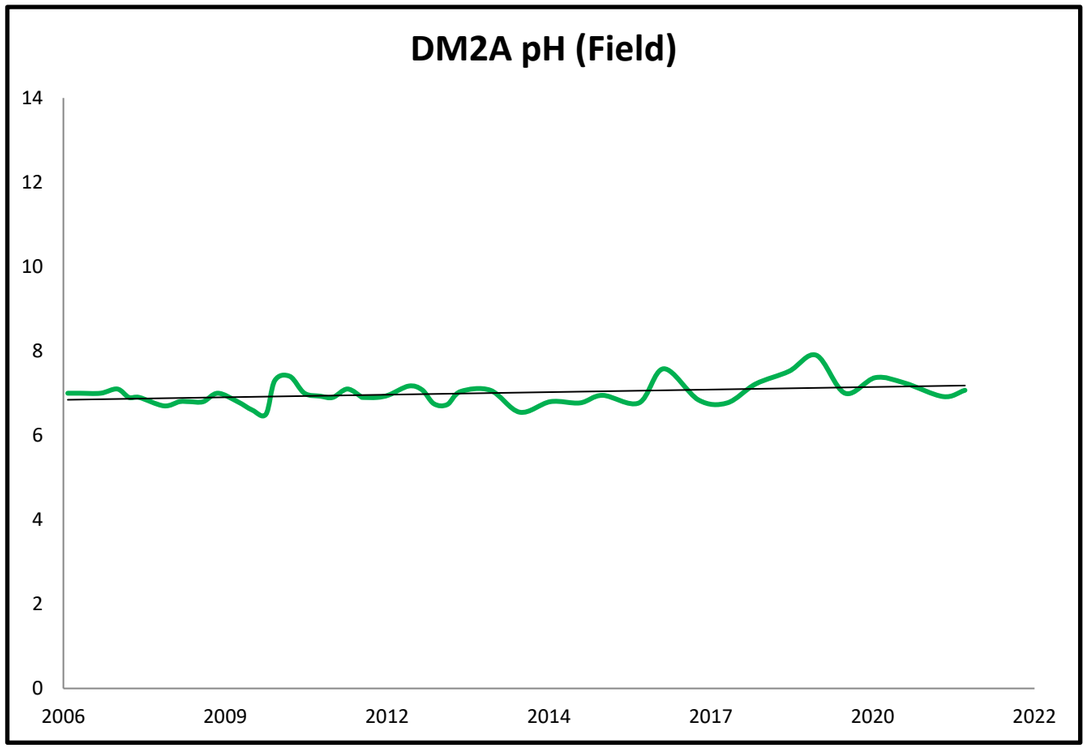

DM1A SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

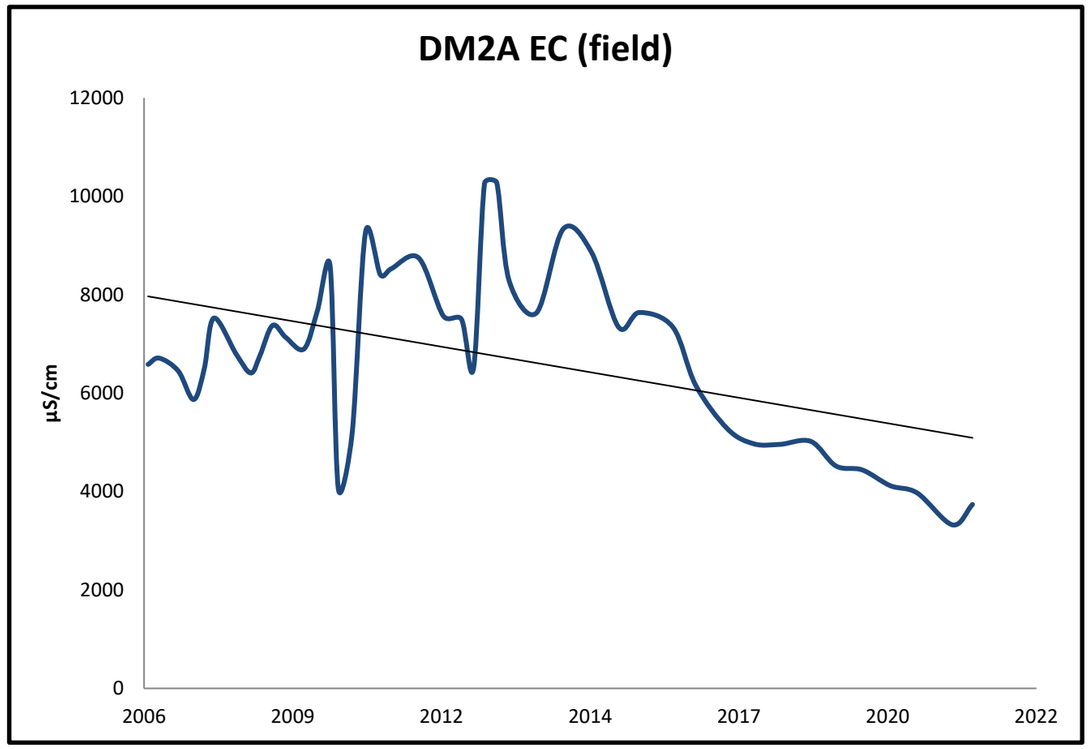

DM1C pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

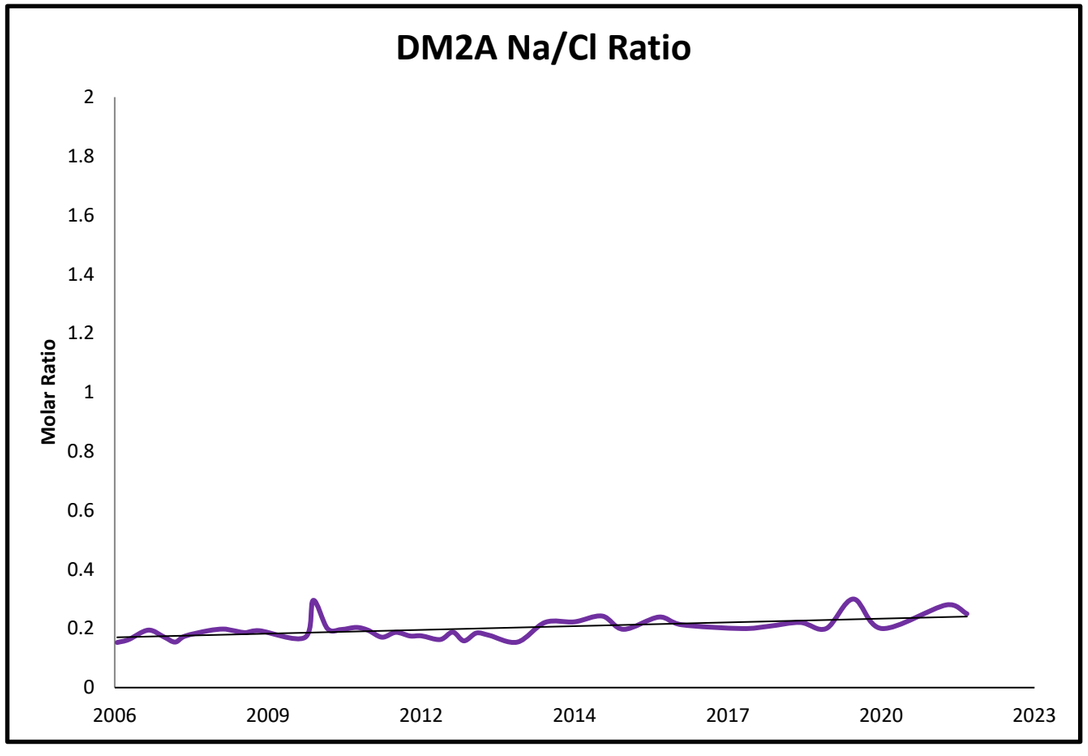

DM1C EC (field)
µS/cm
3000
2500
2000
1500
1000
500
0
2006
2009
2012
2014
2017
2020
2022

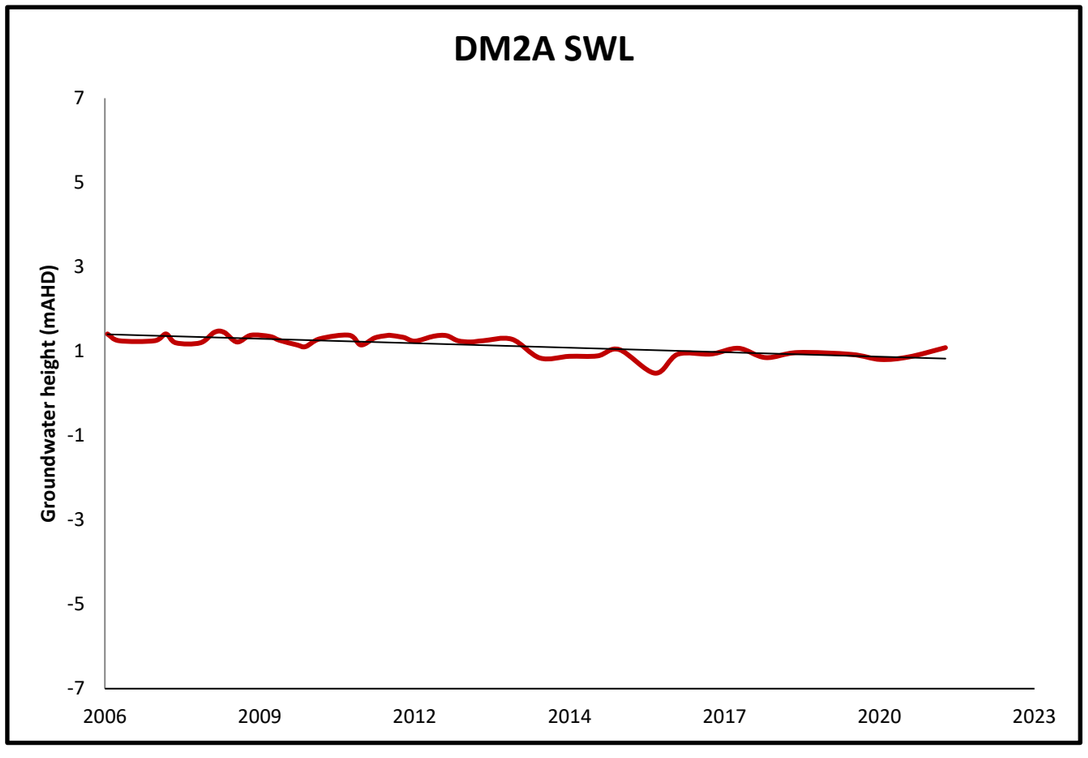

DM1C Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023


DM1C SWL
Groundwater height (mAHD)
9
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

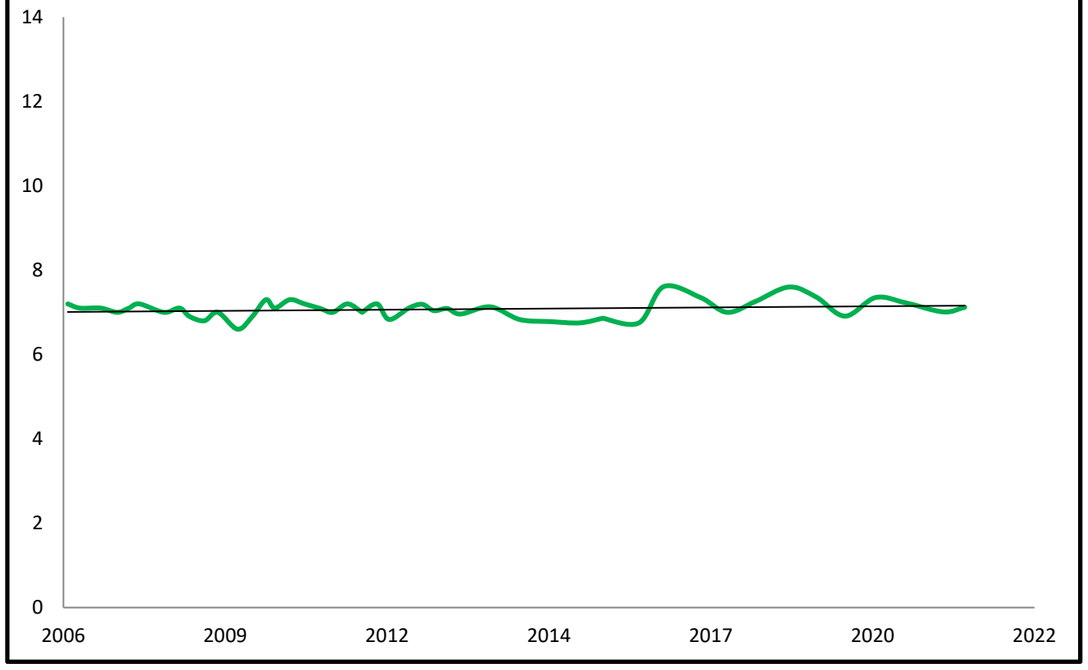

DM2A pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022


DM2A EC (field)
µS/cm
12000
10000
8000
6000
4000
2000
0
2006
2009
2012
2014
2017
2020
2022

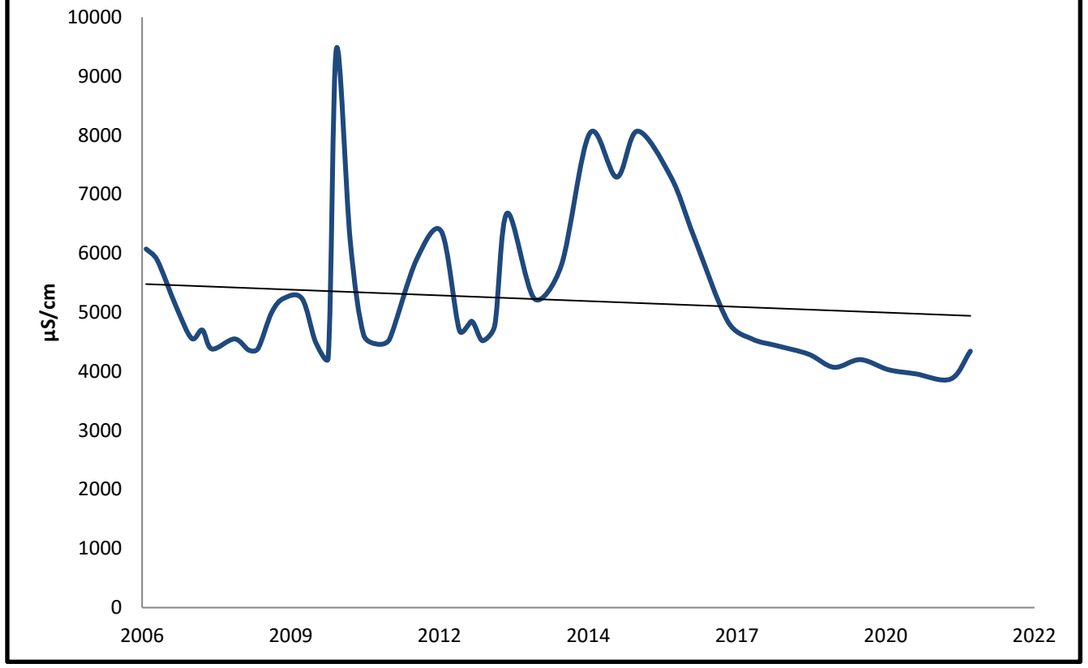

DM2A Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023


DM2A SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

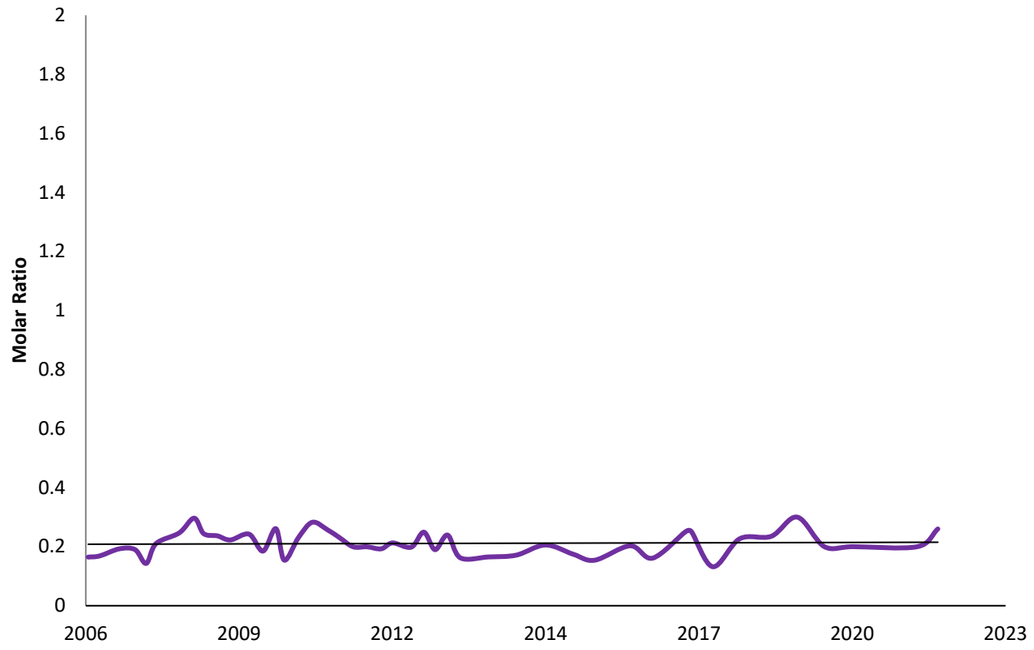
DM2C pH (Field)



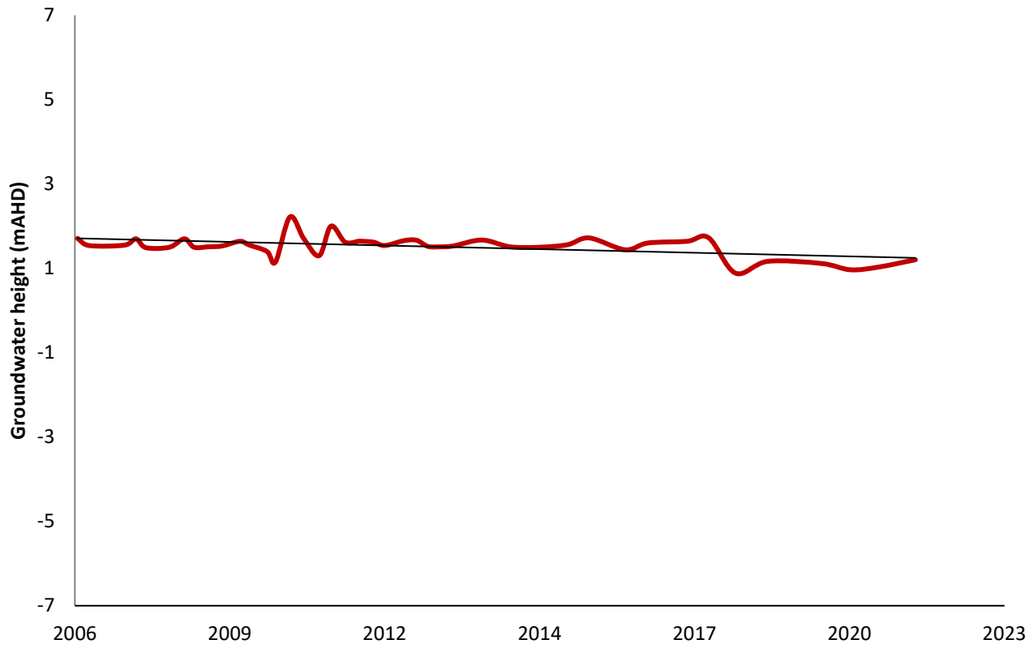
DM2C EC (field)

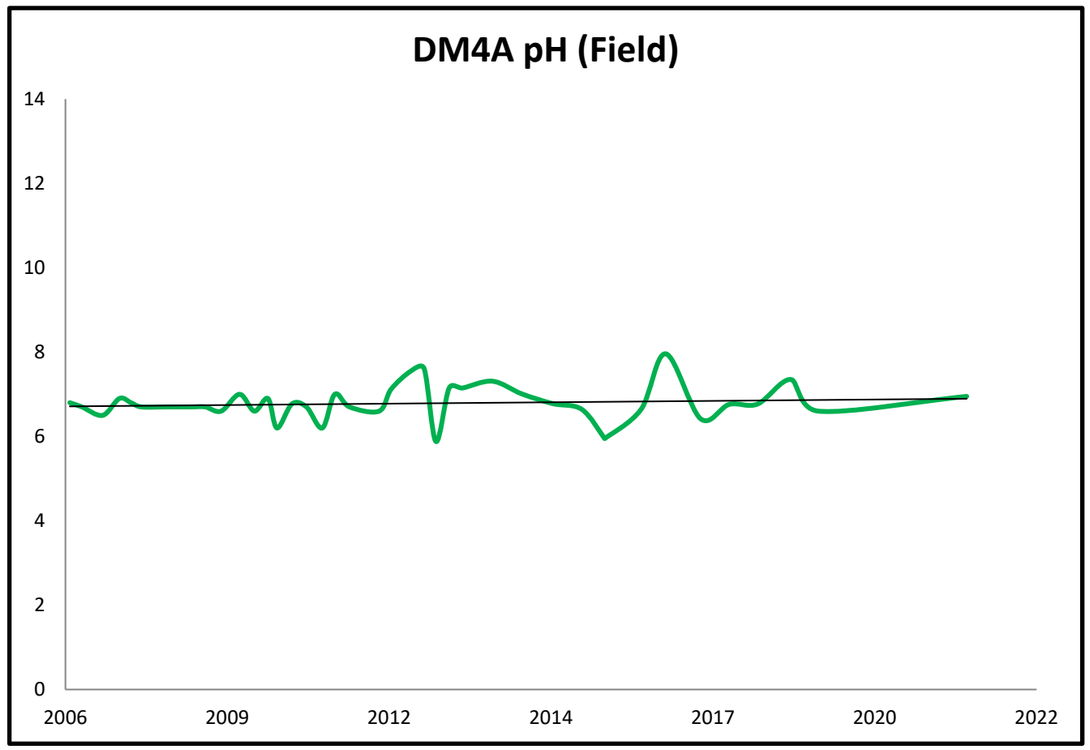


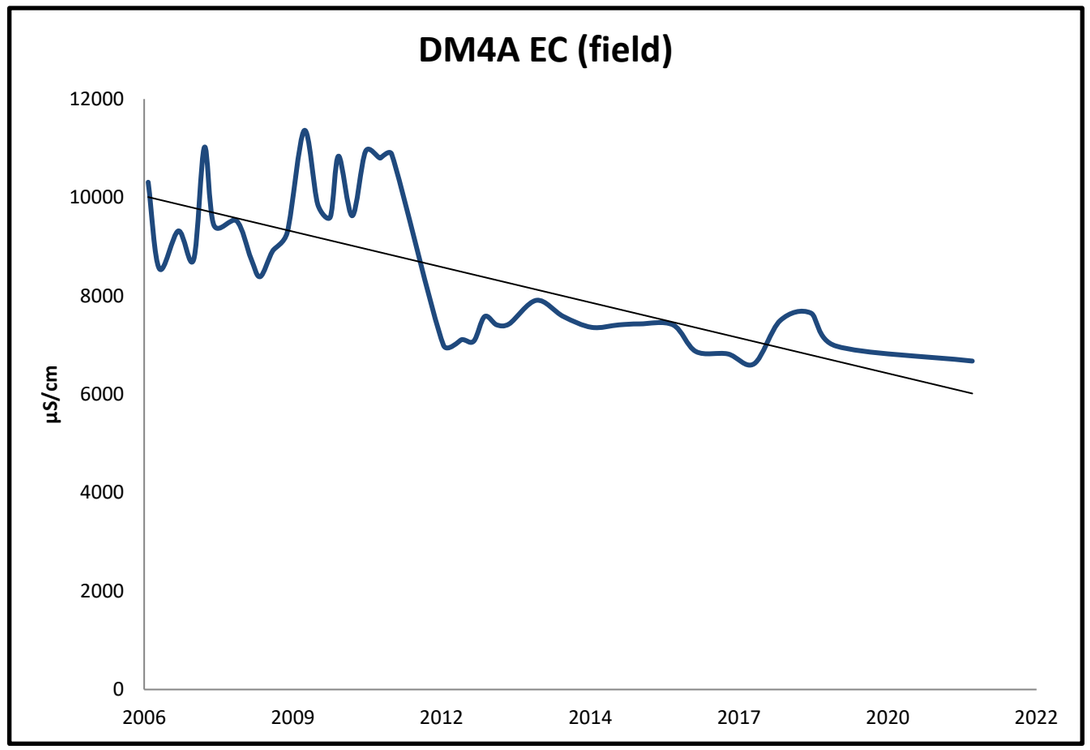
DM2C Na/Cl Ratio

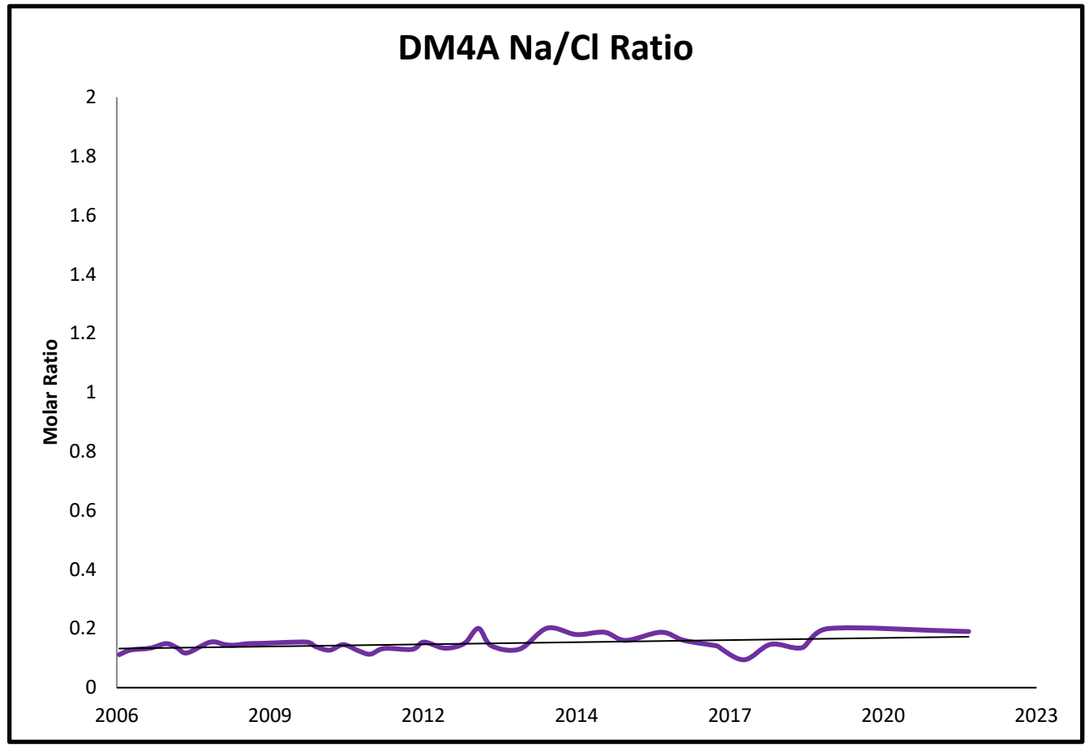


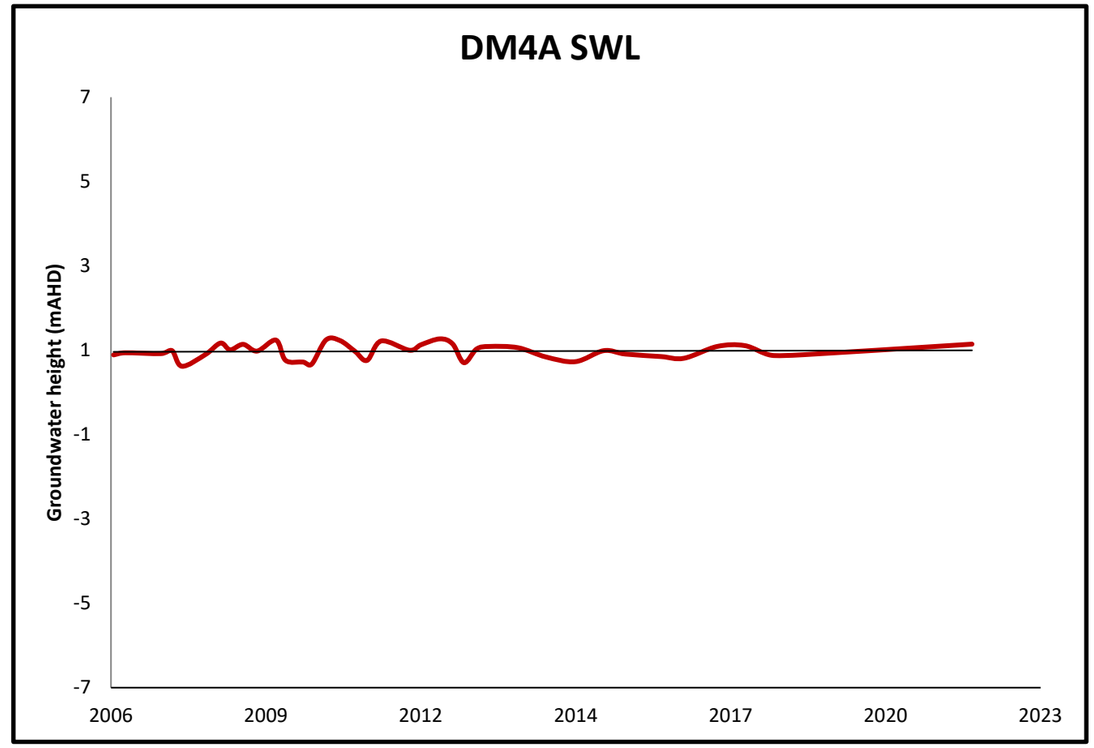
DM2C SWL

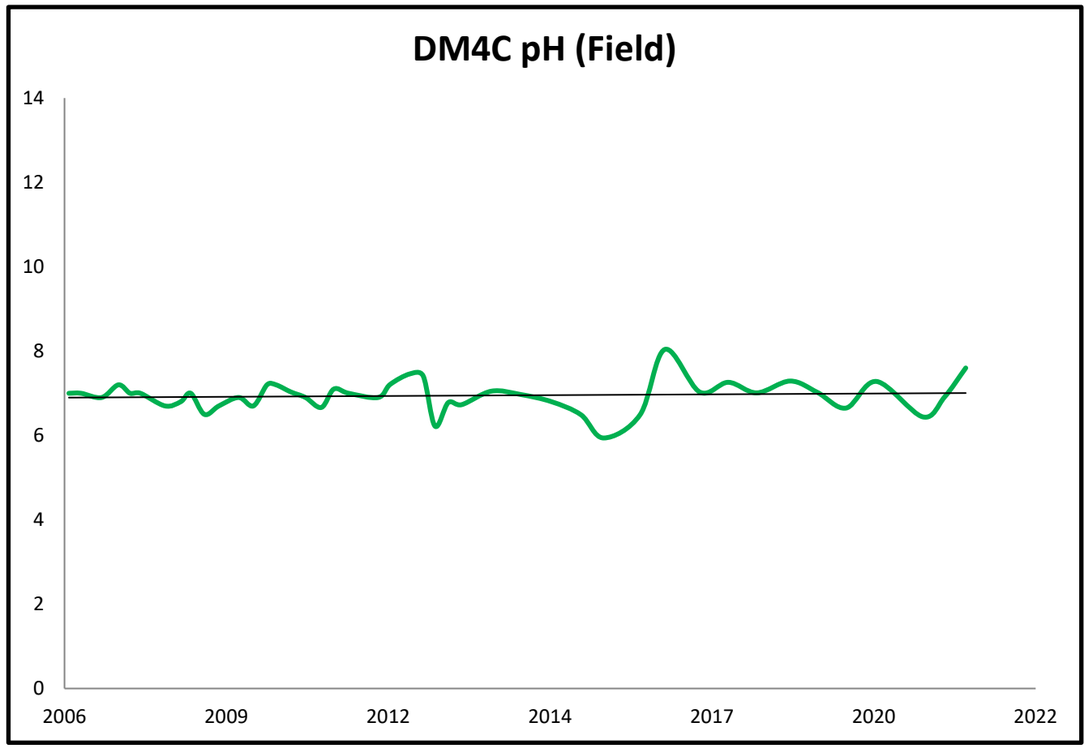


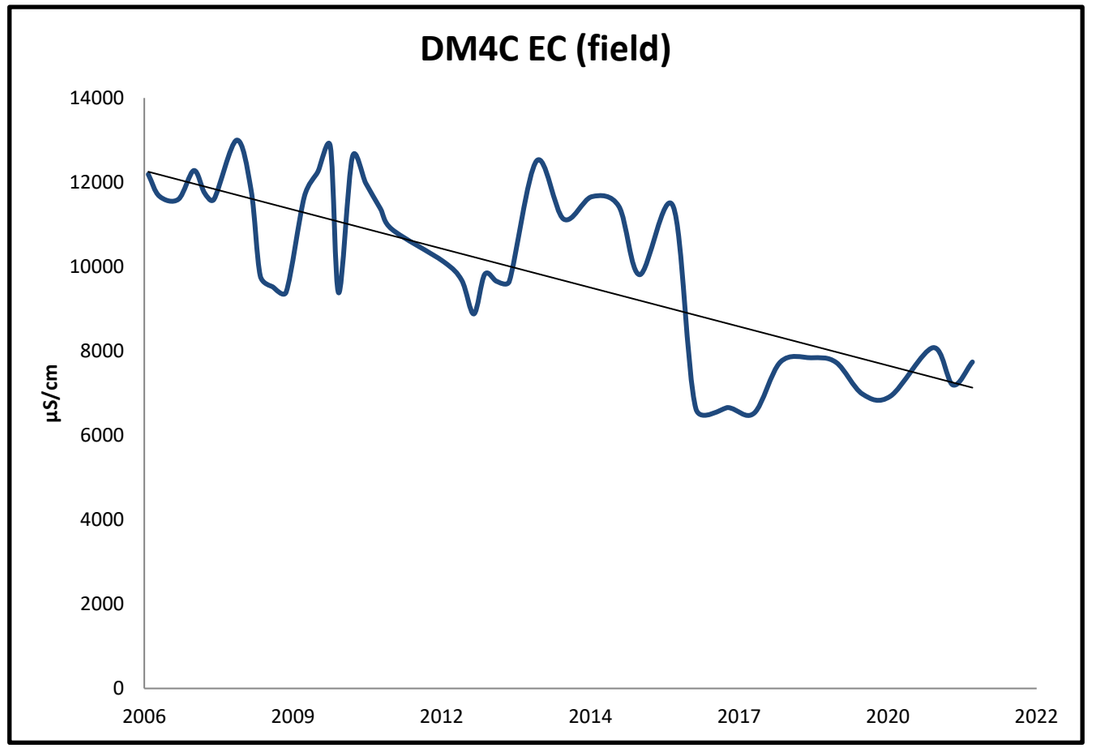

DM4A pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

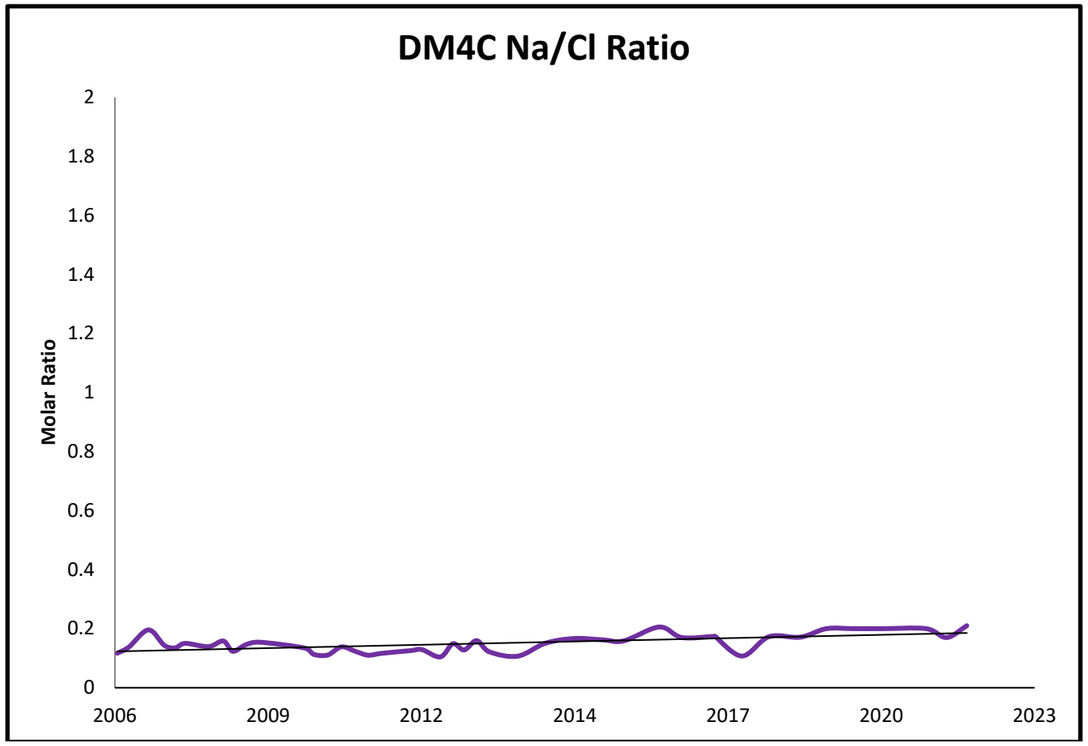

DM4A EC (field)
12000
10000
8000
6000
4000
2000
0
µS/cm
2006
2009
2012
2014
2017
2020
2022

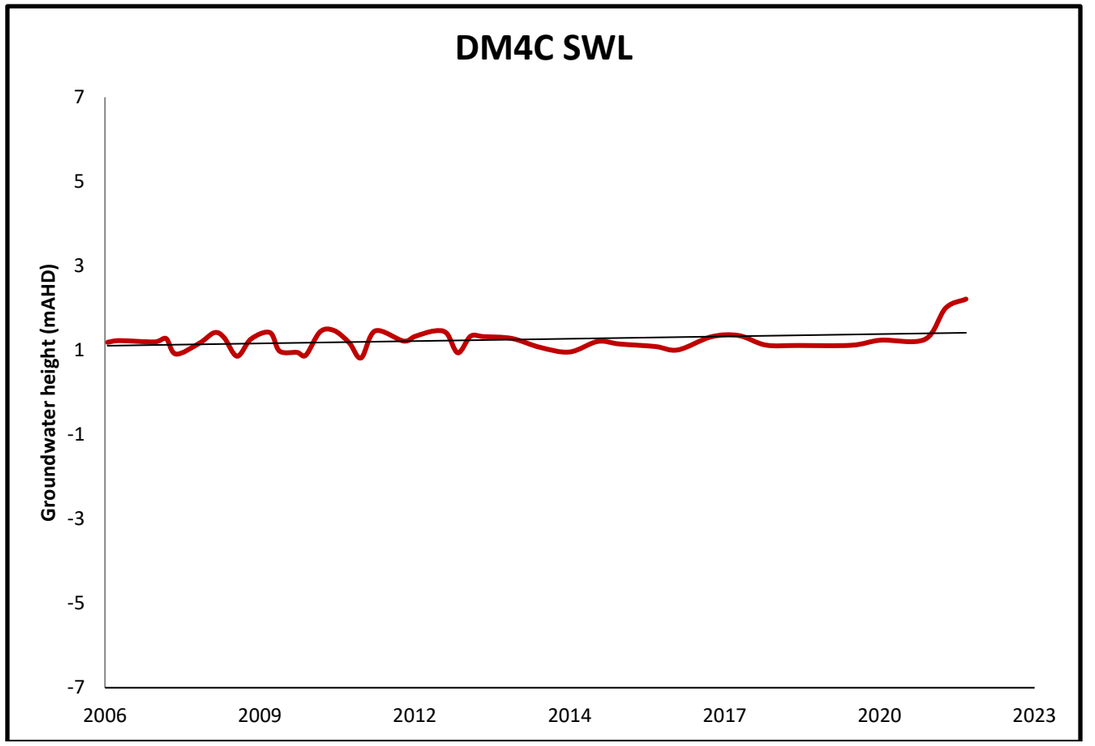

DM4A Na/Cl Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Molar Ratio
2006
2009
2012
2014
2017
2020
2023

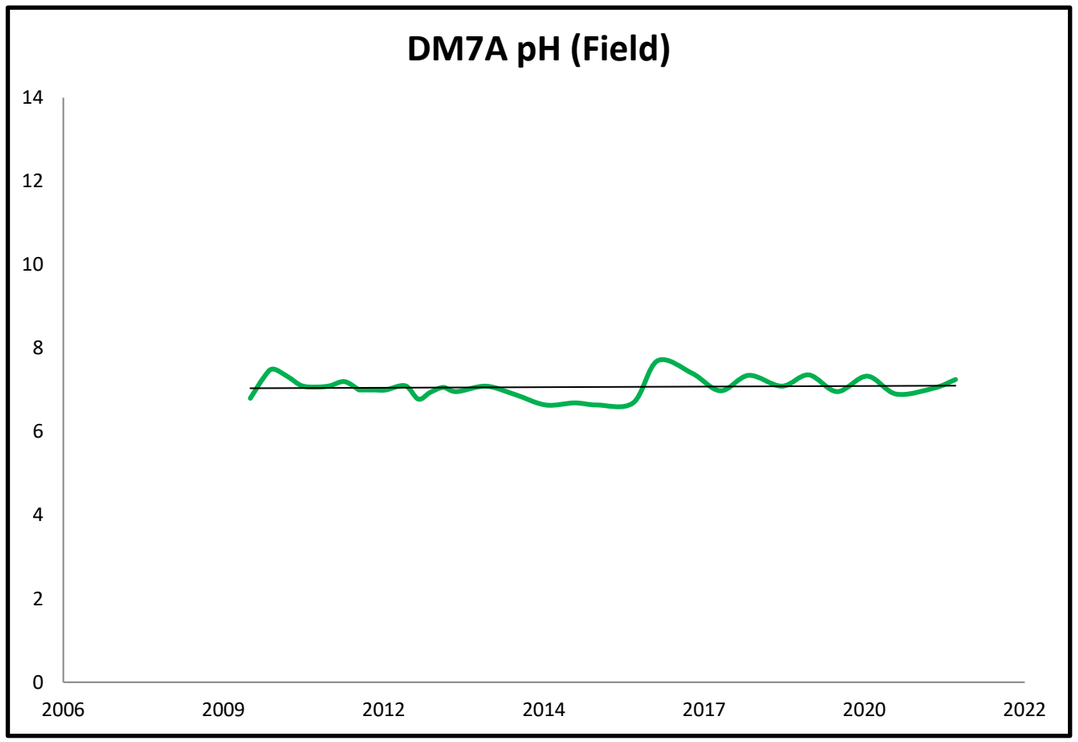

DM4A SWL
7
5
3
1
-1
-3
-5
-7
Groundwater height (mAHD)
2006
2009
2012
2014
2017
2020
2023

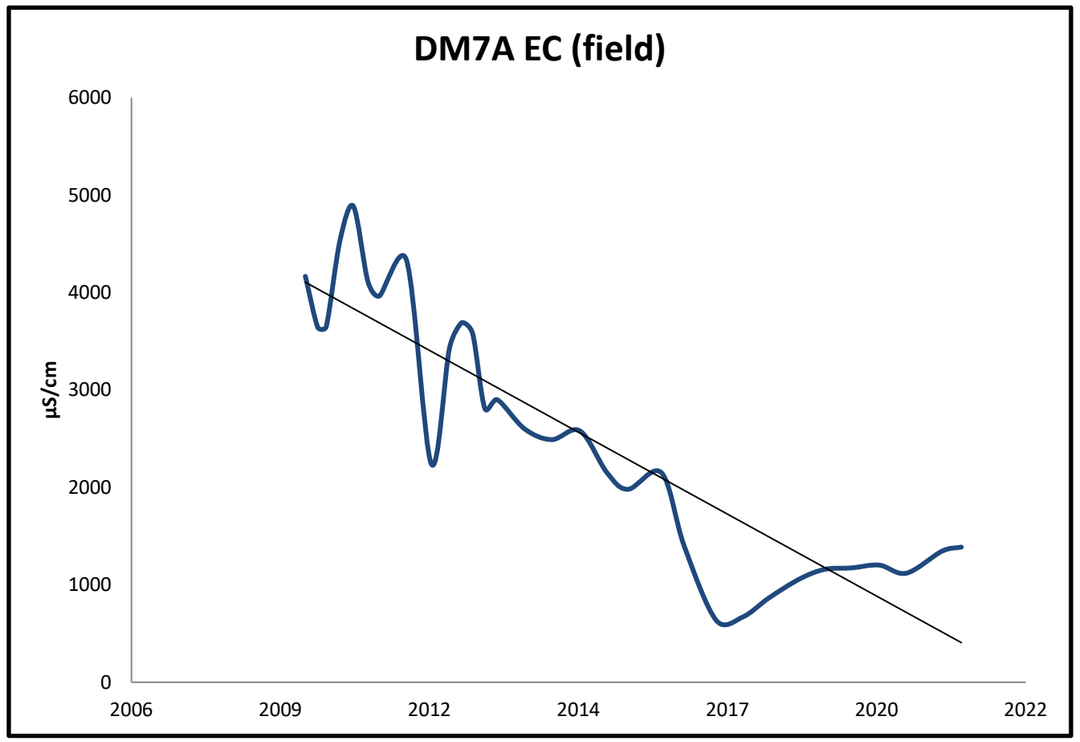

DM4C pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

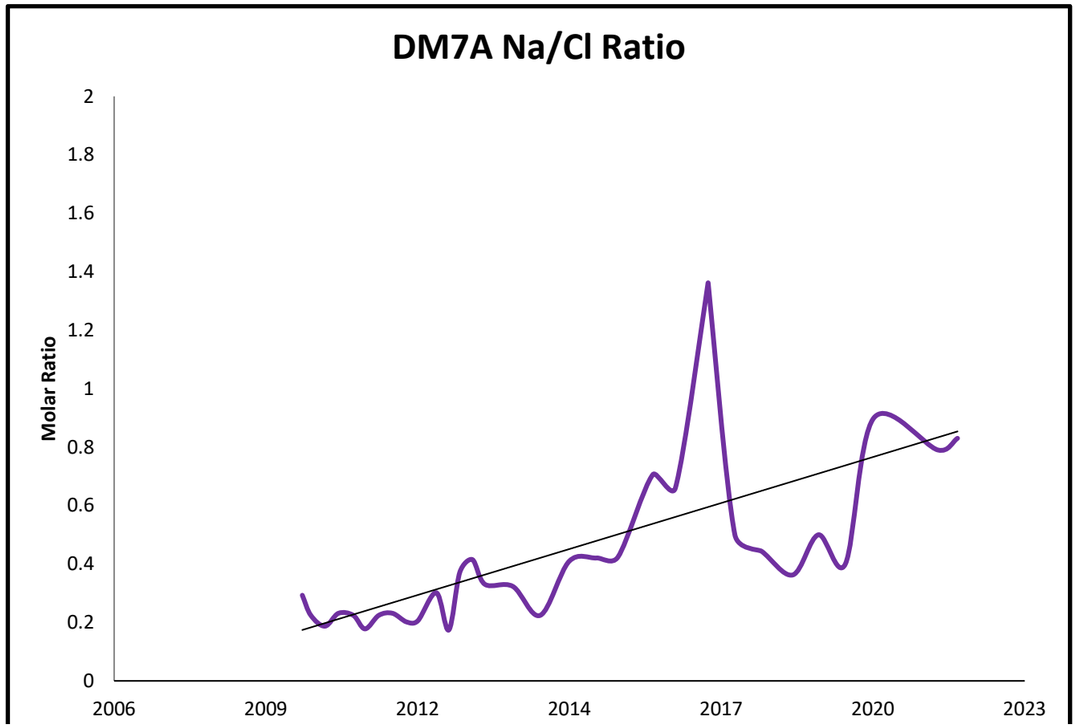

DM4C EC (field)
µS/cm
14000
12000
10000
8000
6000
4000
2000
0
2006
2009
2012
2014
2017
2020
2022

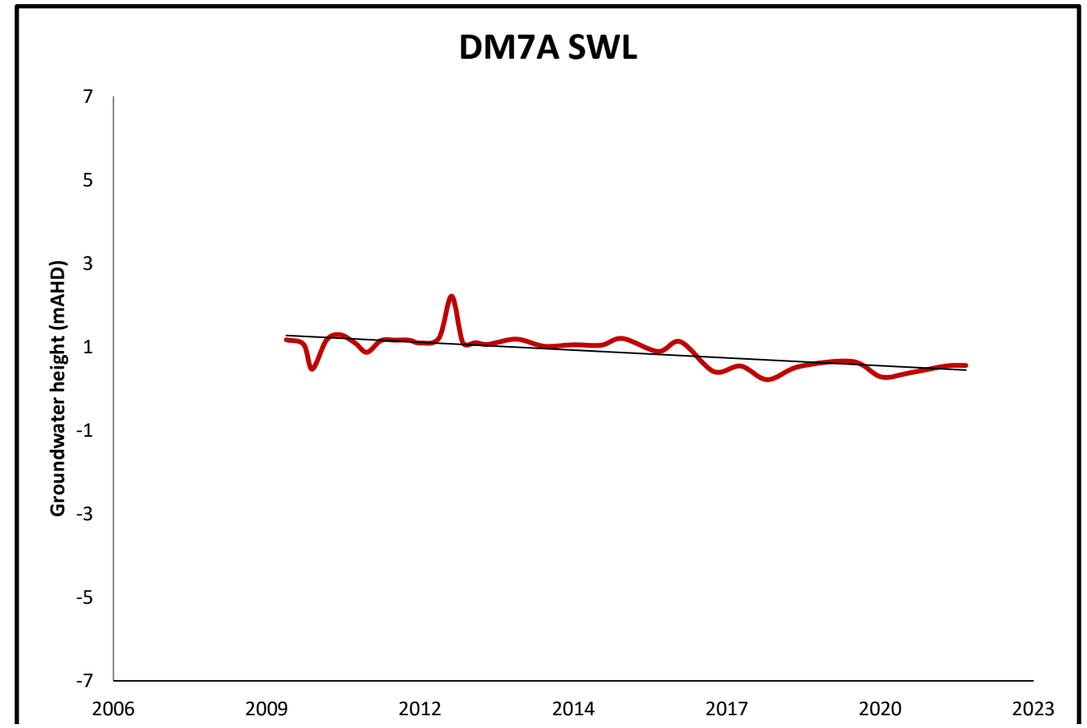

DM4C Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

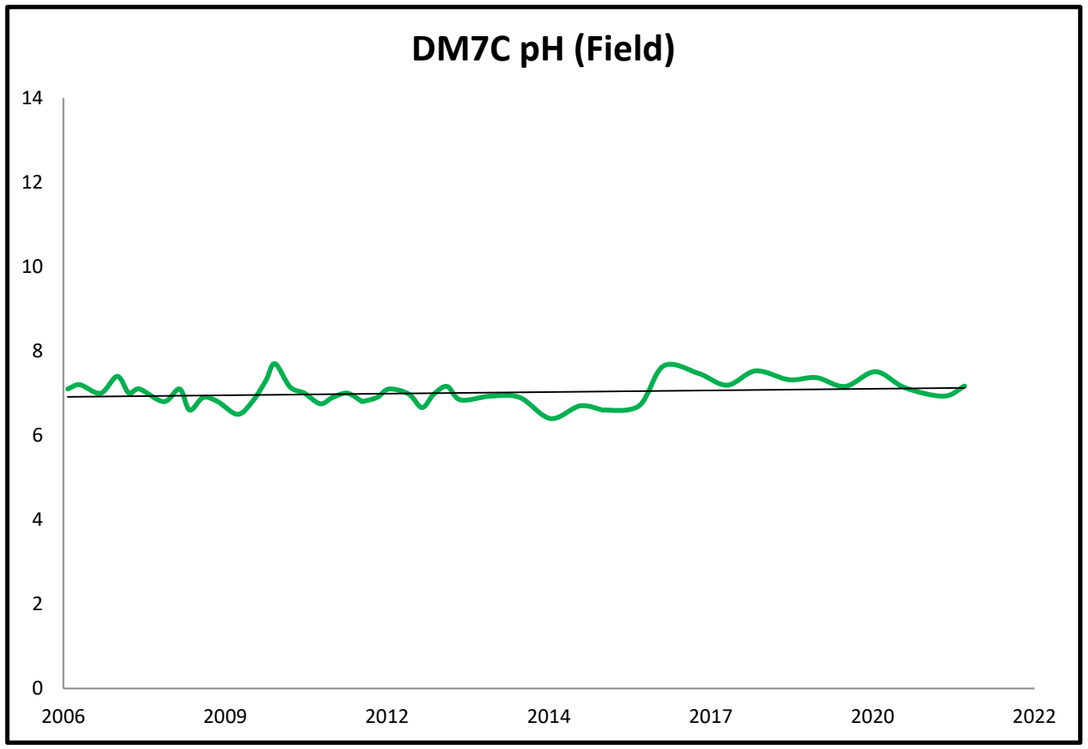

DM4C SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

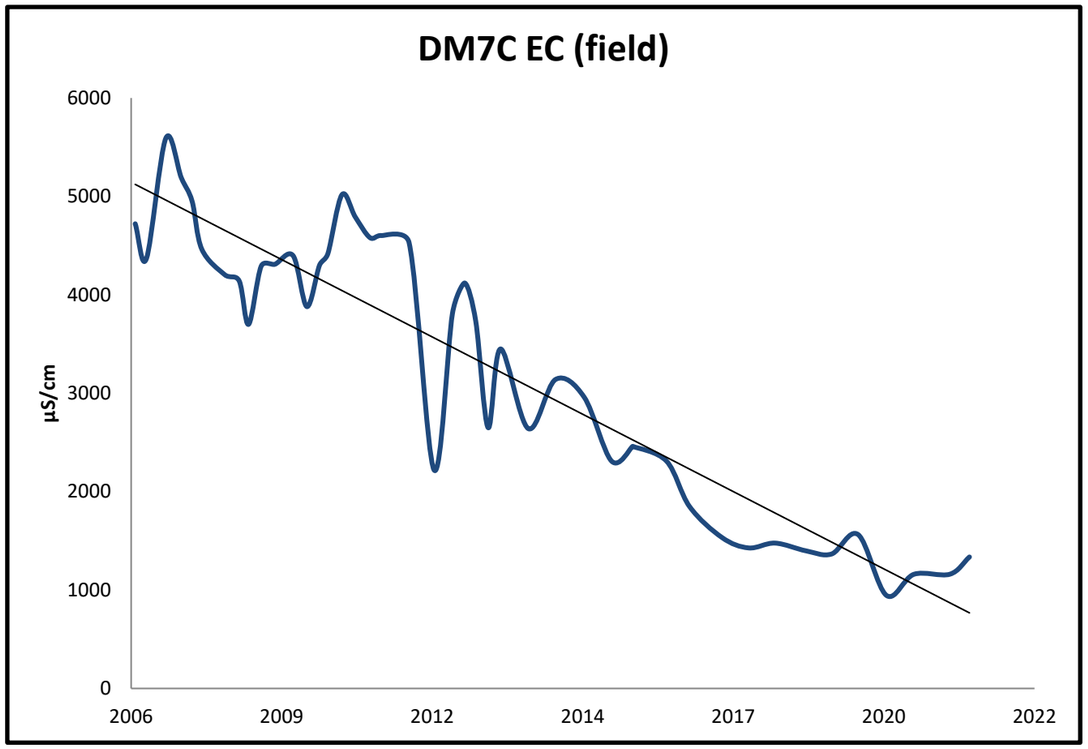

DM7A pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

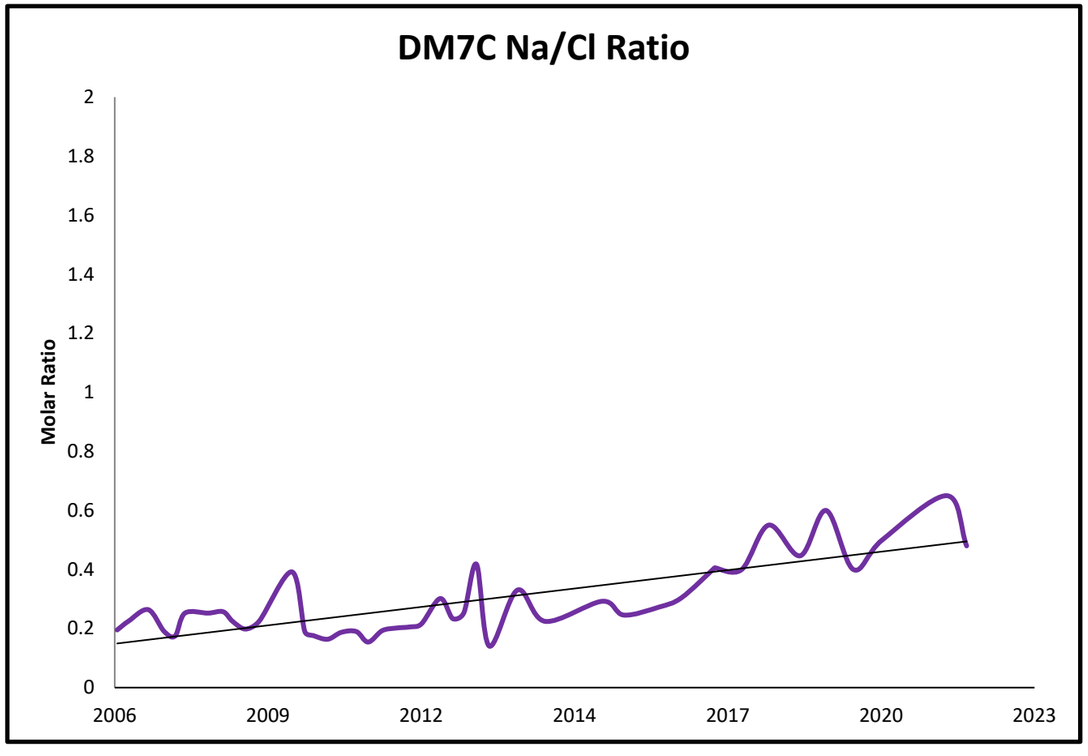

DM7A EC (field)
µS/cm
6000
5000
4000
3000
2000
1000
0
2006
2009
2012
2014
2017
2020
2022

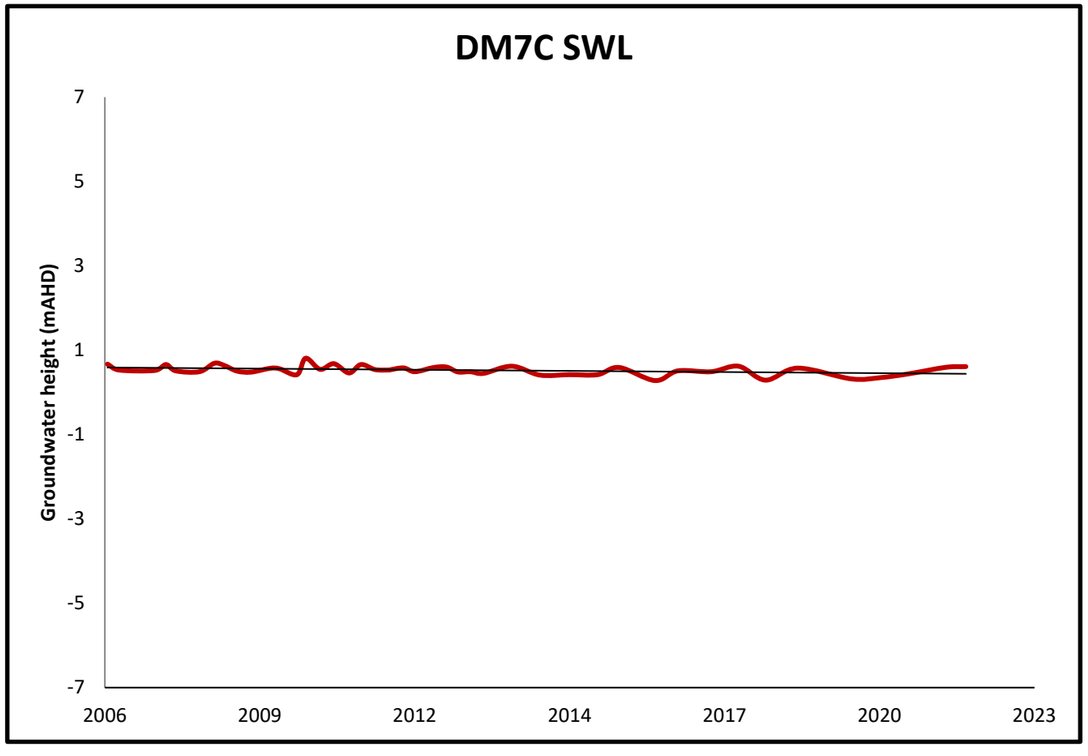

DM7A Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

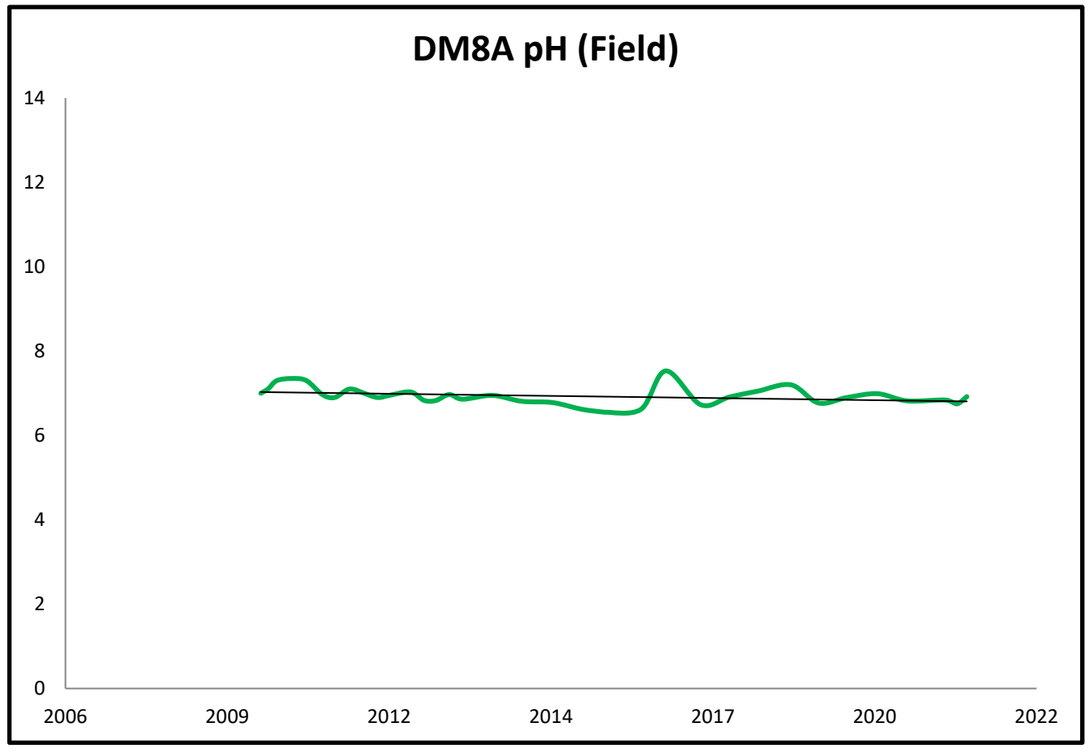

DM7A SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

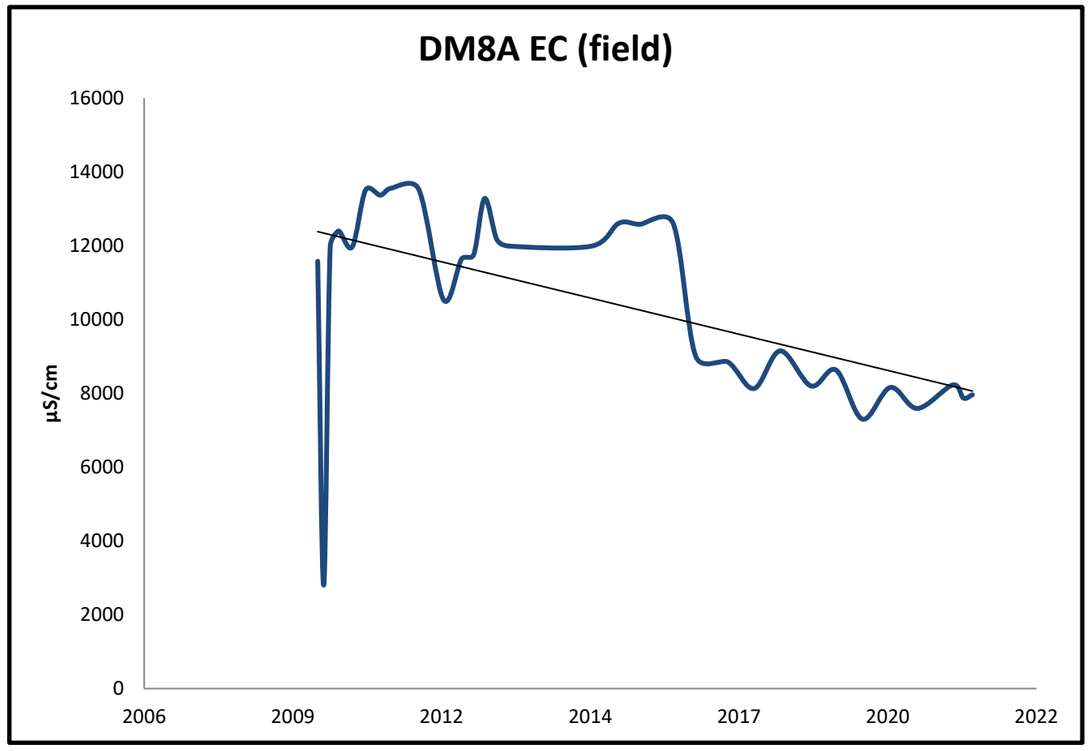

DM7C pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

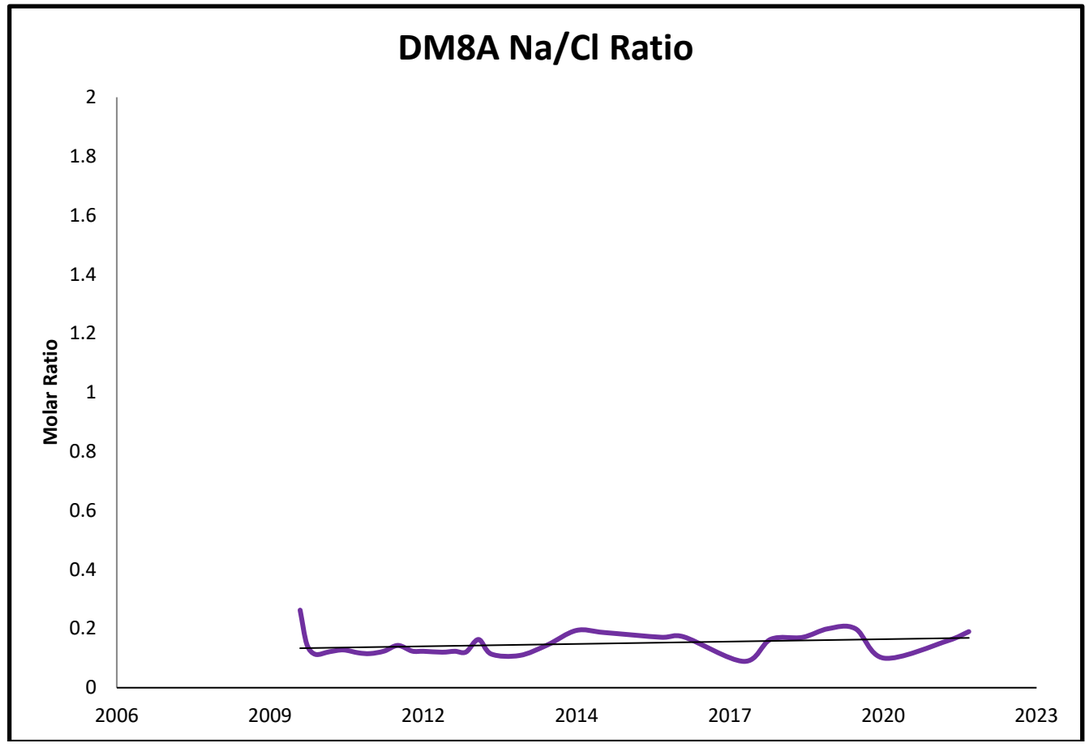

DM7C EC (field)
µS/cm
6000
5000
4000
3000
2000
1000
0
2006
2009
2012
2014
2017
2020
2022

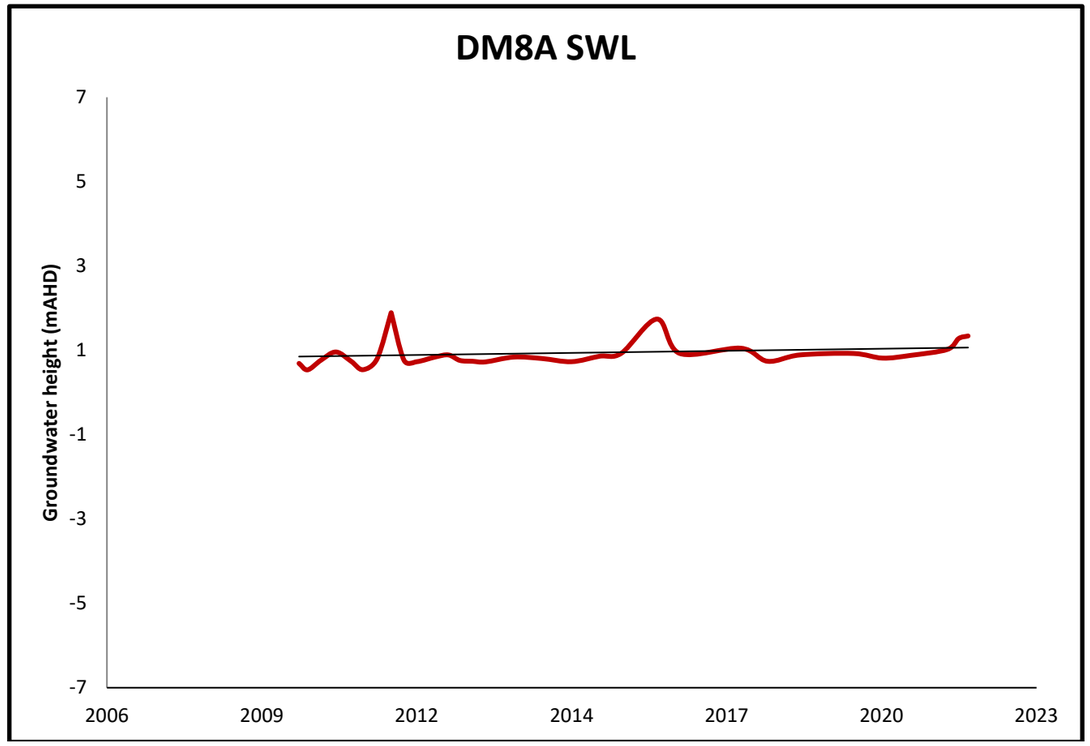

DM7C Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

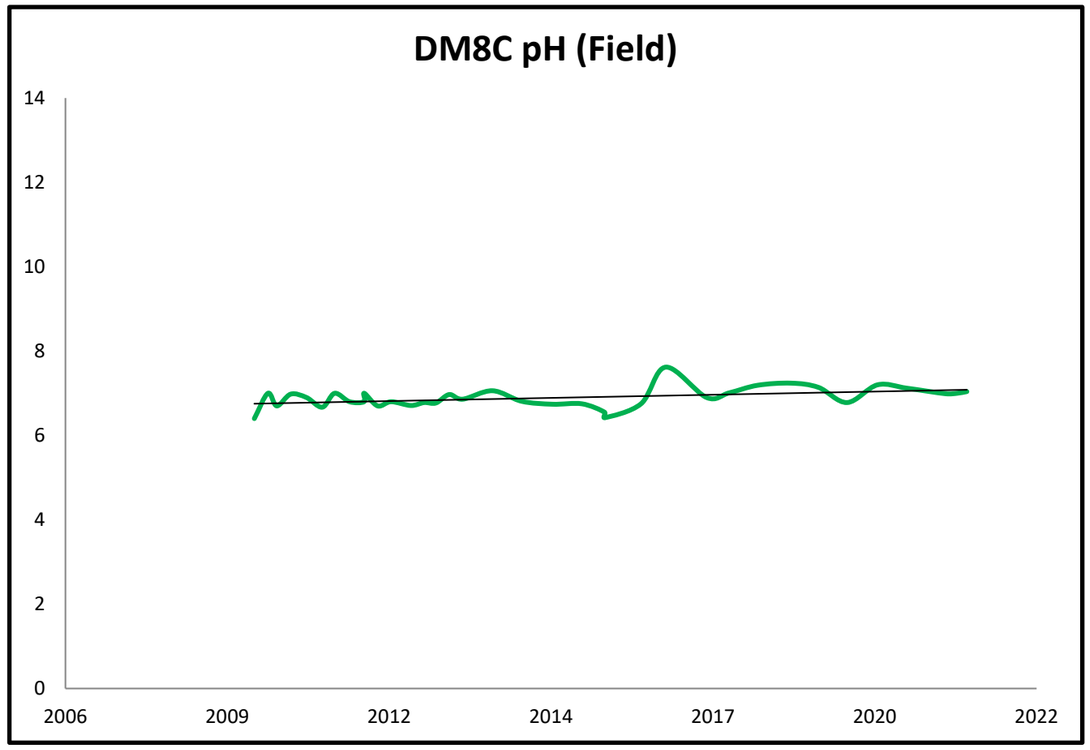

DM7C SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

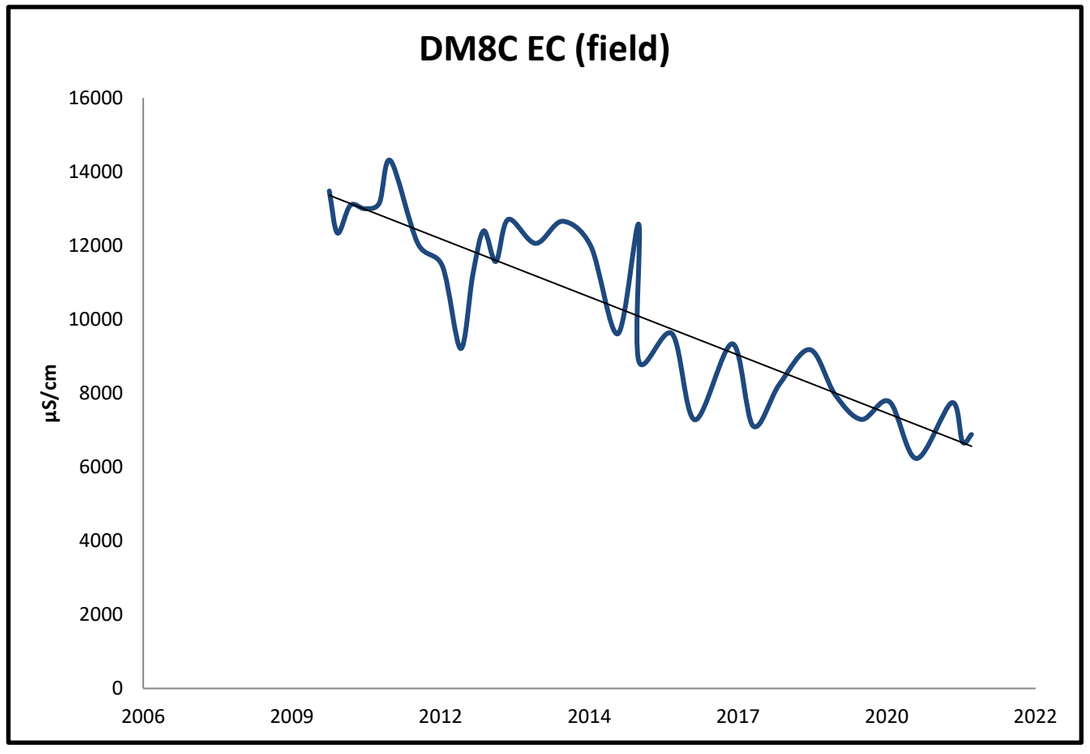

DM8A pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

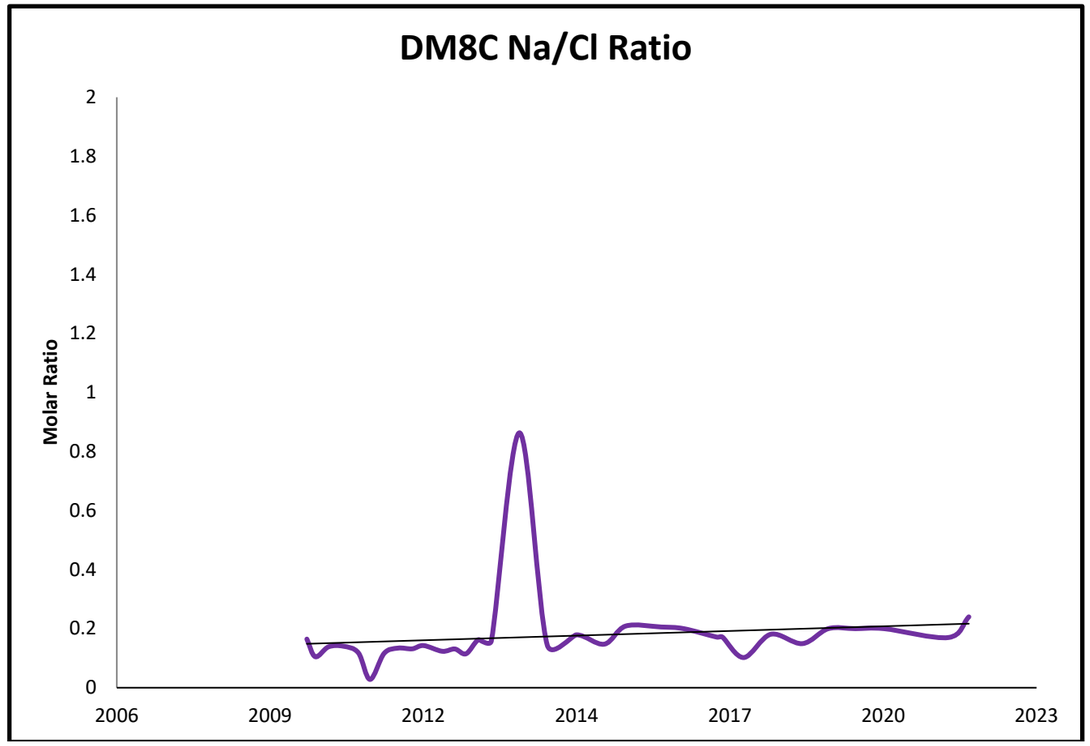

DM8A EC (field)
µS/cm
16000
14000
12000
10000
8000
6000
4000
2000
0
2006
2009
2012
2014
2017
2020
2022

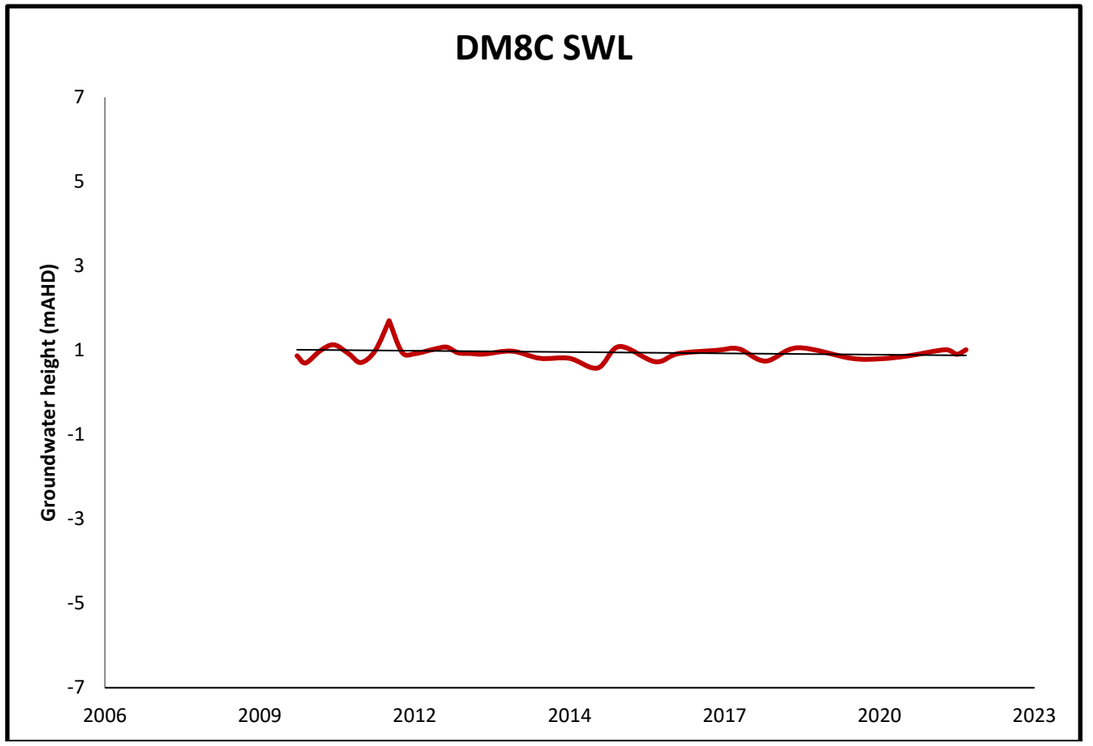

DM8A Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

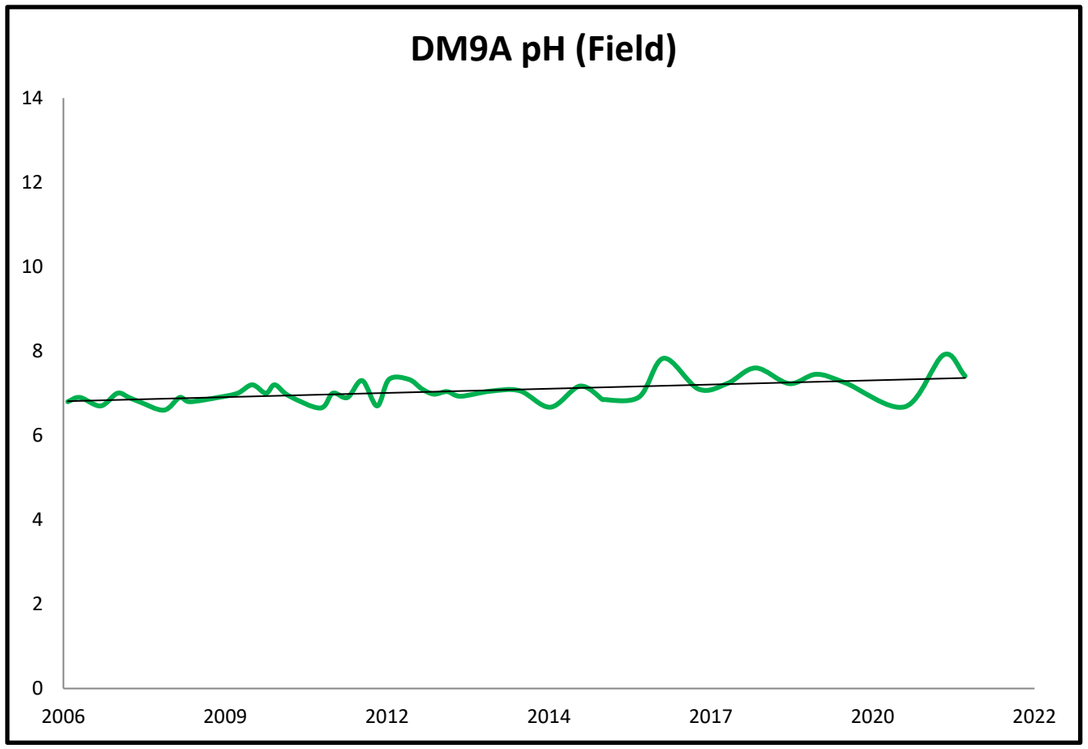

DM8A SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

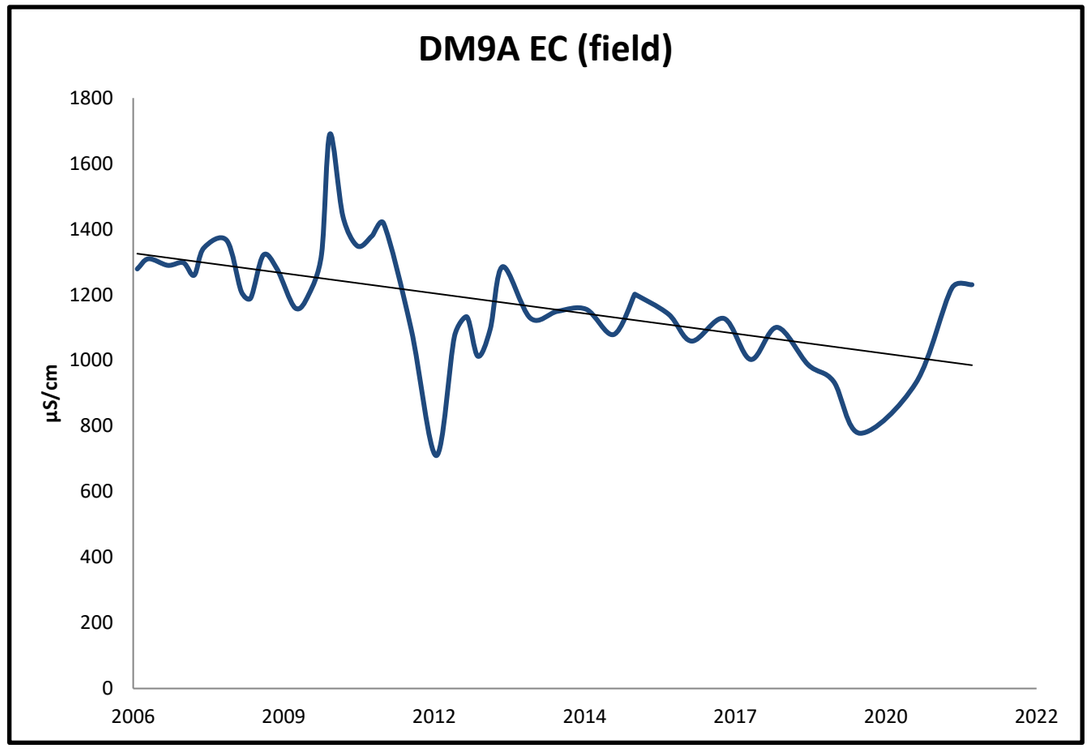

DM8C pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

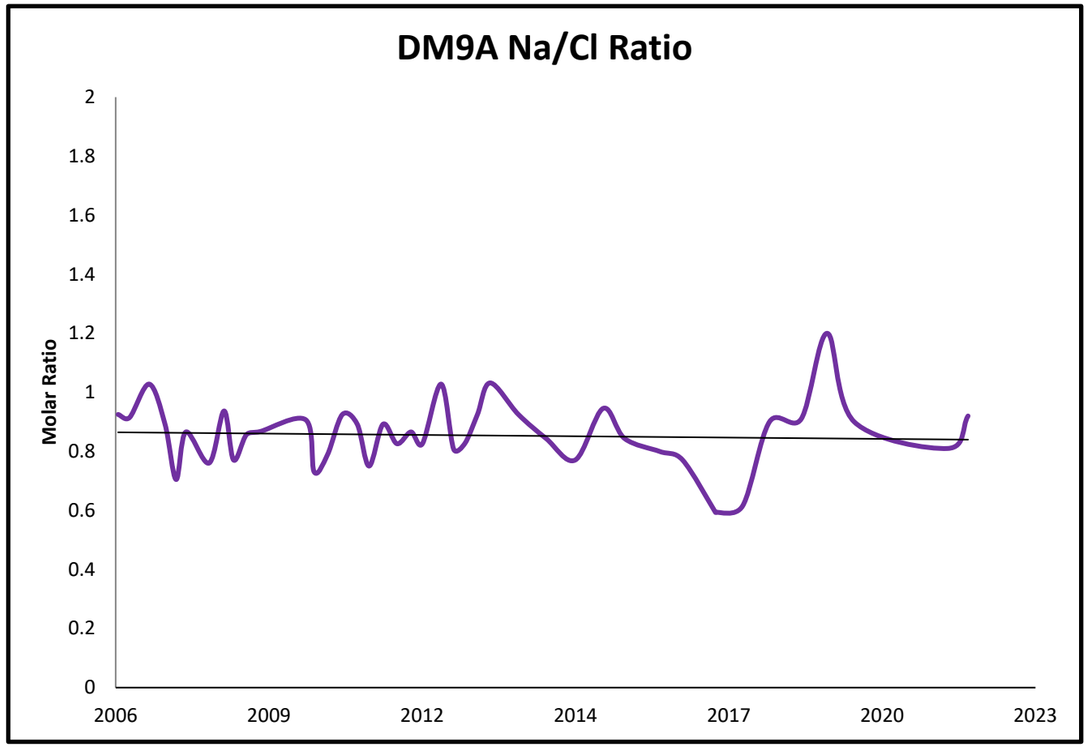

DM8C EC (field)
µS/cm
16000
14000
12000
10000
8000
6000
4000
2000
0
2006
2009
2012
2014
2017
2020
2022

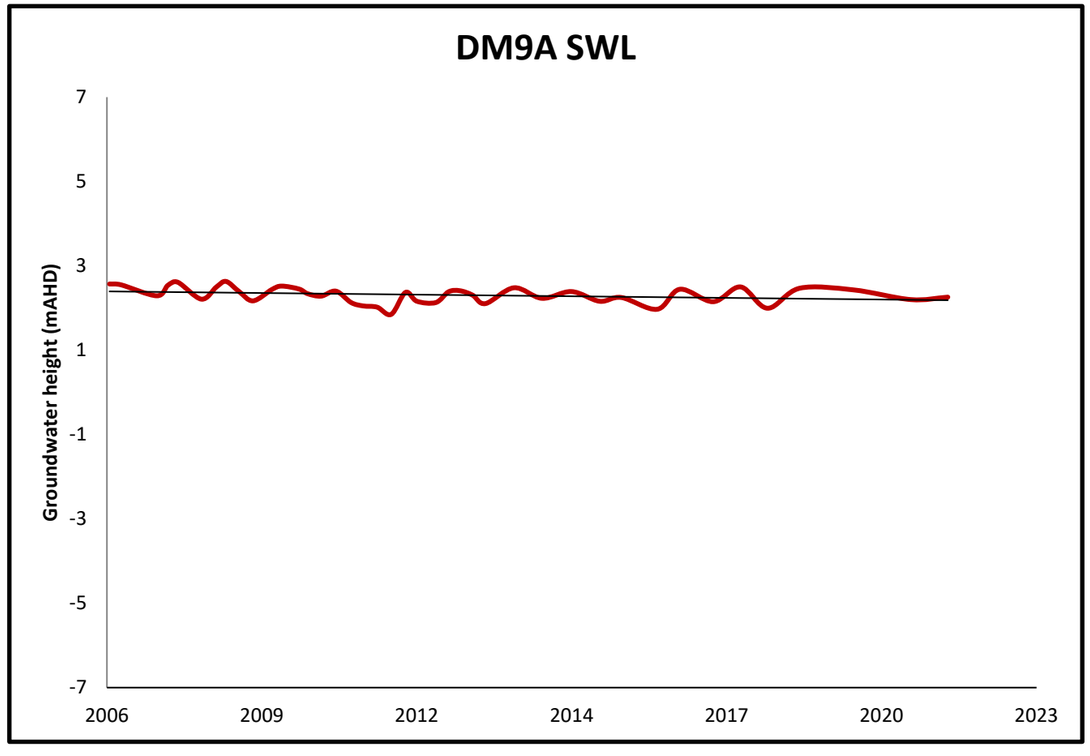

DM8C Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

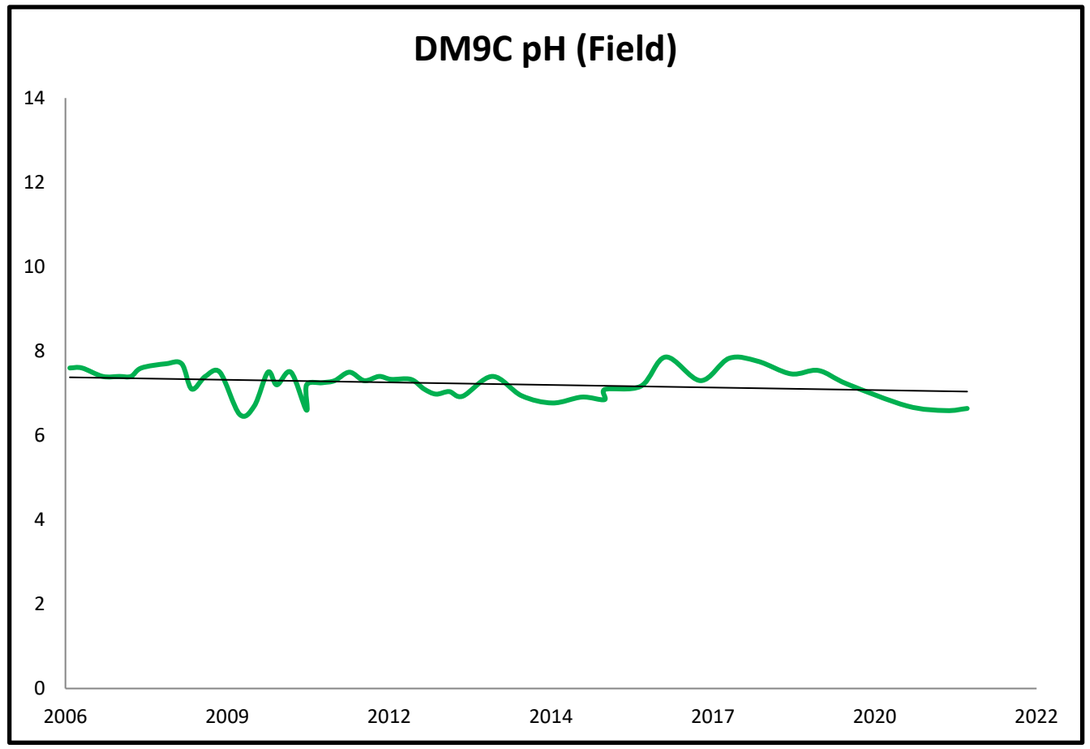

DM8C SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

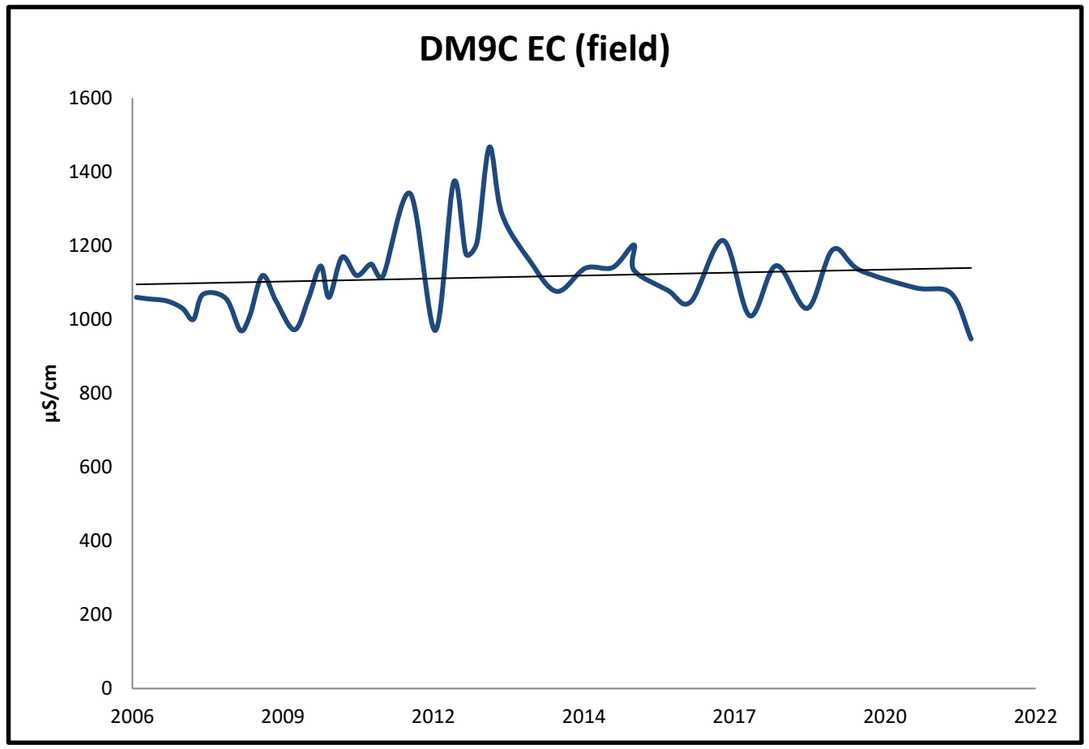

DM9A pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022

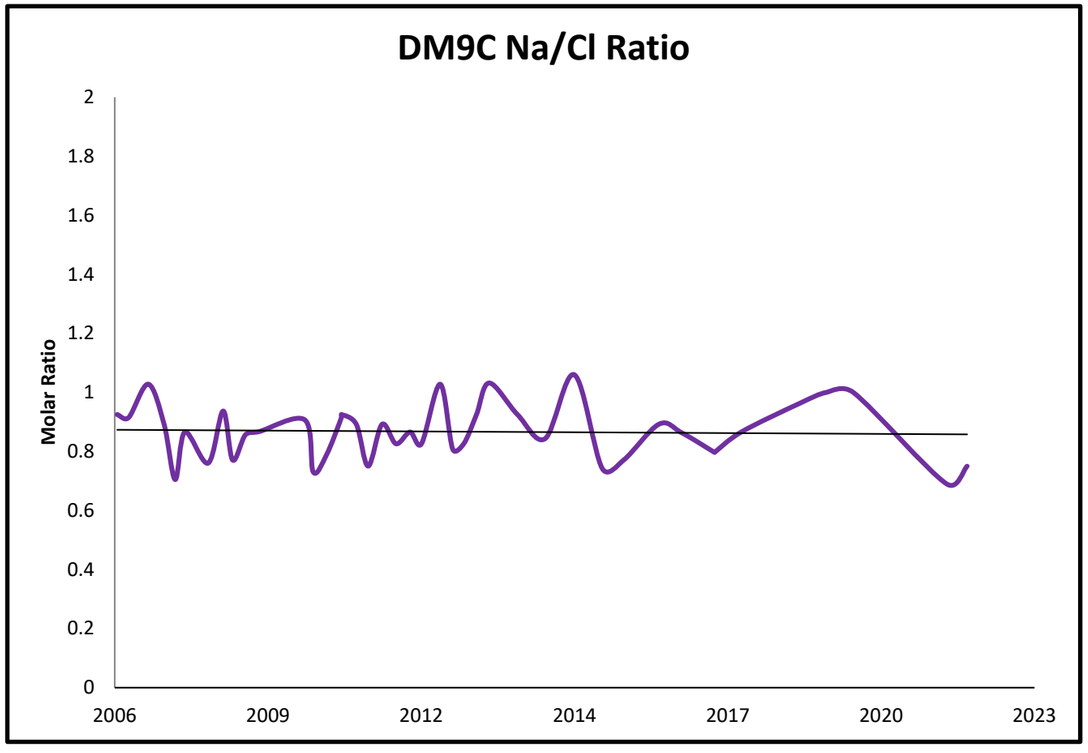

DM9A EC (field)
µS/cm
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2009
2012
2014
2017
2020
2022

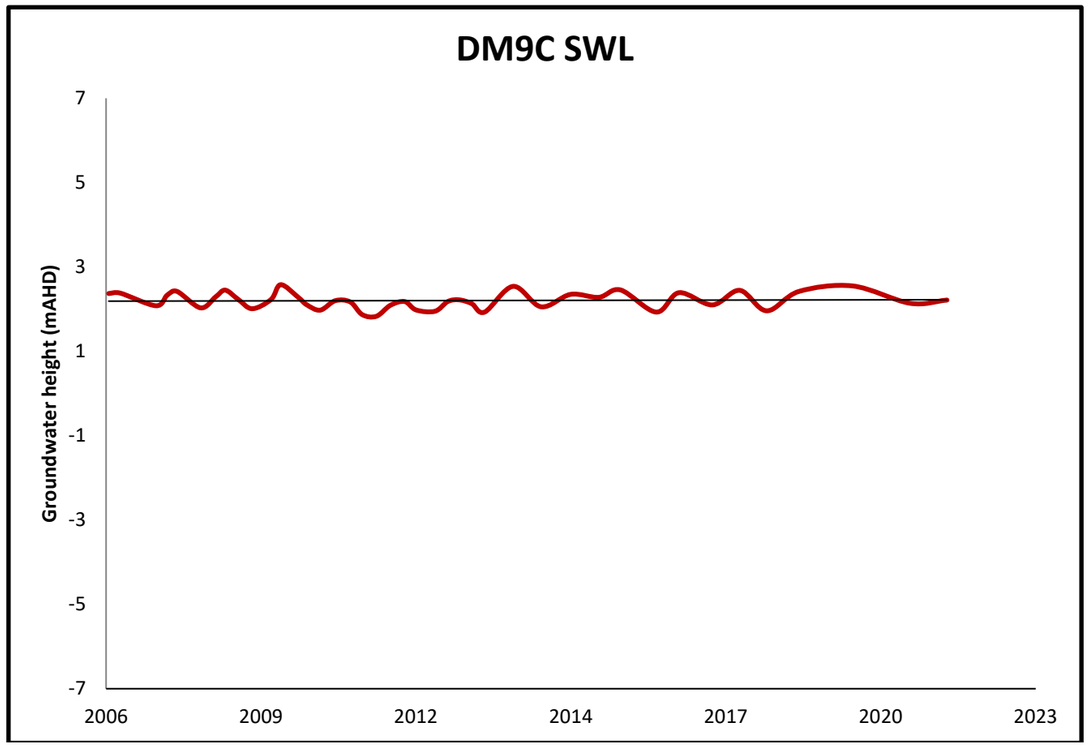

DM9A Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023

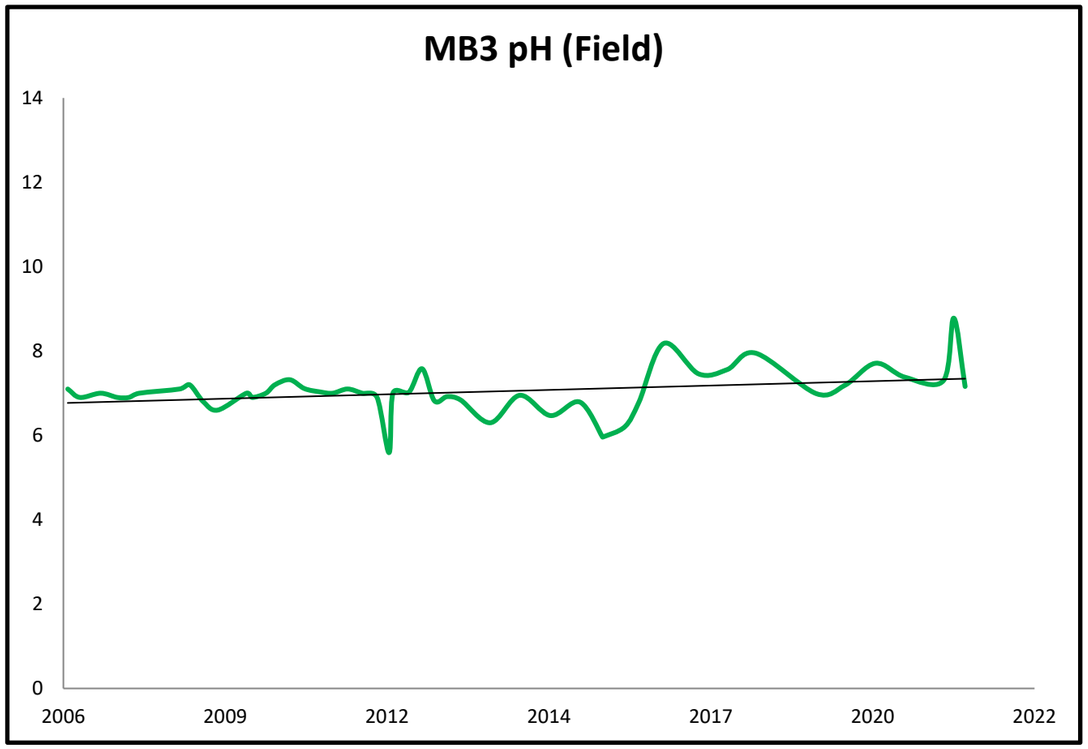

DM9A SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023


DM9C pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022


DM9C EC (field)
µS/cm
1600
1400
1200
1000
800
600
400
200
0
2006
2009
2012
2014
2017
2020
2022


DM9C Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023


DM9C SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023


MB3 pH (Field)
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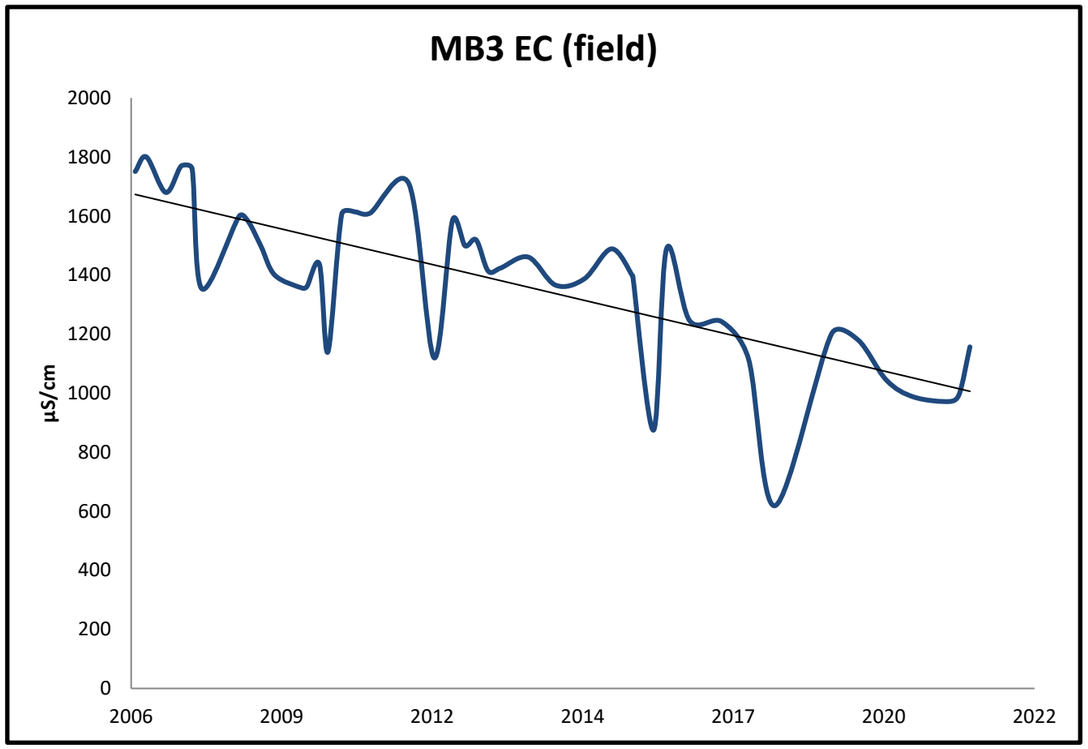
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022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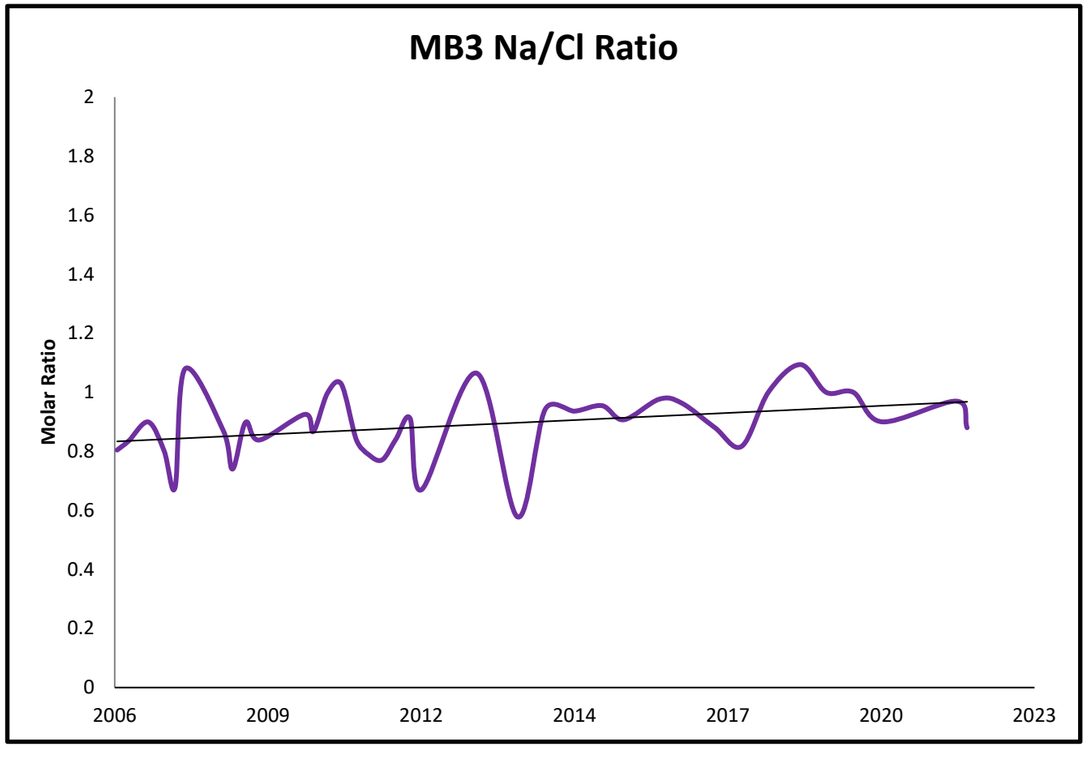
µS/cm
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2009
2012
2014
2017
2020
2022


MB3 Na/Cl Ratio
Molar Ratio
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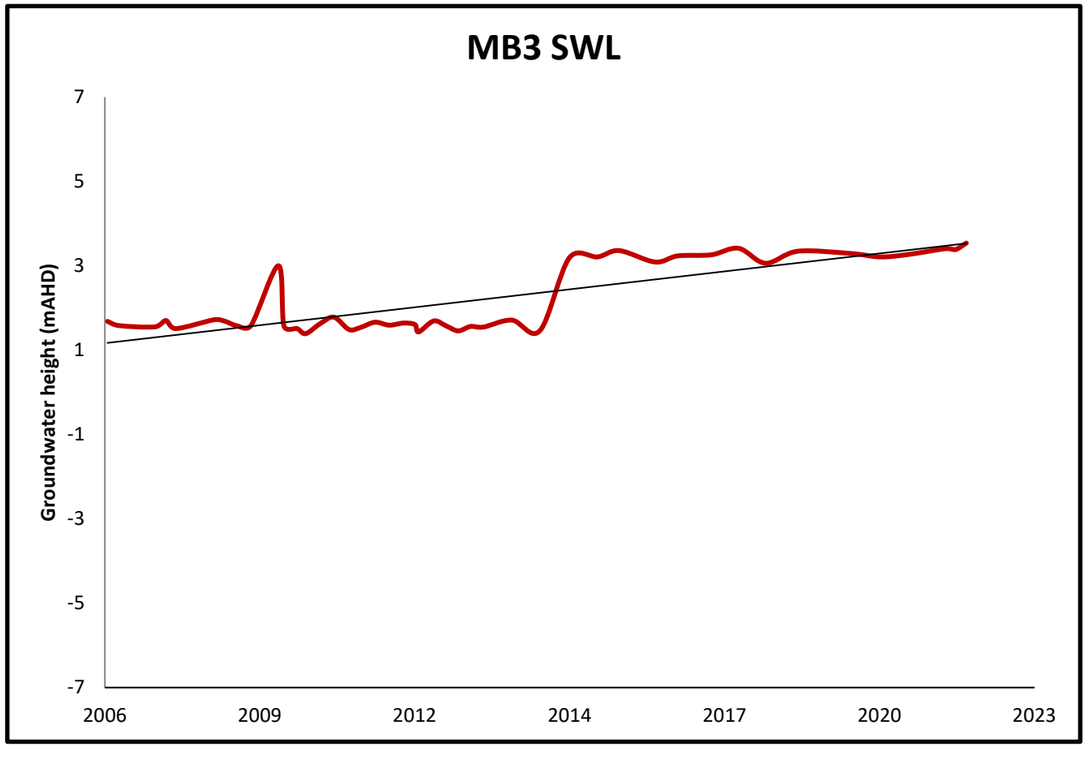
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023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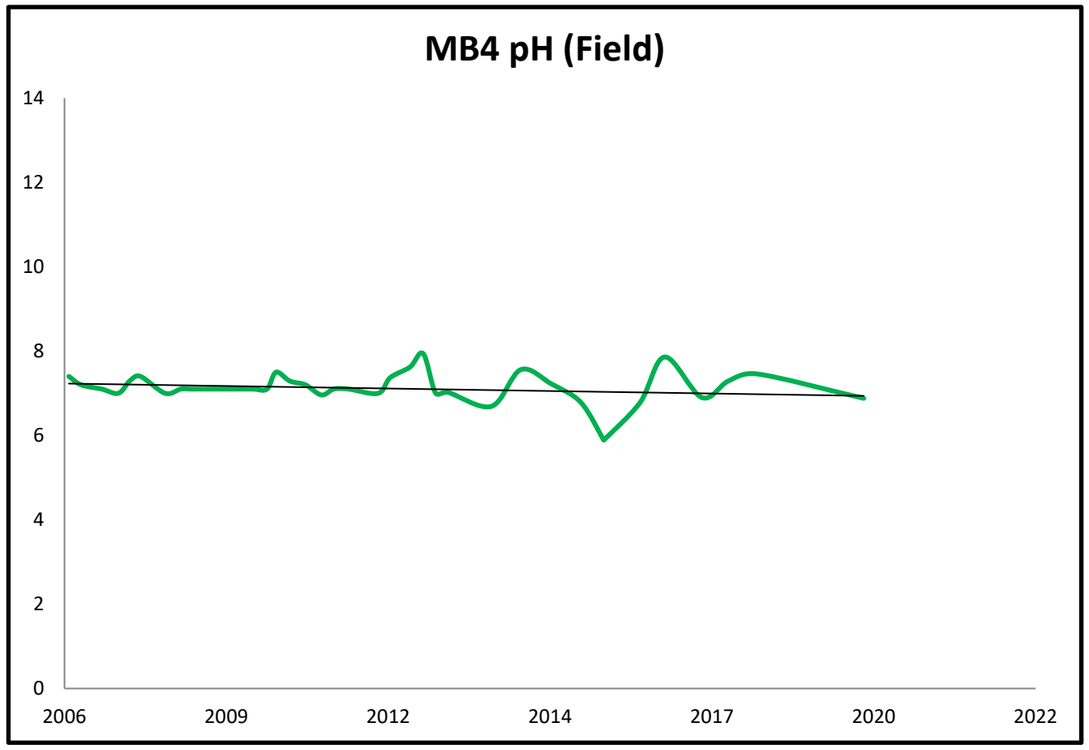
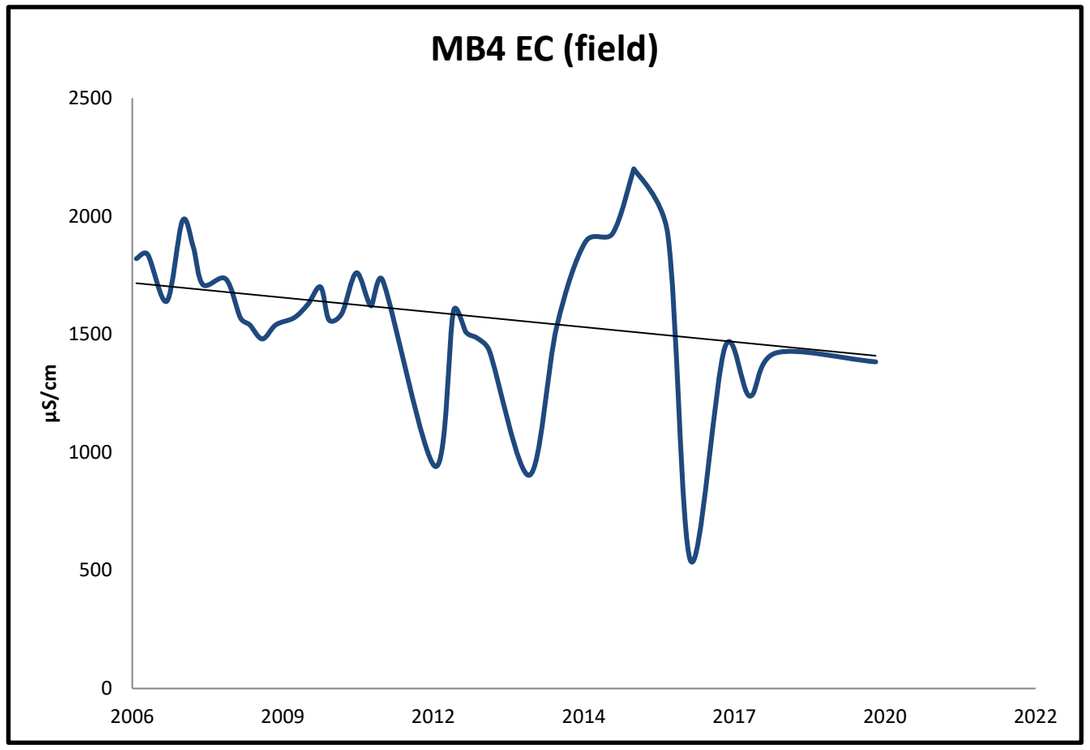
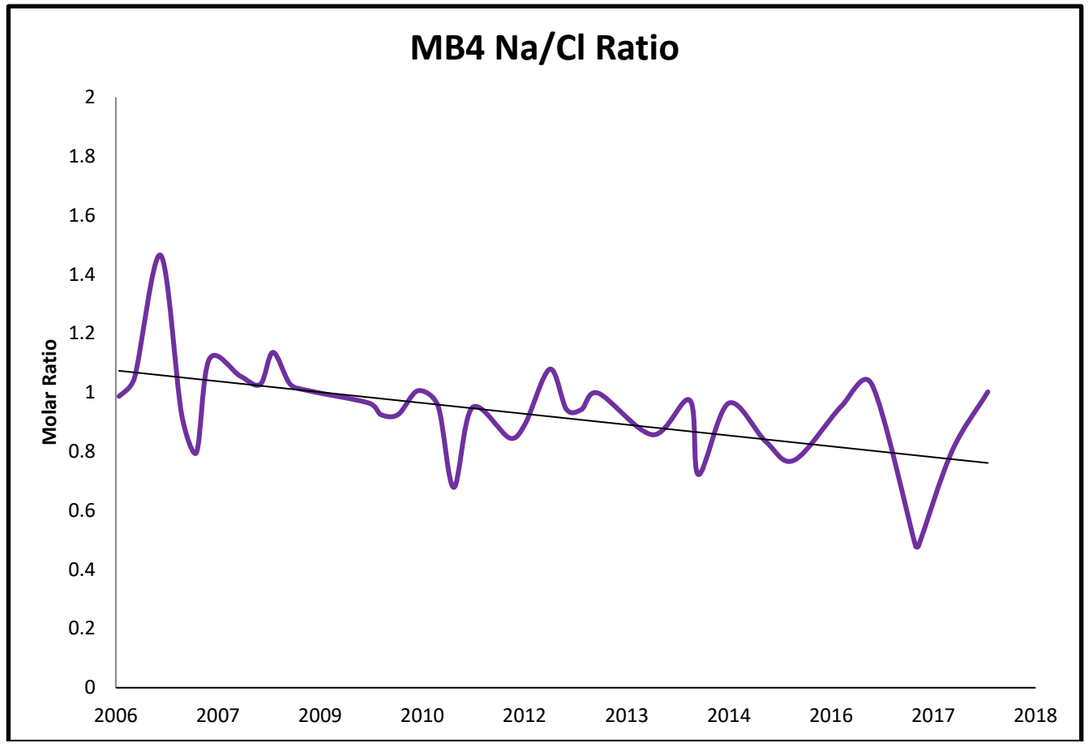
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023


MB4 pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022


MB4 EC (field)
µS/cm
2500
2000
1500
1000
500
0
2006
2009
2012
2014
2017
2020
2022


MB4 Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
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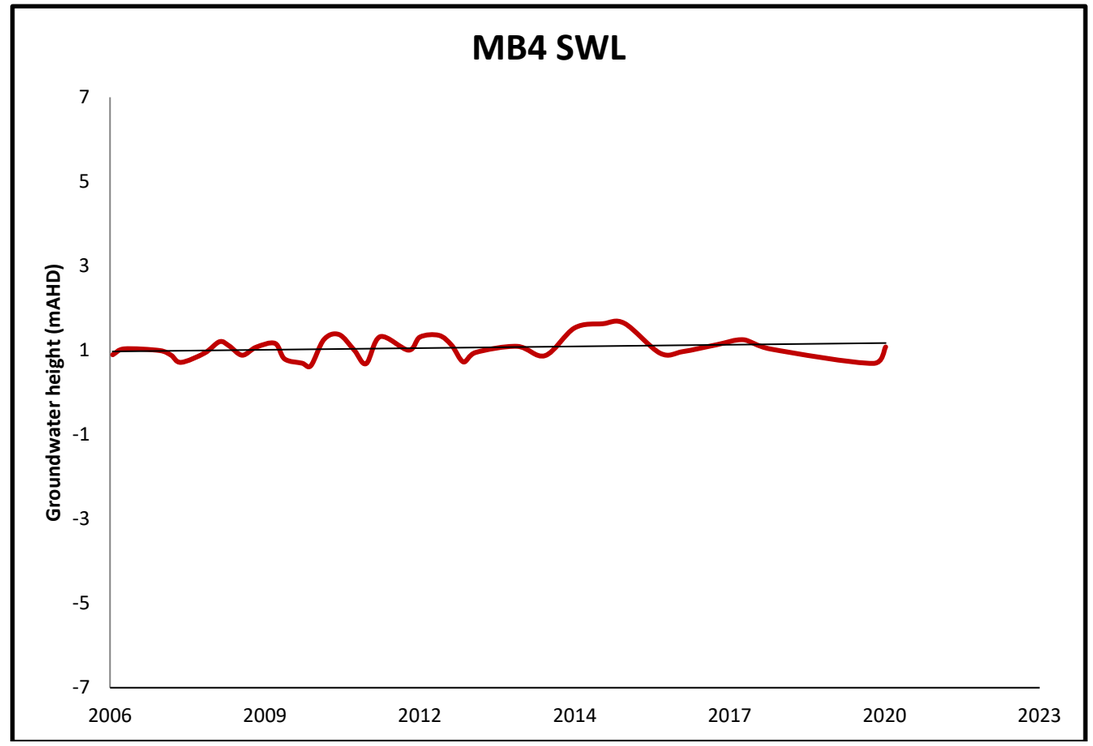
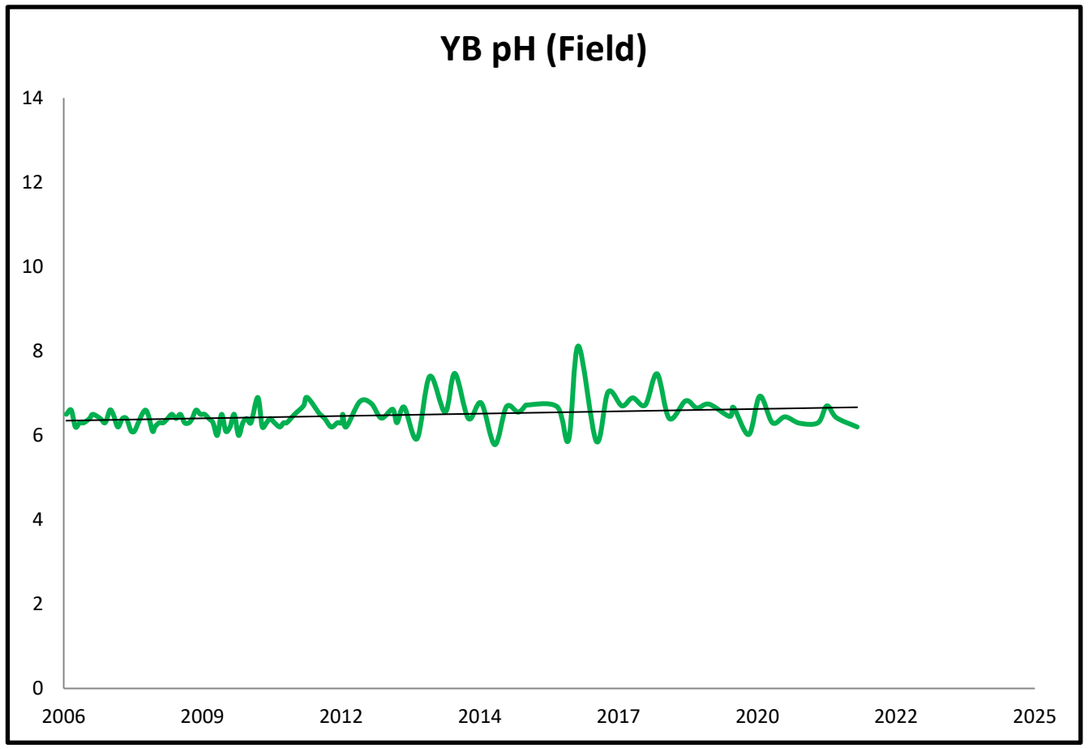
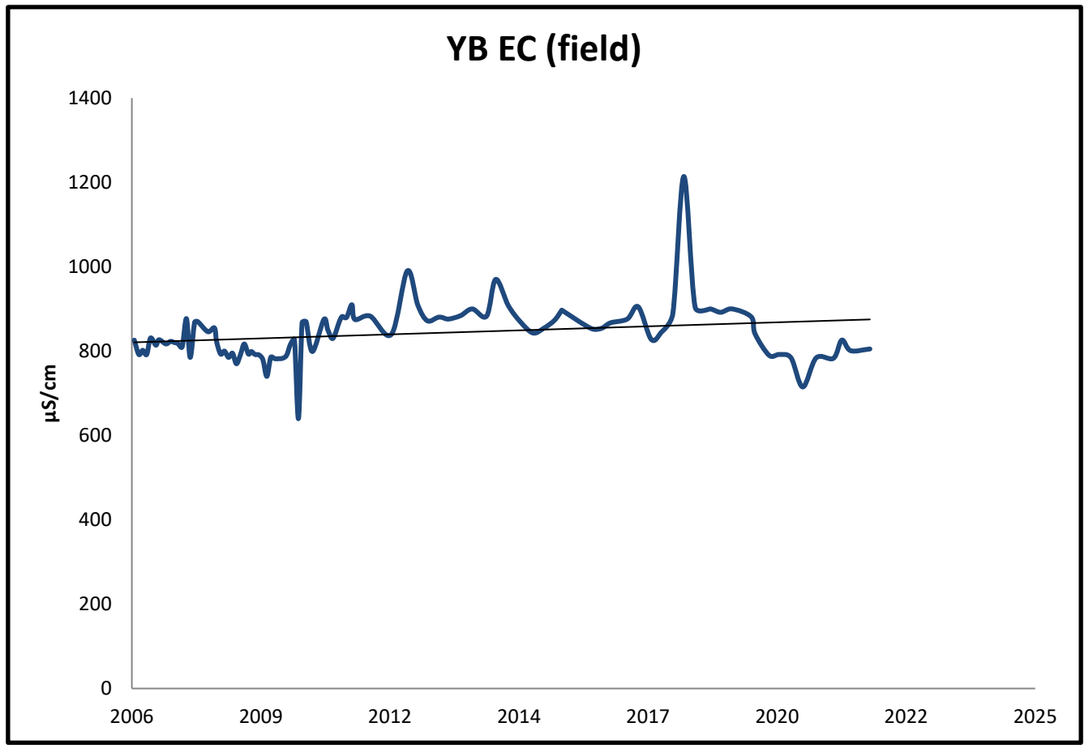
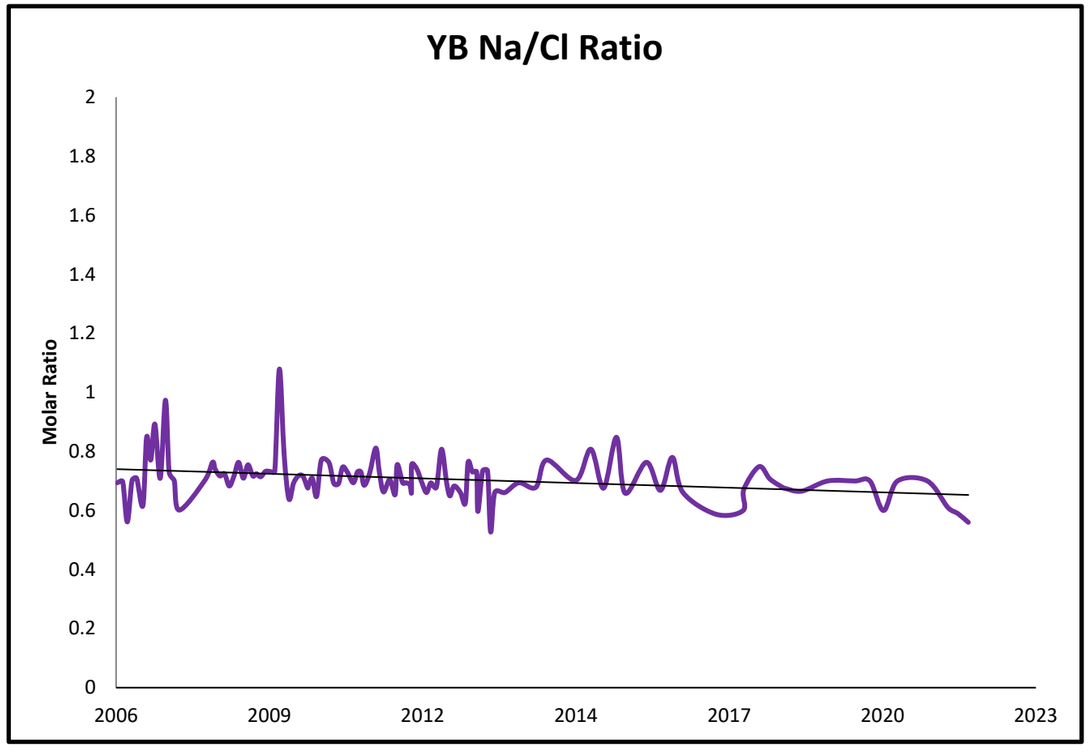
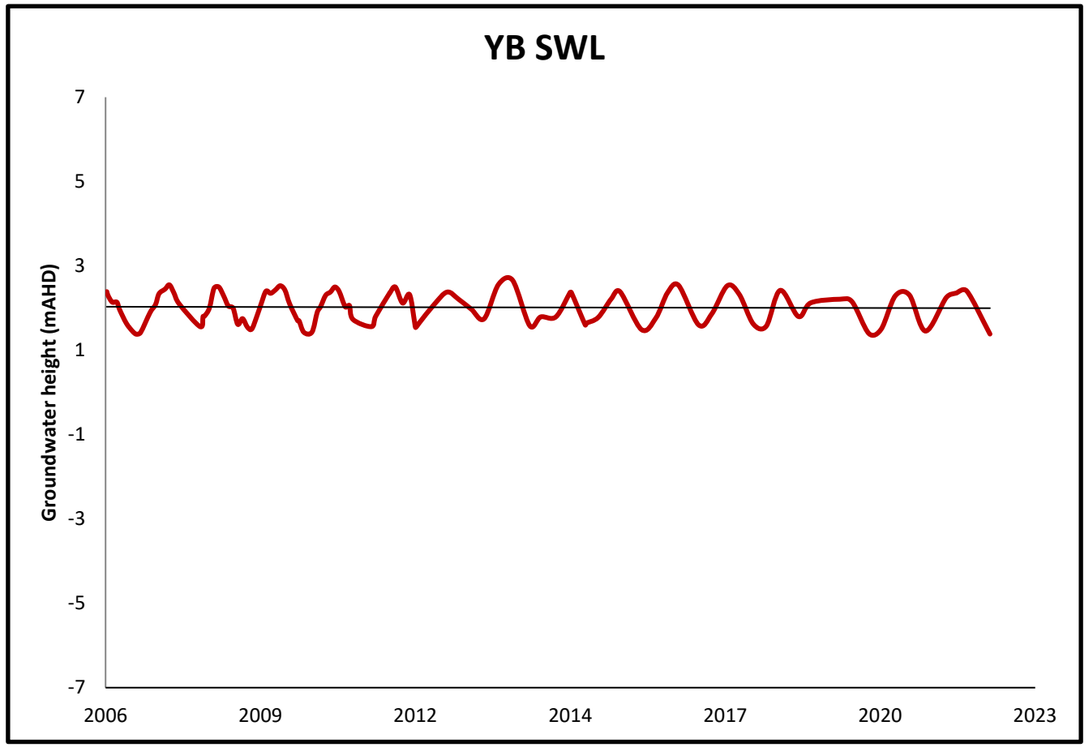
2009
2010
2012
2013
2014
2016
2017
2018


MB4 SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023


YB pH (Field)
14
12
10
8
6
4
2
0
2006
2009
2012
2014
2017
2020
2022
2025


YB EC (field)
µS/cm
1400
1200
1000
800
600
400
200
0
2006
2009
2012
2014
2017
2020
2022
2025


YB Na/Cl Ratio
Molar Ratio
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006
2009
2012
2014
2017
2020
2023


YB SWL
Groundwater height (mAHD)
7
5
3
1
-1
-3
-5
-7
2006
2009
2012
2014
2017
2020
2023

Appendix F
Annual Radiological Report

Radiation Professionals Australia

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operations@radproaustralia.com

ABN: 50 631 060 449

2021
Annual Radiation Monitoring Report
Tronox Holdings Pty Ltd
Dalyellup Rehabilitation Site

TRONOX

PROJECT: **Dalyellup Rehabilitation Area Annual Site Gamma Survey**

DATE: 11 November 2021

PREPARED BY: Trevor Boal

DOCUMENT INFORMATION

Document Number: TROX211013_Anual Site Visit Report

Revision: Rev 0

REVISION HISTORY

REVISION NUMBER	ISSUE DATE	PREPARED BY	REVIEWED BY	REVISION DESCRIPTION
Rev0	19/11/21	TB	BL	Issued for Use
Rev1	13/12/2021	TB	DS	Updated with Client Comments

RECORD OF APPROVAL

ROLE	NAME	SIGNATURE	DATE
Senior Radiation Protection Advisor	Barry Lewington		19/11/2021

Contents

Tables

Figures

1. Executive Summary

Tronox Pigment Bunbury Ltd (Tronox), previously Cristal Pigment, operated a facility for the disposal of solid waste residues from their Kemerton and Australind pigment plants. The waste residues contain Naturally Occurring Radioactive Material (NORM), in the form of traces of radionuclides in the decay chains of uranium and thorium. The residues were shipped as a slurry and then gravity fed into disposal cells at the Dalyellup site (the Site). The Site has since been rehabilitated. Rehabilitation of the Dalyellup site was completed in 2013. An aerial view of the Site is shown in Figure 1.

As part of the regulatory commitments for the rehabilitation of the Site, a Radiation Management Plan (RMP) was developed outlining the monitoring program that Tronox is to carry out.

This RMP was submitted to the regulatory authority, namely Radiological Council of Western Australia (RCWA) in October 2013 and was endorsed by the RCWA on 2 August 2016. [5]

Tronox was committed to a 5-year ongoing radiation monitoring program from years 2013 to 2018 after the rehabilitation of the area was completed. The monitoring program has exceeded the 5-year commitment made by Tronox. Tronox submitted a revised RMP that requested a change to the monitoring programme in the RMP to the RCWA in January 2019. Tronox is still awaiting approval of the revised RMP. RCWA has informed Tronox that the Site is under review by the Department of Water and Environment Regulation (DWER).

The RMP that was endorsed by the RCWA in 2016 was used as the basis for this 2021 monitoring program.

Radiation Professionals Australia (RPA) personnel carried out this required monitoring survey on 8 November 2021.

Summary of Results

The average gamma dose rate within the boundaries of the Dalyellup rehabilitated area was 0.15 ± 0.004 microGray per hour (µGy/h) with a range of 0.14 to 0.16 µG/h.

This is comparable to the results of previous years. The gamma radiation dose rates are consistent with the natural background gamma radiation levels expected in the local area and general Perth coastal plain, which has a range of 0.07 to 0.27 µGy/h, depending on local geological characteristics (Toussaint, 1985) [1].

For the period from October 2020 to August 2021, most of the measured radon activity concentrations and thoron activity concentration were less than the minimum detectable level (MDL) (see Table 6). The three measurements of activity concentrations that were greater than MDL have large measurement errors, and the measured activity concentrations are only slightly above the MDL.

The data do not provide an indication of long-term elevation in the radon and thoron levels for the Dalyellup Rehabilitation area.

The results for 2020-2021 indicate that radon and thoron activity concentration levels are low and would pose no radiological health issues to the public.

Regarding the results for radionuclides in the water from the monitoring bores, the highest recorded activity concentration for Ra-226 was in October 2020 of 0.19 Bq/L for bore DM9A, and in 2021 was 0.03 Bq/L for bores DM1C, DM8C, DM4A and DM4C. The highest recorded activity concentration for Ra-228 in October 2020 was 0.17 Bq/L for bore DM9A, and in 2021, all measurements were less than the MDL of 0.08 Bq/L. The data presented indicates that there is no leaching of radionuclides from the rehabilitated area into the surrounding groundwater. None of the sample locations have activity concentrations exceeding the recommended 0.5 Bq/L gross alpha screening concentration trigger value set out in the Australian Drinking Water Guideline [7].

Figure 1: Aerial view of the Dalyellup Rehabilitated Site

2. Introduction

Tronox Pigment Bunbury Ltd (Tronox), previously Cristal Pigment, operated a facility for the disposal of solid waste residue from their Kemerton and Australind pigment plants. The land waste disposal facility is located at Dalyellup, 8 km south of Bunbury town centre. The waste residues contain Naturally Occurring Radioactive Material (NORM), in the form of traces of radionuclides in the decay chains of uranium and thorium. The residue was shipped to the disposal facility by tanker trucks as a slurry and then gravity fed into disposal cells at the Dalyellup site.

The Dalyellup rehabilitation site has residue ponds that have been capped with a minimum of 2 metres of local sand (shown in Figure 1). Post-capping, a rehabilitation program was initiated which includes periodic radiation surveys to ensure that the site has returned to pre disturbance natural background radiation dose rates for the area. Rehabilitation of the Dalyellup site was completed in 2013.

Tronox has prepared and implemented a Radiation Management Plan (RMP) for a radiation monitoring period of 5 year from 2013 to 2018. The RMP was endorsed by RCWA [5], for the monitoring period from 2013 to 2018.

The monitoring program has exceeded the 5-year commitment made by Tronox (formerly Cristal) and is under review with the RCWA and DWER. It is noted a revised RMP that included a change to the monitoring requirements was submitted by Tronox to the RCWA in January 2019 and is still awaiting endorsement.

The current endorsed/approved RMP [4] was used as the basis for this 2021 monitoring program.

Radiation Professionals Australia (RPA) has been contracted for the past 7 years to undertake the required environmental radiation monitoring surveys and prepare an annual report of the results of the Dalyellup site. The first monitoring of the site took place in October 2013.

The gamma monitoring site survey as required took place on 8th of November 2021 of 20 locations around the rehabilitated perimeter and 16 locations within this area over the capped waste pond the Dalyellup. The gamma survey was conducted using a nominal grid size of 100m by 100m (see Figure 2) detector probe set at 1 metre above the ground surface with three integrated measurements taken at each data test point and averaged.

The measurement of radon and thoron in air are carried out by Tronox that are provided to RPA for inclusion in the annual report.

Monitoring bore water sampling is also being carried out by a contractor with the radiometric results issued to RPA for inclusion into the annual reports.

The purpose of the annual site visits is to undertake environmental radiation monitoring on behalf of Tronox, in support of the required site regulatory and legal compliance monitoring requirements for:

- Reporting requirements to the Radiological Council Western Australia (RCWA), [2] & [3];
- Radiation Management Plan (RMP), [4] and [5] approved commitments; and
- The ongoing rehabilitation program for the Site.

3. Future Work

The radiation monitoring program set out in the approved RCWA 2016 RMP is required to continue until the regulators approve the revised submitted RMP, or a decision is made that no further restrictions or requirements are necessary for the rehabilitated Site. Tronox to follow this up with the regulators for clarification.

4. Scope and Work Method

A gamma radiation monitoring survey was carried out at the 36 historical locations using an environmental radiation monitor with the detector positioned at a standard 1 metre above the ground surface.

Radon-in-air and thoron-in-air monitors were deployed for periods of about 3 months at 8 locations 1 meter above ground around the perimeter boundary that were used in previous years to record radon and thoron airborne concentrations. Results were forwarded to RPA for preparing the annual report.

Tronox are responsible to conducted 3 monthly ground water sampling from November 2020 to October 2021 for laboratory radiometric analysis of Radium 226 (Ra-226) and Radium 228 (Ra-228). The ground water results were forwarded to RPA for preparing the annual report.

The monitoring locations for the gamma measurements, radon-in-air and thoron-in-air measurements and the bore locations for ground water monitoring are provided in Figure 2.

Table 1: Ongoing Monitoring Program for the Dalyellup Site

Parameter	Site/Locations	Frequency	Technique
Gamma	A 100 x 100m grid over the site Refer to Figure 2	Annually. *(Note 1: 2021 represents year 8 of annual reports)*	On foot, using rate-meter Radeye GX6002 dose rate meter with energy compensated environmental GM probe, (MC-71 probe), WGPS for locations from historical test points 3 x Integrated 60sec measurements @ 1m above ground
Radon-in-air and Thoron-in-air	Sampling locations 1,3,5,7,9,13,16, and 20. Refer to Figure 2	Approx. 3 monthly (quarterly) change outs. *(Note 1: 2021 represents year 8 of annual reports)*	Track etch (RadTrak). *Note 2: Quarterly replacements are undertaken by Tronox* *Report issued to RPA*

Water Quality	Water bores around site: DM1, DM2, DM4, DM7, DM8, DM9. MB3, MB4 and YB. Refer to Figure 2	Annually, *(Note 1: 2021 represents year 8 of annual reports)*	Water sampling as per AS/NZ 5667.11:1998. Samples collected by contractor Report issued to RPA Analysis for Ra226/Ra228 *Note 3: Periodic sampling is undertaken by Tronox*

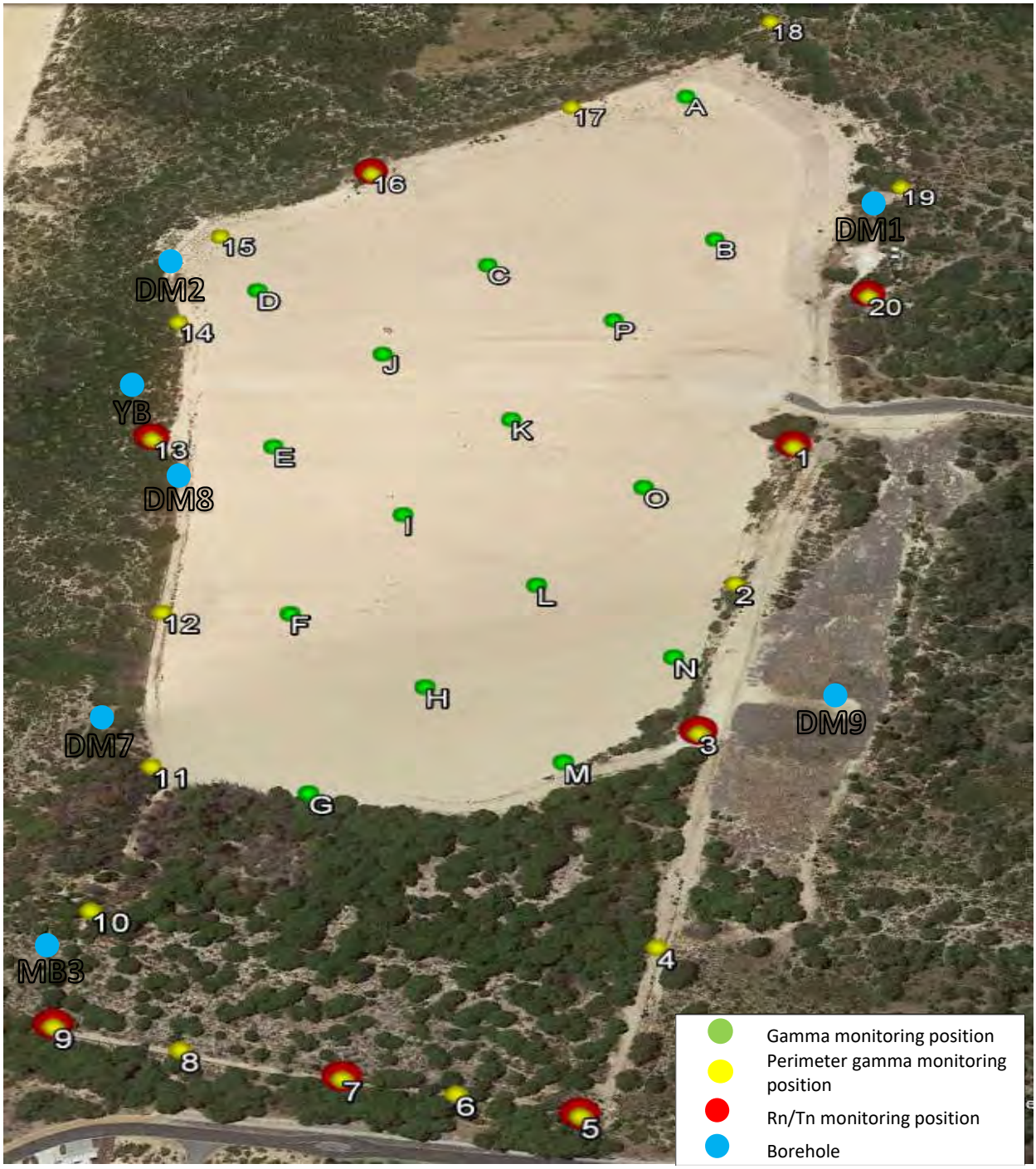


Figure 2: Monitoring locations at Dalyellup Site.

4.1. Methodology Environmental Gamma Monitoring

The gamma survey was conducted using a Radeye GX dose rate meter coupled to an energy compensated GM gamma detector (type MC-71).

The instrument is calibrated annually. The calibration certificate is attached in Appendix 10.1.

Measurements were taken with the detector placed at one metre above the ground. At each survey location, three (3) one (1) minute integrated measurements were taken and recorded on a field tablet along with the GPS co-ordinates of that location. A total of 20 perimeter and 16 points over the previously rehabilitated areas of the capped pond area was taken at the same locations as per previous years.

Table 2: Summary of Gamma Measurements

Area	Type of measurement/sampling	No of Samples
Perimeter of site (Locations RP01-RP20)	Gamma-in-air monitoring	20
Rehabilitated Area & Capped Pond (Locations A-P)	Gamma-in-air monitoring	16

Uncertainty Budget

Overall uncertainty in dose rate readings is a product of the standard deviation of the readings and the uncertainty of the measurement. Factors that contribute to the uncertainty of the measurement at such low intensities are the calibration of the instrument, energy and angular dependence, environmental factors, scale resolution and reading parallax (for digital instruments parallax and scale resolution is assumed to be zero).

The overall uncertainty budget is outlined below.

Calibration Uncertainty: For the Radeye GX dose rate meter used for this work the calibration uncertainty is ±10% with a normal distribution ref to Appendix 10.1 calibration certificate.

Energy and Angular Dependence: Using the IEC standard IEC 60846-1 Ed. 1.0 [6], the energy and angular dependence for this work and with this instrument is estimated to be 25% with a rectangular distribution.

Environmental Factors: For the instrument used, under normal working conditions, the uncertainty from environmental factors should not be more than 10% with a rectangular distribution.

Standard Deviation: For a 95% confidence level the following formula can be used to calculate the standard deviation of the time averaged readings.

$$u(H^*[10]) = \frac{\Delta H^*[10]}{H^*[10]}$$

$$\Delta H^*[10] = \frac{2 \times \sqrt{CPM}}{CPM} \times H^*[10]$$

Where u is the standard uncertainty, H*[10] is the ambient dose equivalent and CPM is the time averaged reading in counts over a one-minute period and Δ is the uncertainty. This uncertainty has a normal distribution.

The **overall combined standard uncertainty** u total (with a normal distribution) can then be calculated with the following equation:

$$u_{total} = \sqrt{\sum \left(\frac{u(i)}{z}\right)^2}$$

Where u (i) are the uncertainty sources detailed above and z is the probability divisor (1 for normal distributions and 1.73 for rectangular distributions). This gives a total uncertainty for a confidence level of 95%.

All gamma survey points were located with a Garmin Map GPS 12 "etrex" using the WGS 84 (GDA94) datum projected in the UTM format, referenced to map zone 50H.

4.2. Radon and Thoron

The radon measurement was performed using closed alpha-track detectors as supplied by Landauer following the United States (US) quality guidance in EPA 402-R-95-012 [8]. Detectors are deployed in pairs, with a radon only monitor and a radon and thoron monitor placed together at each monitoring location for an exposure period of approximately 90 days.

The detector container is manufactured from electrically conducting plastic. Air containing radon and thoron enters the detector container through a small slit (filter) in the radon only detector. Only the radon gas enters the detector chamber, as the diffusion time for the air to enter the container is long enough to prevent thoron gas from entering.

The thoron detector is constructed differently with holes covered by paper filters in through which both thoron and radon gas enter the chamber. The thoron concentration is calculated by subtracting the radon only measurement from the total value of the combined radon and thoron detector. Analysis of monitors is conducted by Landauer in an accredited laboratory to determine the radon and thoron levels.

The radon detector is marked with (R) after the detector number in the results table (see Appendix 10.3) and the combined radon and thoron detector with (T). For each result an uncertainty associated with the measurement to a 95% confidence level is also given. Radon and thoron measurements were conducted at locations along the perimeter fence of the site over a period from 22 October 2020 to 22 January 2021, from 22 January 2021 to 14 May 2021 and from 14 May 2021 to 17 August 2021. At the end of each exposure period, the detectors were collected and sent to

Landauer for analysis. A total of 8 locations were monitored (Figure 2) and results are shown in Table 6.

4.3. Monitoring Equipment

Table 3: Equipment Details for measurement of gamma radiation

Equipment	Model	Serial Number	Calibration Due Date
Radeye dose rate meter Probe	GX6002 MC71HMV	00513 19020	12/11/2021

4.4. Licenced Personnel

Table 4: Radiation Licence Information

Radiation Protection Advisor	Radiation Licence Details
Barry Lewington	Western Australia: Licence for Radioactive Substances: LS 91/2000 12169
Andrew Count	Western Australia: Licence for Radioactive Substances: LS 1087/2021 34566

5. Results

5.1. Gamma Dose Rate

The statistical analysis of the gamma dose rate data for the Dalyellup Rehabilitated Area are summarised in Table 5. The gamma data for the years 2015 to 2021 are shown in figure 3. The gamma dose rates are given in micro-Grays per hour (µGy/h), which is the absorbed dose rate in air.

The full gamma dose rate data are presented in appendix 10.2.

Within the uncertainty of the measurements, the average dose rate was determined to be 0.15 µGy/h, ranging between 0.14 µGy/h and 0.16 µGy/h.

These results are within the statistical variation of the background gamma dose rates and are typical of the background gamma measurements of the Perth Coastal Plain which has a range between 0.07 to 0.27 µGy/h depending on the local geological characteristics (Toussaint, 1985) [1].

Based on the most recent gamma radiation survey, the results show that gamma radiation levels are consistent with the general natural background gamma radiation levels and therefore pose no radiological health issues to the public or the environment.

Table 5: Summary of Gamma Dose Rate measurement results for 2021

Location	Mean and Std Dev (µGy/h)	Minimum (µGy/h)	Maximum (µGy/h)
Dalyellup Site	0.15 ± 0.004	0.14	0.16

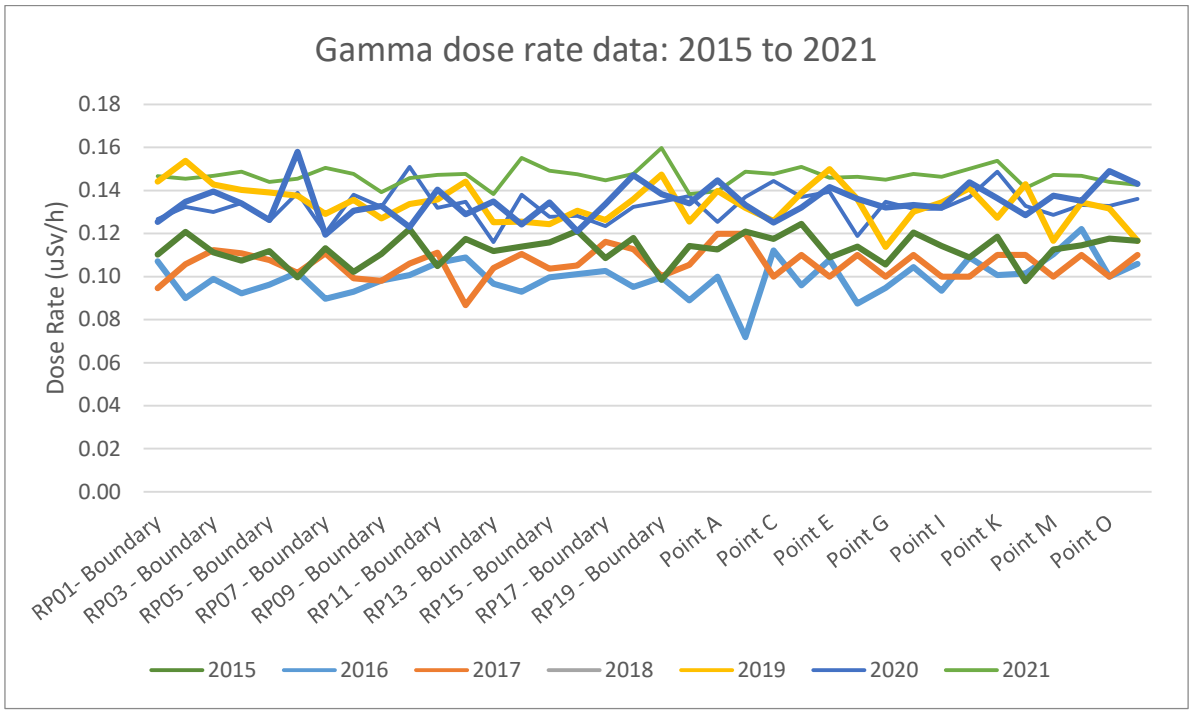


Figure 3: Comparison of environmental gamma dose rates for 2015 – 2021

5.2. Radon and Thoron

Most of the measured radon activity concentrations and thoron activity concentration for 3 sets of measurements between October 2020 to August 2021 were less than the MDL (see Table 6). The three measurements of activity concentrations that were greater than minimum detectable level (MDL) have large measurement errors, and the measured activity concentrations are only slightly above the MDL.

The data do not provide an indication of long-term elevation in the radon and thoron levels for the Dalyellup Rehabilitation area.

The results for 2020-2021 indicate that radon and thoron activity concentration levels are low and would pose no radiological health issues to the public.

The laboratory analysis results for radon and thoron activity concentration levels for the 3 measurement periods are presented in Appendix 10.3.

Table 6: Rn/Th monitoring results for 2020 - 2021

		Oct 20 – Jan 21		Jan 21 – May 21		May 21 – Aug 21	
Point #	**Location**	**Radon (Bq/m³)**	**Thoron (Bq/m³)**	**Radon (Bq/m³)**	**Thoron (Bq/m³)**	**Radon (Bq/m³)**	**Thoron (Bq/m³)**
RM01	RP20 - Boundary	<15	<30	<15	<30	<30	<30
RM02	RP16 - Boundary	<15	<30	<15	<30	<30	<30
RM03	RP13 - Boundary	<15	<30	<20	70 ± 22	<30	<30
RM04	RP09 - Boundary	<15	<30	<15	<30	<30	<30
RM05	RP07 - Boundary	<15	<30	24 ± 10	<30	<30	43 ± 22
RM06	RP05 - Boundary	<15	<30	<15	<30	<30	<30
RM07	RP03 - Boundary	<40	<30	<20	<30	<30	<30
RM08	RP01 - Boundary	<15	<30	<15	<30	<30	<30

5.3. Bore Water Concentrations

The activity concentration levels for Ra-226 and for Ra-228 in water are presented in Table 7.

The laboratory analysis reports are provided in Appendix 10

Locations identified as “A” are for ‘deep’ bore hole samples and those indicated as “C” are for ‘shallow’ bore hole samples.

A summary of the average activity concentrations for Ra-226 and Ra-228 in the bore water for the past 7 years are presented in Table 8 and Table 9, respectively.

The data in Table 7 summarises the analysis of water samples were collected in October 2020, January 2021, June 2021, and October 2021. The samples collected in October 2020 and January 2021 were analysed by SGS Melbourne EH&S laboratory while the samples collected in June 2021 and October 2021 were analysed by ALS Environmental, Perth. There is a marked difference in the minimum detectable level (MDL) between the two laboratories: for Ra-226, SGS has an MDL in the range 0.04-0.08 while ALS has an MDL of 0.01 Bq/L; while for Ra-228, SGS has an MDL in the range 0.09-0.20 while ALS has an MDL of 0.08 Bq/L. For the activity concentration values that exceed the MDL, SGS provides a value for the uncertainty, while ALS does not. The results from the two laboratories are consistent, as the SGS results have large uncertainties. However, as many of the results are <MDL, and in the analysis of the results, a value is assigned to a particular monitoring bore of being equal to the MDL for those results that were determined to be <MDL. As the ALS laboratory has a lower MDL, it appears that the results for 2021 as set out in Table 8 and Table 9 are lower but comparable to previous monitoring periods.

The highest recorded activity concentration for Ra-226 in October 2020 was 0.19 Bq/L for bore DM9A, and in 2021 was 0.03 Bq/L for bores DM1C, DM8C, DM4A and DM4C. The highest recorded activity concentration for Ra-228 in October 2020 was 0.17 Bq/L for bore DM9A, and in 2021, all measurements were less than the MDL of 0.08 Bq/L.

The screening levels for drinking water as set by Reference [7], state that compliance with the guideline for radiological quality of drinking water should be assessed, initially, by screening for gross alpha and gross beta activity concentrations. The recommended screening level for gross alpha activity is 0.5 Bq/L. The concentrations of both Ra-226 and Ra-228 have been determined, as these are the most significant naturally occurring radionuclides in Australian water supplies.

The data presented indicates that there is no leaching of radionuclides from the rehabilitated area into the surrounding groundwater. None of the sample locations have activity concentrations exceeding the recommended 0.5 Bq/L gross alpha screening concentration limits.

Table 7: Results of Water Monitoring period for October 2020-2021

Analysis Report Date	Location	Ra-226 Bq/L	Ra-228 Bq/L
14/10/2020	DM1A	<0.057	<0.160
11/06/2021	DM1A	<0.01	<0.08
21/10/2021	DM1A	<0.01	<0.08
14/10/2020	DM1C	<0.062	<0.093
07/06/2021	DM1C	0.03	<0.08
21/10/2021	DM1C	0.01	<0.08
14/10/2020	DM2A	<0.079	<0.160
08/06/2021	DM2A	0.01	<0.08
20/10/2021	DM2A	0.01	<0.08
14/10/2020	DM2C	<0.056	<0.160
08/06/2021	DM2C	0.01	<0.08
19/10/2021	DM2C	0.01	<0.08
08/06/2021	DM4A	---	---
18/10/2021	DM4A	0.03	<0.08
26/01/2021	DM4C	0.064 ± 0.045	<0.18
09/06/2021	DM4C	0.02	<0.08
18/10/2021	DM4C	0.03	<0.08
14/10/2020	DM7A	<0.041	<0.140
11/06/2021	DM7A	<0.01	<0.08
18/10/2021	DM7A	0.01	<0.08
14/10/2020	DM7C	<0.047	<0.120

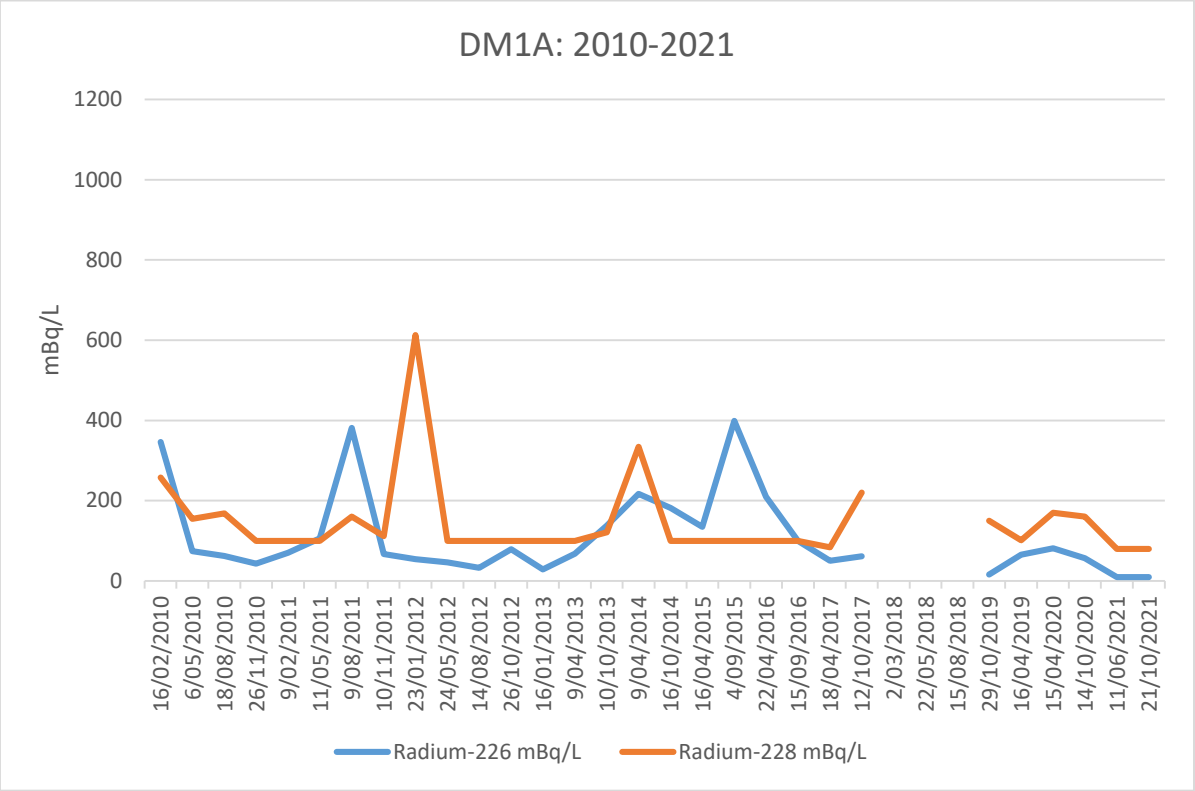
Analysis Report Date	Location	Ra-226 Bq/L	Ra-228 Bq/L
11/06/2021	DM7C	0.02	<0.08
18/10/2021	DM7C	<0.01	<0.08
14/10/2020	DM8A	0.026 ± 0.015	<0.150
08/06/2021	DM8A	0.01	<0.08
19/10/2021	DM8A	0.02	<0.08
14/10/2020	DM8C	<0.067	0.097 ± 0.037
08/06/2021	DM8C	0.03	<0.08
19/10/2021	DM8C	0.02	<0.08
14/10/2020	DM9A	0.193 ± 0.026	<0.061
10/06/2021	DM9A	<0.01	<0.08
14/10/2020	DM9C	<0.061	0.068 ± 0.034
21/10/2021	DM9C	0.08	<0.08
14/10/2020	MB3	<0.055	<0.200
08/06/2021	MB3	---	---
12/08/2021	MB3	<0.01	<0.08
21/10/2021	MB3	0.01	0.08
14/10/2020	YB	0.064 ± 0.017	<0.150
26/01/2021	YB	0.071 ± 0.037	<0.180
09/06/2021	YB	0.02	<0.08
12/08/2021	YB	0.02	<0.08
20/10/2021	YB	0.03	<0.08

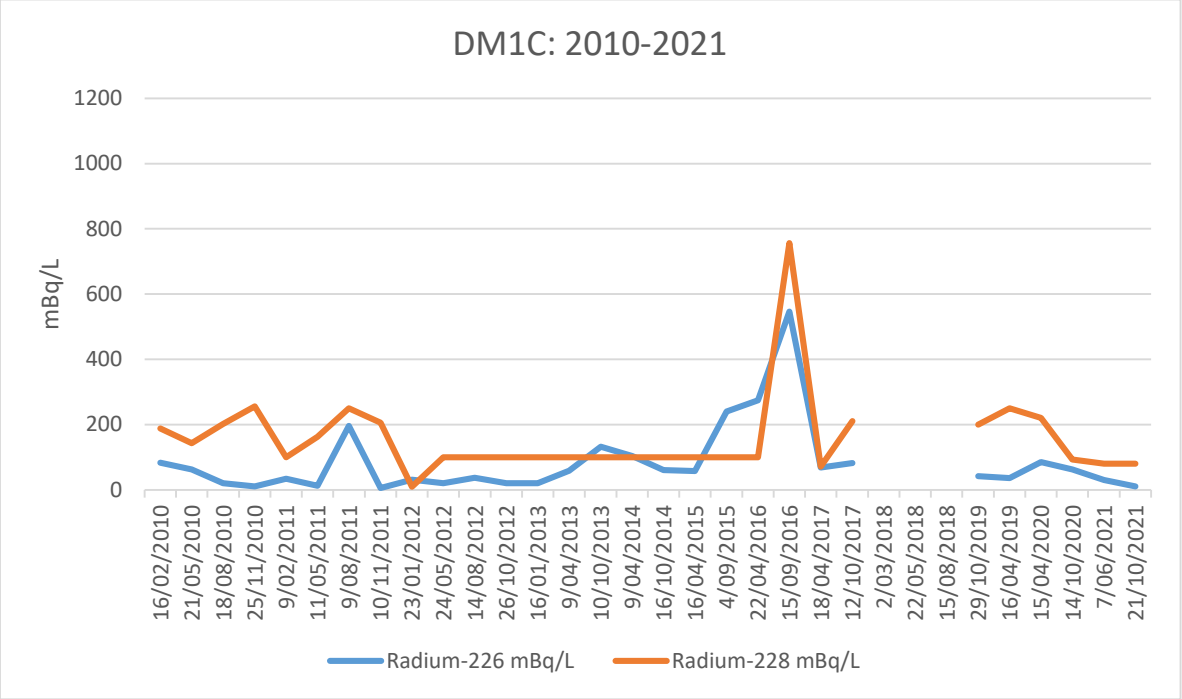
Table 8: Ra-226 Average Activity Concentrations (mBq/L) for period 2013 – Oct 2021

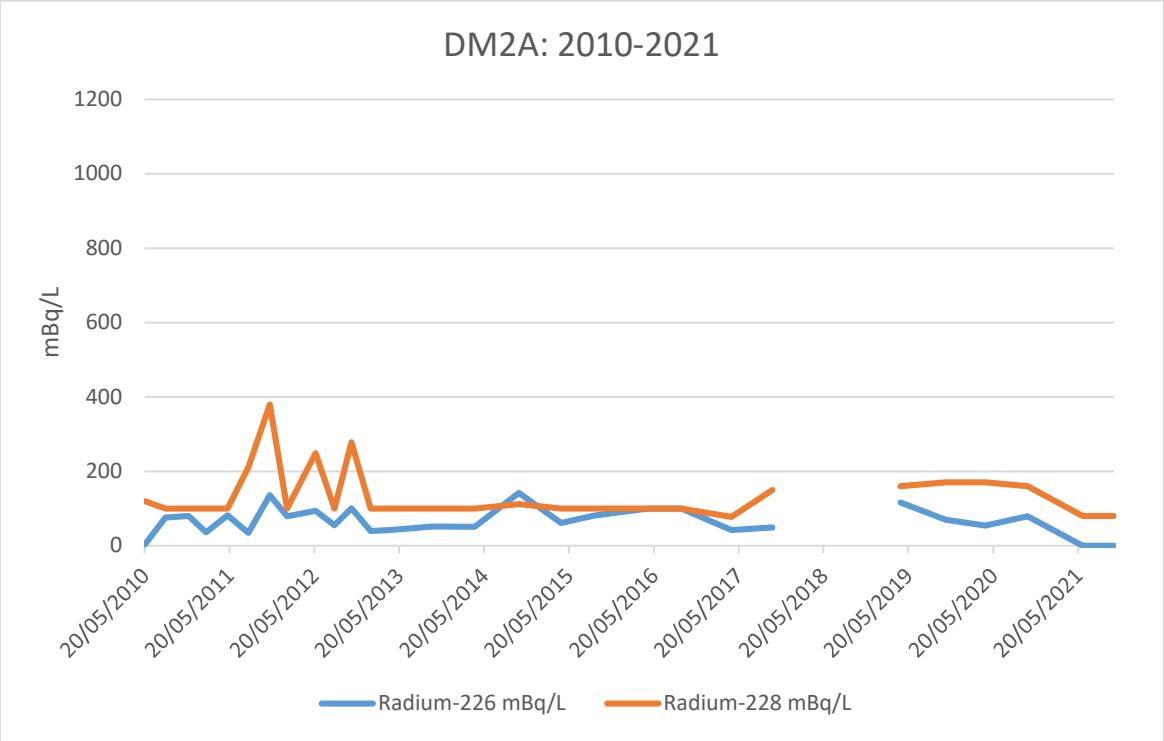
REPORT YEAR	DM1A	DM1C	DM2A	DM2C	DM4A	DM4C	DM7A	DM7C	DM8A	DM8C	DM9A	DM9C	MB3	MB4	YB
2013	78	70	45	31	33	17	53	40	62	69	62	52	25	35	53
2014	199.5	81.5	96.5	66.5	45	45.5	79	80.5	94.5	67	3	254	37	34.5	56.3
2015	267	148.5	71	110	107.5	59.5	56	161.3	109.5	93	148.5	61.3	109.5	110	72.5
2016	155	410.5	<100	<100	192	<100	<100	<100	<100	122	<100	909	151	158	382.5
2017	61	75	62	36.5	<49	42	<75	49	50	90.5	121.7	84	<35	<57	31.3
2018	46	55	115	<50	<58	40	<85	<72	29	50	102	<66	<94	<43	38.7
2019	<65	<42	<116	<60	<64	<41	<51	<61	<65	<55	<157	<46	<80	N/A	44.0
2020	62.5	60.5	65.5	62	-	52	54	61.5	41	69.5	101	83	62.5	43	73
2021	10	20	10	10	30	25	10	15	15	25	10	80	10	N/A	23

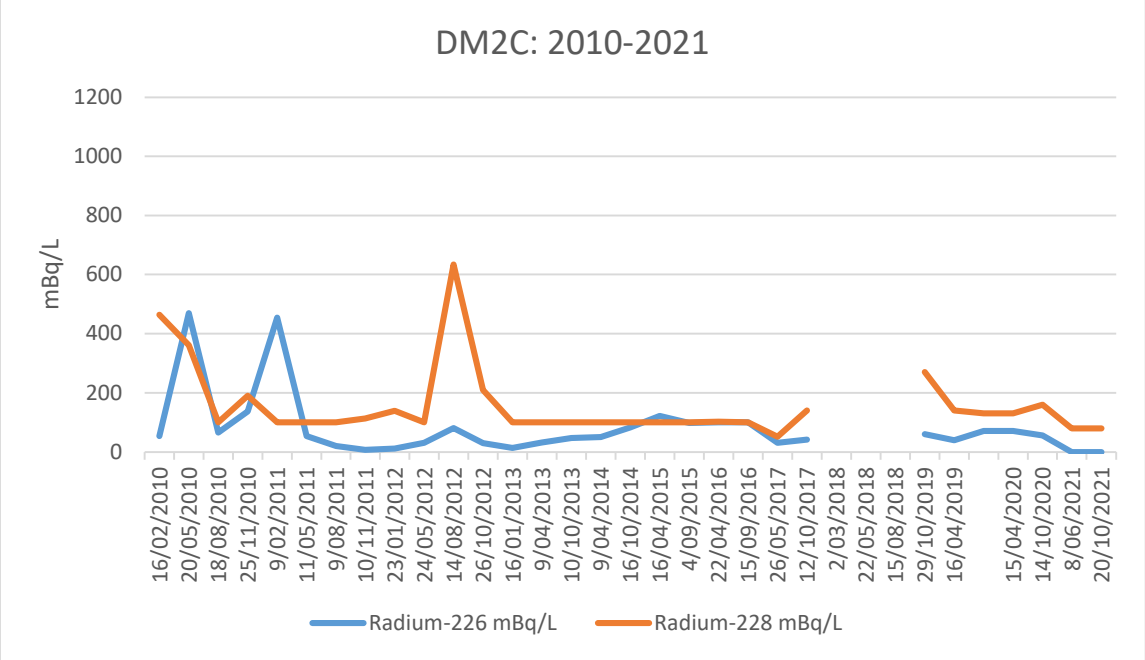
Table 9: Ra-228 Average activity concentrations (mBq/L) for period 2013 – Oct 2021

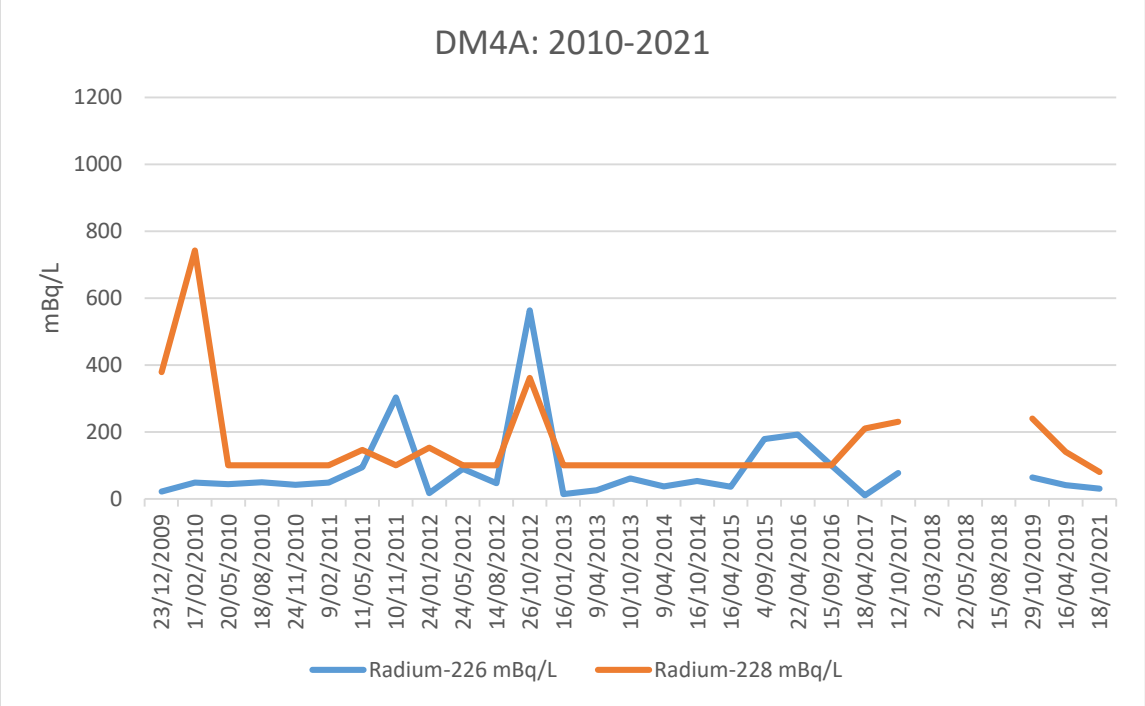
YEAR	DM1A	DM1C	DM2A	DM2C	DM4A	DM4C	DM7A	DM7C	DM8A	DM8C	DM9A	DM9C	MB3	MB4	YB
2013	107	<100	<100	<100	<100	<100	<100	<100	132	<100	133	133	<100	<100	<100
2014	217	<100	106	<100	<100	<100	140.5	125	102	<100	<100	148.5	125	<100	<100
2015	<100	<100	<100	<100	<100	<100	<100	<100	224	120.5	<100	158.3	123	<100	<100
2016	<100	757	<100	102	<100	<100	<100	<100	<100	<100	<100	574	<100	<100	192
2017	<220	71	78	52	<150	<14	<210	140	62	206	155	160	<96	<180	82.3
2018	<190	<220	263	<90	<130	<150	<240	<210	<140	<140	<150	<160	<170	<110	120.5
2019	<150	<250	<170	<270	<240	<160	<200	<230	<190	<150	<97	<180	<210	N/A	63.0
2020	185	240	150	140	-	160	170	115	190	200	<180	<210	160	170	106.7
2021	80	80	80	80	80	80	80	80	80	80	80	80	80	N/A	80

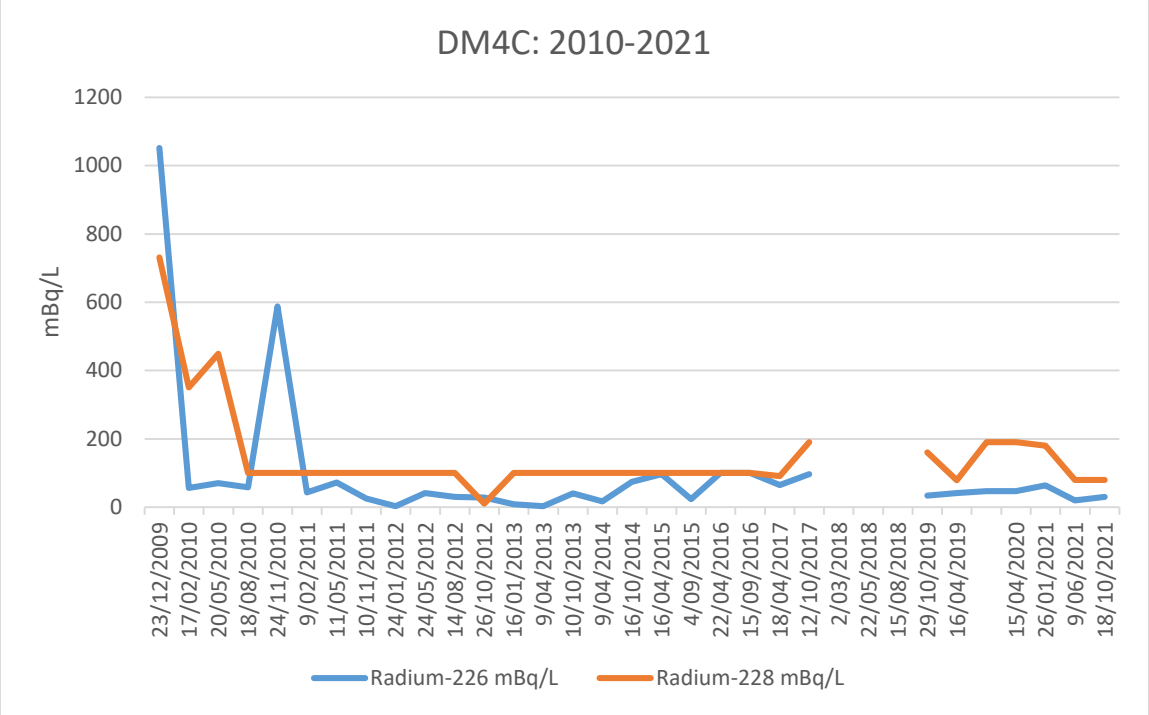

DM1A: 2010-2021
mBq/L
1200
1000
800
600
400
200
0
16/02/2010
6/05/2010
18/08/2010
26/11/2010
9/02/2011
11/05/2011
9/08/2011
10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
11/06/2021
21/10/2021
Radium-226 mBq/L
Radium-228 mBq/L

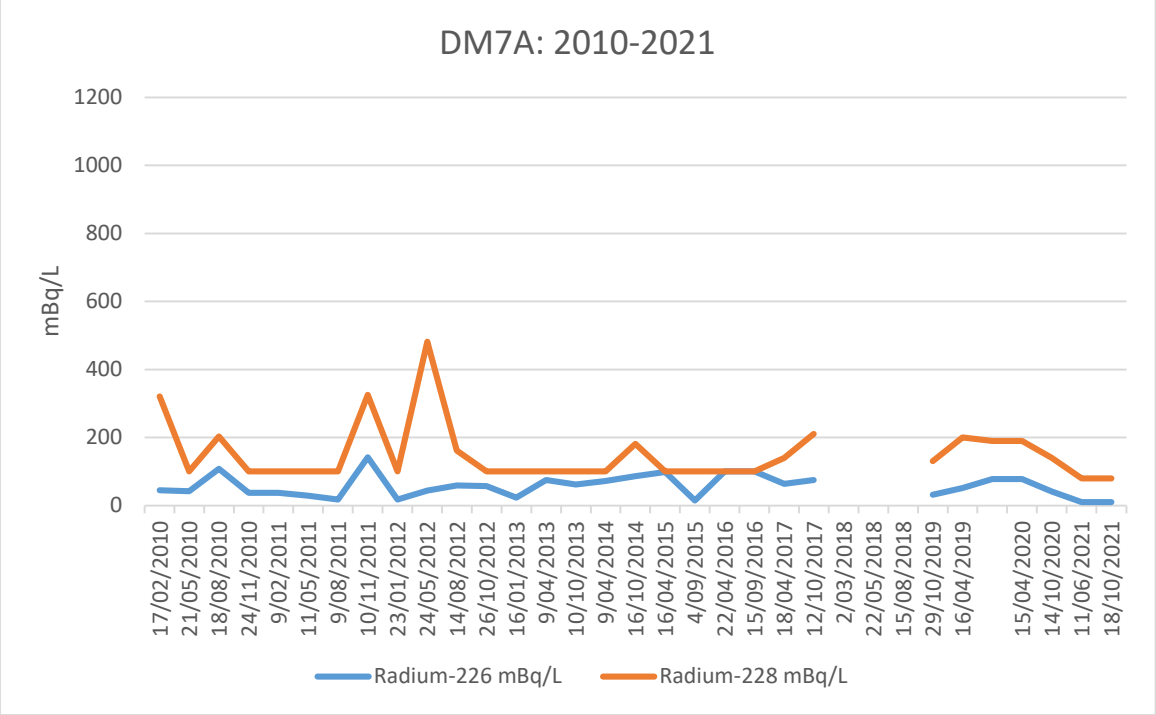

DM1C: 2010-2021
mBq/L
1200
1000
800
600
400
200
0
16/02/2010
21/05/2010
18/08/2010
25/11/2010
9/02/2011
11/05/2011
9/08/2011
10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
7/06/2021
21/10/2021
Radium-226 mBq/L
Radium-228 mBq/L

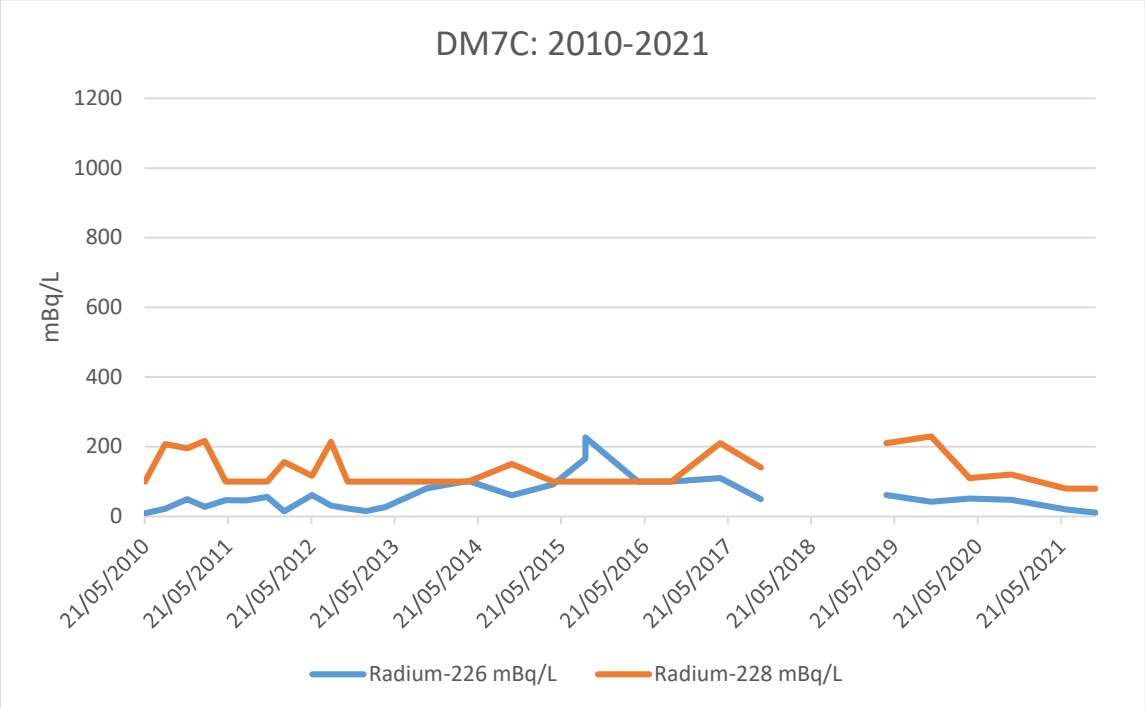

DM2A: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
20/05/2010
20/05/2011
20/05/2012
20/05/2013
20/05/2014
20/05/2015
20/05/2016
20/05/2017
20/05/2018
20/05/2019
20/05/2020
20/05/2021
Radium-226 mBq/L
Radium-228 mBq/L

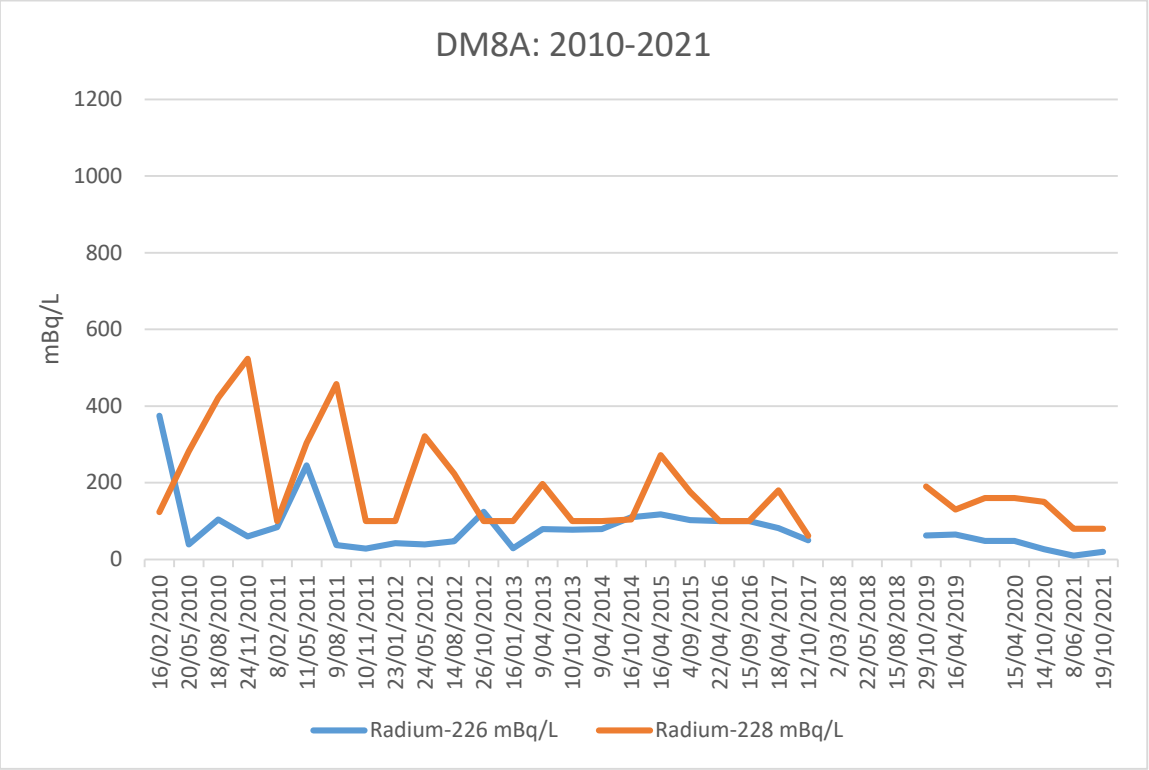

DM2C: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
16/02/2010
20/05/2010
18/08/2010
25/11/2010
9/02/2011
11/05/2011
9/08/2011
10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
26/05/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
8/06/2021
20/10/2021
Radium-226 mBq/L
Radium-228 mBq/L

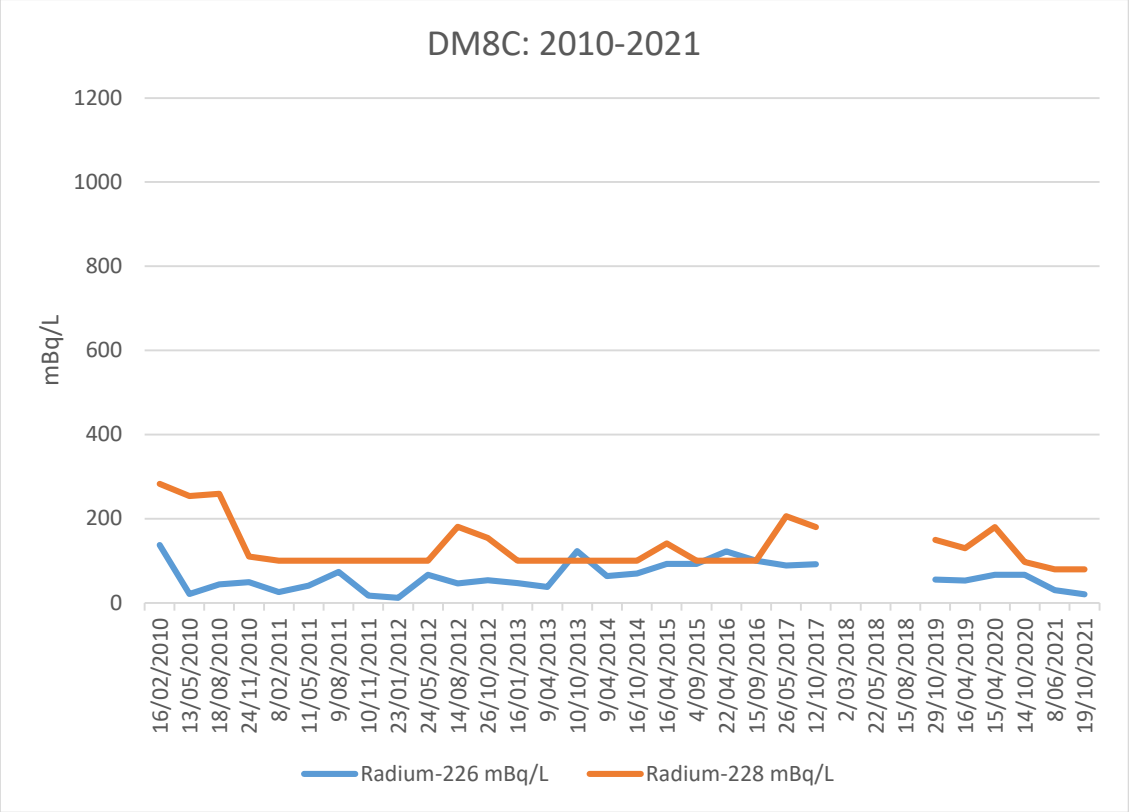

DM4A: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
23/12/2009
17/02/2010
20/05/2010
18/08/2010
24/11/2010
9/02/2011
11/05/2011
10/11/2011
24/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
18/10/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM4C: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
23/12/2009
17/02/2010
20/05/2010
18/08/2010
24/11/2010
9/02/2011
11/05/2011
10/11/2011
24/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
26/01/2021
9/06/2021
18/10/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM7A: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
17/02/2010
21/05/2010
18/08/2010
24/11/2010
9/02/2011
11/05/2011
9/08/2011
10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
11/06/2021
18/10/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM7C: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
21/05/2010
21/05/2011
21/05/2012
21/05/2013
21/05/2014
21/05/2015
21/05/2016
21/05/2017
21/05/2018
21/05/2019
21/05/2020
21/05/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM8A: 2010-2021
mBq/L
1200
1000
800
600
400
200
0
16/02/2010
20/05/2010
18/08/2010
24/11/2010
8/02/2011
11/05/2011
9/08/2011
10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
16/04/2015
4/09/2015
22/04/2016
15/09/2016
18/04/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
8/06/2021
19/10/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM8C: 2010-2021
mBq/L
1200
1000
800
600
400
200
0
16/02/2010
13/05/2010
18/08/2010
24/11/2010
8/02/2011
11/05/2011
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10/11/2011
23/01/2012
24/05/2012
14/08/2012
26/10/2012
16/01/2013
9/04/2013
10/10/2013
9/04/2014
16/10/2014
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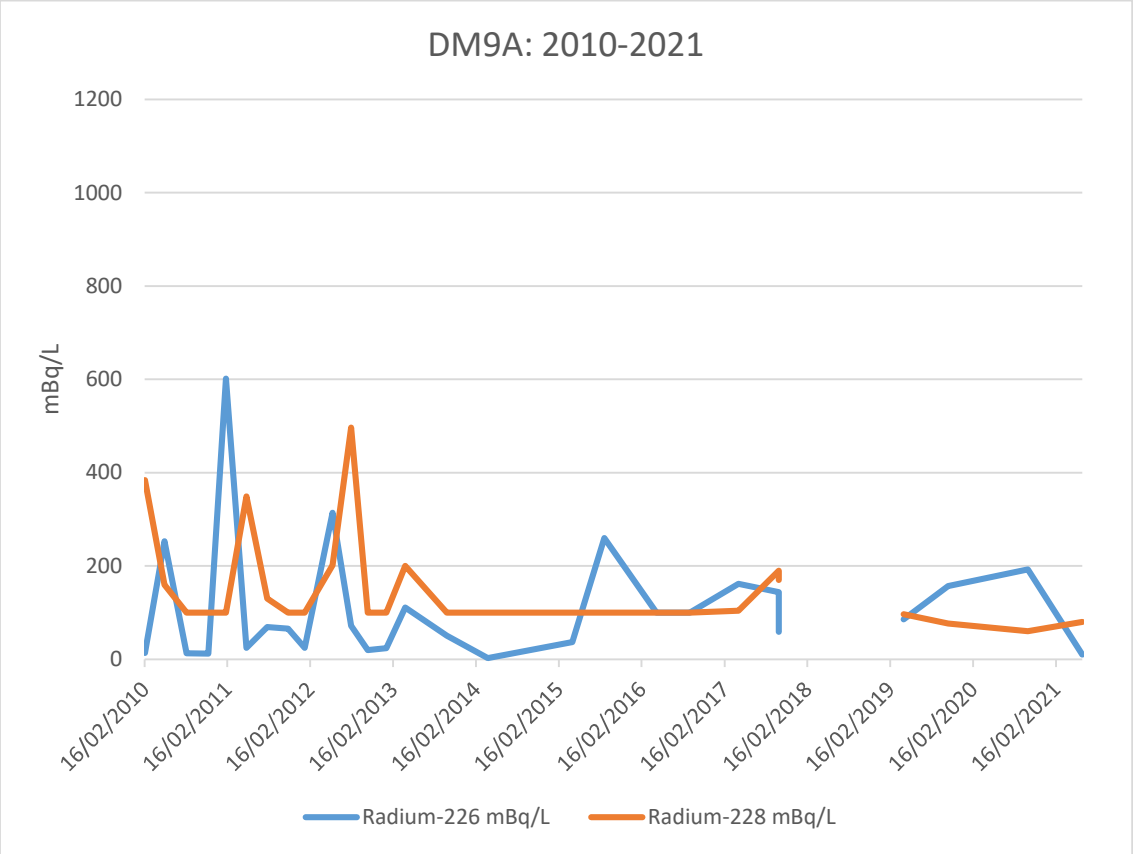
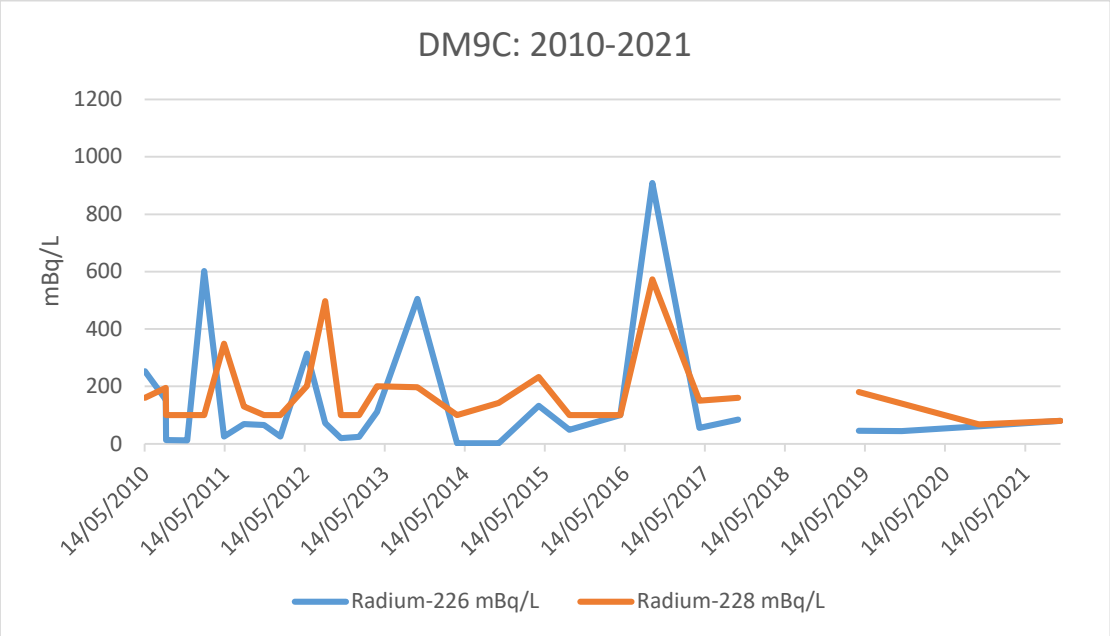
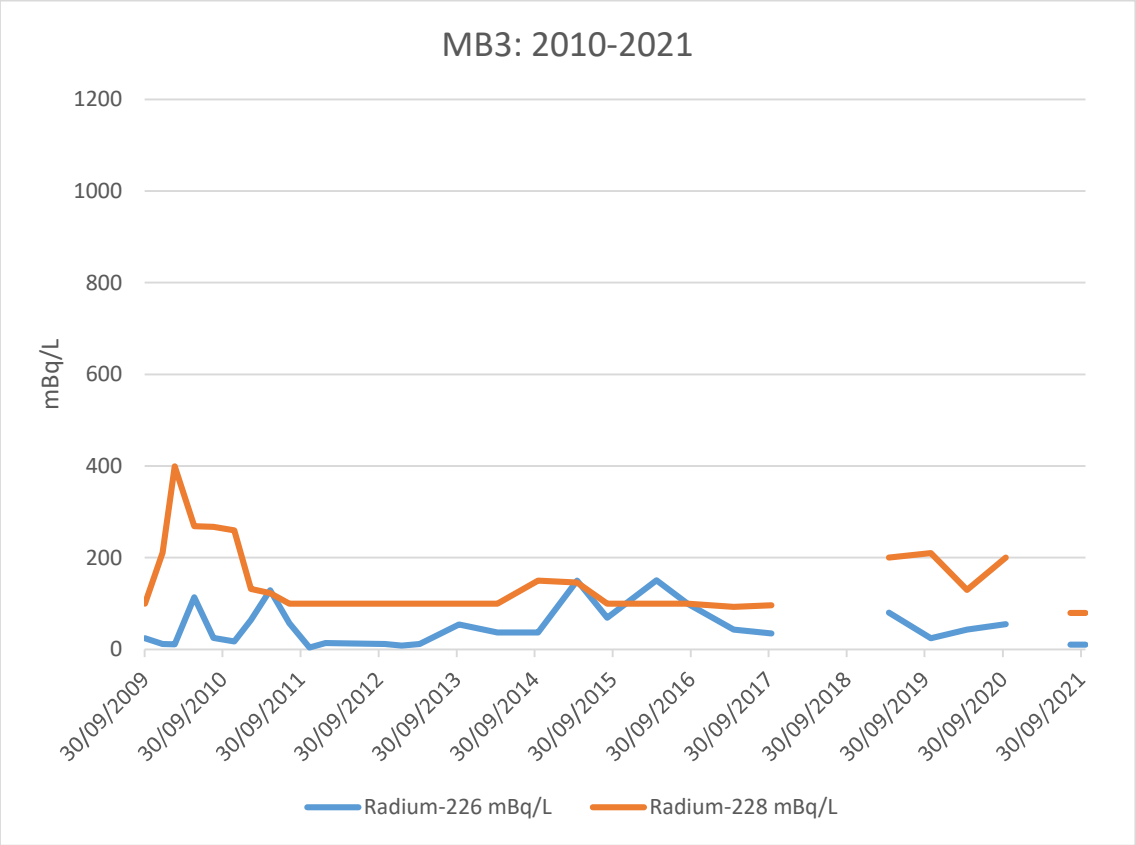
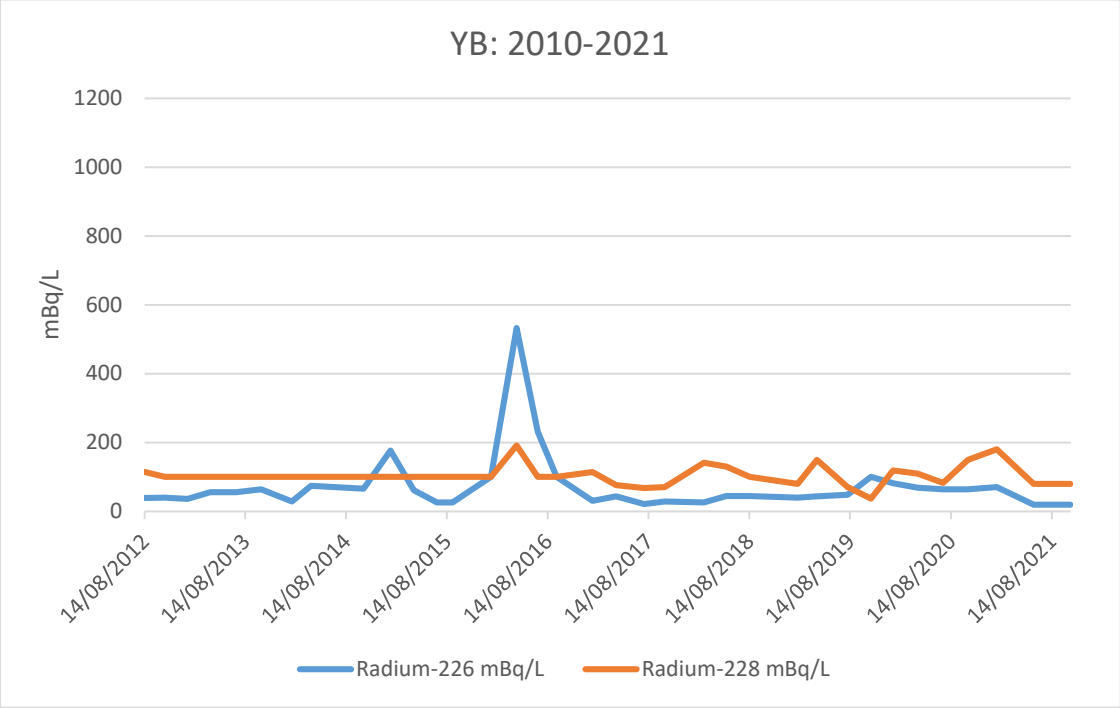
4/09/2015
22/04/2016
15/09/2016
26/05/2017
12/10/2017
2/03/2018
22/05/2018
15/08/2018
29/10/2019
16/04/2019
15/04/2020
14/10/2020
8/06/2021
19/10/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM9A: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
16/02/2010
16/02/2011
16/02/2012
16/02/2013
16/02/2014
16/02/2015
16/02/2016
16/02/2017
16/02/2018
16/02/2019
16/02/2020
16/02/2021
Radium-226 mBq/L
Radium-228 mBq/L


DM9C: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
14/05/2010
14/05/2011
14/05/2012
14/05/2013
14/05/2014
14/05/2015
14/05/2016
14/05/2017
14/05/2018
14/05/2019
14/05/2020
14/05/2021
Radium-226 mBq/L
Radium-228 mBq/L


MB3: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
30/09/2009
30/09/2010
30/09/2011
30/09/2012
30/09/2013
30/09/2014
30/09/2015
30/09/2016
30/09/2017
30/09/2018
30/09/2019
30/09/2020
30/09/2021
Radium-226 mBq/L
Radium-228 mBq/L


YB: 2010-2021
1200
1000
800
600
400
200
0
mBq/L
14/08/2012
14/08/2013
14/08/2014
14/08/2015
14/08/2016
14/08/2017
14/08/2018
14/08/2019
14/08/2020
14/08/2021
Radium-226 mBq/L
Radium-228 mBq/L

6. Conclusions and Further Work

The average gamma dose rate within the boundaries of the Dalyellup rehabilitated area was 0.15 ± 0.004 µGy/h with a range of 0.14 to 0.16 µG/h.

This is comparable to the results of previous years. The gamma radiation dose rates are consistent with the natural background gamma radiation levels expected in the local area and general Perth coastal plain, which has a range of 0.07 to 0.27 µGy/h, depending on local geological characteristics (Toussaint, 1985) [1].

For the period from October 2020 to August 2021, most of the measured radon activity concentrations and thoron activity concentration were less than the minimum detectable level (MDL) (see Table 6). The three measurements of activity concentrations that were greater than MDL have large measurement errors, and the measured activity concentrations are only slightly above the MDL.

The data do not provide an indication of long-term elevation in the radon and thoron levels for the Dalyellup Rehabilitation area.

The results for 2020-2021 indicate that radon and thoron activity concentration levels are low and would pose no radiological health issues to the public.

Regarding the results for radionuclides in the water from the monitoring bores, the highest recorded activity concentration for Ra-226 was in October 2020 of 0.19 Bq/L for bore DM9A, and in 2021 was 0.03 Bq/L for bores DM1C, DM8C, DM4A and DM4C. The highest recorded activity concentration for Ra-228 in October 2020 was 0.17 Bq/L for bore DM9A, and in 2021, all measurements were less than the MDL of 0.08 Bq/L. The data presented indicates that there is no leaching of radionuclides from the rehabilitated area into the surrounding groundwater. None of the sample locations have activity concentrations exceeding the recommended 0.5 Bq/L gross alpha screening concentration trigger value set out in the Australian Drinking Water Guideline [7].

As per the commitment, Tronox is to continue with the monitoring periods for the gamma, water and radon and thoron until the regulators have provided amendment to the commitment.

7. References, Regulations, Codes

[1] Toussaint LF (1985) Radiation Protection in Australia 3(4) 151-55 Background Radiation in Western Australia.

[2] Radiological Council, “Radiation Safety Act,” 1975.

[3] Radiological Council, “Radiation Safety (General) Regulations,” 1983.

[4] Cristal Pigment, “Radiation Management Plan For Cristal Pigment Australia Limited, Dalyellup Waste Residue Disposal Facility, Post-Decommissioning and Rehabilitation, CRIS150130-RMP-V1.0,” January 2016.

[5] “Letter from Radiological Council to Peter Allen, Radiation Safety Act, Radiation Management Plan, 05390_160714ds1,” 2nd August 2016.

[6] International Electrotechnical Committee, “IEC 60846-1 Ed. 1.0, Radiation protection instrumentation - Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation Part 1: Portable workplace and environmental meters and monitors,” 2009.

8. Quality Assurance Programme

8.1. Quality Assurance

The results of this Site Visit will be managed in accordance with the requirements of Radiation Professionals Australia's Quality Assurance program. The aim of this program is to provide continual improvement of the radiation monitoring and assessment procedures. The quality of results obtained were evaluated using standardised documented procedures, calibrated equipment that is well maintained and qualified individuals.

8.2. Monitoring Equipment, Procedures and Methods

All sampling equipment and procedures used are as described in the DMIRS NORM guidelines or Radiation Professionals Australia Field procedures.

8.3. Calibration Records

All equipment is calibrated at least on an annual basis, or more often as required. Calibration certificates are retained by Radiation Professionals Australia and the relevant calibrations certificates accompany equipment to site.

8.4. Training and Experience of Personnel

Appropriately trained and experienced personnel are employed to undertake any measurements and surveys required.

The Radiation Safety Officer responsible for and overseeing the implementation of this Site Visit is certified as competent and holds a current license from the Radiological Council of WA.

9. Glossary

ALARA	As low as reasonably achievable, considering social and economic factors
Becquerel (Bq)	One atom decaying (disintegrating) per second
Contamination Level	An amount of radioactivity present in air, water or on surfaces, the presence of which is undesirable to the extent it could be harmful if uncontrolled or not guarded against
Controlled area	means an area to which access is subject to control and in which workers are required to follow specific procedures aimed at controlling exposure to radiation
Exposure	Exposure to radiation
Gamma ray or radiation	Gamma rays are electromagnetic energy, like x-rays, are very penetrating, and pass with some reduction in intensity through many centimetres of solids. Gamma exposure reduces with the inverse square of distance to the point source
Hazard	Anything with the potential to cause harm
mSv	Unit used to describe effective dose is the Sievert (Sv). Frequently used SI multiples are the milliSievert (1 mSv = 10−3 Sv = 0.001 Sv) and microSievert (1 µSv = 10−6 Sv = 0.000001 Sv)
Personal radiation dosimeters	Thermo-Luminescent Dosimeters, electronic dosimeters, Optical Stimulation Dosimeters, film badges, or quartz fibre electroscopes
PPE/RPE	Personal / Respiratory Protective Equipment
Radiation	means ionizing radiation, that is electromagnetic or corpuscular radiation capable of producing ions directly or indirectly in its passage through matter
Reasonably practicable	Whether risk management measures are reasonably practicable (as defined by Section 5 of the Workplace Health and Safety Act 2007) is to be decided regarding: • the likelihood that the risk could result in injury, • the seriousness of any injury that could result from realisation of the risk, • the availability, suitability, effectiveness and cost of the measures; and • any other relevant factors.
RMP	Radiation Management Plan
TLD	A thermoluminescent dosimeter used for measuring personal or positional gamma radiation dose over a known period

10. Appendices

10.1. Instrument Calibration Certificate

Australian Government | ANSTO

CALIBRATION REPORT

INSTRUMENT CALIBRATION FACILITY

REPORT No : CC201286	PO No: PO-0019	Serial No. 00513	DATE : 12/11/2020

Instrument : Dose rate meter	Make : THERMO	Model : RADEYE GX	MTE : 6002	Client : RADIATION PROFESSIONALS

Isotope	Exposure rate (T)	Instrument Readings µSv/h / mSv/h					Instrument Mean (I)	Response (I/T)			Stability %
Cs -137	11 µSv/h	10.3	10.4	10.0	10.3	10.1	10.22	0.93	+/-	0.09	99
	50 µSv/h	46.1	45.1	45.3	46.0	45.6	45.6	0.91	+/-	0.09	100
	100 µSv/h	88.8	89.7	88.0	87.5	89.3	88.7	0.89	+/-	0.09	100
	500 µSv/h	442	449	447	444	452	447	0.89	+/-	0.09	100
	1000 µSv/h	928	921	924	930	918	924	0.92	+/-	0.09	100

RECORDED BY : C.PERRY SIGNATURE: DATE : 12/11/2020

NOTE: Calibrated with probe MC71MHV Serial Number 19020

Exposure rates are traceable to the Australian standards of air kerma and exposure at a confidence level of 95%.

STATEMENT OF COMPLIANCE. CHECKED BY : M.GUSTAFSON SIGNATURE:

INSTRUMENT IS WITHIN MANUFACTURERS SPECIFICATIONS (+/-20%)

Calibration Equipment used : Calibration Facility, ANSTO Equipment No 172266

Australian Nuclear Science and Technology Organisation, New Illawarra Road, Lucas Heights, NSW
Postal Address: Locked Bag 2001, Kirrawee DC NSW 2232 Telephone: (02) 9717 3208
E-Mail: gill@ansto.gov.au or mgu@ansto.gov.au

10.2. Gamma Dose Rate Data

Point #	Location / Comment	Mean Count (cpm)	Absorbed Dose Rate (µGy/h)
1	**RP20 - Boundary**	99	0.14 ± 0.04
2	**RP19 - Boundary**	114	0.16 ± 0.04
3	**RP18 - Boundary**	106	0.15 ± 0.04
4	**Point A**	100	0.14 ± 0.04
5	**RP17 - Boundary**	104	0.14 ± 0.04
6	**RP16 - Boundary**	106	0.15 ± 0.04
7	**RP15 - Boundary**	107	0.15 ± 0.04
8	**RP14 - Boundary**	111	0.16 ± 0.04
9	**RP13 - Boundary**	99	0.14 ± 0.04
10	**RP12 - Boundary**	106	0.15 ± 0.04
11	**RP11 - Boundary**	105	0.15 ± 0.04
12	**RP10 - Boundary**	104	0.15 ± 0.04
13	**RP09 - Boundary**	100	0.14 ± 0.04
14	**RP08 - Boundary**	106	0.15 ± 0.04
15	**RP07 - Boundary**	108	0.15 ± 0.04
16	**RP06 - Boundary**	104	0.15 ± 0.04
17	**RP05 - Boundary**	103	0.14 ± 0.04
18	**RP04 - Boundary**	106	0.15 ± 0.04
19	**RP03 - Boundary**	105	0.15 ± 0.04
20	**RP02 - Boundary**	104	0.15 ± 0.04
21	**RP01 - Boundary**	105	0.15 ± 0.04
22	**Point B**	106	0.15 ± 0.04
23	**Point C**	106	0.15 ± 0.04
24	**Point D**	108	0.15 ± 0.04
25	**Point E**	104	0.15 ± 0.04
26	**Point F**	105	0.15 ± 0.04
27	**Point G**	104	0.14 ± 0.04
28	**Point H**	106	0.15 ± 0.04
29	**Point I**	105	0.15 ± 0.04
30	**Point J**	107	0.15 ± 0.04
31	**Point K**	110	0.15 ± 0.04
32	**Point L**	101	0.14 ± 0.04

33	**Point M**	105	0.15 ± 0.04
34	**Point N**	105	0.15 ± 0.04
35	**Point O**	103	0.14 ± 0.04
36	**Point P**	102	0.14 ± 0.04

Average	0.15 µGy/h
Minimum	0.14 µGy/h
Maximum	0.16 µGy/h
Median	0.15 µGy/h
Standard Dev	0.004 µGy/h

10.3 Radon and Thoron laboratory reports

radonova
The global leader in radon measurement

RADON/THORON MONITORING REPORT
Issued by an Accredited Laboratory

REPORT NUMBER 5821250:1
REPORT PAGE 2(2)
REPORT DATE 2021-02-25
PRINT DATE 2021-02-26

Test results

Detector	Start date	Stop date	Location	Detector comment	Avg Radon/Thoron conc. (Bq/m³)	Total Radon exp. (kBqh/m³)
730503-0 (R)	2020-10-22	2021-01-22	RM01		< 15	< 33
464116-3 (T)	2020-10-22	2021-01-22	RM01		< 30	< 66
381199-9 (R)	2020-10-22	2021-01-22	RM02		< 15	< 33
229860-2 (T)	2020-10-22	2021-01-22	RM02		< 30	< 66
801828-5 (R)	2020-10-22	2021-01-22	RM03		< 15	< 33
465619-5 (T)	2020-10-22	2021-01-22	RM03		< 30	< 66
678026-6 (R)	2020-10-22	2021-01-22	RM04		< 15	< 33
930329-8 (T)	2020-10-22	2021-01-22	RM04		< 30	< 66
602532-4 (R)	2020-10-22	2021-01-22	RM05		< 15	< 33
507046-1 (T)	2020-10-22	2021-01-22	RM05		< 30	< 66
416110-5 (R)	2020-10-22	2021-01-22	RM06		< 15	< 33
465062-8 (T)	2020-10-22	2021-01-22	RM06		< 30	< 66
605992-7 (R)	2020-10-22	2021-01-22	RM07		< 40	< 88
614484-4 (T)	2020-10-22	2021-01-22	RM07		< 30	< 66
691554-0 (R)	2020-10-22	2021-01-22	RM08		< 15	< 33
465464-6 (T)	2020-10-22	2021-01-22	RM08		< 30	< 66

AU_RT_TH_001 - V1.00 / 2017-06-05 - JO / LB

Comment to the results

Tryggve Rönnqvist (Electronically signed)
Signature Radonova Laboratories AB, Measurement Specialist

Radonova Inc.
900 Oakmont Lane Suite 207, Westmont IL 60559
Telephone: 331.814.2200 E-mail: help@radonova.com

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RADON/THORON MONITORING REPORT
Issued by an Accredited Laboratory

REPORT NUMBER 5757495:1 | REPORT PAGE 2(2)

REPORT DATE 2021-06-17 | PRINT DATE 2021-06-17

Test results

Detector	Start date	Stop date	Location	Detector comment	Avg Radon/Thoron conc. (Bq/m³)	Total Radon exp. (kBqh/m³)
336033-6 (R)	2021-01-22	2021-05-14	RM01		< 15	< 40
615897-6 (T)	2021-01-22	2021-05-14	RM01		< 30	< 80
620395-4 (R)	2021-01-22	2021-05-14	RM02		< 15	< 40
229868-5 (T)	2021-01-22	2021-05-14	RM02		< 30	< 80
391990-9 (R)	2021-01-22	2021-05-14	RM03		< 20	< 53
466208-6 (T)	2021-01-22	2021-05-14	RM03		70 ± 22	189 ± 62
363613-1 (R)	2021-01-22	2021-05-14	RM04		< 15	< 40
455813-6 (T)	2021-01-22	2021-05-14	RM04		< 30	< 80
594946-6 (R)	2021-01-22	2021-05-14	RM05		24 ± 10	64 ± 28
507244-2 (T)	2021-01-22	2021-05-14	RM05		< 30	< 80
276504-8 (R)	2021-01-22	2021-05-14	RM06		< 15	< 40
455721-1 (T)	2021-01-22	2021-05-14	RM06		< 30	< 80
670869-7 (R)	2021-01-22	2021-05-14	RM07		< 20	< 53
925926-8 (T)	2021-01-22	2021-05-14	RM07		< 30	< 80
962755-5 (R)	2021-01-22	2021-05-14	RM08		< 15	< 40
687102-4 (T)	2021-01-22	2021-05-14	RM08		< 30	< 80

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB, Measurement Specialist

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RADON/THORON MONITORING REPORT
Issued by an Accredited Laboratory

REPORT NUMBER 5917195:1
REPORT PAGE 2(2)
REPORT DATE 2021-09-23
PRINT DATE 2021-09-23

Test results

Detector	Start date	Stop date	Location	Detector comment	Avg Radon/Thoron conc. (Bq/m³)	Total Radon exp. (kBqh/m³)
683948-4 (R)	2021-05-14	2021-08-17	RM01		< 30	< 68
509114-5 (T)	2021-05-14	2021-08-17	RM01		< 30	< 68
649103-9 (R)	2021-05-14	2021-08-17	RM02		< 30	< 68
509536-9 (T)	2021-05-14	2021-08-17	RM02		< 30	< 68
577645-5 (R)	2021-05-14	2021-08-17	RM03		< 30	< 68
509881-9 (T)	2021-05-14	2021-08-17	RM03		< 30	< 68
285442-0 (R)	2021-05-14	2021-08-17	RM04		< 30	< 68
506746-7 (T)	2021-05-14	2021-08-17	RM04		< 30	< 68
246597-9 (R)	2021-05-14	2021-08-17	RM05		< 30	< 68
509734-0 (T)	2021-05-14	2021-08-17	RM05		43 ± 22	99 ± 54
522340-9 (R)	2021-05-14	2021-08-17	RM06		< 30	< 68
509782-9 (T)	2021-05-14	2021-08-17	RM06		< 30	< 68
370681-9 (R)	2021-05-14	2021-08-17	RM07		< 30	< 68
509735-7 (T)	2021-05-14	2021-08-17	RM07		< 30	< 68
909659-5 (R)	2021-05-14	2021-08-17	RM08		< 30	< 68
507945-4 (T)	2021-05-14	2021-08-17	RM08		< 30	< 68

AU_RT_TH_001 : V1.00 / 2017-06-07. / JO / LB

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB, Measurement Specialist

Radonova Inc.
900 Oakmont Lane Suite 207, Westmont IL 60559
Telephone: 331.814.2200 E-mail: help@radonova.com

SGS

ANALYTICAL REPORT

ilac-MRA

NATA

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Andre Stass	Manager	Adam Atkinson
Client	TRONOX PIGMENT BUNBURY	Laboratory	SGS Melbourne EH&S
Address	LOCKED BAG 245 BUNBURY WA 6230	Address	10/585 Blackburn Road Notting Hill Victoria 3168
Telephone	0428 945 476	Telephone	+61395743200
Facsimile	61 8 94111275	Facsimile	+61395743399
Email	andre@stass.com.au	Email	Au.SampleReceipt.Melbourne@sgs.com
Project	Dalyellup October 2020	SGS Reference	ME316936 R0
Order Number	4601138137	Date Received	15/10/2020
Samples	13	Date Reported	7/1/2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(22793).

SIGNATORIES

S. Rutkowski

Stephen RUTKOWSKI
Senior Health Physicist

SGS

ANALYTICAL RESULTS ME316936 R0

Radionuclides by Gamma Ray Spectrometry in liquids [ARS-SOP-AS301/AS406] Tested: 23/12/2020

PARAMETER	UOM	LOR	DM 1A WATER - 14/10/2020 ME316936.001	DM 1C WATER - 14/10/2020 ME316936.002	MB 3 WATER - 14/10/2020 ME316936.003	DM 2A WATER - 14/10/2020 ME316936.004	DM 2C WATER - 14/10/2020 ME316936.005
Radium-226	Bq/L	-	<0.057	<0.062	<0.055	<0.079	<0.056
Radium-228	Bq/L	-	<0.160	<0.093	<0.200	<0.160	<0.160

PARAMETER	UOM	LOR	DM 8CD WATER - 14/10/2020 ME316936.006	DM 7A WATER - 14/10/2020 ME316936.007	DM 7C WATER - 14/10/2020 ME316936.008	DM 8A WATER - 14/10/2020 ME316936.009	DM 8C WATER - 14/10/2020 ME316936.010
Radium-226	Bq/L	-	<0.069	<0.041	<0.047	0.026 ±0.015	<0.067
Radium-228	Bq/L	-	<0.190	<0.140	<0.120	<0.150	0.097 ±0.037

PARAMETER	UOM	LOR	YB WATER - 14/10/2020 ME316936.011	DM 8A WATER - 14/10/2020 ME316936.012	DM 9C WATER - 14/10/2020 ME316936.013
Radium-226	Bq/L	-	0.064 ±0.017	0.193 ±0.028	<0.051
Radium-228	Bq/L	-	<0.150	0.174 ±0.044	0.068 ±0.034

7/01/2021 Page 2 of 3

SGS

METHOD SUMMARY

ME316936 R0

METHOD	METHODOLOGY SUMMARY
ARS-SOP-AS301/AS406	Analysis of radionuclides in liquids by high resolution gamma ray spectrometry after radiochemical preparation. Radiochemical preparation involves total sample evaporation, sample co-precipitation using stable elemental carriers, or a combination thereof. In some cases, preparation may involve merely transferring liquid to a standard geometry container such as a Marinelli beaker.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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7/01/2021 Page 3 of 3

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ANALYTICAL REPORT

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NATA

Accreditation No. 2562

CLIENT DETAILS

Contact	Andre Steee
Client	TRONOX PIGMENT BUNBURY
Address	LOCKED BAG 245 BUNBURY WA 6230
Telephone	0425 845 476
Facsimile	61 8 94111275
Email	andre@steee.com.au
Project	Dalyellup January 2021
Order Number	4501152748
Samples	2

LABORATORY DETAILS

Manager	Adam Aldhaon
Laboratory	SGS Melbourne EH&S
Address	10/585 Blackburn Road Notting Hill Victoria 3168
Telephone	+61395743200
Facsimile	+61395743399
Email	Au.SampleReceipt.Melbourne@sgs.com
SGS Reference	ME318537 R0
Date Received	25/1/2021
Date Reported	16/4/2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(22793).

SIGNATORIES

Sara SHOYOOKHI
Physicist

SGS

ANALYTICAL RESULTS ME318537 R0

Radionuclides by Gamma Ray Spectrometry in liquids [ARS-SOP-AS301/AS426] Tested: 14/4/2021

PARAMETER	UOM	LOR	DM 40	YB
Radium-226	Bq/L	-	0.084 ±0.045	0.071 ±0.037
Radium-228	Bq/L	-	<0.18	<0.18

16/04/2021 Page 1 of 3

SGS

METHOD SUMMARY ME318537 R0

METHOD	METHODOLOGY SUMMARY
ARS-SOP-AS301/AS406	Analysis of radionuclides in liquids by high resolution gamma ray spectrometry after radiochemical preparation. Radiochemical preparation involves total sample evaporation, sample co-precipitation using stable elemental carriers, or a combination thereof. In some cases, preparation may involve merely transferring liquid to a standard geometry container such as a Marinelli beaker.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
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For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety

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18/04/2021 Page 3 of 3

Find (1/1)
uncertainty
Previous

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2106387	Page	: 1 of 7
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 08-Jun-2021 13:45
Order number	: EP/894/21	Date Analysis Commenced	: 09-Jun-2021
C-O-C number	: 23784	Issue Date	: 25-Jun-2021 09:13
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 6		
No. of samples analysed	: 6		

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Accreditation No. 825
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

RIGHT SOLUTIONS | RIGHT PARTNER

Find (1/1)
uncertainty
Previous

Page : 2 of 7
Work Order : EP2106387
Client : Tronox Pigment Bunbury
Project : W_Tronox_Quarterly GME

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In [illegible] are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ORC metals conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EK058G/EK059G: Nitrate and NOx results for EP2106387 #5 and #6 have been confirmed by re-preparation and re-analysis.
- EG035: Positive Hg result EP2106387 #4 has been confirmed by reanalysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Find (1/1)

uncertainty

Previous

Page : 4 of 7
Work Order : EP2106387
Client : Tronox Pigment Bunbury
Project : W_Tronox_Quarterly GME

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	KM7	KM22	DM1C(R)	PB7B	
				Sampling date / time	07-Jun-2021 17:04	07-Jun-2021 17:04	08-Jun-2021 06:50	08-Jun-2021 06:53	08-Jun-2021 06:54
Compound	CAS Number	LOR	Unit		EP2106387-002	EP2106387-003	EP2106387-004	EP2106387-005	EP2106387-006
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Cadmium	7440-43-9	0.05	µg/L		<0.05	<0.05	<0.05	—	—
Chromium	7440-47-3	0.2	µg/L		1.4	0.8	1.6	—	—
Cobalt	7440-48-4	0.1	µg/L		—	—	0.6	—	—
Copper	7440-50-8	0.5	µg/L		0.6	<0.5	2.9	—	—
Iron	7439-89-6	2	µg/L		199	120	240	72	84
Lead	7439-92-1	0.1	µg/L		0.1	<0.1	0.3	—	—
Manganese	7439-96-5	0.5	µg/L		11.2	8.8	282	—	—
Molybdenum	7439-98-7	0.1	µg/L		—	—	1.1	—	—
Nickel	7440-02-0	0.5	µg/L		0.9	<0.5	3.3	—	—
Selenium	7782-49-2	0.2	µg/L		<0.2	<0.2	—	—	—
Thorium	7440-29-1	0.1	µg/L		—	—	<0.1	—	—
Uranium	7440-61-1	0.05	µg/L		—	—	0.88	—	—
Vanadium	7440-62-2	0.2	µg/L		1.5	1.4	1.8	—	—
Zinc	7440-66-6	1	µg/L		6	1	—	—	—
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		—	—	<0.01	—	—
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		—	—	1.73	—	—
Nitrate as NO3	14797-55-8	0.01	mg/L		0.22	0.04	—	0.09	0.49
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		—	—	1.73	—	—
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		2.87	3.08	30.2	—	—
ø Total Cations	----	0.01	meq/L		2.89	2.99	25.8	—	—
ø Ionic Balance	----	0.01	%		0.34	1.44	7.92	—	—
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		—	—	0.03	—	—
Radium 228	7440-14-4	0.08	Bq/L		—	—	<0.08	—	—

Find (1/1)

uncertainty

Previous

Page : 7 of 7
Work Order : EP2106387
Client : Tronox Pigment Bunbury
Project : W_Tronox_Quarterly GME

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.
(WATER) EA251CA: Radium 226 and Radium 228 Activity
Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).
(WATER) EG035T: Total Mercury by FIMS
(WATER) EG035F: Dissolved Mercury by FIMS

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2106551	Page	: 1 of 4
Amendment	: 1		
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021 10:00
Order number	: EP/894/21	Date Analysis Commenced	: 10-Jun-2021
C-O-C number	: 23835	Issue Date	: 24-Jun-2021 16:35
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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Signatories

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Signatories	Position	Accreditation Category
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Page : 4 of 4
Work Order : EP2106551 Amendment 1
Client : Tronox Pigment Bunbury
Project : W_Tronox_Quarterly GME

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM2C	DM2A	DM8C(R)	DM8A	R18
				Sampling date / time	08-Jun-2021 09:50	08-Jun-2021 10:18	08-Jun-2021 11:41	08-Jun-2021 12:58	09-Jun-2021 07:29
Compound	CAS Number	LOR	Unit		EP2106551-001	EP2106551-002	EP2106551-003	EP2106551-004	EP2106551-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		0.9	1.0	0.8	0.7	<0.5
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		1.54	1.06	0.33	0.26	<0.05
Vanadium	7440-62-2	0.2	µg/L		15.8	1.4	0.5	<0.2	<0.2
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.02	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		5.25	1.08	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		5.25	1.10	<0.01	<0.01	<0.01
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		46.9	38.3	95.5	99.3	<0.01
ø Total Cations	----	0.01	meq/L		48.0	39.1	95.6	97.1	<0.01
ø Ionic Balance	----	0.01	%		---	---	---	---	<0.01
ø Ionic Balance	----	0.01	%		1.18	1.00	0.04	1.10	---
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.01	0.01	0.03	0.01	<0.01
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	<0.08

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.
(WATER) EA251CA: Radium 228 and Radium 228 Activity
Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).
(WATER) EG035F: Dissolved Mercury by FIMS

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2106586	Page	: 1 of 6
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021 17:05
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 23906	Issue Date	: 24-Jun-2021 19:25
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	DM4C	---	---	---
				Sampling date / time	09-Jun-2021 10:10	09-Jun-2021 14:27	---	---	---
Compound	CAS Number	LOR	Unit		EP2106586-001	EP2106586-002	----	----	----
					Result	Result	---	---	---
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		---	<0.1	---	---	---
Manganese	7439-96-5	0.5	µg/L		---	120	---	---	---
Molybdenum	7439-98-7	0.1	µg/L		---	3.4	---	---	---
Nickel	7440-02-0	0.5	µg/L		---	<0.5	---	---	---
Thorium	7440-29-1	0.1	µg/L		---	<0.1	---	---	---
Uranium	7440-61-1	0.05	µg/L		---	<0.05	---	---	---
Vanadium	7440-62-2	0.2	µg/L		---	<0.2	---	---	---
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		---	<0.01	---	---	---
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		---	<0.01	---	---	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		---	<0.01	---	---	---
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		---	86.9	---	---	---
ø Total Cations	---	0.01	meq/L		---	85.5	---	---	---
ø Ionic Balance	---	0.01	%		---	0.82	---	---	---
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.02	0.02	---	---	---
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	---	---	---

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2106657	Page	: 1 of 4
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 11-Jun-2021 17:45
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 24037	Issue Date	: 25-Jun-2021 15:49
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM1A	DM7A(R)	DM9C(R)	DM9A(R)	DM7C(R)
				Sampling date / time	11-Jun-2021 08:53	11-Jun-2021 10:38	10-Jun-2021 04:15	10-Jun-2021 06:20	11-Jun-2021 12:37
Compound	CAS Number	LOR	Unit		EP2106657-001	EP2106657-002	EP2106657-003	EP2106657-004	EP2106657-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		1.1	0.7	1.4	<0.5	2.4
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		1.01	<0.05	<0.05	0.47	0.77
Vanadium	7440-62-2	0.2	µg/L		1.0	0.5	<0.2	1.2	4.0
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.02	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		1.96	0.16	0.02	1.83	0.78
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		1.96	0.18	0.02	1.83	0.78
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		29.5	15.0	11.4	13.8	12.4
ø Total Cations	---	0.01	meq/L		29.8	14.7	10.7	14.8	13.0
ø Ionic Balance	---	0.01	%		0.44	0.80	3.20	3.53	2.29
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		<0.01	<0.01	0.14	<0.01	0.02
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	0.08	<0.08	<0.08

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.
(WATER) EA251CA: Radium 226 and Radium 228 Activity
Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).
(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2109249	Page	: 1 of 6
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 13-Aug-2021 15:15
Order number	: 30086132	Date Analysis Commenced	: 13-Aug-2021
C-O-C number	: 26241	Issue Date	: 30-Aug-2021 12:32
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/894/20_V7		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	SQC1	MB3	—	—
				Sampling date / time	12-Aug-2021 10:57	12-Aug-2021 10:58	12-Aug-2021 14:06	—	—
Compound	CAS Number	LOR	Unit		EP2109249-001	EP2109249-002	EP2109249-003	——	——
					Result	Result	Result	—	—
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		—	—	<0.1	—	—
Manganese	7439-96-5	0.5	µg/L		—	—	2.2	—	—
Molybdenum	7439-98-7	0.1	µg/L		—	—	1.3	—	—
Nickel	7440-02-0	0.5	µg/L		—	—	0.7	—	—
Thorium	7440-29-1	0.1	µg/L		—	—	<0.1	—	—
Uranium	7440-61-1	0.05	µg/L		—	—	1.28	—	—
Vanadium	7440-62-2	0.2	µg/L		—	—	1.1	—	—
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		—	—	<0.01	—	—
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		—	—	7.05	—	—
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	——	0.01	mg/L		—	—	7.05	—	—
EN055: Ionic Balance									
ø Total Anions	——	0.01	meq/L		—	—	11.6	—	—
ø Total Cations	——	0.01	meq/L		—	—	12.6	—	—
ø Ionic Balance	——	0.01	%		—	—	4.40	—	—
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.02	0.03	<0.01	—	—
Radium 228	7440-14-4	0.05	Bq/L		<0.05	<0.05	<0.05	—	—

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2112485	Page	: 1 of 6
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021 10:20
Order number	: 30006132	Date Analysis Commenced	: 20-Oct-2021
C-O-C number	: 28901	Issue Date	: 29-Oct-2021 16:34
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/694/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM4C	DM4A	DM7C	DM7A	---
				Sampling date / time	18-Oct-2021 12:49	18-Oct-2021 12:55	18-Oct-2021 15:33	18-Oct-2021 15:36	---
Compound	CAS Number	LOR	Unit		EP2112485-001	EP2112485-002	EP2112485-003	EP2112485-004	-----
					Result	Result	Result	Result	---
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		<0.5	3.0	0.6	<0.5	---
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	---
Uranium	7440-61-1	0.05	µg/L		<0.05	<0.05	0.75	<0.05	---
Vanadium	7440-62-2	0.2	µg/L		<0.2	<0.2	3.4	0.4	---
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	0.01	<0.01	---
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.02	0.01	1.02	0.50	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		0.02	0.01	1.03	0.50	---
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		72.7	60.9	14.5	15.0	---
ø Total Cations	---	0.01	meq/L		80.9	67.5	14.5	14.6	---
ø Ionic Balance	---	0.01	%		5.30	5.12	0.08	1.40	---
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.03	0.03	<0.01	0.01	---
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	---

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2112534	Page	: 1 of 6
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021 10:25
Order number	: 30086132	Date Analysis Commenced	: 21-Oct-2021
C-O-C number	: 28953	Issue Date	: 29-Oct-2021 17:49
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 2		
Quote number	: EP/894/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Signatories

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Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

RIGHT SOLUTIONS | RIGHT PARTNER

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM8C(R)	SQC1	DM8A	DM2C	---
				Sampling date / time	19-Oct-2021 10:20	19-Oct-2021 10:25	19-Oct-2021 12:20	19-Oct-2021 14:28	---
Compound	CAS Number	LOR	Unit		EP2112534-001	EP2112534-002	EP2112534-003	EP2112534-004	------
					Result	Result	Result	Result	---
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		0.8	0.7	<0.5	<0.5	---
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	---
Uranium	7440-61-1	0.05	µg/L		0.79	0.77	0.08	1.90	---
Vanadium	7440-62-2	0.2	µg/L		0.5	0.5	<0.2	4.3	---
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.02	0.01	---
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.02	0.01	<0.02	2.61	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		0.02	0.01	0.01	2.62	---
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		69.2	80.0	90.0	46.9	---
ø Total Cations	---	0.01	meq/L		80.8	81.1	92.7	51.4	---
ø Ionic Balance	---	0.01	%		7.77	0.67	1.47	4.56	---
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.02	0.03	0.02	0.01	---
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	---

Radiation Professionals Australia

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2112613	Page	: 1 of 6
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021 11:25
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29040	Issue Date	: 03-Nov-2021 13:35
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 3		
Quote number	: EP/894/20_V7		
No. of samples received	: 3		
No. of samples analysed	: 3		

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Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	DM2A	---	---	---
				Sampling date / time	20-Oct-2021 16:24	20-Oct-2021 17:45	---	---	---
Compound	CAS Number	LOR	Unit		EP2112613-001	EP2112613-002	———	———	———
					Result	Result	---	---	---
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		---	<0.1	---	---	---
Manganese	7439-96-5	0.5	µg/L		---	5.0	---	---	---
Molybdenum	7439-98-7	0.1	µg/L		---	3.0	---	---	---
Nickel	7440-02-0	0.5	µg/L		---	0.7	---	---	---
Thorium	7440-29-1	0.1	µg/L		---	<0.1	---	---	---
Uranium	7440-61-1	0.05	µg/L		---	0.91	---	---	---
Vanadium	7440-62-2	0.2	µg/L		---	1.4	---	---	---
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		---	0.03	---	---	---
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		---	2.37	---	---	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		---	2.40	---	---	---
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		---	41.0	---	---	---
ø Total Cations	---	0.01	meq/L		---	43.3	---	---	---
ø Ionic Balance	---	0.01	%		---	2.72	---	---	---
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.03	0.01	---	---	---
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	---	---	---

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP2112719	Page	: 1 of 8
Client	: Tronox Pigment Bunbury	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021 17:05
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29069	Issue Date	: 03-Nov-2021 13:34
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 4		
Quote number	: EP/694/20_V7		
No. of samples received	: 7		
No. of samples analysed	: 7		

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Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

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Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM9C	DM9A	DM1A(R)	DM1C(R)	MB3
				Sampling date / time	21-Oct-2021 09:21	21-Oct-2021 10:27	21-Oct-2021 11:54	21-Oct-2021 11:54	21-Oct-2021 15:01
Compound	CAS Number	LOR	Unit		EP2112719-001	EP2112719-002	EP2112719-003	EP2112719-004	EP2112719-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		8.6	1.4	1.3	0.9	<0.5
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		<0.05	0.38	0.89	<0.05	1.50
Vanadium	7440-62-2	0.2	µg/L		<0.2	1.1	1.0	<0.2	1.1
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.34	1.25	2.17	0.17	6.25
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L		0.34	1.25	2.17	0.17	6.25
EN055: Ionic Balance									
ø Total Anions	---	0.01	meq/L		10.1	14.1	29.8	15.2	13.0
ø Total Cations	---	0.01	meq/L		9.88	14.3	30.9	14.9	13.5
ø Ionic Balance	---	0.01	%		1.23	0.84	1.88	1.02	1.80
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		0.08	<0.01	<0.01	0.01	<0.01
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	<0.08

Photos

Figure 4: Photo rehabilitated area looking south location A

Figure 5: Photo fence line location 7

Figure 6: Photo survey carried out Location M

Appendix G
Site Management Plan (GHD 2019)

Tronox Pigment Bunbury Ltd

Former Dalyellup Waste Residue Facility

October 2019

Executive summary

Tronox Pigment Bunbury Ltd (Tronox) engaged GHD Pty Ltd (GHD) to prepare a Site Management Plan (SMP) for the decommissioned Dalyellup Waste Residue Disposal Facility (DWRF). The DWRF is located at Lot 9077 on Deposited Plan 60716 and part Lot 9090 on deposited plan 69838 (the 'Site'), Maidment Parade, Dalyellup, Western Australia (Figure 1, Appendix A). The Site currently comprises a vacant lot with a sandy area to the centre and north of the Site, and endemic bushland apparent to the south and west of the Site. The intended future use of the Site is endemic bushland.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.6 and the assumptions and qualifications contained throughout the report.

Background

The Site formerly operated as a licensed facility from 1989 to 2013 comprising a number of historic waste disposal pond areas for the disposal of Treated Solid Residue (TSR) from the production of titanium dioxide pigment. Partial remediation was undertaken in 2001 (capping of southern ponds with two metres of coastal sand and subsequent revegetation). The Site was reported to DWER in September 2009 as per reporting obligations under Section 11 of the *'Contaminated Sites Act 2003'* (the Act) due to the presence of treated solid residue (TSR) associated with the historic waste disposal pond areas.

In 2013, a Closure Notice was issue by the Department of Water and Environment Regulation (DWER) and remediation of central and northern ponds was undertaken in 2013 (capping with a minimum of two metres of clean fill material sourced from the Site). A Closure Plan was prepared to satisfy the conditions of Ministerial Statements (Condition 4 of Ministerial Statement 213 and Condition 4-1 of Ministerial Statement 332).

As part of licence requirements, monitoring of radiation, soil and groundwater has been undertaken at the Site since the early 1990s. Other investigations and risk assessments have been undertaken at the Site since 2001.

Assessments have identified that:

- The TSR is generating saline leachate with a salt plume migrating from the Site. However, there is no evidence of an adverse impact to the relevant receptor (the marine environment).
- Potential for sustained discharge of metals (chromium and vanadium) at concentrations above relevant ecological assessment criteria is considered very low.
- Concentrations of contaminants of potential concern within capping material were below relevant Health Investigation Levels (HIL) for public open space.
- Concentrations of metals in capping material exceeded relevant Ecological Investigation Levels (EIL). However, the likelihood of these metals entering into the marine environment at elevated concentrations was low.

Concentrations of gamma radiation (from post-remediation monitoring of the capping layer) are unlikely to pose a risk to human health. Mr Jason Clay of Senversa Pty Ltd, is the appointed DWER accredited contaminated sites auditor for this project. The Auditor reviewed assessments undertaken and submitted a Mandatory Auditors Report (MAR) to DWER in October 2013 in relation to the Closure Plan. The conditions of Ministerial Statements 213 and 332 were cleared by the Environmental Protection Authority in April 2015. The Auditor prepared

a subsequent MAR in 2015 at completion of remediation and validation works to assess the suitability of the Site for intended future use as endemic regional bushland.

The MAR was accepted by the Department of Health (DoH), the Radiological Council and the DWER subject to numerous restrictions placed on site use, including the development of a site management plan (SMP). On this basis, DWER, in consultation with DoH, classified the Site under the *Contaminated Sites Act 2003* (CS Act) as 'remediated for restricted use' in February 2018, with land use of the Site restricted to endemic bushland.

The Radiation Management Plan (RMP), approved by the Radiological Council of Western Australia (Radiological Council), was prepared separately by Radiation Professionals (2016) for Tronox[1] to: *"describe the organisational arrangements and procedures that are to be implemented for the purposes of controlling exposure to ionising radiation post decommissioning and rehabilitation of the Dalyellup Waste Residue Disposal Facility" Radiation Professionals (2016)*. The RMP was considered by the Radiological Council in January 2016 and no objection was raised. The Radiological Council note that this RMP is to be implemented on an ongoing basis.

A SMP was prepared for the Site in 2015. The resulting MAR and associated endorsed documentation (including the SMP), were submitted by the Contaminated Site Auditor to DWER in January 2018. In relation to this, DWER identified requirements for further consideration in the SMP (DWER reference DMO 1323, May 2019) such that the document would be suitable to identify ongoing management requirements at the Site.

In September 2019, the Radiological Council provided feedback on the Closure Plan (version 3, July 2018) for the Site. This feedback noted that no objections were raised to the plan with respect to aspects covering radiation safety and management. There was also a response provided by the Radiological Council to advice from DWER regarding the use of ground penetrating radar or surveys to monitor the subsidence of land as the TSR layer compacts to ensure 2 m of fill is maintained. This feedback from the Radiological Council noted:

- Two metres of fill was initially enforced by the Radiological Council as it reflected the requirements of the original relevant Australian code of practice. Tronox has provided information in the Final Closure Plan that demonstrates that 0.5 m of capping over the disposal ponds would be sufficient to attenuate the radiological parameters to background levels, however, a higher thickness of fill should be included in the rehabilitation design to account for future intrusion and erosion scenarios. Tronox have also noted that bringing in more fill to compensate for minimum layer may destroy the rehabilitation process.
- In consideration of this, two metres of capping should be applied at the time of rehabilitation, however, if subsidence due to compaction after the initial rehabilitation no additional fill is required.

Purpose and objectives of the SMP

The purpose of this SMP is to document the overall management framework for the Site to address residual risks potential human and ecological risks associated with the ongoing intended use of the Site as endemic bushland. This SMP also addresses requirements identified by DWER (2019). The objectives of the SMP are therefore to:

- Demonstrate that:
  - Residual risks to on-site and off-site ecological and human health receptors remain acceptable.

[1] Formerly Cristal Pigment Australia Ltd.

  - Remediation and rehabilitation of the Site has been successful in returning the former waste residue disposal facility to its intended end use as endemic bushland.
- Provide management strategies to ensure the ongoing compliance with restrictions on use imposed through the Site's classification under the CS Act. This includes detailed specifications for each management strategy action triggered by specific activities anticipated to occur at the Site.
- Ensure that periodic review of the management strategies is undertaken at an appropriate interval to address any change to site conditions or regulations (review every 12 months).

To support the above, the RMP (prepared separately by Radiation Professionals, 2016) is included in this SMP at Appendix B.

GHD considers that appropriate implementation of the management procedures outlined in this SMP will be sufficient to mitigate residual risks posed to relevant on-site and off-site receptors and render the Site suitable for ongoing use as endemic bushland. The SMP remains valid until such time that DWER considers ongoing management measures are no longer required to mitigate the potential risk to human health and/or the environment associated with Site conditions.

Should Tronox wish to use the Site for an alternative land use then further assessment would be required. Subject to outcomes of such assessment, further remedial action may be required for an alternative land use.

Table of contents

Table Index

Figure Index

Appendices

1. Introduction

Tronox Pigment Bunbury Ltd (Tronox) engaged GHD Pty Ltd (GHD) to prepare a Site Management Plan (SMP) for the decommissioned Dalyellup Waste Residue Disposal Facility (DWRF). The DWRF is located at Lot 9077 on Deposited Plan 60716 and part Lot 9090 on deposited plan 69838 (the Site), Maidment Parade, Dalyellup, Western Australia (Figure 1, Appendix A). The intended future use of the Site is endemic bushland.

1.1 Background

The Site formerly operated as a licensed facility from 1989 to 2013 comprising a number of historic waste disposal pond areas for the disposal of Treated Solid Residue (TSR) from the production of titanium dioxide pigment. Partial remediation was undertaken in 2001 (capping of southern ponds with two metres of coastal sand and subsequent revegetation). The Site was reported to DWER in September 2009 as per reporting obligations under Section 11 of the *'Contaminated Sites Act 2003'* (the Act) due to the presence of treated solid residue (TSR) associated with the historic waste disposal pond areas.

In 2013, a Closure Notice was issue by the Department of Water and Environment Regulation (DWER) and remediation of central and northern ponds was undertaken in 2013 (capping with a minimum of two metres of clean fill material sourced from the Site). A Closure Plan was prepared to satisfy the conditions of Ministerial Statements (Condition 4 of Ministerial Statement 213 and Condition 4-1 of Ministerial Statement 332). As part of licence requirements, monitoring of radiation, soil and groundwater has been undertaken at the Site since the early 1990s. Other investigations and risk assessments have been undertaken at the Site since 2001. Following the DWER closure notice, the following assessments were undertaken by GHD:

- GHD Pty Ltd (2013) *Dalyellup Facility – Rehabilitation Sand Stockpile Characterisation Program, Sampling and Analysis Plan – Area 4, Area 5 and Eastern Turning Circle, August 2013* (GHD 2013)*;*
- GHD Pty Ltd (2014) *Dalyellup Facility – Rehabilitation Sand Stockpile Characterisation Program, Sampling and Analysis Plan – Central Tailings Pond, January 2014* (GHD, 2014);
- GHD Pty Ltd (2014) *Dalyellup Waste Residue Disposal Facility, Eastern Turning Circle Validation, January 2014* (GHD, 2014a);
- GHD Pty Ltd (2015) *Dalyellup Facility – Rehabilitation Sand Stockpile Characterisation Program Validation – Central Tailings Pond, Area 4, Area5_Rev 2* (GHD, 2015);
- GHD Pty Ltd (2015) *Dalyellup Waste Residue Disposal Facility – Minninup Road, Dalyellup, Western Australia, Hydrogeological Assessment* (GHD, 2015a);
- GHD Pty Ltd (2015) *Environmental Management Plan, Lot 9077 on Deposited Plan 60716, Dalyellup (Rev 2)* (GHD, 2015b).

Assessments have identified that:

- The TSR is generating saline leachate with a salt plume migrating from the Site. However there is no evidence of an adverse impact to the relevant receptor (the marine environment).
- Potential for sustained discharge of metals (chromium and vanadium) at concentrations above relevant ecological assessment criteria is considered very low.
- Concentrations of contaminants of potential concern within capping material were below relevant Health Investigation Levels (HIL) for public open space.

- Concentrations of metals in capping material exceeded relevant Ecological Investigation Levels (EIL). However, the likelihood of these metals entering into the marine environment at elevated concentrations was low.

A radiation management plan (RMP), approved by the Radiological Council of Western Australia (RCWA), has also been produced for the Site and is provided in this report as Appendix B (Radiation Professionals, 2016). The RMP reported that the concentrations of gamma radiation (from post-remediation monitoring of the capping layer) are unlikely to pose a risk to human health.

Mr Jason Clay of Senversa Pty Ltd, is the appointed DWER accredited contaminated sites auditor for this project. The Auditor reviewed assessments undertaken and submitted a Mandatory Auditors Report (MAR) to DWER in October 2013 in relation to the Closure Plan. The conditions of Ministerial Statements 213 and 332 were cleared by the Environmental Protection Authority in April 2015. The Auditor prepared a subsequent MAR in 2015 at completion of remediation and validation works to assess the suitability of the Site for intended future use as endemic regional bushland.

The MAR was accepted by the Department of Health (DoH), the Radiological Council and the DWER subject to numerous restrictions placed on Site use, including the development of a site management plan (SMP). On this basis, DWER, in consultation with DoH, classified the Site under the *Contaminated Sites Act 2003* (CS Act) as 'remediated for restricted use' in February 2018 with land use of the Site restricted to endemic bushland.

A Radiation Management Plan (RMP) was prepared separately (by Radiation Professionals, 2016) for Tronox[2] to: *"describe the organisational arrangements and procedures that are to be implemented for the purposes of controlling exposure to ionising radiation post decommissioning and rehabilitation of the Dalyellup Waste Residue Disposal Facility" Radiation Professionals (2016)*. The RMP includes (but is not limited to):

- Ongoing routine radiation monitoring as detailed in the RMP (Appendix B) to support declassification of the Site (i.e. relinquishing the Registration under the Radiation Safety Act WA).
- A requirement for assessment and planning of any penetration works (i.e. works that are required to penetrate the soil cap) prior to any work being performed.

The RMP was considered by the Government of Western Australia Radiological Council in January 2016 and no objection was raised. As identified in the RMP, the Radiological Council has advised that the RMP is to be implemented on an ongoing basis.

A SMP was prepared for the Site in 2015. The resulting MAR and associated endorsed documentation (including the SMP), were submitted by the Contaminated Site Auditor to DWER in January 2018. In relation to this, DWER identified requirements for further consideration in the SMP (DWER reference DMO 1323, May 2019) such that this would be suitable for ongoing site management of the Site.

In September 2019, the Radiological Council provided feedback on the Closure Plan (version 3, July 2018) for the Site. This feedback noted that no objections were raised to the plan with respect to aspects covering radiation safety and management. This correspondence by the Radiological Council also responded to advice from DWER, regarding the use of ground penetrating radar or surveys to monitor the subsidence of land as the TSR layer compacts to ensure 2 m of fill is maintained. This feedback from the Radiological Council noted:

- Two metres of fill was initially enforced by the Radiological Council as it reflected the requirements of the original relevant Australian code of practice. Tronox has provided

[2] Formerly Cristal Pigment Australia Ltd.

information in the Final Closure Plan that demonstrates that 0.5 m of capping over the disposal ponds would be sufficient to attenuate the radiological parameters to background levels, however, a higher thickness of fill should be included in the rehabilitation design to account for future intrusion and erosion scenarios. Tronox have also noted that bringing in more fill to compensate for minimum layer may destroy the rehabilitation process.

- In consideration of this, two metres of capping should be applied at the time of rehabilitation, however, if subsidence due to compaction after the initial rehabilitation no additional fill is required.

This correspondence from the Radiological Council has been provided in Appendix C of this report.

1.2 Purpose

The purpose of this SMP is to document the overall management framework for the Site to address residual risks potential human and ecological risks associated with the ongoing future use of the Site as endemic bushland.

1.3 Objectives

The objectives of the SMP are therefore to:

- Demonstrate that:
  - Residual risks to on-site and off-site ecological and human health receptors remain acceptable.
  - Remediation and rehabilitation of the Site has been successful in returning the former waste residue disposal facility to its intended end use as endemic bushland and meets the completion criteria leading to relinquishment of the Site.
- Provide management strategies to ensure the ongoing compliance with restrictions on use imposed through the Site's classification under the CS Act. This includes detailed specifications for each management strategy action triggered by specific activities anticipated to occur at the Site.
- Ensure that periodic review of the management strategies is undertaken at an appropriate interval to address any change to site conditions or regulations (review every 12 months).

To support the above, the RMP (prepared separately by Radiation Professionals, 2016) is included in this SMP at Appendix B for ease of reference.

GHD considers that appropriate implementation of the management procedures outlined in this SMP will be sufficient to mitigate residual risks posed to relevant on-site and off-site receptors and render the Site suitable for ongoing use as endemic bushland. The SMP remains valid until such time that DWER considers ongoing management measures are no longer required to mitigate the potential risk to human health and/or the environment associated with Site conditions.

Should Tronox wish to use the Site for an alternative land use then further assessment would be required. Subject to outcomes of such assessment, further remedial action may be required for an alternative use.

1.4 Guidance documents

This SMP was prepared with reference to the following guidelines and related documents:

- Assessment of Site Contamination National Environment Protection Council (ASC NEPM) (2013), *National Environment Protection (Assessment of Site Contamination) Measure, Amendment Measure 2013 (No. 1).*
- Australian Standard (AS) (1987), *Ambient Air – Guide for Measurement of Horizontal Wind for Air Quality Applications* (AS 2923 – 1987).
- AS (1998a), *Water Quality – Sampling, Part 1: Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples* (AS 5667.1:1998).
- AS (1998b), Water Quality – *Sampling, Part 11: Guidance on the Sampling of Groundwater* (AS 5667.11:1998).
- Australian Standard/New Zealand Standard (AS/NZS) (2003), *Methods for sampling and analysis of ambient air: Method 9.3. Determination of suspended particulate matter – Total suspended particulate matter (TSP High volume sampler gravimetric method)* (AS/NZS 3580.9.3: 2003).
- AS/NZS (2003), *Methods for sampling and analysis of ambient air: Method 10.1: Determination of particulate matter – Deposited matter – Gravimetric method* (AS/NZS 3580.10.1:2003).
- AS/NZS (2007), *Methods for sampling and analysis of ambient air: Part 1.1: Guide to siting air monitoring equipment* (AS/NZS 3580.1.1:2007).
- AS (2008), *Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser* (AS 3580.9.8:2008).
- Australian Weeds Committee (2010), *Weeds of national significance.*
- Belton-Taylforth (2005), *Capel Coastal Strategy. Shire of Capel.*
- Department of Environment and Conservation (DEC) (2006), *Contaminated Sites Management Series - Community Consultation Guideline. Land and Water Quality Branch.*
- DEC (2011), *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.*
- Department of Environment Regulation (DER) (2014), *Assessment and management of contaminated sites. Contaminated sites guideline.*
- Department of Health (DoH) (2011), *Guidelines for the Non-Potable Uses of Recycled Water in Western Australia.*
- Department of Parks and Wildlife (DPaW) (2014) *Weeds.*
- Department of Primary Industries and Regional Development (2007), *Biosecurity and Agriculture Management Act 2007.*
- Department of Water (2013), *Guideline for the approval of non-drinking water systems in Western Australia.*
- Department of Water (2011), *Operational policy 1.01 – Managed aquifer recharge in Western Australia.*
- National Uniform Drillers Licensing Committee (2012) *Minimum construction requirements for water bores in Australia (No. 3).*
- Radiation Professionals (2016), *Radiation Management Plan*. Document Number: CRIS150130-RMP-V1.0.

- Department of Mines and Petroleum Environmental Protection Authority (DMP EPA) *Guidelines for preparing mine closure plans May 2015.*

1.5 Stakeholder commitment

Tronox is the key stakeholder which has obligations under this SMP. A statement from Tronox acknowledging and accepting its obligations under the SMP is included in Appendix E.

Other relevant stakeholders have been made aware of the SMP, agree to its content and agree to abide by it. Statements to confirm this from the relevant stakeholders are included in Appendix E. Local residents are not required to sign a commitment to the SMP but have been included in the stakeholder engagement actions detailed in Section 3.5, and have access to the Tronox Annual Environmental Reports through the Shire of Capel library.

1.6 Limitations

This Report has been prepared for Tronox Pigment Bunbury Ltd. by GHD Pty Ltd and may only be used and relied on by Tronox Pigment Bunbury Ltd. for the purpose agreed between GHD Pty Ltd and the Tronox Pigment Bunbury Ltd. as set out in Section 1.4 of this Report.

GHD Pty Ltd otherwise disclaims responsibility to any person other than Tronox Pigment Bunbury Ltd. arising in connection with this Report. GHD Pty Ltd also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD Pty Ltd in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD Pty Ltd has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD Pty Ltd described in this Report (refer Section(s) 1.7 of this Report). GHD Pty Ltd disclaims liability arising from any of the assumptions being incorrect.

GHD Pty Ltd has prepared this Report on the basis of information provided by Tronox Pigment Bunbury Ltd. and others who provided information to GHD Pty Ltd (including Government authorities), which GHD Pty Ltd has not independently verified or checked beyond the agreed scope of work. GHD Pty Ltd does not accept liability in connection with such unverified information, including errors and omissions in the Report which were caused by errors or omissions in that information.

For avoidance of doubt, the above applies to the RMP prepared separately by Radiation Professionals (2016) as included in this SMP at Appendix B.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the Site may be different from the Site conditions found at the specific sample points.

Investigations undertaken in respect of this Report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this Report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD Pty Ltd does not accept responsibility arising from, or

in connection with, any change to the Site conditions. GHD Pty Ltd is also not responsible for updating this Report if the Site conditions change.

Any future remedial actions that are required to penetrate the soil cap will require a specific management plan to be prepared and implemented to address risks to relevant receptors such as (but not necessarily limited to) maintenance workers. Specific reference must be made to the RMP (Appendix B) for any penetration works (i.e. works that are required to penetrate the soil cap) and this SMP (GHD, 2019) prior to any work being performed.

1.7 Assumptions

No routine maintenance works specified under this SMP require penetration of the soil cap. Ground penetration is only permitted where further remedial works are required and should be undertaken in accordance with a specific management plan to be prepared and implemented to document the management protocols required to address risk to relevant receptors such as (but not necessarily limited to) maintenance workers. Specific reference must be made to the RMP (Appendix B) for any penetration works (i.e. works that are required to penetrate the soil cap) prior to any work being performed.

Two metres of clean fill is to be applied to the Site during remediation (this is a conservative value as it has been demonstrated that 0.5 m of clean fill would be sufficient to attenuate the radiological parameters to background levels). However, this two metre capping does not need to be maintained across the Site to avoid compromising the rehabilitation process (Appendix C).

2. Site characterisation

2.1 Legal identification

The Site is located in Dalyellup, Western Australia. The legal identification of the Site is provided in Table 1.

Table 1 Legal identification

Legal identification of Dalyellup Waste Residue Disposal Facility (DWRF).	
Common name	The former Dalyellup Waste Residue Disposal Facility (DWRF)
Street address	Maidment Parade, Dalyellup, Western Australia
Legal description	Lot 9077 on deposited plan 60716 (Volume 2717/Folio 207) Lot 9090 on deposited plan 69838 (Volume 2790/Folio 895)
Ownership	Tronox Pigment Bunbury Ltd, formerly Cristal Pigment Australia Ltd.
Local government authority	Shire of Capel
Local planning scheme zoning	Regional Open Space (*Shire of Capel Town Planning Scheme No. 7*, Department of Planning, Lands and Heritage (DPLH), 2015)
Restrictions on use	The land use of the Site is restricted to endemic bushland. The Site should not be developed for irrigated land uses, such as parkland or playing fields, or more sensitive uses such as residential use or childcare centres without further contamination assessment and/or remediation. Ongoing management of the Site is required to be undertaken in accordance with the approved SMP. Other than for analytical testing or remediation, groundwater abstraction is not permitted at the Site. Other than for remediation purposes, ground disturbance is not permitted and a minimum of 2 m of clean fill is to be applied to the Site at the time of remediation (Appendix C). Lot 9077 is currently classified by DWER as 'remediated for restricted use'. Lot 9090 is currently not classified under the *Contaminated Sites Act 2003.*

2.2 Site description

The former DWRF is located in Dalyellup, Western Australia, approximately 8 km south west of the City of Bunbury and encompasses an area approximately 15 hectares. The Site is predominantly vacant and unsealed, with endemic bushland present to the south and east of the Site with a main access road to the Site (Maidment Parade) extending from the eastern boundary of the Site. A large sandy area is apparent in the central and northern sections of the Site (see Figure 1, Appendix A). The Site is currently used as endemic bushland.

2.3 Surrounding land use

The surrounding land use is summarised below and shown in Figure 1 (Appendix A):

North: The Site is bound to the north by endemic bushland. There is a waste water treatment plant (zoned 'public utility', DPLH, 2015) also located approximately 500 m north of the Site.

South: A residential area is located south of the Site, with Hutt Drive (road reserve) located along the southern boundary of the Site.

East: Maidment Parade is located east of the endemic bushland which bounds the Site to the east. Residential housing is located east of Maidment Parade.

West: The Indian Ocean is located to the west of the Site, with a beach and dune complex located between the Site and the ocean.

2.4 Topography

As part of the Site closure, the ground surface was levelled to between 26 – 27 m AHD. The eastern turning circle is levelled to between 22 – 34.5 m AHD, sloping downwards from south to north (GHD, 2015a).

Geographe Bay is located 200 m west of the Site. The coastal dunes drop steeply from the western boundary of the Site to sea level (GHD, 2015a).

2.5 Regional geology and hydrogeology

Geological formations underlying the Site and also present in the broader area, along with associated aquifer types are as summarised in Table 2.

Table 2 Geology and hydrogeology of the Bunbury region

Age	Formation	Thickness (m)	Aquifer type	On-Site
Quaternary	Safety Bay Sand	40	Superficial	Present
	Tamala Limestone	40	Superficial	Present
	Bassendean Sand	15	Superficial	Not present
	Guildford Formation	20	Superficial	Not present
	Yoganup Formation	15	Superficial	Not present
Cretaceous	Leederville Formation	300	Regionally confined	Not present
	Bunbury Basalt	70	Aquiclude	Not present
Jurassic	Yarragadee Formation	200 – 500	Confined basement	Present
	Cockleshell Gully Formation	400	Confined basement – hydraulically connected to Yarragadee	

2.6 Groundwater flow

The Hydrogeological Assessment Report (GHD, 2015a) identifies that groundwater is flowing in a westerly direction towards the Indian Ocean. Mounding has also been noted around groundwater monitoring well DM8R (GHD, 2015a) (see Figure 2, Appendix A for monitoring well locations).

2.7 Local/Site geology and lithology

Site lithology is discussed in detail in the hydrogeological assessment report (GHD, 2015a) and summarised below.

2.7.1 Local/Site

The sediments below the disposal area are calcareous, fine to medium grained sands. They range in depth from 10 to 20 metres. Limestone, sand and sandy clays occur in the area at depths between 10 to 50 metres. Below these sediments are dark grey, silty, micaceous clays. The clays appear from 20 to 40 metres, and occasionally occur above or within the sandy limestone layers.

Some heavy minerals and silty organic matter occur throughout the profile. The secondary dunes are overlain by approximately 0.5 to 1.0 m of topsoil. The area is underlain by superficial formations, which extend from the ground surface to about 10 m AHD. The Superficial formations form an anisotropic unconfined aquifer comprising sand and limestone with a basal section of less permeable silty sand and sandy clay (MIC, 2011).

2.7.2 Disposed material

TSR was deposited at the Site between 1989 and 2013. The Site was licensed to dispose 200,000 tonnes of TSR per year. The TSR is an inert, mostly insoluble, non-toxic, clay-like material and has a chemical composition described as a mixture containing aluminium, calcium, chloride, chromium, iron, manganese, sulphur, titanium and vanadium and other trace constituents at high pH to precipitate metals as hydroxides.

3. Plan management and control

3.1 General

The SMP outlines management measures relating to the ongoing management of potential human health and environmental risks associated with soil and groundwater contamination identified at the Site. Should monitoring undertaken as part of the ongoing management plan identify a need for further remedial action that requires penetration of the cap, a further site management plan should be developed specific to the proposed activity. This plan should be prepared with due regard to relevant receptors and the requirements of the RMP (RadPro 2016).

3.2 Distribution

The SMP has been prepared by GHD for Tronox. The Safety, Health, Environment and Quality Manager (SHEQ Manager) at Tronox is responsible for the distribution of the SMP. The SHEQ Manager should ensure that anyone entering the Site should be made aware of and comply with the requirements of the SMP. The SMP will also be issued to the appointed Western Australian Department of Water and Environmental Regulation (DWER) Contaminated Site Auditor (Jason Clay, Senversa) for review and comment.

3.3 Review and update

The SMP will be reviewed (and where required based on outcomes from such review) updated on an annual basis and, where needed in response to other triggers (refer to Table 3).

Any revisions to the SMP will be advised to DWER prior to implementation. Records of revision will be maintained in accordance with the Tronox document control system.

3.4 Roles and responsibilities

Whilst Tronox occupies the Site, the Tronox SHEQ Manager is responsible for the implementation of this SMP (i.e. further remedial action, weed control, dust management and groundwater monitoring including appointment of a consultant to the groundwater undertake monitoring work).

The Tronox Radiation Safety Officer is responsible for implementation of the RMP. Reference should be made to the RMP (Appendix B) for further details of roles and responsibilities. The Tronox Radiation Safety Officer has appointed a separate consultant to undertake ongoing routine radiation monitoring that is required by the RMP (Appendix B). This comprises a gamma survey, radon and thoron monitoring in air and groundwater sampling for uranium, thorium, radon 226 and radon 228 (detailed further in Appendix B). It is the responsibility of the separate consultant appointed by the Tronox Radiation Safety Officer to:

- Implement the radiological monitoring undertaken on-site in accordance with the RMP (Appendix B).
- Ensure that the methods used for this monitoring are in line with relevant Australian standards, including the Western Australian (1975) *Radiation Safety Act* and the WA Department of Mines and Petroleum (2010) *Managing naturally occurring radioactive material (NORM) in mining and mineral processing – guideline (2nd edition).*
- Reporting of the results to the Tronox Radiation Safety Officer.

The Tronox SHEQ manager is responsible for documenting radiological monitoring results in the Annual Environmental Report for the Site.

Tronox understands the Shire of Capel does not intend to purchase the land and take on the associated future liabilities that may arise as a result of Tronox's historical site operations. Therefore, Tronox, as the owner, will remain responsible for the implementation of this SMP. If in the future land ownership is transferred, the land title will have a memorial stating that the Site is registered under the *Contamination Sites Act 2003*. Tronox may also provide a copy of the SMP to future land owners who will be responsible for understanding, accepting and implementing the measures outlined in the SMP.

3.5 Stakeholder engagement

GHD has not been commissioned to undertake stakeholder engagement activities. However, it is understood that Tronox have engaged with the Shire of Capel as required to fulfil conditions of the lease agreement and achieve approval for the closure plan. In addition, all stakeholders listed in Section 3.5.1 below, have been provided with a copy of the Annual Environmental Report, which outlines the environmental condition of the Site. These reports have also been made publicly accessible through the Shire of Capel library.

3.5.1 Identification of stakeholders

Consistent with the Final Closure Plan (FCP Cristal, 2013), Tronox will undertake appropriate engagement with relevant stakeholders in relation to ongoing management of the Site. For ongoing management of the Site under endemic bushland use, identified stakeholders comprise:

- Local residents.
- Dalyellup Beach Pty Ltd.
- The Shire of Capel.
- Department of Water and Environment Regulation (DWER).
- Radiological Council of Western Australia.
- Department of Health.
- Satterley Property Group.

Other interested parties/stakeholders may be identified during ongoing management of the Site. Where identified, appropriate engagement with such stakeholders will be undertaken, documented and where relevant, the SMP updated to reflect this. Local residents are not required to sign a commitment to the SMP but have been included in the stakeholder engagement table (refer to Table 3 below).

As noted in Section 1.5, Tronox is the key stakeholder which has obligations under this SMP. A statement from Tronox acknowledging and accepting its obligations under the SMP is included in Appendix E. Other relevant stakeholders have also provided statements of acknowledgement of the SMP in Appendix E.

3.5.2 Triggers, management and actions

The main scenarios that have been identified as possible triggers for further stakeholder engagement for the Site, in relation to the proposed use as endemic bushland, have been identified in Table 3 below. These comprise:

- Community member enquiries.
- Site worker enquiries.

- Requirements (if any) for changes to ongoing management strategies which are identified during the periodic (annual) SMP review, groundwater sampling, RMP sampling or visual site inspections.
- Indications of dunal instability/loss of integrity which may affect the Site.
- Requirements (if any) for additional work which is outside the scope of the management strategies in this SMP.

The corresponding management approach for the above; actions resulting from the management approach; tools for implementing stakeholder engagement and frequency of required engagement, have been identified in Table 3 below.

All stakeholder queries and responses will be documented in a Stakeholder Consultation Log. The Stakeholder Consultation Log will be reviewed annually by Tronox to identify the need for further response actions to the community and/or other stakeholders. This Stakeholder Consultation Log will be published in the Annual Environmental Report, which will be made publically available through the Shire of Capel or via the Shire of Capel library.

Information reported on the Stakeholder Consultation Log will include consultation technique, nuisance conditions, events requiring actions, information/management provided and any follow-up consultation activities.

Table 3 Triggers, management and actions

Trigger	Impact type	Management	Actions	Activities/tools	Frequency	Responsible personnel
Community or other stakeholder enquiry/concern	Perceived negative impact (e.g. apparent vegetation distress, compromised capping, dust generation) or other perceived impact which may not be measurable or have specific guidelines.	Discuss concerns with stakeholder. Record full details in log. Assess enquiry/concern. Develop a suitable response action (where needed) to the enquiry/concern.	Inform relevant stakeholders of assessment outcome and response action (where action is to be taken). Implement appropriate response action as needed. Update SMP (if response action requires this - refer to Section 3.3). Close out enquiry/concern with stakeholder and update log	Telephone calls. Emails. Written correspondence. Face to face meeting/s (e.g. one-on-one meeting/s)	As required in relation to the nature of the enquiry/concern .	Tronox SHEQ manager.
Site workers enquiry/concern				Tronox annual reports are made publically available through the Shire of Capel library.	Annual	Tronox SHEQ manager
SMP annual review .	Relevant SMP management strategy insufficient to address residual risks for endemic bushland use.	Refer to Section 3.3. Identify changes required to relevant SMP management strategy.	Implement changes.	Telephone calls. Emails. Written correspondence. Fact sheets/FAQ's.	Annual (or as required in relation to identified need).	Tronox SHEQ manager

Trigger	Impact type	Management	Actions	Activities/tools	Frequency	Responsible personnel
		Consult relevant stakeholders. Record full details in log. Obtain regulatory approval (where needed). Amend relevant management strategy.				
Groundwater sampling results indicate any changes in contaminant concentrations that pose a risk to identified receptors (refer to Section 4.6).	The relevant SMP management strategy is insufficient to address residual risks in groundwater.	Refer to Section 4.5.6. Identify changes required to relevant SMP management strategy (including any further remedial action required). Consult relevant stakeholders. Record full details in log. Obtain regulatory approval (where needed). Amend relevant management strategy.	Implement the changes.	Telephone calls. Emails. Written correspondence. Face to face meeting/s (e.g. one-on-one meeting/s). Fact sheets/FAQ's.	As required in relation to identified need.	Tronox SHEQ manager

Trigger	Impact type	Management	Actions	Activities/tools	Frequency	Responsible personnel
Radiation monitoring results obtained from the appointed RMP consultant indicate either one or both of the following: • An increasing trend in radiation levels in the area. • A specific radiological concern has been identified	The relevant RMP management strategy is insufficient to address residual radiation risks.	Refer to RMP (Appendix B). Identify changes required to relevant RMP management strategy (including any further remedial action required). Consult relevant stakeholders. Record full details in log. Obtain regulatory approval (where needed). Amend relevant management strategy.	Refer to RMP (Appendix B). Implement the changes.	Telephone calls. Emails. Written correspondence. Face to face meetings (e.g. one on one meetings). Fact sheets/FAQ's.	As required in relation to identified need.	Tronox SHEQ manager, Tronox Radiation Safety Officer and appointed RMP consultant (as required)
Quarterly visual inspection	Visual inspection indicates that cap integrity is compromised or that the management plan is not sufficient to	Refer to Section 3.3.	Implement changes.	Telephone calls. Emails. Written correspondence. Fact sheets/FAQ's.	As required in relation to the identified need	Tronox SHEQ manager, Tronox Radiation Safety Officer

Trigger	Impact type	Management	Actions	Activities/tools	Frequency	Responsible personnel
	address residual risks.					
Indicators of dunal instability/loss of integrity which may affect the Site	Potential effect upon TSR containment/capping integrity	Dune stabilisation management strategy (Section 8.2)	Consultation with relevant stakeholders.	Telephone calls. Emails. Written correspondence. Face to face meetings (e.g. one on one meetings or community meetings).	As required in relation to the nature of the unintended disturbance	Tronox SHEQ manager, Tronox Radiation Safety Officer

4. Groundwater management

Historical groundwater monitoring events for the Site have reported metals (including chromium, zinc, copper, lead, cobalt, vanadium and zinc) at concentrations exceeding ecological assessment levels for marine waters (DER, 2014) however, the risk is considered to be low (refer to Section 1). A groundwater management strategy comprising ongoing monitoring is required to demonstrate that:

- Residual risks to relevant ecological and human health receptors remain acceptable.
- Remediation and rehabilitation of the Site has been successful in returning the Site to the intended end use as endemic bushland.

Given the potential use of groundwater up and cross hydraulic gradient for non-potable uses, DWER (2019) has requested that the non-potable use of groundwater assessment criteria (DER, 2014) are also adopted for screening risk assessment purposes.

To provide a consistent methodology for ongoing monitoring of groundwater, a sampling, analysis and quality plan (SAQP) will be implemented for the Site as presented in Section 4.1 below. Ongoing routine radiation groundwater monitoring will be undertaken as described in the RMP (refer to Appendix B) to support declassification of the Site (i.e. relinquishing the Registration under the Radiation Safety Act WA).

4.1 Sampling, analysis and quality plan (SAQP)

The purpose of this SAQP is to guide field staff undertaking groundwater monitoring works on-site and ensure consistent application of sampling methodologies and analysis over time. With reference to Schedule B2 of the NEPM (ASC NEPC, 1999), this Section:

- Details the objectives of the groundwater investigation and include reference to appropriate site plans and diagrams.
- Provides DQOs indicating the quality assurance (QA) plan and details of quality control (QC) samples to be collected.
- Identifies required pre-mobilisation tasks (including the preparation of health and safety documentation).
- Identifies the media required to be sampled.
- Identifies the frequency and pattern required for sampling.
- Details the sampling procedures required for fieldwork.
- Provides details of the analytes and parameters to be monitored and the number, location and details of the sampling points. This SAQP also provide details of the analysis methods required (including methods for interpreting and analysing field data).

4.1.1 Objective

The objective of the groundwater investigation for the Site is to collect data representative of the current groundwater quality within the targeted aquifers beneath the Site to monitor the condition of groundwater beneath the Site over time.

This information will be used demonstrate whether residual risks to on-site and off-site receptors remain acceptable and whether the remediation and rehabilitation of the Site has been successful in returning the Site to the intended end use (endemic bushland).

4.1.2 Data quality objectives

Development of data quality objectives (DQOs) for the investigation is based on guidance presented in NEPC, 1999.

The DQO process comprises the following seven steps and is presented in detail in.

- Step 1: State the problem.
- Step 2: Identify the principal study question.
- Step 3: Inputs to the decision.
- Step 4: Boundaries of the study.
- Step 5: Decision rules.
- Step 6: Tolerable limits on decision errors.
- Step 7: Optimisation of the data collection process.

Table 4 Data quality objectives

DQO	Sub-item	Description
Step 1: State the problem	Problem description	Saline leachate and metals (including hexavalent chromium, chromium, copper, cobalt, lead, vanadium and zinc) are present in groundwater beneath the Site exceeding relevant ecological assessment criteria. The risk is considered to be low (refer to Section 1) however, ongoing monitoring is required to demonstrate that: • Residual risks to relevant ecological and human health* receptors remain acceptable. • Remediation and rehabilitation of the Site has been successful in returning the Site to the intended end use as endemic bushland. Ongoing routine radiation monitoring (as detailed in the RMP (Appendix B) is also required to support declassification of the Site (i.e. relinquishing the Registration under the Radiation Safety Act WA). **Given the potential use of groundwater up and cross hydraulic gradient for non-potable uses, such non-potable use also requires ongoing consideration in ongoing monitoring (DWER 2019).*
	Identify members of the planning team	The project team structure is outlined as follows: **Client:** Tronox **Environmental Consultant:** GHD **Contaminated Sites Auditor:** Mr. Jason Clay (Senversa)
	Specify constraints	The following potential constraints were identified: • Tronox has noted that groundwater monitoring wells within the monitoring network have historically been vandalised or damaged and have previously required replacing prior to sampling. It is possible that wells may be damaged between sampling events which may prohibit sampling. • There could be access issues (e.g. overgrown vegetation) preventing access to the locations. Refer to Section 4.5.2 for measures to address these constraints.
	Develop a conceptual site model (CSM)	Previous assessments and risk outcomes have been summarised in Section 1.
Step 2: Identify the principal study question	Identify the principal study question	Do residual risks to relevant ecological and human health receptors remain acceptable*? *i.e. such that remediation and rehabilitation of the Site has been successful in returning the Site to the intended end use as endemic bushland.

DQO	Sub-item	Description
	Identify alternative actions that could result from resolving the principal study question	If: Analytes in groundwater exceed the relevant groundwater guidelines in Section 4.4 (and in the case of ecological receptors are not consistent with a very low risk from previous assessment)* Then: The alternative action identified Section 4.6 may require (comprising further investigation and/or other management action) Further investigation may include assessment of additional lines of evidence such as residual rainfall mass inputs vs concentration data and bore concentrations vs predicted concentrations at point of receptor exposure. *i.e. the established risk profile is changed from previous assessment such that residual risks to relevant ecological and human health receptors may not remain acceptable.
Step 3: Inputs to the decision	Identify the information that will be required to resolve the decision	The following inputs are required: • Ongoing groundwater monitoring data including trend data. • Supporting understanding of current and former land use practices site characterisation, previous remedial works undertaken on-site, historical groundwater data including trend data, previous assessment outcomes including analyte concentration and related trend data used to determine previous risk assessment outcomes. • Relevant guideline criteria.
	Determine the sources for each item of identified information	Sources for required information include: • Tronox Annual Environmental Reports and ongoing groundwater monitoring results. • RMP (refer to Appendix B) and associated ongoing routine groundwater monitoring results (radiation) and annual reports. • Previous environmental assessment and remediation reports for the Site (refer to Section 1.1). • Relevant published guidelines (guideline criteria).
	Identify the information needed to establish the assessment levels	Groundwater assessment criteria have been selected based on the identified receptors proximal to the Site. Groundwater concentrations will be compared to the 95% marine water guidelines (ANZG, 2018) due to the Indian Ocean being identified as the primary receptor of groundwater quality at the Site. Non-Potable Use of Groundwater (NPUG) (Department of Health, 2014) guidelines have also been adopted at up and cross hydraulic gradient well locations due to proximal residents to the east and south of the Site (refer to Section 4.4). Criteria relevant to ionising radiation are addressed in the RMP (Appendix B).
	Confirm that appropriate analytical methods exist to provide the necessary data	National Association of Testing Authorities (NATA) accreditation is available for all identified contaminants of potential concern (CoPCs) from the nominated laboratories.
Step 4: Boundaries of the study	Define the spatial boundaries of the decision	The spatial boundary of the Site is defined by the location of the monitoring well locations which comprise the monitoring well network (see Table 6) The locations of these wells are shown in Figure 2 (Appendix A).
	Define the temporal boundaries of the decision	Ongoing until such time that DWER considers ongoing management measures are no longer required to mitigate the potential risk to human health and/or the environment associated with Site conditions.
	Define the scale of the decision making	The scale of decision making consists of the extent of the monitoring well network and identified receptors (refer to Section 1).
Step 5: Decision rules	Combine the outputs from the previous	If: • Analytes in groundwater at the Site do not exceed relevant guidelines (Section 4.4) or,

DQO	Sub-item	Description
	DQO steps and develop a decision rule	• Guidelines with respect to ecological receptors only are exceeded, however, exceedances are consistent with previous assessment (not increased – very low risk*). Then: risks remain acceptable. If however, analytes in groundwater exceed the relevant groundwater guidelines in Section 4.4 (and in the case of ecological receptors are not consistent with a very low risk from previous assessment) then alternative action, (refer to Section 4.6) may be required. **i.e. the established risk profile is unchanged from previous assessment.*
Step 6: Tolerable limits on decision errors	Determine the possible range of the parameter of interest	The range of the parameters of interest (i.e. CoPC) are based on the laboratory limits of reporting to the maximum reported levels of analytes.
	Decision errors	Two types of decision errors are possible: Sampling errors, which occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the Site (i.e. the samples collected are not representative of the Site conditions). Measurement errors, which occur during sample collection, handling preparation, analysis and data reduction. To minimise the potential for decision errors, the following data quality indicators (DQIs) will be adhered to: completeness, comparability, representativeness, precision and accuracy. Further discussion of these DQIs is provided in Table 5. There are two main types of decision errors likely to result from the proposed routine groundwater monitoring events, outlined below. Type I: Concluding that the residual groundwater contamination on-site has increased in concentration when it has not. This may result in unnecessary expenditures for management and/or remediation. Type II: Concluding that the groundwater contamination on-site has decreased in concentration when it has not. This may result in threats to human health and the environment.
Step 7: Optimisation of the data collection process.		The SMP has been developed with reference to the guideline documents identified in Section 1.4. In order to optimise the data collection process, the following actions have been undertaken: • Auditor engagement and consultation throughout the development of the SMP (this report). • This SMP specifies the required data collection methods, reporting requirements, field and laboratory quality control and quality assurance procedures to be followed for the routine groundwater monitoring on-site. This will optimise the data collection process by providing clear sampling instructions each monitoring round which will assist in minimising the risk of sampling error. • Preparation of standard field sheets for use when undertaking the routine groundwater monitoring on-site. • Use of suitable laboratory limits of reporting.

4.2 Data quality indicators

Data quality indicators (DQIs) for this SAQP have been nominated to determine the reliability of field procedures and analytical results. Field procedures and laboratory procedures will be considered in the DQIs in accordance with NEPC, 1999. A summary of the DQIs to be followed during groundwater monitoring on-site has been provided in Table 5.

Table 5 Data quality indicators

DQI	Evaluation criteria
Completeness	All locations proposed to be sampled are sampled. Samples will be analysed according to the proposed analysis. See Section 4.5.4.
	All field documentation will be complete and correct, including chain of custody documentation for samples.
	Field forms and documentation capture all relevant important information.
	Samples will be analysed within appropriate holding times.
	Appropriate laboratory limits of reporting are selected for comparison to relevant assessment criteria.
Comparability	Standardised operating procedure for groundwater sampling will be followed and are in line with relevant guidelines.
	Field staff are experienced in the sampling of groundwater and appropriately trained. A small field team will be used to ensure consistency in field procedures.
	Consistent laboratory use with consistent analytical methods will be used for each monitoring event.
	Sampling will be undertaken with consideration to climatic conditions, with the aim to schedule sampling events during timeframes where the climate is considered consistent and representative of region.
Representativeness	Samples will be collected in a uniform and consistent manner, therefore representative of the media in the field.
Precision	Sufficient quantities of field blind and split duplicates will be collected to enable comparison within and between laboratories.
	Sufficient quantities of internal laboratory duplicates will be analysed to enable comparison within laboratories.
	Relative percentage difference calculations will be undertaken to show that a large majority of duplicate sample concentrations are within defined difference limits.
	Field equipment used will be calibrated by equipment supplier.
Accuracy	Sufficient quantities of field blanks, rinsate blanks and transport blanks will be collected and analysed to allow for an assessment of potential cross contamination.
	Sufficient quantities of internal laboratory method blanks, surrogate spikes and laboratory control samples will be analysed to determine laboratory accuracy.

4.3 Groundwater monitoring network

The monitoring well network is comprised of six shallow monitoring wells within the Superficial aquifer (with reported well depths ranging between 7.8 – 43 m below ground level (m bgl)), eight deep monitoring wells within the Superficial aquifer (with reported depths ranging between 12.5 and 50 m bgl) and one monitoring well targeting the Yarragadee aquifer (with a reported depth of 72 m bgl) (Figure 2, Appendix A). The monitoring well network has been detailed below in Table 6.

Table 6 Monitoring well network

Current Well Id	Alternate well Id	Targeted aquifer	Date drilled	Depth of well (m bgl)	Screened interval (m bgl)	Elevation (m AHD)	Top of Casing (m AHD)	Easting	Northing
Up-gradient wells									
DM1RS	DM1R	Superficial	15.12.92	43	39 – 42	40.05	39.56	370837	6304504
DM1RD	DM1	Superficial	15.12.92	50	45 – 48	40.05	39.54	370837	6304504
DM9S	DM9R	Superficial	23.7.96	28	24 - 28	33.8	34.35	370765.78	6304209.08
DM9D	DM9	Superficial	23.7.96	46	42 – 46	33.8	34.28	370765.78	6304209.08
Down-gradient wells									
DM2RS	DM2R	Superficial	27.02.89	26.5	23.5 – 25.5	24.489	26.4	370525	6304503
DM2RD	DM2	Superficial	27.02.89	35.3	27 – 30	24.489	26.25	370525	6304503
DM4RS	DM4R	Superficial	4.04.96	7.8	4.8 – 7.8	3.643	4.78	370364.96	6304368.66
DM4RD	DM4	Superficial	13.02.89	12.5	9.5 – 12.5	4.444	4.77	370364.96	6304368.66
DM7RS	DM7R	Superficial	27.5.92	23	19 – 22	20.497	24.52	370479.84	6304180.9
DM7RD	DM7	Superficial	29.5.09	30.8	26 – 29	20.497	24.66	370479.84	6304180.9
DM8RS	DM8R	Superficial	23.7.96	28	24 – 28	26.19	26.47	370506.9	6304410.2
DM8RD	DM8	Superficial	23.7.96	36	32 – 36	26.19	26.39	370506.9	6304410.2
Yarragadee well									
YBd	YB	Yarragadee	24.03.05	72	66 – 72	26	27.2	370516	6304473
Background wells									
MBR3D	MB3R	Superficial	22.11.00	34.5	28 – 34	25.9	27.93	370416.8	6304040.34
MB4D	MB4	Superficial	10.11.88	16.2	2.2 – 16.2	5.13	3.35	370245	6303905

4.4 Groundwater guidelines

4.4.1 Ecological receptors

Groundwater concentrations for relevant analytes will be compared to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) 95% Marine Waters guidelines, as the Site is directly up-gradient from the Indian Ocean, which is considered to be the primary receptor of groundwater quality at the Site.

Concentrations of relevant analytes exceeding the above criteria will be compared to recorded exceedances in previous assessment that were determined to represent a very low risk to aid decision making concerning requirements for alternative action.

4.4.2 Human health receptors

Due to the proximal residential area to the east and south of the Site, there is potential use of groundwater up and cross hydraulic gradient for non-potable uses. As such the relevant Non-Potable Use of Groundwater (NPUG) assessment criteria (Department of Health, 2014) have been adopted for screening purposes at the well locations up and cross hydraulic gradient from the Site at relevant locations (i.e. DM1RS, DM1RD, DM9S, DM9D, MBR3D, DM7RS, DM7RD, MB4D: refer to Figure 2, Appendix A).

Criteria relevant to ionising radiation are addressed in the RMP (Appendix B).

4.5 Groundwater sampling

4.5.1 Pre-mobilisation tasks

A Site-specific job safety environment analysis (JSEA) will be prepared prior to the commencement of fieldwork. The JSEA will document health and safety systems and procedures applicable for the term of the contract, site organisation and coordination, hazard evaluation and management, communication procedures, personal protective equipment required and emergency procedures including route to the nearest hospital.

4.5.2 Inspection of groundwater monitoring network integrity and contingency response

Groundwater wells will be inspected prior to each monitoring event to confirm the groundwater monitoring network integrity is intact and all wells are able to be sampled. These inspections will need to be scheduled to ensure enough time is provided to replace any unserviceable wells if this is required, prior to each groundwater sampling event (the frequency of these events is identified in Table 7 below).

In the event that groundwater wells are damaged beyond repair or otherwise become unserviceable, these should be decommissioned (where relevant) in accordance with *The minimum construction requirements for water bores in Australia* (National Uniform Drillers Licensing Committee, 2012) and replaced in accordance with the NEPM requirements (ASC NEPC, 1999) with new monitoring wells which are purpose-constructed to meet the requirements of the groundwater management strategy.

4.5.3 Sampling methodology

Groundwater sampling techniques will be consistent with AS/NZS 5667.11:1998 *Water quality - Sampling Part 11: Guidance on Sampling of Groundwaters* and standard low flow sampling techniques. Groundwater sampled from the Superficial and Yarragadee aquifers will be completed using the following methodology:

- Groundwater monitoring wells will be gauged using a water level meter to determine the depth to water and the depth to the base of the well, and recorded on the groundwater field record sheet (Appendix D).
- A low flow pump will be inserted into the monitoring well. In each well the pump inlet will be located in the centre of the well screened interval to ensure consistency in results between monitoring rounds. This is suitable for the contaminants of concern including metals and major ions.
- The well will be purged using the inserted low flow pump (at approximately 300-500 ml/min) until field parameters have stabilised to within approximately 10%. Field parameters including those listed in Section 4.5.4 will be recorded on the groundwater field record sheet (Appendix D).
- Following stabilisation field parameters, samples will be collected directly into laboratory supplied appropriately pre-treated sample bottles for the contaminants of potential concern, identified in Table 7.
- Field duplicates and split duplicates (inter-laboratory duplicates) will each be collected at a rate of 1 in 20. Relative Percentage Difference (RPD) will be calculated to evaluate the variability in duplicates, using the following formula:
  %RPD = |A-B|/|A+B| x 200
  This will not be calculated if both sample results are below the detection limit. Where one is below the detection limit, the RPD will be calculated by assigning that sample half the detection limit. The RPD acceptance limit will be 30% (as per ASC NEPC, 1999).
- Rinsate blanks will be collected at the end of each day by pouring laboratory supplied rinsate water over reusable equipment that has undergone decontamination and collecting that water in laboratory bottles.
- Samples analysed for dissolved metals will be field filtered to 0.45 microns.
- Samples will be place directly into chilled eskies containing ice and forwarded to the NATA accredited laboratory for analysis along with a chain of custody form.

Table 6 presents the monitoring wells that will be sampled during the groundwater monitoring event. The well locations are presented on Figure 2 (Appendix A).

4.5.4 Groundwater analysis

Depth to water will be gauged in each well and the following parameters measured prior to sample collection:

- Depth to water (m top of PVC casing [TOC]).
- pH.
- Electric conductivity (mS/cm).
- Temperature (degrees Celsius).
- REDOX (mV).

The samples taken from the Yarragadee and Superficial aquifer will be analysed in a NATA accredited laboratory for the suite provided in Table 7.

Table 7 Laboratory analytical suite for Superficial and Yarragadee aquifer

Aquifer	Analytes	Units	Frequency
Superficial	pH	pH units	Bi-annually
	Electrical conductivity	µS/cm	
	Total dissolved solids	mg/L	
	Bicarbonate Calcium Carbonate Chloride Manganese Potassium Sodium Sulphate	mg/L	
Yarragadee			Quarterly in January, April, July and October (with a minimum of 45 days between sampling events)
	Nitrate-nitrogen	mg/L	
	Filtered metals: arsenic, boron, cadmium, chromium (total, hexavalent and trivalent), cobalt, copper, iron, lead, magnesium, mercury, molybdenum, nickel, selenium, vanadium	mg/L	

Ongoing routine radiation monitoring of groundwater beneath the Site is undertaken separately by a consultant appointed by the Tronox Radiation Safety Officer (refer to Section 3.4). The RMP (Appendix B) identifies that annual groundwater sampling of radium-226 and radium -228 is undertaken by the appointed consultant across all monitoring locations (Appendix C and Figure 2, Appendix A).

This monitoring program has been developed in order to observe Site conditions over time. This monitoring is to be ongoing, until DWER are satisfied that the remediation and rehabilitation of the Site has been successful in returning the former waste residue disposal facility to its intended land use as endemic bushland.

4.6 Annual Environmental Report

An Annual Environmental Report will be prepared by Tronox and submitted to DWER that identifies the objectives and scope of the monitoring program. Each annual environmental report will also present the findings of the work, including an assessment of groundwater flow direction and quality, seasonal variation, spatial and temporal trends (including emerging trends) and ongoing risks from groundwater contamination.

Reporting of the groundwater management strategy will be undertaken with reference to relevant guidance documents identified in Section 1.4; in particular DER (2014).

Groundwater monitoring results, including trend analysis will also be reviewed annually to assess whether the SMP and associated sampling regime require any revisions based on the results obtained over the monitoring period (e.g. reduced analytical suite).

In the first instance, any increases in analyte concentrations will be noted in the Annual Environmental Reports to document these groundwater changes over time. Mann-Kendall trend analysis will be used to assess concentration trends across the Site, with the results of this analysis also reported in the Annual Environmental Report. Should a rising trend in an analyte be observed, a groundwater investigation to delineate the contamination and/or further remedial action may be required. Any changes in contaminant concentrations that pose a risk to identified receptors will be appropriately communicated to relevant stakeholders.

Results from the separate ongoing routine radiation groundwater monitoring will be considered as is described in the RMP (refer to Appendix B).

5. Dust management

5.1 Requirements for dust management

Dust monitoring was completed by Cristal until the ponds were covered in October 2013, eliminating the generation of TSR dust.

While the ponds remained uncovered, Cristal's SHEQ Manager completed dust monitoring using a TSP and PM10 high volume sampler for 24 hours, every six days at the southern and south eastern ends of the central ponds. This was completed between 1 October to 31 March of each year and was completed according to the Australian Standard AS 3580.9.3:2003 *Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method*.

As the ponds are now capped, and ground disturbance is restricted at the Site, it is considered that no routine dust management or monitoring measures are warranted as part of ongoing routine maintenance. However, should ongoing monitoring at the Site trigger a requirement for further remedial action requiring ground disturbance, appropriate measures should be developed as part of a specific management plan to address identified risks.

5.2 Further remedial action

To this end, in order to manage dust generated during ground disturbing works, an appropriate dust management and an air quality monitoring program will be required. Dust management and associated air quality monitoring measures should be developed with reference to the following standards and guidelines:

- AS/NZS 3580.9.3:2003 *Methods for sampling and analysis of ambient air: Method 9.3: Determination of suspended particulate matter – Total suspended particulate matter (TSP High volume sampler gravimetric method.*
- AS/NZS 3580.10.1:2003 *Methods for sampling and analysis of ambient air: Method 10.1: Determination of particulate matter – Deposited matter – Gravimetric method*
- AS/NZS 3580.1.1:2007 *Methods for sampling and analysis of ambient air: Part 1.1: Guide to siting air monitoring equipment.*
- AS 3580.9.8:2008 *Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser.*
- AS 2923-1987 *Ambient Air – Guide for Measurement of Horizontal Wind for Air Quality Applications.*
- DEC 2011 *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.*

Such measures should include implementing all measures necessary to effectively control all dust and windborne material emanating from the Site to prevent it from being blown over or onto property outside the Site. The measures shall include, but not be limited to:

- Frequent watering of areas being disturbed or surface destabilised.
- Water used for dust suppression will not be allowed to escape off-site by the stormwater system, sewer or any other means.
- At least one water cart to be readily available at all times during land disturbance (e.g. during dune stabilisation).

- Staging any excavations (e.g. dune stabilisation works) and stockpiling (if required).
- Discontinuing dust creating works when wind velocities are such that dust suppression is not achievable.
- The stabilisation using watering equipment and any approved stabilisation agent to all disturbed and exposed areas prior to any shutdowns or the operation of water carts through these periods to control dust.
- Any stockpiles that are to remain on Site for more than four weeks to be stabilised, where required.
- Inspection of site access with public roads and (if needed) implementation of street sweeping at an appropriate frequency to mitigate potential for dust generation.
- Mobile plant movements to be restricted to designated routes and standing areas, minimising the disturbance of unsealed surfaces.

The level of dust management (and associated monitoring) to be implemented during ground disturbing works should be commensurate to the risk of dust generation in relation to the further remedial action to be undertaken. A site risk assessment should be undertaken with reference to *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities DEC* (2011) to determine the level of dust management required.

Given the sensitivity of surrounding land uses (residential land use to the south and east of the Site and the Indian Ocean to the west of the Site), consideration should also be given to implementation of an appropriate period of background monitoring of the Site before further remedial action commences. This would provide a credible 'baseline' for air quality for comparison with monitoring results during the works to assist in optimising dust management measures and for stakeholder reassurance. Further advice on this matter is presented in DEC (2011).

5.3 Annual Environmental Report

As identified in Section 4.6, an Annual Environmental Report will be prepared by Tronox and submitted to DWER. The Annual Environmental Report will provide details of any works that are implemented which disturb the soil capping, including details of dust management measures implemented to ensure that residual risks to relevant ecological and human health receptors remain acceptable.

6. Weed management

Revegetation of the Site primarily comprises grass species and native shrubs, which naturally occur onsite. Seeding commenced in May 2018. Weed management is required on-site to allow the planted species to develop and prevent weeds from taking over the Site. The purpose of this is to manage vegetation growth until planted species are matured to withstand weed species. Soil stabilisation is also a desired outcome to reduce wind-blown and surface water erosion.

A weed management plan will be developed considering the below issues.

Invasive species (including weeds) represent the biggest threat to biodiversity after habitat loss. Weeds are plants that grow in areas where they are not wanted and where they may have an environmental or economic impact. Weeds can impact on natural values by:

- Out-competing native species for nutrients, water, space and sunlight.
- Reducing the natural diversity by smothering native plants or preventing them from growing back.
- Reducing habitat for native animals.
- Altering fire regimes (Department of Parks and Wildlife (DPaW) 2014).

The major vectors for the introduction and spread of weeds at the Site include:

- Dumping of rubbish.
- Escape of garden plants, though this is unlikely as the nearest residential buildings are across Hutt Drive, 180 metres south of the central ponds.
- Human and animal transport.

Weed species may become a threat as they may spread into areas of newly revegetated native vegetation on top of the central and northern ponds, adjacent to the currently rehabilitated southern pond.

Significant Weeds

No introduced weed species listed as a Declared Pest under Section 22 of the Department of Agriculture and Food Western Australia (DAFWA) *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weeds of National Significance (Australian Weeds Committee 2010) have been recorded by or reported to Cristal.

Introduced plants occur throughout the Site, with the primary weeds being veldt grass (*Ehrharta calycina*), couch grass (*Cynodon dactylon*) and onion weed (*Trachyandra divaricate*). These have thrived in the southern pond rehabilitation area (Cox et al 2005).

Reference should be made to the DPaW prioritised weed ranking sheets provided on their website (DPaW 2014).

6.1 Current plant cover

Revegetation of native vegetation across the Site is essential to prevent erosion occurring onsite. Native flora re-vegetation of the Southern Ponds is well established and a similar planting regime has commenced on the Eastern Turning Circle. The remaining portions of the Site were hydro-mulched and an annual, sterile rye grass was planted as an interim soil cover to stabilise the soil along the central and northern portion of the Site. GHD understands that to date all remedial works have been completed on-site and that a final surface vegetation covering has been planted across the Site.

6.2 Monitoring

Weed species should be identified within the revegetated areas. As part of the weed management plan for the Site, the following objectives to manage weeds within the targeted areas mentioned above should include:

- Reduce the spread of weeds;
- Prevent the introduction of new weeds;
- Control and/or eliminate both noxious and environmental weeds.

As part of the weed management at the Site, annual monitoring of weeds in March-April should be completed. Any weeds observed will be sprayed with herbicide as per management practice outlined in Section 6.3.

6.3 Management

Weed spraying is required annually within the rehabilitation area. Weeds should be sprayed with an appropriate weed management poison according to the manufacturer's instructions during a period of dry, calm weather. This should be performed using a targeted approach if the weed issue is minor, but may require a broader application if there are significant numbers of weeds.

Restricting public access to revegetation zones will reduce the opportunity for weeds to be transported into these zones.

7. Soil capping integrity management

7.1 Requirement for management

The Site has been capped with a minimum of two metres of clean fill sourced from the Site to meet the Closure Notice requirements. As per correspondence with the Radiological Council of Western Australia (2019), two metres of clean fill should be applied across the Site at the time of remediation. However, if subsidence is noted across the Site, no additional fill is required for remedial purposes as it may destroy the rehabilitation process. In addition, it has been demonstrated that 0.5 m of clean fill is sufficient on-site to attenuate the radiological parameters to background levels (Appendix C). Notwithstanding, the integrity of the soil cap must be maintained to ensure that residual risks to on-site and off-site ecological and human health receptors remain acceptable for intended end use as endemic bushland.

Overall, it is considered that soil cap integrity may be compromised through settlement, slumping erosion or unintended mechanical disturbance.

Depressions from suspected slumping of sand have been observed on the Site. Thompson Surveying Consultants surveyed the Site in November 2013 following completion of the capping. The Site was re-surveyed in February 2015 and confirmed that the cap had slumped up to 0.2 m (GHD, 2015).

These observations indicate a degree of settlement has occurred following placement of soil capping upon TSR within the historic waste disposal ponds and most likely relates to settlement within the vertical profile of TSR (which itself would be subject to a degree of long-term settlement, consistent with such disposal pond residues). The presence of depressions is consistent with differential components of overall settlement related to variations in factors such as physical properties of TSR, sequencing of remediation earthworks and placement of additional cap material in excess of 2 m.

Settlement effects of this nature are not uncommon within materials associated with historic waste disposal ponds (and subsequent remediation with a soil cap). Such effects can be addressed through implementation of further remedial actions, as required, for use as endemic bushland (this is low sensitivity use with respect to settlement effects). Ongoing management measures are required to mitigate impacts that compromise the capping integrity across the Site.

However, management of settlement effects need to be considered with respect to the broader rehabilitation process occurring on-site. The following sections detail the monitoring and management strategy required across the Site, with the assumption that no additional fill will be required on-site should these effects be evidenced (as per correspondence in Appendix C).

7.2 Monitoring and management strategy

7.2.1 Restriction – penetration work

As identified in the RMP (Appendix B), no routine maintenance works are contemplated in this SMP for endemic bushland use that require penetration work (i.e. penetration of the soil cap).

Any future maintenance works that are required to penetrate the soil cap will require a specific management plan to be prepared and implemented to address risks to relevant receptors such as (but not necessarily limited to) maintenance workers. Specific reference must be made to the RMP (Appendix B) for any penetration works (i.e. works that are required to penetrate the soil cap) prior to any work being performed.

7.2.2 Ongoing routine radiation monitoring

Ongoing routine radiation monitoring (as detailed in the RMP (Appendix B) is undertaken to support declassification of the Site (i.e. relinquishing the Registration under the Radiation Safety Act WA). This includes a gamma radiation survey, undertaken by a separately appointed consultant (appointed by Tronox) which is completed annually as part of the RMP for the Site, in order to monitor the integrity of the capping (refer to Appendix B) for implementation of the current RMP.

The monitoring of the capping is to be undertaken in accordance with the regulations identified in Section 14 of the RMP (Appendix B). These include the Western Australia (1975) *Radiation Safety Act,* the Western Australia (1983) *Radiation Safety (General) Regulations* and the WA Department of Mines and Petroleum (2010) *Managing naturally occurring radioactive material (NORM) in mining and mineral processing – guideline (2nd edition)*. Results are reviewed by the Tronox Radiation Safety Officer including consideration of any need for further action in relation to results.

7.2.3 Visual inspection

Quarterly visual inspection will be undertaken to inspect the capping surface for indicators that the capping surface integrity has been comprised. Inspection will comprise:

- Perimeter fencing inspections.
- Systematic grid based walkover of the Site surface.
- Identification of potential indicators that the capping surface integrity has been comprised such as (but not limited to):
  - Uneven ground surface (e.g. depressions, surface water ponding).
  - Evidence of erosion (e.g. development of rills/gulley indicative of the formation of preferential surface water flow paths) with a potential to affect capping integrity.
  - Diseased, damaged or otherwise distressed vegetation.
  - Indicators of significant activity by burrowing animals.
  - Indicators of unauthorised disturbance/penetration of capping.
  - Indicators of unauthorised access/trafficking of vehicles.
- Record location of any indicators that the capping surface integrity has been comprised.
- Preparation of inspection records, (comparison with previous records for any identified indicators) and incorporation in the Tronox document management system for use in ongoing management of the Site.

Data will be compared to previous inspections to inform decision making concerning the need for further remedial action in order to maintain the integrity of the capping layer (e.g. application of additional soil capping, vegetation stabilisation).

7.2.4 Further remedial action

Where the integrity of the cap appears to be compromised i.e. through slumping, settlement or erosion of the cap, an assessment of the risk should be undertaken to understand whether further remedial action is required to mitigate potential risk to human health or the environment. An evaluation of further remedial action should be considerate of advice provided by the Radiation Council of WA (2019), which stipulates that no additional fill is required for remedial purposes as it may destroy the rehabilitation process. To this end, one or more of the following management measures may be implemented (depending upon the severity of the observed impacts and outcomes of the risk assessment):

- Completion of a risk assessment to determine if further remedial action is warranted.
- Addition of stabilising vegetation where erosion is noted.
- Review of site drainage, and consideration of additional drainage infrastructure, (where this cannot otherwise be addressed with measures that do not penetrate the cap and subject to the requirements identified in Section 7.2.1).

Contingency plan: unintended disturbance of TSR

Ground penetration is not permitted at the Site except where required for further remedial action. Any further remedial action should be undertaken in accordance with a specific site management plan. This plan should acknowledge the potential for unintended disturbance of TSR residues which are confined beneath a soil cap comprising a minimum of two metres of clean fill. To this end, in the event that unintended disturbance of TSR occurs, the following measures should be considered to mitigate risks to on and off site receptors:

- Cease the work immediately.
- Restrict access to the affected location/area/excavation.
- Alert the Tronox SHEQ Manager and Tronox Radiation Safety Officer and provide details.
- Tronox Radiation Safety Officer to provide advice concerning protection of human health in accordance with the RMP (Appendix B). This may comprise short-term response actions and follow up actions as necessary, such as one or more of the following:
  - Further restrictions upon access immediate response radiation monitoring (as appropriate).
  - Notification of relevant stakeholders as/where needed to mitigate to on and off site receptors (refer to Section 3.5).
  - Covering exposed TSF (e.g. replacement of soil cap material if TSF is exposed in-situ or covering TSF with an appropriate thickness of clean fill materials as a temporary measure if exposed at surface such as within an excavation stockpile).
  - Implementation of appropriate dust suppression measure and temporary covers/barriers as required to minimise TSF contact with other materials, rainwater and surface run-off).
  - Follow up action: preparation and implementation of a site-specific management plan to manage the disturbed TSF (e.g. planned penetration work for reburial of disturbed TSR including any associated impacted material and reinstatement of a minimum of two metres of clean fill.
- Event incident reporting to be undertaken as detailed in the RMP (Appendix B).

7.2.5 Annual Environmental Report

As identified in Section 4.6, an Annual Environmental Report will be prepared by Tronox and submitted to DWER. The Annual Environmental Report will summarise outcomes of monitoring and inspections and will provide details of any works that are implemented which disturb the soil capping, including details of reinstatement undertaken in order to demonstrate that two metres of clean fill remains across the Site and:

- Residual risks to relevant ecological and human health receptors remain acceptable.
- Remediation and rehabilitation of the Site has been successful in returning the Site to the intended end use as endemic bushland.

8. Dune stabilisation

8.1 Dunal system

The site is bounded to the west by a significant dunal system, between the TSR ponds and Dalyellup Beach. These dunes can range in height from 10 to 40 metres and, while blowouts have occurred in the past, several dunes in this sector have been rehabilitated in the past as opportunities have arisen, including those adjacent to this site, (Belton-Taylforth, 2005).

There is no current Coastal Hazard Management and Adaptation Plan for this region and the latest coastal management report available is the *Capel Coastal Strategy*, written by Belton-Taylforth for the Shire of Capel in October 2005.

The dunes are integral to ongoing coastal management of erosion and inundation risk of the Site and adjacent sites, including the Dalyellup Beach Estate.

With respect to whether or not the dunes are at risk of coastal erosion, they do sit within the default setback zone in absence of any calculation. In accordance with State Coastal Planning Policy 2.6, a high level calculation would be 40 m for the short term erosion allowance, 90 m for the sea level rise allowance and assuming a stable coastline with no factor of safety, the required setback from the vegetation line is 110 m. This is in line with the setback of the adjacent Dalyellup Beach Estate, so would appear to be a reasonable high level assumption.

Ongoing stability and integrity of the dunal system west of the Site is relevant to ensuring that residual risks from TSR at the Site to relevant ecological and human health receptors remain acceptable. As the intended site use is endemic bushland, no future works are proposed by Tronox that would adversely affect the stability and integrity of the dunes. It is however recommended that, while the state of the dunes presents no obvious risk of erosion to the Site or adjacent sites, a management strategy is implemented to:

- Allow early identification of possible indicators of dunal instability/loss of integrity due to external factors (i.e. unrelated to Tronox activities).
- Trigger notification of relevant stakeholders, in particular, external stakeholders that may have an influence upon or be responsible for the stability and integrity of the dunes beyond the Site. This is consistent with the Shire of Capel Coastal Strategy which requires the Shire of Capel to liaise with private land owners who own land proximal to the high water mark in order to manage dune stability (Belton-Taylforth, 2005).
- Allow early implementation of appropriate management measures. This many include practical measures to mitigate risk of future blowouts (generally occurring through sand loss through Aeolian processes, coastal erosion or vegetation damage due to vehicle access).

8.2 Monitoring and management strategy

8.2.1 Dunal stability and integrity monitoring

Monitoring (by visual inspection methods) of the condition of the dunes to the west of the Site should be completed in conjunction with quarterly inspections of soil cap integrity (refer to Section 7.2.3). A written and photographic record of dune conditions should be made and should include details of vegetation extent and condition, any evidence of new tracks and any activities observed outside of Tronox site activities that may adversely be impacting on the dune system.

The above records will be compared to previous monitoring records in conjunction with an annual review of available aerial photography showing vegetation condition and dunal features.

Any areas requiring rehabilitation should be recorded and identified to the Tronox SHEQ Manager for further action in a timely manner. The Tronox SHEQ Manager will also notify relevant stakeholders of such requirements, in particular, external stakeholders that may have an influence upon or be responsible for the stability and integrity of the dunes beyond the Site.

8.2.2 Restriction of access

The dune area within the Site will be appropriately signed (e.g. 'no access - dune rehabilitation area') to deter public access to assist in mitigating damage to vegetation along the dunes to minimise stability/integrity is not otherwise compromised.

8.2.3 Further remedial action

No additional clearing of the dunes should be permitted and efforts should be made to maintain or enhance the existing dune system where practical through approved vegetation planting. If dunal instability is observed, a topographical survey may be required to determine the extent of the impact.

If further remedial actions are triggered to facilitate the stability and integrity of the dunes within the Site, the Tronox SHEQ Manager (or delegate) will arrange for one (or more) of the following measures to be implemented as appropriate:

- Revegetation of the dune systems in areas showing vegetation degradation using endemic species native to the area and suitable for dune stabilisation. Any revegetation should be undertaken in conjunction with a geotextile (such as Jute Mat ® or similar) to ensure sand stabilisation during vegetation establishment
- If unauthorised access to the site is leading to additional tracks being formed (vehicle or pedestrian), additional protection measures may need to be implemented to prevent access through the dune system (where appropriate).

8.2.4 Annual Environmental Report

As identified in Section 4.6, an Annual Environmental Report will be prepared by Tronox and submitted to DWER. The Annual Environmental Report will provide details of any action implemented as a result of dunal stability and integrity monitoring.

9. Site Access Management

Site access including the entrance road and Site security will require management to ensure:

- Regular monitoring of the Site can be successfully completed, as outlined in this SMP.
- Mitigate risk of unauthorised access.
- Minimisation of risk to the community.
- Maximise success of the Site revegetation.

All signs, access roads for monitoring locations and fences surrounding the Site will be maintained by Tronox until such time that DWER considers ongoing management measures are no longer required to mitigate the potential risk to human health and/or the environment associated with Site conditions. Signs will be placed along the access road, located on Tronox property, to identify the Site as private property (rehabilitation area) with no public access (i.e. trespassing prohibited).

9.1 Monitoring

Monitoring of the condition of signs, fencing and the road should be completed as part of other routine monitoring. Any areas requiring maintenance should be recorded in the Site notes and provided to the SHEQ Manager for action.

9.2 Management

Required maintenance reported to the SHEQ Manager should be attended to in a timely manner and action taken should be recorded in the Annual Environmental Report.

Public access to revegetation areas will be restricted to ensure vegetation is not damaged and to reduce spread of weeds.

10. Reporting

Tronox will complete an Annual Environment Report describing the monitoring results and management activities completed for the Site as part of this SMP for the previous year. This will be provided to the DWER by 30 June each year until the DWER are satisfied that the remediation of the Site has been fully and appropriately actioned.

The Annual Environment Report will address the following:

- Current operations at the Site.
- Results of all monitoring and related management actions for the previous year (refer to Sections 4.6, 7.2.5, 8.2.4, 1 and 9.2).
- Ministerial conditions and company commitments.
- Comparison of the performance of the Site against completion criteria (as identified in the Closure Plan for the Site).

Reporting of the relevant management strategies will be undertaken with reference to the relevant guidance documents identified in Section 1.4. Refer to the RMP (Appendix B) for details of review concerning radiological conditions on the Site and the need for further action. The outcomes of such review will be documented in the Annual Environment Report. The Annual Environmental Report will be made available to DWER, Office of Environmental Protection Authority, RCWA and to the Shire of Capel for public access.

11. SMP Actions Summary

Table 8 outlines the required roles, responsibilities and timeframes for the SMP to be implemented during the monitoring period. GHD notes that a statement of acknowledgement of responsibility for each of the relevant stakeholders has been included in this SMP as Appendix E.

Table 8 SMP Actions

Management Item	Task	Timeframe	Responsible Officer
Groundwater (Section 4)	Superficial aquifer monitoring	Six monthly (April and October)	Tronox SHEQ Manager
	Yarragadee aquifer monitoring	Quarterly	Tronox SHEQ Manager
Dust (Section 5)	Further remedial action	As required during further remedial action	Tronox SHEQ Manager
Weeds (Section 6)	Weed monitoring & spraying	Annually (Spring)	Tronox SHEQ Manager
Soil capping integrity (Section 7)	Visual inspection	Annually	Tronox SHEQ manager
	Further remedial action	As required	Tronox SHEQ manager
	Contingency Plan	As required	Tronox SHEQ manager
Dune stabilisation (Section 8)	Monitoring dune condition on the western boundary of the Site	Annually (in conjunction with the soil capping integrity inspection)	Tronox SHEQ Manager
	Revegetation of degraded dunal areas	As required	Tronox SHEQ Manager
	Deter public access to dunes (e.g. install signage)	As required	Tronox SHEQ Manager
Site access (Section 9)	Check signs, fencing and roads	Routinely (quarterly during Yarragadee aquifer monitoring)	Tronox SHEQ Manager
Reporting (Section 10)	Annual Environmental Report preparation	Annually to include the previous years' results of monitoring for items listed in this table (also to include historical trend and baseline data for the relevant management strategies). This will	Tronox SHEQ Manager

Management Item	Task	Timeframe	Responsible Officer
		include a comparison of the Site performance to completion criteria identified in the Closure report for the Site.	
Radiation Management Plan (See Appendix B)	Undertake radiation monitoring	Routinely (annually for the gamma survey and groundwater monitoring and quarterly for air monitoring for radon and thoron in air)	Trained personnel appointed by Tronox's Radiation Safety Officer
Revision to SMP	Review and revise SMP based on the findings of the Annual Environmental Report.	Annually	Tronox SHEQ Manager

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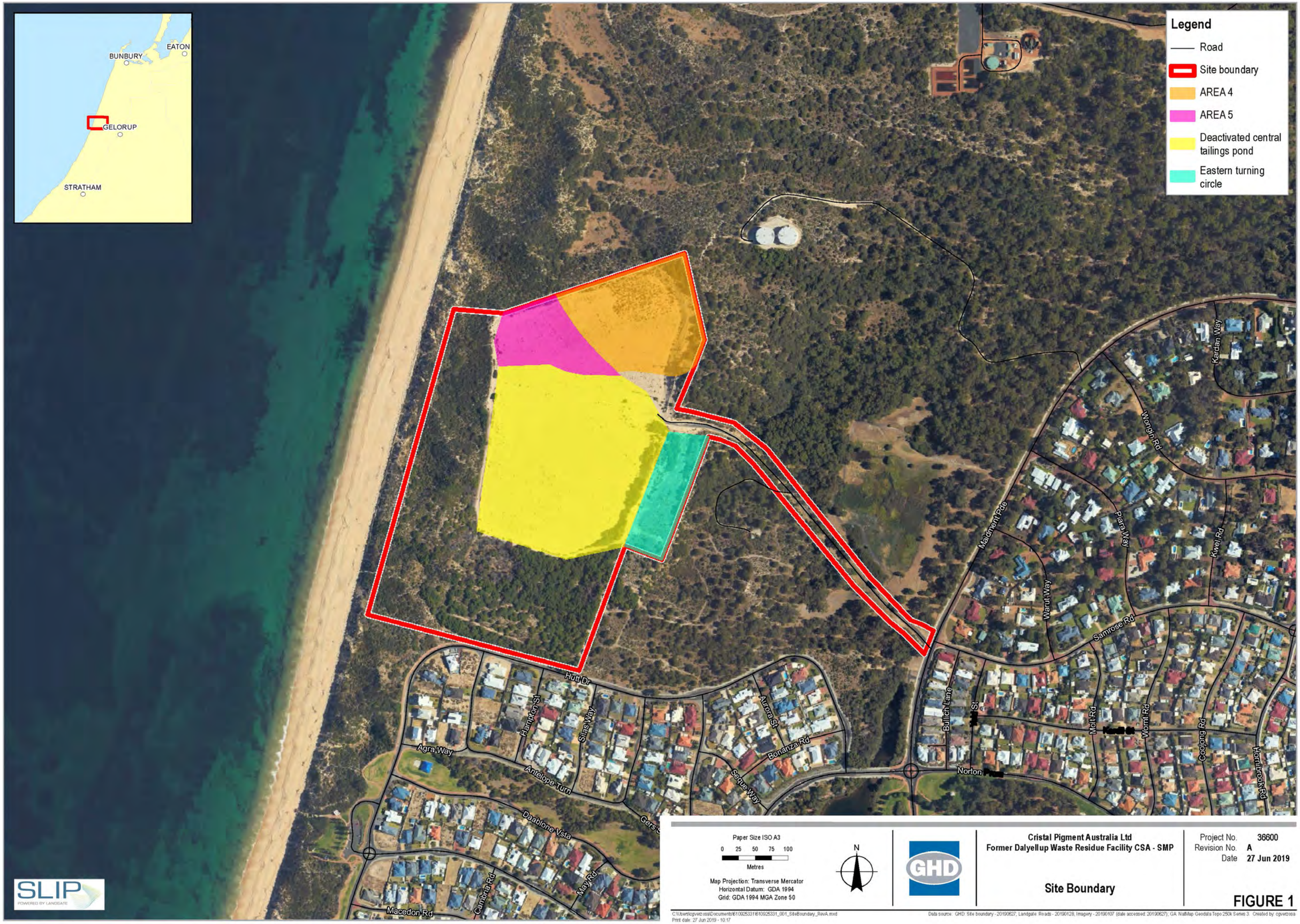
Appendices

Appendix A – Figures



Paper Size ISO A3

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Cristal Pigment Australia Ltd
Former Dalyellup Waste Residue Facility CSA - SMP

Site Boundary

Project No. 36600
Revision No. A
Date 27 Jun 2019

FIGURE 1

C:\Users\cgiverzosa\Documents\61092533\61092533_001_SiteBoundary_RevA.mxd
Print date: 27 Jun 2019 - 10:17

Data source: GHD: Site boundary - 20190627; Landgate: Roads - 20190128, Imagery - 20190107 (date accessed: 20190627); GA: NatMap Geodata Topo 250k Series 3. Created by: cgiverzosa

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Cristal Pigment Australia Ltd
Former Dalyellup Waste Residue Facility CSA - SMP

Groundwater Well Locations

Project No. **61-36600**
Revision No. **0**
Date:19 Jul 2019

FIGURE 2

C:\Users\cgverzosa\Documents\610925331\610925331_002_GWWellLocations_RevA.mxd
Print date: 19 Jul 2019 - 13:44

Data source: GHD: Groundwater well locations; Landgate: Roads - 20190128, Imagery - 20190107 (accessed: 20190719). Created by: cgverzosa

Appendix B – Radiation Management Plan

Government of **Western Australia**
RADIOLOGICAL COUNCIL

Address all correspondence to
The Secretary

Your ref
Our ref 05390_160714ds1
Enquiries Mr D Surin 08 9388 4999

Operations Manager
Cristal Pigment Australia Ltd – Dalyellup
Attn: Mr Peter Allen, Environmental Superintendent
Locked Bag 245
BUNBURY WA 6230

Dear Mr Allen

RADIATION SAFETY ACT
Radiation Management Plan

Thank you for the submission of your Radiation Management Plan (RMP) for the Dalyellup Waste Residue Disposal Facility – Post-Decommissioning and Rehabilitation.

Council considered the revision of the RMP dated January 2016 at its 232nd Meeting and raised no objection to the plan. Any subsequent significant variation to the RMP will need to be submitted to the Council for approval. It is noted that the RMP outlines the five-year ongoing monitoring program after rehabilitation for the years 2013 to 2018. Any proposals to reduce the frequency of ongoing monitoring after this term will also need to be submitted to Council for approval.

Should you have any queries on this matter, please contact Mr Duncan Surin at this office.

Yours faithfully

Ms Hazel Upton
Secretary, Radiological Council

02 AUG 2016

Letters: Locked Bag 2006 P O Nedlands WA 6009
Telephone (61 8) 9388 4999 **Facsimile** (61 8) 9382 0701
www.radiologicalcouncil.wa.gov.au
wa.gov.au

Radiation Management Plan

For

CRISTAL PIGMENT AUSTRALIA LIMITED

Dalyellup Waste Residue Disposal Facility

Post-Decommissioning and Rehabilitation

Doc Number: CRIS150130-RMP-V1.0

Current as of January 2016

Record of Approval:

Role	Name	Signature	Date
Prepared by	Annelize van Rooyen		04/01/2016
Endorsed by			

Document Number	CRIS150130-RMP	Version	V1.0

Revision History

Revision Number	Issue Date	Prepared By	Approved By	Approval Date	Revision Description
0		A van Rooyen			First Draft
0.1	04/01/2016	A van Rooyen			Review
1.0	14/01/2016	Sophie Holman	P Allen		First Issue

Record of Amendments:

Document Section	Name	Description
4.2	The Registered Manager	Remove from 4.2 the Mines Act.
6.1	Background radiation	Section 6.1 has 0.1µSv/hr to be consistent with the rest of the document - 0.1µSv.hr-1.

Record of Addenda:

Title	Revision	Description	Date of Issue

Contents

Figures

Tables

Appendix

1 Purpose

The purpose of this Radiation Management Plan (RMP) is to describe the organisational arrangements and procedures that are to be implemented for the purposes of controlling exposure to ionising radiation post decommissioning and rehabilitation of the Dalyellup Waste Residue Disposal Facility located on Minninup Road, Dalyellup.

It outlines the systems and the processes that will ensure compliance with standards and regulatory requirements on radiation protection of workers, members of the public and the environment following rehabilitation and remediation of the site. The aim of this RMP is to, as a minimum, support the proposed classification of Remediated – Restricted Use.

This RMP is compliant to and should be used in reference with documents as listed in section 14. The RMP will be reviewed and amended as necessary based on results from ongoing monitoring of the site.

2 Scope

This plan applies to all activities with radiological safety implications associated with the site and summarises the ongoing monitoring of the rehabilitated site.

3 Project Description

3.1 Site Location and Access

Cristal Pigment Australia Ltd (Cristal Pigment), previously known as Millennium Inorganic Chemicals Ltd, operated a solid residue disposal facility near Dalyellup, 8 km south of Bunbury town centre, for the disposal of solid residue from their Kemerton and Australind pigment plants. The residues contained technically enhanced naturally occurring radioactive material (TENORM), in the form of traces of uranium and thorium.

The layout of the site is shown in Figure 1 below.

Figure 1 Layout of the Site

3.2 Background

The Dalyellup facility was operated under Environmental Protection Act 1986 Licence (L6130/1989/12). It operated as a licenced facility for the disposal of Treated Solid Residue (TSR) from the production of titanium dioxide pigment since March 1989. The licence expired on 3 March 2013 at the end of the 24-year operation. The site comprised of 5 disposal ponds in total, serviced by access roads and surrounded by coastal dunes. A Closure Notice was issued by the Department of Environmental Regulation (DER) on 14 May 2013 and revised on 1 August 2013.

As required by the contaminated sites legislation, a Mandatory Auditor's Report (MAR) was submitted to the DER in relation to the Remediation, Validation and Closure Plan for the site.

The Radiological Council of WA (RCWA) responded to the MAR[1] stating:

"The documentation provided with the request for technical advice has been reviewed by officers of the Radiological Council. The overall conclusion in the report to classify the site as remediated for restricted use is supported, with the proposed site use being for public open space and recreating grounds. In the assessment of the proponent's Final Closure Plan, the Council stated that it had no objections to the plan with respect to those aspects covering radiation safety and management, with

[1] MAR for the former Dalyellup Tailings facility, Hazel Upton, Secretary, RCWA, Sept 2015, Ref: CS4121_150918ds1

the exception of the timing of the cessation of radiation monitoring. The Council supported the proponent's commitment for continued ongoing monitoring of the site upon closure, but stated that it would be prudent that amendments in monitoring from the operational stage (as set out in the Operational Radiation Monitoring Program) to the post-rehabilitation stage be clearly identified in a separate protocol or plan as provided for in the Radiation Management Plan - Decommissioning and Rehabilitation. This would also include the potential for the relaxation of any monitoring requirements during the specified control period, only where the remediation validation has been verified and approved by the relevant authorities including the Radiological Council and, where appropriate, the Department of Environment Regulation and Environmental Protection Authority.

The Council reiterates that the most significant radiological aspect to be flagged is in ensuring that there will be no future intrusion of the site after rehabilitation. The proposed end use of the site and 2 metres of capping over the disposal ponds should minimise the possibility of intrusion. "

As part of the decommissioning and rehabilitation of the facility, the residue ponds were capped with a sand layer using the original sand removed from the pond areas. Before final rehabilitation a gamma survey was commissioned to ensure that capping layer is successful in returning the ponds to the natural background gamma of the area.

On the 17th of October 2013 and the 17th and 18th of February 2014, Radiation Professionals personnel travelled to the site of the Dalyellup Facility Residue Pond to carry out gamma radiation monitoring with the intent of determining the progress for the rehabilitation of the area with respect to reducing gamma levels. The results of the gamma monitoring show that the rehabilitation of the area has been successful in returning the gamma radiation levels to within the natural background of the area (0.10 μGy h^{-1}) [7].

The goal of the closure and rehabilitation plan is to ensure that the site is safe for future use. This will be done by ensuring ongoing monitoring is performed to inform risk to the public and the environment. An application for the reclassification of this site has been submitted to the DER and it is anticipated that the site will ultimately be classified as *Remediated – Restricted* Use under the Contaminated Sites legislation.

The Shire of Capel has evaluated a proposal for future use of the site. The preferred redevelopment of the site involves conceptual design for a sports field to include soccer, football, cricket and softball facilities. The conceptual design is shown in Figure 2.

The current facility is administered by RCWA with an existing RMP under the Certificate of Registration of Premises for Radioactive Substances (RS 226/88 5390).

Figure 2: Conceptual Plan for future use of Dalyellup site

4 Responsibilities

Cristal Pigment Australia is responsible for ensuring that adequate measures had been taken to control the exposure to workers, members of the public and the environment as a result of their prior operation of the site.

Ongoing monitoring of the rehabilitated site will take place for a period as agreed by the Regulator, stakeholders and Cristal Pigment and will be overseen by a RSO.

It is the responsibility of Cristal Pigment to ensure that a RSO is appointed. The RSO will oversee all monitoring of the site, provide advice, supervision, instruction, training and written procedures, consulting and cooperating with workers and safety and health representatives as well as preparing reports and keeping detailed records of monitoring data.

The following personnel will be involved in the ongoing monitoring of the site and have roles and responsibilities as designated in Table 1 below:

Table 1: Roles and Responsibilities

Designation	Responsibility
Executive Director	Overall responsibility for the Radiation Safety of workers and the public from the hazards associated with activities of the site.
Managers and Supervisors	Responsible for the support of the Executive Director responsibilities on site for the protection of workers and the public from the hazards associated with the activities of the site. Providing the tools, PPE and administrative tools needed to the RSO and employees in the fulfillment of their work.
Radiation Safety Officer	Responsible for the application of the Radiation Safety Management Program, including monitoring and assessment of exposures, analysis of monitoring results and reporting thereof.
Contractors	Responsible for ensuring that safety rules and procedures are followed, safety features implemented and maintained and adherence to safety direction from RSO, procedures and signage, proper use and storage of PPE and the reporting of hazardous situations and incidents.

4.1 The Registrant/Responsible Person

The responsibilities of the Registrant/Responsible Person are defined in the Act, Regulations, in the conditions imposed on the registration and in relevant ARPANSA Codes of Practice. Some of the major responsibilities as required include, but are not limited to:

- Nominating a suitably trained and licensed Radiation Safety Officer to Radiological Council and ensure an RSO (or deputy RSO) is available to provide advice at all times.
- Ensuring the availability of calibrated radiation survey equipment

- Maintaining records of all exposure received by all employees from working with radiation devices during the course of their employment.

4.2 The Registered Manager

The Operations Manager is responsible for control and supervision of the premises under the Radiation Safety Act. This includes overseeing radiation management and liaising with the Department of Health. At Dalyellup, the Operations Manager will also be the Registrant.

4.3 Radiation Safety Officer (RSO) duties

The Radiation Safety Officer (RSO) or their nominated deputy is responsible for the onsite implementation of the Radiation Management Plan (RMP) and safe work practices as well as carrying out the radiation monitoring. The responsibilities of the RSO include:

- Assist the company to comply with the Radiation Safety Act and Regulations;
- Ensure facilities are maintained to a suitably safe standard;
- Assist in the preparation and enforcement of safety rules;
- Ensure training, instruction and supervision to perform duties safely is provided;
- Ensure all monitoring equipment is maintained and regularly calibrated;
- Ensure all monitoring is done according to approved standards and to satisfy regulatory requirements;
- Investigate and report any radiation exposure or contamination incidents;
- Report radiation hazards or non-compliance with standards or commitments;
- Maintain records of monitoring, calibrations, and serial numbers;
- Report on any incidents or accidents;
- Maintain the security of radioactive material.

The role of the RSO is to ensure the duty of the Registrant is fulfilled. Central to this function is the development, documentation and implementation of the Radiation Management Plan and associated radiation work practices. The RSO must ensure that the RMP be regularly reviewed as required and all personnel comply with the RMP. This role includes the implementation of a radiation monitoring program and investigation of any abnormal exposures or incidents, or of circumstances which may lead to either of these. It also includes the provision of appropriate information, training and supervision to employees with respect to the handling of NORM or TENORM so that any exposures are kept ALARA. The RSO must keep all relevant records and notify the Registrant on any significant matters. The RSO is required to report directly to the Radiological Council.

5 Radiation Protection Principles

Cristal Pigment and the management of the site are committed to maintaining standards of radiation safety recommended by the International Atomic Energy Agency, (IAEA), and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). These requirements are implemented in all Radiation Safety System documentation. Cristal Pigment management are committed to keeping all radiological exposures As Low as Reasonably Achievable (ALARA) taking into account social and economic factors.

In practical terms, this means that they will plan for the control of exposure to radiation and employ a hierarchy of controls, including:

- Avoidance of exposure, where practicable;
- Isolation of sources of radiation, where practicable, through shielding, containment and remote handling techniques;
- Engineering controls to reduce radiation levels and intakes of radioactive materials on and off site;
- Adoption of safe work practices, including work methods that make use of time, distance and shielding to minimize exposure; and
- Where other means of controlling exposure are not practicable or not sufficient, the use of approved personal protective equipment.

5.1 Justification of Radiological Exposures

Radiological exposures to individuals during the operation of a site have to be within dose constraints. These exposures have to be justified based on the net benefit of the exposure. As this will be a public use site, no exposures to individuals can be justified.

5.2 Optimisation of Radiation Protection

No routine works are expected on this site; thus no exposures are expected. In the event of site development works, any penetration work will undergo assessment and planning prior to any work being performed. The specific actions will undergo ALARA assessment which will include a dose assessment. A generic dose assessment for installation of lighting poles has been prepared and is attached as Appendix A. The outcome of this assessment showed no significant exposures to any worker during installation of lights on site, based on the stated assumptions.

Optimisation of Radiation Protection measures were taken into account during the remediation of the site so as to ensure that the magnitude of exposure, the number of people who are exposed, and the likelihood of incurring exposure to radiation, are As Low as Reasonably Achievable (ALARA), taking into account economic and social factors.

5.3 Radiation Dose Limits

Individual doses due to the residual radiological hazards on this site must not exceed the specified annual effective dose limits and equivalent dose limits given in the ARPANSA Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002) [RPS 1]. Where the RPS 1 adheres to the recommendations of the International Commission on Radiation Protection (ICRP).

Cristal Pigment is committed to ensuring that effective radiation doses (including committed effective radiation doses) to all persons do not exceed the dose limits for members of the public. Dose limits and constraints are summarised in Table 2 below.

Table 2 Dose Limits and Constraints

Class	Occupationally Exposed workers	Public*
Effective Dose Limit	20 $mSv.a^{-1}$, averaged over five consecutive years. 50 mSv in any single year.	1 $mSv.a^{-1}$ effective dose.
Effective Dose Constraint	10 $mSv.a^{-1}$	0.5 $mSv.a^{-1}$ effective dose.

** Public dose limits only are applicable to this site.*

5.4 Defence in Depth

Cristal Pigment adopts the defence in depth principle and has incorporated in-depth defensive measures (multiple barriers) into the design and rehabilitation of the site to compensate for potential failures in protection or safety measures.

6 Radiological Hazards and Controls

The radiological hazards associated with this the site will arise from exposure to low levels of Naturally Occurring Radioactive Material (NORM) and Technically Enhanced Naturally Occurring Radioactive Material (TENORM) that may be present in the rehabilitated areas of the previous residue ponds. These ponds have been fully capped and remediated to ensure public safety.

6.1 Background radiation

The background radiation dose rate on site is approximately 0.1 µSv.hr^{-1}, but will vary slightly between locations. Background dose rates will be monitored by means of passive radiation monitoring badges at various locations on the site.

6.2 Airborne contamination

All the residue ponds and affected areas have been remediated and capped with clean layers of sand. These areas have been monitored and showed no elevated levels in respect to radioactive materials. Strict penetration controls will be adhered to on site to ensure that potentially contaminated materials not be unearthed or exposed during any ground or other works.

7 Radiological Classification of Areas

As this is a rehabilitated site, there are no classified areas.

8 Ongoing Routine Monitoring

Ongoing monitoring will be performed to support the declassification of the site. The object is to gather data through annual monitoring to support the case for relinquishing the Registration under the Radiation Safety Act WA.

Monitoring requirements have been established, taking into consideration the history and past activities on the site. Parameters and methodology are summarised in Table 3.

Table 3: Ongoing Monitoring of the Dalyellup site

Parameter	Site/Locations	Frequency	Technique
Gamma	A 100 x 100m grid over the site	Annually after rehabilitation for a period of 5 (2013-2018)	On foot, using rate-meter (Radeye or Mini 6-80) with large volume, energy compensated environmental GM, (MC-71 probe), and WGPS for locations 3 x Integrated 60sec measurements @ 1m above ground
Radon Thoron in air	Sampling locations 1,3,5,7,9,13,16,20. Refer to figure 1	3 monthly (quarterly) change outs for a period of 2013 -2018	Track etch (RadTrak)
Water Quality	Water bores around site: DM1,DM2,DM4,DM7,DM8,DM9.MB3,MB4 and YB. Refer to figure 1	Annually for a period of 2013-2018	Water sampling as per AS/NZ 5667.11:1998 then elemental U and Th analysis plus radionuclide analysis for Ra226/228

Monitoring results will be summarised in a report that will be made available to all relevant stakeholders. Any elevated or unexplained results will be investigated and sources will be removed/remediated according to the outcome.

9 Radiation Monitoring Instrumentation

The radiation monitoring equipment to be used for the surveys on site, consists of a combination of portable radiation and contamination monitoring instrumentation designed to monitor the radiological conditions.

- The survey meters at a minimum, must be able to measure between 0 $\mu Sv.hr^{-1}$ and 1000 $\mu Sv.hr^{-1}$ and continue to indicate when radiation levels exceed the maximum readings in their measured range.
- Portable air samplers will be used to assess contaminant concentrations in air.
- All survey equipment is calibrated at a minimum every 12 months.

10 Review and Audit of the Radiation Management Plan

10.1 Performance Indicators

Performance indicators used to measure the effectiveness of radiological control measures include:

- Monitoring results from routine radiological surveys,
- Event/Incident Reports.

10.1.1 Monitoring Results

The RSO or designated person will review the radiological conditions on the site, as measured during routine or special surveys and will make recommendations as needed to remedy the following situations:

- There is a trend towards increasing radiation or contamination levels in an area
- There is a specific radiological concern

10.1.2 Event / Incident Reports

Events and incidents recorded will be investigated according to company incident investigation process [D1.10 - Incident Reporting Form]. The frequency and magnitude of radiological events will be considered an indicator of the effectiveness of the Radiation Protection Plan and its implementation.

The contact details for the relevant regulators for radiation safety are summarised in Table 4.

Table 4: Contact details of relevant regulators

Physical Address	Mailing Address
Radiation Health/Radiological Council The Secretary Radiological Council Grace Vaughan House 227 Stubbs Terrace Shenton Park WA 6008 Telephone: (08) 9388 4999 Web: www.radiologicalcouncil.wa.gov.au	 The Secretary Radiological Council Locked Bag 2006 PO NEDLANDS WA 6009

11 Quality Management

All monitoring and survey logs as well as site records are quality management documents and shall be managed according to the company Quality Management System.

The RMP is reviewed annually from the date of the first submission, as deemed necessary or after a significant deviation from the plan.

12 List of commitments

Item	Commitment	Section	Page
1	Cristal Pigment will comply with all WA laws and regulations governing radiation safety	1	5
2	The RMP will be updated and submitted to the regulatory authorities as needed	1	5
3	Cristal Pigment will appoint a suitably qualified RSO	4	9
4	Management will ensure that supporting documentation is established for all processes as needed by the RMP	4	9
5	Routine monitoring will be done according the established program	8	13
6	Annual reports will be provided and will include results of monitoring and updated dose assessments if needed	10.1.1	15

13 Glossary

Activity – amount of radioactive material in a sample, measured in Becquerels, where 1 Bq = 1 atomic decay per second.

ALARA – As Low As Reasonably Achievable, social and economic circumstances being taken into account.

Alpha – high energy, high speed particle radiation, actually a double-ionized helium nucleus, emitted from a decaying atom.

ARPANSA – Australian Radiation Protection and Nuclear Safety Agency

Becquerel / Bq – Unit of Activity see above; named after the discoverer of natural radioactivity.

Critical Groups/ Representative Persons – the group within proximity to an activity who are most likely to receive elevated radiation doses as a consequence of that activity

DER – Department of Environment Regulation

Dose – may be absorbed dose, committed dose, equivalent dose, or effective dose.

Gamma radiation – electromagnetic radiation like x-rays, emitted from the nucleus of an atom.

HSE – Health Safety and Environment

IAEA – International Atomic Energy Agency

ICRP – International Commission on Radiological Protection

Member of Public – not occupationally exposed to radiation.

NORM – Naturally Occurring Radioactive Materials

PPE – personal protective equipment e.g. dust masks.

ppm - parts per million, a measure of the concentration of an element in ore.

Radionuclide – also radioisotope, a radioactive form of an element

Radon – decay product of radium, an inert gas, similar to argon, neon, helium etc.

Radon progeny / radon daughters / radon decay products / RnDP – ^{218}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, short lived radionuclide breakdown products of the decay of Radon-222.

RCWA – radiological Council of WA
Representative Persons – See Critical Groups

RMP – Radiation Management Plan

Sievert / Sv – Unit of effective dose.

Thorium – 90th element in the Periodic Table. A radioactive element found in small amounts in most rocks and soils, about as common as lead (~10ppm). ^{232}Th decays very slowly (its half-life is comparable to the age of the Universe). Thorium is commonly used in gas-lamp mantles, welding rods, and hi-tech alloys. Some nuclear reactor designs use thorium in their fuel cycle.

Thoron – an isotope of radon, radon-220

Thoron progeny / thoron daughters / thoron decay products / TnDP – ^{216}Po, ^{212}Pb, ^{212}Bi, ^{212}Po, ^{208}Tl, short lived radionuclide breakdown products of the decay of Radon-220.

UNSCEAR – United Nations Scientific Committee on the Effects of Atomic Radiation

Uranium – 92nd element in the Periodic Table. A radioactive element found in small amounts in most rocks and soils (~3ppm). ^{238}U decays very slowly. Uranium is most commonly used in nuclear power plants to generate energy and to create radioisotopes for use in research, industry and medicine.

U_3O_8 - Uranium Oxide

14 References

[1] WA Department of Mines and Petroleum (2010) *Managing naturally occurring radioactive material (NORM) in mining and mineral processing — guideline (2nd edition)*: Resources Safety, Department of Mines and Petroleum, Western Australia

[2] ARPANSA (2005) *RPS9, Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral processing*

[3] ARPANSA (2008) *RPS2, Code of Practice for the Safe Transport of Radioactive Material*

[4] Western Australia (1975) *Radiation Safety Act*

[5] Western Australia (1983) *Radiation Safety (General) Regulations*

[6] Western Australia (2002) *Radiation Safety (Transport of Radioactive Substances) Regulations*

[7] Western Australia (1994) *Mines Safety and Inspection Act*

[8] Western Australia (1995) *Mines Safety and Inspection Regulations*

[9] NHMRC (now ARPANSA) (1985) *RHS 13, Code of Practice for the Disposal of Radioactive Wastes by the User*

[10] NHMRC (now ARPANSA) (1992) *RHS 35, Code of practice for the near-surface disposal of radioactive waste in Australia*

[11] Standards Australian (2004) *AS 3640: 2004. Workplace atmospheres _ Method for sampling and gravimetric determination of inhalable dust,*

[12] Standards Australian (2009) *AS/NZS 1715:2009 Selection, use and maintenance of respiratory protective equipment*

[13] UNSCEAR (2000) *Vol1 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly:* UNSCEAR, Vienna

[14] Toussaint LF (1985) *Radiation Protection in Australia 3(4) 151-55 Background Radiation in Western Australia*

[15] Webb DV, Solomon SB and Thompson JEM (1999). *Radiation Protection in Australasia. Background Radiation Levels and Medical Exposure Levels in Australia Vol 16, No 1*

Appendix A

Dose Assessment for Penetration Work

CALCULATIONS

Assumptions

From Tabba Tabba RMP Table 1

	FEED MATERIAL		CONCENTRATE PRODUCT		TAILINGS MATERIAL	
	ThO_2	U_3O_8	ThO_2	U_3O_8	ThO_2	U_3O_8
ppm	3.5	10.5	86	69	52	35
%U	0.0003	0.0009	0.0076	0.0059	0.0046	0.0030
Bq/g	0.012	0.111	0.301	0.731	0.182	0.371
Specific Activity (Bq/g)	**0.124**		**1.03**		**0.553**	

From Table D.12, NORM 5 Guidelines

	FEED MATERIAL		CONCENTRATE PRODUCT		TAILINGS MATERIAL	
	ThO_2	U_3O_8	ThO_2	U_3O_8	ThO_2	U_3O_8
Ratios	**1:3**		**1.25:1**		**1.5:1**	
$DCF_{AMAD1\mu m}$ (mSv/Bq)	**0.0056**		**0.0068**		**0.0071**	
$DCF_{AMAD1\mu m}$ (mSv/Bq_α)[2]	**0.011**	**0.0072**	**0.011**	**0.0079**	**0.011**	**0.0067**
ALI (Bq/y)	**178**		**147**		**142**	
DAC (Bq/m^3)	**0.074**		**0.061**		**0.059**	

From Tables F.1 and F.2, NORM 5 Guidelines

	Factor		
DCF_{RnDP}(mSv/mJh.m^{-3})	**1.4**		
DCF_{Rn-222}(mSv/mJh.m^{-3})	**3.1E-6**	**Equilibrium Factor**	**0.4**
DCF_{ThDP}(mSv/mJh.m^{-3})	**0.48**		
DCF_{Rn-220}(mSv/mJh.m^{-3})	**3.6E-5**	**Equilibrium Factor**	**1**
Concentration Factor (mJh.m^{-3} in 1 Bq.m^{-3})		**4.45E-3**	
DCF_{Rn-222}(mSv/Bqh.m^{-3})	**6E-3**		
DCF_{Rn-220}(mSv/Bqh.m^{-3})	**2E-3**		

From Tabba Tabba RMP Table 5

SEG	Positions	Number	Class of Work (%)	Expected annual hours
No Risk Workers	• Administrative and Cleaning Staff	5	No Risk (100%)	2400
Low Risk Workers	• Environmental Scientists and Maintenance Staff	4	Low Risk (100%)	2400
Designated Workers	• Processing Personnel and Operators (multi-faceted)	10	No Risk (10%)	240
			Low Risk (60%)	1440
			High Risk (30%)	720

[2] Information from Table B4, RPS9.1

External Radiation Dose to a designated worker, performing tasks in the process plant.
Time = 720 hours per year.
Dose from gamma

$$D_E = DR_\gamma \times T$$
$$= 0.5*720$$
$$= 360\ \mu Sv$$

Where:

- ***D_E*** is the dose from exposure to the gamma radiation for the specific time in µSv
- ***DRγ*** is the average gamma dose rate (µSv.h^{-1}) which was estimated as being in the order of 0.5 µSv/h
- ***T*** is the duration(h) of the exposure

External Radiation Dose to a designated worker, performing tasks on the balance of the site.
Time = 1680 hours per year.
Background dose on site = 0.1 µSv/h
Area dose rate = 0,1 µSv/h (Assumed 2xBG)
Dose from gamma

$$D_E = DR_\gamma \times T$$
$$= 0.1*1680$$
$$= 168\ \mu Sv$$

Dose from Radon, Thoron and progeny concentrations

$$E = f_e \times T \times C_{Rn} \times DCF$$

$$=0.4 \times 720 \times 20 \times 0.009$$

$$=51.84^*\ \mu Sv$$

*This dose does not take into consideration any Ventilation or Respiratory Protection factors. With application of an appropriate protection factor for this value can be reduced further

Where:

- ***E*** is the effective dose from exposure to the concentration of radon for the specific time in µSv
- ***fe*** is the equilibrium factor between radon and progeny, currently 0.4 for outdoor locations
- ***T*** is the estimated total exposure time in hours
- ***C_{Rn}*** is the radon concentration in Bq m^{-3} assumed to be 20 Bq.m^{-3} (2xBG; BG = 10Bq.m^{-3})
- ***DCF*** is the dose conversion factor, for radon (^{222}Rn) currently accepted to be 9 nSv / (Bq h m^{-3})

Due to the very short half-life of thoron, it will not travel far before decaying [UNSCEAR 2000]. The thoron decay product concentrations can be derived from standard

constants and therefor, at a concentration of 1Bq/m^3 of thoron in equilibrium with its daughters the ThDP concentration is 76nJ/m^3.

Thus 720h of work would result in a dose of 2µSv which is negligible in comparison to the dose from RnDP. This is also at a total overestimation of the Thoron levels.

Inhalation Dose to a designated worker, exposed to Concentrate dust in the process plant (no protection)

Committed effective dose from inhalation of alphas:

Isotope	DCF (Sv/Bq)	Activity (Bq)	Dose (Sv)
^{232}Th	2.3 x 10^{-5}	1	2.3 x 10^{-5}
^{228}Ra	2.6 x 10-6		2.6 x 10-6
^{228}Ac	1.4 x 10^{-8}		1.4 x 10^{-8}
^{228}Th	3.9 x 10^{-5}	1	3.9 x 10^{-5}
^{224}Ra	2.9 x 10^{-6}	1	2.9 x 10^{-6}
^{220}Rn	-	1	-
^{216}Po	-	1	-
^{212}Bi	3.0 x 10^{-8}	0.359	3.0 x 10^{-8}
^{212}Po	-	0.641	-
^{208}Tl	-		-
TOTAL		6	6.76 x 10^{-5}

Time = 720 hours per year.
Dust loading = 5 mg/l (5 g/m^3),

- ⇨ 1.2 x 10^{-3} m^3/h x 5 g/m^3 = 0.006 g/h
- ⇨ 0.006 g/h x 720 h = 4.32 g/year
- ⇨ 4.32 g/year x 1.03 Bq/g = 4.45 Bq/year

ALI for dust of 1µm AMAD for Th and U in a ratio as per Table 1 for Concentrate is 147 Bq/year for a dose of 1 mSv
Thus, 4.45 Bq/year will result in a dose of 0.030mSv/year

Inhalation Dose to a designated worker, exposed to ore dust in general (no protection)

Time = 1680 hours per year.
Dust loading = 5 mg/l (5 g/m^3),

- ⇨ 1.2 x 10^{-3} m^3/h x 5 g/m^3 = 0.006 g/h
- ⇨ 0.006 g/h x 1680 h = 10.08 g/year
- ⇨ 10.08 g/year x 0.124 Bq/g = 1.25 Bq/year

ALI for dust of 1µm AMAD for Th and U in a ratio as per Table 1 for feed material is 178 Bq/year for a dose of 1 mSv
Thus, 1.25 Bq/year will result in a dose of 0.007mSv/year

Effective dose to the worker

Total Effective Dose Equivalent (TEDE) is the sum total of all the sources of exposure to the individual. This means it is the sum total of the exposure to external sources like the gamma radiation and the internal sources like inhalation of radon and alpha activity and ingestion of radionuclides from drinking water and other sources.

$$TEDE = D_E + E + D_{Inh} + D_{Ing}$$

=0.36 + 0.168 +0.052+ 0.030 + 0.007

=0.617 mSv

Dose from ingestion is not taken into consideration as the potential for ingestion doses is extremely low and will be managed as incidental exposures following an incident. It is not expected to occur as result of normal operations.

Solving the above calculations results in a potential dose to the designated worker of 0.617mSv per year without taking into account any engineering controls, PPE for dust reduction measures or other occupancy factors.

Calculations based on estimates and not measured data. Calculations will be updated as monitoring results becomes available. Dose from BG not included in calculations

Calculations done by:

Annelize van Rooyen 12/11/2015

SRPA: Radiation Professionals

Appendix C – Correspondence with Radiological Council of Western Australia

Government of **Western Australia**
RADIOLOGICAL COUNCIL

Address all correspondence to
The Secretary

Your ref DWERA-001916
Our ref CS156_190816ds | D-AA-19/161089
Enquiries Mr D Surin 08 9222 2000

Mr Anthony Sutton
Executive Director, EPA Services
Department of Water and Environmental Regulation
Locked Bag 10
JOONDALUP DC WA 6919

Attn: Mr Stuart Simmonds

Dear Mr Simmonds

RADIATION SAFETY ACT
Dalyellup Solid Residue Disposal Facility – Final Closure Plan

Thank you for your email of 11 June 2019 in which you request advice and comments on the Final Closure Plan (version 3, July 2018) for the Dalyellup solid residue disposal facility operated by Tronox (formerly Cristal Pigment).

The plan has been reviewed by officers of the Council and has also been considered against the Final Closure Plan June 2013 for this site and Council's previous feedback to both the OEPA (31 January 2014, our ref CS156_140109ds2) and Cristal Pigment. No objections have been raised on the plan with respect to those aspects covering radiation safety and management.

The following comments are also provided but do not have bearing on the approval of the plan –

- Council has recently been advised that the Department of Water and Environmental Regulation has requested Tronox to contemporise the Site Management Plan (SMP). In doing so, Tronox has requested the Radiological Council's opinion with respect to the radiological commitment of a minimum 2 m depth of fill over the solid residue disposal ponds, as Tronox advises that DWER has insisted that Tronox conduct annual ground penetrating and/or surveyor surveys to monitor the subsidence of the land as the TSR layer compacts to ensure that the 2 m minimum fill is maintained. Tronox states that bringing in more fill to compensate for a compromised minimum layer may destroy the rehabilitation process.

  The figure of 2 m was initially enforced by the Radiological Council as it reflected the requirements of the original relevant Australian code of practice. Covering the disposal ponds with at least 2 metres of neutral fill would minimise the possibility of intrusion, and should ensure that the gamma radiation levels are essentially the same as the surrounding area and that emanation of radon and thoron will be

Letters: Locked Bag 2006 PO Nedlands WA 6009
Email: radiation.health@health.wa.gov.au
Telephone: (61 8) 9222 2000
www.radiologicalcouncil.wa.gov.au

unlikely to be significant.

The proponent has provided information in the Final Closure Plans to demonstrate that a 0.5 m capping over the disposal ponds would be sufficient to attenuate the radiological parameters to background levels; however, a higher thickness of fill should be included in the rehabilitation design to account for future intrusion and erosion scenarios. The 2 m capping should be applied at the time of rehabilitation; if there is subsidence due to compaction after the initial rehabilitation, no additional fill should be required.

- In sections 14.2.2 and section 17.1 (pages 35 and 47 of 2410), Tronox discusses the assessment of the uptake of radionuclides of deep rooted plants on the rehabilitated southern ponds. When is this assessment expected to be undertaken?

- In section 14.2.2 (page 35 of 2410), Tronox mentions a buffer zone. For clarification, in advice provided to Tronox on 16 August 2018, Council advised that a buffer is not required as is it managed under the Contaminated Sites Act. Council's historic recommendations in 2000 on a buffer zone for the waste residue facility were before the Contaminated Sites Act was enacted and while the site was still operational.

- In Appendix B Radiological Considerations (commencing page 152 of 2410), the *Operational Radiation Monitoring Program at Solid Reside Disposal Site, Dalyellup, Annual report: year ending 30 September 2012* was also included in the previous version of the final closure plan (from June 2013). Although Council had liaised with Cristal Pigment on a number of matters within that report upon review of the 2013 Final Closure Plan, the matters are repeated in this appendix. It would be appropriate for an updated and more recent report to be provided.

Should you have any queries on this matter, please contact Mr Duncan Surin at this office.

Yours faithfully

H. Upton

Ms Hazel Upton
Secretary, Radiological Council

6 September 2019

CC: Mr Peter Allen
By email, peter.allen@tronox.com

Appendix D – Field Sheets

Groundwater Purging and Sampling Record

Bore ID: ……..

Job Information	Sampling Information		Bore Information
Client:	Purge Method:		Standing Water Level (m BTOC):
Project:	Sample Method:		Bore Depth (m):
Project Number:	Water Level Meter Type: Dip / Interface / Other:		Screen (m) from: to:
Sampler:	Water Quality Meter Type:		Bore Diameter (mm):
Date:	Flow Cell: Y / N	Pump Depth:	Well Cap Secure: Y / N
Round:	Field Filtered: Y / N	Filter Type:	Other:

Time	Volume (L)	pH (pH units)	Elec Cond (µS / mS)	Temp (°C)	SWL (m BTOC)	Comments: (Colour, turbidity, sediment load, sheen, odour, flow rate, etc)
Stable when 3 consecutive readings:		+/- 0.05 pH	+/- 3%	-	stable	

Field QA Checks:
Air bubbles in vials? Y / N
Any violent reactions? Y / N
Decontamination as per procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC Updated? Y / N

Purge Volumes
Casing int. dia. (mm) 50 100
Vol (L/m of casing) 2.0 7.9
(Double for gravel pack)

Comments: (Duplicate samples, access, condition of headworks, etc.)

Appendix E – Tronox commitment statement and stakeholder acknowledgement of the SMP

By signing Table 9 below, Tronox Pigment Bunbury Ltd. acknowledges its responsibility in implementing the Site Management Plan as detailed in this report (see Table 9 for current revision of the report). This commitment statement acknowledges that Tronox Pigment Bunbury Ltd. is aware of the SMP, agrees to its content and agrees to abide by it. If revisions to the SMP are required based on the annual review of this report, this commitment statement will be updated as identified in Table 9 below:

Table 9 Tronox agreement

Report Reference	Tronox Personnel Name and Position	Tronox Personnel Signature	Date
Former Dalyellup Waste Residue Facility. Site Management Plan. August 2019 (Rev 6) (Reference: 6136600-37992)			

The following confirmation (shown as Attachments E1 – E5, Appendix E) has also been provided by the key stakeholders (as listed in Section 3.5.1) noting that they are aware of the SMP, agree to its content and agree to abide to the SMP.

E.1 Correspondence with Dalyellup Beach Pty. Ltd.
E.2 Correspondence with The Shire of Capel
E.3 Correspondence with Department of Water and Environmental Regulation (DWER)
E.4 Correspondence with Department of Health
E.5 Correspondence with Satterley Property Group

GHD

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10 Victoria Street
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12511395-41170/https://projectsportal.ghd.com/sites/pp18_02/formerdalyellupwaste/ProjectDocs/6136600_REP_Cristal Pigment SMP_Rev6_July 2019.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J Stegna	A Rentsch		F Hannon		16.03.15
Rev0	A Rentsch	F Hannon		F Hannon		27.03.15
Rev1	A Clarke	F Hannon		F Hannon		02.06.15
Rev2	A Clarke	F Hannon		F Hannon		23.06.15
Rev3	D. Shuttleworth	K. Skippings		K. Skippings		20.12.17
Rev4	D. Shuttleworth	K.Skippings		K.Skippings		16.01.2018
Rev5	D. Shuttleworth	K. Skippings		K. Skippings		
Rev6	D. Shuttleworth	S. French	*on file	K. Skippings		28.08.2019
Rev7	D. Shuttleworth	K. Skippings		K. Skippings		19.09.2019
Rev8	D. Shuttleworth	K. Skippings		K. Skippings		07.10.2019

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Appendix H
Laboratory Reports

Appendix H
Laboratory Reports

TRONOX

AP_DPS1404 ChemCentre Chain of Custody Record

Environmental Scientist: 9780 8779
E-mail signed COC to: ap.sheqbunbury@tronox.com and chris.roberts@tronox.com

Tronox Pigment Bunbury Ltd.
ABN 50 008 683 627

Locked Bag 245
Bunbury WA 6230

Tel (08) 9780 8333
Fax (08) 9780 8444

Site: DALYELLUP Sheet

Attention: Kevin Robins, ChemCentre, Cnr Manning Road and Conlon Street, Bentley WA 6102. Tel.: 08-9422-9900 Fax.: 08-9422-9998

Lab. No. 2053128	Sample ID	Date Sampled	Number of Containers					Analysis Required													Changes to Normal Scheduled Analyses / Comments
			1L	1L acid	125mL	125mL acid	125mL acid filtered	Schedule 1	Schedule 2	Schedule 3	Schedule 4	Schedule 5	Schedule 6	Schedule 7	Schedule 8	Schedule 9	Schedule 10	Schedule 11	Schedule 12	Schedule 13	Schedule 14	
001	YB	26/01/21	1													X					
002	DM4C	26/01/21	1		1	1	1		X													

Department:	Environmental	Method of Shipment:	Courier	Results Required By:	Laboratory Signature:
Sent By:	STASS Environmental	Date:	27 January 2021	Date:	Received Date & Time: 27/1/21 11:3
					Sample Condition: cold

Schedules for Analysis of Samples at ChemCentre

SCHEDULE 1	Collie River & Ocean Outfall	1x1L plastic 1x125mL plastic (Metals) - acidified 1x125mL plastic (Nutrients) FILTER	Total Metals (Al, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Mo, Hg, Ni, Se, Na, Ti, V, Zn) pH, EC, TDS, TSS, Turbidity, NH_4, HCO_3, Cl, CO_3, NO_3, Total P, SO_4
SCHEDULE 2	Dalyellup	1x500mL plastic 1x60mL plastic (preserved) 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) – acidified FILTER	Dissolved (filterable) Metals (B, Cd, Ca, Cr, Cr(III), Cr(VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Na, V) TDS, HCO_3, CO_3, Cl, NO_3-N, SO_4, Molar Na:Cl Ratio
SCHEDULE 3	Kemerton Recovery Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total alkalinity, Total acidity
SCHEDULE 4	Australind Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total Alkalinity, Total Acidity
SCHEDULE 5	Kemerton Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Al, As, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Na, V, Zn)TDS, Total Acidity, HCO_3, Cl, NO_3, SO_4, pH, EC, Total Alkalinity
SCHEDULE 6	Kemerton and Australind TSR - Mud Solid	Approx. 2L in plastic jar/s	*Centrifuge supplied mud/water sample. Test the solid fraction as follows. (Total metals since a solid)* LOI (650°C), Al, As, Ba, Be, B, Cd, Ca, C, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, S, Th, Sn, Ti, U, V, Zn, Cl

SCHEDULE 7	Kemerton TSR and Australind TSR - Pore Water (Supernatant)	From above	*Centrifuge supplied mud/water sample. Test the liquid fraction as follows.* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SCHEDULE 8	Kemerton and Australind TSR – Mud Solid (ASLP Leachate)	From above	*Perform ASLP on Mud solid as specified by AS4439.3:1997 using Reagent Water. Analyse leachate for;* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SCHEDULE 9	Dalyellup YB – Quarterly	1x250mL plastic	Cl, Na, Molar Na:Cl Ratio.
SCHEDULE 10	Dalyellup	2x1L glass	YB, MB3 and DM8 – dioxins and furans
SCHEDULE 11	Kemerton and Australind Production Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic Metals acidified - FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, HCO_3, Cl, SO_4, NO_3
SCHEDULE 12	Australind Recovery Bores	1x500mL plastic 1x125mL plastic (Metals) acidified -FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, Total Acidity, Cl, SO_4
SCHEDULE 13	Golder and Australind Bores	1x500mL plastic 2x125mL plastic (Metals) - acidified FILTER ONE 2x125mL plastic (Nutrients) FILTER ONE	Total Metals (Fe) Dissolved (filterable) Metals (Al, As, Cd, Cr, Cu, Pb, Mg, Mn, Hg, Ni, Se, Na, K, Zn) pH, EC, TDS, Turbidity, Cl, SO_4, CO_3 Total P, Total N as N, Total Kjeldahl as N (TKN), nitrate and nitrite as N (TON)
SCHEDULE 14	Kemerton, KM6	1 x1L glass 2x40mL glass vials	Total hydrocarbons

Notes: TDS by evaporation, not calculation.
Dissolved metals are field filtered unless specified.
Low detection levels required for metals. Most samples are saline.
If filter apparatus is unavailable, any sample that was to be filtered into an acidified 125mL bottle MUST be filtered into a NON-ACIDIFIED 125mL bottle (thoroughly wash acid out of bottle if necessary). The sample must be filtered before being acidified.

Sample Acknowledgement Receipt

PO Box 1250, Bentley Delivery Centre
Bentley WA 6983
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

CLIENT DETAILS

Contact	Chris Roberts
Client	Tronox Pigment Bunbury Limited
Address	Locked Bag 245
	Bunbury WA 6230
Telephone	08 9780 8779
Facsimile	
Email	chris.roberts@tronox.com;ap.sheqbunbury@tronox.com
Project	
Client Job Ref.	Dalyellup
CoC No	
PO Number	None
Samples	2

LABORATORY DETAILS

Registration # 20S3128

Manager	David Lynch
Laboratory	Inorganic Chemistry Section
Telephone	9422 9953
Facsimile	9422 9998
Email	eclabmanager@chemcentre.wa.gov.au
Registered By	Upulmal Govinnage
Samples Received	Wed 27/01/2021
Report Due	Wed 10/02/2021
Receipt Print By	Upulmal Govinnage

SUBMISSION DETAILS

This is to confirm that 2 samples received on 27/01/2021. Results are expected to be ready by Wed 10/02/2021.
Please quote Registration #20S3128 when making enquiries.

Sample counts by matrix	2 water	Sample Disposal Type	Dispose
Date documentation received	27/01/2021		

Samples are accepted on the basis that the ChemCentre terms and conditions of analysis are understood and accepted. Samples will be held for one month from date of reporting before disposal or return as marked above.

INVOICING DETAILS

The person submitting the sample is considered to be the client and is responsible for payment. It is not acceptable to ChemCentre for a third party to be made responsible for payment.

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission or before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

Sample Acknowledgement Receipt

PO Box 1250, Bentley Delivery Centre
Bentley WA 6983
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

SUMMARY OF ANALYSIS

Lab No	Client ID	Alkalinity in water	ChromiumIII by calculation in waters	Colourimetric using discrete analyser	Elements dissolved in water by ICPMS	Hexavalent chromium, outsourced to NMI	Mercurylow levels total in water by cold VGAAS	Metals direct in Water by ICPAES	Nitrate nitrogen in water by FIA	Nitrate nitrogen in water corrected for nitrite	Nitrite nitrogen in water by FIA
001	YB	×	×	✓	×	×	×	✓	×	×	×
002	DM4C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Lab No	Client ID	Sodium to chloride ratio DA	Solids total dissolved in water by gravimetric								
001	YB	✓	×								
002	DM4C	✓	✓								

This table indicates the testing requested. This is not a report of the results

ChemCentre
Scientific Services Division
Report of Examination

Accredited for compliance with ISO/IEC 17025 - Testing, Accreditation No. 8

Purchase Order: None
ChemCentre Reference: 20S3128 R0

Resources and Chemistry Precinct
Cnr Manning Road and Townsing Drive
Bentley
WA 6102
Bentley WA 6983
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

Tronox Pigment Bunbury Limited
Locked Bag 245
Bunbury WA 6230

Attention: Chris Roberts

Report on: 2 samples received on 27/01/2021

LAB ID	Material	Client ID and Description
20S3128 / 001	water	YB
20S3128 / 002	water	DM4C

LAB ID			001	002
Client ID			YB	DM4C
Sampled			26/01/2021	26/01/2021
Analyte	**Method**	**Unit**		
Bicarbonate as CaCO3	iALK2WATI	mg/L		250
Carbonate as CaCO3	iALK2WATI	mg/L		<1
Chloride	iCO1WCDA	mg/L	205	2540
Na:Cl ratio*	Na:Cl MRatio		0.7	0.2
Nitrogen, nitrate	iNTAN1WCALC	mg/L		<0.01
Sulphate	iCO1WCDA	mg/L		570
Total dissolved solids(grav)	iSOL1WDGR	mg/L		5500
Boron	iMET1WCMS	mg/L		0.24
Cadmium	iMET1WCMS	mg/L		<0.0001
Calcium	iMET1WCICP	mg/L		515
Chromium	iMET1WCICP	mg/L		0.002
Chromium(III)	iCR3+2WCCA	mg/L		0.002
Chromium(VI)*	eNW_D2	mg/L		<0.001
Cobalt	iMET1WCMS	mg/L		<0.0001
Copper	iMET1WCMS	mg/L		<0.0001
Iron	iMET1WCICP	mg/L		3.2
Lead	iMET1WCMS	mg/L		<0.0001
Magnesium	iMET1WCICP	mg/L		619
Manganese	iMET1WCMS	mg/L		0.15
Mercury	iHGL1WCVG	mg/L		<0.00005
Molybdenum	iMET1WCMS	mg/L		0.003
Nickel	iMET1WCMS	mg/L		<0.001
Potassium	iMET1WCICP	mg/L		13.3
Sodium	iMET1WCICP	mg/L	94.4	293
Vanadium	iMET1WCMS	mg/L		0.0001
Date Analysed	eNW_D2			4/2/2021
	iALK2WATI			28/1/2021
	iCO1WCDA		28/1/2021	28/1/2021
	iCR3+2WCCA			4/2/2021
	iHGL1WCVG			3/2/2021

LAB ID		001	002
Client ID			
Sampled			
Analyte	**Method**	**Unit**	
Date Analysed	iMET1WCICP	2/2/2021	2/2/2021
	iMET1WCMS		1/2/2021
	iNTAN1WCALC		29/1/2021
	iSOL1WDGR		29/1/2021
	Na:Cl MRatio	2/2/2021	2/2/2021
Sample Condition		Cold	Cold

Method	Method Description
eNW_D2	Hexavalent chromium, outsourced to NMI
iALK2WATI	Alkalinity, Bicarbonate, Carbonate, Hydroxide and Total Carbon Dioxide by acid titration. pH and Conductivity in water (compensated to 25C) by meter.
iCO1WCDA	Colourimetric analysis by DA (Discrete Autoanalyser).
iCR3+2WCCA	Dissolved Chromium (III) species by calculation (Dissolved Cr minus Cr(VI)- NMI NSW).
iHGL1WCVG	Dissolved mercury in water by digestion, CV-AAS.
iMET1WCICP	Total dissolved metals by ICPAES.
iMET1WCMS	Total dissolved metals by ICPMS.
iNTAN1WCALC	Nitrate expressed as nitrogen by FIA.
iSOL1WDGR	Total dissolved solids (TDS) by gravimetry, dried at 178 - 182 C.
Na:Cl MRatio	Calculated sodium:chloride molar ratio.

A quality assurance report is attached.

CrVI analysis was subcontracted to NMI, 105 Delhi Road, North Ryde, NSW, 2133. NATA accreditation 198. A copy of their report is attached.

These results apply only to the sample(s) as received. Unless arrangements are made to the contrary, these samples will be disposed of after 30 days of the issue of this report.
This report may only be reproduced in full.

*Analysis not covered by scope of ChemCentre's NATA accreditation.

Alex Martin
Chemist
SSD Inorganic Chemistry
4-Feb-2021

Quality Assurance Report

Client : Tronox Pigment Bunbury Limited
Client Ref No : Dalyellup
CoC No :
QA Report No : 20S3128-QA R 0

Analyte	Method	Unit	LoR	Blank	Sample Duplicates			Acceptable	Recoveries		Acceptable
					Sample	Duplicate	RPD	RPD	LCS	Matrix Spike	Recovery
							%	%	%	%	%
Scientific Services Division											
Sample Matrix : water											
					20S3128/002						
Boron - Filterable	iMET1WCMS	mg/L	0.005	<0.005	0.24	0.25	4%	10%	-	-	75% - 125%
Calcium - Filterable	iMET1WCICP	mg/L	0.1	<0.1	515	518	<1%	10%	104%	-	75% - 125%
Cadmium - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<1%	10%	98%	-	75% - 125%
Chloride	iCO1WCDA	mg/L	1	<1	2540	2570	1%	10%	104%	-	75% - 125%
Cobalt - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<1%	10%	99%	-	75% - 125%
Carbonate as CaCO3	iALK2WATI	mg/L	1	<1	<1	<1	<1%	10%	-	-	90% - 110%
Chromium - Filterable	iMET1WCICP	mg/L	0.001	<0.001	0.002	0.001	66%	10%	104%	-	75% - 125%
Chromium(III)	iCR3+2WCCA	mg/L	0.001	<0.001	0.002	0.001	66%	10%	-	-	75% - 125%
Chromium - Hexavalent	eNW_D2	mg/L	0.001	<0.001	<0.001	<0.001	<1%	10%	-	-	75% - 125%
Copper - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<1%	10%	101%	-	75% - 125%
Iron - Filterable	iMET1WCICP	mg/L	0.005	<0.005	3.2	3.2	<1%	10%	104%	-	75% - 125%
Bicarbonate as CaCO3	iALK2WATI	mg/L	1	<1	250	250	<1%	10%	-	-	90% - 110%
Mercury - Filterable	iHGL1WCVG	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<1%	10%	109%	-	75% - 125%
Potassium - Filterable	iMET1WCICP	mg/L	0.1	<0.1	13.3	13.4	<1%	10%	93%	-	75% - 125%
Magnesium - Filterable	iMET1WCICP	mg/L	0.1	<0.1	619	619	<1%	10%	104%	-	75% - 125%
Manganese - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	0.15	0.15	<1%	10%	99%	-	75% - 125%
Molybdenum - Filterable	iMET1WCMS	mg/L	0.001	<0.001	0.003	0.003	<1%	10%	102%	-	75% - 125%

Quality Assurance Report

Analyte	Method	Unit	LoR	Blank	Sample	Duplicate	RPD	Acceptable RPD	LCS	Matrix Spike	Acceptable Recovery
Nitrate as NO3-N	iNTAN1WCALC	mg/L	0.01	<0.01	<0.01	<0.01	<1%	10%	-	-	75% - 125%
Sodium - Filterable	iMET1WCICP	mg/L	0.1	<0.1	293	293	<1%	10%	99%	-	75% - 125%
Na:Cl ratio	Na:Cl MRatio		0.1	<0.1	0.2	0.2	<1%	10%	-	-	75% - 125%
Nickel - Filterable	iMET1WCMS	mg/L	0.001	<0.001	<0.001	<0.001	<1%	10%	98%	-	75% - 125%
Lead - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<1%	10%	103%	-	75% - 125%
Sulfate	iCO1WCDA	mg/L	1	<1	570	570	<1%	10%	103%	-	75% - 125%
Total Dissolved Solids (Evap)	iSOL1WDGR	mg/L	10	<10	5500	5800	5%	10%	101%	-	75% - 125%
Vanadium - Filterable	iMET1WCMS	mg/L	0.0001	<0.0001	0.0001	0.0001	<1%	10%	100%	-	75% - 125%

Definitions:

RPD = Relative Percentage Difference
LCS = Laboratory Control Sample
LoR = Limit of Reporting

Quality Control Acceptance Criteria

Waters:

Lab Dups RPD <10% for results greater than 5 X LOR.
For results less than 5 x LOR no acceptance criteria for RPD.
Matrix spikes, LCS and Surrogate recoveries: Generally 75% - 125% for inorganics/metals, 60% - 140% for organics (+/- 50% surrogates) and 10% - 140% for labile SVOCs (including labile surrogates) unless other values are stated above.

Soils:

Soils: Lab Dups RPD<20% for results greater than 5 X LOR.
For results less than 5 x LOR no acceptance criteria for RPD.
Matrix spikes, LCS and Surrogate recoveries: Generally 75% - 125% for inorganics/metals, 60% - 140% for organics (+/- 50% surrogates) and 10% - 140% for labile SVOCs (including labile surrogates) unless other values are stated above.

PO Box 1250, Bentley Delivery Centre,Bentley,WA,6983, TEL: +61 8 9422 9800, FAX: +61 8 9422 9801,www.chemcentre.wa.gov.au

Quality Assurance Report

Analyte	Method	Unit	LoR	Blank	Sample	Duplicate	RPD	Acceptable RPD	LCS	Matrix Spike	Acceptable Recovery

Alex Martin
Chemist
SSD Inorganic Chemistry

04-Feb-2021

Stass Environmental
PO Box 11
Kalamunda, WA 6926
Ph (08) 63635276
Fx (08) 94547615

CHAIN OF CUSTODY & ANALYSIS REQUEST

LAB SCG WRS
ADDRESS Welshpool
LAB CONTACT
PHONE 9475 0099

PROJECT # TRONOX Dalyellup
PROJECT NAME Dallyellup January 2021
COLLECTORS NAME Andre Stass
LAB JOB #

PRELIM. RESULTS BY: ☐ VERBAL ☐ FAX ☑ EMAIL
andre@stass.com.au
FINAL REPORT BY:
LAB QUOTE REF:

SAMPLE ID	DEPTH (metres)	LAB #	MATRIX: WATER	SOIL	SWAB	SLUDGE	PRESERVATION METHOD: ICE	ACIDIFIED	OTHER	NONE	SAMPLING DATE	No. OF CONTAINERS	PHENOL SP.	TPH	BTEX (PURGE & TRAP)	HCO3	Ra 226 and Ra 228	NO 3 as N	Na, Ca, K, Mg	SO4, NO3, NH4, Cl scan	As, Cd, Cr, Cu, Mn, Ni, Pb, Zn, Hg	B, Cr(vi), Cr (total), Co, Se, V, Mo	pH	Conductivity (mS/m)	TDS (mg/l)	REMARKS
DISCRETE SAMPLE REQUEST:														ANALYSIS REQUIRED & METHOD CODE												
DM 4C			*				*				26-Jan-21						*									email results to
YB			*				*				26-Jan-21						*									andre@stass.com.au
																										Chris.Roberts@tronox.com
																										craig.mcmanus@tronox.com
																										Purchase Order from Tronox Pty Ltd
																										SGS Melbourne job, for :
																										Stephen Rutkowski
																										tel 0414 597 502

SGS EHS Melbourne COC
ME318537

Relinquished by:	Date	Time	Received by:	Date	Time	
Andre Stass			SP	27/1/21	1113	Custody Seals Intact? Yes / No
Relinquished by:	Date	Time	Received by:	Date	Time	Samples Received Chilled? (Yes) / No
			N. Sandu	28/1/21	11:20	

Additional Comments:

Queries to Andre at 08 6363 5276

SGS Notting Hill Bottle Map

Job Number:		Eskies /boxes:	1	Ice /icebricks:	1	Temperature:	19.8C

Sample ID	Tray No.	soil	water	oil	filter	impinger	other
YB	RAD		✓				
DM 4U	RAD		✓				
Totals							

PRESERVATIVE	BOTTLE TYPE	YB	DM 4U	Totals
none	250 mL Jar glass + teflon lid			
none	125 mL Jar glass + teflon lid			
none (NO HEADSPACE)	40 mL Glass VOA vial + teflon lid			
none (HALF FILLED)	40 mL Glass VOA vial + teflon lid			
none	1 Litre Plastic (opaque)			
none	500 mL Plastic (opaque)	1	1	
none	250 mL Plastic (opaque)			
none	125 mL Plastic (opaque)			
none	1 Litre Amber glass + teflon lid			
none	500mL Amber glass + teflon lid			
none	200mL Amber glass + teflon lid			
none	100mL Amber glass + teflon lid			
HNO_3	1 Litre Plastic (opaque)			
HNO_3 (field filter)	125 mL Plastic (opaque)			
HNO_3 (no filtering)	125 mL Plastic (opaque)			
HCl (no filtering)	125 mL Plastic (opaque)			
HCl (field filter)	125 mL Plastic (opaque)			
0.125M EDTA (field filter)	125 mL Plastic (opaque)			
5M H_2SO_4	125 mL Plastic (opaque)			
NaOH	125 mL Plastic (opaque)			
Zn acetate & NaOH	125 mL Plastic (opaque)			
H_2SO_4	500 mL Amber glass + teflon lid			
$CuSO_4$	100 mL Amber glass + teflon lid			
none (foil covered)	500 mL Amber glass + teflon lid			
0.5mL thiosulphate + 3mL HNO_3 (NO HEADSPACE)	500 mL Amber glass + teflon lid			
Lugol	100 mL Amber glass + teflon lid			
sterilised -thiosulphate **(24hr holding time)**	200mL or 500 mL Plastic (clear)			
Buffer/dechlorinating agent (NH_4Cl)	40 mL Glass VOA vial + teflon lid			
Dechlorinating agent (NH_4Cl)	40 mL Glass VOA vial + teflon lid			

Comments:

Bottle supplied by client

N.Sand 28/1/21 11:30am

SAMPLE RECEIPT ADVICE

ME318537

CLIENT DETAILS

Contact	Andre Stass
Client	TRONOX PIGMENT BUNBURY
Address	LOCKED BAG 245 BUNBURY WA 6230
Telephone	0428 945 476
Facsimile	61 8 94111275
Email	andre@stass.com.au
Project	**Dallyellup January 2021**
Order Number	**TBA**
Samples	2

LABORATORY DETAILS

Manager	Adam Atkinson
Laboratory	SGS Melbourne EH&S
Address	10/585 Blackburn Road Notting Hill Victoria 3168
Telephone	+61395743200
Facsimile	+61395743399
Email	Au.SampleReceipt.Melbourne@sgs.com
Samples Received	Thu 28/1/2021
Report Due	Tue 13/4/2021
SGS Reference	**ME318537**

SUBMISSION DETAILS

This is to confirm that 2 samples were received on Thursday 28/1/2021. Results are expected to be ready by COB Tuesday 13/4/2021. Please quote SGS reference ME318537 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	2 Water
Date documentation received	28/1/2021	Type of documentation received	COC
Number of eskies/boxes received	1	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	19.8C
Sufficient sample for analysis	Yes	Turnaround time requested	Standard

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

SAMPLE RECEIPT ADVICE

ME318537

CLIENT DETAILS

Client TRONOX PIGMENT BUNBURY

Project Dallyellup January 2021

SUMMARY OF ANALYSIS

No.	Sample ID	Radionuclides by Gamma Ray Spectrometry in
001	DM 4C	2
002	YB	2

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

Environmental Division
Perth

Work Order Reference
EP2106387

Telephone : -- 61-8-9406 1301

ALS Environmental

ADELAIDE 21 Burma Road Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680
Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541
Ph: 024423 2063 E: nowra@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818
Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Level 5, 225 St Georges Terrace, Perth 6000, Australia		☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact? Yes / No / N/A
PROJECT: Tronox GME	**ALS QUOTE NO.:**	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
ORDER NUMBER:		COC: [redacted] 2 3 4 5 6 7	Random Sample Temperature on Receipt: 2.1 °C
PROJECT MANAGER: Bronwyn van Valkengoed	**CONTACT PH:** 0408 751 386	OF: [redacted] 2 3 4 5 6 7	Other comments:
SAMPLER: Brooke Kelly	**SAMPLER MOBILE:** 0420 349 797		
COC emailed to ALS? ALS COMPASS	**EDD FORMAT (or default):** ESDAT		
Email Reports to: bronwyn.vanvalkengoed@arcadis.com; brooke.kelly@arcadis.com			
~~Email Invoice to :~~ AU.Accounts.Payable@arcadis.com ; bronwyn.vanvalkengoed@arcadis.com			

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
Brooke Kelly	SP		
DATE/TIME: 8.6.21, 07:00	DATE/TIME: 8/6/21 1345	DATE/TIME:	DATE/TIME:

ALS COMPASS COC NUMBER: 23784

CHAIN OF CUSTODY

(ALS) COC#: 23784 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Australind, Kemerton, Dalyellup

ORDER NO: EP/894/21

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: 'C

Other comments:

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

SAMPLE DETAILS							ANALYSIS REQUIRED					
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 11: Kemerton and Australind Production Bores WATER	Suite 2: Dalyellup WATER	Suite 4: Australind Monitor Bores WATER	Suite 5: Kemerton Monitor Bores WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	R17		07/06/2021 05:00 PM	Water	ALS: 8 Non ALS: 0	No		X	X	X		
002	KM7		07/06/2021 05:04 PM	Water	ALS: 3 Non ALS: 0	No				X		
003	KM22		07/06/2021 05:04 PM	Water	ALS: 3 Non ALS: 0	No				X		
004	DM1C(R)		08/06/2021 06:50 AM	Water	ALS: 6 Non ALS: 0	No		X				
005	PB7B		08/06/2021 06:53 AM	Water	ALS: 2 Non ALS: 0	No	X					
006	QC11		08/06/2021 06:54 AM	Water	ALS: 2 Non ALS: 0	No	X					

CHAIN OF CUSTODY

ALS COC#: 23784 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Australind, Kemerton, Dalyellup

ORDER NO: EP/894/21

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	R17	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012291	Red/Green	Yes	
001	R17	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012067	Red/Green	Yes	
001	R17	Clear Plastic Bottle - NaOH	60 mL	00141020014126	Blue	No	
001	R17	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002525	Red/Green	Yes	
001	R17	Clear Plastic Bottle - Natural	500 mL	00071020142133	Green	No	
001	R17	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019265	Red/Green	No	
001	R17	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019266	Red/Green	No	
001	R17	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002358	Red/Green	Yes	
002	KM7	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002257	Red/Green	Yes	
002	KM7	Clear Plastic Bottle - Natural	500 mL	00071020142225	Green	No	
002	KM7	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002519	Red/Green	Yes	
003	KM22	Clear Plastic Bottle - Natural	500 mL	00071020142313	Green	No	
003	KM22	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002738	Red/Green	Yes	
003	KM22	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002375	Red/Green	Yes	
004	DM1C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019273	Red/Green	No	
004	DM1C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019222	Red/Green	No	
004	DM1C(R)	Clear Plastic Bottle - NaOH	60 mL	00141020014151	Blue	No	
004	DM1C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012131	Red/Green	Yes	
004	DM1C(R)	Clear Plastic Bottle - Natural	500 mL	00071020142156	Green	No	
004	DM1C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012068	Red/Green	Yes	
005	PB7B	Clear Plastic Bottle - Natural	500 mL	00071020142312	Green	No	
005	PB7B	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002271	Red/Green	Yes	
006	QC11	Clear Plastic Bottle - Natural	500 mL	00071020142294	Green	No	
006	QC11	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005002668	Red/Green	Yes	

Total Bottle Count: ALS: 24, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2106387**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: bronwyn.vanvalkengoed@arcadis.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: W_Tronox_Quarterly GME	Page	: 1 of 4
Order number	: EP/894/21	Quote number	: EP2021TROPIG0001_V6 (EP/894/20_V6)
C-O-C number	: 23784	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Dalyellup		
Sampler	: Brooke Kelly		

Dates

Date Samples Received	: 08-Jun-2021 13:45	Issue Date	: 24-Jun-2021
Client Requested Due Date	: 24-Jun-2021	Scheduled Reporting Date	: **24-Jun-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 2.1 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 6 / 6

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- ORC metals conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Radionuclides analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **ORC metals analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method Sample ID	Sample Container Received	Preferred Sample Container for Analysis
Hexavalent Chromium by Discrete Analyser - Dissolved : EG050G-F		
R17	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
DM1C(R)	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA005P pH (PCT)	WATER - EA010P Electrical Conductivity (PCT)	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EK058G (Nitrate as NO3) Nitrate as NO3 by Discrete Analyser	WATER - EK058G Nitrate as N by Discrete Analyser
EP2106387-001	07-Jun-2021 17:00	R17	✓	✓	✓	✓	✓	✓	✓
EP2106387-002	07-Jun-2021 17:04	KM7	✓	✓	✓			✓	
EP2106387-003	07-Jun-2021 17:04	KM22	✓	✓	✓			✓	
EP2106387-004	08-Jun-2021 06:50	DM1C(R)			✓	✓	✓		✓
EP2106387-005	08-Jun-2021 06:53	PB7B	✓	✓	✓			✓	
EP2106387-006	08-Jun-2021 06:54	QC11	✓	✓	✓			✓	

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - ED038 Default Acidity as CaCO3 only	WATER - ED093F Dissolved Major Cations	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG035T-UT Total Mercury - Ultra-trace	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2106387-001	07-Jun-2021 17:00	R17	✓	✓		✓	✓	✓	✓
EP2106387-002	07-Jun-2021 17:04	KM7		✓		✓		✓	✓
EP2106387-003	07-Jun-2021 17:04	KM22		✓		✓		✓	✓
EP2106387-004	08-Jun-2021 06:50	DM1C(R)	✓			✓		✓	✓
EP2106387-005	08-Jun-2021 06:53	PB7B			✓			✓	
EP2106387-006	08-Jun-2021 06:54	QC11			✓			✓	

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)
EP2106387-005	08-Jun-2021 06:53	PB7B	✓
EP2106387-006	08-Jun-2021 06:54	QC11	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator							
KM22	Clear Plastic Bottle - Natural	----	07-Jun-2021	08-Jun-2021	×	----	----
KM7	Clear Plastic Bottle - Natural	----	07-Jun-2021	08-Jun-2021	×	----	----
R17	Clear Plastic Bottle - Natural	----	07-Jun-2021	08-Jun-2021	×	----	----

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Brooke Kelly

- *AU Certificate of Analysis - NATA (COA)	Email	brooke.kelly@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brooke.kelly@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brooke.kelly@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	brooke.kelly@arcadis.com
- Chain of Custody (CoC) (COC)	Email	brooke.kelly@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	brooke.kelly@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	brooke.kelly@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- A4 - AU Tax Invoice (INV)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2106387**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 08-Jun-2021 13:45
Order number	: EP/894/21	Date Analysis Commenced	: 09-Jun-2021
C-O-C number	: 23784	Issue Date	: 25-Jun-2021 09:13
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 6		
No. of samples analysed	: 6		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ORC metals conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EK058G/EK059G: Nitrate and NOx results for EP2106387 #5 and #6 have been confirmed by re-preparation and re-analysis.
- EG035: Positive Hg result EP2106387 #4 has been confirmed by reanalysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	KM7	KM22	DM1C(R)	PB7B	QC11
				Sampling date / time	07-Jun-2021 17:04	07-Jun-2021 17:04	08-Jun-2021 06:50	08-Jun-2021 06:53	08-Jun-2021 06:54
					EP2106387-002	EP2106387-003	EP2106387-004	EP2106387-005	EP2106387-006
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**6.59**	**6.46**	----	**8.53**	**8.57**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**301**	**331**	----	**662**	**670**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**206**	**239**	**1750**	**368**	**374**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	**5**	**7**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**32**	**14**	**384**	**92**	**91**
Total Alkalinity as CaCO3	----	1	mg/L		**32**	**14**	**384**	**97**	**98**
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		**20**	**11**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**19**	**14**	**219**	**22**	**21**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**65**	**89**	**637**	**156**	**157**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**17**	**16**	**140**	----	----
Magnesium	7439-95-4	1	mg/L		**8**	**8**	**52**	----	----
Sodium	7440-23-5	1	mg/L		**30**	**33**	**324**	**85**	**84**
Potassium	7440-09-7	1	mg/L		**3**	**4**	**16**	----	----
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		----	----	**0.002**	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		<0.005	<0.005	**0.005**	----	----
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		----	----	<0.01	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		----	----	<0.01	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Aluminium	7429-90-5	5	µg/L		**278**	**272**	----	----	----
Arsenic	7440-38-2	0.2	µg/L		**0.8**	**1.0**	**15.3**	----	----
Boron	7440-42-8	5	µg/L		----	----	**97**	----	----

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	KM7	KM22	DM1C(R)	PB7B	QC11
				Sampling date / time	07-Jun-2021 17:04	07-Jun-2021 17:04	08-Jun-2021 06:50	08-Jun-2021 06:53	08-Jun-2021 06:54
					EP2106387-002	EP2106387-003	EP2106387-004	EP2106387-005	EP2106387-006
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Cadmium	7440-43-9	0.05	µg/L		<0.05	<0.05	<0.05	----	----
Chromium	7440-47-3	0.2	µg/L		**1.4**	**0.8**	**1.6**	----	----
Cobalt	7440-48-4	0.1	µg/L		----	----	**0.6**	----	----
Copper	7440-50-8	0.5	µg/L		**0.6**	<0.5	**2.9**	----	----
Iron	7439-89-6	2	µg/L		**199**	**120**	**240**	**72**	**84**
Lead	7439-92-1	0.1	µg/L		**0.1**	<0.1	**0.3**	----	----
Manganese	7439-96-5	0.5	µg/L		**11.2**	**8.8**	**282**	----	----
Molybdenum	7439-98-7	0.1	µg/L		----	----	**1.1**	----	----
Nickel	7440-02-0	0.5	µg/L		**0.9**	<0.5	**3.3**	----	----
Selenium	7782-49-2	0.2	µg/L		<0.2	<0.2	----	----	----
Thorium	7440-29-1	0.1	µg/L		----	----	<0.1	----	----
Uranium	7440-61-1	0.05	µg/L		----	----	**0.88**	----	----
Vanadium	7440-62-2	0.2	µg/L		**1.5**	**1.4**	**1.8**	----	----
Zinc	7440-66-6	1	µg/L		**6**	**1**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	----	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	**1.73**	----	----
Nitrate as NO3	14797-55-8	0.01	mg/L		**0.22**	**0.04**	----	**0.09**	**0.49**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	**1.73**	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**2.87**	**3.08**	**30.2**	----	----
ø Total Cations	----	0.01	meq/L		**2.89**	**2.99**	**25.8**	----	----
ø Ionic Balance	----	0.01	%		**0.34**	**1.44**	**7.92**	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		----	----	**0.03**	----	----
Radium 228	7440-14-4	0.08	Bq/L		----	----	<0.08	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	R17	----	----	----	----
			Sampling date / time	07-Jun-2021 17:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2106387-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.49**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	<1	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	R17	----	----	----	----
				Sampling date / time	07-Jun-2021 17:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2106387-001	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Arsenic	7440-38-2	0.2	µg/L		<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L		<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L		<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L		<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L		<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L		<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L		<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L		<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Selenium	7782-49-2	0.2	µg/L		<0.2	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
Zinc	7440-66-6	1	µg/L		<1	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
Nitrate as NO3	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L		<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%		<0.01	----	----	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		<0.01	----	----	----	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035T: Total Mercury by FIMS

(WATER) EG035F: Dissolved Mercury by FIMS

QUALITY CONTROL REPORT

Work Order	: **EP2106387**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 08-Jun-2021
Order number	: EP/894/21	Date Analysis Commenced	: 09-Jun-2021
C-O-C number	: 23784	Issue Date	: 25-Jun-2021
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 3738726)									
EP2106387-002	KM7	EA005-P: pH Value	----	0.01	pH Unit	6.59	6.50	1.4	0% - 20%
EP2106438-006	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.97	6.98	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3738725)									
EP2106387-002	KM7	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	301	300	0.3	0% - 20%
EP2106438-006	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	206000	207000	0.1	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3730803)									
EP2106383-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	93300	93400	0.1	0% - 20%
EP2106383-009	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	54100	52900	2.2	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3738724)									
EP2106387-002	KM7	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	32	32	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	32	32	0.0	0% - 20%
EP2106438-006	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	86	87	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	86	87	0.0	0% - 20%
ED038A: Acidity (QC Lot: 3731948)									
EP2106387-001	R17	ED038: Acidity as CaCO3	----	1	mg/L	2	1	0.0	No Limit
EP2106571-005	Anonymous	ED038: Acidity as CaCO3	----	1	mg/L	10	10	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3727372)									
EP2106492-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	177	175	1.1	0% - 20%
EP2106387-002	KM7	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	19	19	0.0	0% - 50%
ED045G: Chloride by Discrete Analyser (QC Lot: 3727373)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED045G: Chloride by Discrete Analyser (QC Lot: 3727373) - continued									
EP2106387-002	KM7	ED045G: Chloride	16887-00-6	1	mg/L	65	64	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3728478)									
EP2106387-002	KM7	ED093F: Calcium	7440-70-2	1	mg/L	17	17	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	8	8	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	30	30	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.0	No Limit
EP2106499-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	17	17	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	17	17	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	84	85	1.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	24	25	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3738575)									
EP2106387-001	R17	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EP2106638-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	209	211	0.9	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	101	102	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1360	1390	1.8	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	39	39	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3738574)									
EP2106634-005	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2106387-001	R17	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3730816)									
EP2106387-001	R17	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 3730812)									
ES2121407-001	Anonymous	EG035T-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3739807)									
EP2106387-001	R17	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106643-003	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736242)									
EP2106387-001	R17	EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EP2106475-005	Anonymous	EG094B-F: Selenium	7782-49-2	0.2	µg/L	0.0014 mg/L	1.3	0.0	No Limit
		EG094B-F: Iron	7439-89-6	2	µg/L	0.003 mg/L	2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736243)									
EP2106387-001	R17	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736243) - continued									
EP2106387-001	R17	EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Zinc	7440-66-6	1	µg/L	<1	<1	0.0	No Limit
		EG094A-F: Aluminium	7429-90-5	5	µg/L	<5	<5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	<5	<5	0.0	No Limit
EP2106475-005	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0002 mg/L	0.2	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0037 mg/L	3.6	4.1	0% - 50%
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.0020 mg/L	2.0	0.0	0% - 50%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	1.0	1.0	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	0.0005 mg/L	0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.0045 mg/L	4.4	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.0006 mg/L	0.6	0.0	No Limit
		EG094A-F: Zinc	7440-66-6	1	µg/L	0.008 mg/L	7	0.0	No Limit
		EG094A-F: Aluminium	7429-90-5	5	µg/L	<0.005 mg/L	<5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	111	110	0.0	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3727371)									
EP2106492-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106387-002	KM7	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3727299)									
EP2106383-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	13.4	13.4	0.3	0% - 20%
EP2106383-011	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	7.32	7.34	0.3	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3732102)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	99.1	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	104	85.6	112
EA005P: pH by PC Titrator (QCLot: 3738726)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.0	98.5	102
				----	7 pH Unit	100	98.5	102
EA010P: Conductivity by PC Titrator (QCLot: 3738725)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	98.7	92.1	105
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3730803)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	104	88.1	114
				<10	1000 mg/L	95.6	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3738724)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	104	81.2	126
				<1	200 mg/L	96.5	90.0	110
ED038A: Acidity (QCLot: 3731948)								
ED038: Acidity as CaCO3	----	----	mg/L	----	19.5 mg/L	100	83.6	128
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3727372)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	87.7	113
				<1	500 mg/L	106	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3727373)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	106	87.9	114
				<1	1000 mg/L	100	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3728478)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.1	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	93.0	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	91.7	89.7	108
ED093F: Dissolved Major Cations (QCLot: 3738575)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	108	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	88.0	110

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
ED093F: Dissolved Major Cations (QCLot: 3738575) - continued								
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	99.6	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	101	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3738574)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.2	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3730816)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	94.0	85.0	115
EG035T: Total Mercury by FIMS (QCLot: 3730812)								
EG035T-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	97.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	105	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736242)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	96.4	80.4	113
EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	87.2	82.9	121
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736243)								
EG094A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	94.4	88.0	116
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	90.9	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	80.4	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	88.2	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	91.7	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	87.7	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	85.0	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	97.3	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	91.9	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	88.8	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	87.1	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	93.5	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	93.0	87.1	113
EG094A-F: Zinc	7440-66-6	1	µg/L	<1	10 µg/L	89.6	80.1	125
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3727371)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	99.7	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3727299)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3727372)							
EP2106387-001	R17	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	105	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3727373)							
EP2106387-001	R17	ED045G: Chloride	16887-00-6	1000 mg/L	100	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3738574)							
EP2106387-004	DM1C(R)	EG020A-F: Chromium	7440-47-3	0.2 mg/L	93.1	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3730816)							
EP2106387-002	KM7	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	93.0	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 3730812)							
EP2106387-001	R17	EG035T-UT: Mercury	7439-97-6	0.1 µg/L	98.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)							
EP2106387-001	R17	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736243)							
EP2106387-002	KM7	EG094A-F: Arsenic	7440-38-2	50 µg/L	108	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	106	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	97.9	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	104	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	102	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	108	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	97.4	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	102	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	100	70.0	130
		EG094A-F: Zinc	7440-66-6	50 µg/L	107	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3727371)							
EP2106387-001	R17	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	100	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3727299)							
EP2106383-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2106387**	Page	: 1 of 9
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 08-Jun-2021
Site	: Dalyellup	Issue Date	: 25-Jun-2021
Sampler	: Brooke Kelly	No. of samples received	: 6
Order number	: EP/894/21	No. of samples analysed	: 6

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2106383--001	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
R17, KM22	KM7,	----	----	----	16-Jun-2021	07-Jun-2021	**9**
Clear Plastic Bottle - Natural							
PB7B,	QC11	----	----	----	16-Jun-2021	08-Jun-2021	**8**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count: QC	Count: Regular	Rate (%): Actual	Rate (%): Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	12	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
R17, KM22	KM7,	**07-Jun-2021**	**----**	----	----	**16-Jun-2021**	07-Jun-2021	✗
Clear Plastic Bottle - Natural (EA005-P)								
PB7B,	QC11	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	08-Jun-2021	✗

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**16-Jun-2021**	05-Jul-2021	✓
Clear Plastic Bottle - Natural (EA010-P) PB7B, QC11	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	06-Jul-2021	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	14-Jun-2021	✓
Clear Plastic Bottle - Natural (EA015H) DM1C(R), PB7B, QC11	**08-Jun-2021**	**----**	----	----	**11-Jun-2021**	15-Jun-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) R17	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	04-Dec-2021	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) DM1C(R)	**08-Jun-2021**	**----**	----	----	**11-Jun-2021**	05-Dec-2021	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**16-Jun-2021**	21-Jun-2021	✓
Clear Plastic Bottle - Natural (ED037-P) DM1C(R), PB7B, QC11	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	22-Jun-2021	✓
ED038A: Acidity							
Clear Plastic Bottle - Natural (ED038) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	21-Jun-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**09-Jun-2021**	05-Jul-2021	✓
Clear Plastic Bottle - Natural (ED041G) DM1C(R), PB7B, QC11	**08-Jun-2021**	**----**	----	----	**09-Jun-2021**	06-Jul-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**09-Jun-2021**	05-Jul-2021	✓
Clear Plastic Bottle - Natural (ED045G) DM1C(R), PB7B, QC11	**08-Jun-2021**	**----**	----	----	**09-Jun-2021**	06-Jul-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) KM7, KM22	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	05-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) R17	**07-Jun-2021**	**----**	----	----	**17-Jun-2021**	05-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) PB7B, QC11	**08-Jun-2021**	**----**	----	----	**11-Jun-2021**	06-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) DM1C(R)	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	06-Jul-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) R17	**07-Jun-2021**	**----**	----	----	**17-Jun-2021**	04-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) DM1C(R)	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	05-Dec-2021	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	05-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) DM1C(R)	**08-Jun-2021**	**----**	----	----	**11-Jun-2021**	06-Jul-2021	✓
EG035T: Total Mercury by FIMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T-UT) R17	**07-Jun-2021**	**----**	----	----	**11-Jun-2021**	05-Jul-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH (EG050G-F) R17	**07-Jun-2021**	**----**	----	----	**16-Jun-2021**	05-Jul-2021	✓
Clear Plastic Bottle - NaOH (EG050G-F) DM1C(R)	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	06-Jul-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) R17, KM7, KM22	**07-Jun-2021**	**----**	----	----	**16-Jun-2021**	04-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) DM1C(R), PB7B, QC11	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	05-Dec-2021	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) R17	**07-Jun-2021**	**----**	----	----	**09-Jun-2021**	09-Jun-2021	✓
Clear Plastic Bottle - Natural (EK057G) DM1C(R)	**08-Jun-2021**	**----**	----	----	**09-Jun-2021**	10-Jun-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G) R17	**07-Jun-2021**	**----**	----	----	**09-Jun-2021**	09-Jun-2021	✓
Clear Plastic Bottle - Natural (EK059G) DM1C(R)	**08-Jun-2021**	**----**	----	----	**09-Jun-2021**	10-Jun-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acidity as Calcium Carbonate	ED038	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	12	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acidity as Calcium Carbonate	ED038	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Acidity as Calcium Carbonate	ED038	WATER	In house: Referenced to APHA 2310 B Acidity is determined by manual titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS - Ultra-trace	EG035T-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

ALS Environmental

ADELAIDE 21 Burma Road Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680
Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541
Ph: 024423 2063 E: nowra@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818
Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Level 5, 225 St Georges Terrace, Perth 6000, Australia		☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact? Yes / No / N/A
PROJECT: Tronox GME	**ALS QUOTE NO.:**	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
ORDER NUMBER:		COC: [redacted] 2 3 4 5 6 7	Random Sample Temperature on Receipt: [redacted] °C
PROJECT MANAGER: Bronwyn van Valkengoed	**CONTACT PH:** 0408 751 386	OF: [redacted] 2 3 4 5 6 7	Other comments:
SAMPLER: Brooke Kelly	**SAMPLER MOBILE:** 0420 349 797		
COC emailed to ALS? ALS COMPASS	**EDD FORMAT (or default):** ESDAT		
Email Reports to: bronwyn.vanvalkengoed@arcadis.com; brooke.kelly@arcadis.com			
~~Email Invoice to:~~ ~~AU.Accounts.Payable@arcadis.com ; bronwyn.vanvalkengoed@arcadis.com~~			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Brooke Kelly			
DATE/TIME: 9.6.21, 07:30	DATE/TIME: 10/6 10am	DATE/TIME:	DATE/TIME:

ALS COMPASS COC NUMBER: 23835

Environmental Division
Perth
Work Order Reference
EP2106551

Telephone : +61-8-9406 1301

CHAIN OF CUSTODY

ALS COC#: 23835 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED		
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 2: Dalyellup WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	DM2C		08/06/2021 09:50 AM	Water	ALS: 6 Non ALS: 0	No	X		
002	DM2A		08/06/2021 10:18 AM	Water	ALS: 6 Non ALS: 0	No	X		
003	DM8C(R)		08/06/2021 11:41 AM	Water	ALS: 6 Non ALS: 0	No	X		
004	DM8A		08/06/2021 12:58 PM	Water	ALS: 6 Non ALS: 0	No	X		
005	R18		09/06/2021 07:29 AM	Water	ALS: 6 Non ALS: 0	No	X		

CHAIN OF CUSTODY

ALS COC#: 23835 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	DM2C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012119	Red/Green	Yes	
001	DM2C	Clear Plastic Bottle - Natural	500 mL	00071020142142	Green	No	
001	DM2C	Clear Plastic Bottle - NaOH	60 mL	00141020014076	Blue	No	
001	DM2C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019232	Red/Green	No	
001	DM2C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019259	Red/Green	No	
001	DM2C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012130	Red/Green	Yes	
002	DM2A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012108	Red/Green	Yes	
002	DM2A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012138	Red/Green	Yes	
002	DM2A	Clear Plastic Bottle - NaOH	60 mL	00141020013980	Blue	No	
002	DM2A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019275	Red/Green	No	
002	DM2A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019268	Red/Green	No	
002	DM2A	Clear Plastic Bottle - Natural	500 mL	00071020142140	Green	No	
003	DM8C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019277	Red/Green	No	
003	DM8C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019248	Red/Green	No	
003	DM8C(R)	Clear Plastic Bottle - Natural	500 mL	00071020142148	Green	No	
003	DM8C(R)	Clear Plastic Bottle - NaOH	60 mL	00141020014109	Blue	No	
003	DM8C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012082	Red/Green	Yes	
003	DM8C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012165	Red/Green	Yes	
004	DM8A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012066	Red/Green	Yes	
004	DM8A	Clear Plastic Bottle - NaOH	60 mL	00141020014135	Blue	No	
004	DM8A	Clear Plastic Bottle - Natural	500 mL	00071020142130	Green	No	
004	DM8A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012083	Red/Green	Yes	
004	DM8A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019249	Red/Green	No	
004	DM8A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019242	Red/Green	No	
005	R18	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019282	Red/Green	No	
005	R18	Clear Plastic Bottle - NaOH	60 mL	00141020014154	Blue	No	

CHAIN OF CUSTODY

COC#: 23835 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

005	R18	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012115	Red/Green	Yes	
005	R18	Clear Plastic Bottle - Natural	500 mL	00071020142192	Green	No	
005	R18	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012314	Red/Green	Yes	
005	R18	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019230	Red/Green	No	

Total Bottle Count: ALS: 30, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EP2106551**		
Amendment	: **1**		
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: bronwyn.vanvalkengoed@arcadis.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: W_Tronox_Quarterly GME	Page	: 1 of 3
Order number	: EP/894/21	Quote number	: EP2021TROPIG0001_V6 (EP/894/20_V6)
C-O-C number	: 23835	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Dalyellup		
Sampler	: Brooke Kelly		

Dates

Date Samples Received	: 10-Jun-2021 10:00	Issue Date	: 24-Jun-2021
Client Requested Due Date	: 29-Jun-2021	Scheduled Reporting Date	: **29-Jun-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 7.6 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 5 / 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Radium 226/228 analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **UT Mercury analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method Sample ID	Sample Container Received	Preferred Sample Container for Analysis
Hexavalent Chromium by Discrete Analyser - Dissolved : EG050G-F		
DM2C	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
DM2A	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
DM8C(R)	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
DM8A	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
R18	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2106551-001	08-Jun-2021 09:50	DM2C	✓	✓	✓	✓	✓	✓	✓
EP2106551-002	08-Jun-2021 10:18	DM2A	✓	✓	✓	✓	✓	✓	✓
EP2106551-003	08-Jun-2021 11:41	DM8C(R)	✓	✓	✓	✓	✓	✓	✓
EP2106551-004	08-Jun-2021 12:58	DM8A	✓	✓	✓	✓	✓	✓	✓
EP2106551-005	09-Jun-2021 07:29	R18	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh
EP2106551-001	08-Jun-2021 09:50	DM2C	✓
EP2106551-002	08-Jun-2021 10:18	DM2A	✓
EP2106551-003	08-Jun-2021 11:41	DM8C(R)	✓
EP2106551-004	08-Jun-2021 12:58	DM8A	✓
EP2106551-005	09-Jun-2021 07:29	R18	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable		
- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com
Bronwyn Van Valkengoed		
- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com
Brooke Kelly		
- *AU Certificate of Analysis - NATA (COA)	Email	brooke.kelly@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brooke.kelly@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brooke.kelly@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	brooke.kelly@arcadis.com
- Chain of Custody (CoC) (COC)	Email	brooke.kelly@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	brooke.kelly@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	brooke.kelly@arcadis.com
Chris Roberts		
- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- A4 - AU Tax Invoice (INV)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2106551**	Page	: 1 of 4
Amendment	: **1**		
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021 10:00
Order number	: EP/894/21	Date Analysis Commenced	: 10-Jun-2021
C-O-C number	: 23835	Issue Date	: 24-Jun-2021 16:35
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Amendment (24/06/2021): This report has been amended to alter the client code. All analysis results are as per the previous report.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	DM2C	DM2A	DM8C(R)	DM8A	R18
				Sampling date / time	08-Jun-2021 09:50	08-Jun-2021 10:18	08-Jun-2021 11:41	08-Jun-2021 12:58	09-Jun-2021 07:29
					EP2106551-001	EP2106551-002	EP2106551-003	EP2106551-004	EP2106551-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**3300**	**2790**	**8320**	**8940**	<10
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**250**	**286**	**285**	**196**	<1
Total Alkalinity as CaCO3	----	1	mg/L		**250**	**286**	**285**	**196**	<1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**253**	**185**	**641**	**584**	<1
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**1300**	**1020**	**2710**	**2950**	<1
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**425**	**426**	**628**	**694**	<1
Magnesium	7439-95-4	1	mg/L		**235**	**117**	**619**	**597**	<1
Sodium	7440-23-5	1	mg/L		**166**	**182**	**299**	**300**	<1
Potassium	7440-09-7	1	mg/L		**11**	**12**	**11**	**12**	<1
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		**0.344**	**0.029**	**0.001**	<0.001	<0.001
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	<0.005
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		**0.02**	<0.01	<0.01	<0.01	<0.01
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		**0.32**	**0.02**	<0.01	<0.01	<0.01
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Arsenic	7440-38-2	0.2	µg/L		**0.5**	**1.1**	**4.3**	**8.7**	<0.2
Boron	7440-42-8	5	µg/L		**212**	**156**	**187**	**124**	<5
Cadmium	7440-43-9	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.2	µg/L		**344**	**30.0**	**0.9**	<0.2	<0.2
Cobalt	7440-48-4	0.1	µg/L		**0.3**	**0.1**	<0.1	**0.2**	<0.1
Copper	7440-50-8	0.5	µg/L		**2.8**	**4.7**	**0.6**	**1.4**	<0.5
Iron	7439-89-6	2	µg/L		**12**	**5**	**2800**	**9610**	<2
Lead	7439-92-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.5	µg/L		**3.2**	**3.4**	**86.4**	**1610**	<0.5
Molybdenum	7439-98-7	0.1	µg/L		**1.9**	**3.4**	**14.9**	**1.8**	<0.1

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM2C	DM2A	DM8C(R)	DM8A	R18
				Sampling date / time	08-Jun-2021 09:50	08-Jun-2021 10:18	08-Jun-2021 11:41	08-Jun-2021 12:58	09-Jun-2021 07:29
Compound	CAS Number	LOR	Unit		EP2106551-001	EP2106551-002	EP2106551-003	EP2106551-004	EP2106551-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		**0.9**	**1.0**	**0.8**	**0.7**	<0.5
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		**1.54**	**1.06**	**0.33**	**0.26**	<0.05
Vanadium	7440-62-2	0.2	µg/L		**15.8**	**1.4**	**0.5**	<0.2	<0.2
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**5.25**	**1.08**	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**5.25**	**1.10**	<0.01	<0.01	<0.01
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**46.9**	**38.3**	**95.5**	**99.3**	<0.01
ø Total Cations	----	0.01	meq/L		**48.0**	**39.1**	**95.6**	**97.1**	<0.01
ø Ionic Balance	----	0.01	%		**----**	**----**	**----**	**----**	<0.01
ø Ionic Balance	----	0.01	%		**1.18**	**1.00**	**0.04**	**1.10**	**----**
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.01**	**0.01**	**0.03**	**0.01**	<0.01
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	<0.08

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2106551**	Page	: 1 of 7
Amendment	: **1**		
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021
Order number	: EP/894/21	Date Analysis Commenced	: 10-Jun-2021
C-O-C number	: 23835	Issue Date	: 24-Jun-2021
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3733894)									
EP2106438-005	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	132000	133000	1.0	0% - 20%
EP2106494-004	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	38800	37900	2.2	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3741442)									
EP2106517-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	145	146	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	145	146	0.0	0% - 20%
EP2106519-004	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	114	113	1.4	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	114	113	1.4	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3741444)									
EP2106640-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	139	158	12.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	139	158	12.5	0% - 20%
EP2106640-012	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	15	7.8	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	15	7.8	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3730099)									
EP2106551-002	DM2A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	185	185	0.0	0% - 20%
EP2106594-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	7	40.5	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 3730100)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED045G: Chloride by Discrete Analyser (QC Lot: 3730100) - continued									
EP2106551-002	DM2A	ED045G: Chloride	16887-00-6	1	mg/L	1020	1040	1.2	0% - 20%
EP2106594-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1800	1810	0.3	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3741330)									
EP2106551-001	DM2C	ED093F: Calcium	7440-70-2	1	mg/L	425	421	0.9	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	235	234	0.6	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	166	163	1.5	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	11	11	0.0	0% - 50%
EP2106594-007	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	69	66	3.5	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	60	59	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	572	571	0.2	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	37	37	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3741331)									
EP2106551-001	DM2C	EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.344	0.343	0.3	0% - 20%
EP2106594-007	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3740906)									
EP2106551-002	DM2A	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2106657-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3739807)									
EP2106387-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106643-003	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736246)									
EP2106551-001	DM2C	EG094B-F: Iron	7439-89-6	2	µg/L	12	9	28.3	No Limit
EP2106586-003	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247)									
EP2106551-001	DM2C	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	1.54	1.52	1.1	0% - 20%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.3	0.3	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	1.9	1.9	0.0	0% - 50%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.5	0.5	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	344	343	0.4	0% - 20%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	15.8	15.8	0.0	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	2.8	2.7	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	3.2	3.1	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.9	0.9	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	212	218	3.0	0% - 20%
EP2106586-003	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247) - continued									
EP2106586-003	Anonymous	EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	<5	<5	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3730098)									
EP2106551-002	DM2A	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.0	No Limit
EP2106594-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3730105)									
EP2106547-012	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106587-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	17.6	17.5	0.4	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3743515)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	99.3	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	101	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3733894)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	102	88.1	114
				<10	1000 mg/L	102	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3741442)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	108	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED037P: Alkalinity by PC Titrator (QCLot: 3741444)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	105	81.2	126
				<1	200 mg/L	99.0	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3730099)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	106	87.7	113
				<1	500 mg/L	107	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3730100)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	112	87.9	114
				<1	1000 mg/L	106	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3741330)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	105	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	100	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	99.7	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	100	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741331)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.7	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	91.0	85.0	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	105	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736246)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	96.7	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	90.3	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	83.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	94.1	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	92.3	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	94.8	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	87.5	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	88.5	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.2	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	95.4	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	84.8	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	92.4	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	94.2	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3730098)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	103	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3730105)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	95.7	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3730099)							
EP2106551-001	DM2C	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	117	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3730100)							
EP2106551-001	DM2C	ED045G: Chloride	16887-00-6	1000 mg/L	95.4	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741331)							
EP2106551-002	DM2A	EG020A-F: Chromium	7440-47-3	0.2 mg/L	97.6	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)							
EP2106551-003	DM8C(R)	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	94.0	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)							
EP2106387-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)							
EP2106551-002	DM2A	EG094A-F: Arsenic	7440-38-2	50 µg/L	114	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	113	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	94.4	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	114	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	98.1	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	100.0	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	93.8	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	101	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	99.5	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3730098)							
EP2106551-001	DM2C	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	106	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3730105)							
EP2106544-008	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	100	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2106551**	Page	: 1 of 8
Amendment	: **1**		
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021
Site	: Dalyellup	Issue Date	: 24-Jun-2021
Sampler	: Brooke Kelly	No. of samples received	: 5
Order number	: EP/894/21	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	16	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**14-Jun-2021**	15-Jun-2021	✓
Clear Plastic Bottle - Natural (EA015H) R18	**09-Jun-2021**	**----**	----	----	**14-Jun-2021**	16-Jun-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**18-Jun-2021**	05-Dec-2021	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) R18	**09-Jun-2021**	**----**	----	----	**18-Jun-2021**	06-Dec-2021	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	22-Jun-2021	✓
Clear Plastic Bottle - Natural (ED037-P) R18	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	23-Jun-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**10-Jun-2021**	06-Jul-2021	✓
Clear Plastic Bottle - Natural (ED041G) R18	**09-Jun-2021**	**----**	----	----	**10-Jun-2021**	07-Jul-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**10-Jun-2021**	06-Jul-2021	✓
Clear Plastic Bottle - Natural (ED045G)							
R18	**09-Jun-2021**	**----**	----	----	**10-Jun-2021**	07-Jul-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	06-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
R18	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Jul-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	05-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
R18	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	06-Dec-2021	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**17-Jun-2021**	06-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
R18	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Jul-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH (EG050G-F)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	06-Jul-2021	✓
Clear Plastic Bottle - NaOH (EG050G-F)							
R18	**09-Jun-2021**	**----**	----	----	**16-Jun-2021**	07-Jul-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**16-Jun-2021**	05-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
R18	**09-Jun-2021**	**----**	----	----	**16-Jun-2021**	06-Dec-2021	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**10-Jun-2021**	10-Jun-2021	✓
Clear Plastic Bottle - Natural (EK057G)							
R18	**09-Jun-2021**	**----**	----	----	**10-Jun-2021**	11-Jun-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
DM2C, DM2A, DM8C(R), DM8A	**08-Jun-2021**	**----**	----	----	**10-Jun-2021**	10-Jun-2021	✓
Clear Plastic Bottle - Natural (EK059G)							
R18	**09-Jun-2021**	**----**	----	----	**10-Jun-2021**	11-Jun-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	16	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

ALSCompass
SAMPLING Intelligence

ALS

Environmental Division
Perth
Work Order Reference
EP2106586

Telephone : -- 61-8-9406 1301

Custody Document for Submissions via ALS Compass App

Project: Tronox GME **Client:** Tronox **Project Manager:** Bronwyn van Valkengoed
Phone: ( )

ALS Compass COC Reference: 23906 **# Samples:** 5 **Sampler:** Brooke Kelly
Phone: (0420349797)

Turnaround Requirements: Standard X Urgent

Special Instructions:

N/A

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
Brooke Kelly	EG		
Date / Time:	Date / Time:	Date / Time:	Date / Time:
10-6-21, 13:00	10/06/21 @1705		

CHAIN OF CUSTODY

ALS COC#: 23906 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 10: Dalyellup WATER	Suite 2: Dalyellup WATER	Suite 9: Dalyellup YB - Quarterly WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	YB		09/06/2021 10:10 AM	Water	ALS: 4 Non ALS: 0	No			X		
002	DM4C		09/06/2021 02:27 PM	Water	ALS: 6 Non ALS: 0	No		X			
003	R19		10/06/2021 09:39 AM	Water	ALS: 10 Non ALS: 0	No			X		
~~004~~	QC13		10/06/2021 09:46 AM	Water	ALS: 2 Non ALS: 0	No	X				
~~005~~	MB3R		10/06/2021 09:45 AM	Water	ALS: 2 Non ALS: 0	No	X				

CHAIN OF CUSTODY

(ALS) COC#: **23906** *ALS Laboratory:* EP Perth

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Brooke Kelly QUOTE NO: EP/894/20 / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019257	Red/Green	No	
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019208	Red/Green	No	
001	YB	Clear Plastic Bottle - Natural	250 mL	00071119072528	Green	No	
001	YB	Clear Plastic Bottle - Natural	250 mL	00071119072413	Green	No	
002	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019264	Red/Green	No	
002	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012072	Red/Green	Yes	
002	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012096	Red/Green	Yes	
002	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014418	Red/Green	No	
002	DM4C	Clear Plastic Bottle - NaOH	60 mL	00141020013651	Blue	No	
002	DM4C	Clear Plastic Bottle - Natural	500 mL	00071020142188	Green	No	
003	R19	Amber Glass Bottle - Unpreserved	500 mL	00050820010542	Orange	No	
003	R19	Amber Glass Bottle - Unpreserved	500 mL	00050820010545	Orange	No	
003	R19	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019225	Red/Green	No	
003	R19	Clear Plastic Bottle - Natural	250 mL	00071119072484	Green	No	
003	R19	Clear Plastic Bottle - Natural	250 mL	00071119072408	Green	No	
003	R19	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019215	Red/Green	No	
003	R19	Clear Plastic Bottle - NaOH	60 mL	00141020014310	Blue	No	
003	R19	Clear Plastic Bottle - Natural	500 mL	00071020142139	Green	No	
003	R19	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012248	Red/Green	Yes	
003	R19	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012226	Red/Green	Yes	
004	QC13	Amber Glass Bottle - Unpreserved	500 mL	00050820010543	Orange	No	
004	QC13	Amber Glass Bottle - Unpreserved	500 mL	00050820010560	Orange	No	
005	MB3R	Amber Glass Bottle - Unpreserved	500 mL	00050820010561	Orange	No	
005	MB3R	Amber Glass Bottle - Unpreserved	500 mL	00050820010544	Orange	No	

Total Bottle Count: ALS: 24, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2106586**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: bronwyn.vanvalkengoed@arcadis.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: W_Tronox_Quarterly GME	Page	: 1 of 3
Order number	: EP/894/21	Quote number	: EP2021TROPIG0001_V6 (EP/894/20_V6)
C-O-C number	: 23906	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Dalyellup		
Sampler	: Brooke Kelly		

Dates

Date Samples Received	: 10-Jun-2021 17:05	Issue Date	: 24-Jun-2021
Client Requested Due Date	: 29-Jun-2021	Scheduled Reporting Date	: **29-Jun-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 6.2 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 3 / 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- EG035F-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- EA251 analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Please note that your submission has been split into several Work Orders EP2106586 and EP2106605 to facilitate the regular delivery of data.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method Sample ID	Sample Container Received	Preferred Sample Container for Analysis
Hexavalent Chromium by Discrete Analyser - Dissolved : EG050G-F		
DM4C	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered
R19	- Clear Plastic Bottle - NaOH	- Clear Plastic Bottle - NaOH Filtered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - ED045G Chloride by Discrete Analyser	WATER - ED093T Total Major Cations (including digestion)	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EK058G Nitrate as N by Discrete Analyser
EP2106586-001	09-Jun-2021 10:10	YB		✓	✓	✓			
EP2106586-002	09-Jun-2021 14:27	DM4C	✓	✓			✓	✓	✓
EP2106586-003	10-Jun-2021 09:39	R19	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2106586-002	09-Jun-2021 14:27	DM4C	✓	✓	✓
EP2106586-003	10-Jun-2021 09:39	R19	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Brooke Kelly

- *AU Certificate of Analysis - NATA (COA)	Email	brooke.kelly@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brooke.kelly@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brooke.kelly@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	brooke.kelly@arcadis.com
- Chain of Custody (CoC) (COC)	Email	brooke.kelly@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	brooke.kelly@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	brooke.kelly@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- A4 - AU Tax Invoice (INV)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2106586**	Page	: 1 of 6
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021 17:05
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 23906	Issue Date	: 24-Jun-2021 19:25
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035F-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper. Result confirmed by re-preparation and re-analysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	YB	DM4C	----	----	----
				Sampling date / time	09-Jun-2021 10:10	09-Jun-2021 14:27	----	----	----
					EP2106586-001	EP2106586-002	--------	--------	--------
					Result	Result	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		----	**7000**	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	**250**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	**250**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	**576**	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**227**	**2480**	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	**549**	----	----	----
Magnesium	7439-95-4	1	mg/L		----	**558**	----	----	----
Sodium	7440-23-5	1	mg/L		----	**274**	----	----	----
Potassium	7440-09-7	1	mg/L		----	**11**	----	----	----
ED093T: Total Major Cations									
Sodium	7440-23-5	1	mg/L		**90**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		----	<0.001	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		----	<0.005	----	----	----
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		----	<0.01	----	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		----	<0.01	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Arsenic	7440-38-2	0.2	µg/L		----	**11.6**	----	----	----
Boron	7440-42-8	5	µg/L		----	**169**	----	----	----
Cadmium	7440-43-9	0.05	µg/L		----	<0.05	----	----	----
Chromium	7440-47-3	0.2	µg/L		----	<0.2	----	----	----
Cobalt	7440-48-4	0.1	µg/L		----	<0.1	----	----	----
Copper	7440-50-8	0.5	µg/L		----	**0.8**	----	----	----
Iron	7439-89-6	2	µg/L		----	**6070**	----	----	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	DM4C	----	----	----
				Sampling date / time	09-Jun-2021 10:10	09-Jun-2021 14:27	----	----	----
Compound	CAS Number	LOR	Unit		EP2106586-001	EP2106586-002	--------	--------	--------
					Result	Result	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		----	<0.1	----	----	----
Manganese	7439-96-5	0.5	µg/L		----	**120**	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		----	**3.4**	----	----	----
Nickel	7440-02-0	0.5	µg/L		----	<0.5	----	----	----
Thorium	7440-29-1	0.1	µg/L		----	<0.1	----	----	----
Uranium	7440-61-1	0.05	µg/L		----	<0.05	----	----	----
Vanadium	7440-62-2	0.2	µg/L		----	<0.2	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	<0.01	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		----	**86.9**	----	----	----
ø Total Cations	----	0.01	meq/L		----	**85.5**	----	----	----
ø Ionic Balance	----	0.01	%		----	**0.82**	----	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.02**	**0.02**	----	----	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	R19	----	----	----	----
			Sampling date / time	10-Jun-2021 09:39	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2106586-003	--------	--------	--------	--------
				Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L	<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	R19	----	----	----	----
				Sampling date / time	10-Jun-2021 09:39	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2106586-003	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L		<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%		<0.01	----	----	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		<0.01	----	----	----	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2106586**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 23906	Issue Date	: 24-Jun-2021
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3738028)									
EP2106515-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	186	178	4.1	0% - 50%
EP2106586-002	DM4C	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	7000	7320	4.5	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3743991)									
EP2106590-008	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	129	129	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	129	129	0.0	0% - 20%
EP2106582-010	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	120	123	2.2	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	120	123	2.2	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3732697)									
EP2106586-003	R19	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EP2106618-009	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4260	4310	1.1	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3732698)									
EP2106586-003	R19	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EP2106618-009	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	26100	27300	4.7	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3734685)									
EP2106514-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1540	1520	0.6	0% - 20%
EP2106579-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	184	184	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3741329)									
EP2106586-002	DM4C	ED093F: Calcium	7440-70-2	1	mg/L	549	558	1.6	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	558	556	0.4	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	274	272	0.7	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3741329) - continued									
EP2106586-002	DM4C	ED093F: Potassium	7440-09-7	1	mg/L	11	11	0.0	0% - 50%
ED093T: Total Major Cations (QC Lot: 3738611)									
EP2106509-001	Anonymous	ED093T: Sodium	7440-23-5	1	mg/L	133	136	2.3	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3741327)									
EP2106536-011	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2106586-002	DM4C	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3740906)									
EP2106551-002	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2106657-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3749902)									
EP2106586-002	DM4C	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106897-006	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736246)									
EP2106551-001	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	12	9	28.3	No Limit
EP2106586-003	R19	EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247)									
EP2106551-001	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	1.54	1.52	1.1	0% - 20%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.3	0.3	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	1.9	1.9	0.0	0% - 50%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.5	0.5	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	344	343	0.4	0% - 20%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	15.8	15.8	0.0	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	2.8	2.7	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	3.2	3.1	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.9	0.9	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	212	218	3.0	0% - 20%
EP2106586-003	R19	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247) - continued									
EP2106586-003	R19	EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	<5	<5	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3732696)									
EP2106586-003	R19	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106618-009	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.44	0.44	0.0	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3732709)									
EP2106586-003	R19	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106618-009	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	31.2	30.1	3.4	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3743515)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	99.3	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	101	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3738028)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	104	88.1	114
				<10	1000 mg/L	100	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3743991)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	112	81.2	126
				<1	200 mg/L	95.0	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3732697)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	106	87.7	113
				<1	500 mg/L	101	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3732698)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	111	87.9	114
				<1	1000 mg/L	99.2	87.9	114
ED045G: Chloride by Discrete Analyser (QCLot: 3734685)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.7	87.9	114
				<1	1000 mg/L	100	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3741329)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	107	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	98.9	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	99.5	89.7	108
ED093T: Total Major Cations (QCLot: 3738611)								
ED093T: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	110	85.0	115
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741327)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	92.8	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	91.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3749902)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG050F: Dissolved Hexavalent Chromium (QCLot: 3749902) - continued								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	102	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736246)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	96.7	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	90.3	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	83.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	94.1	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	92.3	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	94.8	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	87.5	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	88.5	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.2	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	95.4	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	84.8	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	92.4	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	94.2	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3732696)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	106	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3732709)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	100	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3732697)							
EP2106586-002	DM4C	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3732698)							
EP2106586-002	DM4C	ED045G: Chloride	16887-00-6	1000 mg/L	110	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3734685)							
EP2106514-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	99.2	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741327)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741327) - continued							
EP2106536-002	Anonymous	EG020A-F: Chromium	7440-47-3	0.2 mg/L	95.3	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)							
EP2106551-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	94.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3749902)							
EP2106586-002	DM4C	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	101	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)							
EP2106551-002	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	114	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	113	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	94.4	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	114	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	98.1	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	100.0	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	93.8	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	101	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	99.5	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3732696)							
EP2106586-002	DM4C	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	106	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3732709)							
EP2106586-002	DM4C	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	96.7	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2106586**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 10-Jun-2021
Site	: Dalyellup	Issue Date	: 24-Jun-2021
Sampler	: Brooke Kelly	No. of samples received	: 3
Order number	: EP/894/21	No. of samples analysed	: 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EP2106586--002	DM4C	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	16	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / ***Container*** / Client Sample ID(s)	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) DM4C	**09-Jun-2021**	**----**	----	----	**16-Jun-2021**	16-Jun-2021	✓
Clear Plastic Bottle - Natural (EA015H) R19	**10-Jun-2021**	**----**	----	----	**16-Jun-2021**	17-Jun-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) YB, DM4C	**09-Jun-2021**	**----**	----	----	**18-Jun-2021**	06-Dec-2021	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) R19	**10-Jun-2021**	**----**	----	----	**18-Jun-2021**	07-Dec-2021	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) DM4C	**09-Jun-2021**	**----**	----	----	**18-Jun-2021**	23-Jun-2021	✓
Clear Plastic Bottle - Natural (ED037-P) R19	**10-Jun-2021**	**----**	----	----	**18-Jun-2021**	24-Jun-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) DM4C	**09-Jun-2021**	**----**	----	----	**11-Jun-2021**	07-Jul-2021	✓
Clear Plastic Bottle - Natural (ED041G) R19	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	08-Jul-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) DM4C	**09-Jun-2021**	**----**	----	----	**11-Jun-2021**	07-Jul-2021	✓
Clear Plastic Bottle - Natural (ED045G) YB	**09-Jun-2021**	**----**	----	----	**21-Jun-2021**	07-Jul-2021	✓
Clear Plastic Bottle - Natural (ED045G) R19	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	08-Jul-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) DM4C	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) R19	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	08-Jul-2021	✓
ED093T: Total Major Cations							
Clear Plastic Bottle - Natural (ED093T) YB	**09-Jun-2021**	**16-Jun-2021**	16-Jun-2021	✓	**16-Jun-2021**	16-Jun-2021	✓
Clear Plastic Bottle - Natural (ED093T) R19	**10-Jun-2021**	**16-Jun-2021**	17-Jun-2021	✓	**16-Jun-2021**	17-Jun-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) DM4C	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	06-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) R19	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Dec-2021	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) DM4C	**09-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) R19	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	08-Jul-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH (EG050G-F) DM4C	**09-Jun-2021**	**----**	----	----	**22-Jun-2021**	07-Jul-2021	✓
Clear Plastic Bottle - NaOH (EG050G-F) R19	**10-Jun-2021**	**----**	----	----	**22-Jun-2021**	08-Jul-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) DM4C	**09-Jun-2021**	**----**	----	----	**16-Jun-2021**	06-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) R19	**10-Jun-2021**	**----**	----	----	**16-Jun-2021**	07-Dec-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) DM4C	**09-Jun-2021**	**----**	----	----	**11-Jun-2021**	11-Jun-2021	✓
Clear Plastic Bottle - Natural (EK057G) R19	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	12-Jun-2021	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G) DM4C	**09-Jun-2021**	**----**	----	----	**11-Jun-2021**	11-Jun-2021	✓
Clear Plastic Bottle - Natural (EK059G) R19	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	12-Jun-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	38	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	16	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	38	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Major Cations - Total	ED093T	WATER	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Samples are digested by USEPA 3005 prior to analysis. The ICPAES technique ionises the sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.

Analytical Methods	Method	Matrix	Method Descriptions
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

ALSCompass
SAMPLING *Intelligence*

ALS

Environmental Division
Perth
Work Order Reference
EP2106657

Telephone : +61-8-9406 1301

Custody Document

ALS USE ONLY (Circle)

Custody Seal Intact?	YES	NO	N/A
Free ice / frozen ice bricks present upon receipt?	YES	NO	N/A
Random Sample Temperature on receipt		°C	

Project: Tronox **Client:** Arcadis **Project Manager:** Bronwyn Van Valkengoed

ALS Compass COC Ref: **# Samples:** 5 **Phone:** (0408 751 386)

Sampler: Jaimon Hollett

Phone: (0420 838 328)

Turnaround Requirement: Standard Urgent

Special Instructions:

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
Jaimon Hollett	EC		
Date / Time:	**Date / Time:**	**Date / Time:**	**Date / Time:**
11/6/21 540	11/6/21 1745		

CHAIN OF CUSTODY

ALS COC#: 24037 *ALS Laboratory:* EP Perth

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED		
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 2: Dalyellup WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	DM1A		11/06/2021 08:53 AM	Water	ALS: 6 Non ALS: 0	No	X		
002	DM7A(R)		11/06/2021 10:38 AM	Water	ALS: 6 Non ALS: 0	No	X		
003	DM9C(R)		10/06/2021 04:15 AM	Water	ALS: 6 Non ALS: 0	No	X		
004	DM9A(R)		10/06/2021 06:20 AM	Water	ALS: 6 Non ALS: 0	No	X		
005	DM7C(R)		11/06/2021 12:37 PM	Water	ALS: 6 Non ALS: 0	No	X		

CHAIN OF CUSTODY

ALS COC#: 24037 ALS Laboratory: EP Perth

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2020TIWEST0003

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EMAIL INVOICES TO: chris.roberts@tronox.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	DM1A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019267	Red/Green	No	
001	DM1A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012070	Red/Green	Yes	
001	DM1A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012168	Red/Green	Yes	
001	DM1A	Clear Plastic Bottle - Natural	500 mL	00071020142138	Green	No	
001	DM1A	Clear Plastic Bottle - NaOH	60 mL	00141020014320	Blue	No	
002	DM7A(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019270	Red/Green	No	
002	DM7A(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014427	Red/Green	No	
002	DM7A(R)	Clear Plastic Bottle - Natural	500 mL	00071020142168	Green	No	
002	DM7A(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019251	Red/Green	No	
002	DM7A(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012078	Red/Green	Yes	
002	DM7A(R)	Clear Plastic Bottle - NaOH	60 mL	00141020013942	Blue	No	
003	DM9C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012073	Red/Green	Yes	
003	DM9C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012084	Red/Green	Yes	
003	DM9C(R)	Clear Plastic Bottle - NaOH	60 mL	00141020014188	Blue	No	
003	DM9C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012077	Red/Green	Yes	
003	DM9C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019250	Red/Green	No	
003	DM9C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019276	Red/Green	No	
004	DM9A(R)	Clear Plastic Bottle - Natural	500 mL	00071020142095	Green	No	
004	DM9A(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019281	Red/Green	No	
004	DM9A(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019278	Red/Green	No	
004	DM9A(R)	Clear Plastic Bottle - Natural	500 mL	00071020142158	Green	No	
004	DM9A(R)	Clear Plastic Bottle - NaOH	60 mL	00141020013673	Blue	No	
004	DM9A(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012111	Red/Green	Yes	
005	DM7C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012163	Red/Green	Yes	
005	DM7C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019289	Red/Green	No	
		Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012170	Red/Green	Yes	

CHAIN OF CUSTODY

(ALS) *COC#:* **24037** *ALS Laboratory:* EP Perth

CLIENT: TIWEST - TRONOX MANAGEMENT

PROJECT: W_Tronox_Quarterly GME

SITE: Dalyellup

ORDER NO: EP/894/21

PROJECT MANAGER: Bronwyn Vanvalkengoed

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2020TIWEST0003

EMAIL REPORTS TO: chris.roberts@tronox.com, brooke.kelly@arcadis.com, bronwyn.vanValkengoed@arcadis.com

EMAIL INVOICES TO: chris.roberts@tronox.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 0 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

005	DM7C(R)	Clear Plastic Bottle - NaOH	60 mL	00141020014197	Blue	No	
005	DM7C(R)	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519019283	Red/Green	No	
005	DM7C(R)	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005012316	Red/Green	Yes	
005	DM7C(R)	Clear Plastic Bottle - Natural	500 mL	00071020142143	Green	No	

Total Bottle Count: ALS: 30, Non ALS: 0

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2106657**	Page	: 1 of 4
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 11-Jun-2021 17:45
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 24037	Issue Date	: 25-Jun-2021 15:49
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	DM1A	DM7A(R)	DM9C(R)	DM9A(R)	DM7C(R)
				Sampling date / time	11-Jun-2021 08:53	11-Jun-2021 10:38	10-Jun-2021 04:15	10-Jun-2021 06:20	11-Jun-2021 12:37
					EP2106657-001	EP2106657-002	EP2106657-003	EP2106657-004	EP2106657-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1730**	**770**	**738**	**744**	**674**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**371**	**372**	**110**	**275**	**344**
Total Alkalinity as CaCO3	----	1	mg/L		**371**	**372**	**110**	**275**	**344**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**227**	**56**	**44**	**85**	**62**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**617**	**226**	**294**	**230**	**150**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**163**	**109**	**70**	**121**	**130**
Magnesium	7439-95-4	1	mg/L		**59**	**50**	**15**	**41**	**44**
Sodium	7440-23-5	1	mg/L		**376**	**115**	**132**	**120**	**63**
Potassium	7440-09-7	1	mg/L		**18**	**7**	**9**	**5**	**5**
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		**0.001**	<0.001	<0.001	**0.181**	**0.001**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	<0.005
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		<0.01	<0.01	<0.01	**0.02**	<0.01
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	<0.01	**0.16**	<0.01
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Arsenic	7440-38-2	0.2	µg/L		**2.6**	**13.0**	**3.6**	**2.5**	**1.3**
Boron	7440-42-8	5	µg/L		**118**	**76**	**10**	**49**	**68**
Cadmium	7440-43-9	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.2	µg/L		**1.2**	<0.2	<0.2	**181**	**0.9**
Cobalt	7440-48-4	0.1	µg/L		**0.2**	**0.3**	**0.3**	<0.1	**0.1**
Copper	7440-50-8	0.5	µg/L		**2.0**	<0.5	**0.9**	**0.7**	**9.7**
Iron	7439-89-6	2	µg/L		**4**	**2070**	**17200**	**48**	**4**
Lead	7439-92-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	**0.7**
Manganese	7439-96-5	0.5	µg/L		**10.2**	**99.5**	**104**	**3.7**	**41.6**
Molybdenum	7439-98-7	0.1	µg/L		**1.3**	**0.9**	**0.4**	**0.2**	**12.0**

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM1A	DM7A(R)	DM9C(R)	DM9A(R)	DM7C(R)
				Sampling date / time	11-Jun-2021 08:53	11-Jun-2021 10:38	10-Jun-2021 04:15	10-Jun-2021 06:20	11-Jun-2021 12:37
Compound	CAS Number	LOR	Unit		EP2106657-001	EP2106657-002	EP2106657-003	EP2106657-004	EP2106657-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		**1.1**	**0.7**	**1.4**	<0.5	**2.4**
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		**1.01**	<0.05	<0.05	**0.47**	**0.77**
Vanadium	7440-62-2	0.2	µg/L		**1.0**	**0.5**	<0.2	**1.2**	**4.0**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**1.96**	**0.16**	**0.02**	**1.83**	**0.78**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**1.96**	**0.18**	**0.02**	**1.83**	**0.78**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**29.5**	**15.0**	**11.4**	**13.8**	**12.4**
ø Total Cations	----	0.01	meq/L		**29.8**	**14.7**	**10.7**	**14.8**	**13.0**
ø Ionic Balance	----	0.01	%		**0.44**	**0.80**	**3.20**	**3.53**	**2.29**
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		<0.01	<0.01	**0.14**	<0.01	**0.02**
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	**0.08**	<0.08	<0.08

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2106657**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 9213 6700	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 11-Jun-2021
Order number	: EP/894/21	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 24037	Issue Date	: 25-Jun-2021
Sampler	: Brooke Kelly		
Site	: Dalyellup		
Quote number	: EP/894/20_V6		
No. of samples received	: 5		
No. of samples analysed	: 5		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3738053)									
EP2106517-007	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	41700	41700	0.0	0% - 20%
EP2106585-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	624	619	0.9	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3740675)									
EP2106619-002	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	283	283	0.0	0% - 20%
EP2106649-006	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	107000	106000	1.2	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3743992)									
EP2106690-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	160	159	0.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	160	159	0.8	0% - 20%
EP2106630-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3732864)									
EP2106657-002	DM7A(R)	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	56	56	0.0	0% - 20%
EP2106633-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	746	742	0.6	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3732863)									
EP2106657-002	DM7A(R)	ED045G: Chloride	16887-00-6	1	mg/L	226	228	0.8	0% - 20%
EP2106633-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2060	2020	2.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3741343)									
EP2106657-001	DM1A	ED093F: Calcium	7440-70-2	1	mg/L	163	160	1.4	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	59	58	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	376	371	1.4	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3741343) - continued									
EP2106657-001	DM1A	ED093F: Potassium	7440-09-7	1	mg/L	18	18	0.0	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3741341)									
EP2106689-002	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2106657-001	DM1A	EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3740906)									
EP2106551-002	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2106657-003	DM9C(R)	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3739807)									
EP2106387-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2106643-003	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736246)									
EP2106551-001	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	12	9	28.3	No Limit
EP2106586-003	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247)									
EP2106551-001	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	1.54	1.52	1.1	0% - 20%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.3	0.3	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	1.9	1.9	0.0	0% - 50%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.5	0.5	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	344	343	0.4	0% - 20%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	15.8	15.8	0.0	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	2.8	2.7	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	3.2	3.1	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.9	0.9	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	212	218	3.0	0% - 20%
EP2106586-003	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3736247) - continued									
EP2106586-003	Anonymous	EG094A-F: Boron	7440-42-8	5	µg/L	<5	<5	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3732861)									
EP2106657-002	DM7A(R)	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.0	No Limit
EP2106633-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.03	0.03	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3732875)									
EP2106656-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.48	2.52	2.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3749083)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	95.8	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	102	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3738053)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	104	88.1	114
				<10	1000 mg/L	101	88.1	114
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3740675)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	104	88.1	114
				<10	1000 mg/L	102	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3743992)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	112	81.2	126
				<1	200 mg/L	94.0	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3732864)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	87.7	113
				<1	500 mg/L	103	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3732863)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	96.0	87.9	114
				<1	1000 mg/L	98.2	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3741343)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	104	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	101	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	101	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741341)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	91.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	105	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736246)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736246) - continued								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	96.7	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	90.3	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	83.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	94.1	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	92.3	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	94.8	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	87.5	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	88.5	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.2	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	95.4	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	84.8	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	92.4	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	94.2	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3732861)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	103	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3732875)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	97.6	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3732864)							
EP2106633-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	110	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3732863)							
EP2106633-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	82.7	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3741341)							
EP2106509-006	Anonymous	EG020A-F: Chromium	7440-47-3	0.2 mg/L	97.1	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3740906)							
EP2106551-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	94.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3739807)							
EP2106387-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3736247)							
EP2106551-002	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	114	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	113	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	94.4	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	114	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	98.1	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	100.0	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	93.8	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	101	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	99.5	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3732861)							
EP2106633-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	102	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3732875)							
EP2106656-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	5 mg/L	90.4	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2106657**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Bronwyn Van Valkengoed	Telephone	: +61-8-9406 1301
Project	: W_Tronox_Quarterly GME	Date Samples Received	: 11-Jun-2021
Site	: Dalyellup	Issue Date	: 25-Jun-2021
Sampler	: Brooke Kelly	No. of samples received	: 5
Order number	: EP/894/21	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	20	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) DM9C(R)	**10-Jun-2021**	**----**	----	----	**16-Jun-2021**	17-Jun-2021	✓
Clear Plastic Bottle - Natural (EA015H) DM9A(R)	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	17-Jun-2021	✓
Clear Plastic Bottle - Natural (EA015H) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**17-Jun-2021**	18-Jun-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**22-Jun-2021**	07-Dec-2021	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**22-Jun-2021**	08-Dec-2021	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**18-Jun-2021**	24-Jun-2021	✓
Clear Plastic Bottle - Natural (ED037-P) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**18-Jun-2021**	25-Jun-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	08-Jul-2021	✓
Clear Plastic Bottle - Natural (ED041G) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**11-Jun-2021**	09-Jul-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	08-Jul-2021	✓
Clear Plastic Bottle - Natural (ED045G) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**11-Jun-2021**	09-Jul-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	08-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**17-Jun-2021**	09-Jul-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	07-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**17-Jun-2021**	08-Dec-2021	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**17-Jun-2021**	08-Jul-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**17-Jun-2021**	09-Jul-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH (EG050G-F) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**16-Jun-2021**	08-Jul-2021	✓
Clear Plastic Bottle - NaOH (EG050G-F) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**16-Jun-2021**	09-Jul-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**16-Jun-2021**	07-Dec-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**16-Jun-2021**	08-Dec-2021	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	12-Jun-2021	✓
Clear Plastic Bottle - Natural (EK057G) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**11-Jun-2021**	13-Jun-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G) DM9C(R), DM9A(R)	**10-Jun-2021**	**----**	----	----	**11-Jun-2021**	12-Jun-2021	✓
Clear Plastic Bottle - Natural (EK059G) DM1A, DM7A(R), DM7C(R)	**11-Jun-2021**	**----**	----	----	**11-Jun-2021**	13-Jun-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	20	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	36	**11.11**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	36	**11.11**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	36	**5.56**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

ALSCompass
SAMPLING *Intelligence*

ALS

Environmental Division
Perth
Work Order Reference
EP2109249

Telephone : – 61-8-9406 1301

Custody Document

ALS USE ONLY (Circle)			
Custody Seal Intact?	YES	NO	N/A
Free ice / frozen ice bricks present upon receipt?	YES	NO	N/A
Random Sample Temperature on receipt		°C	

Project: Tronox Pigment Bunbury **Client:** Arcadis

Project Manager: Bronwyn Van Valkengoed
Phone: (0408 751 386)

ALS CompassCOC Ref: 26241 **# Samples:** 4

Sampler: Jamon Hollett
Phone: (0420 838 328)

Turnaround Requirement: Standard Urgent

Special Instructions:

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
JH	EG		
Date / Time: 13/8/21	Date / Time: 1318 @ 1515	Date / Time:	Date / Time:

CHAIN OF CUSTODY

ALS COC#: 26241 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY: EG	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: 13/8 @1515	DATE TIME:	DATE TIME:

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE:

/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 10: Dalyellup WATER	Suite 2: Dalyellup WATER	Suite 9: Dalyellup YB - Quarterly WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	YB		12/08/2021 10:57 AM	Water	ALS: 4 Non ALS: 0	No	X		X		
002	SQC1		12/08/2021 10:58 AM	Water	ALS: 4 Non ALS: 0	No	X		X		
003	MB3		12/08/2021 02:05 PM	Water	ALS: 6 Non ALS: 0	No		X			
004	RQC1		13/08/2021 08:41 AM	Water	ALS: 4 Non ALS: 0	No		Partial 7/8	Partial 2/3		

CHAIN OF CUSTODY

ALS COC#: 26241 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	PARTIAL ANALYSIS GROUP NAME	MATRIX	SELECTED ANALYSIS NAME
004	RQC1	Suite 2: Dalyellup WATER	Water	- EG050G-F Dissolved Hexavalent Chromium - EK058G Nitrate as N by Discrete Analyser - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh Water (inc. Fe & Se) - EG049G-F Dissolved Trivalent Chromium by ICP & DA - EA015H Total Dissolved Solids - Standard Level - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity - EG035F-UT Dissolved Mercury - Ultra-Trace
004	RQC1	Suite 9: Dalyellup YB - Quarterly WATER	Water	- ED045G Chloride by Discrete Analyser - ED093T Total Major Cations (including digestion)

CHAIN OF CUSTODY

(ALS) COC#: **26241** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts

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QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013731	Red/Green	No	
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013741	Red/Green	No	
001	YB	Clear Plastic Bottle - Natural	250 mL	00070520068231	Green	No	
001	YB	Amber Glass Bottle - Unpreserved	100 mL	00400621081687	Orange	No	
002	SQC1	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013689	Red/Green	No	
002	SQC1	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013695	Red/Green	No	
002	SQC1	Clear Plastic Bottle - Natural	250 mL	00070520068237	Green	No	
002	SQC1	Amber Glass Bottle - Unpreserved	100 mL	00400621081721	Orange	No	
003	MB3	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005005868	Red/Green	Yes	
003	MB3	Clear Plastic Bottle - NaOH Filtered	60 mL	00140519002016	Blue	No	
003	MB3	Clear Plastic Bottle - Natural	500 mL	00071020169267	Green	No	
003	MB3	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013722	Red/Green	No	
003	MB3	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013688	Red/Green	No	
003	MB3	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005005727	Red/Green	Yes	
004	RQC1	Clear Plastic Bottle - Natural	500 mL	00071020169319	Green	No	
004	RQC1	Clear Plastic Bottle - NaOH Filtered	60 mL	00140519002003	Blue	No	
004	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005005676	Red/Green	No	
004	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005005640	Red/Green	No	

Total Bottle Count: ALS: 18, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2109249**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: chris.roberts@tronox.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: Tronox Pigment Bunbury	Page	: 1 of 3
Order number	: 30086132	Quote number	: EP2021TROPIG0001_V7 (EP/894/20_V7)
C-O-C number	: 26241	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Tronox Dalyellup		
Sampler	: Jaimon Hollet		

Dates

Date Samples Received	: 13-Aug-2021 15:15	Issue Date	: 17-Aug-2021
Client Requested Due Date	: 01-Sep-2021	Scheduled Reporting Date	: **01-Sep-2021**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 3.2 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 4 / 4

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Dioxins + Furans conducted by ALS Brisbane, NATA Site No. 818.
- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Radium 226/228 analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Please note that your submission has been split into several Work Orders EP2109249 and EP2109413 to facilitate the regular delivery of data.**
- **Dioxins + Furans analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818.**
- **UT Mercury analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911.**
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - ED045G Chloride by Discrete Analyser	WATER - ED093T Total Major Cations (including digestion)	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - EK058G Nitrate as N by Discrete Analyser
EP2109249-001	12-Aug-2021 10:57	YB	✓	✓	✓				
EP2109249-002	12-Aug-2021 10:58	SQC1	✓	✓	✓				
EP2109249-003	12-Aug-2021 14:05	MB3	✓			✓	✓	✓	✓
EP2109249-004	13-Aug-2021 08:41	RQC1		✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2109249-003	12-Aug-2021 14:05	MB3	✓	✓	✓
EP2109249-004	13-Aug-2021 08:41	RQC1	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

Jaimon Hollet

- *AU Certificate of Analysis - NATA (COA)	Email	jaimon.hollet@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jaimon.hollet@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jaimon.hollet@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jaimon.hollet@arcadis.com
- Chain of Custody (CoC) (COC)	Email	jaimon.hollet@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	jaimon.hollet@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	jaimon.hollet@arcadis.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2109249**	Page	: 1 of 6
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 13-Aug-2021 15:15
Order number	: 30086132	Date Analysis Commenced	: 13-Aug-2021
C-O-C number	: 26241	Issue Date	: 30-Aug-2021 12:32
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/894/20_V7		
No. of samples received	: 4		
No. of samples analysed	: 4		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Dioxins + Furans conducted by ALS Brisbane, NATA Site No. 818.
- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EG094-F: Positive results for sample EP2109249-004 have been confirmed by reanalysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	YB	SQC1	MB3	----	----
			Sampling date / time	12-Aug-2021 10:57	12-Aug-2021 10:58	12-Aug-2021 14:05	----	----
Compound	CAS Number	LOR	Unit	EP2109249-001	EP2109249-002	EP2109249-003	--------	--------
				Result	Result	Result	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	----	630	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	----	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	----	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	----	345	----	----
Total Alkalinity as CaCO3	----	1	mg/L	----	----	345	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	----	58	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	232	229	123	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	----	138	----	----
Magnesium	7439-95-4	1	mg/L	----	----	27	----	----
Sodium	7440-23-5	1	mg/L	----	----	77	----	----
Potassium	7440-09-7	1	mg/L	----	----	7	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	1	mg/L	89	88	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	----	----	<0.001	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	----	----	<0.005	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	----	----	<0.01	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	----	----	<0.01	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	----	----	1.9	----	----
Boron	7440-42-8	5	µg/L	----	----	32	----	----
Cadmium	7440-43-9	0.05	µg/L	----	----	<0.05	----	----
Chromium	7440-47-3	0.2	µg/L	----	----	0.7	----	----
Cobalt	7440-48-4	0.1	µg/L	----	----	<0.1	----	----
Copper	7440-50-8	0.5	µg/L	----	----	2.0	----	----
Iron	7439-89-6	2	µg/L	----	----	4	----	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	SQC1	MB3	----	----
				Sampling date / time	12-Aug-2021 10:57	12-Aug-2021 10:58	12-Aug-2021 14:05	----	----
Compound	CAS Number	LOR	Unit		EP2109249-001	EP2109249-002	EP2109249-003	--------	--------
					Result	Result	Result	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		----	----	<0.1	----	----
Manganese	7439-96-5	0.5	µg/L		----	----	**2.2**	----	----
Molybdenum	7439-98-7	0.1	µg/L		----	----	**1.3**	----	----
Nickel	7440-02-0	0.5	µg/L		----	----	**0.7**	----	----
Thorium	7440-29-1	0.1	µg/L		----	----	<0.1	----	----
Uranium	7440-61-1	0.05	µg/L		----	----	**1.28**	----	----
Vanadium	7440-62-2	0.2	µg/L		----	----	**1.1**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	----	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	**7.05**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	**7.05**	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		----	----	**11.6**	----	----
ø Total Cations	----	0.01	meq/L		----	----	**12.6**	----	----
ø Ionic Balance	----	0.01	%		----	----	**4.40**	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.02**	**0.03**	<0.01	----	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	----	----

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)			Sample ID	RQC1	----	----	----	----
			Sampling date / time	13-Aug-2021 08:41	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2109249-004	--------	--------	--------	--------
				Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L	**35**	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	**1.0**	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)				Sample ID	RQC1	----	----	----	----
				Sampling date / time	13-Aug-2021 08:41	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2109249-004	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		**0.5**	----	----	----	----
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		<0.01	----	----	----	----
ø **Total Cations**	----	0.01	meq/L		<0.01	----	----	----	----
ø **Ionic Balance**	----	0.01	%		<0.01	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology). Only applies to samples EP2109249 (004).

(WATER) EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS

(WATER) EG020F: Dissolved Metals by ICP-MS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2109249**	Page	: 1 of 9
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 13-Aug-2021
Order number	: 30086132	Date Analysis Commenced	: 13-Aug-2021
C-O-C number	: 26241	Issue Date	: 30-Aug-2021
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/894/20_V7		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3849391)									
EP2109218-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	554	554	0.0	0% - 20%
EP2109273-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	654	662	1.1	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3847729)									
EP2109236-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	182	200	9.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	182	200	9.5	0% - 20%
EP2109236-012	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	174	176	0.7	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	174	176	0.7	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3845814)									
EP2109249-004	RQC1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EP2109265-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	91	90	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3845815)									
EP2109249-004	RQC1	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EP2109265-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	330	326	1.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3848364)									
EP2109108-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	258	259	0.0	0% - 20%
EP2109108-011	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	14	14	0.0	0% - 50%
ED093F: Dissolved Major Cations (QC Lot: 3852379)									
EP2109249-004	RQC1	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3852379) - continued									
EP2109249-004	RQC1	ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EP2109441-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	42	41	2.7	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	82	82	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 3852454)									
EP2109460-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	326	316	3.2	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	1340	1330	1.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	16800	16900	0.5	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	922	920	0.2	0% - 20%
EP2109280-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
ED093T: Total Major Cations (QC Lot: 3847557)									
EP2109249-001	YB	ED093T: Sodium	7440-23-5	1	mg/L	89	86	3.5	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3852455)									
EP2109460-002	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.010	<0.010	0.0	No Limit
EP2109280-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3871857)									
EP2109249-004	RQC1	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3854166)									
EP2109249-003	MB3	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3848909)									
EP2109202-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2109236-004	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3850643)									
EP2109249-003	MB3	EG094B-F: Iron	7439-89-6	2	µg/L	4	4	0.0	No Limit
EP2109265-010	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	0.008 mg/L	8	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3850644)									
EP2109249-003	MB3	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	1.28	1.29	0.9	0% - 20%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	1.3	1.3	0.0	0% - 50%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	1.9	1.9	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.7	0.7	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3850644) - continued									
EP2109249-003	MB3	EG094A-F: Vanadium	7440-62-2	0.2	µg/L	1.1	1.1	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	2.0	2.1	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	2.2	2.2	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.7	0.7	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	32	37	13.7	No Limit
EP2109265-010	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00283 mg/L	2.83	0.0	0% - 20%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0006 mg/L	0.6	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0004 mg/L	0.4	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0020 mg/L	2.0	0.0	0% - 50%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.0126 mg/L	12.7	0.0	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	0.360 mg/L	376	4.2	0% - 20%
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3853841)									
EP2109249-004	RQC1	EG094A-F: Lead	7439-92-1	0.1	µg/L	0.5	0.5	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	1.0	1.0	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	35	36	0.0	No Limit
EP2109249-004	RQC1	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3853842)									
EP2109249-004	RQC1	EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3845813)									
EP2109249-004	RQC1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2109265-006	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3846150)									
EP2109167-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	4.83	4.83	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3846150) - continued									
EP2109236-009	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	8.08	8.01	0.8	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3860339)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	93.4	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	87.9	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3849391)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	102	88.1	114
				<10	1000 mg/L	101	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3847729)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	108	81.2	126
				<1	200 mg/L	99.9	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3845814)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	87.7	113
				<1	500 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3845815)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	102	87.9	114
				<1	1000 mg/L	98.5	87.9	114
ED045G: Chloride by Discrete Analyser (QCLot: 3848364)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	98.4	87.9	114
				<1	1000 mg/L	97.2	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3852379)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	97.9	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	97.6	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	90.9	89.7	108
ED093F: Dissolved Major Cations (QCLot: 3852454)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	105	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	99.3	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	104	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	97.1	89.7	108
ED093T: Total Major Cations (QCLot: 3847557)								
ED093T: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	92.9	85.0	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3852455)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	100	85.0	120
EG020F: Dissolved Metals by ICP-MS (QCLot: 3871857)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	86.8	85.0	111
EG035F: Dissolved Mercury by FIMS (QCLot: 3854166)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	90.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3848909)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	103	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3850643)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	101	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3850644)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	100	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	83.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	96.9	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	87.4	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	86.3	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	95.6	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	88.1	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.9	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	97.6	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	97.2	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	91.1	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	96.1	87.1	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3853841)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	100	79.0	121
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	99.0	79.0	129
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	92.5	87.0	111
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	91.2	80.0	122
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	97.1	82.0	124
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	95.1	83.0	117
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	103	74.0	118
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	92.2	83.0	123
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	96.4	74.0	108
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	96.3	86.0	118
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	10 µg/L	83.0	70.0	130
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	91.7	70.0	130
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	92.4	78.0	128
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3853842)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3853842) - continued								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	92.6	79.0	115
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3845813)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3846150)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.6	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3845814)							
EP2109249-003	MB3	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	91.6	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3845815)							
EP2109249-003	MB3	ED045G: Chloride	16887-00-6	1000 mg/L	100	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3848364)							
EP2109108-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	93.4	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3852455)							
EP2109280-002	Anonymous	EG020A-F: Chromium	7440-47-3	0.2 mg/L	96.3	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3871857)							
ES2131266-001	Anonymous	EG020A-F: Chromium	7440-47-3	1 mg/L	92.0	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3854166)							
EP2109249-004	RQC1	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	90.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3848909)							
EP2109202-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	102	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3850644)							
EP2109265-001	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	111	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	105	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	93.0	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	115	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	95.4	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	96.9	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	98.0	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	106	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3850644) - continued							
EP2109265-001	Anonymous	EG094A-F: Vanadium	7440-62-2	50 µg/L	103	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3853841)							
ES2129654-004	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	112	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	94.3	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	85.8	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	# Not Determined	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	# Not Determined	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	99.6	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	# Not Determined	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	# Not Determined	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	89.0	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3845813)							
EP2109249-003	MB3	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	101	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3846150)							
EP2109167-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2109249**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 13-Aug-2021
Site	: Tronox Dalyellup	Issue Date	: 30-Aug-2021
Sampler	: Jaimon Hollet	No. of samples received	: 4
Order number	: 30086132	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG094F: Dissolved Metals in Fresh Water by ORC-ICPI	ES2129654--004	Anonymous	**Cobalt**	7440-48-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG094F: Dissolved Metals in Fresh Water by ORC-ICPI	ES2129654--004	Anonymous	**Copper**	7440-50-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG094F: Dissolved Metals in Fresh Water by ORC-ICPI	ES2129654--004	Anonymous	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG094F: Dissolved Metals in Fresh Water by ORC-ICPI	ES2129654--004	Anonymous	**Nickel**	7440-02-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2109167--002	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	17	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation* Date extracted	Due for extraction	Evaluation	*Analysis* Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) MB3	**12-Aug-2021**	**----**	----	----	**17-Aug-2021**	19-Aug-2021	✓
Clear Plastic Bottle - Natural (EA015H) RQC1	**13-Aug-2021**	**----**	----	----	**17-Aug-2021**	20-Aug-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251)							
YB, SQC1, MB3	**12-Aug-2021**	**----**	----	----	**23-Aug-2021**	08-Feb-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
MB3	**12-Aug-2021**	**----**	----	----	**16-Aug-2021**	26-Aug-2021	✓
Clear Plastic Bottle - Natural (ED037-P)							
RQC1	**13-Aug-2021**	**----**	----	----	**16-Aug-2021**	27-Aug-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
MB3	**12-Aug-2021**	**----**	----	----	**13-Aug-2021**	09-Sep-2021	✓
Clear Plastic Bottle - Natural (ED041G)							
RQC1	**13-Aug-2021**	**----**	----	----	**13-Aug-2021**	10-Sep-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
MB3	**12-Aug-2021**	**----**	----	----	**13-Aug-2021**	09-Sep-2021	✓
Clear Plastic Bottle - Natural (ED045G)							
YB, SQC1	**12-Aug-2021**	**----**	----	----	**16-Aug-2021**	09-Sep-2021	✓
Clear Plastic Bottle - Natural (ED045G)							
RQC1	**13-Aug-2021**	**----**	----	----	**13-Aug-2021**	10-Sep-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
MB3	**12-Aug-2021**	**----**	----	----	**20-Aug-2021**	09-Sep-2021	✓
Clear Plastic Bottle - Natural (ED093F)							
RQC1	**13-Aug-2021**	**----**	----	----	**19-Aug-2021**	20-Aug-2021	✓
ED093T: Total Major Cations							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (ED093T)							
RQC1	**13-Aug-2021**	**16-Aug-2021**	10-Sep-2021	✓	**16-Aug-2021**	10-Sep-2021	✓
Clear Plastic Bottle - Natural (ED093T)							
YB, SQC1	**12-Aug-2021**	**16-Aug-2021**	19-Aug-2021	✓	**16-Aug-2021**	19-Aug-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
MB3	**12-Aug-2021**	**----**	----	----	**20-Aug-2021**	08-Feb-2022	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
RQC1	**13-Aug-2021**	**----**	----	----	**28-Aug-2021**	09-Feb-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
MB3	**12-Aug-2021**	**----**	----	----	**19-Aug-2021**	09-Sep-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
RQC1	**13-Aug-2021**	**----**	----	----	**19-Aug-2021**	10-Sep-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
MB3	**12-Aug-2021**	**----**	----	----	**16-Aug-2021**	09-Sep-2021	✓
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
RQC1	**13-Aug-2021**	**----**	----	----	**16-Aug-2021**	10-Sep-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
MB3	**12-Aug-2021**	**----**	----	----	**17-Aug-2021**	08-Feb-2022	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
RQC1	**13-Aug-2021**	**----**	----	----	**19-Aug-2021**	09-Feb-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
MB3	**12-Aug-2021**	**----**	----	----	**13-Aug-2021**	14-Aug-2021	✓
Clear Plastic Bottle - Natural (EK057G)							
RQC1	**13-Aug-2021**	**----**	----	----	**13-Aug-2021**	15-Aug-2021	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
MB3	**12-Aug-2021**	**----**	----	----	**13-Aug-2021**	14-Aug-2021	✓
Clear Plastic Bottle - Natural (EK059G)							
RQC1	**13-Aug-2021**	**----**	----	----	**13-Aug-2021**	15-Aug-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	15	**26.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	17	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	**13.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	**13.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Major Cations - Total	ED093T	WATER	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Samples are digested by USEPA 3005 prior to analysis. The ICPAES technique ionises the sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.

Analytical Methods	Method	Matrix	Method Descriptions
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

ALSCompass
SAMPLING *Intelligence*

ALS

Environmental Division
Perth
Work Order Reference
EP2112485

Telephone : +61-8-9406 1301

Custody Document for Submissions via ALS Compass App

Project: Tronox Palyellup **Client:** Arcadis **Project Manager:** Bronwyn Van Valkengoed

Phone: (0408 751 386)

ALS Compass COC Reference: 28901 **# Samples:** 5 **Sampler:** Jarrod Hollett

Phone: (0420 838 328)

Turnaround Requirements: (Standard) _____ Urgent _____

Special Instructions:	ALS Use Only
	Custody seal intact? YES NO (N/A)
	Free ice / frozen ice bricks upon receipt? (YES) NO N/A
	Random sample temperature on receipt? 5.6 °C

Custody:

Relinquished by: JH JH	**Received by:** NO	**Relinquished by:**	**Received by:**
Date / Time: 19/10/21	**Date / Time:** 20/10/21 10:20.	**Date / Time:**	**Date / Time:**

CHAIN OF CUSTODY

ALS COC#: **28901** *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: ND 1020 20/10/21	DATE TIME:	DATE TIME:

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comments:			

PROJECT MANAGER: Chris Roberts CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Jaimon Hollett QUOTE NO: EP/894/20 / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

SAMPLE DETAILS							ANALYSIS REQUIRED		
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 2: Dalyellup WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	DM4C		18/10/2021 12:49 PM	Water	ALS: 6 Non ALS: 0	No	X		
002	DM4A		18/10/2021 12:55 PM	Water	ALS: 6 Non ALS: 0	No	X		
003	DM7C		18/10/2021 03:33 PM	Water	ALS: 6 Non ALS: 0	No	X		
004	DM7A		18/10/2021 03:36 PM	Water	ALS: 6 Non ALS: 0	No	X		
005	RQC1	Rinsate, no radium analysis required	18/10/2021 05:54 PM	Water	ALS: 4 Non ALS: 0	No	X		

CHAIN OF CUSTODY

ALS COC#: **28901** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	DM4C	Clear Plastic Bottle - Natural	500 mL	00070621107817	Green	No	
001	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054873	Red/Green	Yes	
001	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054988	Red/Green	Yes	
001	DM4C	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009783	Blue	No	
001	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014484	Red/Green	No	
001	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014498	Red/Green	No	
002	DM4A	Clear Plastic Bottle - Natural	500 mL	00070621107809	Green	No	
002	DM4A	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009799	Blue	No	
002	DM4A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054805	Red/Green	Yes	
002	DM4A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054816	Red/Green	Yes	
002	DM4A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014469	Red/Green	No	
002	DM4A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014538	Red/Green	No	
003	DM7C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014488	Red/Green	No	
003	DM7C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014497	Red/Green	No	
003	DM7C	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009760	Blue	No	
003	DM7C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054904	Red/Green	Yes	
003	DM7C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055094	Red/Green	Yes	
003	DM7C	Clear Plastic Bottle - Natural	500 mL	00070621107828	Green	No	
004	DM7A	Clear Plastic Bottle - Natural	500 mL	00070621107826	Green	No	
004	DM7A	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009778	Blue	No	
004	DM7A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055036	Red/Green	Yes	
004	DM7A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054969	Red/Green	Yes	
004	DM7A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014475	Red/Green	No	
004	DM7A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014480	Red/Green	No	
005	RQC1	Clear Plastic Bottle - Natural	500 mL	00071020142163	Green	No	
005	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005012308	Red/Green	No	

CHAIN OF CUSTODY

ALS COC#: **28901** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comments:			

005	RQC1	Clear Plastic Bottle - NaOH Filtered	60 mL	00141020013697	Blue	No	
005	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005012159	Red/Green	No	

Total Bottle Count: ALS: 28, Non ALS: 0

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2112485**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: chris.roberts@tronox.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: Tronox Pigment Bunbury	Page	: 1 of 3
Order number	: 30086132	Quote number	: EP2021TROPIG0001_V7 (EP/894/20_V7)
C-O-C number	: 28901	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Tronox Dalyellup		
Sampler	: Jaimon Hollet		

Dates

Date Samples Received	: 20-Oct-2021 10:20	Issue Date	: 20-Oct-2021
Client Requested Due Date	: 04-Nov-2021	Scheduled Reporting Date	: **04-Nov-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 5.6 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 5 / 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- EG035-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- EA251 analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EP2112485-005 : 18-Oct-2021 17:54 : RQC1 - Rinsate, no radium analysis required

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2112485-001	18-Oct-2021 12:49	DM4C	✓	✓	✓	✓	✓	✓	✓
EP2112485-002	18-Oct-2021 12:55	DM4A	✓	✓	✓	✓	✓	✓	✓
EP2112485-003	18-Oct-2021 15:33	DM7C	✓	✓	✓	✓	✓	✓	✓
EP2112485-004	18-Oct-2021 15:36	DM7A	✓	✓	✓	✓	✓	✓	✓
EP2112485-005	18-Oct-2021 17:54	RQC1 Rinsate, no ra...	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA251-LSC (CA) Radium 226/228 in Water
EP2112485-001	18-Oct-2021 12:49	DM4C	✓
EP2112485-002	18-Oct-2021 12:55	DM4A	✓
EP2112485-003	18-Oct-2021 15:33	DM7C	✓
EP2112485-004	18-Oct-2021 15:36	DM7A	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Attachment - Report (SUBCO)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- Attachment - Report (SUBCO)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

Jaimon Hollet

- *AU Certificate of Analysis - NATA (COA)	Email	jaimon.hollet@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jaimon.hollet@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jaimon.hollet@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jaimon.hollet@arcadis.com
- Attachment - Report (SUBCO)	Email	jaimon.hollet@arcadis.com
- Chain of Custody (CoC) (COC)	Email	jaimon.hollet@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	jaimon.hollet@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	jaimon.hollet@arcadis.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2112485**	Page	: 1 of 6
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021 10:20
Order number	: 30086132	Date Analysis Commenced	: 20-Oct-2021
C-O-C number	: 28901	Issue Date	: 29-Oct-2021 16:34
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/894/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EA015H (Total Dissolved Solids): TDS for samples #1 and #2 potentially biasing high due to possible sample matrix interferences.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	DM4C	DM4A	DM7C	DM7A	----
			Sampling date / time	18-Oct-2021 12:49	18-Oct-2021 12:55	18-Oct-2021 15:33	18-Oct-2021 15:36	----
Compound	CAS Number	LOR	Unit	EP2112485-001	EP2112485-002	EP2112485-003	EP2112485-004	--------
				Result	Result	Result	Result	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	6430	5440	895	780	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	265	85	348	383	----
Total Alkalinity as CaCO3	----	1	mg/L	265	85	348	383	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	543	420	65	52	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1990	1790	219	224	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	544	543	146	99	----
Magnesium	7439-95-4	1	mg/L	507	373	50	52	----
Sodium	7440-23-5	1	mg/L	270	217	68	121	----
Potassium	7440-09-7	1	mg/L	10	11	4	6	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	9.7	17.1	1.4	11.2	----
Boron	7440-42-8	5	µg/L	135	41	28	50	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	----
Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.5	<0.2	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	2.2	0.1	0.1	----
Copper	7440-50-8	0.5	µg/L	1.2	0.7	1.7	<0.5	----
Iron	7439-89-6	2	µg/L	3990	22200	2	2410	----
Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Manganese	7439-96-5	0.5	µg/L	94.2	730	63.4	106	----
Molybdenum	7439-98-7	0.1	µg/L	3.2	0.4	11.2	0.7	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM4C	DM4A	DM7C	DM7A	----
				Sampling date / time	18-Oct-2021 12:49	18-Oct-2021 12:55	18-Oct-2021 15:33	18-Oct-2021 15:36	----
Compound	CAS Number	LOR	Unit		EP2112485-001	EP2112485-002	EP2112485-003	EP2112485-004	--------
					Result	Result	Result	Result	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		<0.5	**3.0**	**0.6**	<0.5	----
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	----
Uranium	7440-61-1	0.05	µg/L		<0.05	<0.05	**0.75**	<0.05	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	<0.2	**3.4**	**0.4**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	**0.01**	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	**0.01**	**1.02**	**0.50**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	**0.01**	**1.03**	**0.50**	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**72.7**	**60.9**	**14.5**	**15.0**	----
ø Total Cations	----	0.01	meq/L		**80.9**	**67.5**	**14.5**	**14.6**	----
ø Ionic Balance	----	0.01	%		**5.30**	**5.12**	**0.08**	**1.40**	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.03**	**0.03**	<0.01	**0.01**	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID: RQC1 Rinsate, no radium analysis required	----	----	----	----
			Sampling date / time	18-Oct-2021 17:54	----	----	----	----
				EP2112485-005	--------	--------	--------	--------
				Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L	<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L	<0.1	----	----	----	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)				Sample ID	RQC1 Rinsate, no radium analysis required	----	----	----	----
				Sampling date / time	18-Oct-2021 17:54	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EP2112485-005**	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L		<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%		<0.01	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2112485**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021
Order number	: 30086132	Date Analysis Commenced	: 20-Oct-2021
C-O-C number	: 28901	Issue Date	: 29-Oct-2021
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup		
Quote number	: EP/894/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3968692)									
EP2112485-004	DM7A	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	780	774	0.9	0% - 20%
EP2112465-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	5680	5650	0.5	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3979935)									
EP2112485-002	DM4A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	85	89	4.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	85	89	4.5	0% - 20%
EP2112616-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	166	161	2.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	166	161	2.9	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3966844)									
EP2112566-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	106	107	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3966845)									
EP2112566-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	130	133	1.9	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3978213)									
EP2112485-001	DM4C	ED093F: Calcium	7440-70-2	1	mg/L	544	540	0.7	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	507	505	0.4	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	270	273	1.2	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	10	10	0.0	0% - 50%
EP2112772-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	33	34	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	76	77	1.6	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	641	654	2.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3978213) - continued									
EP2112772-001	Anonymous	ED093F: Potassium	7440-09-7	1	mg/L	25	25	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3978214)									
EP2112485-001	DM4C	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2112772-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3976279)									
EP2112485-002	DM4A	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2112534-005	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3968673)									
EP2112364-007	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112364-014	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3969202)									
EP2112485-003	DM7C	EG094B-F: Iron	7439-89-6	2	µg/L	2	4	56.5	No Limit
EP2112432-010	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	0.013 mg/L	12	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3969204)									
EP2112485-003	DM7C	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.75	0.73	2.8	0% - 50%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.1	0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	11.2	11.4	1.2	0% - 20%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	1.4	1.3	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.5	0.5	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	3.4	3.4	0.0	0% - 50%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	1.7	1.6	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	63.4	64.3	1.4	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.6	0.5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	28	36	25.3	No Limit
EP2112432-010	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00008 mg/L	0.09	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.0004 mg/L	0.4	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	0.0002 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0006 mg/L	0.6	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0009 mg/L	0.9	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.0022 mg/L	2.2	0.0	0% - 50%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0005 mg/L	0.5	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.501 mg/L	494	1.4	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.0018 mg/L	1.8	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3969204) - continued									
EP2112432-010	Anonymous	EG094A-F: Boron	7440-42-8	5	µg/L	0.263 mg/L	258	2.2	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3966842)									
EP2112566-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.12	0.13	0.0	0% - 50%
EP2112566-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3967124)									
EP2112611-007	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	11.0	11.0	0.3	0% - 20%
EP2112611-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	33.6	32.7	2.7	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3976470)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	98.3	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	96.1	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3968692)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	99.7	88.1	114
				<10	1000 mg/L	101	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3979935)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	107	81.2	126
				<1	200 mg/L	102	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3966844)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	96.1	87.7	113
				<1	500 mg/L	100	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3966845)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.6	87.9	114
				<1	1000 mg/L	97.0	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3978213)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.8	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	96.7	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	98.7	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.5	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3978214)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.5	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3976279)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	95.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3968673)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	97.9	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3969202)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	104	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3969204)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	105	83.5	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3969204) - continued								
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	90.8	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	100	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	86.8	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	94.5	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	91.9	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	89.0	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	100	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	102	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	106	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	95.6	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	90.2	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3966842)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	99.7	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3967124)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	95.2	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3966844)							
EP2112566-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	120	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3966845)							
EP2112566-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	91.8	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3978214)							
EP2112485-002	DM4A	EG020A-F: Chromium	7440-47-3	0.2 mg/L	91.5	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3976279)							
EP2112485-003	DM7C	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	92.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3968673)							
EP2112364-007	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	91.2	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3969204)							
EP2112432-012	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	128	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3969204) - continued							
EP2112432-012	Anonymous	EG094A-F: Cadmium	7440-43-9	12.5 µg/L	107	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	85.3	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	130	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	101	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	84.5	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	98.4	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	118	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	92.8	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3966842)							
EP2112566-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	97.2	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3967124)							
EP2112611-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2112485**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021
Site	: Tronox Dalyellup	Issue Date	: 29-Oct-2021
Sampler	: Jaimon Hollet	No. of samples received	: 5
Order number	: 30086132	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2112611--001	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	11	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**21-Oct-2021**	25-Oct-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251)							
DM4C, DM4A, DM7C, DM7A	**18-Oct-2021**	**----**	----	----	**26-Oct-2021**	16-Apr-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**27-Oct-2021**	01-Nov-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**20-Oct-2021**	15-Nov-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**20-Oct-2021**	15-Nov-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**27-Oct-2021**	15-Nov-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**27-Oct-2021**	16-Apr-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**26-Oct-2021**	15-Nov-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**21-Oct-2021**	15-Nov-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**21-Oct-2021**	16-Apr-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**20-Oct-2021**	20-Oct-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
DM4C, DM4A, DM7C, DM7A, RQC1 - Rinsate, no radium analysis required	**18-Oct-2021**	**----**	----	----	**20-Oct-2021**	20-Oct-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	11	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Environmental Division
Perth
Work Order Reference
EP2112534

Telephone : - 61-8-9406 1301

ALSCompass SAMPLING Intelligence

Custody Document for Submissions via ALS Compass App

Project: Tronox Palyellup **Client:** Arcadis **Project Manager:** Bronwyn Van Valkengoed
Phone: (0408 751 386)

ALS Compass COC Reference: 28901 **# Samples:** 5 **Sampler:** Duncan Hollett
Phone: (0420 838 328)

Turnaround Requirements: (Standard) _____ Urgent _____

Special Instructions:	ALS Use Only			
	Custody seal intact?	YES	NO	(N/A)
	Free ice / frozen ice bricks upon receipt?	(YES)	NO	N/A
	Random sample temperature on receipt? 5 to		°C	

Custody:

Relinquished by:	**Received by:**	**Relinquished by:**	**Received by:**
DH	NO		
Date / Time: 19/10/21	**Date / Time:** 20/10/21 10:20.	**Date / Time:**	**Date / Time:**

CHAIN OF CUSTODY

ALS COC#: **28901** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: ND 1020 20/10/21	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comments:			

SAMPLE DETAILS							ANALYSIS REQUIRED		
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 2: Dalyellup WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	DM4C		18/10/2021 12:49 PM	Water	ALS: 6 Non ALS: 0	No	X		
002	DM4A		18/10/2021 12:55 PM	Water	ALS: 6 Non ALS: 0	No	X		
003	DM7C		18/10/2021 03:33 PM	Water	ALS: 6 Non ALS: 0	No	X		
004	DM7A		18/10/2021 03:36 PM	Water	ALS: 6 Non ALS: 0	No	X		
005	RQC1	Rinsate, no radium analysis required	18/10/2021 05:54 PM	Water	ALS: 4 Non ALS: 0	No	X		

CHAIN OF CUSTODY

ALS COC#: 28901 *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	DM4C	Clear Plastic Bottle - Natural	500 mL	00070621107817	Green	No	
001	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054873	Red/Green	Yes	
001	DM4C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054988	Red/Green	Yes	
001	DM4C	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009783	Blue	No	
001	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014484	Red/Green	No	
001	DM4C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014498	Red/Green	No	
002	DM4A	Clear Plastic Bottle - Natural	500 mL	00070621107809	Green	No	
002	DM4A	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009799	Blue	No	
002	DM4A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054805	Red/Green	Yes	
002	DM4A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054816	Red/Green	Yes	
002	DM4A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014469	Red/Green	No	
002	DM4A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014538	Red/Green	No	
003	DM7C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014488	Red/Green	No	
003	DM7C	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014497	Red/Green	No	
003	DM7C	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009760	Blue	No	
003	DM7C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054904	Red/Green	Yes	
003	DM7C	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055094	Red/Green	Yes	
003	DM7C	Clear Plastic Bottle - Natural	500 mL	00070621107828	Green	No	
004	DM7A	Clear Plastic Bottle - Natural	500 mL	00070621107826	Green	No	
004	DM7A	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009778	Blue	No	
004	DM7A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055036	Red/Green	Yes	
004	DM7A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054969	Red/Green	Yes	
004	DM7A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014475	Red/Green	No	
004	DM7A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014480	Red/Green	No	
005	RQC1	Clear Plastic Bottle - Natural	500 mL	00071020142163	Green	No	
005	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005012308	Red/Green	No	

CHAIN OF CUSTODY

COC#: **28901** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comments:			

005	RQC1	Clear Plastic Bottle - NaOH Filtered	60 mL	00141020013697	Blue	No	
005	RQC1	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005012159	Red/Green	No	

Total Bottle Count: ALS: 28, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2112534**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: chris.roberts@tronox.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: Tronox Pigment Bunbury	Page	: 1 of 3
Order number	: 30086132	Quote number	: EP2021TROPIG0001_V7 (EP/894/20_V7)
C-O-C number	: 28953	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Tronox Dalyellup 2		
Sampler	: Jaimon Hollet		

Dates

Date Samples Received	: 20-Oct-2021 10:25	Issue Date	: 21-Oct-2021
Client Requested Due Date	: 03-Nov-2021	Scheduled Reporting Date	: **03-Nov-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 3.2 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 5 / 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- EG035-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- EA251 analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EP2112534-005 : 19-Oct-2021 15:12 : RQC2 - Rinsate, no radium analysis required

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2112534-001	19-Oct-2021 10:20	DM8C(R)	✓	✓	✓	✓	✓	✓	✓
EP2112534-002	19-Oct-2021 10:25	SQC1	✓	✓	✓	✓	✓	✓	✓
EP2112534-003	19-Oct-2021 12:20	DM8A	✓	✓	✓	✓	✓	✓	✓
EP2112534-004	19-Oct-2021 14:28	DM2C	✓	✓	✓	✓	✓	✓	✓
EP2112534-005	19-Oct-2021 15:12	RQC2 Rinsate, no ra...	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA251-LSC (CA) Radium 226/228 in Water
EP2112534-001	19-Oct-2021 10:20	DM8C(R)	✓
EP2112534-002	19-Oct-2021 10:25	SQC1	✓
EP2112534-003	19-Oct-2021 12:20	DM8A	✓
EP2112534-004	19-Oct-2021 14:28	DM2C	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

Jaimon Hollet

- *AU Certificate of Analysis - NATA (COA)	Email	jaimon.hollet@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jaimon.hollet@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jaimon.hollet@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jaimon.hollet@arcadis.com
- Chain of Custody (CoC) (COC)	Email	jaimon.hollet@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	jaimon.hollet@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	jaimon.hollet@arcadis.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2112534**	Page	: 1 of 6
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021 10:25
Order number	: 30086132	Date Analysis Commenced	: 21-Oct-2021
C-O-C number	: 28953	Issue Date	: 29-Oct-2021 17:49
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 2		
Quote number	: EP/894/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035-UT conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EK057G (Nitrite): LOR raised for sample #3 due to possible sample matrix interference.
- EA015H (Total Dissolved Solids): TDS for samples #1 and #2 potentially biasing high due to possible sample matrix interferences.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	DM8C(R)	SQC1	DM8A	DM2C	----
			Sampling date / time	19-Oct-2021 10:20	19-Oct-2021 10:25	19-Oct-2021 12:20	19-Oct-2021 14:28	----
Compound	CAS Number	LOR	Unit	EP2112534-001	EP2112534-002	EP2112534-003	EP2112534-004	--------
				Result	Result	Result	Result	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	6320	6580	7110	3780	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	302	302	223	280	----
Total Alkalinity as CaCO3	----	1	mg/L	302	302	223	280	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	539	531	573	412	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1840	2230	2610	1160	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	514	514	644	509	----
Magnesium	7439-95-4	1	mg/L	515	516	564	207	----
Sodium	7440-23-5	1	mg/L	288	292	318	198	----
Potassium	7440-09-7	1	mg/L	10	10	12	13	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	0.273	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	<0.01	<0.01	0.03	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	0.24	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	6.9	7.0	8.5	0.6	----
Boron	7440-42-8	5	µg/L	174	140	80	142	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	----
Chromium	7440-47-3	0.2	µg/L	0.7	0.7	<0.2	273	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	<0.1	0.4	----
Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	1.0	1.0	----
Iron	7439-89-6	2	µg/L	1740	1710	12800	3	----
Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Manganese	7439-96-5	0.5	µg/L	63.4	62.7	997	18.0	----
Molybdenum	7439-98-7	0.1	µg/L	20.0	20.4	2.9	2.0	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM8C(R)	SQC1	DM8A	DM2C	----
				Sampling date / time	19-Oct-2021 10:20	19-Oct-2021 10:25	19-Oct-2021 12:20	19-Oct-2021 14:28	----
Compound	CAS Number	LOR	Unit		EP2112534-001	EP2112534-002	EP2112534-003	EP2112534-004	--------
					Result	Result	Result	Result	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		**0.8**	**0.7**	<0.5	<0.5	----
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	----
Uranium	7440-61-1	0.05	µg/L		**0.79**	**0.77**	**0.08**	**1.90**	----
Vanadium	7440-62-2	0.2	µg/L		**0.5**	**0.5**	<0.2	**4.3**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.02	**0.01**	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	**0.01**	<0.02	**2.61**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	**0.01**	**0.01**	**2.62**	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**69.2**	**80.0**	**90.0**	**46.9**	----
ø Total Cations	----	0.01	meq/L		**80.8**	**81.1**	**92.7**	**51.4**	----
ø Ionic Balance	----	0.01	%		**7.77**	**0.67**	**1.47**	**4.56**	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.02**	**0.03**	**0.02**	**0.01**	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)			Sample ID	**RQC2 Rinsate, no radium analysis required**	----	----	----	----
			Sampling date / time	19-Oct-2021 15:12	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EP2112534-005**	--------	--------	--------	--------
				Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L	<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L	<0.1	----	----	----	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)				Sample ID	RQC2 Rinsate, no radium analysis required	----	----	----	----
				Sampling date / time	19-Oct-2021 15:12	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2112534-005	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L		<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%		<0.01	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2112534**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021
Order number	: 30086132	Date Analysis Commenced	: 21-Oct-2021
C-O-C number	: 28953	Issue Date	: 29-Oct-2021
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 2		
Quote number	: EP/894/20_V7		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3971127)									
EP2112534-001	DM8C(R)	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	6320	6060	4.3	0% - 20%
EP2112582-004	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	66600	59500	11.3	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3979935)									
EP2112485-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	85	89	4.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	85	89	4.5	0% - 20%
EP2112616-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	166	161	2.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	166	161	2.9	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3969593)									
EP2112534-002	SQC1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	531	534	0.5	0% - 20%
EP2112547-004	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5620	5680	1.1	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3969594)									
EP2112534-002	SQC1	ED045G: Chloride	16887-00-6	1	mg/L	2230	1840	19.3	0% - 20%
EP2112547-004	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	19000	18900	0.2	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3978213)									
EP2112485-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	544	540	0.7	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	507	505	0.4	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	270	273	1.2	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	10	10	0.0	0% - 50%
EP2112772-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	33	34	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3978213) - continued									
EP2112772-001	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	76	77	1.6	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	641	654	2.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	25	25	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3978214)									
EP2112485-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2112772-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3976279)									
EP2112485-002	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2112534-005	RQC2 Rinsate, no radium analysis required	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3975345)									
EP2112534-001	DM8C(R)	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112670-007	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3971911)									
EP2112547-008	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	<0.002 mg/L	<2	0.0	No Limit
EP2112489-004	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	<0.002 mg/L	<2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3971913)									
EP2112547-008	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	0.00027 mg/L	0.29	8.5	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00016 mg/L	0.15	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.0002 mg/L	0.2	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0003 mg/L	0.3	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.0003 mg/L	0.3	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0004 mg/L	0.4	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	0.0017 mg/L	1.7	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.0048 mg/L	4.8	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.0141 mg/L	14.0	0.0	0% - 20%
		EG094A-F: Boron	7440-42-8	5	µg/L	0.122 mg/L	124	2.0	0% - 20%
EP2112489-004	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.0002 mg/L	0.2	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3971913) - continued									
EP2112489-004	Anonymous	EG094A-F: Copper	7440-50-8	0.5	µg/L	0.0012 mg/L	1.2	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.122 mg/L	120	1.9	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.0009 mg/L	0.9	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	0.009 mg/L	9	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3969592)									
EP2112534-002	SQC1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112547-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3969806)									
EP2112534-002	SQC1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.01	0.0	No Limit
EP2112547-006	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.71	1.72	0.9	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3976470)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	98.3	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	96.1	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3971127)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	102	88.1	114
				<10	1000 mg/L	103	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3979935)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	107	81.2	126
				<1	200 mg/L	102	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3969593)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	87.7	113
				<1	500 mg/L	104	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3969594)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	103	87.9	114
				<1	1000 mg/L	94.0	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3978213)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.8	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	96.7	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	98.7	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.5	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3978214)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.5	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3976279)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	95.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3975345)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	98.5	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3971911)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	102	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3971913)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	110	83.5	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3971913) - continued								
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	94.6	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	102	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	97.8	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	90.8	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	105	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	103	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	101	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	102	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	104	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	102	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	100	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3969592)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	99.0	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3969806)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	106	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3969593)							
EP2112534-001	DM8C(R)	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3969594)							
EP2112534-001	DM8C(R)	ED045G: Chloride	16887-00-6	1000 mg/L	120	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3978214)							
EP2112485-002	Anonymous	EG020A-F: Chromium	7440-47-3	0.2 mg/L	91.5	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3976279)							
EP2112485-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	92.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3975345)							
EP2112534-001	DM8C(R)	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	97.2	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3971913)							
EP2112489-010	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	124	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3971913) - continued							
EP2112489-010	Anonymous	EG094A-F: Cadmium	7440-43-9	12.5 µg/L	111	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	98.4	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	118	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	111	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	95.8	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	99.5	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	111	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	102	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3969592)							
EP2112547-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	95.6	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3969806)							
EP2112534-001	DM8C(R)	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	103	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2112534**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 20-Oct-2021
Site	: Tronox Dalyellup 2	Issue Date	: 29-Oct-2021
Sampler	: Jaimon Hollet	No. of samples received	: 5
Order number	: 30086132	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EP2112534--001	DM8C(R)	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	11	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinse, no radium analysis required	**19-Oct-2021**	**----**	----	----	**22-Oct-2021**	26-Oct-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251)							
DM8C(R), SQC1, DM8A, DM2C	**19-Oct-2021**	**----**	----	----	**26-Oct-2021**	17-Apr-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinse, no radium analysis required	**19-Oct-2021**	**----**	----	----	**27-Oct-2021**	02-Nov-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**21-Oct-2021**	16-Nov-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**21-Oct-2021**	16-Nov-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**27-Oct-2021**	16-Nov-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**27-Oct-2021**	17-Apr-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**26-Oct-2021**	16-Nov-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**25-Oct-2021**	16-Nov-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**22-Oct-2021**	17-Apr-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**21-Oct-2021**	21-Oct-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
DM8C(R), SQC1, DM8A, DM2C, RQC2 - Rinsate, no radium analysis required	**19-Oct-2021**	**----**	----	----	**21-Oct-2021**	21-Oct-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	11	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	**11.76**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	**11.76**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	17	**5.88**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Environmental Division
Perth
Work Order Reference
EP2112613

Telephone : +61-8-9406 1301

ALSCompass SAMPLING Intelligence

Custody Document for Submissions via ALS Compass App

Project: Tronox Pahyeltup 3 **Client:** Arcadis **Project Manager:** Bronwyn Van Valkenpeel
Phone: (0408 751 386)

ALS Compass COC Reference: 29040 **# Samples:** 3 **Sampler:** Jaihon Hollett
Phone: (0420 838 328)

Turnaround Requirements: ~~Standard~~ _____ Urgent _____

Special Instructions:	ALS Use Only
	Custody seal intact? YES NO N/A
	Free ice / frozen ice bricks upon receipt? YES NO N/A
	Random sample temperature on receipt? 13.0 °C

Custody:

Relinquished by: JH JH	**Received by:** ND	**Relinquished by:**	**Received by:**
Date / Time: 21/10/21	**Date / Time:** 22/10/21 1125	**Date / Time:**	**Date / Time:**

CHAIN OF CUSTODY

ALS COC#: 29040 ALS Laboratory: EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: MW 1125 22/10/21	DATE TIME:	DATE TIME:

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup 3

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts CONTACT PH: SAMPLER MOBILE:

PRIMARY SAMPLER: Jaimon Hollett QUOTE NO: EP/894/20 / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS: 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED			
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 2: Dalyellup WATER	Suite 9: Dalyellup YB - Quarterly WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	YB		20/10/2021 04:24 PM	Water	ALS: 3 Non ALS: 0	No		X		
002	DM2A		20/10/2021 05:45 PM	Water	ALS: 6 Non ALS: 0	No	X			
003	RQC3	Rinsate, no radium analysis required	20/10/2021 05:48 PM	Water	ALS: 4 Non ALS: 0	No	X	X		

CHAIN OF CUSTODY

ALS COC#: **29040** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup 3

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013773	Red/Green	No	
001	YB	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519013732	Red/Green	No	
001	YB	Clear Plastic Bottle - Natural	250 mL	00071020169228	Green	No	
002	DM2A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014517	Red/Green	No	
002	DM2A	Clear Plastic Bottle - Unfiltered; Lab-acidified	1 L	00280519014522	Red/Green	No	
002	DM2A	Clear Plastic Bottle - Natural	500 mL	00070621107794	Green	No	
002	DM2A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055141	Red/Green	Yes	
002	DM2A	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054998	Red/Green	Yes	
002	DM2A	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009470	Blue	No	
003	RQC3	Clear Plastic Bottle - NaOH Filtered	60 mL	00141020013510	Blue	No	
003	RQC3	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005055006	Red/Green	No	
003	RQC3	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005055093	Red/Green	No	
003	RQC3	Clear Plastic Bottle - Natural	500 mL	00070621107795	Green	No	

Total Bottle Count: ALS: 13, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2112613**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: chris.roberts@tronox.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: Tronox Pigment Bunbury	Page	: 1 of 3
Order number	: 30086132	Quote number	: EP2021TROPIG0001_V7 (EP/894/20_V7)
C-O-C number	: 29040	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Tronox Dalyellup 3		
Sampler	: Jaimon Hollet		

Dates

Date Samples Received	: 22-Oct-2021 11:25	Issue Date	: 22-Oct-2021
Client Requested Due Date	: 10-Nov-2021	Scheduled Reporting Date	: **10-Nov-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 13.0 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 3 / 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Radium analysis will be conducted by ALS Environmental, Canberra, NATA accreditation No. 992, Site No. 1524.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **UT Mercury analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911.**
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EP2112613-003 : 20-Oct-2021 17:48 : RQC3 - Rinsate, no radium analysis required

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - ED045G Chloride by Discrete Analyser	WATER - ED093T Total Major Cations (including digestion)	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - EK058G Nitrate as N by Discrete Analyser
EP2112613-001	20-Oct-2021 16:24	YB	✓	✓	✓				
EP2112613-002	20-Oct-2021 17:45	DM2A	✓			✓	✓	✓	✓
EP2112613-003	20-Oct-2021 17:48	RQC3 Rinsate, no ra...		✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2112613-002	20-Oct-2021 17:45	DM2A	✓	✓	✓
EP2112613-003	20-Oct-2021 17:48	RQC3 Rinsate, no ra...	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

Jaimon Hollet

- *AU Certificate of Analysis - NATA (COA)	Email	jaimon.hollet@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jaimon.hollet@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jaimon.hollet@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jaimon.hollet@arcadis.com
- Chain of Custody (CoC) (COC)	Email	jaimon.hollet@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	jaimon.hollet@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	jaimon.hollet@arcadis.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2112613**	Page	: 1 of 6
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021 11:25
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29040	Issue Date	: 03-Nov-2021 13:35
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 3		
Quote number	: EP/894/20_V7		
No. of samples received	: 3		
No. of samples analysed	: 3		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- UT Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EG094: Positive B result for sample EP2112613 -003 has been confirmed by re-analysis.
- TDS by method EA-015 may bias high for sample #2 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- It has been noted that Dissolved Hexavalent Chromium (EG050G-F) is greater than Dissolved Chromium (EG020A-F) for sample #2, however this difference is within the limits of experimental variation. Result confirmed by re-preparation and re-analysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	YB	DM2A	----	----	----
			Sampling date / time	20-Oct-2021 16:24	20-Oct-2021 17:45	----	----	----
Compound	CAS Number	LOR	Unit	EP2112613-001	EP2112613-002	--------	--------	--------
				Result	Result	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	3200	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	280	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	----	280	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	237	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	242	1080	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	423	----	----	----
Magnesium	7439-95-4	1	mg/L	----	173	----	----	----
Sodium	7440-23-5	1	mg/L	----	176	----	----	----
Potassium	7440-09-7	1	mg/L	----	11	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	1	mg/L	88	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	----	0.307	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	----	<0.005	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	----	<0.01	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	----	0.32	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	----	0.9	----	----	----
Boron	7440-42-8	5	µg/L	----	168	----	----	----
Cadmium	7440-43-9	0.05	µg/L	----	<0.05	----	----	----
Chromium	7440-47-3	0.2	µg/L	----	307	----	----	----
Cobalt	7440-48-4	0.1	µg/L	----	0.2	----	----	----
Copper	7440-50-8	0.5	µg/L	----	1.3	----	----	----
Iron	7439-89-6	2	µg/L	----	9	----	----	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	YB	DM2A	----	----	----
				Sampling date / time	20-Oct-2021 16:24	20-Oct-2021 17:45	----	----	----
Compound	CAS Number	LOR	Unit		EP2112613-001	EP2112613-002	--------	--------	--------
					Result	Result	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Lead	7439-92-1	0.1	µg/L		----	<0.1	----	----	----
Manganese	7439-96-5	0.5	µg/L		----	**5.0**	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		----	**3.0**	----	----	----
Nickel	7440-02-0	0.5	µg/L		----	**0.7**	----	----	----
Thorium	7440-29-1	0.1	µg/L		----	<0.1	----	----	----
Uranium	7440-61-1	0.05	µg/L		----	**0.91**	----	----	----
Vanadium	7440-62-2	0.2	µg/L		----	**1.4**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	**0.03**	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	**2.37**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	**2.40**	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		----	**41.0**	----	----	----
ø Total Cations	----	0.01	meq/L		----	**43.3**	----	----	----
ø Ionic Balance	----	0.01	%		----	**2.72**	----	----	----
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.03**	**0.01**	----	----	----
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	----	----	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)			Sample ID	**RQC3 Rinsate, no radium analysis required**	----	----	----	----
			Sampling date / time	20-Oct-2021 17:48	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EP2112613-003**	--------	--------	--------	--------
				Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	<10	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L	**13**	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----

Analytical Results

Sub-Matrix: **RINSATE** (Matrix: **WATER**)			Sample ID	RQC3 Rinsate, no radium analysis required	----	----	----	----
			Sampling date / time	20-Oct-2021 17:48	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2112613-003	--------	--------	--------	--------
				Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued								
Iron	7439-89-6	2	µg/L	<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L	<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L	<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L	<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L	<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%	<0.01	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2112613**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29040	Issue Date	: 03-Nov-2021
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 3		
Quote number	: EP/894/20_V7		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3976443)									
EP2112613-002	DM2A	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	3200	3170	0.8	0% - 20%
EP2112719-005	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	704	710	0.8	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3979935)									
EP2112485-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	85	89	4.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	85	89	4.5	0% - 20%
EP2112616-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	166	161	2.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	166	161	2.9	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3972652)									
EP2112613-003	RQC3 Rinsate, no radium analysis required	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EP2112759-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	928	920	0.9	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3972653)									
EP2112613-003	RQC3 Rinsate, no radium analysis required	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EP2112759-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	10500	10400	1.5	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3975326)									
EP2112422-014	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	21800	22100	1.6	0% - 20%
EP2112743-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	37	37	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3982276)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 3982276) - continued									
EP2112613-002	DM2A	ED093F: Calcium	7440-70-2	1	mg/L	423	423	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	173	172	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	176	176	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	11	11	0.0	0% - 50%
EP2112845-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	69	69	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	49	48	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	949	943	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	33	33	0.0	0% - 20%
ED093T: Total Major Cations (QC Lot: 3974428)									
EP2112613-001	YB	ED093T: Sodium	7440-23-5	1	mg/L	88	88	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3982277)									
EP2112613-002	DM2A	EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.307	0.306	0.3	0% - 20%
EP2112845-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3979074)									
EP2112613-002	DM2A	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3975345)									
EP2112534-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112670-007	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3977327)									
EP2112613-002	DM2A	EG094B-F: Iron	7439-89-6	2	µg/L	9	8	0.0	No Limit
EP2112688-002	Anonymous	EG094B-F: Iron	7439-89-6	2	µg/L	0.004 mg/L	4	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3977328)									
EP2112613-002	DM2A	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.91	0.87	4.7	0% - 50%
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.2	0.2	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	3.0	3.0	0.0	0% - 20%
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.9	0.9	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	307	306	0.4	0% - 20%
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	1.4	1.4	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	1.3	1.3	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	5.0	5.0	0.0	0% - 50%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.7	0.6	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	168	181	7.6	0% - 20%
EP2112688-002	Anonymous	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00035 mg/L	0.36	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3977328) - continued									
EP2112688-002	Anonymous	EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0003 mg/L	0.4	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0003 mg/L	0.3	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0014 mg/L	1.4	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	0.130 mg/L	131	0.0	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3972651)									
EP2112613-003	RQC3 Rinsate, no radium analysis required	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112759-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3972656)									
EP2112767-006	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.0	No Limit
EP2112688-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.82	0.83	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3984245)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	95.1	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	93.5	85.6	112
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3976443)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	103	88.1	114
				<10	1000 mg/L	100	88.1	114
ED037P: Alkalinity by PC Titrator (QCLot: 3979935)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	107	81.2	126
				<1	200 mg/L	102	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3972652)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	95.2	87.7	113
				<1	500 mg/L	103	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3972653)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	94.5	87.9	114
				<1	1000 mg/L	93.2	87.9	114
ED045G: Chloride by Discrete Analyser (QCLot: 3975326)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	101	87.9	114
				<1	1000 mg/L	109	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3982276)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	101	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	104	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	102	89.7	108
ED093T: Total Major Cations (QCLot: 3974428)								
ED093T: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	110	85.0	115
EG020F: Dissolved Metals by ICP-MS (QCLot: 3982277)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.5	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3979074)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	92.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3975345)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG050F: Dissolved Hexavalent Chromium (QCLot: 3975345) - continued								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	98.5	92.1	109
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977327)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	97.8	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977328)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	110	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	82.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	96.3	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	91.0	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	97.0	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	92.7	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	92.2	82.7	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.2	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	98.3	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	105	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	90.8	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	91.8	87.1	113
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3972651)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3972656)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	105	90.5	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3972652)							
EP2112613-002	DM2A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	112	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3972653)							
EP2112613-002	DM2A	ED045G: Chloride	16887-00-6	1000 mg/L	85.8	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3975326)							
EP2112422-013	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3982277)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3982277) - continued							
EP2112613-003	RQC3 Rinsate, no radium analysis required	EG020A-F: Chromium	7440-47-3	0.2 mg/L	101	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3979074)							
EP2112613-003	RQC3 Rinsate, no radium analysis required	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	93.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3975345)							
EP2112534-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	97.2	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977328)							
EP2112613-003	RQC3 Rinsate, no radium analysis required	EG094A-F: Arsenic	7440-38-2	50 µg/L	103	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	101	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	97.0	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	110	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	94.6	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	87.6	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	98.2	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	105	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	96.3	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3972651)							
EP2112759-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	110	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3972656)							
EP2112688-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	103	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2112613**	Page	: 1 of 7
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021
Site	: Tronox Dalyellup 3	Issue Date	: 03-Nov-2021
Sampler	: Jaimon Hollet	No. of samples received	: 3
Order number	: 30086132	No. of samples analysed	: 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	EP2112422--013	Anonymous	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	20	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H)								
DM2A,	RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**27-Oct-2021**	27-Oct-2021	✓
EA251CA: Radium 226 and Radium 228 Activity								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251)								
YB,	DM2A	**20-Oct-2021**	**----**	----	----	**29-Oct-2021**	18-Apr-2022	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
DM2A,	RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**27-Oct-2021**	03-Nov-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
DM2A,	RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**22-Oct-2021**	17-Nov-2021	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
DM2A,	RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**22-Oct-2021**	17-Nov-2021	✓
Clear Plastic Bottle - Natural (ED045G)								
YB		**20-Oct-2021**	**----**	----	----	**26-Oct-2021**	17-Nov-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**28-Oct-2021**	17-Nov-2021	✓
ED093T: Total Major Cations							
Clear Plastic Bottle - Natural (ED093T)							
YB, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**25-Oct-2021**	27-Oct-2021	✓	**25-Oct-2021**	27-Oct-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**28-Oct-2021**	18-Apr-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**27-Oct-2021**	17-Nov-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**25-Oct-2021**	17-Nov-2021	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**26-Oct-2021**	18-Apr-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**22-Oct-2021**	22-Oct-2021	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
DM2A, RQC3 - Rinsate, no radium analysis required	**20-Oct-2021**	**----**	----	----	**22-Oct-2021**	22-Oct-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	39	**10.26**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	20	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	39	**10.26**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Major Cations - Total	ED093T	WATER	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Samples are digested by USEPA 3005 prior to analysis. The ICPAES technique ionises the sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.

Analytical Methods	Method	Matrix	Method Descriptions
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

ALSCompass
SAMPLING *Intelligence*

Environmental Division
Perth
Work Order Reference
EP2112719

Telephone : +61-8-9406 1301

Custody Document for Submissions via ALS Compass App

Project: Tronox Pailyellup 4 ~~Bunbury~~ **Client:** Arcadis **Project Manager:** Bronwyn Van Valkengoed.
Phone: (0408 751 386)

ALS Compass COC Reference: 29069 **# Samples:** 7 **Sampler:** Jamon Hollett
Phone: (0420 838 328)

Turnaround Requirements: (Standard) _____ Urgent _____

Special Instructions:	ALS Use Only			
	Custody seal intact?	YES	NO	(N/A)
	Free ice / frozen ice bricks upon receipt?	(YES)	NO	N/A
	Random sample temperature on receipt?	3.8	°C	

Custody:

Relinquished by: JH JH	**Received by:** ND	**Relinquished by:**	**Received by:**
Date / Time: 22/10/2021	**Date / Time:** 22/10/21 15:05	**Date / Time:**	**Date / Time:**

CHAIN OF CUSTODY

COC#: 29069 *ALS Laboratory:* EP Perth

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup 4

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts

PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:

QUOTE NO: EP/894/20

SAMPLER MOBILE: / EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED			
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Suite 1: Collie River & Ocean Outfall WATER	Suite 2: Dalyellup WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	DM9C		21/10/2021 09:21 AM	Water	ALS: 6 Non ALS: 0	No		X		
002	DM9A		21/10/2021 10:27 AM	Water	ALS: 6 Non ALS: 0	No		X		
003	DM1A(R)		21/10/2021 11:54 AM	Water	ALS: 6 Non ALS: 0	No		X		
004	DM1C(R)		21/10/2021 11:54 AM	Water	ALS: 6 Non ALS: 0	No		X		
005	MB3		21/10/2021 03:01 PM	Water	ALS: 6 Non ALS: 0	No		X		
006	RQC4	Rinsate, no radium analysis required	21/10/2021 03:05 PM	Water	ALS: 4 Non ALS: 0	No		X		
007	KOE		22/10/2021 09:56 AM	Water	ALS: 4 Non ALS: 0	No	X			

CHAIN OF CUSTODY

ALS COC#: **29069** *ALS Laboratory:* EP Perth

CLIENT: TROPIG - Tronox Pigment Bunbury

PROJECT: Tronox Pigment Bunbury

SITE: Tronox Dalyellup 4

ORDER NO: 30086132

PROJECT MANAGER: Chris Roberts
PRIMARY SAMPLER: Jaimon Hollett

CONTACT PH:
QUOTE NO: EP/894/20

SAMPLER MOBILE:
/ EP2021TROPIG0001

EMAIL REPORTS TO: jaimon.hollett@arcadis.com, bronwynvanvalkengoed@arcadis.com

EMAIL INVOICES TO:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

005	MB3	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009289	Blue	No	
005	MB3	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054839	Red/Green	Yes	
005	MB3	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054960	Red/Green	No	
005	MB3	Clear Plastic Bottle - Natural	500 mL	00070621107753	Green	No	
006	RQC4	Clear Plastic Bottle - Natural	250 mL	00070621107797	Green	No	
006	RQC4	Clear Plastic Bottle - NaOH Filtered	60 mL	00140321009500	Blue	No	
006	RQC4	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054977	Red/Green	Yes	
006	RQC4	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005055132	Red/Green	Yes	
007	KOE	Clear HDPE (U-T ORC) - Filtered; Lab-acidified	60 mL	00382005054966	Red/Green	Yes	
007	KOE	Clear Plastic Bottle - Natural	500 mL	00070621107803	Green	No	
007	KOE	Clear Plastic Bottle - Sulfuric Acid	60 mL	00100621079748	Purple	No	
007	KOE	Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified	60 mL	00382005055111	Red/Green	No	

Total Bottle Count: ALS: 38, Non ALS: 0

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2112719**

Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: chris.roberts@tronox.com	E-mail	: amber.foster@alsglobal.com
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: Tronox Pigment Bunbury	Page	: 1 of 3
Order number	: 30086132	Quote number	: EP2021TROPIG0001_V7 (EP/894/20_V7)
C-O-C number	: 29069	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Tronox Dalyellup 4		
Sampler	: Jaimon Hollet		

Dates

Date Samples Received	: 22-Oct-2021 17:05	Issue Date	: 22-Oct-2021
Client Requested Due Date	: 10-Nov-2021	Scheduled Reporting Date	: **10-Nov-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 3.8 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 7 / 7

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Mercury analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911.**
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG035F-UT Dissolved Mercury - Ultra-Trace	WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA	WATER - EG050G-F Dissolved Hexavalent Chromium	WATER - EG094-F Dissolved Metals by ORC - Ultra Trace in Fresh	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP2112719-001	21-Oct-2021 09:21	DM9C	✓	✓	✓	✓	✓	✓	✓
EP2112719-002	21-Oct-2021 10:27	DM9A	✓	✓	✓	✓	✓	✓	✓
EP2112719-003	21-Oct-2021 11:54	DM1A(R)	✓	✓	✓	✓	✓	✓	✓
EP2112719-004	21-Oct-2021 11:54	DM1C(R)	✓	✓	✓	✓	✓	✓	✓
EP2112719-005	21-Oct-2021 15:01	MB3	✓	✓	✓	✓	✓	✓	✓
EP2112719-006	21-Oct-2021 15:05	RQC4	✓	✓	✓	✓	✓	✓	✓
EP2112719-007	22-Oct-2021 09:56	KOE	✓						✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA005P pH (PCT)	WATER - EA010P Electrical Conductivity (PCT)	WATER - EA045 Turbidity	WATER - EA251-LSC (CA) Radium 226/228 in Water	WATER - EG094-T Total Metals by ORC - Ultra Trace in Fresh Water	WATER - EK055G Ammonia as N By Discrete Analyser	WATER - EK055G-NH4 Ammonium as N
EP2112719-001	21-Oct-2021 09:21	DM9C				✓			
EP2112719-002	21-Oct-2021 10:27	DM9A				✓			
EP2112719-003	21-Oct-2021 11:54	DM1A(R)				✓			
EP2112719-004	21-Oct-2021 11:54	DM1C(R)				✓			
EP2112719-005	21-Oct-2021 15:01	MB3				✓			
EP2112719-007	22-Oct-2021 09:56	KOE	✓	✓	✓		✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA025H Suspended Solids - Standard Level	WATER - EG035T-UT Total Mercury - Ultra-trace	WATER - EK058G (Nitrate as NO3) Nitrate as NO3 by Discrete Analyser	WATER - EK067G Total Phosphorus as P By Discrete Analyser
EP2112719-007	22-Oct-2021 09:56	KOE	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Payable

- A4 - AU Tax Invoice (INV)	Email	invoices-au.pigment@tronox.com

Bronwyn Van Valkengoed

- *AU Certificate of Analysis - NATA (COA)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bronwyn.vanvalkengoed@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bronwyn.vanvalkengoed@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bronwyn.vanvalkengoed@arcadis.com
- Chain of Custody (CoC) (COC)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	bronwyn.vanvalkengoed@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	bronwyn.vanvalkengoed@arcadis.com

Chris Roberts

- *AU Certificate of Analysis - NATA (COA)	Email	chris.roberts@tronox.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris.roberts@tronox.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris.roberts@tronox.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris.roberts@tronox.com
- Chain of Custody (CoC) (COC)	Email	chris.roberts@tronox.com
- EDI Format - ESDAT (ESDAT)	Email	chris.roberts@tronox.com
- EDI Format - TRONOX (TRONOX)	Email	chris.roberts@tronox.com

Jaimon Hollet

- *AU Certificate of Analysis - NATA (COA)	Email	jaimon.hollet@arcadis.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jaimon.hollet@arcadis.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jaimon.hollet@arcadis.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jaimon.hollet@arcadis.com
- Chain of Custody (CoC) (COC)	Email	jaimon.hollet@arcadis.com
- EDI Format - ESDAT (ESDAT)	Email	jaimon.hollet@arcadis.com
- EDI Format - TRONOX (TRONOX)	Email	jaimon.hollet@arcadis.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2112719**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021 17:05
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29069	Issue Date	: 03-Nov-2021 13:34
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 4		
Quote number	: EP/894/20_V7		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Mercury conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- EG093: Samples containing high levels of sulfate may precipitate barium under the acidic conditions of this method and may therefore bias results low.

Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	DM9C	DM9A	DM1A(R)	DM1C(R)	MB3
				Sampling date / time	21-Oct-2021 09:21	21-Oct-2021 10:27	21-Oct-2021 11:54	21-Oct-2021 11:54	21-Oct-2021 15:01
					EP2112719-001	EP2112719-002	EP2112719-003	EP2112719-004	EP2112719-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**590**	**749**	**1710**	**788**	**704**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**121**	**317**	**365**	**348**	**386**
Total Alkalinity as CaCO3	----	1	mg/L		**121**	**317**	**365**	**348**	**386**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**37**	**98**	**235**	**55**	**64**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**246**	**202**	**623**	**253**	**140**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**63**	**112**	**166**	**105**	**145**
Magnesium	7439-95-4	1	mg/L		**14**	**41**	**61**	**28**	**31**
Sodium	7440-23-5	1	mg/L		**119**	**120**	**394**	**165**	**80**
Potassium	7440-09-7	1	mg/L		**16**	**5**	**18**	**8**	**8**
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		**0.001**	**0.072**	**0.002**	<0.001	<0.001
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	<0.005
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		<0.01	**0.01**	<0.01	<0.01	<0.01
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	**0.06**	<0.01	<0.01	<0.01
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Arsenic	7440-38-2	0.2	µg/L		<0.2	**2.3**	**3.3**	**11.8**	**2.1**
Boron	7440-42-8	5	µg/L		**17**	**48**	**104**	**55**	**61**
Cadmium	7440-43-9	0.05	µg/L		**0.27**	<0.05	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.2	µg/L		**1.0**	**67.4**	**1.6**	<0.2	**0.7**
Cobalt	7440-48-4	0.1	µg/L		**0.3**	<0.1	**0.1**	<0.1	<0.1
Copper	7440-50-8	0.5	µg/L		**14.6**	**2.5**	**0.8**	**0.6**	<0.5
Iron	7439-89-6	2	µg/L		<2	<2	**9**	**2460**	**2**
Lead	7439-92-1	0.1	µg/L		**1.2**	**0.1**	<0.1	<0.1	<0.1
Manganese	7439-96-5	0.5	µg/L		**67.7**	**2.9**	**5.2**	**101**	**0.5**
Molybdenum	7439-98-7	0.1	µg/L		**0.7**	**0.1**	**1.0**	**0.6**	**1.3**

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	DM9C	DM9A	DM1A(R)	DM1C(R)	MB3
				Sampling date / time	21-Oct-2021 09:21	21-Oct-2021 10:27	21-Oct-2021 11:54	21-Oct-2021 11:54	21-Oct-2021 15:01
Compound	CAS Number	LOR	Unit		EP2112719-001	EP2112719-002	EP2112719-003	EP2112719-004	EP2112719-005
					Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		**8.6**	**1.4**	**1.3**	**0.9**	<0.5
Thorium	7440-29-1	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.05	µg/L		<0.05	**0.38**	**0.89**	<0.05	**1.50**
Vanadium	7440-62-2	0.2	µg/L		<0.2	**1.1**	**1.0**	<0.2	**1.1**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.34**	**1.25**	**2.17**	**0.17**	**6.25**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.34**	**1.25**	**2.17**	**0.17**	**6.25**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**10.1**	**14.1**	**29.8**	**15.2**	**13.0**
ø Total Cations	----	0.01	meq/L		**9.88**	**14.3**	**30.9**	**14.9**	**13.5**
ø Ionic Balance	----	0.01	%		**1.23**	**0.84**	**1.88**	**1.02**	**1.80**
EA251CA: Radium 226 and Radium 228 Activity									
Radium 226	13982-63-3	0.01	Bq/L		**0.08**	<0.01	<0.01	**0.01**	<0.01
Radium 228	7440-14-4	0.08	Bq/L		<0.08	<0.08	<0.08	<0.08	<0.08

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RQC4	----	----	----	----
				Sampling date / time	21-Oct-2021 15:05	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2112719-006	--------	--------	--------	--------
					Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		<10	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		<1	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L		<1	----	----	----	----
Sodium	7440-23-5	1	mg/L		<1	----	----	----	----
Potassium	7440-09-7	1	mg/L		<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.005	µg/L		<0.005	----	----	----	----
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		<0.01	----	----	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Arsenic	7440-38-2	0.2	µg/L		<0.2	----	----	----	----
Boron	7440-42-8	5	µg/L		<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L		<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L		<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L		<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L		<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L		<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L		<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L		<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L		<0.1	----	----	----	----

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RQC4	----	----	----	----
				Sampling date / time	21-Oct-2021 15:05	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2112719-006	--------	--------	--------	--------
					Result	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Nickel	7440-02-0	0.5	µg/L		<0.5	----	----	----	----
Thorium	7440-29-1	0.1	µg/L		<0.1	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		<0.05	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		<0.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L		<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%		<0.01	----	----	----	----

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)			Sample ID	KOE	----	----	----	----
			Sampling date / time	22-Oct-2021 09:56	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2112719-007	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.21**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**30100**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**22400**	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**8**	----	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**5.0**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**31**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**31**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**220**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**11000**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**4020**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**50**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**2840**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**49**	----	----	----	----
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.005	µg/L	**0.006**	----	----	----	----
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**936**	----	----	----	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	----	----	----	----
Chromium	7440-47-3	0.5	µg/L	**17.0**	----	----	----	----
Copper	7440-50-8	1	µg/L	<1	----	----	----	----
Iron	7439-89-6	5	µg/L	**361**	----	----	----	----
Lead	7439-92-1	0.2	µg/L	**1.7**	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	**369**	----	----	----	----

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Sample ID	KOE	----	----	----	----
				Sampling date / time	22-Oct-2021 09:56	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2112719-007	--------	--------	--------	--------
					Result	----	----	----	----
EG093T: Total Metals in Saline Water by ORC-ICPMS - Continued									
Molybdenum	7439-98-7	0.1	µg/L		**231**	----	----	----	----
Nickel	7440-02-0	0.5	µg/L		**7.9**	----	----	----	----
Selenium	7782-49-2	2	µg/L		<2	----	----	----	----
Titanium	7440-32-6	5	µg/L		**120**	----	----	----	----
Vanadium	7440-62-2	0.5	µg/L		**134**	----	----	----	----
Zinc	7440-66-6	5	µg/L		<5	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.02**	----	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	14798-03-9_N	0.01	mg/L		**0.02**	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as NO3	14797-55-8	0.01	mg/L		**1.46**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.02**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**315**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**329**	----	----	----	----
ø Ionic Balance	----	0.01	%		**2.17**	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA251CA: Radium 226 and Radium 228 Activity

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EG035F: Dissolved Mercury by FIMS

(WATER) EG035T: Total Mercury by FIMS

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2112719**	Page	: 1 of 8
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Contact	: Amber Foster
Address	: Locked Bag 245, Bunbury WA 6230 139 Old Coast Road Australind 6233	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 08 9780 9779	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021
Order number	: 30086132	Date Analysis Commenced	: 22-Oct-2021
C-O-C number	: 29069	Issue Date	: 03-Nov-2021
Sampler	: Jaimon Hollet		
Site	: Tronox Dalyellup 4		
Quote number	: EP/894/20_V7		
No. of samples received	: 7		
No. of samples analysed	: 7		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 3982628)									
EP2112696-007	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	8.01	8.06	0.6	0% - 20%
EP2112743-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.95	7.96	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3982629)									
EP2112696-007	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	476	470	1.1	0% - 20%
EP2112743-005	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	424	424	0.0	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3976443)									
EP2112613-002	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	3200	3170	0.8	0% - 20%
EP2112719-005	MB3	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	704	710	0.8	0% - 20%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 3976444)									
EP2112719-007	KOE	EA025H: Suspended Solids (SS)	----	5	mg/L	8	6	31.6	No Limit
EA045: Turbidity (QC Lot: 3972642)									
EP2112688-001	Anonymous	EA045: Turbidity	----	0.1	NTU	0.2	0.2	0.0	No Limit
EP2112772-011	Anonymous	EA045: Turbidity	----	0.1	NTU	70.0	70.0	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3982627)									
EP2112719-002	DM9A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	317	326	2.7	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	317	326	2.7	0% - 20%
EP2112696-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	74	75	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	74	75	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3972652)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3972652) - continued									
EP2112613-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EP2112759-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	928	920	0.9	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3972653)									
EP2112613-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EP2112759-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	10500	10400	1.5	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3974280)									
EP2112422-013	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	422	413	2.1	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	992	1010	1.7	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	13100	13200	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	369	379	2.6	0% - 20%
EP2112737-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	25	25	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	49	49	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	190	190	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	12	12	0.0	0% - 50%
ED093F: Dissolved Major Cations (QC Lot: 3984691)									
EP2112719-001	DM9C	ED093F: Calcium	7440-70-2	1	mg/L	63	61	2.9	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	14	13	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	119	120	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	16	16	0.0	0% - 50%
EP2112972-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	9	10	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	28	29	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	202	204	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	10	10	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3984692)									
EP2112880-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2112719-001	DM9C	EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3979074)									
EP2112613-002	Anonymous	EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 3979243)									
EP2112719-007	KOE	EG035T-UT: Mercury	7439-97-6	0.005	µg/L	0.006	0.007	15.4	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 3983519)									
EP2112719-001	DM9C	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112811-004	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 3980490)									
EP2112719-007	KOE	EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	231	235	1.9	0% - 20%
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG093A-T: Lead	7439-92-1	0.2	µg/L	1.7	1.7	0.0	No Limit
		EG093A-T: Chromium	7440-47-3	0.5	µg/L	17.0	17.0	0.0	0% - 20%
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	369	369	0.2	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 3980490) - continued									
EP2112719-007	KOE	EG093A-T: Nickel	7440-02-0	0.5	µg/L	7.9	7.7	2.7	0% - 50%
		EG093A-T: Vanadium	7440-62-2	0.5	µg/L	134	134	0.0	0% - 20%
		EG093A-T: Copper	7440-50-8	1	µg/L	<1	<1	0.0	No Limit
		EG093A-T: Aluminium	7429-90-5	5	µg/L	936	912	2.6	0% - 20%
		EG093A-T: Titanium	7440-32-6	5	µg/L	120	122	2.1	0% - 20%
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.0	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 3980491)									
EP2112719-007	KOE	EG093B-T: Selenium	7782-49-2	2	µg/L	<2	<2	0.0	No Limit
		EG093B-T: Iron	7439-89-6	5	µg/L	361	358	0.8	0% - 20%
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3977747)									
EP2112719-001	DM9C	EG094B-F: Iron	7439-89-6	2	µg/L	<2	<2	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 3977748)									
EP2112719-001	DM9C	EG094A-F: Boron	7440-42-8	5	µg/L	17	13	24.8	No Limit
EP2112719-001	DM9C	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	0.27	0.25	4.8	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.3	0.3	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	1.2	1.2	0.0	0% - 50%
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.7	0.7	0.0	No Limit
		EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	1.0	1.0	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	14.6	14.9	1.5	0% - 20%
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	67.7	68.0	0.4	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	8.6	8.7	0.0	0% - 50%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 3972663)									
EP2112759-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.35	0.36	4.1	0% - 20%
EP2112772-009	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.01	0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3972651)									
EP2112613-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2112759-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3972655)									
EP2112750-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	3.61	3.49	3.5	0% - 20%
EP2112750-007	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.38	0.38	0.0	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3982732)									
EP2112784-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	1.08	1.08	0.0	0% - 20%
EP2112916-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.02	<0.02	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA251CA: Radium 226 and Radium 228 Activity (QCLot: 3984245)								
EA251: Radium 226	13982-63-3	0.01	Bq/L	<0.01	2.5 Bq/L	95.1	89.9	110
EA251: Radium 228	7440-14-4	0.08	Bq/L	<0.08	2.5 Bq/L	93.5	85.6	112
EA005P: pH by PC Titrator (QCLot: 3982628)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.5	102
				----	7 pH Unit	100	98.5	102
EA010P: Conductivity by PC Titrator (QCLot: 3982629)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	96.5	92.1	105
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3976443)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	246 mg/L	103	88.1	114
				<10	1000 mg/L	100	88.1	114
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 3976444)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	95 mg/L	110	89.1	120
				<5	1000 mg/L	102	89.1	120
EA045: Turbidity (QCLot: 3972642)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	90.6	109
ED037P: Alkalinity by PC Titrator (QCLot: 3982627)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	105	81.2	126
				<1	200 mg/L	101	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3972652)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	95.2	87.7	113
				<1	500 mg/L	103	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 3972653)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	94.5	87.9	114
				<1	1000 mg/L	93.2	87.9	114
ED093F: Dissolved Major Cations (QCLot: 3974280)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	94.7	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	92.6	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	103	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	90.7	89.7	108

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
ED093F: Dissolved Major Cations (QCLot: 3984691)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	104	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	102	89.7	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 3984692)								
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.4	85.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3979074)								
EG035F-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	92.0	85.0	115
EG035T: Total Mercury by FIMS (QCLot: 3979243)								
EG035T-UT: Mercury	7439-97-6	0.005	µg/L	<0.005	0.1 µg/L	93.0	85.0	115
EG050F: Dissolved Hexavalent Chromium (QCLot: 3983519)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	96.4	92.1	109
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 3980490)								
EG093A-T: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	103	70.0	130
EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	102	70.0	130
EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	106	70.0	130
EG093A-T: Copper	7440-50-8	1	µg/L	<1	10 µg/L	100	70.0	130
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	101	70.0	130
EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	95.1	70.0	130
EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	114	70.0	130
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	100	70.0	130
EG093A-T: Titanium	7440-32-6	5	µg/L	<5	10 µg/L	101	70.0	130
EG093A-T: Vanadium	7440-62-2	0.5	µg/L	<0.5	10 µg/L	103	70.0	130
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	10 µg/L	106	70.0	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 3980491)								
EG093B-T: Iron	7439-89-6	5	µg/L	<5	50 µg/L	108	90.7	112
EG093B-T: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	99.6	84.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977747)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	99.9	80.4	113
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977748)								
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	101	83.5	122
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	86.1	70.0	130
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	94.9	86.6	114
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	94.4	83.1	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	93.0	75.1	122
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	91.2	77.8	123
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	90.6	82.7	109

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977748) - continued								
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	93.6	86.1	111
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	95.3	86.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	100	81.6	120
EG094A-F: Thorium	7440-29-1	0.1	µg/L	<0.1	----	----	----	----
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	92.7	85.0	115
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	95.1	87.1	113
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3972663)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.7	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3972651)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3972655)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	90.5	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3982732)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	75.1	70.0	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3972652)							
EP2112613-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	112	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3972653)							
EP2112613-002	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	85.8	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3984692)							
EP2112719-002	DM9A	EG020A-F: Chromium	7440-47-3	0.2 mg/L	101	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3979074)							
EP2112613-003	Anonymous	EG035F-UT: Mercury	7439-97-6	0.1 µg/L	93.0	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 3979243)							
EP2112719-007	KOE	EG035T-UT: Mercury	7439-97-6	0.1 µg/L	90.0	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 3983519)							
EP2112719-001	DM9C	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	96.8	70.0	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 3980490)							
EP2112774-001	Anonymous	EG093A-T: Cadmium	7440-43-9	12.5 µg/L	102	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 3980490) - continued							
EP2112774-001	Anonymous	EG093A-T: Chromium	7440-47-3	50 µg/L	105	70.0	130
		EG093A-T: Copper	7440-50-8	50 µg/L	96.2	70.0	130
		EG093A-T: Lead	7439-92-1	50 µg/L	102	70.0	130
		EG093A-T: Manganese	7439-96-5	50 µg/L	99.4	70.0	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	100	70.0	130
		EG093A-T: Vanadium	7440-62-2	50 µg/L	105	70.0	130
		EG093A-T: Zinc	7440-66-6	50 µg/L	96.9	70.0	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 3977748)							
EP2112719-002	DM9A	EG094A-F: Arsenic	7440-38-2	50 µg/L	112	70.0	130
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	118	70.0	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	124	70.0	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	113	70.0	130
		EG094A-F: Copper	7440-50-8	50 µg/L	111	70.0	130
		EG094A-F: Lead	7439-92-1	50 µg/L	84.3	70.0	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	103	70.0	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	125	70.0	130
		EG094A-F: Vanadium	7440-62-2	50 µg/L	104	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3972663)							
EP2112719-007	KOE	EK055G: Ammonia as N	7664-41-7	1 mg/L	119	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3972651)							
EP2112759-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	110	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3972655)							
EP2112750-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	93.3	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3982732)							
EP2112784-001	Anonymous	EK067G: Total Phosphorus as P	----	2 mg/L	90.0	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2112719**	Page	: 1 of 10
Client	: **Tronox Pigment Bunbury**	Laboratory	: Environmental Division Perth
Contact	: Chris Roberts	Telephone	: +61-8-9406 1301
Project	: Tronox Pigment Bunbury	Date Samples Received	: 22-Oct-2021
Site	: Tronox Dalyellup 4	Issue Date	: 03-Nov-2021
Sampler	: Jaimon Hollet	No. of samples received	: 7
Order number	: 30086132	No. of samples analysed	: 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
KOE	----	----	----	28-Oct-2021	22-Oct-2021	**6**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Radium 226 and Radium 228 Activity	0	20	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
KOE	**22-Oct-2021**	**----**	----	----	**28-Oct-2021**	22-Oct-2021	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
KOE	**22-Oct-2021**	**----**	----	----	**28-Oct-2021**	19-Nov-2021	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**27-Oct-2021**	28-Oct-2021	✓
Clear Plastic Bottle - Natural (EA015H)							
KOE	**22-Oct-2021**	**----**	----	----	**27-Oct-2021**	29-Oct-2021	✓
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
KOE	**22-Oct-2021**	**----**	----	----	**26-Oct-2021**	29-Oct-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
KOE	**22-Oct-2021**	**----**	----	----	**22-Oct-2021**	24-Oct-2021	✓
EA251CA: Radium 226 and Radium 228 Activity							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EA251)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3	**21-Oct-2021**	**----**	----	----	**29-Oct-2021**	19-Apr-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**28-Oct-2021**	04-Nov-2021	✓
Clear Plastic Bottle - Natural (ED037-P)							
KOE	**22-Oct-2021**	**----**	----	----	**28-Oct-2021**	05-Nov-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**22-Oct-2021**	18-Nov-2021	✓
Clear Plastic Bottle - Natural (ED041G)							
KOE	**22-Oct-2021**	**----**	----	----	**22-Oct-2021**	19-Nov-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**22-Oct-2021**	18-Nov-2021	✓
Clear Plastic Bottle - Natural (ED045G)							
KOE	**22-Oct-2021**	**----**	----	----	**22-Oct-2021**	19-Nov-2021	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**29-Oct-2021**	18-Nov-2021	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
KOE	**22-Oct-2021**	**----**	----	----	**25-Oct-2021**	19-Nov-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**29-Oct-2021**	19-Apr-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-UT)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**27-Oct-2021**	18-Nov-2021	✓
EG035T: Total Mercury by FIMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T-UT)							
KOE	**22-Oct-2021**	**----**	----	----	**27-Oct-2021**	19-Nov-2021	✓
EG050F: Dissolved Hexavalent Chromium							
Clear Plastic Bottle - NaOH Filtered (EG050G-F)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**28-Oct-2021**	18-Nov-2021	✓
EG093T: Total Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093A-T)							
KOE	**22-Oct-2021**	**27-Oct-2021**	20-Apr-2022	✓	**27-Oct-2021**	20-Apr-2022	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**26-Oct-2021**	19-Apr-2022	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
KOE	**22-Oct-2021**	**----**	----	----	**22-Oct-2021**	19-Nov-2021	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**22-Oct-2021**	23-Oct-2021	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
DM9C, DM9A, DM1A(R), DM1C(R), MB3, RQC4	**21-Oct-2021**	**----**	----	----	**22-Oct-2021**	23-Oct-2021	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
KOE	**22-Oct-2021**	**29-Oct-2021**	19-Nov-2021	✓	**29-Oct-2021**	19-Nov-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	0	20	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	6	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	1	**200.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	19	**10.53**	**10.53**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	6	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Radium 226 and Radium 228 Activity	EA251	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Ultra-trace	EG035T-UT	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Radium 226 and Radium 228 Activity	EA251	WATER	In-house: Determination of radium 226 and radium 226 radioactivity in water samples by Liquid Scintillation Counting (LSC).
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS - Ultra-trace	EG035F-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Total Mercury by FIMS - Ultra-trace	EG035T-UT	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Trivalent Chromium - Dissolved	EG049G-F	WATER	In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ammonium as N	EK055G-NH4	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 4500-NH3 G. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Digestion for Total Recoverable Metals - ORC	* EN25-ORC	WATER	In house: Referenced to USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM Schedule B(3)

Appendix I
Dioxin and Furans Data

May 28, 2014

Scherger Associates
3017 Rumsey Drive
Ann Arbor. MI 48105
USA
1-734-213-8150

Mr. Peter Allen
Environmental Superintendent
Millennium Inorganic Chemicals, A Cristal Company
Locked Bag 245
Bunbury WA 6230
AUSTRALIA

Dear Mr. Allen:

As requested, I have performed a peer review of the sampling and analysis procedures used for the annual dioxins and furans sampling and analysis, performed in April 2014, This annual sampling and analysis is required by the Dalyellup Closure Notice of 1 August 2013. The sampling procedures used are described in the written document - Sampling of Treated Solid Residue and Groundwater for Dioxin and Furan Determination (Cristal Procedure AP/M054-16 version 3). This sampling plan was previously reviewed and found to follow standard industry practice and good laboratory practice for the sampling and analysis of dioxins and furans in solid and liquid (water) samples. I have also reviewed the laboratory reports and quality assurance data summary provided by the laboratory. These laboratory reports indicate that approved analytical procedures were followed and the quality assurance results indicate that the data meet standard industry practice, good laboratory practice and typical requirements of the regulatory agencies. The National Measurement Institute, the laboratory for this work, represents that they are a NATA accredited laboratory (NATA #198) as required by the Closure Notice. Further, I have reviewed the results for the groundwater for the April 2014 samples. The groundwater samples have no measureable concentration of either dioxins or furans, except for a low level of OCDD in well YB. A brief report of my review of these data is attached. As stated in that report, the low level of OCDD is most likely a data anomaly, but results from this well should be tracked carefully in future annual sampling events to look for any changes or trends in the well water quality.

Based upon my review, it is my opinion that the procedures outlined in the sampling plan and used for sample collection, and the data reported by the laboratory meet the requirements as described in the Closure Notice.

Dale A. Scherger

Dale A. Scherger, P.E.
Principal and Owner
Scherger Associates

Dale Scherger

Digitally signed by Dale Scherger
DN: cn=Dale Scherger gn=Dale Scherger c=United States l=US o=Scherger Associates e=daleres@aol.com
Reason: I am the author of this document
Location:
Date: 2014-05-28 10:14-04:00

Scherger Associates
Ann Arbor, MI, USA

May 27, 2014

Peer Review of Sampling Procedures and Analytical Data for the April 2014 Sampling of Groundwater per Dalyellup Facility Closure Notice Requirements for Millennium Inorganic Chemicals, A Cristal Company

by
Dale A. Scherger, P.E.

Background

The Dalyellup Facility is no longer receiving residues from Millennium Inorganic Chemical (MIC), a Cristal Company. The Closure Notice for the Dalyellup Facility, dated 1 August 2013 requires that MIC monitor dioxins and furans in the groundwater on a annual basis. The Closure Notice Item 1.1.2 requires that representative samples be collected and analyzed, and requires that the samples be collected and analyzed by an organization with NATA accreditation.

This report and the accompanying cover letter present the results of the peer review for the collection and analysis of samples in April 2014, as requested by MIC.

In 2010 prior to the start of the sampling and analysis program, MIC developed a written sampling procedure titled: Sampling of Treated Solid Residue and Groundwater for Dioxin and Furan Determination (Cristal Procedure AP/M054-16). The sampling plan was reviewed to ensure that the procedures met standard industry practice and procedures. The plan details the methods to be used for sample collection, sample compositing and handling, storage, and shipment to the laboratory. In July 2011, the sampling and analysis plan was updated to improve the field logs that are used during sampling events and to clarify the instructions to the laboratory to ensure best detection limits are achieved for the samples. This updated plan, Cristal Procedure AP/M054-16 version 3, was reviewed and approved by this reviewer at that time. The procedures were found to meet the industry standard and typical regulatory agency requirements as established throughout the world.

Sample Procedures

The groundwater samples (YB, MB3, DM8A and DM8C) were collected on 9 April 2014 in accordance with the established procedures (MIC AP/M054-16 version 3). The wells were purged prior to the collection of samples. Sixty (60) litres of groundwater were removed from each of the three wells DM8A, DM8C, and MB3 during the purging cycle. Sixty five (65) liters were purged from well YB. The groundwater samples were collected and placed into clean glass bottles provided by the analytical laboratory. Two 1-liter bottles of each groundwater sample were collected so that the laboratory would have sufficient volume available for extraction and concentration to achieve the desired low detection limits. Samples were stored under ice and/or in a refrigerator prior to shipment to the laboratory.

The written procedures that were followed for sample collection, handling, storage and shipment ensured that the samples were collected and handled in accordance with industry standards and good laboratory practice and produced representative samples for analysis.

Laboratory Analysis

All analyses were performed and reported by the National Measurement Institute. The laboratory is a NATA accredited laboratory (NATA Accreditation Number 198), as required by the Closure Notice. The laboratory report provided dioxin and furan results for the target individual congeners, total concentration for each chlorination level, and also provided TEQ results using the World Health Organization Toxicity Equivalent Factors (WHO_{95} TEF) and the calculated WHO_{95} TEQ concentrations.

The laboratory quality assurance data indicated the data were of sound quality with all of the labeled compound recoveries within the established lower and upper control limits (60 out of 60 labeled compound recoveries were within target limits). The method blank associated with the water samples was reported as less than values (< LOD) for all dioxin and furan congeners, except for trace levels of octachlorodibenzofuran (OCDF), octachlorodibenzodioxin (OCDD), and 1,2,3,4,6,7,8 heptachlorodibenzodioxin (HpCDD). There were no data qualifiers on any of these sample results.

Review of the data report indicates that these data are sound and useable data for purposes of representing the concentrations of dioxins and furans in the groundwater.

Groundwater Results

Four (4) groundwater samples were collected on April 9, 2014 and sent to the laboratory for analysis. Samples were collected at locations YB, MB3, DM8A and DM8C. Samples were received by the laboratory cold and in good condition on April 14, 2014, as indicated by the chain of custody sheet.

There were no measureable dioxins or furans in the groundwater samples from wells MB3, DM8A, and DM8C. All reported values for all congeners were reported as less than the level of detection or limit of reporting (LOD or LOR) for these samples. One (1) liter samples sizes were used in the analysis to achieve detection limits for the various congeners ranging from < 0.4 pg/L to < 9 pg/L. Well YB showed all reported dioxin and furan isomers as less than the LOD/LOR also, except there was a reported value of 9.6 pg/L of OCDD. OCDD was also found in the method blank (2.2 pg/L). The reported value in well YB for OCDD is just slightly above the LOR of 7 pg/L for OCDD, using the laboratory convention of setting the LOR at 3X the concentration measured in the blank.

Well YB has been sampled six times over the past five years and has not shown the presence of any dioxin or furan congeners. It is suspected that this trace level of OCDD is a anomaly due either to external contamination or laboratory analysis variability. OCDD is the least toxic of the dioxin and furan isomers (TEF = 0.0003). A similar "positive" result for another congener 1,2,3,7,8 PeCDD occurred in August 2012 in Well DM8A (see discussion below). This congener has not been detected in the past two sampling events suggesting the low level measurement was an anomaly.

Given that a trace level of OCDD was detected in well YB, it is important to carefully track the results for the next two annual sampling periods to see if any detectable levels are found at this location. If future results indicate the current result is not an anomaly, then in this reviewer's opinion additional investigation at this well location will be warranted.

Table 1 shows the historical WHO_{95} TEQ data for Well YB for the period 2010 through 2014. The laboratory reports the lower, middle, and upper bound of the dioxins and furans data on a TEQ basis. These boundaries are reported to present the statistically significant range for the data. Variability can be expected at these low levels and the TEQ boundaries help to show the potential range within a given sample. Table 1 also shows the actual concentration of OCDD (not TEQ based) reported in the 2010 to 2014 well YB samples.

As can be seen, the most recent 2014 data are well within the historical TEQ range for the past 5 years of data. These historical data should be compared to future dioxin and furan measurements in well YB in order to track any changes in the well.

Table 1. Well YB Historical TEQ Results for Dioxins and Furans and Concentration of OCDD

		WHO_{95} TEQ			Reported Concentration
Well YB	Month Sampled	Lower Bound pg TEQ/kg	Middle Bound pg TEQ/kg	Upper Bound pg TEQ/kg	OCDD pg/L
	Apr-14	0.00	1.50	3.10	9.60
	Feb-13	0.00	1.95	3.90	<1.69
	Sep-12	0.00	2.13	4.26	<7.34
	Feb-12	0.00	2.72	5.44	<4.37
	Aug-11	0.00	3.00	6.00	<7.20
	Feb-11	0.00	3.94	7.89	<9.29
	Aug-10	0.00	3.08	6.16	<9.29

Well DM8A Tracking Data

During the sampling event in August 2012, the groundwater sample from DM8A showed a trace level of one congener 1,2,3,7,8 pentachlorodibenzo-p-dioxin (PeCDD) at 1.32 pg/L. This was the first time that any detectable dioxins or furans had been reported in any groundwater sample. The February 2013 and April 2014 sampling events have shown all congeners in well DM8A are below the LOR (all "<" values). Therefore, it does appear that the result of the previous sampling in August 2012 was an anomaly. Results will continue to be carefully reviewed to ensure that the August 2012 result for well DM8A was an anomaly.

Table 2. Well DM8A Historical TEQ Results for Dioxins and Furans and Concentration of PeCDD

		WHO_{95} TEQ			Reported Concentration
Well DM8A	Month Sampled	Lower Bound pg TEQ/kg	Middle Bound pg TEQ/kg	Upper Bound pg TEQ/kg	1,2,3,7,8 PeCDD pg/L
	Apr-14	0.00	1.6	3.1	<0.7
	Feb-13	0.00	2.57	5.13	<1.46
	Sep-12	1.32	3.00	4.68	1.32
	Feb-12	0.00	2.52	5.03	<1.88
	Aug-11	0.00	2.16	4.33	<1.44
	Feb-11	0.00	3.15	6.29	<1.59
	Aug-10	0.00	1.86	3.71	<1.28

TRONOX

AP_DPS1404 ChemCentre Chain of Custody Record

Environmental Scientist: 9780 8779
E-mail signed COC to: ap.sheqbunbury@tronox.com and chris.roberts@tronox.com

Tronox Pigment Bunbury Ltd.
ABN 50 008 683 627

Locked Bag 245
Bunbury WA 6230

Tel (08) 9780 8333
Fax (08) 9780 8444

Site:

Attention: Kevin Robins, ChemCentre, Cnr Manning Road and Conlon Street, Bentley WA 6102. Tel.: 08-9422-9900 Fax.: 08-9422-9998

Lab. No.	Sample ID	Date Sampled	Number of Containers					Analysis Required													Changes to Normal Scheduled Analyses / Comments
			1L	1L acid	125mL	125mL acid	125mL acid filtered	Schedule 1	Schedule 2	Schedule 3	Schedule 4	Schedule 5	Schedule 6	Schedule 7	Schedule 8	Schedule 9	Schedule 10	Schedule 11	Schedule 12	Schedule 13	Schedule 14	
20550688/001.	QC14	9.6.21 1700	2														X					

Department: Environmental Sent By: BROOKE KELLY (sampler)	Method of Shipment: Courier Date: 11.6.21	Results Required By: 5 DAY TAT Date:	Laboratory Signature: DC Received Date & Time: 11/6/21 @ 08:55 Sample Condition: Cold.

EAMIL RESULTS IN ESDAT FORMAT TO brooke.kelly@arcadis.com and bronwyn.vanvalkengoed@arcadis.com

Schedules for Analysis of Samples at ChemCentre

SCHEDULE 1	Collie River & Ocean Outfall	1x1L plastic 1x125mL plastic (Metals) - acidified 1x125mL plastic (Nutrients) FILTER	Total Metals (Al, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Mo, Hg, Ni, Se, Na, Ti, V, Zn) pH, EC, TDS, TSS, Turbidity, NH_4, HCO_3, Cl, CO_3, NO_3, Total P, SO_4
SCHEDULE 2	Dalyellup	1x500mL plastic 1x60mL plastic (preserved) 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) – acidified FILTER	Dissolved (filterable) Metals (B, Cd, Ca, Cr, Cr(III), Cr(VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Na, V) TDS, HCO_3, CO_3, Cl, NO_3-N, SO_4, Molar Na:Cl Ratio
SCHEDULE 3	Kemerton Recovery Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total alkalinity, Total acidity
SCHEDULE 4	Australind Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total Alkalinity, Total Acidity
SCHEDULE 5	Kemerton Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Al, As, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Na, V, Zn)TDS, Total Acidity, HCO_3, Cl, NO_3, SO_4, pH, EC, Total Alkalinity
SCHEDULE 6	Kemerton and Australind TSR - Mud Solid	Approx. 2L in plastic jar/s	*Centrifuge supplied mud/water sample. Test the solid fraction as follows. (Total metals since a solid)* LOI (650°C), Al, As, Ba, Be, B, Cd, Ca, C, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, S, Th, Sn, Ti, U, V, Zn, Cl

SCHEDULE 7	Kemerton TSR and Australind TSR - Pore Water (Supernatant)	From above	*Centrifuge supplied mud/water sample. Test the liquid fraction as follows.* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SCHEDULE 8	Kemerton and Australind TSR – Mud Solid (ASLP Leachate)	From above	*Perform ASLP on Mud solid as specified by AS4439.3:1997 using Reagent Water. Analyse leachate for;* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SCHEDULE 9	Dalyellup YB – Quarterly	1x250mL plastic	Cl, Na, Molar Na:Cl Ratio.
SCHEDULE 10	Dalyellup	2x1L glass	YB, MB3 and DM8 – dioxins and furans
SCHEDULE 11	Kemerton and Australind Production Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic Metals acidified - FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, HCO_3, Cl, SO_4, NO_3
SCHEDULE 12	Australind Recovery Bores	1x500mL plastic 1x125mL plastic (Metals) acidified -FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, Total Acidity, Cl, SO_4
SCHEDULE 13	Golder and Australind Bores	1x500mL plastic 2x125mL plastic (Metals) - acidified FILTER ONE 2x125mL plastic (Nutrients) FILTER ONE	Total Metals (Fe) Dissolved (filterable) Metals (Al, As, Cd, Cr, Cu, Pb, Mg, Mn, Hg, Ni, Se, Na, K, Zn) pH, EC, TDS, Turbidity, Cl, SO_4, CO_3 Total P, Total N as N, Total Kjeldahl as N (TKN), nitrate and nitrite as N (TON)
SCHEDULE 14	Kemerton, KM6	1 x1L glass 2x40mL glass vials	Total hydrocarbons

Notes: TDS by evaporation, not calculation.
Dissolved metals are field filtered unless specified.
Low detection levels required for metals. Most samples are saline.
If filter apparatus is unavailable, any sample that was to be filtered into an acidified 125mL bottle MUST be filtered into a NON-ACIDIFIED 125mL bottle (thoroughly wash acid out of bottle if necessary). The sample must be filtered before being acidified.

Australian Government
National Measurement Institute

CERTIFICATE OF ANALYSIS # DAU21_222

Client	ChemCentre (WA) PO Box 1250 Bentley WA 6983	**Job No.**	CHEM06/210616
		Sampled by	Client
		Date Sampled	9-Jun-21
		Date Received	16-Jun-21
Contact	Dale Carter		

The results relate only to the sample(s) as received and tested.

Method AUTL_MET_001 **Date Reported** 2-Jul-21

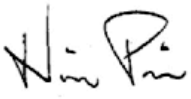
Details

The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in aqueous samples by high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS).
This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported.
The dioxin toxicity equivalent (WHO_{05}-TEQ_{DF}) in each sample is calculated using World Health Organization toxic equivalency factors (WHO_{05}-TEFs). All results are corrected for labelled surrogate recoveries.

After sampling, the liquid is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation



Nino Piro
Senior Chemist
Australian Ultra Trace Laboratory

Dr Alan Yates
Senior Analyst
Australian Ultra Trace Laboratory

Accreditation

NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025 - Testing.

Measurement uncertainty is available upon request.

Sample Details : Job No. CHEM06/210616

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N21/015092X	20S5068/001	Water	Water

Project Details

Project Name	*Not specified*
Project Number	*20S5068*

Key

Analytes

TCDD	Tetrachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin	OCDF	Octachlorodibenzofuran

Units & Abbreviations

pg/kg	picograms per kilogram
<	level less than limit of detection (LOD)
WHO_{05}-TEF†	World Health Organization toxic equivalency factor
WHO_{05}-TEQ_{DF}†	World Health Organization toxic equivalents (Dioxins & Furans)

† as defined by Van den Berg et al., *Toxicol. Sci.* ***93*** *(2), pp. 223–241* (2006)

TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:

$$WHO_{05}\text{-}TEQ_{DF} = \sum_{i=1}^{7}\left[PCDD_i \times TEF_i\right] + \sum_{j=1}^{10}\left[PCDF_j \times TEF_j\right]$$

i = PCDD congener index (1 - 7)
j = PCDF congener index (1 - 10)

Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.

Surrogate Recovery	percentage recovery for $^{13}C_{12}$ labelled surrogate standard
⚑	Laboratory surrogate recovery outside normal acceptance criteria: Solid and liquid matrices **25 - 125%**

Results : Job No. CHEM06/210616

Laboratory Reg. No.	N21/015092X	**Date Extracted**	24-Jun-21
Client Sample Ref.	20S5068/001	**DB5 Analysis**	30-Jun-21
Matrix	Water		
Description	Water		

PCDD/F Congeners	Level pg/kg	WHO_{05}-TEF	WHO_{05}-TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.4	0.1	0.02	66	
2,3,7,8-TCDD	<0.2	1	0.1	78	
1,2,3,7,8-PeCDF	<0.2	0.03	0.003	60	
2,3,4,7,8-PeCDF	<0.2	0.3	0.03	61	
1,2,3,7,8-PeCDD	<0.4	1	0.2	75	
1,2,3,4,7,8-HxCDF	<0.1	0.1	0.005	76	
1,2,3,6,7,8-HxCDF	<0.1	0.1	0.005	69	
2,3,4,6,7,8-HxCDF	<0.1	0.1	0.005	69	
1,2,3,7,8,9-HxCDF	<0.1	0.1	0.005	62	
1,2,3,4,7,8-HxCDD	<0.2	0.1	0.01	85	
1,2,3,6,7,8-HxCDD	<0.3	0.1	0.015	80	
1,2,3,7,8,9-HxCDD	<0.3	0.1	0.015		
1,2,3,4,6,7,8-HpCDF	<0.09	0.01	0.00045	58	
1,2,3,4,7,8,9-HpCDF	<0.1	0.01	0.0005	60	
1,2,3,4,6,7,8-HpCDD	0.35	0.01	0.0035	70	
OCDF	<0.2	0.0003	0.00003		
OCDD	5.9	0.0003	0.0018	64	

PCDD/F Homologue Groups	Level pg/kg
Total TCDF isomers	<3
Total TCDD isomers	<1
Total PeCDF isomers	<1
Total PeCDD isomers	<2
Total HxCDF isomers	<0.6
Total HxCDD isomers	<0.9
Total HpCDF isomers	<0.2
Total HpCDD isomers	0.99

Summary Results		
Sum of PCDD and PCDF congeners		
Excluding LOD values	6.9	pg/kg
WHO_{05} -TEQ_{DF}		
Lower Bound [excluding LOD values]	**0.0053**	pg/kg
Middle Bound [including half LOD values]	**0.42**	pg/kg
Upper Bound [including LOD values]	**0.83**	pg/kg

CHEMCENTRE CHAIN OF CUSTODY

Samples to: Scientific Services Division, Building 500 Resources and Chemistry Precinct, Cnr Manning Rd & Townsing Drive, Off Conlon Street, Bentley WA 6102

GOVERNMENT OF WESTERN AUSTRALIA

ChemCentre EXPERT SOLUTIONS

NATA ACCREDITATION

Postal Address: PO Box 1250, Bentley Delivery Centre, WA 6983
PH: (08) 9422 9800
Fax: (08) 9422 9801
Email: ssd@chemcentre.wa.gov.au

**CLIENT (Billing): Arcadis
**CONTACT: Jaimon Hollett
CCWA QUOTE REF: AP_DPS 1404
**POSTAL ADDRESS: Level 5, 225 St Georges Terrace, Perth
**PURCHASE ORDER #: 4501169578

COURIER NAME:
CONSIGNMENT NO:

SAMPLED BY: Jaimon Hollett
**RESULTS TO EMAIL:

**ANALYSIS REQUIRED

Schedule 9 tics: Cl, Na, Molar: Na:Cl ratio, dissolved trans.

SSD JOB NO: 2150672

Please indicate if QC results are required:
- ☐ Method QC
- ☐ Batch QC
- ☐ Special LOD (use comments section)

*Method QC data refers to results from a lab blank and a lab verification standard.
*Batch QC data refers to results obtained from duplicate and spiked samples supplied by client and incurs extra charges.

LAB ID	** SAMPLE REFERENCE / DESCRIPTION	** SAMPLE MATRIX (e.g SOLID, LIQUID, FOOD, BIOTA)	** DATE SAMPLED	TIME SAMPLED	Comments/ Sampling Details
2150672/001	SQC2	Liquid	12/8/21	1300	

RELINQUISHED BY:	Jaimon Hollett	DATE	TIME
PHONE NO:	0420 838 328	13/8/21	1355
EMAIL:	Jaimon.hollett@arcadis.com		

RECEIVED BY: Cate
DATE/TIME: 13-8-21 @ 1355

LAB COMMENTS: COLD / AMBIENT / FROZEN

TURN AROUND TIME (TAT) REQUIRED:

Working Days	7-10	1	2	3	5	other (please specify)
Surcharge*	None	100%	75%	50%	25%	
Please tick						

PAGE No: ____ of ____

* Standard TAT is 10 working days (15 for soil samples). Urgent TAT will attract a surcharge and must be agreed to prior to sample submission.

** Note: All fields marked with ' ** ' are required and will be included on the Certificate of Analysis exactly as they appear on this form. Empty fields may be listed as 'Not supplied'.

SCHEDULE 7	Kemerton TSR and Australind TSR - Pore Water (Supernatant)	From above	*Centrifuge supplied mud/water sample. Test the liquid fraction as follows.* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SCHEDULE 8	Kemerton and Australind TSR – Mud Solid (ASLP Leachate)	From above	*Perform ASLP on Mud solid as specified by AS4439.3:1997 using Reagent Water. Analyse leachate for;* Total Metals (Al, As, Ba, Be, B, Cd, Ca, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Th, Sn, Ti, U, V, Zn) CO_3, Cl, NO_3-N, SO_4
SQC2 = **SCHEDULE 9**	Dalyellup YB – Quarterly	1x250mL plastic	Cl, Na, Molar Na:Cl Ratio. 1 x set
SCHEDULE 10	Dalyellup	2x1L glass	YB, MB3 and DM8 – dioxins and furans 1 x set.
SCHEDULE 11	Kemerton and Australind Production Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic Metals acidified - FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, HCO_3, Cl, SO_4, NO_3
SCHEDULE 12	Australind Recovery Bores	1x500mL plastic 1x125mL plastic (Metals) acidified -FILTER	Dissolved (filterable) Metals (Na, Fe) pH, EC, TDS, Total Alkalinity, Total Acidity, Cl, SO_4
SCHEDULE 13	Golder and Australind Bores	1x500mL plastic 2x125mL plastic (Metals) - acidified FILTER ONE 2x125mL plastic (Nutrients) FILTER ONE	Total Metals (Fe) Dissolved (filterable) Metals (Al, As, Cd, Cr, Cu, Pb, Mg, Mn, Hg, Ni, Se, Na, K, Zn) pH, EC, TDS, Turbidity, Cl, SO_4, CO_3 Total P, Total N as N, Total Kjeldahl as N (TKN), nitrate and nitrite as N (TON)
SCHEDULE 14	Kemerton, KM6	1 x1L glass 2x40mL glass vials	Total hydrocarbons

Notes: TDS by evaporation, not calculation.
Dissolved metals are field filtered unless specified.
Low detection levels required for metals. Most samples are saline.
If filter apparatus is unavailable, any sample that was to be filtered into an acidified 125mL bottle MUST be filtered into a NON-ACIDIFIED 125mL bottle (thoroughly wash acid out of bottle if necessary). The sample must be filtered before being acidified.

AH Jaimon Hollet.
Level 5/225 St Georges Tce Perth

SQC2 = Schedule 9 + 10

Schedules for Analysis of Samples at ChemCentre

~~SCHEDULE 1~~	Collie River & Ocean Outfall	1x1L plastic 1x125mL plastic (Metals) - acidified 1x125mL plastic (Nutrients) FILTER	Total Metals (Al, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Mo, Hg, Ni, Se, Na, Ti, V, Zn) pH, EC, TDS, TSS, Turbidity, NH_4, HCO_3, Cl, CO_3, NO_3, Total P, SO_4 XXSQ4 .
SCHEDULE 2	Dalyellup	1x500mL plastic 1x60mL plastic (preserved) 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) – acidified FILTER	Dissolved (filterable) Metals (B, Cd, Ca, Cr, Cr(III), Cr(VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Na, V) TDS, HCO_3, CO_3, Cl, NO_3-N, SO_4, Molar Na:Cl Ratio
SCHEDULE 3	Kemerton Recovery Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total alkalinity, Total acidity
SCHEDULE 4	Australind Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, Se, Na, V, Zn)pH, EC, TDS, HCO_3, Cl, NO_3, SO_4, Total Alkalinity, Total Acidity
SCHEDULE 5	Kemerton Monitor Bores	1x500mL plastic 1x125mL plastic (Nutrients) FILTER 1x125mL plastic (Metals) - acidified - FILTER	Dissolved (filterable) Metals (Al, As, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Na, V, Zn)TDS, Total Acidity, HCO_3, Cl, NO_3, SO_4, pH, EC, Total Alkalinity
SCHEDULE 6	Kemerton and Australind TSR - Mud Solid	Approx. 2L in plastic jar/s	*Centrifuge supplied mud/water sample. Test the solid fraction as follows. (Total metals since a solid)* LOI (650°C), Al, As, Ba, Be, B, Cd, Ca, C, Cr, Cr (VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, S, Th, Sn, Ti, U, V, Zn, Cl

Australian Government
National Measurement Institute

CERTIFICATE OF ANALYSIS # DAU21_268

Client	ChemCentre (WA) PO Box 1250 Bentley WA 6983	**Job No.**	CHEM06/210817
		Sampled by	Client
		Date Sampled	12-Aug-21
		Date Received	17-Aug-21
Contact	Kevin Robins		

The results relate only to the sample(s) as received and tested.

Method AUTL_MET_001 **Date Reported** 9-Sep-21

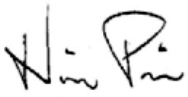
Details

The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in aqueous samples by high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS).
This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported.
The dioxin toxicity equivalent (WHO_{05}-TEQ_{DF}) in each sample is calculated using World Health Organization toxic equivalency factors (WHO_{05}-TEFs). All results are corrected for labelled surrogate recoveries.

After sampling, the liquid is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation



Nino Piro
Senior Chemist
Australian Ultra Trace Laboratory

Robert Crough
Chemist
Australian Ultra Trace Laboratory

Accreditation

NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025 - Testing.

This report shall not be reproduced, except in full.
Measurement uncertainty is available upon request.

Sample Details : Job No. CHEM06/210817

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N21/019541X	21S0672/001_SQC2	Water	Water

Project Details

Project Name	*Not specified*
Project Number	*21S0672*

Key

Analytes

TCDD	Tetrachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin	OCDF	Octachlorodibenzofuran

Units & Abbreviations

pg/kg	picograms per kilogram
<	level less than limit of detection (LOD)
WHO_{05}-TEF†	World Health Organization toxic equivalency factor
WHO_{05}-TEQ_{DF}†	World Health Organization toxic equivalents (Dioxins & Furans)

† as defined by Van den Berg et al., *Toxicol. Sci.* ***93*** *(2), pp. 223–241* (2006)

TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:

$$WHO_{05}\text{-}TEQ_{DF} = \sum_{i=1}^{7}\left[PCDD_i \times TEF_i\right] + \sum_{j=1}^{10}\left[PCDF_j \times TEF_j\right]$$

i = PCDD congener index (1 - 7)
j = PCDF congener index (1 - 10)

Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.
Surrogate Recovery	percentage recovery for $^{13}C_{12}$ labelled surrogate standard
⚑	Laboratory surrogate recovery outside normal acceptance criteria: Solid and liquid matrices **25 - 125%**

Results : Job No. CHEM06/210817

Laboratory Reg. No. N21/019541X **Date Extracted** 27-Aug-21

Client Sample Ref. 21S0672/001_SQC2 **DB5 Analysis** 30-Aug-21
Matrix Water
Description Water

PCDD/F Congeners	Level pg/kg	WHO_{05}-TEF	WHO_{05}-TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.3	0.1	0.015	102	
2,3,7,8-TCDD	<0.2	1	0.1	107	
1,2,3,7,8-PeCDF	<0.1	0.03	0.0015	100	
2,3,4,7,8-PeCDF	<0.1	0.3	0.015	105	
1,2,3,7,8-PeCDD	<0.3	1	0.15	102	
1,2,3,4,7,8-HxCDF	<0.08	0.1	0.004	119	
1,2,3,6,7,8-HxCDF	<0.08	0.1	0.004	105	
2,3,4,6,7,8-HxCDF	<0.08	0.1	0.004	111	
1,2,3,7,8,9-HxCDF	<0.2	0.1	0.01	63	
1,2,3,4,7,8-HxCDD	<0.3	0.1	0.015	89	
1,2,3,6,7,8-HxCDD	<0.2	0.1	0.01	98	
1,2,3,7,8,9-HxCDD	<0.2	0.1	0.01		
1,2,3,4,6,7,8-HpCDF	<0.2	0.01	0.001	98	
1,2,3,4,7,8,9-HpCDF	<0.2	0.01	0.001	123	
1,2,3,4,6,7,8-HpCDD	<0.3	0.01	0.0015	106	
OCDF	<0.5	0.0003	0.000075		
OCDD	<0.5	0.0003	0.000075	108	

PCDD/F Homologue Groups	Level pg/kg
Total TCDF isomers	<2
Total TCDD isomers	<1
Total PeCDF isomers	<0.7
Total PeCDD isomers	<2
Total HxCDF isomers	<1
Total HxCDD isomers	<1
Total HpCDF isomers	<0.8
Total HpCDD isomers	<0.6

Summary Results		
Sum of PCDD and PCDF congeners		
Excluding LOD values	0	pg/kg
WHO_{05} -TEQ_{DF}		
Lower Bound [excluding LOD values]	**0**	pg/kg
Middle Bound [including half LOD values]	**0.34**	pg/kg
Upper Bound [including LOD values]	**0.68**	pg/kg

CHAIN OF CUSTODY DOCUMENTATION

Chem Centre — AES Laboratory Group

CLIENT:	Arcadis	SAMPLER:	Jarmon Hollett
ADDRESS / OFFICE:	Level 5, 225 St Georges Terrace	MOBILE:	0420 838 328
PROJECT MANAGER:	Bronwyn Van Valkengoed	PHONE:	
PROJECT NUMBER:	30086132 PROJECT TASK:	EMAIL REPORT TO:	jarmon.hollett@arcadis.com bronwyn.vanvalkengoed.com
PROJECT NAME:	Thorax Bunbury	EMAIL INVOICE TO:	au.accounts.payable@arcadis.com
SITE:	PO No:		
RESULTS REQUIRED:	Standard TA	Quote No.	AP_DPS14047

FOR LABORATORY USE ONLY

COOLER SEAL (circle appropriate)

Intact: Yes No N/A

SAMPLE TEMPERATURE

CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

CC Job # 2150770

ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

Schedule ID

Notes: e.g. Highly contaminated samples

e.g. "High PAHs expected".

Extra volume for QC or trace LORs etc.

	SAMPLE INFORMATION (note: S = Soil, W=Water)				CONTAINER INFORMATION			Schedule ID
ALS ID	2150770 SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	MSpike Vol	
1	001. SQC4	W	19/8/21	1100		2		X
2	002. SQC6	W	19/8/21	1200		2		X
3								
4								
5								
6								
7								
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RELINQUISHED BY:				RECEIVED BY				METHOD OF SHIPMENT
Name:	Jarmon Hollett	Date:	20/8/21	Name:		Date:	20-8-21	Con' Note No:
Of:	Arcadis	Time:		Of:		Time:	@11am	
Name:		Date:		Name:		Date:		Transport Co:
Of:		Time:		Of:		Time:		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Australian Government
National Measurement Institute

CERTIFICATE OF ANALYSIS # DAU21_271

Client	ChemCentre (WA) PO Box 1250 Bentley WA 6983	**Job No.**	CHEM06/210826
		Sampled by	Client
		Date Sampled	19-Aug-21
		Date Received	26-Aug-21
Contact	Kevin Robins		

The results relate only to the sample(s) as received and tested.

Method AUTL_MET_001 **Date Reported** 9-Sep-21

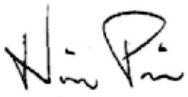
Details

The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in aqueous samples by high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS).
This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported.
The dioxin toxicity equivalent (WHO_{05}-TEQ_{DF}) in each sample is calculated using World Health Organization toxic equivalency factors (WHO_{05}-TEFs). All results are corrected for labelled surrogate recoveries.

After sampling, the liquid is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation



Nino Piro
Senior Chemist
Australian Ultra Trace Laboratory

Robert Crough
Chemist
Australian Ultra Trace Laboratory

Accreditation

NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025 - Testing.

This report shall not be reproduced, except in full.
Measurement uncertainty is available upon request.

Sample Details : Job No. CHEM06/210826

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N21/020062X	21S0770/001_SQC4	Water	Water
N21/020063X	21S0770/002_SQC6	Water	Water

Project Details

Project Name	*Not specified*
Project Number	*21S0770*

Key

Analytes

TCDD	Tetrachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin	OCDF	Octachlorodibenzofuran

Units & Abbreviations

pg/kg	picograms per kilogram
<	level less than limit of detection (LOD)
WHO_{05}-TEF†	World Health Organization toxic equivalency factor
WHO_{05}-TEQ_{DF}†	World Health Organization toxic equivalents (Dioxins & Furans)

† as defined by Van den Berg et al., *Toxicol. Sci.* ***93*** *(2), pp. 223–241* (2006)

TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:

$$WHO_{05}\text{-}TEQ_{DF} = \sum_{i=1}^{7}\left[PCDD_i \times TEF_i\right] + \sum_{j=1}^{10}\left[PCDF_j \times TEF_j\right]$$

i = PCDD congener index (1 - 7)
j = PCDF congener index (1 - 10)

Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.

Surrogate Recovery	percentage recovery for $^{13}C_{12}$ labelled surrogate standard
⚑	Laboratory surrogate recovery outside normal acceptance criteria: Solid and liquid matrices **25 - 125%**

Results : Job No. CHEM06/210826

Laboratory Reg. No. N21/020062X **Date Extracted** 27-Aug-21

Client Sample Ref. 21S0770/001_SQC4 **DB5 Analysis** 30-Aug-21
Matrix Water
Description Water

PCDD/F Congeners	Level pg/kg	WHO_{05}-TEF	WHO_{05}-TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.5	0.1	0.025	85	
2,3,7,8-TCDD	<0.4	1	0.2	107	
1,2,3,7,8-PeCDF	<0.2	0.03	0.003	90	
2,3,4,7,8-PeCDF	<0.2	0.3	0.03	95	
1,2,3,7,8-PeCDD	<0.5	1	0.25	106	
1,2,3,4,7,8-HxCDF	<0.2	0.1	0.01	105	
1,2,3,6,7,8-HxCDF	<0.2	0.1	0.01	93	
2,3,4,6,7,8-HxCDF	<0.2	0.1	0.01	96	
1,2,3,7,8,9-HxCDF	<0.2	0.1	0.01	76	
1,2,3,4,7,8-HxCDD	<0.4	0.1	0.02	86	
1,2,3,6,7,8-HxCDD	<0.4	0.1	0.02	84	
1,2,3,7,8,9-HxCDD	<0.4	0.1	0.02		
1,2,3,4,6,7,8-HpCDF	<0.3	0.01	0.0015	93	
1,2,3,4,7,8,9-HpCDF	<0.3	0.01	0.0015	104	
1,2,3,4,6,7,8-HpCDD	<0.4	0.01	0.002	98	
OCDF	<0.5	0.0003	0.000075		
OCDD	<0.6	0.0003	0.00009	96	

PCDD/F Homologue Groups	Level pg/kg
Total TCDF isomers	<4
Total TCDD isomers	<3
Total PeCDF isomers	<1
Total PeCDD isomers	<3
Total HxCDF isomers	<2
Total HxCDD isomers	<2
Total HpCDF isomers	<0.8
Total HpCDD isomers	<0.6

Summary Results		
Sum of PCDD and PCDF congeners		
Excluding LOD values	0	pg/kg
WHO_{05} -TEQ_{DF}		
Lower Bound [excluding LOD values]	**0**	pg/kg
Middle Bound [including half LOD values]	**0.61**	pg/kg
Upper Bound [including LOD values]	**1.2**	pg/kg

Results : Job No. CHEM06/210826

Laboratory Reg. No. N21/020063X **Date Extracted** 27-Aug-21

Client Sample Ref. 21S0770/002_SQC6 **DB5 Analysis** 30-Aug-21
Matrix Water
Description Water

PCDD/F Congeners	Level pg/kg	WHO_{05}-TEF	WHO_{05}-TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.5	0.1	0.025	101	
2,3,7,8-TCDD	<0.4	1	0.2	112	
1,2,3,7,8-PeCDF	<0.3	0.03	0.0045	102	
2,3,4,7,8-PeCDF	<0.3	0.3	0.045	97	
1,2,3,7,8-PeCDD	<0.4	1	0.2	100	
1,2,3,4,7,8-HxCDF	<0.1	0.1	0.005	117	
1,2,3,6,7,8-HxCDF	<0.1	0.1	0.005	102	
2,3,4,6,7,8-HxCDF	<0.1	0.1	0.005	106	
1,2,3,7,8,9-HxCDF	<0.2	0.1	0.01	66	
1,2,3,4,7,8-HxCDD	<0.3	0.1	0.015	97	
1,2,3,6,7,8-HxCDD	<0.4	0.1	0.02	90	
1,2,3,7,8,9-HxCDD	<0.4	0.1	0.02		
1,2,3,4,6,7,8-HpCDF	<0.2	0.01	0.001	98	
1,2,3,4,7,8,9-HpCDF	<0.3	0.01	0.0015	107	
1,2,3,4,6,7,8-HpCDD	<0.3	0.01	0.0015	93	
OCDF	<0.4	0.0003	0.00006		
OCDD	<0.6	0.0003	0.00009	98	

PCDD/F Homologue Groups	Level pg/kg
Total TCDF isomers	<4
Total TCDD isomers	<3
Total PeCDF isomers	<2
Total PeCDD isomers	<2
Total HxCDF isomers	<2
Total HxCDD isomers	<2
Total HpCDF isomers	<0.8
Total HpCDD isomers	<0.6

Summary Results		
Sum of PCDD and PCDF congeners		
Excluding LOD values	0	pg/kg
WHO_{05} -TEQ_{DF}		
Lower Bound [excluding LOD values]	**0**	pg/kg
Middle Bound [including half LOD values]	**0.56**	pg/kg
Upper Bound [including LOD values]	**1.1**	pg/kg