
Dundas Surface Water Monitoring 2017

Contamination
mass balance and
remediation options

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Executive Summary

A water quality monitoring program in the Dundas River catchment was initiated to gather data on acid drainage from abandoned / operating mine sites, to review previous findings in light of the two rounds of sampling conducted in 2017, and propose remediation options if appropriate to achieve the adopted 80% protection of aquatic ecosystems water quality objectives.

The program comprises 20 monitoring locations along water courses in the upper reaches of the Dundas River System (Dundas System). For reporting purposes, the Dundas System is comprised of the Dundas River and four areas: Razorback Mine area, Comet & Maestries mining areas, South Comet Mine area, Adelaide Mine area and Red Lead mine.

This report was compiled after two sampling events. The two rounds of sampling were conducted on the 27th of February (summer) and the 5th of May 2017 (autumn). The report includes a map of monitoring locations, together with GPS coordinates and site photographs, tabulated analytical results and mass flow graphs.

Analytical results were compared with the ANZECC 2000 water quality guidelines proposed by and specified by Pitt & Sherry report, March 2013. The results suggest the focus of remediation should be on South Comet Mine; leachate is bypassing the current catchment system and pushing the whole creek above the ANZECC guidelines 80% protection levels.

The attached graphs and mass balance clearly show total zinc and manganese impacting the creek from SCC02 to the Dundas River and beyond. Zinc tends to be a tag for other metals and it is noted that lead and cadmium exceeded ANZECC guidelines, both being toxic to the ecosystem and human health.

ES&D did not detect a peak at either round of sampling from a previously identified acid drainage load in the Dundas River from an unknown sources upstream of the Dundas township bridge, suggesting work completed in the intervening period may have eliminated this source.

The type of remediation for South Comet Mine should be passive and should achieve increased pH (above 7) to remove metals such as manganese. A wetland is the only real option, as reduction and biological systems will not remove manganese. The use of an oyster shell reduction cell as recently trialled in New Zealand (Uster *et.al*) may be appropriate to achieve the remediation objectives.

Razorback wetland system seems to be healthy and will further clean up the area if DR04a is diverted into the dam and a proper overflow weir is fitted although this report indicates that this

is a lower priority. The mass balance is indicating that there are other sources with more impact on the river.

Adelaide Mine is operating and is having a very minor impact on the creek.

Red Lead Mine has been not operating during sampling and so has not impacted the creek, although background results suggest it could as there is minimal retention in place.

1 Background

The site history search discovered that the southern section of the Dundas mineral field has a number of abandoned and several current metallic mine sites. There are 47 historical mine sites in the Dundas mining field, 11 that are located on mining leases and 36 that can be termed 'abandoned'. Additionally there are 24 located in the upper Dundas River catchment, 8 in the Adelaide Mine Creek catchment and 15 in the Comet Creek catchment. There are also 2 operating mines and 1 occasionally operating mine in the mining field, namely the Adelaide Mine, Red Lead Mine and Comet Extended respectively.

The land tenure is Crown Land managed by Forestry Tasmania, Crown Land managed by the Parks and Wildlife Service and private freehold land. The land managed by Forestry Tasmania is located north of the Comet Creek and the land managed by the Parks and Wildlife Service is located to the south of Comet Creek. There are 14 private properties in the mining field, most being located in the former township area, but only one property has permanent residents.

Pitt & Sherry completed a study in 2013 (Pitt & Sherry) in which they proposed a remediation strategy for abandoned mines on the Dundas mineral field. The resulting report provided water quality data from 10 monitoring locations taken over one sampling event and identified runoff from the South Comet Mine as one of the major contributions to contamination of watercourses within the Dundas River system.

Pitt & Sherry proposed capping of all the sites, and adoption of the 80% protection of aquatic ecosystems water quality objectives. At the time of the initial survey, zinc was the key contaminant that was preventing the achievement of that objective. The South Comet Mine is the primary source of the zinc loads in the Dundas River contributing, at the time of the survey, approximately 60% to 70% of the zinc load. The Razorback open cut is the source of approximately 40% to 50% of the zinc loads.

The sulphate emission rates from the South Comet Mine accounted for approximately 80% to 90% of the sulphate emission rates in the Dundas River. The sulphate emission rates from below the Razorback Mine accounted for approximately 30% to 40% sulphate emission rate to the Dundas River. The manganese emission rates in the Dundas River were made up from approximately 50/50 from the South Comet Mine and possibly from the Razorback open cut.

An acid drainage load in the Dundas River from unknown sources upstream of the Dundas township bridge was identified. ES&D did not detect a peak at either round of sampling suggesting work previously completed may have eliminated this source. The amounts of metal contamination exiting Razorback was significantly less this survey.

2 Introduction

Mineral Resources Tasmania (MRT) commissioned ES&D to complete two additional rounds of sampling to produce mass flows down the Dundas Catchments to confirm the Pitt & Sherry surveys from the March 2013 report and to provide remediation strategies if the findings are in line and the results warrant rehabilitation.

The abandoned and current mines present a potential risk to public safety and an environmental risk to the quality of the Dundas River receiving waters. Two remediation programs were undertaken in the Dundas area in the mid-1990s. The remediation programs related to the Razorback Mine and the South Comet Mine and this still appears to be the main focus of study.

Tasmanian abandoned mine remediation strategies and remediation works are funded through the Rehabilitation of Abandoned Mining Lands Trust Fund administered by MRT.

3 Objectives

The objectives of the current study were to review previous findings in light of the two rounds of sampling conducted in 2017, and propose remediation options if appropriate (and taking into account the type of risk posed by the contaminants) to achieve the adopted 80% protection of aquatic ecosystems water quality objectives.

4 Methodology

The following methodology was adopted in undertaking the project:

MRT and the Pitt & Sherry Report confirmed the number and positions of the monitoring points.

GPS readings were taken for the sampling sites, for GIS mapping, reporting and future referencing. Exact locating was used to assure sampling occurred at the same point each survey. On-ground trip traces were incorporated into the sampling maps.

Water flow measurements were taken at accessible sites to quantify the pollutant emission loads for the remediation strategy. A Global Water FB 211 Environmental Flowmeter (with standard rotor) was used. Several seeps were measured with a stop watch and calibrated buckets.

Field water quality measurements were taken using a freshly calibrated Horiba U50 water quality meter.

Water samples were collected at the sample points for analysis by Australian Laboratory Services, a NATA accredited laboratory. The laboratory analytes were pH, EC, total dissolved solids, turbidity, hardness, total alkalinity, acidity, major cations, major anions and heavy metals. All samples were analysed for total metals. At the ambient water sites, 0.43 micron field filtered 'dissolved' metal analyses was also undertaken.

During the sampling photographs were taken that show visible impacts on the environment after key discharge points. These observations confirmed many of the analytical results.

Two people undertook the site investigation to ensure that any potential safety risks were minimised.

4.1 Dundas Mineral Field Setting

The area is characterised by steep hills and mountains. The mining field is located in the Dundas River catchment. The hydrological setting is characterised by the Dundas River which flows from its origin on the north to western slopes of Mt Dundas. The river flows in a westerly direction to its confluence with the Little Henty River, which also flows westwards to the coast and the ocean.

4.2 Identification of Sites for Investigation

The program comprises 20 monitoring locations along water courses in the upper reaches of the Dundas River System (Dundas System).

For reporting purposes, the Dundas System is comprised of the Dundas River, (background site DR01), and five key areas:

- Razorback Mine area,
- Comet & Maestries mining areas,
- South Comet Mine area,
- Adelaide Mine area and
- Red Lead mine

These are shown below in Figure 1. The Dundas mineral field setting is shown in Figure 2 with the other specified areas shown in the following figures.

The historical Dundas sites identified as being of interest during review of the MRT and Pitt & Sherry report for the field investigation were placed onto a GIS. The large amount of information relating to the Dundas mineralised areas, prospective areas and mineral occurrences were not included in the GIS for the sites for field investigation nor reporting. These areas were selected

to expand the areas for which mass balance information is available to better delineate from where contamination is emanating. The risk assessment allowed the historical workings to be safely accessible. The water monitoring sites selected are detailed in Table 1.

Each sample point was photographed and GPS co-ordinates recorded. The Dundas mining field lies approximately 7 km to the east of Zeehan Township and approximately 9 km south of the Renison Bell Mine.

Table 1 - Sample points with description and coordinates

Sample Location	Description	Coordinates		
		Decimal Degrees	GDA94	
		X, Y	Easting	Northing
DR01	Above Concert Creek	-41.86888, 145.44851	371244	5363618
DR02	Above Razorback mine	-41.87139, 145.43626	370232	5363320
DR03	Below Razorback mine	-41.87163, 145.42875	369609	5363282
DR04A	Razorback mine site outflow	-41.86801, 145.43284	369941	5363691
DR04B	Razorback tailings pond outflow	-41.8682, 145.43199	369871	5363668
DR04C	Razorback open cut outflow	-41.86865, 145.42983	369693	5363615
DR05	Township bridge	-41.87611, 145.41746	368682	5362768
DR06	Zeehan Hwy	-41.89929, 145.40282	367515	5360172
CC01	Above Maestries mine	-41.87885, 145.44527	370995	5362506
CC02	Below Maestries & Comet mines	-41.87864, 145.44372	370866	5362527
CC03	Above Adelaide mine	-41.88297, 145.43057	369783	5362026
CC04	Below Adelaide mine	-41.88334, 145.42931	369680	5361983
CC05	Adelaide mine site outflow	-41.88322, 145.42965	369708	5361997
SCC01	Above South Comet mine	-41.88589, 145.44775	371215	5361728
SCC02	Below South Comet mine	-41.88611, 145.44623	371089	5361701
SCC03A	No.1 adit outflow	-41.88609, 145.44682	371138	5361704
SCC03B	South Comet mine site outflow	-41.88609, 145.44711	371162	5361705
SCC04	Above Red Lead mine	-41.88981, 145.43223	369935	5361269
SCC05	Below Red Lead mine	-41.89041, 145.43075	369813	5361200
SCC06	Red Lead mine site outflow	-41.89929, 145.40282	367515	5360172

Mine Sample	Creek Sample
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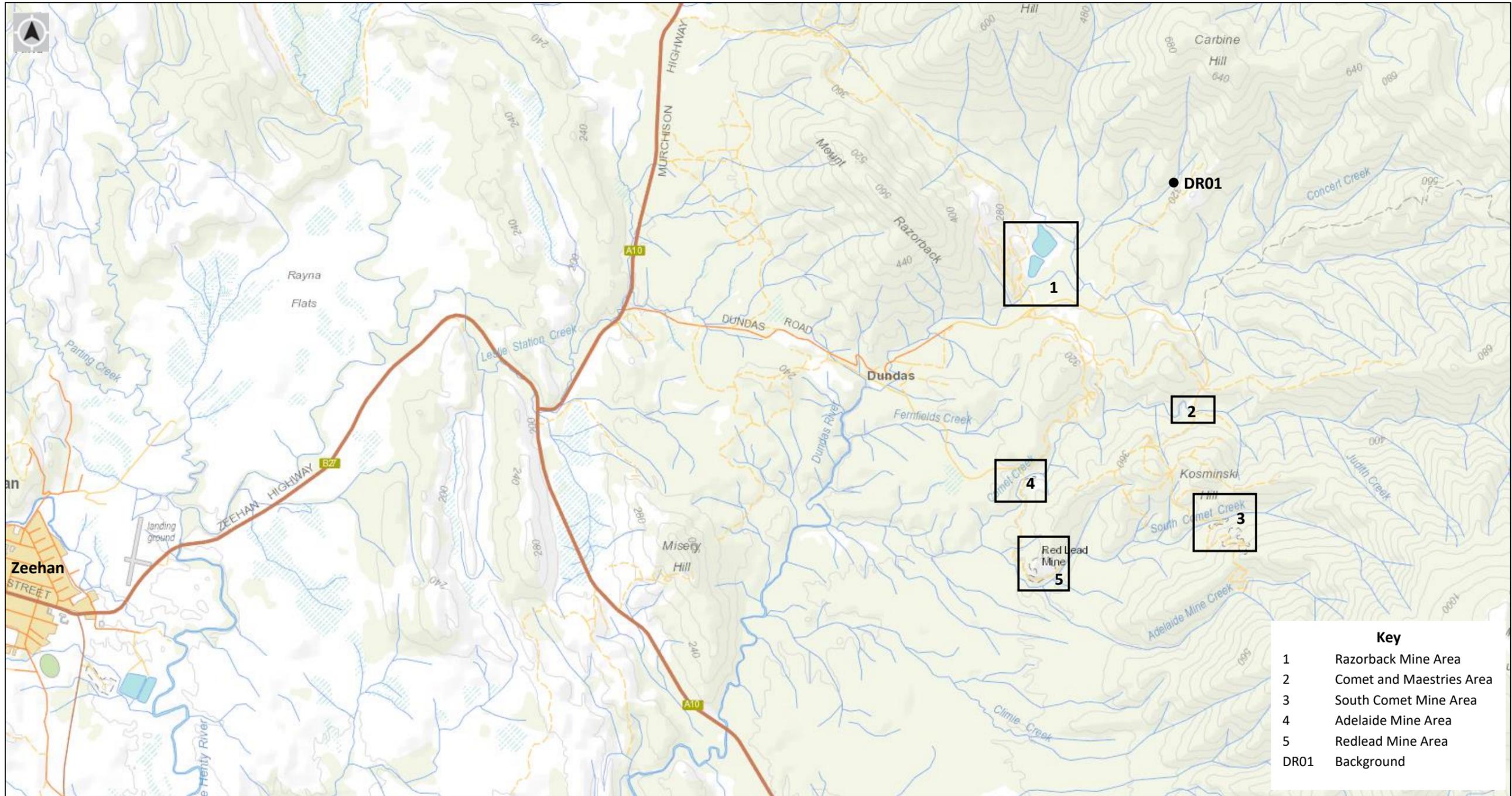


Figure 1 – Dundas system overview, comprising Dundas River and five key monitoring areas

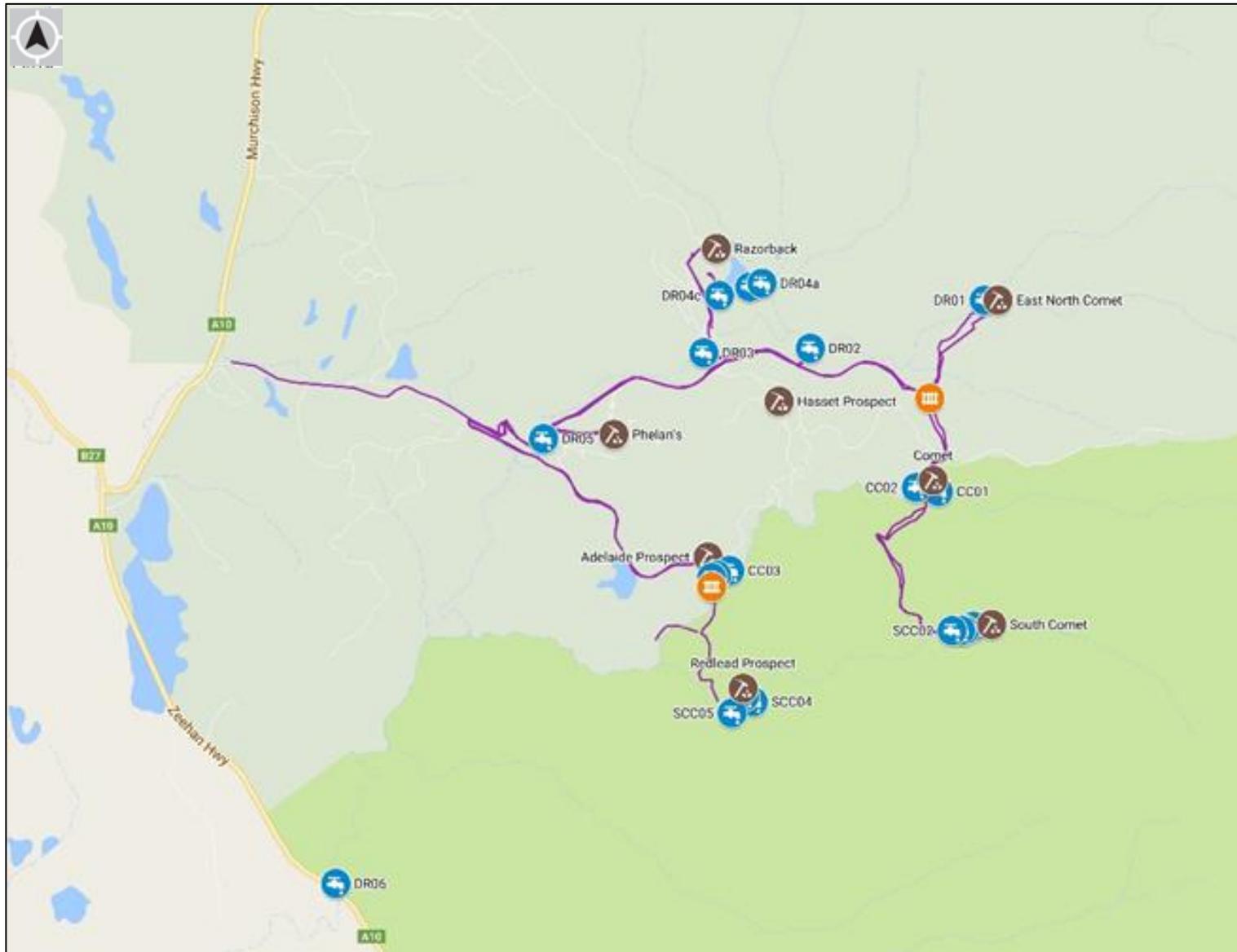


Figure 2 - Dundas system overview – sample points with the travel trace included

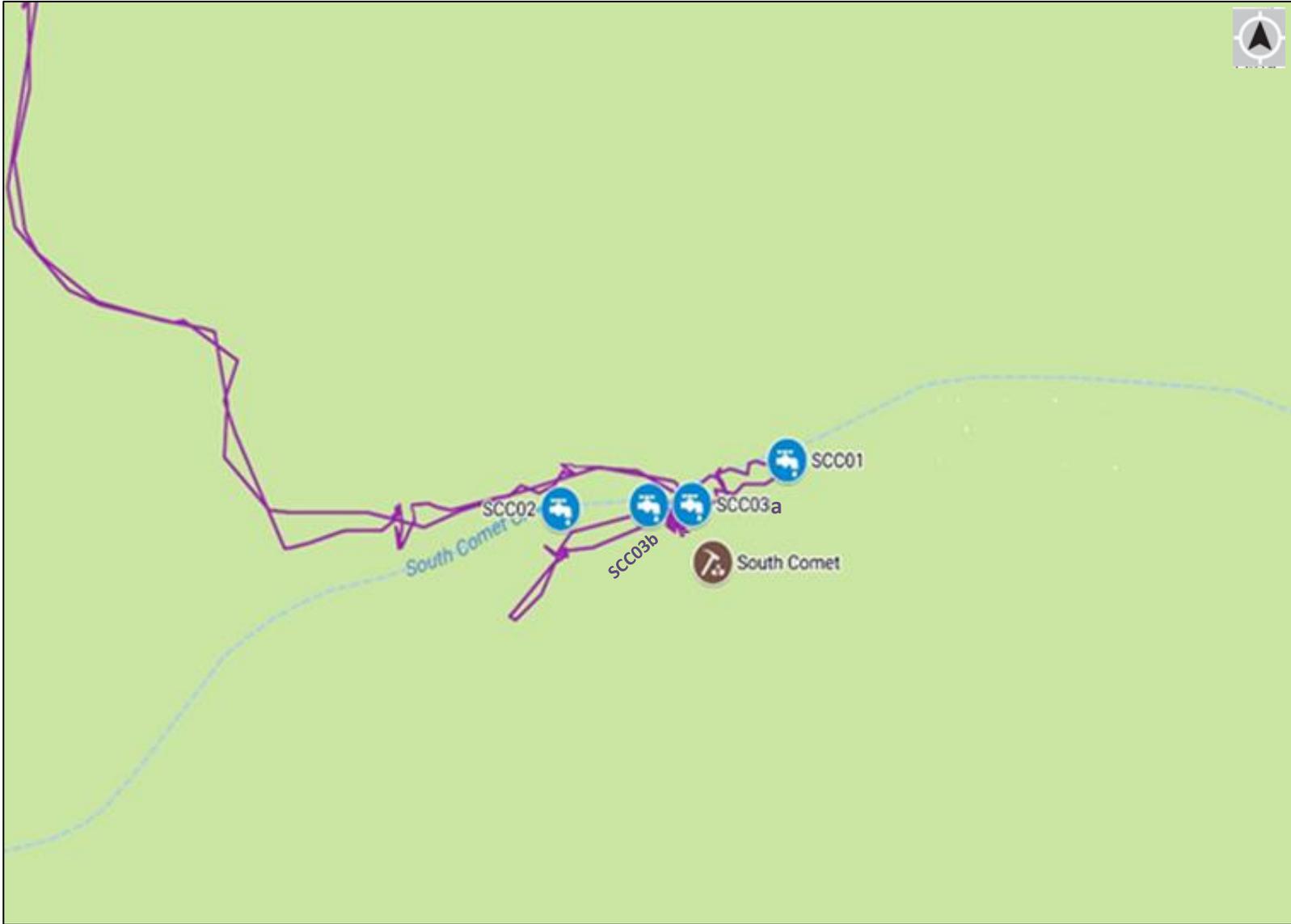


Figure 3 – South Comet sampling points

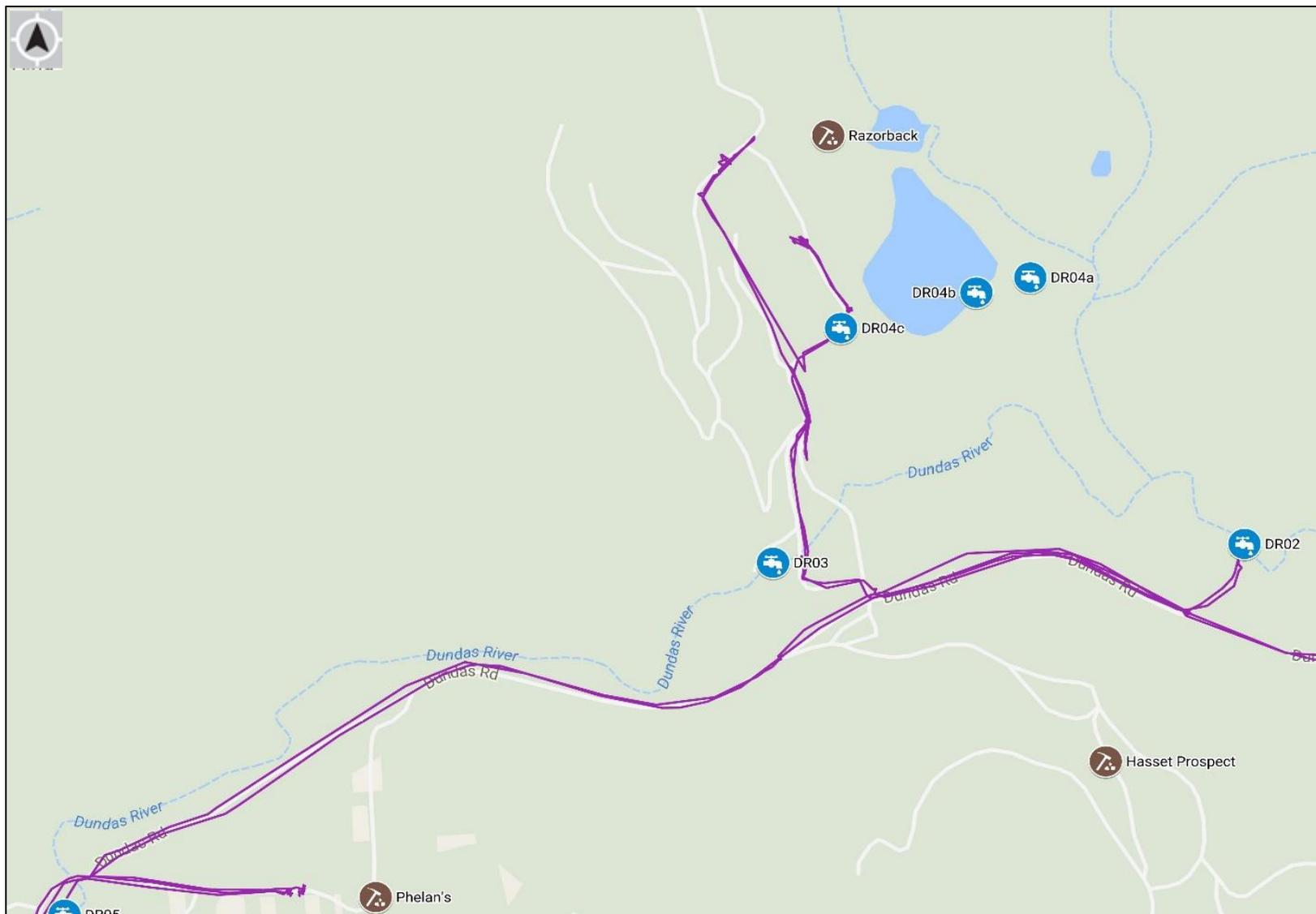


Figure 4 – Razorback sampling points; note the trace seeking upgradient waters

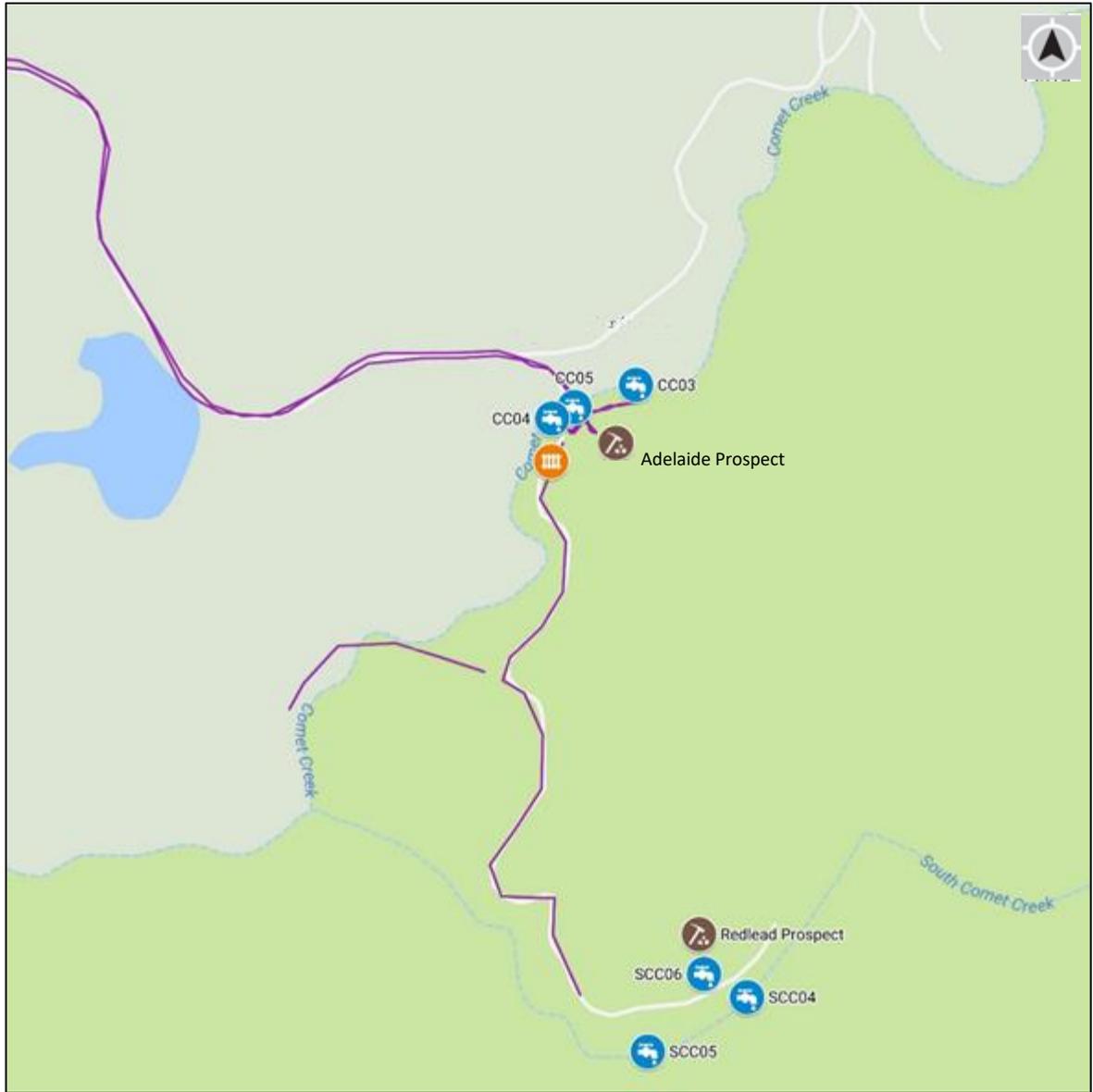


Figure 5 – Adelaide and Redlead sampling points

5 Protected Environmental Values & Water Quality Objectives

The protected environmental values (PEVs) for surface waters in the Dundas River catchment area have been established by the West Coast Council and the Department of Primary Industries, Parks, Water and Environment in accordance with the State Policy on Water Quality Management 1997. The document outlining the PEVs is the Environmental Management Goals for Tasmanian Surface Waters, West Coast Municipal Area (Excluding the Gordon and Pieman River Catchments) December 2000.

The PEVs for the Dundas River are specified in the West Coast municipality PEV document and are summarised as follows:

- A: Protection of Aquatic Ecosystems
 - (ii) Protection of modified (not pristine) ecosystem;
 - (a) from which edible fish are not harvested
- B: Recreational Water Quality & Aesthetics
 - (i) Primary contact water quality (Dundas River at Zeehan Highway Bridge).
 - (ii) Secondary contact water quality.
 - (iii) Aesthetic water quality.

As a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified ecosystem from which edible fish may not be harvested; which will allow people to safely engage in recreation activities such as swimming (Dundas River at Highway Bridge), paddling or boating in aesthetically pleasing waters.

5.1 Water Quality Objectives

The water quality objectives (WQO) for the Dundas River catchment have not been established by the Board of the EPA. Site specific WQOs can be established where sufficient scientific data is available. Where data is not available, the WQOs default to the trigger values in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (known as the ANZECC guidelines). Currently the establishment of WQOs for the Dundas River would require the ANZECC guideline trigger values. Given the history of the site and the historical impacts, it is reasonable to assume that the ANZECC guidelines trigger values for the 80% protection for aquatic ecosystems should apply for the Dundas River.

5.2 Key Water Quality Indicators

The trigger values for 80% protection of aquatic ecosystems were used for the assessment of environmental risks for the remediation strategy. The key indicators and the WQOs for the Dundas River are outlined in Table 2 below.

Table 2 – WQO's

Parameter	ANZECC trigger values 80% protection
pH	6.5 – 7.5
Electrical Conductivity (EC) uS/cm	30 – 350
Turbidity (NTU)	2 – 25
Dissolved oxygen (DO) % saturation	90 – 110
Aluminium (Al) mg/L	0.150
Cadmium (Cd) mg/L	0.0008
Chromium (Cr) mg/L	0.040
Copper (Cu) mg/L	0.0025
Lead (Pb) mg/L	0.0094
Manganese (Mn) mg/L	3.600
Nickel (Ni) mg/L	0.017
Zinc (Zn) mg/L	0.031
Mercury (Hg) mg/L	0.0054

6 Site Assessment

The assessment combined visual, physical and chemical data to produce initially contaminant concentration tables to compare with the quality guidelines and highlight in red the non-compliant results. The mass balances were then produced to give a magnitude assessment and to allow losses and gaps to be identified. The mass balances are best shown in graphs but then the mass flows of the seeps can be used to identify where the contamination is coming from and also what portion of the total contamination is from specific seeps or areas. Recommendations are made based on the greatest magnitudes of contaminants and the impacts of those specific contaminants. It is then up to MRT to determine if the cost of remediation is justified for the removal of specific masses of contaminants and the potential for the creek to then meet and sustain ANZECC guidelines.

7 Results:

Results are tabulated in Appendix 2. Red figures indicate exceedances of the ANZECC Guidelines. Note that these have been applied to the seeps as well, so impacts are more readily identifiable.

A comparison of the analytical results to the guidelines show that conductivity is high at South Comet sites SCC02, SCC03A and SCC03B with the former being the river and the latter two being the seeps into South Comet Creek.

The seeps at South Comet points SCC03A and SCC03B are characterised by low DO, while CC05 has even lower DO, being the discharge from Adelaide Mine (not creek). This is a consistent effect as the background site DR01 and Razorback sample points DR04B and DR04C also indicated low DO.

Dissolved cadmium was elevated right through South Comet locations SCC02, SCC03A and SCC03B, which then impacted Redlead sites SCC04 and SCC05. The dissolved cadmium was elevated at Razorback site DR04C, but was not significantly impacting Dundas River.

There was an anomaly in that the only elevated dissolved chromium was detected at SCC06 coming from the Red Lead Mine but was not impacting South Comet creek based on the results from SC004 (upstream) and SC005 (downstream). It is noted that the Red Lead mine was not operating during either sampling run.

Dissolved copper at South Comet site SCC03B was high: looking at pH it was evident that total copper was impacting the creeks, but elevated dissolved metals occur when the pH is impacting the creeks (ie lower pH in the creek). Copper toxicity is complex but very dependent upon pH.

Dissolved manganese was elevated at South Comet sites SCC02, SCC03A, and SCC03B. Measured manganese was 119mg/l in the seeps compared to a background of 0.2 mg/l, while downstream of SCC02 being lifted to 5 mg/l.

Dissolved nickel was elevated at Razorback sites DR04A and DR04C, CC05, and South Comet sites SCC03A, SCC03B, all being decent seeps.

Dissolved zinc concentrations are impacted by pH. Elevated results were shown for Razorback and South Comet sites. DR02, DR03 and DR04C were all high, while DR05 and DR06 were also impacted from these seeps. This is in common with SCC03A and SCC03B which also had elevated dissolved zinc that impacted on SCC02, SCC04 and SCC05.

Results for total cadmium at South Comet mirrored the soluble impacts with SCC03A and SCC03B impacting SCC02, SCC04 and SCC05. Total chromium as per the soluble results was elevated at SCC06 only.

Total copper was high at SCC03A and SCC03B but not seeming to impacting the creek due to pH.

Total lead was only elevated at DR03 but was not impacting the creek, however elevated lead at SCC03A and SCC03B did appear to be impacting at SCC02, SCC04, SCC05, although SCC06 was also elevated (from the Red Lead Mine).

Total manganese was elevated at, SCC03A and SCC03B, impacting on SCC02 to push it above guidelines. Total manganese impacted further downstream, but not above guidelines.

Total nickel was elevated in the seeps, particularly at, SCC03A and SCC03B, impacting on SCC02 to push it above guidelines. Total nickel impacted further downstream, but not above guidelines.

At Razorback, total zinc was elevated at DR02, DR03 from the seepage at DR04C. This in turn impacted DR05, although there were elevated levels at DR05 and DR06.

At South Comet total zinc was also elevated at SCC03A and SCC03B, impacting SCC02, SCC04 and SCC05.

The second survey found elevated zinc at SCC01 indicating contamination further up South Comet Creek.

The calculated mass loadings have been graphed in Appendix 2 so trends can be easily seen.

8 Discussion

Visual assessments were made with the use of photography (Appendix 1). SCC02 was the most visible impact area (Below South Comet Mine) with precipitated minerals on the rocks below water level. SCC04 and SCC05 also had some minor precipitation but there was no increase observed between the two sites.

The pH is not impacted significantly by the seeps to the waterways, although the second survey did indicate some impact at SCC02. Remediation projects that increase the pH of seeps will significantly reduce the metal inputs into the waterways. This can be modelled by removing the dissolved metal concentrations as they will disappear if the pH of seeps were increased.

Dissolved cadmium at SCC02 was pushed into exceedance with the input of SCC03A, lifting the concentration in the creek from <0.0001 to 0.400 mg/l. Dissolved lead and manganese was also increased at SCC02. Dissolved manganese at SCC02 increased from 0.019 to 5.0 mg/l due to the input at SCC03A and other seeps.

Dissolved zinc was seen to be impacting the waterways from most seepage points. SCC03b seeps were impacting SCC02 and further down South Comet Creek indicating significant contamination. DR04 likewise impacted DR05 and on to DR06.

Total lead was elevated at SCC02 (from 0.0001 up to 0.039 mg/l). Total nickel and manganese were elevated above guidelines due to SCC03A, but there were less impacts down the creek.

Total zinc also impacted most seeps, impacting SCC02 right down South Comet creek. Note that the total zinc at SCC02 was contaminated by the seepage from 0.029 to 5.27 mg/l. DR04C also was seen to contaminate DR05 and DR06 above guidelines with total zinc.

All of the site flows and mass balances are presented in graphs (Appendix 2). This data is too large to discuss in detail so the breaches in ANZECC guidelines as discussed above and to the objective of remediation are the focus of discussion.

Flows of seeps were observed over the two rounds of sampling. Experience shows that the rains tend to purge leachate and although flows in the creeks increase diluting the contaminants, mass flows of contaminants during winter increase. Looking at flows and mass flows also allows us to determine how much of the contamination in the seeps is being collected compared to bypassing to the creeks.

Round one sampling was conducted on the 1st of February 2017 under reasonably dry conditions while the second round was conducted after some decent rains on the 5th of May 2017.

Table 3 - Seepage flows

Sample Location	Round 1 litres / minute	Round 2 litres / minute
DR04A	2400	2875
CC05	360	180
SCC03B	24.6	18
SCC06	108	247

Flows at CC05 are impacted by the operation of the mine, but SCC03B is indicating (if you look at the mass balance for confirmation) that SCC03B is not carrying all of the seeps and it was evident on the second sampling run that substantial flows are passing into the creek on the way to SCC03B, effectively bypassing SCC03B.

The first sampling run found that there was 385 g/hour of total zinc in the creek at SCC02 compared with 0.61 g/hour in the creek at SCC01. Of the 385 grams only 174 grams per hour is accounted for from SCC03B and so 211 grams per hour is bypassing SCC03B.

Part of the remediation plan will be to find and divert this seepage. The magnitude of the seepage at South Comet Creek is summed up by calculating 3.372 tonnes per year of zinc is going into the creek between SCC01 and SCC02. The second sampling event found 654 g/hour at SCC02,

meaning that at a peak 5.7 tonnes per year of zinc seeps in to the creek with 157 g/hour accounted for at SCC03B but 479 g/hour not picked up.

The mass balance from the first sampling run at Razorback mine indicated that the mass of total zinc in the Dundas River at sample point DR02 was elevated at 41 g/hour. DR02 is up stream of the mine. Total zinc at sample point DR03, which is down stream of the mine, was also elevated at 58 g/hour. This means that 17 g/hour of zinc is emanating from the Razorback mine into the Dundas River. This is comparatively low when compared to South Comet Mine.

DR04a accounted for only 1.9 g/hour and DR04C 1.4 g/hour, leaving 13.7 g/hr of zinc bypassing the dams and existing systems into the Dundas River. Thus there are questions about the cost efficiency of developing a wetland if metals are bypassing it. Effort at Razorback should be focused on collecting seepage as a first step. The second sampling run was very similar.

Of note at Razorback is that DR02 has 2.2 g/hour of total lead in the river, but DR03 has 9.5 g/hour with 1 g/hour coming via DR04A and very little in DR04C.

The mass balance graphs show the mass of manganese has a large peak at SCC02 for both sampling runs. There is a very similar graph for zinc, with a large peak at SCC02 and in the case of lead and zinc carry through the whole creek system.

Alkalinity is higher at Comet Creek in May rather than February indicating that higher flows assisted in keeping alkalinity up.

These levels of contamination suggest remediation is required at SCC03A / SCC03B to lift the pH / alkalinity in order to remove metals entering South Comet Creek. A decent passive treatment system such as an anaerobic and / or then aerobic aeration system will have a long term impact on the creeks and allow the ANZECC guidelines to be achieved. Recent trials in New Zealand with oyster and other shells in passive reduction cells have shown considerable success in similar applications. The metal loadings are a little high for conventional limestone drains, although there are some pre-treatment systems that could prevent pacifying of limestone or dolomite drains as the volume of leachate at South Comet Mine is manageable. As Pitt & Sherry suggest, a larger area would be required to allow a wetland development but pH correction is required to remove metals in a wetland, particularly manganese. These systems can be designed and sized to meet the remediation objectives. The remoteness of the site prevents active treatment systems from being cost effective.

The strategy proposed by Pitt & Sherry for Razorback area is a good one. The existing ponds and wetlands appear to be working well.

The onsite mitigation of the acid drainage from the South Comet Mine is limited by the available area and steep topography. The acid drainage from the Razorback open cut can be mitigated by

diversion to the available area of the existing wetlands as proposed by Pitt & Sherry. The data collected will assist this program, although it may not justify it.

9 Recommendations

Focus of remediation should be South Comet Mine, where leachate is bypassing the current catchment system and pushing the whole creek above the ANZECC guidelines 80% protection levels. A look at the attached graphs and mass balance clearly show total zinc and manganese impacting the creek from SCC02 and impacting right through to the Dundas River and beyond. Zinc tends to be a tag for other metals and it is noted that lead and cadmium exceeded ANZECC guidelines both being toxic to the ecosystem and human health.

The type of remediation for South Comet Mine should be passive and should achieve increased pH (above 7) to remove metals such as manganese. A wetland is the only real option as reduction and biological systems will not remove manganese. The use of an oyster shell reduction cell as recently trialled in New Zealand may be appropriate.

Razorback wetland system seems to be healthy and will further clean up the area if DR04A is diverted into the dam and a proper overflow, although this report indicates that this is a lower priority. The mass balance is indicating that there are more significant sources such as SCC03B.

Adelaide mine is operating and is having a very minor impact on the creek.

Red Lead Mine has been not operating during sampling and so has not been seen to have impacted the creek, although background results and observation of the retention pond suggest it could.

References

(Pitt & Sherry) Report Dundas Mineral Field Remediation Strategy, Pitt and Sherry, 31 March 2013.

(Uster *et al*) Waste Mussel Shells to Treat Acid Mine Drainage: A New Zealand Initiative, B. Uster, D. Trumm, J. Pope, P. Weber, A. D. O'Sullivan, C. Weisener, Z. A. Diloreto, Reclamation Matters, American Society of Mining and Reclamation, fall, 2014 Edition.

(ANZECC 2000) Australian Water Quality Guidelines for Fresh and Marine Waters, Australian and New Zealand Environment and Conservation Council

(NEPM) National Environmental Protection (Assessment of Site Contamination) Measure, "Guideline on Data Collection, Sample Design and Reporting", Schedule B (2), 1999 (as amended 2013)

AS 5667.1:1998, Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

Tasmanian Government Land Information System - [http:// www.thelist.tas.gov.au](http://www.thelist.tas.gov.au)

State Policy on Water Quality Management 1997

Environmental Management Goals for Tasmanian Surface Waters, West Coast Municipal Area (Excluding the Gordon and Pieman River Catchments) December 2000

Appendices

Appendix 1 – Photos of Sample Points



SCC03A



SCC03B



SCC02 – Note staining of rocks.



SCC01 – Note no visible staining up stream.



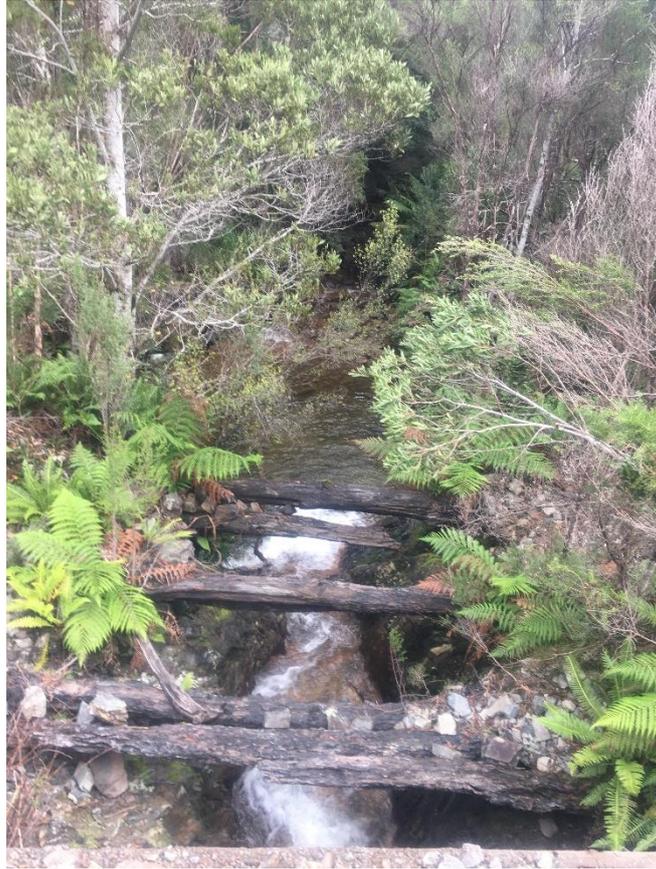
DR04B



DR04A



CC01



CC02



SCC06



DR02



DR03



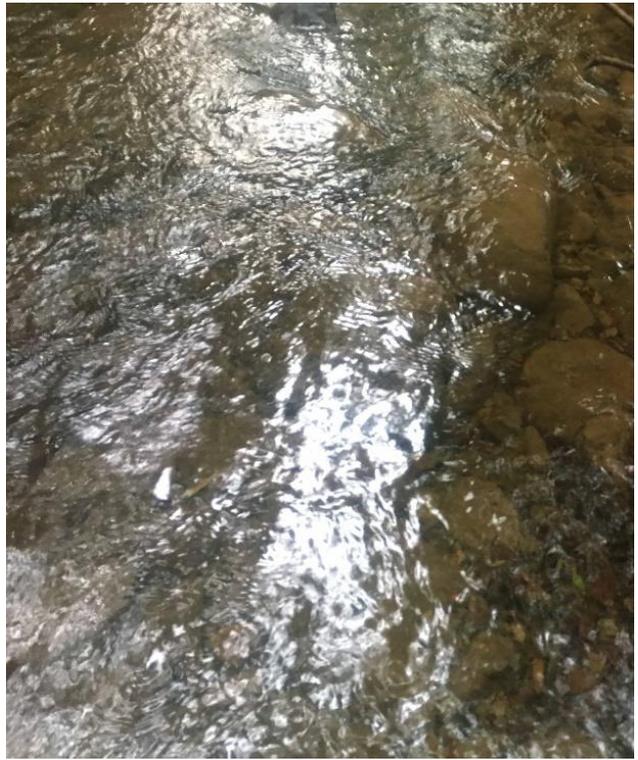
DR04c



DR05 Township bridge



SCC05 Minor impacts minor downstream



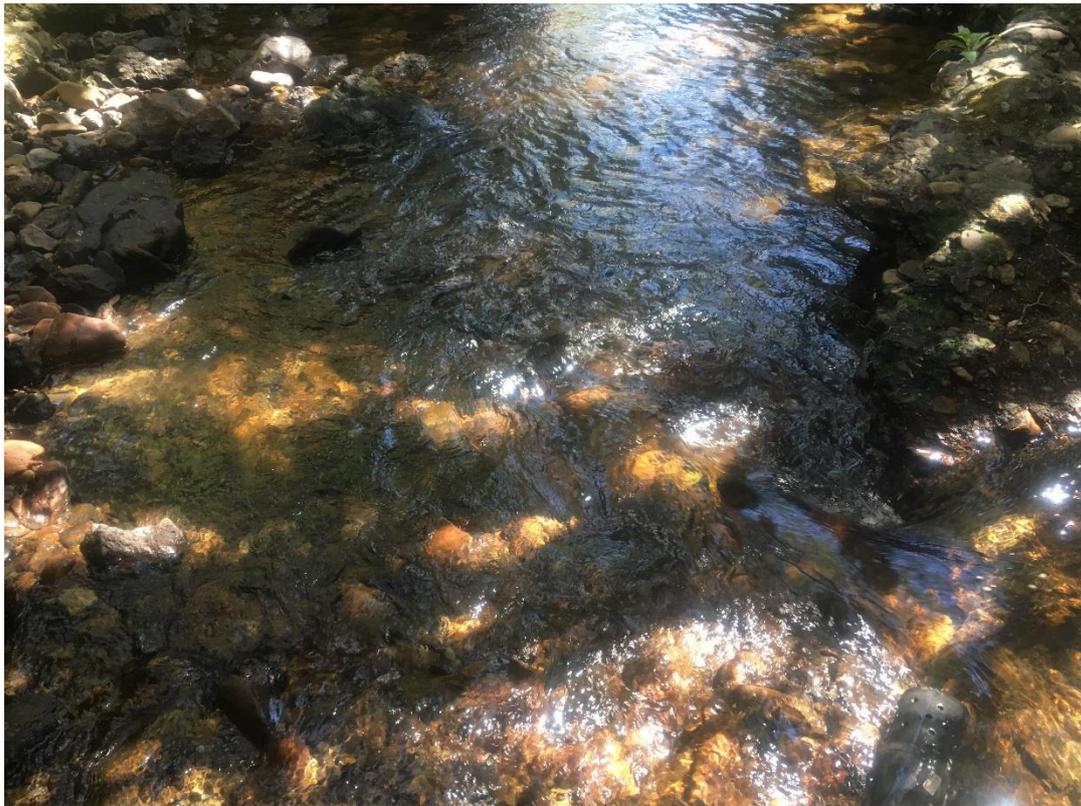
SCC04 Minor impacts upstream



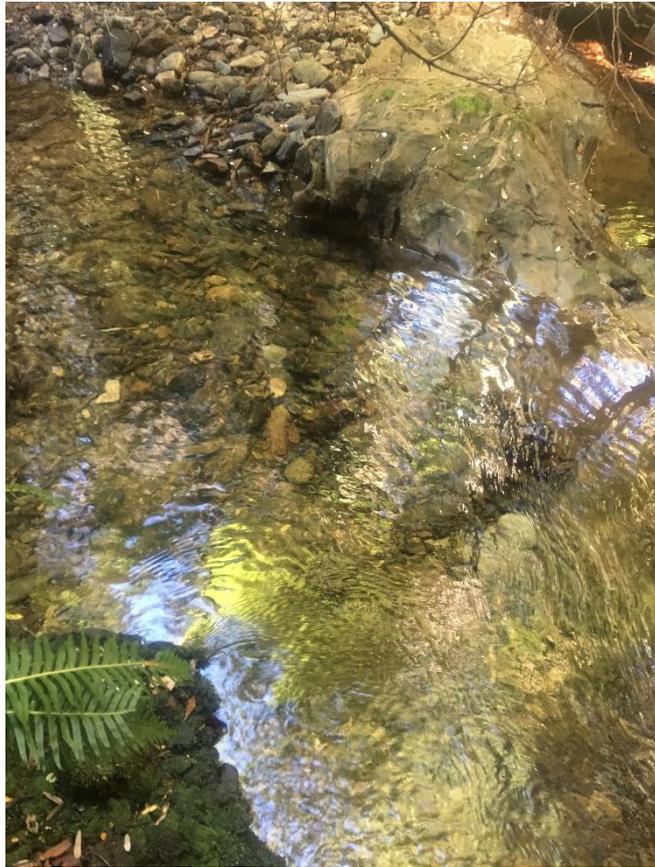
CC05



CC04



CC03



DR01



DR06

NOTES:

Red figures indicate exceedances of the ANZECC Guidelines (80%). These have been applied to the seeps as well, so impacts are more readily identifiable



Shading represents Dundas River Samples.



Shading represents Razorback Mine Samples



Shading represents Comet Creek Samples



Shading represents Comet Creek Mine Samples



Shading represents South Comet Creek Mine Samples

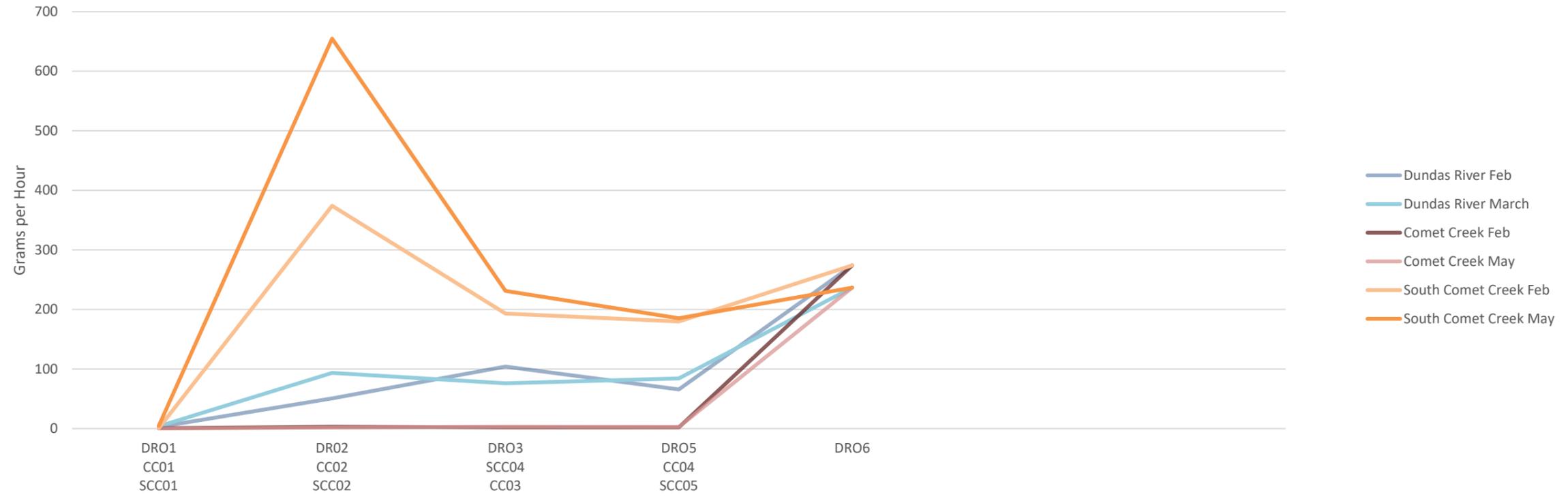
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Analytes	Units	DR01	DR02	DR03	DR04A	DR04B	DR04C	DR05	DR06	CC01	CC02	CC03	CC04	CC05	SCC01	SCC02	SCC03A	SCC03B	SCC04	SCC05	SCC06
Time		11:05 AM	1:25PM	1:40PM	12:45 PM	12:40 PM	12:00 PM	2:00PM	4:30PM	10:40 AM	10:20 AM	2:40PM	3:00PM	2:30PM	9:30AM	10:00 AM	9:05AM	9:15AM	3:40PM	3:30PM	3:21PM
Temperature	C°	10.7	12.3	13.7	15.63	21.09	15.8	13.4	13.8	10.23	10.2	11.63	11.91	11.73	9.9	10.16	11.07	12.1	12.07	12.01	11.75
Potential of hydrogen (PH)	Ph	6.87	7.32	7.7	7.87	7.96	7.21	7.79	7.77	7.37	7.06	7.73	7.58	7.17	6.72	6.62	3.66	3.45	7.34	7.32	7.33
Conductivity (EC)	ms/cm	80	109	121	112	132	255	122	110	76	87	95	99	141	77	1840	1790	1830	142	140	126
Turbidity (NTU)	NTU	0.5	0	2	0.7	5.1	2.9	0	0.2	0.5	0.5	0.4	0	0	0	0	1.1	2.1	0.2	0.6	0
Redox (ORP)	mV	151	92	104	40	64	-21	85	-40	142	130	105	-30	109		212			37	-17	128
Dissolved Oxygen	mg/L	8.27	10.23	9.6	9.85	7.32	7.57	10.04	9.6	11.4	10.15	10.8	10.96	4.94	10.13	9.9	7.36	8.06	10.3	10.2	10.43
Total Dissolved Solids (TDS)	mg/L	0.052	0.071	0.079	0.073	0.086	0.164	0.08	0.071	0.05	0.056	0.062	0.064	0.092	0.05	0.12	1.14	1.17	0.092	0.091	0.82
Flow Rate	L/sec	26.6	87.5	120	40		1.6	130.8	464	70.6	62	85.8	104	2	8.1	20.3	0.3	0.41	43.3	46.7	1.8
Suspended Solids (SS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	16	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as	mg/L	7	22	39	34	29	41	26	22	8	14	21	22	43	6	6	<1	<1	14	14	11
Total Alkalinity as CaCO3	mg/L	7	22	39	34	29	41	26	22	8	14	21	22	43	6	6	<1	<1	14	14	11
Acidity as CaCO3	mg/L	2	2	3	2	2	2	2	3	1	2	2	2	3	2	8	309	303	4	2	3
Sulfate as SO4 - Turbidimetric	mg/L	4	5	6	4	6	58	6	6	3	3	4	4	6	3	52	1050	957	20	20	16
Dissolved Calcium	mg/L	1	3	3	1	1	7	3	3	2	2	3	3	4	1	6	89	89	4	4	2
Dissolved Magnesium	mg/L	2	4	5	7	6	17	5	4	2	2	3	3	7	1	6	89	88	4	4	6
Dissolved Aluminium	mg/L	0.1	0.04	0.04	0.05	0.02	0.01	0.04	0.04	0.02	0.02	0.02	0.02	0.01	0.05	0.05	0.04	0.14	0.04	0.03	0.01
Dissolved Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Cadmium	mg/L	<0.0001	0.0003	0.0003	<0.0001	<0.0001	0.0013	0.0002	0.0005	<0.0001	0.0002	<0.0001	<0.0001	0.0007	<0.0001	0.016	0.408	0.413	0.0043	0.0041	0.0001
Dissolved Chromium	mg/L	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	0.003	0.014	0.13
Dissolved Cobalt	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.103	0.101	0.001	0.001	<0.001
Dissolved Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001
Dissolved Lead	mg/L	0.002	0.004	0.005	0.005	0.002	<0.001	0.004	0.004	<0.001	0.003	0.003	0.003	0.004	<0.001	0.035	0.4	0.514	0.007	0.006	0.006
Dissolved Manganese	mg/L	0.027	0.147	0.214	0.224	0.134	0.019	0.124	0.166	0.013	0.258	0.15	0.139	0.166	0.019	5.02	119	115	1.15	1.04	0.022
Dissolved Nickel	mg/L	<0.001	0.002	0.007	0.022	0.011	0.058	0.007	0.005	<0.001	<0.001	0.003	0.006	0.04	<0.001	0.017	0.33	0.334	0.012	0.012	0.009
Dissolved Zinc	mg/L	<0.005	0.116	0.118	0.01	0.009	0.223	0.072	0.138	0.007	0.015	0.011	0.016	0.132	0.027	5.13	111	112	1.34	1.23	0.019
Dissolved Iron	mg/L	0.45	0.32	0.29	0.44	0.17	0.07	0.28	0.27	0.06	0.46	0.15	0.12	<0.05	0.1	0.28	12.8	5.08	0.13	0.12	<0.05
Total Aluminium	mg/L	0.11	0.06	0.17	0.05	0.03	0.01	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.07	0.06	0.08	0.14	0.07	0.04	0.06
Total Arsenic	mg/L	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
Total Cadmium	mg/L	<0.0001	0.0002	0.0005	<0.0001	<0.0001	0.001	0.0004	0.0004	<0.0001	<0.0001	<0.0001	0.0001	0.0008	<0.0001	0.017	0.442	0.422	0.0044	0.0036	<0.0001
Total Chromium	mg/L	<0.001	<0.001	0.001	0.002	0.002	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.005	<0.001	<0.001	<0.001	<0.001	0.004	0.015	0.148
Total Cobalt	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.11	0.107	0.001	0.001	0.003
Total Copper	mg/L	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	<0.001	<0.001	0.001
Total Lead	mg/L	0.003	0.007	0.022	0.007	0.004	<0.001	0.007	0.005	0.001	0.005	0.005	0.005	0.008	<0.001	0.039	0.616	0.545	0.016	0.013	0.188
Total Manganese	mg/L	0.029	0.161	0.241	0.23	0.163	0.02	0.14	0.164	0.06	0.278	0.152	0.145	0.177	0.021	5.12	123	122	1.24	1.07	0.222
Total Nickel	mg/L	0.005	0.003	0.009	0.023	0.012	0.062	0.008	0.005	<0.001	<0.001	0.003	0.005	0.04	<0.001	0.018	0.355	0.344	0.014	0.012	0.015
Total Zinc	mg/L	0.006	0.131	0.135	0.013	0.01	0.238	0.079	0.152	0.049	0.014	0.01	0.02	0.136	0.029	5.27	120	118	1.46	1.22	0.028
Total Iron	mg/L	0.52	0.52	0.77	0.6	0.26	<0.05	0.49	0.36	0.09	0.58	0.21	0.18	0.1	0.13	0.34	19.2	5.44	0.31	0.18	0.32
Dissolved Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Recoverable Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fluoride	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

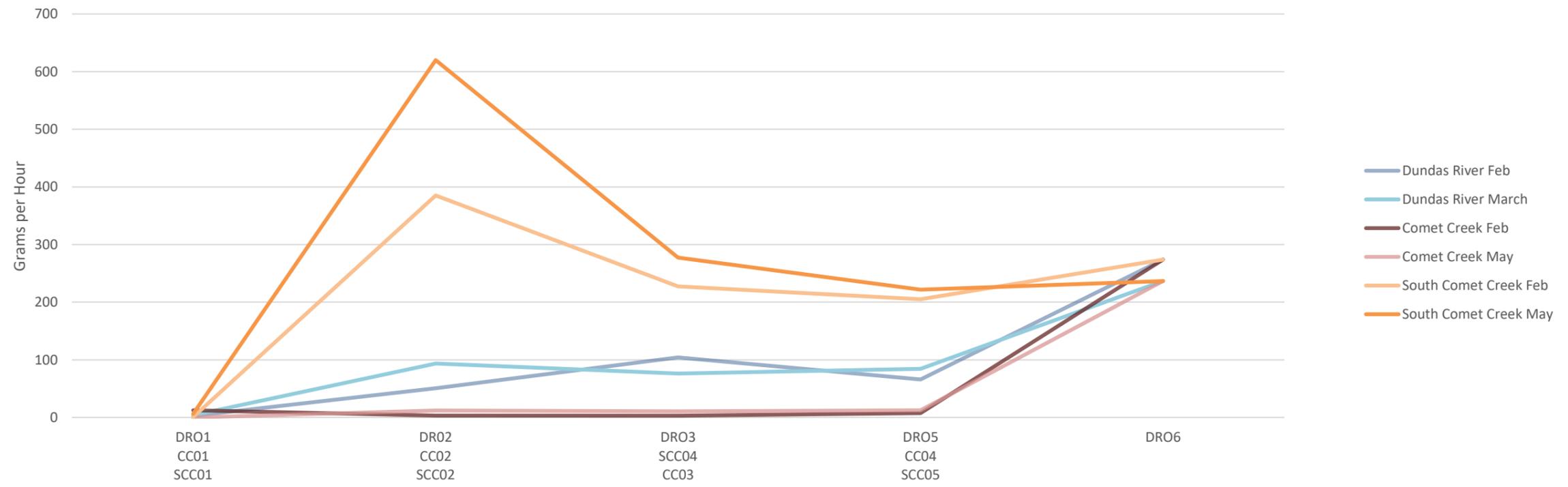
ROUND 2 May 5, 2017

Analytes	Units	DR01	DR02	DR03	DR04A	DR04B	DR04C	DR05	DR06	CC01	CC02	CC03	CC04	CC05	SCC01	SCC02	SCC03A	SCC03B	SCC04	SCC05	SCC06
Time		11:20 AM	11:40 AM	12:45 PM	12:30 PM	12:15 PM	11:55 AM	9:30 AM	2:50 AM	10:55 AM	10:45 AM	1:25 PM	1:35 PM	1:15 PM	10:10 AM	10:25 AM	10:00 AM	9:55 AM	2:15 PM	2:05 PM	2:50 PM
Temperature	C°	9.23	9.62	9.9	10.72	11.6	11	9.54	10.3	8.9	8.98	9.54	9.72	9.56	8.97	8.97	10.81	10.26	9.87	10.27	11.13
Potential of hydrogen (PH)	Ph	6.23	6.15	6.76	6.81	6.82	6.47	7.33	6.63	6.13	5.95	6.49	6.6	6.85	5.7	5.57	3.62	4.45	6.28	6.32	6.45
Conductivity (EC)	ms/cm	68	82	100	110	121	233	6	89	64	72	78	84	79	88	110	1640	1760	11	112	115
Turbidity (NTU)	NTU	0	0	0	0	0	0	0	0.2	0	0	0	0	0	1.3	0	0.5	3.3	0.2	0.6	0
Redox (ORP)	mV	145	163	127	182	173	160	64	212	151	151	131	146	113	218	196	338	206	167	191	187
Dissolved Oxygen	mg/L	12.5	12.8	14.2	12.47	13.05	14.1	9.82	13.4	13.31	14.1	13.5	11.48	11.93	10.39	13.1	12.31	16.2	10.7	13.2	9.39
Total Dissolved Solids (TDS)	mg/L	44	53	64	72	81	152	5	58	30	46	51	53	51	53		1070	1130	72	72	79
Flow Rate	L/sec	47.25	215.1	185.4	47.925	0.16	1.5	162.6	505.97	80.33	238.8	182.7	125.12	1	45.95	80.85	0.27	0.3	84.18	71.5	4.13
Suspended Solids (SS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	30
Hydroxide Alkalinity as	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as	mg/L	5	12	17	36	36	49	20	13	8	9	12	15	12	4	9	<1	<1	10	11	13
Total Alkalinity as CaCO3	mg/L	5	12	17	36	36	49	20	13	8	9	12	15	12	4	9	<1	<1	10	11	13
Acidity as CaCO3	mg/L	3	2	4	3	3	7	2	4	2	2	2	2	2	2	5	332	359	4	3	3
Sulfate as SO4 -	mg/L	5	5	5	5	7	48	6	6	3	3	4	4	3	3	24	1050	1140	14	14	17
Dissolved Calcium	mg/L	2	2	2	1	1	6	2	2	2	2	2	2	2	1	3	88	97	3	3	2
Dissolved Magnesium	mg/L	2	3	4	8	7	16	4	3	2	2	3	3	2	2	3	80	86	4	4	6
Dissolved Aluminium	mg/L	0.14	0.08	0.06	0.04	0.04	0.01	0.07	0.08	0.04	0.04	0.03	0.04	0.04	0.07	0.08	0.3	0.02	0.06	0.06	0.01
Dissolved Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Cadmium	mg/L	<0.0001	0.0004	0.0003	<0.0001	0.0001	0.001	0.0002	0.0003	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0002	0.0054	0.324	0.335	0.0022	0.0021	<0.0001
Dissolved Chromium	mg/L	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.007	0.137
Dissolved Cobalt	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.104	0.112	<0.001	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
Dissolved Lead	mg/L	0.002	0.004	0.003	0.004	0.001	<0.001	0.004	0.004	<0.001	0.002	0.002	0.002	0.002	<0.001	0.016	0.605	0.333	0.006	0.006	0.007
Dissolved Manganese	mg/L	0.018	0.108	0.128	0.217	0.146	0.024	0.103	0.117	0.019	0.133	0.106	0.104	0.102	0.02	2.07	122	132	0.689	0.659	0.012
Dissolved Nickel	mg/L	<0.001	0.002	0.008	0.026	0.02	0.048	0.008	0.005	<0.001	<0.001	0.002	0.005	0.002	<0.001	0.008	0.343	0.369	0.008	0.008	0.01
Dissolved Zinc	mg/L	0.007	0.117	0.1	0.013	0.026	0.196	0.078	0.106	0.016	0.012	0.011	0.02	0.011	0.036	2.01	106	113	0.833	0.809	0.01
Dissolved Iron	mg/L	0.44	0.34	0.27	0.33	0.16	<0.05	0.28	0.24	0.07	0.27	0.14	0.11	0.13	0.1	0.2	4.42	10.7	0.14	0.18	<0.05
Total Aluminium	mg/L	0.18	0.11	0.11	0.08	0.06	<0.01	0.11	0.11	0.06	0.07	0.12	0.13	0.05	0.11	0.09	0.32	0.02	0.11	0.07	0.11
Total Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Cadmium	mg/L	<0.0001	0.0004	0.0003	<0.0001	0.0002	0.001	0.0004	0.0002	<0.0001	<0.0001	<0.0001	0.0002	0.0001	0.0001	0.0065	0.355	0.37	0.0023	0.0025	<0.0001
Total Chromium	mg/L	<0.001	<0.001	0.001	0.003	0.002	<0.001	0.001	0.002	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.009	0.154
Total Cobalt	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.113	0.121	<0.001	<0.001	0.002
Total Copper	mg/L	0.004	0.001	0.001	<0.001	0.001	<0.001	0.002	0.002	<0.001	0.001	0.001	0.002	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.002
Total Lead	mg/L	0.003	0.006	0.004	0.006	0.005	<0.001	0.016	0.005	0.001	0.004	0.018	0.024	0.009	0.001	0.02	0.689	0.373	0.009	0.008	0.248
Total Manganese	mg/L	0.023	0.121	0.114	0.253	0.185	0.022	0.144	0.13	0.013	0.153	0.21	0.19	0.117	0.028	2.25	136	146	0.763	0.72	0.332
Total Nickel	mg/L	<0.001	0.003	0.008	0.03	0.022	0.052	0.009	0.006	<0.001	0.001	0.003	0.008	0.002	<0.001	0.009	0.362	0.39	0.009	0.008	0.02
Total Zinc	mg/L	0.006	0.12	0.086	0.014	0.032	0.2	0.097	0.114	<0.005	0.014	0.016	0.028	0.012	0.039	2.13	113	121	0.915	0.862	0.038
Total Iron	mg/L	0.63	0.5	0.41	0.54	0.38	<0.05	0.55	0.37	0.12	0.36	0.46	0.51	0.19	0.15	0.27	5.25	11.8	0.23	0.21	0.62
Dissolved Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Recoverable Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fluoride	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

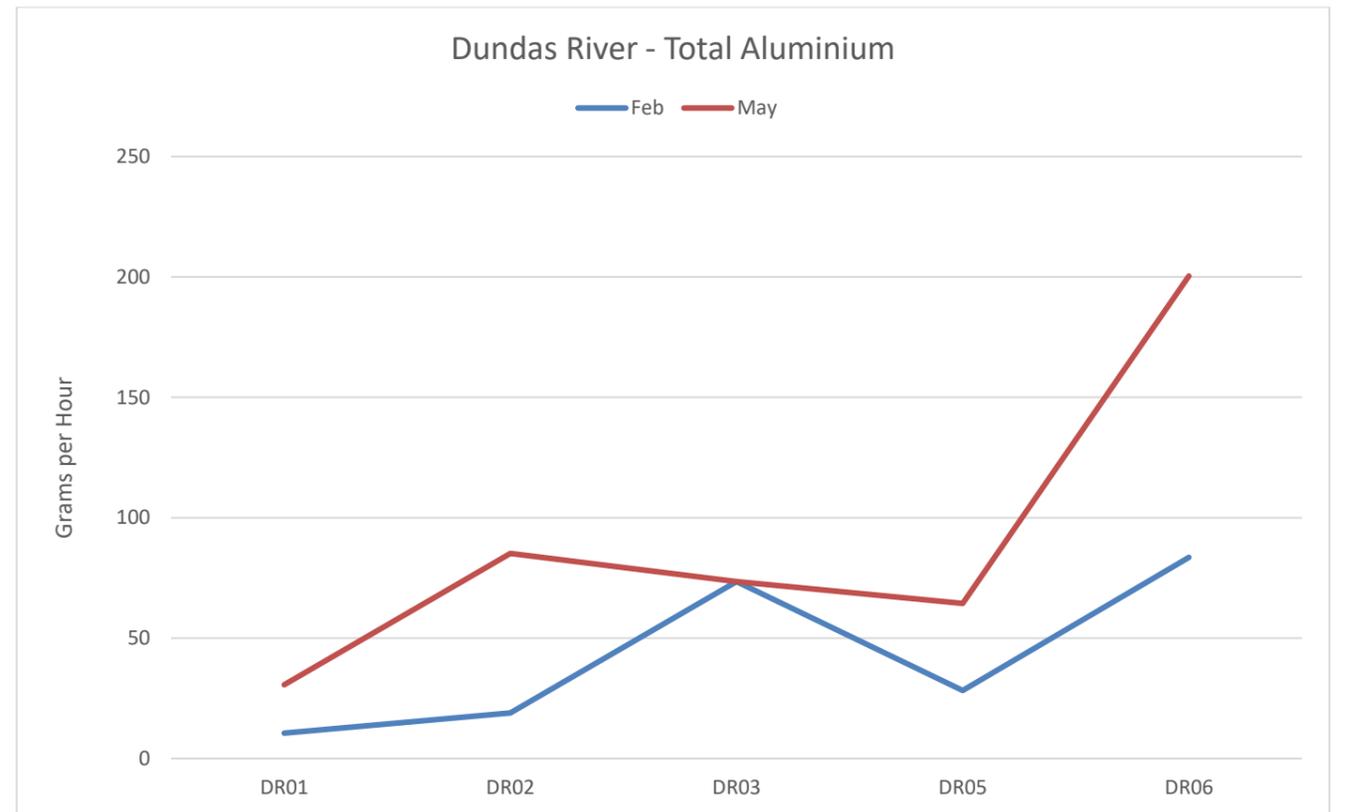
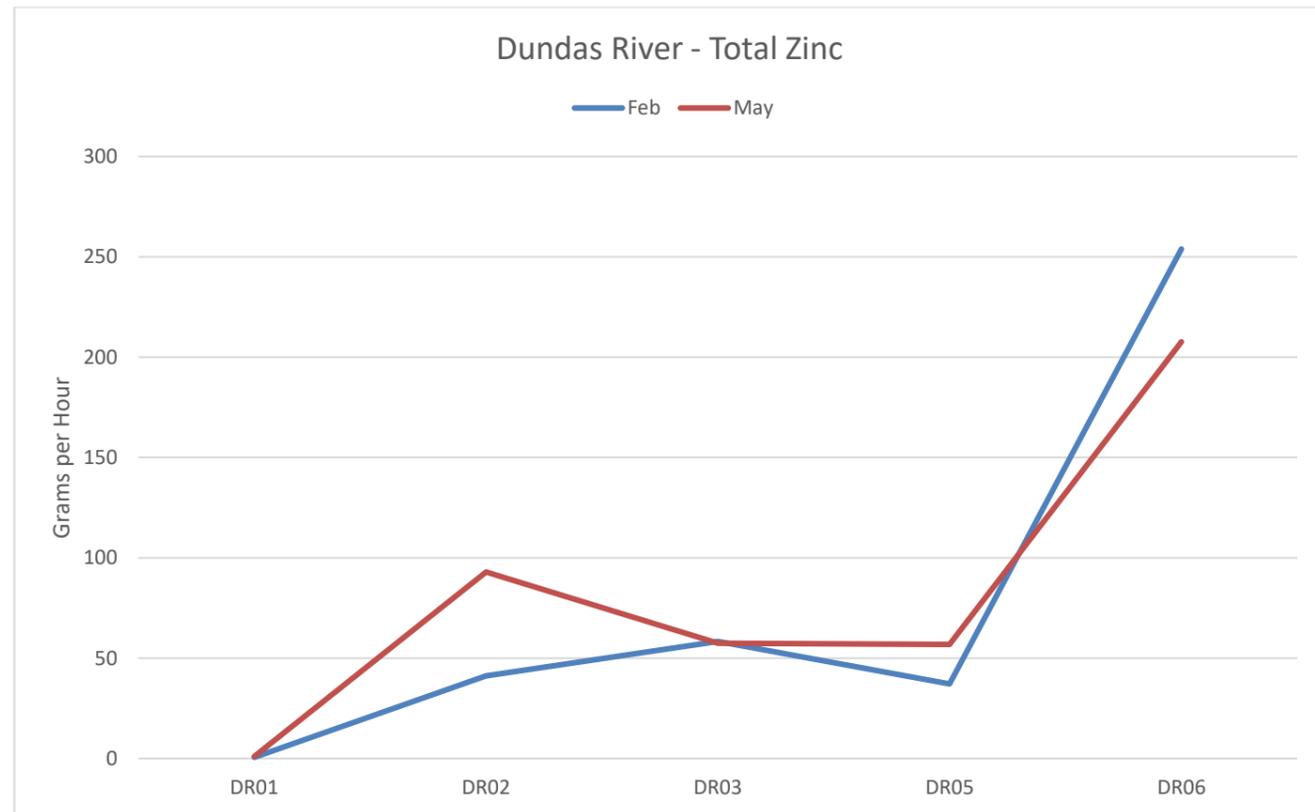
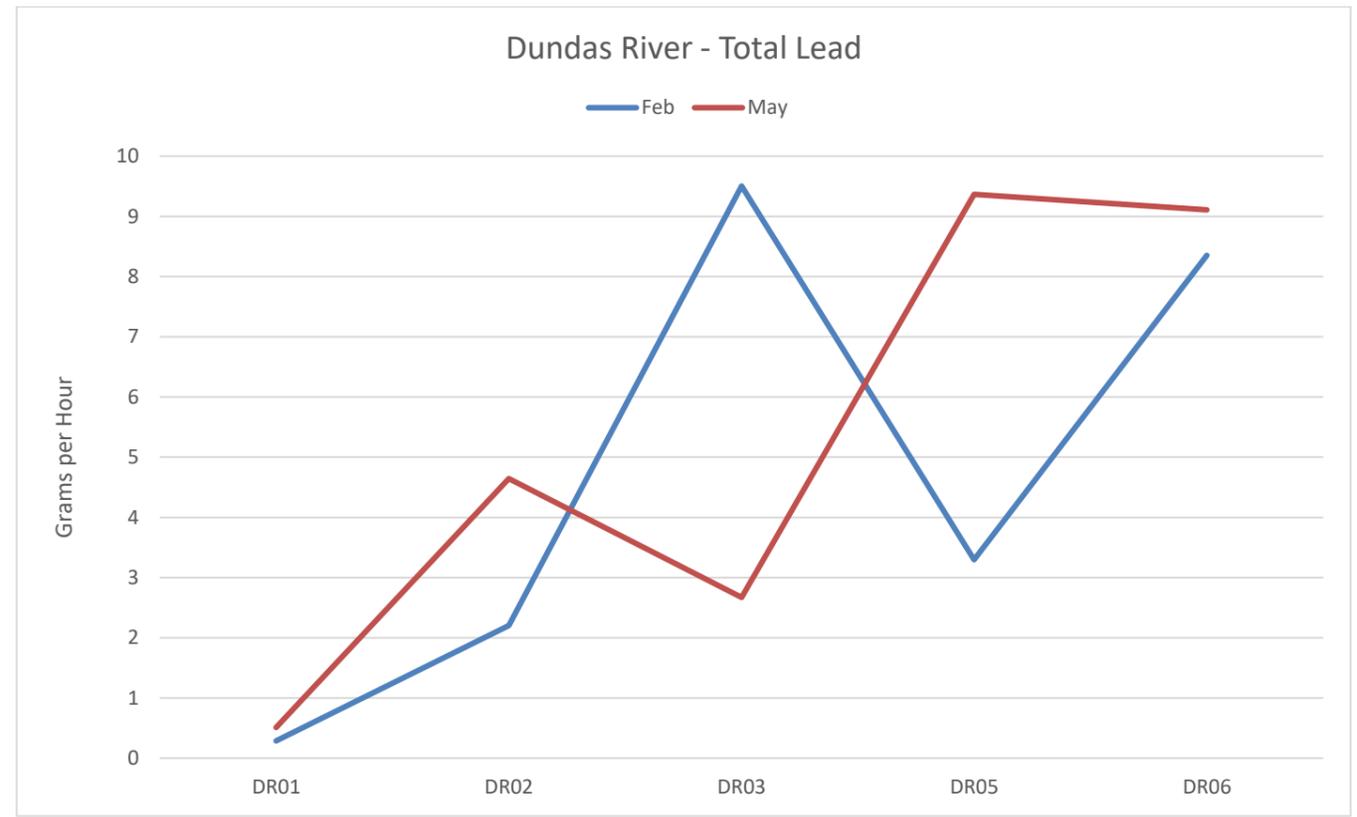
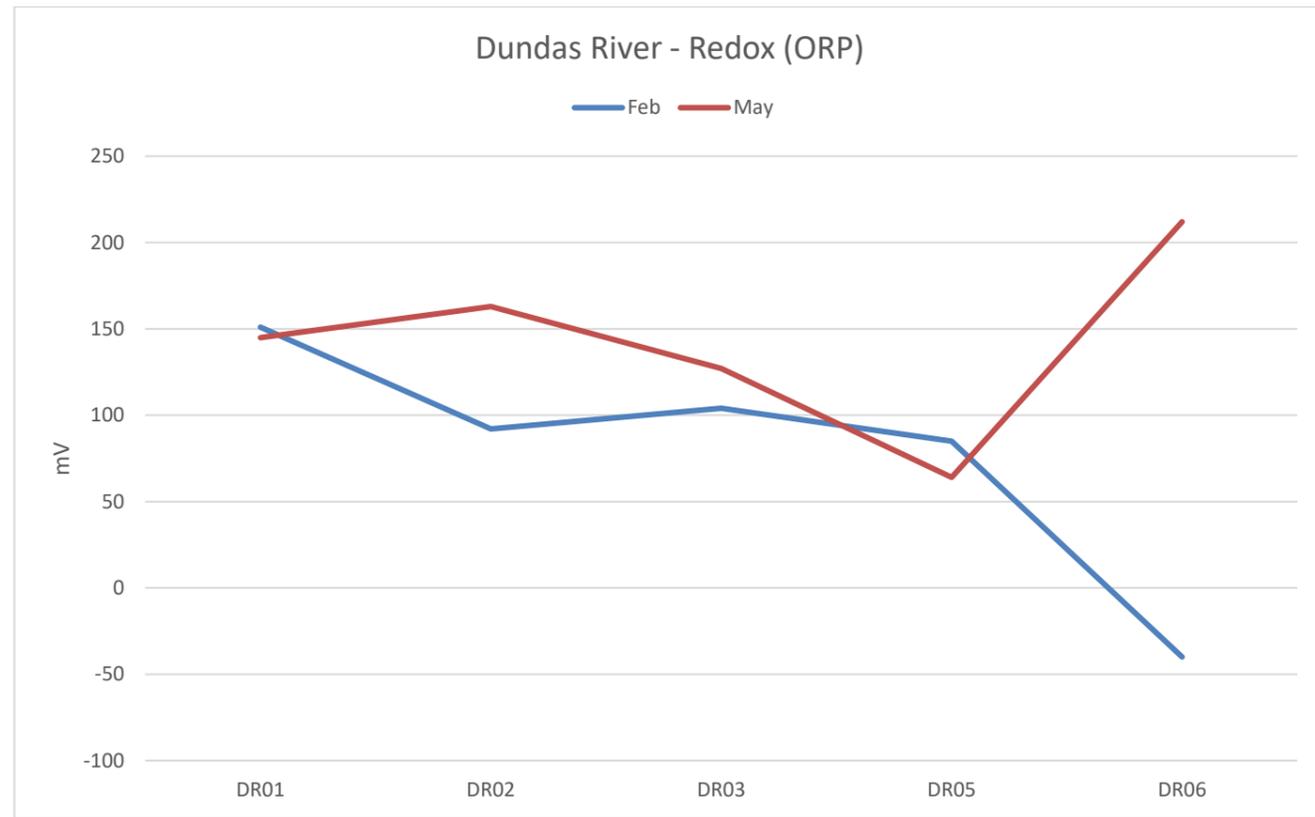
Total Manganese



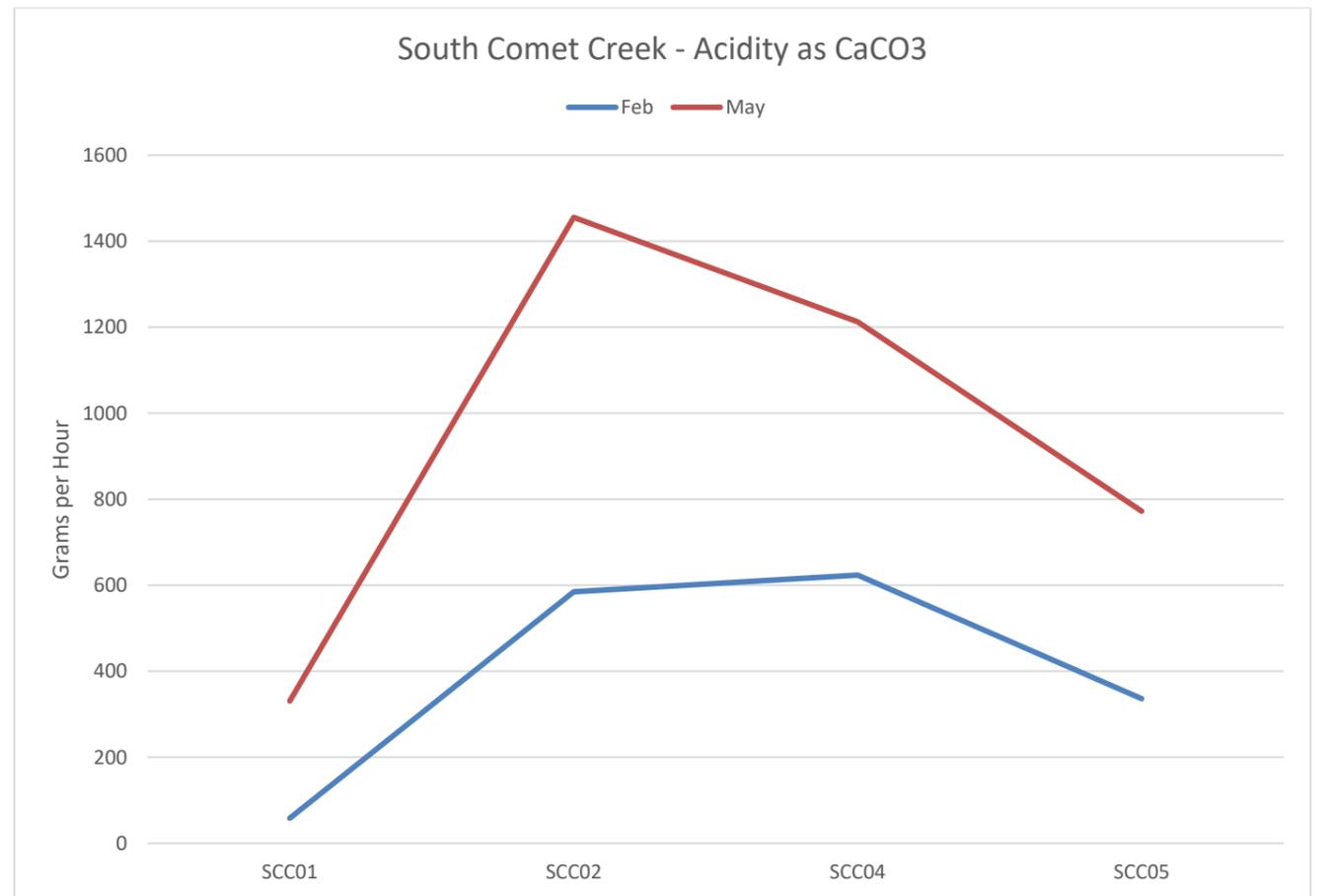
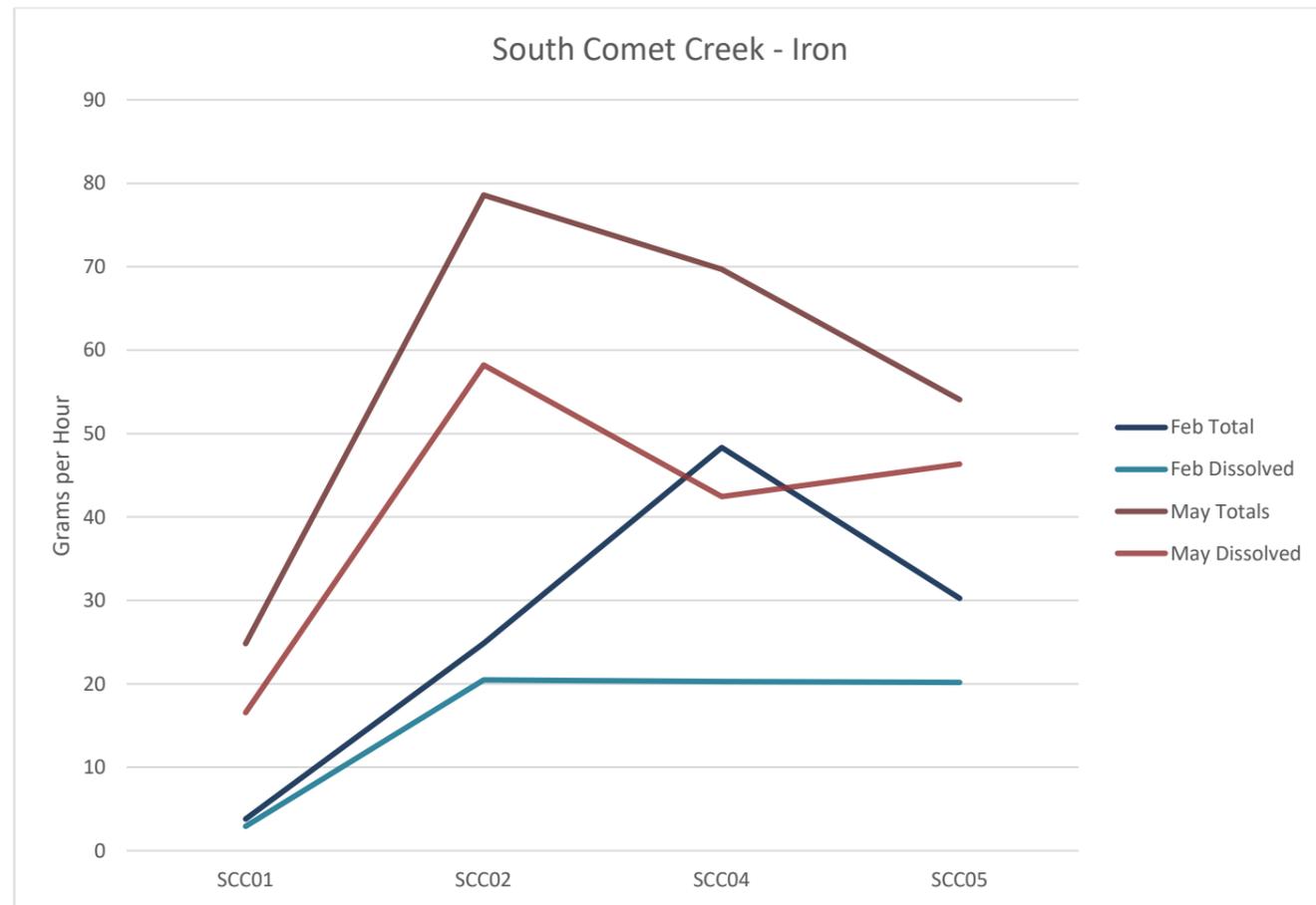
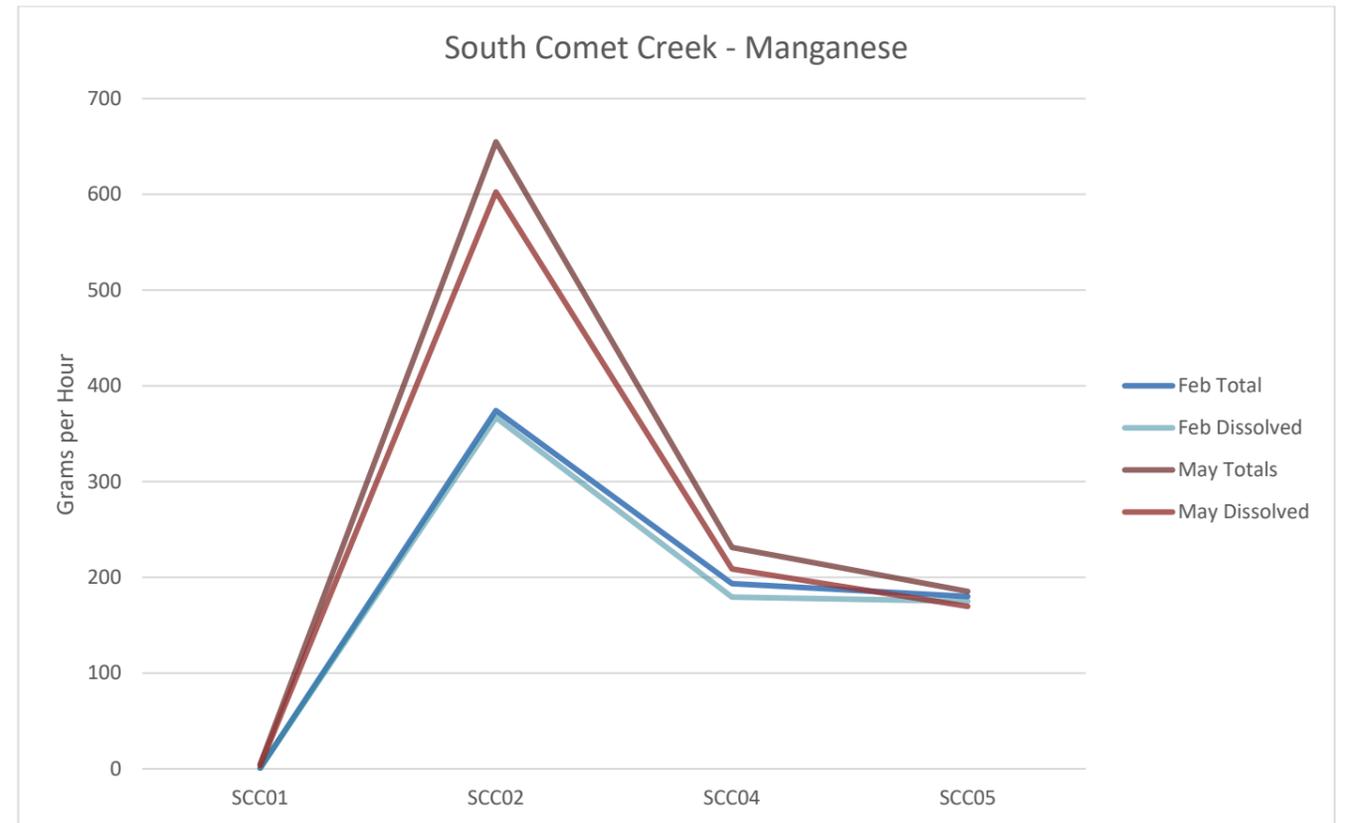
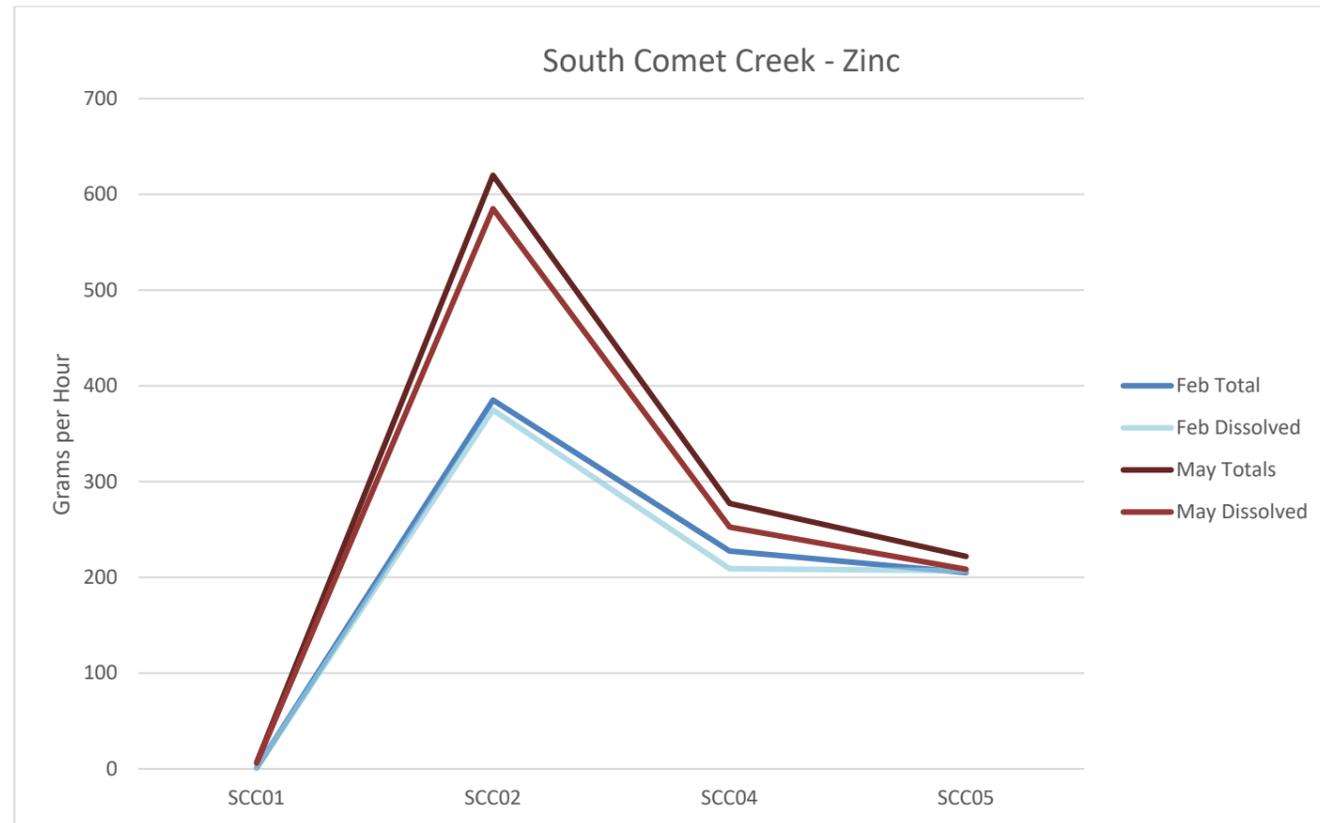
Total Zinc



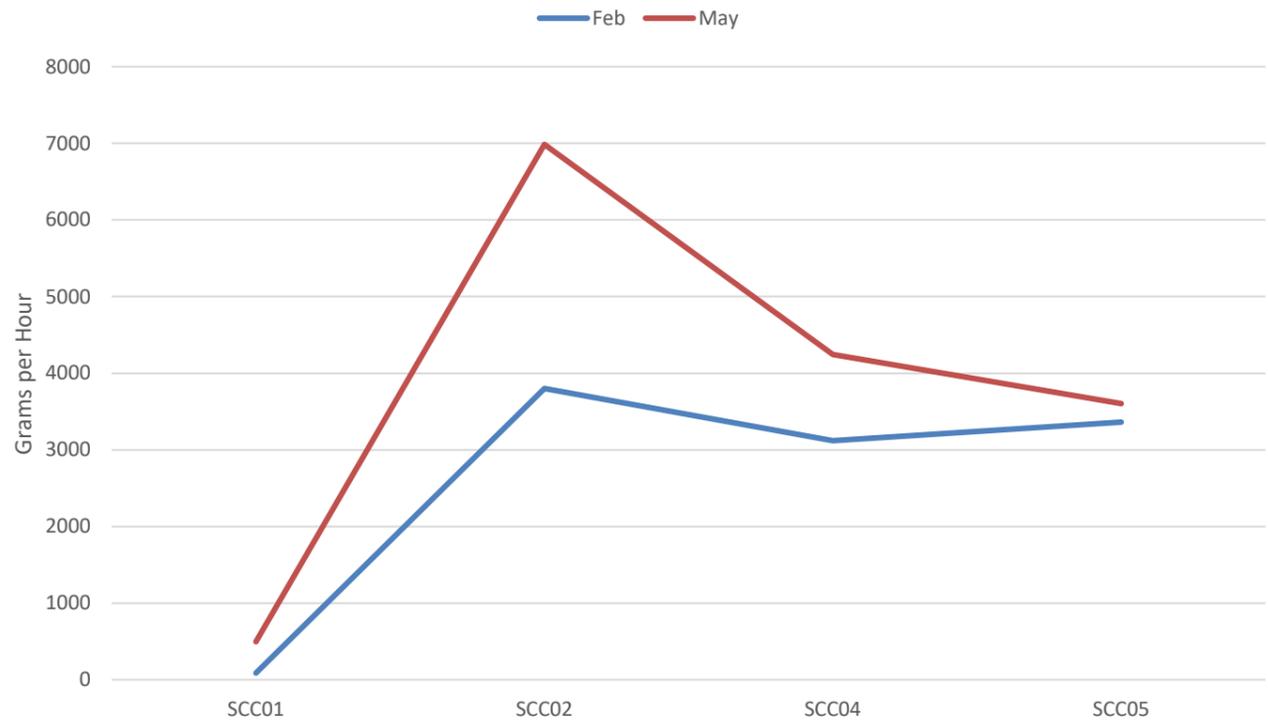
Dundas River



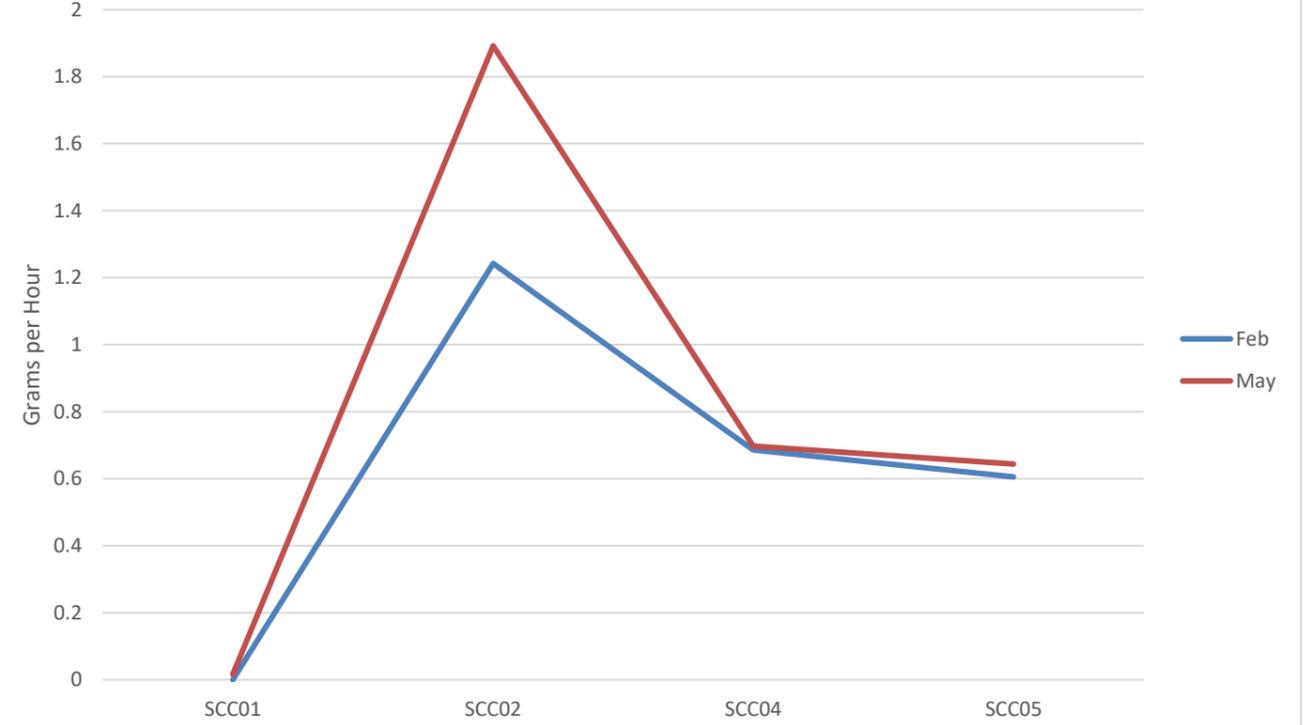
South Comet Creek



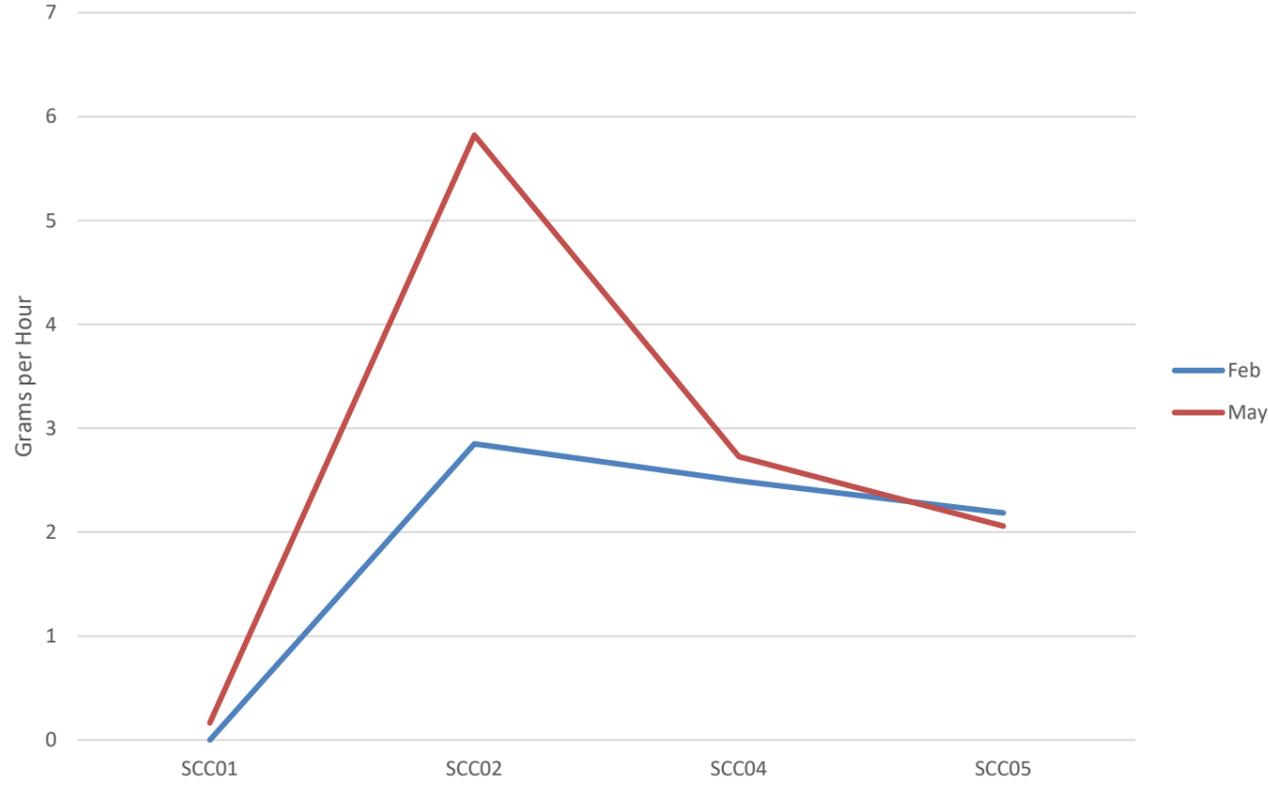
South Comet Creek - Sulfate as SO4 - Turbidimetric



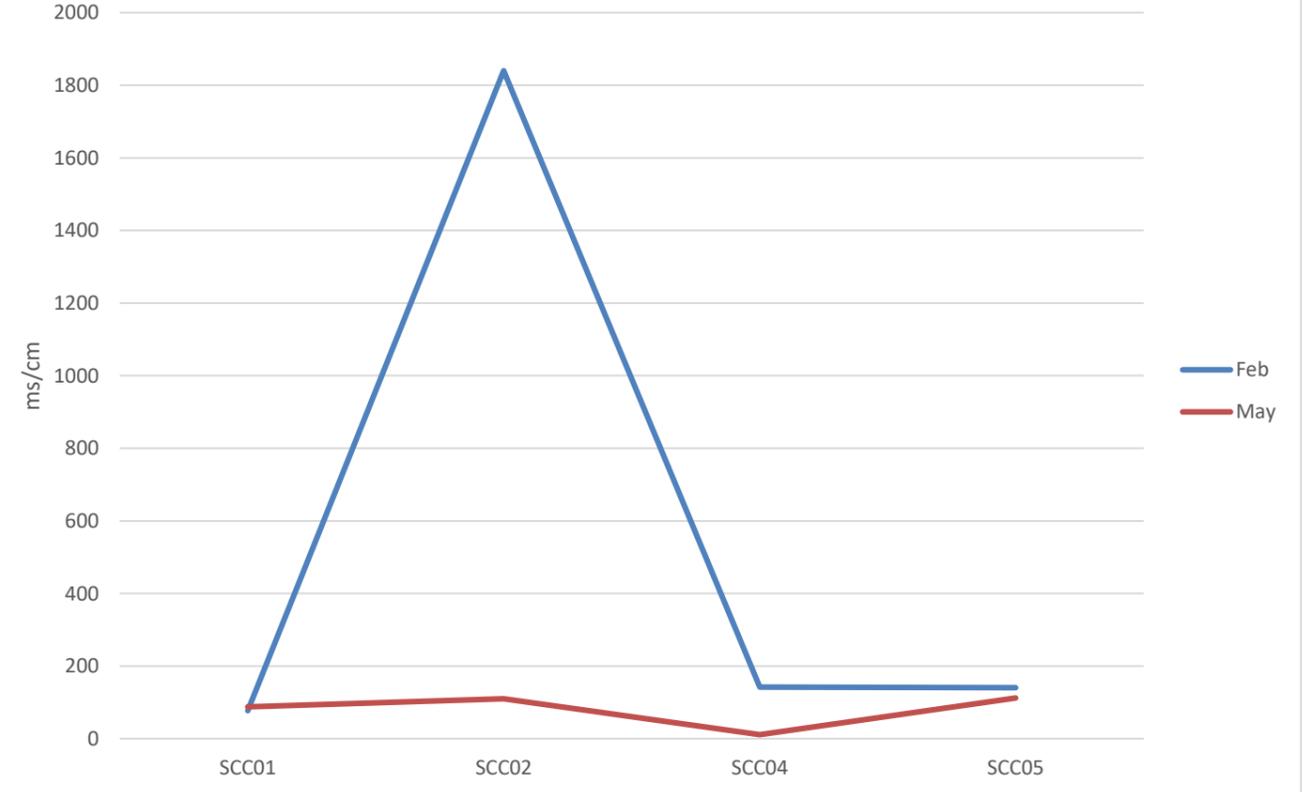
South Comet Creek - Dissolved Cadmium

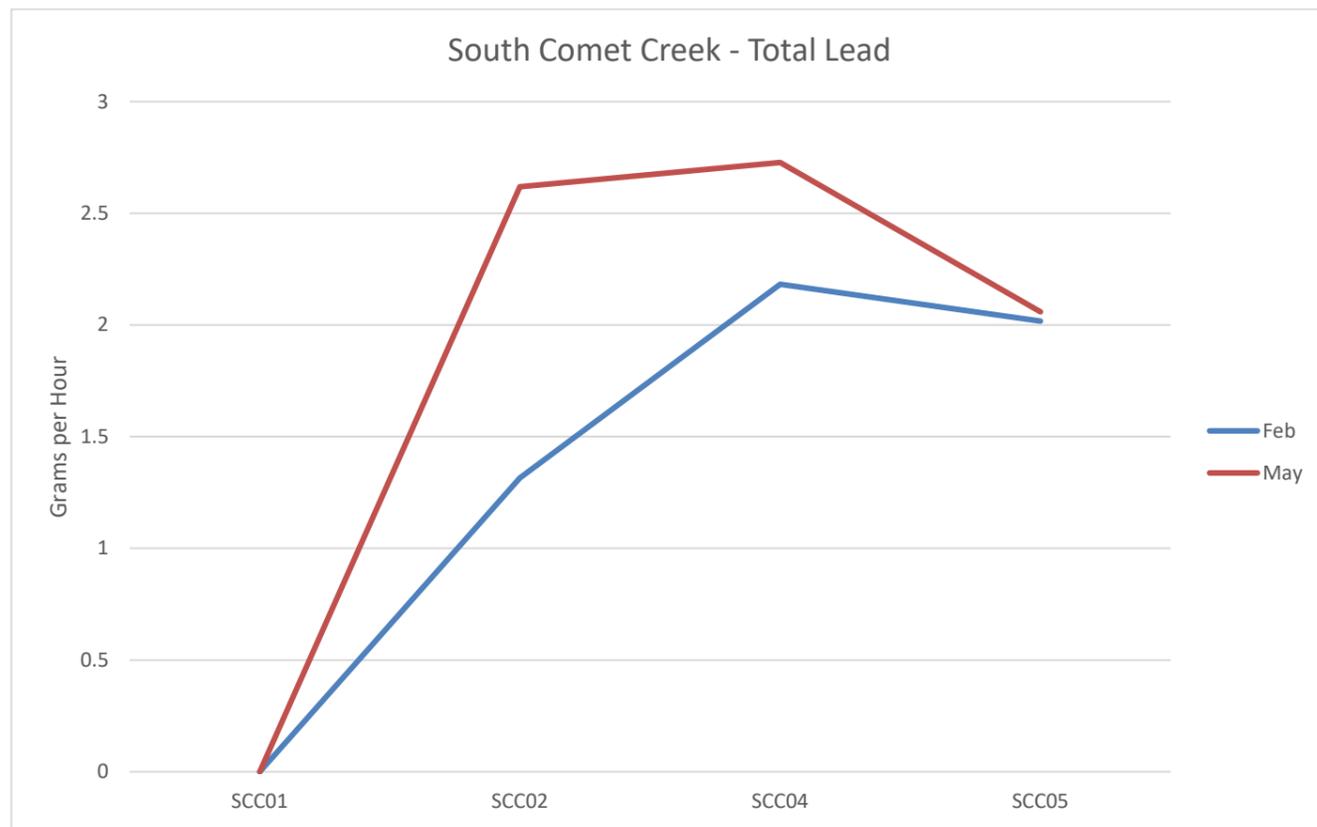


South Comet Creek - Total Lead

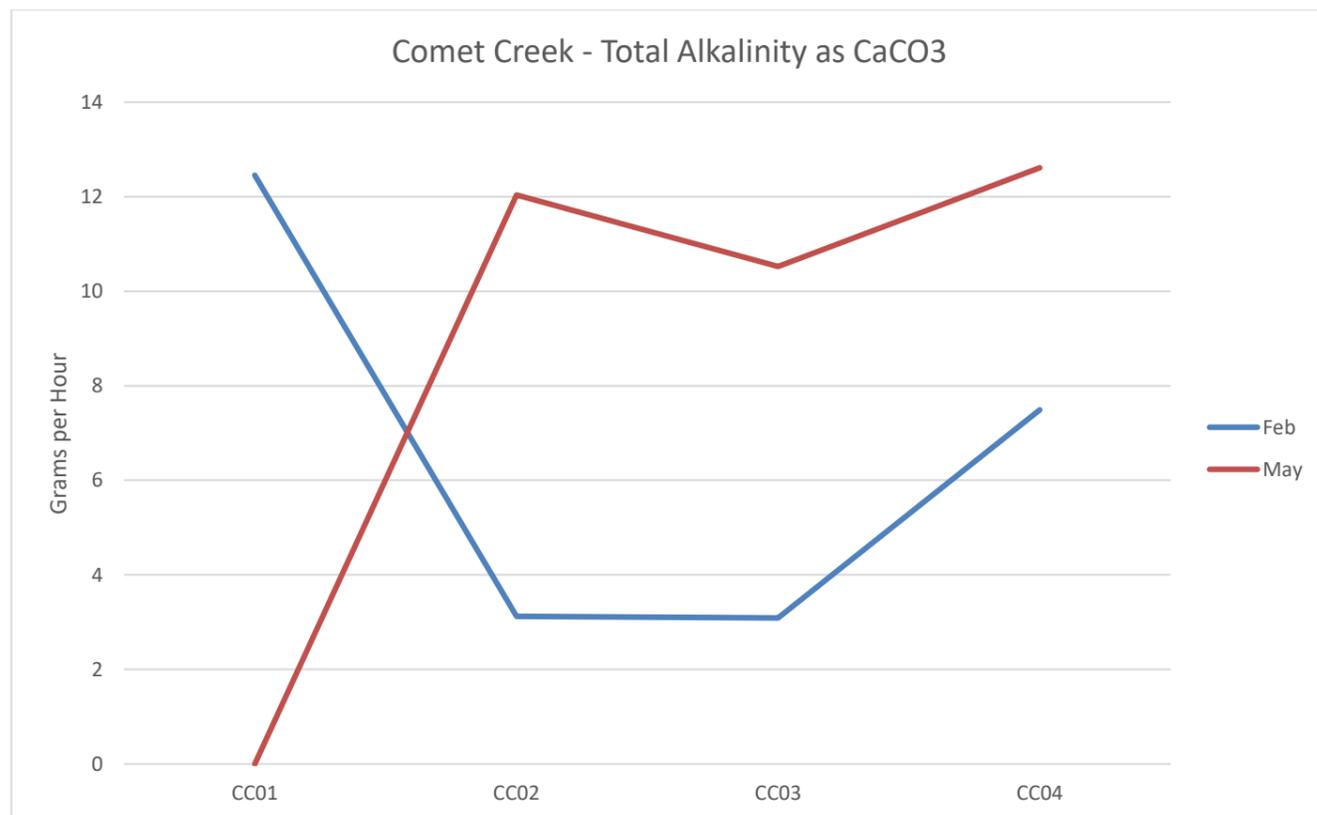


South Comet Creek - EC





Comet Creek



Appendix 3 – Analytical Results

CERTIFICATE OF ANALYSIS

Work Order	: EM1702193	Page	: 1 of 6
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Contact	: Shirley LeCornu
Address	: 14 CATTLEY ST. PO BOX 651 BURNIE TASMANIA, AUSTRALIA 7320	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6442 4037	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 28-Feb-2017 09:05
Order number	: ----	Date Analysis Commenced	: 01-Mar-2017
C-O-C number	: ----	Issue Date	: 07-Mar-2017 14:34
Sampler	: AC, RC		
Site	: ----		
Quote number	: MEQB-167-15		
No. of samples received	: 10		
No. of samples analysed	: 10		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 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.

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.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR06	DR01	SCC01	SCC02	SCC03A
Client sampling date / time				27-Feb-2017 16:30	27-Feb-2017 11:05	27-Feb-2017 11:05	27-Feb-2017 00:00	27-Feb-2017 09:05	
Compound	CAS Number	LOR	Unit	EM1702193-001	EM1702193-002	EM1702193-003	EM1702193-004	EM1702193-005	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	16	
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	22	7	6	6	<1	
Total Alkalinity as CaCO3	----	1	mg/L	22	7	6	6	<1	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	3	2	2	8	309	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	4	3	52	1050	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	3	1	1	6	89	
Magnesium	7439-95-4	1	mg/L	4	2	1	6	89	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.04	0.10	0.05	0.05	0.04	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0005	<0.0001	<0.0001	0.0160	0.408	
Chromium	7440-47-3	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.001	<0.001	<0.001	0.002	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.004	0.103	
Nickel	7440-02-0	0.001	mg/L	0.005	<0.001	<0.001	0.017	0.330	
Lead	7439-92-1	0.001	mg/L	0.004	0.002	<0.001	0.035	0.400	
Zinc	7440-66-6	0.005	mg/L	0.138	<0.005	0.027	5.13	111	
Manganese	7439-96-5	0.001	mg/L	0.166	0.027	0.019	5.02	119	
Iron	7439-89-6	0.05	mg/L	0.27	0.45	0.10	0.28	12.8	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.05	0.11	0.07	0.06	0.08	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.004	
Cadmium	7440-43-9	0.0001	mg/L	0.0004	<0.0001	<0.0001	0.0170	0.442	
Chromium	7440-47-3	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	<0.001	<0.001	0.003	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.004	0.110	
Nickel	7440-02-0	0.001	mg/L	0.005	0.005	<0.001	0.018	0.355	
Lead	7439-92-1	0.001	mg/L	0.005	0.003	<0.001	0.039	0.616	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR06	DR01	SCC01	SCC02	SCC03A
Client sampling date / time				27-Feb-2017 16:30	27-Feb-2017 11:05	27-Feb-2017 11:05	27-Feb-2017 00:00	27-Feb-2017 09:05	
Compound	CAS Number	LOR	Unit	EM1702193-001	EM1702193-002	EM1702193-003	EM1702193-004	EM1702193-005	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.152	0.006	0.029	5.27	120	
Manganese	7439-96-5	0.001	mg/L	0.164	0.029	0.021	5.12	123	
Iron	7439-89-6	0.05	mg/L	0.36	0.52	0.13	0.34	19.2	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SCC06	SCC04	CC02	CC03	CC04
Client sampling date / time				27-Feb-2017 15:21	27-Feb-2017 15:40	27-Feb-2017 10:20	27-Feb-2017 14:40	27-Feb-2017 15:00	
Compound	CAS Number	LOR	Unit	EM1702193-006	EM1702193-007	EM1702193-008	EM1702193-009	EM1702193-010	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
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	11	14	14	21	22	
Total Alkalinity as CaCO3	----	1	mg/L	11	14	14	21	22	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	3	4	2	2	2	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	16	20	3	4	4	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	4	2	3	3	
Magnesium	7439-95-4	1	mg/L	6	4	2	3	3	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.04	0.02	0.02	0.02	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.002	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0043	0.0002	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	0.130	0.003	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.009	0.012	<0.001	0.003	0.006	
Lead	7439-92-1	0.001	mg/L	0.006	0.007	0.003	0.003	0.003	
Zinc	7440-66-6	0.005	mg/L	0.019	1.34	0.015	0.011	0.016	
Manganese	7439-96-5	0.001	mg/L	0.022	1.15	0.258	0.150	0.139	
Iron	7439-89-6	0.05	mg/L	<0.05	0.13	0.46	0.15	0.12	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.06	0.07	0.03	0.03	0.02	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.002	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0044	<0.0001	<0.0001	0.0001	
Chromium	7440-47-3	0.001	mg/L	0.148	0.004	<0.001	<0.001	0.001	
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	0.003	0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.015	0.014	<0.001	0.003	0.005	
Lead	7439-92-1	0.001	mg/L	0.188	0.016	0.005	0.005	0.005	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SCC06	SCC04	CC02	CC03	CC04
Client sampling date / time				27-Feb-2017 15:21	27-Feb-2017 15:40	27-Feb-2017 10:20	27-Feb-2017 14:40	27-Feb-2017 15:00	
Compound	CAS Number	LOR	Unit	EM1702193-006	EM1702193-007	EM1702193-008	EM1702193-009	EM1702193-010	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.028	1.46	0.014	0.010	0.020	
Manganese	7439-96-5	0.001	mg/L	0.222	1.24	0.278	0.152	0.145	
Iron	7439-89-6	0.05	mg/L	0.32	0.31	0.58	0.21	0.18	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	

QUALITY CONTROL REPORT

Work Order	: EM1702193	Page	: 1 of 7
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Contact	: Shirley LeCornu
Address	: 14 CATTLEY ST. PO BOX 651 BURNIE TASMANIA, AUSTRALIA 7320	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6442 4037	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 28-Feb-2017
Order number	: ----	Date Analysis Commenced	: 01-Mar-2017
C-O-C number	: ----	Issue Date	: 07-Mar-2017
Sampler	: AC, RC		
Site	: ----		
Quote number	: MEQB-167-15		
No. of samples received	: 10		
No. of samples analysed	: 10		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 774603)									
EM1702189-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	6	8	31.6	No Limit
EM1702193-009	CC03	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 774875)									
EM1702193-010	CC04	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	22	20	4.85	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	22	20	4.85	0% - 20%
EM1702193-002	DR01	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	7	6	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	7	6	0.00	No Limit
ED038: Acidity (QC Lot: 774876)									
EM1702193-003	SCC01	ED038-P: Acidity as CaCO3	----	1	mg/L	2	2	0.00	No Limit
EM1702197-002	Anonymous	ED038-P: Acidity as CaCO3	----	1	mg/L	2	2	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 773430)									
EM1702191-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	140	140	0.00	0% - 20%
EM1702196-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	67	67	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 773583)									
EM1702193-004	SCC02	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	6	6	0.00	No Limit
EM1702153-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	14	14	0.00	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 773585)									
EM1702193-001	DR06	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0005	0.0005	0.00	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 773585) - continued									
EM1702193-001	DR06	EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.166	0.156	6.58	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.005	0.004	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.138	0.132	4.79	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.04	0.05	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.27	0.24	9.90	No Limit
EM1702153-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.011	0.010	0.00	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.016	0.016	0.00	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.092	0.096	4.26	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.47	0.48	3.94	0% - 20%
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit		
EG020T: Total Metals by ICP-MS (QC Lot: 773590)									
EM1702193-001	DR06	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0006	44.5	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.164	0.162	1.02	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.152	0.142	6.49	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.05	0.06	0.00	No Limit
EG020A-T: Iron	7439-89-6	0.05	mg/L	0.36	0.35	0.00	No Limit		
EM1702193-010	CC04	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.005	0.004	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.145	0.143	1.71	0% - 20%

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 Project : 5733



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 773590) - continued									
EM1702193-010	CC04	EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.020	0.023	17.1	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.02	0.02	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.18	0.18	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 773584)									
EM1702126-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	0.0001	0.0002	0.00	No Limit
EM1702193-003	SCC01	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 772703)									
EM1702189-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1702193-005	SCC03A	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 774874)									
EM1702193-010	CC04	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EM1702193-002	DR01	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 774603)									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	98.0	90	111	
ED037P: Alkalinity by PC Titrator (QCLot: 774875)									
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	101	90	110	
ED038: Acidity (QCLot: 774876)									
ED038-P: Acidity as CaCO3	----	----	mg/L	----	100 mg/L	113	88	119	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773430)									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1 <1	25 mg/L 100 mg/L	105 103	92 92	115 115	
ED093F: Dissolved Major Cations (QCLot: 773583)									
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	101	92	108	
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	103	92	108	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773585)									
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	101	93	105	
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.2	94	108	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	104	86	108	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	90.2	86	110	
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	91.7	88	108	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.4	87	107	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.6	87	109	
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.2	87	109	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	92.0	87	109	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.6	87	107	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.7	94	106	
EG020T: Total Metals by ICP-MS (QCLot: 773590)									
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	105	100	110	
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	102	94	113	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	104	88	110	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.8	87	112	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	88	113	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.2	87	112	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.8	88	113	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.8	88	112	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.7	91	111	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	100	88	112	



Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG020T: Total Metals by ICP-MS (QCLot: 773590) - continued									
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	104	99	110	
EG035F: Dissolved Mercury by FIMS (QCLot: 773584)									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	107	88	117	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772703)									
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.6	87	113	
EK040P: Fluoride by PC Titrator (QCLot: 774874)									
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	101	85	112	

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	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%)		Recovery Limits (%)	
					MS	Low	High	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773430)								
EM1702191-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773585)								
EM1702153-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	98.3	85	131	
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	104	81	133	
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	95.2	71	135	
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	95.2	78	132	
		EG020A-F: Copper	7440-50-8	0.2 mg/L	92.7	76	130	
		EG020A-F: Lead	7439-92-1	0.2 mg/L	95.3	75	133	
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	95.5	64	134	
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	94.3	73	131	
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	96.4	75	131	
EG020T: Total Metals by ICP-MS (QCLot: 773590)								
EM1702193-001	DR06	EG020A-T: Arsenic	7440-38-2	1 mg/L	100	82	118	
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	107	75	129	
		EG020A-T: Chromium	7440-47-3	1 mg/L	91.0	80	118	
		EG020A-T: Cobalt	7440-48-4	1 mg/L	93.4	82	120	
		EG020A-T: Copper	7440-50-8	1 mg/L	92.6	81	115	
		EG020A-T: Lead	7439-92-1	1 mg/L	97.1	83	121	
		EG020A-T: Manganese	7439-96-5	1 mg/L	95.9	73	123	
		EG020A-T: Nickel	7440-02-0	1 mg/L	95.8	80	118	
		EG020A-T: Zinc	7440-66-6	1 mg/L	97.7	74	116	



Sub-Matrix: **WATER**

				<i>Matrix Spike (MS) Report</i>			
				<i>Spike</i>	<i>SpikeRecovery(%)</i>	<i>Recovery Limits (%)</i>	
<i>Laboratory sample ID</i>	<i>Client sample ID</i>	<i>Method: Compound</i>	<i>CAS Number</i>	<i>Concentration</i>	<i>MS</i>	<i>Low</i>	<i>High</i>
EG035F: Dissolved Mercury by FIMS (QCLot: 773584)							
EM1702153-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	77.7	70	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772703)							
EM1702191-009	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	87.7	70	130
EK040P: Fluoride by PC Titrator (QCLot: 774874)							
EM1702193-001	DR06	EK040P: Fluoride	16984-48-8	5 mg/L	105	70	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM1702193	Page	: 1 of 8
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 28-Feb-2017
Site	: ----	Issue Date	: 07-Mar-2017
Sampler	: AC, RC	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10

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

- **NO Quality Control Sample Frequency Outliers exist.**



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	EM1702191--002	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

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	
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
DR06, SCC01, SCC03A, SCC04, CC03,	DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	06-Mar-2017	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
DR06, SCC01, SCC03A, SCC04, CC03,	DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	13-Mar-2017	✓
ED038: Acidity								
Clear Plastic Bottle - Natural (ED038-P)								
DR06, SCC01, SCC03A, SCC04, CC03,	DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	13-Mar-2017	✓



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) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	01-Mar-2017	27-Mar-2017	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	26-Aug-2017	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	01-Mar-2017	26-Aug-2017	✓	02-Mar-2017	26-Aug-2017	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) DR06, SCC01, SCC03A, SCC04, CC03, DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	01-Mar-2017	27-Mar-2017	✓

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 Project : 5733



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	
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P)								
DR06, SCC01, SCC03A, SCC04, CC03,	DR01, SCC02, SCC06, CC02, CC04	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓



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	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Acidity as Calcium Carbonate	ED038-P	2	20	10.00	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
Dissolved Mercury by FIMS	EG035F	2	20	10.00	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
Fluoride by PC Titrator	EK040P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	10.00	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
Suspended Solids (High Level)	EA025H	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acidity as Calcium Carbonate	ED038-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	5.00	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
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	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
Suspended Solids (High Level)	EA025H	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	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
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	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
Suspended Solids (High Level)	EA025H	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	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
Fluoride by PC Titrator	EK040P	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
Total Mercury by FIMS	EG035T	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	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<i>Analytical Methods</i>							
Matrix Spikes (MS) - Continued							
Total Metals by ICP-MS - Suite A	EG020A-T	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
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 (2013) Schedule B(3)
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) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Acidity as Calcium Carbonate	ED038-P	WATER	In house: Referenced to APHA 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) 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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
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 (2013) Schedule B(3)

CERTIFICATE OF ANALYSIS

Work Order : EM1702197 Client : ENVIRONMENTAL SERVICE AND DESIGN PTY LTD Contact : MR ROD COOPER Address : 14 CATTLEY ST. PO BOX 651 BURNIE TASMANIA, AUSTRALIA 7320 Telephone : +61 03 6442 4037 Project : 5733 Order number : ---- C-O-C number : ---- Sampler : AC, RC Site : ---- Quote number : MEQB-167-15 No. of samples received : 11 No. of samples analysed : 11	Page : 1 of 8 Laboratory : Environmental Division Melbourne Contact : Shirley LeCornu Address : 4 Westall Rd Springvale VIC Australia 3171 Telephone : +61-3-8549 9630 Date Samples Received : 28-Feb-2017 09:05 Date Analysis Commenced : 01-Mar-2017 Issue Date : 07-Mar-2017 15:10
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 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.

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.

- It is recognised that total metals is less than dissolved metals for samples EM1702197. However, the difference is within experimental variation of the methods.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR02	DR04B	SCC05	DR05	DR04A
Client sampling date / time					27-Feb-2017 13:25	27-Feb-2017 12:40	27-Feb-2017 15:30	27-Feb-2017 14:00	27-Feb-2017 12:45
Compound	CAS Number	LOR	Unit	EM1702197-001	EM1702197-002	EM1702197-003	EM1702197-004	EM1702197-005	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
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	22	29	14	26	34	
Total Alkalinity as CaCO3	----	1	mg/L	22	29	14	26	34	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	2	2	2	2	2	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	6	20	6	4	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	3	1	4	3	1	
Magnesium	7439-95-4	1	mg/L	4	6	4	5	7	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.04	0.02	0.03	0.04	0.05	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0003	<0.0001	0.0041	0.0002	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.014	<0.001	0.002	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.002	0.011	0.012	0.007	0.022	
Lead	7439-92-1	0.001	mg/L	0.004	0.002	0.006	0.004	0.005	
Zinc	7440-66-6	0.005	mg/L	0.116	0.009	1.23	0.072	0.010	
Manganese	7439-96-5	0.001	mg/L	0.147	0.134	1.04	0.124	0.224	
Iron	7439-89-6	0.05	mg/L	0.32	0.17	0.12	0.28	0.44	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.06	0.03	0.04	0.06	0.05	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0002	<0.0001	0.0036	0.0004	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.002	0.015	<0.001	0.002	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.003	0.012	0.012	0.008	0.023	
Lead	7439-92-1	0.001	mg/L	0.007	0.004	0.013	0.007	0.007	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR02	DR04B	SCC05	DR05	DR04A
Client sampling date / time				27-Feb-2017 13:25	27-Feb-2017 12:40	27-Feb-2017 15:30	27-Feb-2017 14:00	27-Feb-2017 12:45	
Compound	CAS Number	LOR	Unit	EM1702197-001	EM1702197-002	EM1702197-003	EM1702197-004	EM1702197-005	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.131	0.010	1.22	0.079	0.013	
Manganese	7439-96-5	0.001	mg/L	0.161	0.163	1.07	0.140	0.230	
Iron	7439-89-6	0.05	mg/L	0.52	0.26	0.18	0.49	0.60	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR04C	SCC03B	DR03	CC01	Duplicate
Client sampling date / time				27-Feb-2017 12:00	27-Feb-2017 15:30	27-Feb-2017 13:40	27-Feb-2017 10:40	27-Feb-2017 16:00	
Compound	CAS Number	LOR	Unit	EM1702197-006	EM1702197-007	EM1702197-008	EM1702197-009	EM1702197-010	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	----	
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	41	<1	39	8	----	
Total Alkalinity as CaCO3	----	1	mg/L	41	<1	39	8	----	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	2	303	3	1	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	58	957	6	3	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	7	89	3	2	----	
Magnesium	7439-95-4	1	mg/L	17	88	5	2	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.14	0.04	0.02	----	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Cadmium	7440-43-9	0.0001	mg/L	0.0013	0.413	0.0003	<0.0001	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Copper	7440-50-8	0.001	mg/L	<0.001	0.003	<0.001	<0.001	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.101	<0.001	<0.001	----	
Nickel	7440-02-0	0.001	mg/L	0.058	0.334	0.007	<0.001	----	
Lead	7439-92-1	0.001	mg/L	<0.001	0.514	0.005	<0.001	----	
Zinc	7440-66-6	0.005	mg/L	0.223	112	0.118	0.007	----	
Manganese	7439-96-5	0.001	mg/L	0.019	115	0.214	0.013	----	
Iron	7439-89-6	0.05	mg/L	0.07	5.08	0.29	0.06	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.14	0.17	0.04	0.06	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0010	0.422	0.0005	<0.0001	0.0002	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.003	0.002	<0.001	0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.107	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.062	0.344	0.009	<0.001	0.007	
Lead	7439-92-1	0.001	mg/L	<0.001	0.545	0.022	0.001	0.007	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR04C	SCC03B	DR03	CC01	Duplicate
Client sampling date / time				27-Feb-2017 12:00	27-Feb-2017 15:30	27-Feb-2017 13:40	27-Feb-2017 10:40	27-Feb-2017 16:00	
Compound	CAS Number	LOR	Unit	EM1702197-006	EM1702197-007	EM1702197-008	EM1702197-009	EM1702197-010	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.238	118	0.135	0.049	0.085	
Manganese	7439-96-5	0.001	mg/L	0.020	122	0.241	0.060	0.132	
Iron	7439-89-6	0.05	mg/L	<0.05	5.44	0.77	0.09	0.46	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			CC05	----	----	----	----
Client sampling date / time		27-Feb-2017 14:50			----	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1702197-011	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----	----
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	43	----	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	43	----	----	----	----	----
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	3	----	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	----	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	4	----	----	----	----	----
Magnesium	7439-95-4	1	mg/L	7	----	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0007	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.004	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.040	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.004	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.132	----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.166	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.02	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.002	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0008	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.005	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.040	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.008	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CC05	----	----	----	----
Client sampling date / time				27-Feb-2017 14:50	----	----	----	----	
Compound	CAS Number	LOR	Unit	EM1702197-011	-----	-----	-----	-----	
				Result	----	----	----	----	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.136	----	----	----	----	
Manganese	7439-96-5	0.001	mg/L	0.177	----	----	----	----	
Iron	7439-89-6	0.05	mg/L	0.10	----	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	----	----	----	----	

QUALITY CONTROL REPORT

Work Order	: EM1702197	Page	: 1 of 9
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Contact	: Shirley LeCornu
Address	: 14 CATTLEY ST. PO BOX 651 BURNIE TASMANIA, AUSTRALIA 7320	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6442 4037	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 28-Feb-2017
Order number	: ----	Date Analysis Commenced	: 01-Mar-2017
C-O-C number	: ----	Issue Date	: 07-Mar-2017
Sampler	: AC, RC		
Site	: ----		
Quote number	: MEQB-167-15		
No. of samples received	: 11		
No. of samples analysed	: 11		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 774603)									
EM1702189-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	6	8	31.6	No Limit
EM1702193-009	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 774604)									
EM1702197-011	CC05	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 774875)									
EM1702193-010	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	22	20	4.85	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	22	20	4.85	0% - 20%
EM1702193-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	7	6	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	7	6	0.00	No Limit
ED038: Acidity (QC Lot: 774876)									
EM1702193-003	Anonymous	ED038-P: Acidity as CaCO3	----	1	mg/L	2	2	0.00	No Limit
EM1702197-002	DR04B	ED038-P: Acidity as CaCO3	----	1	mg/L	2	2	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 773430)									
EM1702191-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	140	140	0.00	0% - 20%
EM1702196-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	67	67	0.00	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 773434)									
EM1702197-002	DR04B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	6	0.00	No Limit
EM1702198-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	29	29	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 773583)									
EM1702193-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.00	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 773583) - continued									
EM1702193-004	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	6	6	0.00	No Limit
EM1702153-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	14	14	0.00	0% - 50%
ED093F: Dissolved Major Cations (QC Lot: 773589)									
EM1702197-006	DR04C	ED093F: Calcium	7440-70-2	1	mg/L	7	7	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	17	17	0.00	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 773585)									
EM1702193-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0005	0.0005	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.166	0.156	6.58	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.005	0.004	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.138	0.132	4.79	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.04	0.05	0.00	No Limit
EG020A-F: Iron	7439-89-6	0.05	mg/L	0.27	0.24	9.90	No Limit		
EM1702153-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.011	0.010	0.00	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.016	0.016	0.00	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.092	0.096	4.26	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.47	0.48	3.94	0% - 20%
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit		
EG020F: Dissolved Metals by ICP-MS (QC Lot: 773587)									
EM1702197-002	DR04B	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.134	0.130	2.90	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.011	0.010	10.1	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.009	0.007	19.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.02	0.03	0.00	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 773587) - continued									
EM1702197-002	DR04B	EG020A-F: Iron	7439-89-6	0.05	mg/L	0.17	0.17	0.00	No Limit
EM1702220-005	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0007	0.0005	25.1	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.010	0.010	0.00	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.184	0.185	0.782	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.272	0.265	2.62	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.14	0.14	0.00	0% - 50%
EG020A-F: Iron	7439-89-6	0.05	mg/L	0.15	0.15	0.00	No Limit		
EG020T: Total Metals by ICP-MS (QC Lot: 773590)									
EM1702193-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0006	44.5	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.164	0.162	1.02	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.152	0.142	6.49	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.05	0.06	0.00	No Limit
EG020A-T: Iron	7439-89-6	0.05	mg/L	0.36	0.35	0.00	No Limit		
EM1702193-010	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.005	0.004	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.145	0.143	1.71	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.020	0.023	17.1	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.02	0.02	0.00	No Limit
EG020A-T: Iron	7439-89-6	0.05	mg/L	0.18	0.18	0.00	No Limit		
EG020T: Total Metals by ICP-MS (QC Lot: 773591)									
EM1702197-011	CC05	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0008	0.0011	30.6	0% - 50%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.005	0.006	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 773591) - continued									
EM1702197-011	CC05	EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.008	0.008	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.177	0.178	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.040	0.044	7.56	0% - 20%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.136	0.141	3.42	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.02	0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.10	0.10	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 773584)									
EM1702126-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	0.0001	0.0002	0.00	No Limit
EM1702193-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 773588)									
EM1702197-004	DR05	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 772703)									
EM1702189-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1702193-005	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 772704)									
EM1702197-006	DR04C	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 774874)									
EM1702193-010	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EM1702193-002	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 774877)									
EM1702197-011	CC05	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 774603)									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	98.0	90	111	
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 774604)									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	105	90	111	
ED037P: Alkalinity by PC Titrator (QCLot: 774875)									
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	101	90	110	
ED038: Acidity (QCLot: 774876)									
ED038-P: Acidity as CaCO3	----	----	mg/L	----	100 mg/L	113	88	119	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773430)									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	92	115	
				<1	100 mg/L	103	92	115	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773434)									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	92	115	
				<1	100 mg/L	101	92	115	
ED093F: Dissolved Major Cations (QCLot: 773583)									
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	101	92	108	
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	103	92	108	
ED093F: Dissolved Major Cations (QCLot: 773589)									
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	100	92	108	
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	94.7	92	108	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773585)									
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	101	93	105	
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.2	94	108	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	104	86	108	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	90.2	86	110	
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	91.7	88	108	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.4	87	107	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.6	87	109	
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.2	87	109	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	92.0	87	109	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.6	87	107	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.7	94	106	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773587)									
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	102	93	105	



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773587) - continued									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	94	108	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	86	108	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	89.9	86	110	
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	90.9	88	108	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.8	87	107	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.8	87	109	
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.7	87	109	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.8	87	109	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	102	87	107	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.7	94	106	
EG020T: Total Metals by ICP-MS (QCLot: 773590)									
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	105	100	110	
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	102	94	113	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	104	88	110	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.8	87	112	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	88	113	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.2	87	112	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.8	88	113	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.8	88	112	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.7	91	111	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	100	88	112	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	104	99	110	
EG020T: Total Metals by ICP-MS (QCLot: 773591)									
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	108	100	110	
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	104	94	113	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	105	88	110	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.2	87	112	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.1	88	113	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.6	87	112	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	88	113	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.1	88	112	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	98.0	91	111	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	101	88	112	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	103	99	110	
EG035F: Dissolved Mercury by FIMS (QCLot: 773584)									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	107	88	117	
EG035F: Dissolved Mercury by FIMS (QCLot: 773588)									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	105	88	117	



Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772703)									
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.6	87	113	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772704)									
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.9	87	113	
EK040P: Fluoride by PC Titrator (QCLot: 774874)									
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	101	85	112	
EK040P: Fluoride by PC Titrator (QCLot: 774877)									
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	104	85	112	

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	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%)		Recovery Limits (%)	
					MS	Low	High	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773430)								
EM1702191-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 773434)								
EM1702197-003	SCC05	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	97.4	70	130	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773585)								
EM1702153-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	98.3	85	131	
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	104	81	133	
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	95.2	71	135	
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	95.2	78	132	
		EG020A-F: Copper	7440-50-8	0.2 mg/L	92.7	76	130	
		EG020A-F: Lead	7439-92-1	0.2 mg/L	95.3	75	133	
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	95.5	64	134	
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	94.3	73	131	
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	96.4	75	131	
EG020F: Dissolved Metals by ICP-MS (QCLot: 773587)								
EM1702197-002	DR04B	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	96.7	85	131	
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	108	81	133	
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	88.7	71	135	
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	92.9	78	132	
		EG020A-F: Copper	7440-50-8	0.2 mg/L	92.5	76	130	
		EG020A-F: Lead	7439-92-1	0.2 mg/L	97.3	75	133	



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 773587) - continued							
EM1702197-002	DR04B	EG020A-F: Manganese	7439-96-5	0.2 mg/L	89.9	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	92.3	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	93.4	75	131
EG020T: Total Metals by ICP-MS (QCLot: 773590)							
EM1702193-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	100	82	118
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	107	75	129
		EG020A-T: Chromium	7440-47-3	1 mg/L	91.0	80	118
		EG020A-T: Cobalt	7440-48-4	1 mg/L	93.4	82	120
		EG020A-T: Copper	7440-50-8	1 mg/L	92.6	81	115
		EG020A-T: Lead	7439-92-1	1 mg/L	97.1	83	121
		EG020A-T: Manganese	7439-96-5	1 mg/L	95.9	73	123
		EG020A-T: Nickel	7440-02-0	1 mg/L	95.8	80	118
EG020A-T: Zinc	7440-66-6	1 mg/L	97.7	74	116		
EG020T: Total Metals by ICP-MS (QCLot: 773591)							
EM1702197-011	CC05	EG020A-T: Arsenic	7440-38-2	1 mg/L	106	82	118
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	106	75	129
		EG020A-T: Chromium	7440-47-3	1 mg/L	93.7	80	118
		EG020A-T: Cobalt	7440-48-4	1 mg/L	96.8	82	120
		EG020A-T: Copper	7440-50-8	1 mg/L	95.6	81	115
		EG020A-T: Lead	7439-92-1	1 mg/L	100	83	121
		EG020A-T: Manganese	7439-96-5	1 mg/L	100	73	123
		EG020A-T: Nickel	7440-02-0	1 mg/L	98.4	80	118
EG020A-T: Zinc	7440-66-6	1 mg/L	101	74	116		
EG035F: Dissolved Mercury by FIMS (QCLot: 773584)							
EM1702153-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	77.7	70	120
EG035F: Dissolved Mercury by FIMS (QCLot: 773588)							
EM1702197-005	DR04A	EG035F: Mercury	7439-97-6	0.01 mg/L	108	70	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772703)							
EM1702191-009	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	87.7	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 772704)							
EM1702197-007	SCC03B	EG035T: Mercury	7439-97-6	0.01 mg/L	85.5	70	130
EK040P: Fluoride by PC Titrator (QCLot: 774874)							
EM1702193-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	105	70	130
EK040P: Fluoride by PC Titrator (QCLot: 774877)							
EM1702217-002	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	103	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM1702197	Page	: 1 of 8
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 28-Feb-2017
Site	: ----	Issue Date	: 07-Mar-2017
Sampler	: AC, RC	No. of samples received	: 11
Order number	: ----	No. of samples analysed	: 11

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

- **NO** Quality Control Sample Frequency Outliers exist.



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	EM1702191--002	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

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	
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
DR02, SCC05, DR04A, SCC03B, CC01,	DR04B, DR05, DR04C, DR03, CC05	27-Feb-2017	----	----	----	02-Mar-2017	06-Mar-2017	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
DR02, SCC05, DR04A, SCC03B, CC01,	DR04B, DR05, DR04C, DR03, CC05	27-Feb-2017	----	----	----	02-Mar-2017	13-Mar-2017	✓
ED038: Acidity								
Clear Plastic Bottle - Natural (ED038-P)								
DR02, SCC05, DR04A, SCC03B, CC01,	DR04B, DR05, DR04C, DR03, CC05	27-Feb-2017	----	----	----	02-Mar-2017	13-Mar-2017	✓



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) DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, DR03, CC01, CC05	27-Feb-2017	----	----	----	01-Mar-2017	27-Mar-2017	✓	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, DR03, CC01, CC05	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓	
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, DR03, CC01, CC05	27-Feb-2017	----	----	----	02-Mar-2017	26-Aug-2017	✓	
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, DR03, CC01, Duplicate, CC05	27-Feb-2017	01-Mar-2017	26-Aug-2017	✓	02-Mar-2017	26-Aug-2017	✓	
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F) DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, DR03, CC01, CC05	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓	



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	
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) DR02, SCC05, DR04A, SCC03B, CC01, CC05	DR04B, DR05, DR04C, DR03, Duplicate,	27-Feb-2017	----	----	----	01-Mar-2017	27-Mar-2017	✓
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P) DR02, SCC05, DR04A, SCC03B, CC01,	DR04B, DR05, DR04C, DR03, CC05	27-Feb-2017	----	----	----	02-Mar-2017	27-Mar-2017	✓



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	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Acidity as Calcium Carbonate	ED038-P	2	20	10.00	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
Dissolved Mercury by FIMS	EG035F	3	27	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	32	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	3	30	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	3	29	10.34	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	26	11.54	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	3	26	11.54	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	3	27	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acidity as Calcium Carbonate	ED038-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	29	6.90	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	26	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	29	6.90	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	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	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<i>Analytical Methods</i>							
Matrix Spikes (MS) - Continued							
Total Metals by ICP-MS - Suite A	EG020A-T	2	27	7.41	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
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 (2013) Schedule B(3)
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) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Acidity as Calcium Carbonate	ED038-P	WATER	In house: Referenced to APHA 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) 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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



<i>Analytical Methods</i>			
	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
<i>Preparation Methods</i>			
	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
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 (2013) Schedule B(3)

CERTIFICATE OF ANALYSIS

Work Order : **EM1705701**
Client : **ENVIRONMENTAL SERVICE AND DESIGN PTY LTD**
Contact : MR ROD COOPER
Address : 14 CATTLEY ST. PO BOX 651
 BURNIE TASMANIA, AUSTRALIA 7320
Telephone : +61 03 6442 4037
Project : 5733
Order number : ----
C-O-C number : ----
Sampler : AC, RC
Site : ----
Quote number : MEQB-167-15
No. of samples received : 21
No. of samples analysed : 21

Page : 1 of 12
Laboratory : Environmental Division Melbourne
Contact : Shirley LeCornu
Address : 4 Westall Rd Springvale VIC Australia 3171

Telephone : +61-3-8549 9630
Date Samples Received : 08-May-2017 10:50
Date Analysis Commenced : 09-May-2017
Issue Date : 12-May-2017 14:47



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. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 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.

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
∅ = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK040P: Spike failed for EM1705666 #5 due to sample matrix. Result has been confirmed by re-preparation and re-analysis.
- It is recognised that total metals is less than dissolved metals for EM1705701. However, the difference is within experimental variation of the methods.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR06	DR01	SCC01	SCC02	SCC03A
Client sampling date / time				05-May-2017 14:50	05-May-2017 11:20	05-May-2017 10:10	05-May-2017 10:25	05-May-2017 10:00	
Compound	CAS Number	LOR	Unit	EM1705701-001	EM1705701-002	EM1705701-003	EM1705701-004	EM1705701-005	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
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	13	5	4	9	<1	
Total Alkalinity as CaCO3	----	1	mg/L	13	5	4	9	<1	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	4	3	2	5	332	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	5	3	24	1050	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	2	1	3	88	
Magnesium	7439-95-4	1	mg/L	3	2	2	3	80	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.08	0.14	0.07	0.08	0.30	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0003	<0.0001	0.0002	0.0054	0.324	
Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.001	0.001	<0.001	<0.001	0.003	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.002	0.104	
Nickel	7440-02-0	0.001	mg/L	0.005	<0.001	<0.001	0.008	0.343	
Lead	7439-92-1	0.001	mg/L	0.004	0.002	<0.001	0.016	0.605	
Zinc	7440-66-6	0.005	mg/L	0.106	0.007	0.036	2.01	106	
Manganese	7439-96-5	0.001	mg/L	0.117	0.018	0.020	2.07	122	
Iron	7439-89-6	0.05	mg/L	0.24	0.44	0.10	0.20	4.42	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.11	0.18	0.11	0.09	0.32	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0002	<0.0001	0.0001	0.0065	0.355	
Chromium	7440-47-3	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.002	0.004	<0.001	<0.001	0.004	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.002	0.113	
Nickel	7440-02-0	0.001	mg/L	0.006	<0.001	<0.001	0.009	0.362	
Lead	7439-92-1	0.001	mg/L	0.005	0.003	0.001	0.020	0.689	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR06	DR01	SCC01	SCC02	SCC03A
Client sampling date / time				05-May-2017 14:50	05-May-2017 11:20	05-May-2017 10:10	05-May-2017 10:25	05-May-2017 10:00	
Compound	CAS Number	LOR	Unit	EM1705701-001	EM1705701-002	EM1705701-003	EM1705701-004	EM1705701-005	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.114	0.006	0.039	2.13	113	
Manganese	7439-96-5	0.001	mg/L	0.130	0.023	0.028	2.25	136	
Iron	7439-89-6	0.05	mg/L	0.37	0.63	0.15	0.27	5.25	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SCC06	SCC04	CC02	CC03	CC04
Client sampling date / time				05-May-2017 14:50	05-May-2017 14:15	05-May-2017 10:45	05-May-2017 13:25	05-May-2017 13:35	
Compound	CAS Number	LOR	Unit	EM1705701-006	EM1705701-007	EM1705701-008	EM1705701-009	EM1705701-010	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	30	<5	<5	<5	6	
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	13	10	9	12	15	
Total Alkalinity as CaCO3	----	1	mg/L	13	10	9	12	15	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	3	4	2	2	2	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	17	14	3	4	4	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	3	2	2	2	
Magnesium	7439-95-4	1	mg/L	6	4	2	3	3	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.06	0.04	0.03	0.04	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0022	<0.0001	<0.0001	0.0001	
Chromium	7440-47-3	0.001	mg/L	0.137	0.002	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.010	0.008	<0.001	0.002	0.005	
Lead	7439-92-1	0.001	mg/L	0.007	0.006	0.002	0.002	0.002	
Zinc	7440-66-6	0.005	mg/L	0.010	0.833	0.012	0.011	0.020	
Manganese	7439-96-5	0.001	mg/L	0.012	0.689	0.133	0.106	0.104	
Iron	7439-89-6	0.05	mg/L	<0.05	0.14	0.27	0.14	0.11	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.11	0.11	0.07	0.12	0.13	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0023	<0.0001	<0.0001	0.0002	
Chromium	7440-47-3	0.001	mg/L	0.154	0.002	<0.001	0.001	0.002	
Copper	7440-50-8	0.001	mg/L	0.002	<0.001	0.001	0.001	0.002	
Cobalt	7440-48-4	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.020	0.009	0.001	0.003	0.008	
Lead	7439-92-1	0.001	mg/L	0.248	0.009	0.004	0.018	0.024	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SCC06	SCC04	CC02	CC03	CC04
Client sampling date / time				05-May-2017 14:50	05-May-2017 14:15	05-May-2017 10:45	05-May-2017 13:25	05-May-2017 13:35	
Compound	CAS Number	LOR	Unit	EM1705701-006	EM1705701-007	EM1705701-008	EM1705701-009	EM1705701-010	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.038	0.915	0.014	0.016	0.028	
Manganese	7439-96-5	0.001	mg/L	0.332	0.763	0.153	0.210	0.190	
Iron	7439-89-6	0.05	mg/L	0.62	0.23	0.36	0.46	0.51	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR02	DR04B	SCC05	DR05	DR04A
Client sampling date / time				05-May-2017 11:40	05-May-2017 12:15	05-May-2017 14:05	05-May-2017 09:30	05-May-2017 12:30	
Compound	CAS Number	LOR	Unit	EM1705701-011	EM1705701-012	EM1705701-013	EM1705701-014	EM1705701-015	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
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	12	36	11	20	36	
Total Alkalinity as CaCO3	----	1	mg/L	12	36	11	20	36	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	2	3	3	2	3	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	7	14	6	5	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	1	3	2	1	
Magnesium	7439-95-4	1	mg/L	3	7	4	4	8	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.08	0.04	0.06	0.07	0.04	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0001	0.0021	0.0002	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.007	<0.001	0.002	
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.002	0.020	0.008	0.008	0.026	
Lead	7439-92-1	0.001	mg/L	0.004	0.001	0.006	0.004	0.004	
Zinc	7440-66-6	0.005	mg/L	0.117	0.026	0.809	0.078	0.013	
Manganese	7439-96-5	0.001	mg/L	0.108	0.146	0.659	0.103	0.217	
Iron	7439-89-6	0.05	mg/L	0.34	0.16	0.18	0.28	0.33	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.11	0.06	0.07	0.11	0.08	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0002	0.0025	0.0004	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.002	0.009	0.001	0.003	
Copper	7440-50-8	0.001	mg/L	0.001	0.001	<0.001	0.002	<0.001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.003	0.022	0.008	0.009	0.030	
Lead	7439-92-1	0.001	mg/L	0.006	0.005	0.008	0.016	0.006	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR02	DR04B	SCC05	DR05	DR04A
Client sampling date / time				05-May-2017 11:40	05-May-2017 12:15	05-May-2017 14:05	05-May-2017 09:30	05-May-2017 12:30	
Compound	CAS Number	LOR	Unit	EM1705701-011	EM1705701-012	EM1705701-013	EM1705701-014	EM1705701-015	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.120	0.032	0.862	0.097	0.014	
Manganese	7439-96-5	0.001	mg/L	0.121	0.185	0.720	0.144	0.253	
Iron	7439-89-6	0.05	mg/L	0.50	0.38	0.21	0.55	0.54	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR04C	SCC03B	DR03	CC01	FD
Client sampling date / time				05-May-2017 11:55	05-May-2017 09:55	07-May-2017 12:45	05-May-2017 10:55	05-May-2017 16:00	
Compound	CAS Number	LOR	Unit	EM1705701-016	EM1705701-017	EM1705701-018	EM1705701-019	EM1705701-020	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	----	
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	49	<1	17	8	----	
Total Alkalinity as CaCO3	----	1	mg/L	49	<1	17	8	----	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	7	359	4	2	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	48	1140	5	3	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	6	97	2	2	----	
Magnesium	7439-95-4	1	mg/L	16	86	4	2	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.02	0.06	0.04	----	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Cadmium	7440-43-9	0.0001	mg/L	0.0010	0.335	0.0003	<0.0001	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.112	<0.001	<0.001	----	
Nickel	7440-02-0	0.001	mg/L	0.048	0.369	0.008	<0.001	----	
Lead	7439-92-1	0.001	mg/L	<0.001	0.333	0.003	<0.001	----	
Zinc	7440-66-6	0.005	mg/L	0.196	113	0.100	0.016	----	
Manganese	7439-96-5	0.001	mg/L	0.024	132	0.128	0.019	----	
Iron	7439-89-6	0.05	mg/L	<0.05	10.7	0.27	0.07	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.02	0.11	0.06	0.17	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0010	0.370	0.0003	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.001	<0.001	0.004	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.121	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.052	0.390	0.008	<0.001	0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	0.373	0.004	0.001	0.003	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DR04C	SCC03B	DR03	CC01	FD
Client sampling date / time				05-May-2017 11:55	05-May-2017 09:55	07-May-2017 12:45	05-May-2017 10:55	05-May-2017 16:00	
Compound	CAS Number	LOR	Unit	EM1705701-016	EM1705701-017	EM1705701-018	EM1705701-019	EM1705701-020	
				Result	Result	Result	Result	Result	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.200	121	0.086	<0.005	0.007	
Manganese	7439-96-5	0.001	mg/L	0.022	146	0.114	0.013	0.022	
Iron	7439-89-6	0.05	mg/L	<0.05	11.8	0.41	0.12	0.57	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			CC05	----	----	----	----
Client sampling date / time		05-May-2017 13:15			----	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1705701-021	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----	----
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	12	----	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	12	----	----	----	----	----
ED038: 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	3	----	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	----	----	----	----	----
Magnesium	7439-95-4	1	mg/L	2	----	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.04	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.002	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.002	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.011	----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.102	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.13	----	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.05	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0001	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.002	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.009	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CC05	----	----	----	----
Client sampling date / time				05-May-2017 13:15	----	----	----	----	
Compound	CAS Number	LOR	Unit	EM1705701-021	-----	-----	-----	-----	
				Result	----	----	----	----	
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L	0.012	----	----	----	----	
Manganese	7439-96-5	0.001	mg/L	0.117	----	----	----	----	
Iron	7439-89-6	0.05	mg/L	0.19	----	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	----	----	----	----	

QUALITY CONTROL REPORT

Work Order	: EM1705701	Page	: 1 of 10
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Contact	: Shirley LeCornu
Address	: 14 CATTLEY ST. PO BOX 651 BURNIE TASMANIA, AUSTRALIA 7320	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6442 4037	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 08-May-2017
Order number	: ----	Date Analysis Commenced	: 09-May-2017
C-O-C number	: ----	Issue Date	: 12-May-2017
Sampler	: AC, RC		
Site	: ----		
Quote number	: MEQB-167-15		
No. of samples received	: 21		
No. of samples analysed	: 21		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 875705)									
EM1705601-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
EM1705701-003	SCC01	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 875709)									
EM1705701-014	DR05	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 875856)									
EM1705666-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	457	460	0.519	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	457	460	0.519	0% - 20%
EM1705665-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	436	441	1.24	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	436	441	1.24	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 875862)									
EM1705701-005	SCC03A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.00	No Limit
EM1705701-015	DR04A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	36	36	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	36	36	0.00	0% - 20%
ED038: Acidity (QC Lot: 875861)									
EM1705701-006	SCC06	ED038-P: Acidity as CaCO3	----	1	mg/L	3	5	44.7	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED038: Acidity (QC Lot: 875861) - continued									
EM1705701-017	SCC03B	ED038-P: Acidity as CaCO3	----	1	mg/L	359	364	1.46	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 876191)									
EM1705701-003	SCC01	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	3	0.00	No Limit
EM1705701-012	DR04B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	7	7	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 876693)									
EM1705727-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	16	14	12.6	No Limit
EM1705662-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1380	1380	0.239	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 876148)									
EM1705614-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	10	10	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	491	483	1.64	0% - 20%
EM1705701-003	SCC01	ED093F: Calcium	7440-70-2	1	mg/L	1	1	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2	1	0.00	No Limit
ED093F: Dissolved Major Cations (QC Lot: 876152)									
EM1705701-015	DR04A	ED093F: Calcium	7440-70-2	1	mg/L	1	2	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	8	8	0.00	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 876150)									
EM1705701-004	SCC02	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0054	0.0056	2.28	0% - 20%
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.016	0.015	0.00	0% - 50%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	2.07	2.04	1.16	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.008	0.008	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	2.01	2.02	0.499	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.08	0.08	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.20	0.20	0.00	No Limit
EM1705614-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0013	0.0013	0.00	0% - 50%
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.010	0.010	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.246	0.244	0.795	0% - 20%
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.591	0.584	1.12	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.181	0.179	1.09	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.040	0.041	0.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.204	0.203	0.00	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.107	0.108	0.00	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	6.43	6.53	1.49	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.11	0.11	0.00	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 876154)									



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 876154) - continued									
EM1705701-015	DR04A	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.217	0.223	3.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.026	0.026	0.00	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.013	0.021	47.8	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.04	0.04	0.00	No Limit
EG020A-F: Iron	7439-89-6	0.05	mg/L	0.33	0.33	0.00	No Limit		
EG020T: Total Metals by ICP-MS (QC Lot: 875977)									
EM1705453-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.780	0.784	0.469	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	1.57	1.58	1.00	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	2.87	2.85	0.855	0% - 20%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.008	0.008	0.00	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.16	0.14	8.20	0% - 50%
EG020A-T: Iron	7439-89-6	0.05	mg/L	0.05	0.05	0.00	No Limit		
EM1705701-007	SCC04	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0023	0.0026	13.9	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.763	0.772	1.13	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.009	0.008	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.915	0.903	1.32	0% - 20%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.11	0.08	28.4	0% - 50%
EG020A-T: Iron	7439-89-6	0.05	mg/L	0.23	0.23	0.00	No Limit		
EG020T: Total Metals by ICP-MS (QC Lot: 875979)									
EM1705701-018	DR03	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0003	0.0002	48.7	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.00	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 875979) - continued									
EM1705701-018	DR03	EG020A-T: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.114	0.114	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.008	0.008	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.086	0.088	1.89	0% - 50%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.11	0.09	17.7	0% - 50%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.41	0.40	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 876149)									
EM1705701-004	SCC02	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1705614-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	0.0002	0.0002	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 876153)									
EM1705701-015	DR04A	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 878423)									
EM1705640-004	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1705701-005	SCC03A	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 878424)									
EM1705701-016	DR04C	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1705735-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 875860)									
EM1705701-005	SCC03A	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EM1705666-002	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.7	0.6	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 875863)									
EM1705701-015	DR04A	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 875705)									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	95.3	90	111	
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 875709)									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	101	90	111	
ED037P: Alkalinity by PC Titrator (QCLot: 875856)									
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	102	90	110	
ED037P: Alkalinity by PC Titrator (QCLot: 875862)									
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	97.0	90	110	
ED038: Acidity (QCLot: 875861)									
ED038-P: Acidity as CaCO3	----	----	mg/L	----	100 mg/L	99.0	88	119	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 876191)									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	106	92	115	
				<1	100 mg/L	106	92	115	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 876693)									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	114	92	115	
				<1	100 mg/L	104	92	115	
ED093F: Dissolved Major Cations (QCLot: 876148)									
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	99.7	92	108	
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	95.9	92	108	
ED093F: Dissolved Major Cations (QCLot: 876152)									
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	97.1	92	108	
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	92.5	92	108	
EG020F: Dissolved Metals by ICP-MS (QCLot: 876150)									
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	98.0	93	105	
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100.0	94	108	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	89.4	86	108	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.2	86	110	
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	92.6	88	108	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	89.0	87	107	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.6	87	109	
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.4	87	109	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	92.2	87	109	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.9	87	107	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.1	94	106	



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG020F: Dissolved Metals by ICP-MS (QCLot: 876154)									
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	100.0	93	105	
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	95.8	94	108	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	89.5	86	108	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	92.8	86	110	
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	93.7	88	108	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.2	87	107	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.2	87	109	
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	94.6	87	109	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.7	87	109	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	98.4	87	107	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.3	94	106	
EG020T: Total Metals by ICP-MS (QCLot: 875977)									
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	103	100	110	
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	105	94	113	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.3	88	110	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	96.0	87	112	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.4	88	113	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.2	87	112	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.1	88	113	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.5	88	112	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.8	91	111	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	101	88	112	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	104	99	110	
EG020T: Total Metals by ICP-MS (QCLot: 875979)									
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	106	100	110	
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	102	94	113	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.4	88	110	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.4	87	112	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	99.6	88	113	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.8	87	112	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.1	88	113	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	106	88	112	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	100	91	111	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	109	88	112	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	104	99	110	
EG035F: Dissolved Mercury by FIMS (QCLot: 876149)									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.6	88	117	
EG035F: Dissolved Mercury by FIMS (QCLot: 876153)									



Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 876153) - continued								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	89.6	88	117
EG035T: Total Recoverable Mercury by FIMS (QCLot: 878423)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.0	87	113
EG035T: Total Recoverable Mercury by FIMS (QCLot: 878424)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	87	113
EK040P: Fluoride by PC Titrator (QCLot: 875860)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	111	85	112
EK040P: Fluoride by PC Titrator (QCLot: 875863)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	105	85	112

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	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
				Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 876191)							
EM1705701-004	SCC02	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	99.8	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 876693)							
EM1705662-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 876150)							
EM1705614-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	100	85	131
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	96.8	81	133
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	98.2	71	135
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	95.1	78	132
		EG020A-F: Copper	7440-50-8	0.2 mg/L	83.2	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	89.4	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	102	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	91.6	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	93.8	75	131
EG020F: Dissolved Metals by ICP-MS (QCLot: 876154)							
EM1705701-017	SCC03B	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	93.4	85	131
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	# Not Determined	81	133
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	97.0	71	135



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 876154) - continued							
EM1705701-017	SCC03B	EG020A-F: Cobalt	7440-48-4	0.2 mg/L	87.8	78	132
		EG020A-F: Copper	7440-50-8	0.2 mg/L	89.6	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	92.3	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	# Not Determined	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	86.0	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	# Not Determined	75	131
EG020T: Total Metals by ICP-MS (QCLot: 875977)							
EM1705453-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	99.8	82	118
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	92.2	75	129
		EG020A-T: Chromium	7440-47-3	1 mg/L	91.4	80	118
		EG020A-T: Cobalt	7440-48-4	1 mg/L	94.6	82	120
		EG020A-T: Copper	7440-50-8	1 mg/L	85.8	81	115
		EG020A-T: Lead	7439-92-1	1 mg/L	96.9	83	121
		EG020A-T: Manganese	7439-96-5	1 mg/L	93.3	73	123
		EG020A-T: Nickel	7440-02-0	1 mg/L	83.6	80	118
		EG020A-T: Zinc	7440-66-6	1 mg/L	94.8	74	116
EG020T: Total Metals by ICP-MS (QCLot: 875979)							
EM1705701-018	DR03	EG020A-T: Arsenic	7440-38-2	1 mg/L	95.8	82	118
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	91.8	75	129
		EG020A-T: Chromium	7440-47-3	1 mg/L	91.4	80	118
		EG020A-T: Cobalt	7440-48-4	1 mg/L	92.4	82	120
		EG020A-T: Copper	7440-50-8	1 mg/L	90.3	81	115
		EG020A-T: Lead	7439-92-1	1 mg/L	97.7	83	121
		EG020A-T: Manganese	7439-96-5	1 mg/L	93.2	73	123
		EG020A-T: Nickel	7440-02-0	1 mg/L	94.3	80	118
		EG020A-T: Zinc	7440-66-6	1 mg/L	93.2	74	116
EG035F: Dissolved Mercury by FIMS (QCLot: 876149)							
EM1705614-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	95.4	70	120
EG035F: Dissolved Mercury by FIMS (QCLot: 876153)							
EM1705701-016	DR04C	EG035F: Mercury	7439-97-6	0.01 mg/L	91.1	70	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 878423)							
EM1705663-024	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	86.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 878424)							
EM1705701-017	SCC03B	EG035T: Mercury	7439-97-6	0.01 mg/L	89.2	70	130
EK040P: Fluoride by PC Titrator (QCLot: 875860)							

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 Work Order : EM1705701
 Client : ENVIRONMENTAL SERVICE AND DESIGN PTY LTD
 Project : 5733



Sub-Matrix: **WATER**

				<i>Matrix Spike (MS) Report</i>			
		<i>Spike</i>	<i>SpikeRecovery(%)</i>	<i>Recovery Limits (%)</i>			
<i>Laboratory sample ID</i>	<i>Client sample ID</i>	<i>Method: Compound</i>	<i>CAS Number</i>	<i>Concentration</i>	<i>MS</i>	<i>Low</i>	<i>High</i>
EK040P: Fluoride by PC Titrator (QCLot: 875860) - continued							
EM1705666-005	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	# 55.6	70	130
EK040P: Fluoride by PC Titrator (QCLot: 875863)							
EM1705701-013	SCC05	EK040P: Fluoride	16984-48-8	5 mg/L	106	70	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM1705701	Page	: 1 of 10
Client	: ENVIRONMENTAL SERVICE AND DESIGN PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR ROD COOPER	Telephone	: +61-3-8549 9630
Project	: 5733	Date Samples Received	: 08-May-2017
Site	: ----	Issue Date	: 12-May-2017
Sampler	: AC, RC	No. of samples received	: 21
Order number	: ----	No. of samples analysed	: 21

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

- **NO** Quality Control Sample Frequency Outliers exist.



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	
EA025: Total Suspended Solids dried at 104 ± 2°C - Continued								
DR03	07-May-2017	----	----	----	09-May-2017	14-May-2017	✓	
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
DR06, SCC01, SCC03A, SCC04, CC03, DR02, SCC05, DR04A, SCC03B, CC05	DR01, SCC02, SCC06, CC02, CC04, DR04B, DR05, DR04C, CC01,	05-May-2017	----	----	----	09-May-2017	19-May-2017	✓
Clear Plastic Bottle - Natural (ED037-P)								
DR03	07-May-2017	----	----	----	09-May-2017	21-May-2017	✓	
ED038: Acidity								
Clear Plastic Bottle - Natural (ED038-P)								
DR06, SCC01, SCC03A, SCC04, CC03, DR02, SCC05, DR04A, SCC03B, CC05	DR01, SCC02, SCC06, CC02, CC04, DR04B, DR05, DR04C, CC01,	05-May-2017	----	----	----	09-May-2017	19-May-2017	✓
Clear Plastic Bottle - Natural (ED038-P)								
DR03	07-May-2017	----	----	----	09-May-2017	21-May-2017	✓	



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)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, CC05	05-May-2017	----	----	----	09-May-2017	02-Jun-2017	✓
Clear Plastic Bottle - Natural (ED041G)							
DR03	07-May-2017	----	----	----	09-May-2017	04-Jun-2017	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, CC05	05-May-2017	----	----	----	10-May-2017	02-Jun-2017	✓
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F)							
DR03	07-May-2017	----	----	----	10-May-2017	04-Jun-2017	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, CC05	05-May-2017	----	----	----	09-May-2017	01-Nov-2017	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
DR03	07-May-2017	----	----	----	09-May-2017	03-Nov-2017	✓



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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, FD, CC05	05-May-2017	09-May-2017	01-Nov-2017	✓	09-May-2017	01-Nov-2017	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)							
DR03	07-May-2017	09-May-2017	03-Nov-2017	✓	09-May-2017	03-Nov-2017	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, CC05	05-May-2017	----	----	----	09-May-2017	02-Jun-2017	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
DR03	07-May-2017	----	----	----	09-May-2017	04-Jun-2017	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)							
DR06, DR01, SCC01, SCC02, SCC03A, SCC06, SCC04, CC02, CC03, CC04, DR02, DR04B, SCC05, DR05, DR04A, DR04C, SCC03B, CC01, CC05	05-May-2017	----	----	----	10-May-2017	02-Jun-2017	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)							
DR03	07-May-2017	----	----	----	10-May-2017	04-Jun-2017	✓



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	
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P) DR06, SCC01, SCC03A, SCC04, CC03, DR02, SCC05, DR04A, SCC03B, CC05	DR01, SCC02, SCC06, CC02, CC04, DR04B, DR05, DR04C, CC01,	05-May-2017	----	----	----	09-May-2017	02-Jun-2017	✓
Clear Plastic Bottle - Natural (EK040P) DR03		07-May-2017	----	----	----	09-May-2017	04-Jun-2017	✓



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	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Acidity as Calcium Carbonate	ED038-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	4	37	10.81	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	3	26	11.54	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	3	26	11.54	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	3	30	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	3	29	10.34	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	38	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	27	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	3	24	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acidity as Calcium Carbonate	ED038-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Alkalinity by PC Titrator	ED037-P	2	37	5.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	29	6.90	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	38	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	27	14.81	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	24	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	29	6.90	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	38	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	27	7.41	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	24	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	26	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	30	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	38	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	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	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<i>Analytical Methods</i>							
Matrix Spikes (MS) - Continued							
Total Metals by ICP-MS - Suite A	EG020A-T	2	24	8.33	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
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 (2013) Schedule B(3)
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) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Acidity as Calcium Carbonate	ED038-P	WATER	In house: Referenced to APHA 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) 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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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	EG035F	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. This method is compliant with NEPM (2013) Schedule B(3)



<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
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 (2013) Schedule B(3)