



EPL289 – ANNUAL MONITORING REPORT

12th July 2023

Reporting period: 01 July 2022 – 30 June 2023

Author: **Jeremy Barnett**
Environment Specialist
South32 GEMCO



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EXECUTIVE SUMMARY

Groundwater bores within GEMCO's Waste Management Facility were monitored quarterly during FY23 in accordance with the conditions of Environment Protection Licence 289 (EPL289). During FY22, the groundwater monitoring program expanded to include three additional bores installed within the deeper aquifer, which were monitored throughout FY23. Historically, groundwater data associated with this facility was limited to the upper aquifer. Based on the available data for the reporting period, there is a general absence of landfill seepage indicators. The lack of water in the shallow aquifer under this facility for much of the reporting period would also suggest the risk of leachate potentially migrating through this aquifer system is low. The current bore network will enable ongoing monitoring of both the shallow and deep aquifer during FY24.

MONITORING PROGRAM

GEMCO conducts quarterly groundwater monitoring at locations in and around the Waste Management Facility as specified in the conditions of EPL289 (**Figure 1**). Eight groundwater bores have historically been monitored at the active landfill. Due to the expansion of the GEMCO mine footprint, three monitoring bores (WT015, WT025 and WT029) were relocated in FY22. This drilling program included the installation of additional bores (WT025D, WT025S, WT029D, WT029S, WT015D, WT015S) targeting the deep aquifer which has resulted in a total of 11 bores. In accordance with EPL289, the bores are monitored quarterly for groundwater level and quality to detect potential contaminated leachate from the site.

The main waste streams that are disposed of at the facility are green waste, construction waste and putrescible/household waste. Grease trap waste is disposed of at the facility in small volumes (168 kL in FY23) in line with the licence conditions. A minor disposal area is located within the facility for the disposal of sewage sludge following any routine maintenance of the Alyangula sewage treatment facility. Under the conditions of EPL289 tyres and batteries are also stored (not disposed) at the Waste Management Facility.



Figure 1: Groundwater monitoring network associated with Waste Management Facility

Note: Single bores are drilled within the shallow aquifer and where nested bore have been installed, they are drilled within the shallow (S) and deep aquifer (D)

The groundwater flow direction within the area of the Waste Management Facility is to the southwest towards the coast during both wet and dry seasons. Groundwater samples are analysed to evaluate any potential increasing trends of the various analytes which may indicate generation and mobilisation of landfill leachate.

Low flow purging of groundwater monitoring bores was carried out using a Sample Pro® Portable Micropurge Pump with combined QED MP50 compressor/controller unit or alternatively with a bailer when the observed water level was low. A Win-Situ Troll® 600 multi-parameter water quality meter with flow-through cell was used to determine when stabilisation criteria were met and field readings were recorded using a Microsoft application, EQUiS Collect. Field readings were uploaded from the field directly into GEMCO's Environmental Monitoring Database, EQUiS. After stabilisation criteria were met, samples were collected and stored in an esky before sending to a NATA (National Association of Testing Authorities) - Accredited Laboratory (i.e. ALS Laboratories) for analysis.

All parameters required to be analysed under EPL289 were monitored for the reporting period and included total and dissolved metalloids (Mn, Zn, Fe, Ni, Pb), pH, dissolved oxygen (DO), chloride (Cl⁻) potassium (K), total organic nitrogen (TON), total phosphorous, total dissolved solids (TDS), Chemical Oxygen Demand, ammonium, *E Coli*, and *Enterococci*. However, it should be noted that some automatic uploads of field data failed throughout the reporting period (some data is missing for pH, DO and depth to water (DTW)) however this issue has now been resolved. While EPL289 does not detail compliance trigger values for analytes, GEMCO compare metal concentrations to Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) toxicant default guidelines with a 95% level of protection where available (**Table 1**). In addition to the analysis of metal concentrations, the analysis and interpretation of data within this report is focussed on nutrient concentrations and bacteria as indicators of potential mobilisation of landfill leachate and/or seepage from the sewage sludge facility.

Table 1: GEMCO Water quality trigger levels for groundwater

Analyte	Water Quality Trigger Value (mg/L)
Ni	0.011
Pb	0.0034
Mn	1.9
Zn	0.008
Fe	NA

SAMPLING EVENTS

During FY23, groundwater samples were proposed to be collected on a quarterly basis, however only three of the 11 bores had sufficient water to be sampled at varied frequencies (**Table 2**), with the other eight bores being dry during every sampling event.

RESULTS AND DISCUSSION

DATA ANALYSIS

Metals

While total and dissolved metal concentrations have been analysed, it is the dissolved (bioavailable) concentrations that have been presented in **Table 2** and discussed within this report as these are more relevant to the overarching aim of monitoring biological effects. The total metal concentrations are available within the laboratory certificate of analysis. The concentration of lead and manganese were below their respective trigger values for all groundwater bores that were sampled for the FY23 reporting period (**Table 2**). The concentration of lead was at or below the laboratory limit of reporting (LOR) for all samples. The concentration of nickel was above the trigger value on one occasion in February 2023 at WT015D and zinc consistently breached the ANZG (2018) trigger value at most bores throughout the reporting period (**Table 2**). It is unlikely that elevated zinc concentrations are indicative of impacts from the Waste Management Facility, as groundwater sampling across Groote Eylandt consistently shows variable and elevated zinc concentrations. This is considered to reflect the enrichment of zinc and other metals in the underlying geology of Groote Eylandt. Long-term monitoring of metals in groundwater from bores associated with the Waste Management Facility does not show any increasing trends in any of the metals analysed as part of this monitoring program (**Figure 2 - Figure 6**). It should be noted that where metal concentrations were below the LOR, concentrations have been plotted at their LOR for **Figure 2 - Figure 6**.

Nutrients

Nutrient levels for all groundwater samples were either below the LOR or reported at low concentrations (usually <1 mg/L) during the FY23 reporting period (**Table 2**), in line with historical data (**Table 3**). The nutrient concentrations are likely to reflect levels that naturally occur in the local aquifer(s).

Bacteria

Escherichia coli and *Enterococci* bacteria were not detected in any of the groundwater samples during the FY23 reporting period (**Table 2**).

DISCUSSION

The management practices at GEMCO's Waste Management Facility involve the regular capping of waste cells. This assists in ensuring only minimal volumes of leachate are produced and that there is a minimal driving gradient of groundwater to mobilise leachate into the aquifer system(s). Based on the available data, there is a general absence of landfill seepage indicators. Historically, groundwater data was limited to the upper aquifer. In below-average rainfall years, the water table does not intersect the screened intervals of the bores, resulting in a lack of groundwater data for extended periods. Despite above average rainfall for this FY23 reporting period, there was a general absence of water within the upper aquifer. This was likely due to mine dewatering activities that occur adjacent to the Waste Management Facility which result in the temporary lowering of the aquifer. The lack of water in this shallow aquifer under the Facility suggests that the risk of leachate potentially migrating through the aquifer system is low. To monitor potential impacts to the deeper aquifer at the Facility, the three deeper bores installed in FY22 (i.e. WT029, WT015 and WT025) provide groundwater quality data from the deep aquifer for this reporting period and will be used on an ongoing basis to monitor potential impacts from the Waste Management Facility.

Groundwater monitoring will continue in FY24 to determine any trends in water quality parameters that may be the result of landfill leachate. This will be reported to the NT EPA in line with the reporting requirements of EPL289.

Table 2: FY23 water quality results.

Sample Point	Sample Date	pH	DO (%sat)	Chloride (mg/L)	Potassium (mg/L)	Organic Nitrogen as N (mg/L)	Total Phosphorus as P (mg/L)	Total Dissolved Solids (mg/L)	Chemical Oxygen Demand (mg/L)	Ammonium as N (mg/L)	Dissolved metals (mg/L)					Enterococci CFU/100mL	Escherichia coli CFU/100mL	Depth to water (m)
											Iron	Lead	Manganese	Nickel	Zinc			
ANZG (2018) DGV											NA	0.0034	1.9	0.011	0.008			
WT025D	31/08/2022	4.86	33.35	37	< 1	< 0.5	< 0.05	109	< 10	< 0.01	< 0.05	< 0.001	0.287	0.004	0.047	< 10	< 10	11.88
WT015D	31/08/2022	5.39	15.64	22	< 1	< 0.5	0.06	57	< 10	< 0.01	0.41	< 0.001	1.08	0.003	0.014	< 10	< 10	13.69
WT015D	1/12/2022	5.05	25.28	21	< 1	< 1	0.15	59	< 10	< 0.01	< 0.05	< 0.001	0.852	< 0.001	0.017	< 10	< 10	
WT025D	1/12/2022			35	< 1	< 1	0.26	103	17	< 0.01	0.13	< 0.001	0.704	0.001	0.023	< 10	< 10	
WT007	28/02/2023			10	2	0.1	0.01	282	< 10		0.29	< 0.001	0.026	0.006	0.019	< 1	< 10	
WT015D	28/02/2023			22	< 1	0.2	0.04	61	< 10		0.07	< 0.001	1.01	0.014	0.045	< 10	< 10	
WT025D	28/02/2023			34	< 1	0.2	0.04	91	< 10		< 0.05	0.001	0.152	0.009	0.079	< 10	< 10	
WT015D	18/05/2023	6.40	59.14	22	< 1	0.2	0.06	68	< 10	0.15	< 0.05	< 0.001	0.77	< 0.001	< 0.005	< 10	< 10	15.78
WT025D	18/05/2023	4.71	19.54	31	< 1	0.5	0.04	94	< 10	0.04	< 0.05	< 0.001	0.077	< 0.001	0.005	< 10	< 10	15.21

Concentrations above ANZG (2018) trigger values are indicated by grey shading

Note: Ammonium data is not available for the February sampling event as field data (temp, pH) was not provided to the laboratory for this calculation

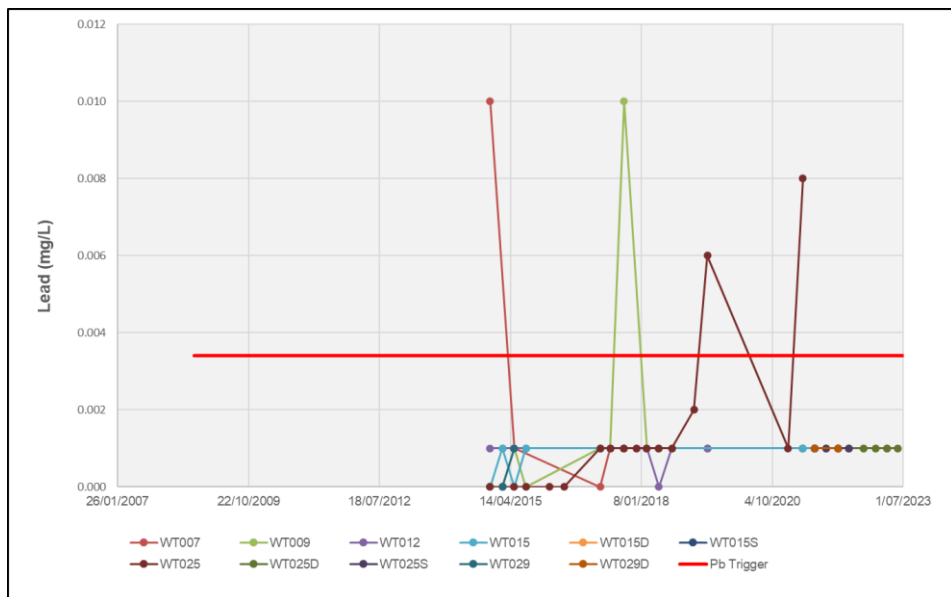


Figure 2: Dissolved lead concentrations in groundwater monitoring bores

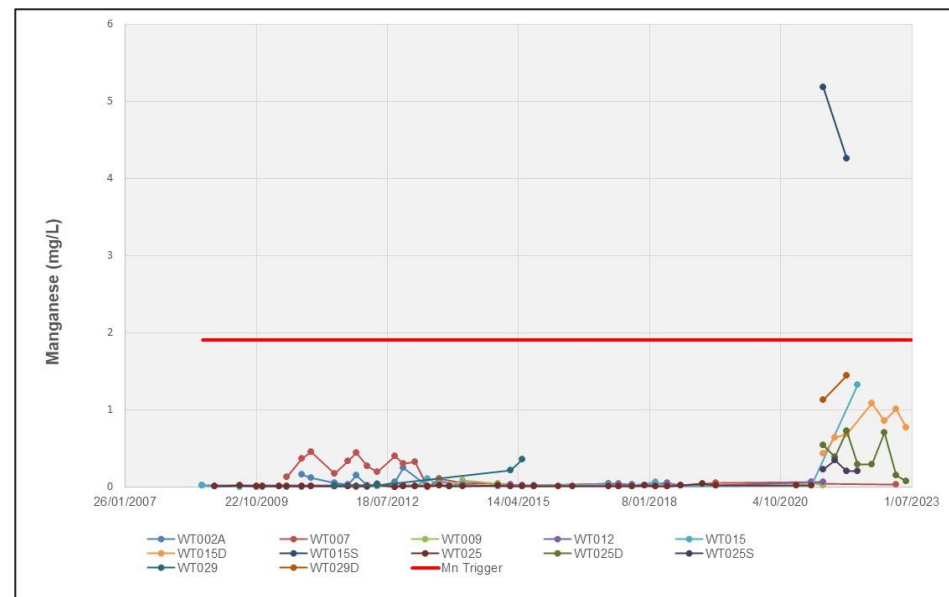


Figure 4: Dissolved manganese concentrations in groundwater monitoring bores

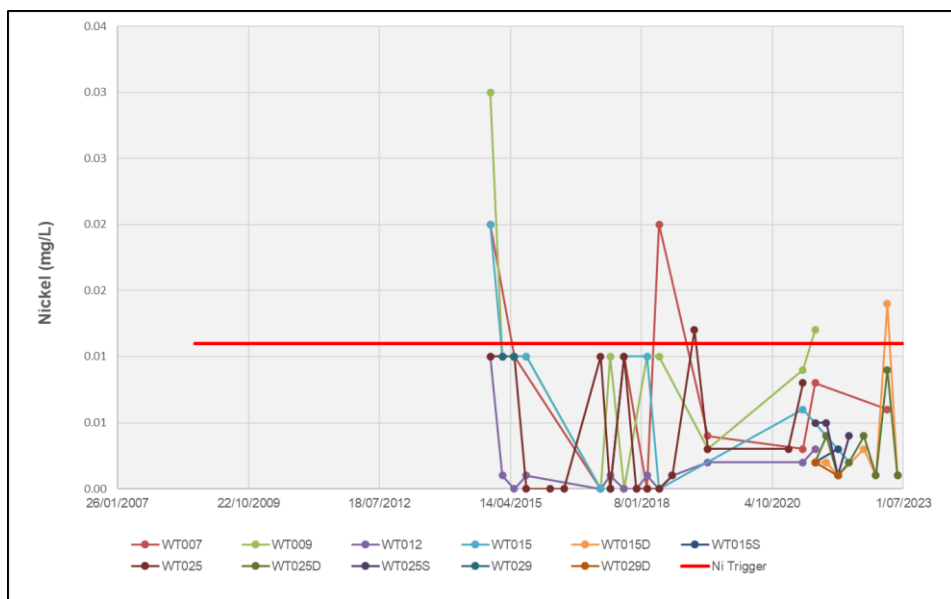


Figure 3: Dissolved nickel concentrations in groundwater monitoring bores

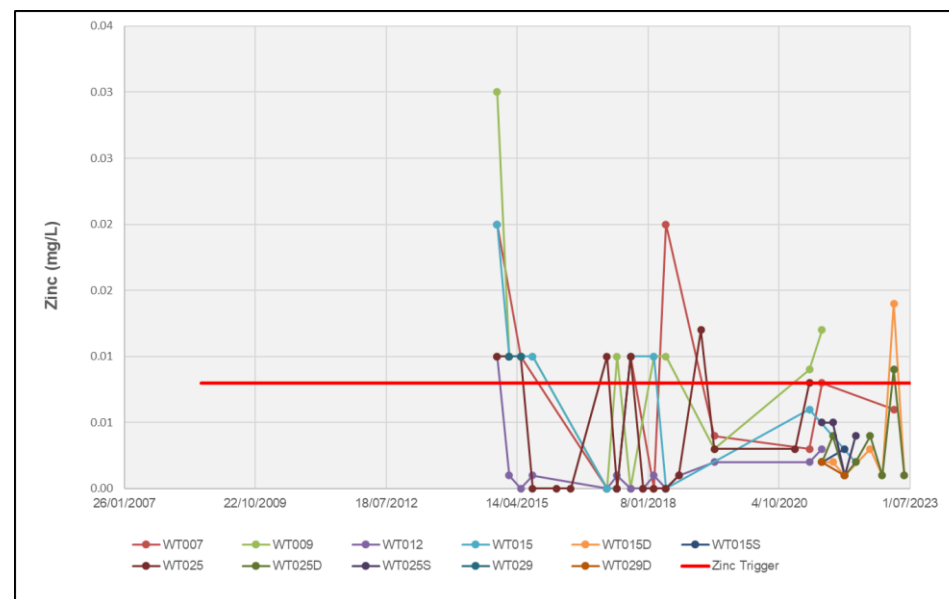


Figure 5: Dissolved zinc concentrations in groundwater monitoring bores

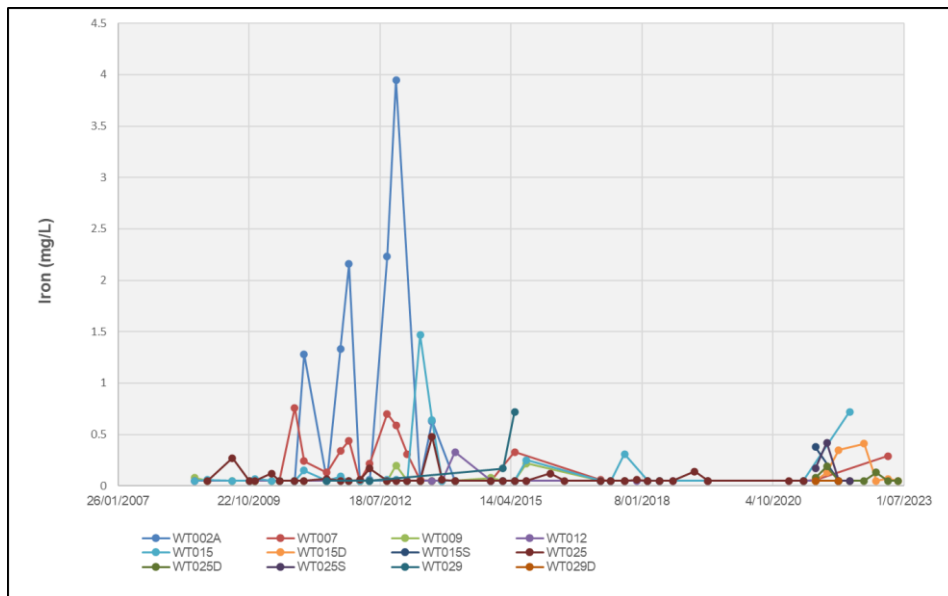


Figure 6: Dissolved iron concentrations in groundwater monitoring bores

Table 3: Long term nutrient concentrations in groundwater associated with waste management facility

Sample Point	Sample Date	Ammonium as N (mg/L)	Organic Nitrogen as N (mg/L)	Potassium (mg/L)	Total Phosphorus as P (mg/L)
WT002A	5/10/2010	0.03		< 1	0.56
WT002A	15/12/2010	0.05		1	
WT002A	7/06/2011	0.04		< 1	
WT002A	19/09/2011	0.03		< 1	
WT002A	23/11/2011	0.05		< 1	
WT002A	16/02/2012	0.01		< 1	
WT002A	30/04/2012	0.03		< 1	
WT002A	10/09/2012	0.06		< 1	
WT002A	18/11/2012	0.09		1	
WT002A	20/05/2013	0.19		< 1	
WT002A	19/08/2013	0.18		1	
WT002A	12/02/2014	0.03		< 1	
WT007	13/06/2010	0.05		4	
WT007	5/10/2010	0.09		4	0.21
WT007	15/12/2010	0.22		4	
WT007	7/06/2011	0.06		3	
WT007	19/09/2011	0.11		3	
WT007	23/11/2011	0.2		3	
WT007	16/02/2012	0.06		4	
WT007	30/04/2012	0.08		3	
WT007	10/09/2012	0.2		2	
WT007	18/11/2012	0.2		2	
WT007	11/02/2013	0.21		3	
WT007	20/05/2013	0.1		3	
WT007	19/08/2013	0.08		2	
WT007	12/02/2014	0.01		2	
WT007	10/11/2014	< 0.01		2	0.01
WT007	12/05/2015	< 0.01		2	< 0.01
WT007	28/02/2017	< 0.01		3	0.05
WT007	15/05/2017	0.05		3	< 0.01
WT007	28/08/2017	0.04		3	0.15
WT007	19/02/2018	0.07		2	0.03
WT007	22/05/2018	0.04		3	0.04
WT007	28/05/2019	< 0.01	0.4	2	0.02
WT007	24/05/2021	< 0.01	0.5	3	< 0.05
WT007	25/08/2021		0.5	2	0.10
WT007	28/02/2023		0.1	2	0.01
WT009	4/09/2008	0.02		3	
WT009	9/12/2008	< 0.01		3	
WT009	10/03/2009	< 0.01		2	
WT009	10/03/2009	< 0.01		2	
WT009	16/06/2009	0.07		2	
WT009	26/10/2009	< 0.01		2	
WT009	8/12/2009	0.01		2	
WT009	8/12/2009	0.01		2	
WT009	12/04/2010	< 0.01		1	
WT009	12/06/2010	< 0.01		2	

Sample Point	Sample Date	Ammonium as N (mg/L)	Organic Nitrogen as N (mg/L)	Potassium (mg/L)	Total Phosphorus as P (mg/L)
WT009	5/10/2010	0.06		2	0.05
WT009	14/12/2010	0.02		1	
WT009	7/06/2011	0.02		1	
WT009	19/09/2011	0.02		2	
WT009	22/11/2011	0.02		1	
WT009	16/02/2012	0.02		1	
WT009	30/04/2012	0.03		1	
WT009	10/09/2012	0.03		1	
WT009	18/11/2012	0.09		2	
WT009	11/02/2013	0.04		2	
WT009	20/05/2013	0.06		1	
WT009	19/08/2013	0.04		2	
WT009	4/11/2013	0.11		2	
WT009	12/02/2014	0.02		1	
WT009	10/11/2014	0.05		1	0.02
WT009	11/02/2015	0.04		1	0.04
WT009	12/05/2015	< 0.01		1	< 0.01
WT009	10/08/2015	< 0.01		1	< 0.01
WT009	28/02/2017	0.03		1	< 0.01
WT009	15/05/2017	0.06		1	0.02
WT009	28/08/2017	0.01		1	0.03
WT009	19/02/2018	0.16		1	0.01
WT009	22/05/2018	0.04		1	0.02
WT009	28/05/2019	0.04	< 0.1	1	0.02
WT009	24/05/2021	< 0.01	< 0.1	2	< 0.01
WT009	25/08/2021		< 0.1	1	< 0.01
WT012	4/09/2008	0.04		< 1	
WT012	19/08/2013	0.1		< 1	
WT012	4/11/2013	0.06		< 1	
WT012	12/02/2014	0.05		< 1	
WT012	10/11/2014	< 0.01		< 1	0.01
WT012	11/02/2015	0.01		< 1	0.06
WT012	12/05/2015	< 0.01		< 1	0.01
WT012	10/08/2015	< 0.01		< 1	< 0.01
WT012	28/02/2017	0.03		< 1	< 0.01
WT012	15/05/2017	0.1		< 1	0.01
WT012	28/08/2017	0.06		< 1	0.14
WT012	30/11/2017	0.27		< 1	0.02
WT012	19/02/2018	0.36		< 1	< 0.01
WT012	22/05/2018	0.07		< 1	< 0.01
WT012	30/08/2018		< 0.1	< 1	< 0.01
WT012	28/05/2019	< 0.01	< 0.1	< 1	< 0.01
WT012	24/05/2021	0.02	< 0.1	< 1	< 0.01
WT012	25/08/2021		0.3	< 1	< 0.01
WT015	3/09/2008	0.04		< 1	
WT015	9/12/2008	< 0.01		< 1	
WT015	9/03/2009	< 0.01		< 1	
WT015	9/03/2009	< 0.01		< 1	
WT015	16/06/2009	0.08		< 1	
WT015	25/10/2009	0.03		< 1	

Sample Point	Sample Date	Ammonium as N (mg/L)	Organic Nitrogen as N (mg/L)	Potassium (mg/L)	Total Phosphorus as P (mg/L)
WT015	8/12/2009	0.03		< 1	
WT015	12/04/2010	< 0.01		< 1	
WT015	13/06/2010	0.05		< 1	
WT015	6/10/2010	0.08		< 1	0.01
WT015	16/12/2010	0.1		< 1	
WT015	7/06/2011	0.02		< 1	
WT015	19/09/2011	< 0.01		< 1	
WT015	22/11/2011	0.05		< 1	
WT015	16/02/2012	0.02		< 1	
WT015	30/04/2012	0.03		< 1	
WT015	10/09/2012	0.02		< 1	
WT015	18/11/2012	0.07		< 1	
WT015	11/02/2013	0.05		< 1	
WT015	20/05/2013	0.15		< 1	
WT015	19/08/2013	1.22		< 1	
WT015	4/11/2013	0.07		< 1	
WT015	12/02/2014	0.06		< 1	
WT015	10/11/2014	< 0.01		< 1	0.11
WT015	11/02/2015	0.01		< 1	0.04
WT015	12/05/2015	< 0.01		< 1	< 0.01
WT015	10/08/2015	0.04		< 1	< 0.01
WT015	28/02/2017	0.21		< 1	0.12
WT015	15/05/2017	0.05		< 1	< 0.01
WT015	28/08/2017	0.04		< 1	0.02
WT015	19/02/2018	0.04		< 1	< 0.01
WT015	22/05/2018	0.04		< 1	< 0.01
WT015	24/05/2021	< 0.01	< 0.1	< 1	< 0.01
WT015	12/05/2022	0.06	0.1	< 1	0.03
WT015D	25/08/2021		< 0.5	< 1	0.26
WT015D	18/11/2021		< 0.1	< 1	0.02
WT015D	17/02/2022	0.05	0.8	< 1	0.02
WT015D	31/08/2022	< 0.01	< 0.5	< 1	0.06
WT015D	1/12/2022	< 0.01	< 1	< 1	0.15
WT015D	28/02/2023		0.2	< 1	0.04
WT015D	18/05/2023	0.15	0.2	< 1	0.06
WT015S	25/08/2021		< 2	2	0.45
WT015S	17/02/2022	0.13	< 1	2	0.16
WT025	9/12/2008	< 0.01		< 1	
WT025	9/03/2009	< 0.01		< 1	
WT025	9/03/2009	< 0.01		< 1	
WT025	16/06/2009	0.08		< 1	
WT025	25/10/2009	< 0.01		< 1	
WT025	8/12/2009	0.01		< 1	
WT025	12/04/2010	< 0.01		< 1	
WT025	13/06/2010	0.02		< 1	
WT025	6/10/2010	0.05		< 1	0.04
WT025	16/12/2010	0.06		< 1	
WT025	7/06/2011	0.03		< 1	
WT025	19/09/2011	< 0.01		< 1	
WT025	22/11/2011	0.02		< 1	

Sample Point	Sample Date	Ammonium as N (mg/L)	Organic Nitrogen as N (mg/L)	Potassium (mg/L)	Total Phosphorus as P (mg/L)
WT025	16/02/2012	0.03		< 1	
WT025	30/04/2012	0.05		< 1	
WT025	10/09/2012	0.03		< 1	
WT025	18/11/2012	0.06		< 1	
WT025	11/02/2013	0.06		< 1	
WT025	20/05/2013	0.05		< 1	
WT025	19/08/2013	0.05		< 1	
WT025	4/11/2013	0.06		< 1	
WT025	12/02/2014	0.04		< 1	
WT025	10/11/2014	0.04		< 1	< 0.01
WT025	11/02/2015	0.02		< 1	0.04
WT025	12/05/2015	< 0.01		< 1	< 0.01
WT025	10/08/2015	< 0.01		< 1	< 0.01
WT025	8/02/2016	0.03		< 1	< 0.01
WT025	27/05/2016	0.02		< 1	< 0.01
WT025	28/02/2017	0.14		< 1	0.05
WT025	15/05/2017	0.05		< 1	< 0.01
WT025	28/08/2017	0.08		< 1	< 0.01
WT025	30/11/2017	0.12		< 1	0.03
WT025	19/02/2018	0.16		< 1	< 0.01
WT025	22/05/2018	0.01		< 1	< 0.01
WT025	30/08/2018		< 0.1	< 1	< 0.01
WT025	14/02/2019		< 1	< 1	< 0.01
WT025	28/05/2019	0.06	< 0.1	< 1	< 0.01
WT025	2/02/2021	< 0.01	< 0.1	< 1	< 0.01
WT025	24/05/2021	< 0.01	0.1	< 1	< 0.01
WT025D	25/08/2021		0.1	< 1	0.01
WT025D	18/11/2021		0.4	< 1	0.04
WT025D	17/02/2022	0.05	2.0	< 1	0.22
WT025D	12/05/2022	0.06	0.5	< 1	0.10
WT025D	31/08/2022	< 0.01	< 0.5	< 1	< 0.05
WT025D	1/12/2022	< 0.01	< 1	< 1	0.26
WT025D	28/02/2023		0.2	< 1	0.04
WT025D	18/05/2023	0.04	0.5	< 1	0.04
WT025S	25/08/2021		0.1	< 1	< 0.01
WT025S	18/11/2021		0.9	< 1	0.07
WT025S	17/02/2022	0.02	< 0.5	< 1	< 0.05
WT025S	12/05/2022	< 0.01	0.6	< 1	0.02
WT029	7/06/2011	0.02		< 1	
WT029	30/04/2012	0.04		< 1	
WT029	11/02/2015	0.03		< 1	0.04
WT029	12/05/2015	< 0.01		< 1	0.08
WT029D	25/08/2021		< 2	< 1	< 0.20
WT029D	17/02/2022	< 0.01	< 1	< 1	0.16

REFERENCES

ANZECC & ARMCANZ 2000, [Australian and New Zealand Guidelines for Fresh and Marine Water Quality](#), Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

CERTIFICATE OF ANALYSIS

Work Order : **EB2225816**
Client : **GEMCO**
Contact : MR JEREMY S BARNETT
Address : ENVIRONMENT DEPARTMENT ALYANGULA
 GROOTE EYLANDT NT, AUSTRALIA 0885

Telephone : ----
Project : ALS_GEMCO_WATER_GROUNDWATER
Order number : 4542424429
C-O-C number : ----
Sampler : JEREMY BARNETT
Site : 60003
Quote number : BN/189/19 V5
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 4
Laboratory : Environmental Division Brisbane
Contact : John Pickering
Address : 2 Byth Street Stafford QLD Australia 4053

Telephone : +61 7 3552 8634
Date Samples Received : 01-Sep-2022 20:11
Date Analysis Commenced : 01-Sep-2022
Issue Date : 08-Sep-2022 14:26



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Nibi Karl	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

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

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

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

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

- EK061G (Total Kjeldahl Nitrogen as N) / EK067G (Total Phosphorus as P): Some samples were diluted due to matrix interference. LOR adjusted accordingly.
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- Microbiological Comment: Membrane filtration result is reported <10 CFU/100mL where 10mL sample was filtered because the sample was turbid, insufficient for filtration at higher volume and there were no target organisms confirmed.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

				Sample ID	WT015D	WT025D	----	----	----
Sampling date / time					31-Aug-2022 00:00	31-Aug-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2225816-001	EB2225816-002	-----	-----	-----
				Result	Result		----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		88	168	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		57	109	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		6	5	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		6	5	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		22	37	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	3	----	----	----
Magnesium	7439-95-4	1	mg/L		1	2	----	----	----
Sodium	7440-23-5	1	mg/L		13	24	----	----	----
Potassium	7440-09-7	1	mg/L		<1	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		1.08	0.287	----	----	----
Nickel	7440-02-0	0.001	mg/L		0.003	0.004	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.014	0.047	----	----	----
Iron	7439-89-6	0.05	mg/L		0.41	<0.05	----	----	----
EK010-1: Chlorine									
Total Residual Chlorine	----	0.02	mg/L		0.02	<0.02	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	<0.01	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	14798-03-9_N	0.01	mg/L		<0.01	<0.01	----	----	----
EK060G: Organic Nitrogen as N (TKN-NH3) By Discrete Analyser									
Organic Nitrogen as N	----	0.1	mg/L		<0.5	<0.5	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

				Sample ID	WT015D	WT025D			
				Sampling date / time	31-Aug-2022 00:00	31-Aug-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2225816-001	EB2225816-002	-----	-----	-----
					Result	Result	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.06	<0.05	----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		0.74	1.14	----	----	----
∅ Total Cations	----	0.01	meq/L		0.65	1.36	----	----	----
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<10	<10	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
<i>Escherichia coli</i>	----	1	CFU/100mL		<10	<10	----	----	----
MW023: Enterococci by Membrane Filtration									
<i>Enterococci</i>	----	1	CFU/100mL		<10	<10	----	----	----

QUALITY CONTROL REPORT

Work Order	: EB2225816	Page	: 1 of 6
Client	: GEMCO	Laboratory	: Environmental Division Brisbane
Contact	: MR JEREMY S BARNETT	Contact	: John Pickering
Address	: ENVIRONMENT DEPARTMENT ALYANGULA GROOTE EYLANDT NT, AUSTRALIA 0885	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8634
Project	: ALS_GEMCO_WATER_GROUNDWATER	Date Samples Received	: 01-Sep-2022
Order number	: 4542424429	Date Analysis Commenced	: 01-Sep-2022
C-O-C number	: ----	Issue Date	: 08-Sep-2022
Sampler	: JEREMY BARNETT		
Site	: 60003		
Quote number	: BN/189/19 V5		
No. of samples received	: 2		
No. of samples analysed	: 2		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Nibi Karl	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA010P: Conductivity by PC Titrator (QC Lot: 4558470)									
EB2225547-007	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	359	354	1.6	0% - 20%
EB2225757-009	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	246	245	0.5	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4558471)									
EB2225547-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	137	134	2.1	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	137	134	2.1	0% - 20%
EB2225757-009	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	74	73	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	74	73	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4559640)									
EB2225202-018	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	351	364	3.6	0% - 20%
EB2225690-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2490	2470	1.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4559633)									
EB2225202-018	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	7320	7340	0.3	0% - 20%
EB2225690-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2620	2620	0.2	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4562472)									
EB2225768-009	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EB2225816-002	WT025D	ED093F: Calcium	7440-70-2	1	mg/L	3	3	0.0	No Limit

Page : 3 of 6
 Work Order : EB2225816
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED093F: Dissolved Major Cations (QC Lot: 4562472) - continued									
EB2225816-002	WT025D	ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	24	24	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4562466)									
EB2225544-009	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.025	<0.025	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.025	<0.025	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.025	<0.025	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.125	<0.125	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.25	<0.25	0.0	No Limit
EB2225544-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.025	<0.025	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.199	0.215	7.9	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.025	<0.025	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.125	<0.125	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	3.16	3.29	4.2	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4562473)									
EB2225816-002	WT025D	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.287	0.286	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.047	0.049	2.9	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EK010-1: Chlorine (QC Lot: 4555744)									
EB2225816-001	WT015D	EK010-1: Total Residual Chlorine	----	0.02	mg/L	0.02	0.02	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4557686)									
EB2222760-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.10	<0.10	0.0	No Limit
EB2222763-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.10	<0.10	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4561634)									
EB2225768-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.2	0.0	No Limit
EB2225776-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.5	2.5	0.0	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4561635)									
EB2225776-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	5.26	5.37	2.1	0% - 20%
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 4555979)									
EB2225215-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	8670	8650	0.2	0% - 20%
EB2225793-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	13	14	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA010P: Conductivity by PC Titrator (QCLot: 4558470)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	99.6	90.0	106
				<1	12890 µS/cm	102	90.0	106
ED037P: Alkalinity by PC Titrator (QCLot: 4558471)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	106	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4559640)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.8	85.0	118
				<1	100 mg/L	95.1	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 4559633)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.9	90.0	115
				<1	1000 mg/L	105	90.0	115
ED093F: Dissolved Major Cations (QCLot: 4562472)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	105	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	101	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	99.2	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4562466)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.8	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	103	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	104	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	107	82.0	114
EG020F: Dissolved Metals by ICP-MS (QCLot: 4562473)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.4	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	102	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	103	82.0	114
EK010-1: Chlorine (QCLot: 4555744)								
EK010-1: Total Residual Chlorine	----	0.02	mg/L	<0.02	0.89 mg/L	95.5	88.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4557686)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	95.4	83.5	114
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4561634)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	1 mg/L	91.8	70.1	108

Page : 5 of 6
 Work Order : EB2225816
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4561635)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	0.442 mg/L	102	90.2	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4555979)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	50 mg/L	97.8	86.0	112
				<10	500 mg/L	104	86.0	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**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4559640)							
EB2225888-011	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	85.6	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4559633)							
EB2225888-011	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4562466)							
EB2225544-002	Anonymous	EG020A-F: Lead	7439-92-1	25 mg/L	84.2	70.0	130
		EG020A-F: Manganese	7439-96-5	25 mg/L	94.3	70.0	130
		EG020A-F: Nickel	7440-02-0	25 mg/L	101	70.0	130
		EG020A-F: Zinc	7440-66-6	25 mg/L	108	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4562473)							
EB2225816-002	WT025D	EG020A-F: Lead	7439-92-1	1 mg/L	97.7	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	93.6	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	106	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	115	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4557686)							
EB2222762-001	Anonymous	EK055G: Ammonia as N	7664-41-7	4 mg/L	92.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4561634)							
EB2225776-005	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	91.1	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4561635)							
EB2225776-005	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	# Not Determined	70.0	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4555979)							
EB2225215-003	Anonymous	EP026SP: Chemical Oxygen Demand	----	196 mg/L	103	70.0	130

Page : 6 of 6
Work Order : EB2225816
Client : GEMCO
Project : ALS_GEMCO_WATER_GROUNDWATER



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB2225816	Page	: 1 of 7
Client	: GEMCO	Laboratory	: Environmental Division Brisbane
Contact	: MR JEREMY S BARNETT	Telephone	: +61 7 3552 8634
Project	: ALS_GEMCO_WATER_GROUNDWATER	Date Samples Received	: 01-Sep-2022
Site	: 60003	Issue Date	: 08-Sep-2022
Sampler	: JEREMY BARNETT	No. of samples received	: 2
Order number	: 4542424429	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- **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							
ED045G: Chloride by Discrete Analyser	EB2225888--011	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK067G: Total Phosphorus as P by Discrete Analyser	EB2225776--005	Anonymous	Total Phosphorus as P	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK010-1: Chlorine							
Clear Plastic Bottle - Natural WT015D,	WT025D	----	----	----	02-Sep-2022	01-Sep-2022	1

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	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) WT015D,	WT025D	31-Aug-2022	----	----	----	03-Sep-2022	28-Sep-2022	✔
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) WT015D,	WT025D	31-Aug-2022	----	----	----	03-Sep-2022	14-Sep-2022	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) WT015D,	WT025D	31-Aug-2022	----	----	----	05-Sep-2022	28-Sep-2022	✔
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) WT015D,	WT025D	31-Aug-2022	----	----	----	05-Sep-2022	28-Sep-2022	✔



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) WT015D, WT025D	31-Aug-2022	----	----	----	06-Sep-2022	28-Sep-2022	✓	
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) WT015D, WT025D	31-Aug-2022	----	----	----	06-Sep-2022	27-Feb-2023	✓	
EK010-1: Chlorine								
Clear Plastic Bottle - Natural (EK010-1) WT015D, WT025D	31-Aug-2022	----	----	----	02-Sep-2022	01-Sep-2022	✗	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) WT015D, WT025D	31-Aug-2022	----	----	----	02-Sep-2022	28-Sep-2022	✓	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) WT015D, WT025D	31-Aug-2022	06-Sep-2022	28-Sep-2022	✓	06-Sep-2022	28-Sep-2022	✓	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) WT015D, WT025D	31-Aug-2022	06-Sep-2022	28-Sep-2022	✓	06-Sep-2022	28-Sep-2022	✓	
EP026SP: Chemical Oxygen Demand (Spectrophotometric)								
Clear Plastic Bottle - Sulfuric Acid (EP026SP) WT015D, WT025D	31-Aug-2022	----	----	----	02-Sep-2022	28-Sep-2022	✓	
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006) WT015D, WT025D	31-Aug-2022	----	----	----	01-Sep-2022	01-Sep-2022	✓	
MW023: Enterococci by Membrane Filtration								
Sterile Plastic Bottle - Sodium Thiosulfate (MW023) WT015D, WT025D	31-Aug-2022	----	----	----	01-Sep-2022	01-Sep-2022	✓	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	3	20	15.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	7	28.57	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	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	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Page : 5 of 7
 Work Order : EB2225816
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Matrix Spikes (MS) - Continued							
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	8	12.50	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
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . 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 BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45um 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.
Residual Chlorine by DPD Colourimetry	EK010-1	WATER	In house: Referenced to APHA 4500-Cl G, using Palintest Chlorometer 1000
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ammonium as N	EK055G-NH ₄	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 4500-NH ₃ G. This method is compliant with NEPM Schedule B(3)
Organic Nitrogen as N (TKN - NH ₃) (discrete analyser)	EK060G	WATER	In house: Referenced to APHA 4500-Norg/4500-NH ₃ . This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloured and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7
Enumeration of Enterococci by Membrane Filtration	MW023	WATER	AS4276.9
Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176
Ph: 02 8794 8555 E: samples_sydney@aisenviro.com

☐ **Newcastle:** 5 Rosogum Rd, Warabrook NSW 2304
Ph: 02 4088 9433 E: samples_newcastle@aisenviro.com

☐ **Brisbane:** 32 Shand St, Stafford Q1 10 4053
 Ph:07 3343 7222 Email:brisbane@niscenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818
 Ph:07 4796 0600 E: townsville.environmental@niscenviro.com

☐ **Melbourne:** 2-4 Westal Rd, Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@aservico.com

☐ **Adelaide:** 2-1 Burnis Rd, Fochaka SA 5095
Ph: 08 8350 0890 E: adelaide@aservico.com

☐ Perth: 10 Hod Way, Malaga WA 6090
Ph: 08 9200 7855 E: samples.perth@alsesyno.com

☐ Launceston: 27 Wellington St, Launceston TAS 7250
Ph: 03 6331 2168 E: launceston@alsesyno.com

Environmental Division
Brisbane

Work Order Reference

Work Order Reference
EB2225816



Telephone : + 61-7-3243 7222

NA
NA

CLIENT: GEMCO		TURNAROUND REQUIREMENTS : ☒ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		FOR LAB		 Telephone : + 61-7-3243 7222			
OFFICE:		☐ Standard TAT (List due date):		Custody:					
PROJECT: Groundwater	SITE: 60003	ALS QUOTE NO.: BN/189/19	COC SEQUENCE NUMBER (Circle)		Free Ice				
ORDER NUMBER: 452132952			COC: 1 2 3 4 5 6 7		Random				
PROJECT MANAGER: Jeremy Barnett		CONTACT PH: 0427 089167		OF: 1 2 3 4 5 6 7		Other comments:			
SAMPLER: Jeremy Barnett		SAMPLER MOBILE: 0427 089 167		RELINQUISHED BY:		RECEIVED BY:			
COC emailed to ALS? NO		EDD FORMAT: ALS-Envirosys tabular format South32 EQuIS Database Format		DATE/TIME:		RECEIVED BY:			
Email Reports to: gemco_esys_dl@bhpbilliton.com; gemco_support@sra.com.au; jeremy.s.barnett@south32.net; environmentaldata@south32.net						DATE/TIME:		RECEIVED BY:	
Email Invoice to: EnviroCosting.Brisbane@alsglobal.com						DATE/TIME:		RECEIVED BY:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Please name the results file: ALS_GEMCO_WATER_GROUNDWATER (insert the workorder number here).CSV

[illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vol HCl Preserved; VS = VOA Vol Sodium Bisulfate Preserved; VS = VOA Vol Sulfuric Preserved; AV = Airfreight Unpreserved Vol S = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Astatic Bag for Acid Solution Solids; B = Unpreserved bag;

CERTIFICATE OF ANALYSIS

Work Order : **EB2236142**
Client : **GEMCO**
Contact : MR JEREMY S BARNETT
Address : ENVIRONMENTAL DEPARTMENT ALYANGULA
 GROOTE EYLANDT NT, AUSTRALIA 0885

Telephone : ----
Project : ALS_GEMCO_WATER_GROUNDWATER
Order number : 4542424429
C-O-C number : ----
Sampler : JEREMY BARNETT
Site : 60003
Quote number : BN/189/19 V5
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 5
Laboratory : Environmental Division Brisbane
Contact : John Pickering
Address : 2 Byth Street Stafford QLD Australia 4053

Telephone : +61 7 3552 8634
Date Samples Received : 02-Dec-2022 12:20
Date Analysis Commenced : 02-Dec-2022
Issue Date : 07-Dec-2022 11:32



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Liz Heizmann	Microbiologist	Brisbane Microbiological, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

- EK061G (Total Kjeldahl Nitrogen as N): Some samples were diluted due to matrix interference. LOR adjusted accordingly.
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- MW006 is ALS's internal code and is equivalent to AS4276.5.
- Microbiological Comment: Membrane filtration result is reported <10 CFU/100mL where 10mL sample was filtered because the sample was turbid, insufficient for filtration at higher volume and there were no target organisms detected.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

				Sample ID	WT015D	WT025D	----	----	----
Sampling date / time					01-Dec-2022 00:00	01-Dec-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2236142-001	EB2236142-002	-----	-----	-----
				Result	Result		----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		91	159	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		59	103	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		5	17	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		5	17	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		21	35	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	3	----	----	----
Magnesium	7439-95-4	1	mg/L		<1	2	----	----	----
Sodium	7440-23-5	1	mg/L		14	24	----	----	----
Potassium	7440-09-7	1	mg/L		<1	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.852	0.704	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.017	0.023	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	0.13	----	----	----
EK010-1: Chlorine									
Total Residual Chlorine	----	0.02	mg/L		<0.02	<0.02	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	<0.01	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	14798-03-9_N	0.01	mg/L		<0.01	<0.01	----	----	----
EK060G: Organic Nitrogen as N (TKN-NH3) By Discrete Analyser									
Organic Nitrogen as N	----	0.1	mg/L		<1.0	<1.0	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<1.0	<1.0	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	WT015D	WT025D	----	----	----
Sampling date / time					01-Dec-2022 00:00	01-Dec-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2236142-001	EB2236142-002	-----	-----	-----
Result					Result	Result	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.15	0.26	----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		0.69	1.33	----	----	----
∅ Total Cations	----	0.01	meq/L		0.61	1.36	----	----	----
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<10	17	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
<i>Escherichia coli</i>	----	1	CFU/100mL		<10	<10	----	----	----
MW023: Enterococci by Membrane Filtration									
<i>Enterococci</i>	----	1	CFU/100mL		<10	<10	----	----	----



Analytical Results

Sub-Matrix: **SURFACE WATER**
 (Matrix: **WATER**)

Sample ID

				F3 Quarry	----	----	----	----
Sampling date / time				01-Dec-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2236142-003	-----	-----	-----	-----
Result				Result	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	940	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	578	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	6	----	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	3.8	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.17	----	----	----	----
Barium	7440-39-3	0.001	mg/L	0.019	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.132	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.31	----	----	----	----
Barium	7440-39-3	0.001	mg/L	0.020	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.156	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.08	----	----	----	----
EP071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: EB2236142	Page	: 1 of 7
Client	: GEMCO	Laboratory	: Environmental Division Brisbane
Contact	: MR JEREMY S BARNETT	Contact	: John Pickering
Address	: ENVIRONMENTAL DEPARTMENT ALYANGULA GROOTE EYLANDT NT, AUSTRALIA 0885	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8634
Project	: ALS_GEMCO_WATER_GROUNDWATER	Date Samples Received	: 02-Dec-2022
Order number	: 4542424429	Date Analysis Commenced	: 02-Dec-2022
C-O-C number	: ----	Issue Date	: 07-Dec-2022
Sampler	: JEREMY BARNETT		
Site	: 60003		
Quote number	: BN/189/19 V5		
No. of samples received	: 3		
No. of samples analysed	: 3		



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Liz Heizmann	Microbiologist	Brisbane Microbiological, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD

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

Where 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.

Laboratory Duplicate (DUP) Report

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA010P: Conductivity by PC Titrator (QC Lot: 4744895)									
EB2236148-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1190	1190	0.2	0% - 20%
EB2236091-006	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1000	1000	0.2	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4745609)									
EB2235971-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3270	3280	0.3	0% - 20%
EB2235727-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	192	192	0.0	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 4745880)									
EB2235649-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	2990	3080	2.9	0% - 20%
EB2235684-002	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	200	195	2.2	0% - 50%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4745882)									
EB2235664-007	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	22	26	14.4	No Limit
EB2235708-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	5580	5050	9.9	0% - 20%
EA045: Turbidity (QC Lot: 4744026)									
EB2236105-004	Anonymous	EA045: Turbidity	----	0.1	NTU	31.7	31.6	0.3	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4744893)									
EB2236148-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	57	54	5.3	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	57	54	5.3	0% - 20%
EB2236091-006	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	67	56	18.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	67	56	18.8	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4745610)									

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 4745610) - continued									
EB2235971-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	54	62	13.4	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	1110	1100	0.7	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1170	1170	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4745020)									
EB2236085-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	114	115	0.9	0% - 20%
EB2236091-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	386	386	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4748953)									
EB2236142-002	WT025D	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EB2235685-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1600	1580	1.6	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4745023)									
EB2236085-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	211	217	3.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4748954)									
EB2236142-002	WT025D	ED045G: Chloride	16887-00-6	1	mg/L	35	35	0.0	0% - 20%
EB2235685-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 4744826)									
EB2236142-001	WT015D	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	14	14	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4744825)									
EB2236080-001	Anonymous	EG020A-F: Barium	7440-39-3	0.001	mg/L	0.082	0.083	0.0	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.211	0.214	1.5	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.009	0.003	94.8	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.010	0.011	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.01	0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 4744830)									
EB2236142-003	F3 Quarry	EG020A-T: Barium	7440-39-3	0.001	mg/L	0.020	0.021	0.0	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.156	0.158	1.2	0% - 20%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.31	0.31	0.0	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.08	0.07	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4745958)									
EB2236118-011	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB2236126-003	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	9.27	9.49	2.4	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4744168)									

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 Work Order : EB2236142
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4744168) - continued									
EB2235984-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.0	No Limit
EB2236126-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	14.5	14.0	3.4	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4744167)									
EB2235984-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.04	0.04	0.0	No Limit
EB2236126-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.43	0.38	11.6	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 4746092)									
EB2235312-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	417	408	2.0	No Limit
EB2235911-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	1450	1480	1.7	0% - 20%



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA010P: Conductivity by PC Titrator (QCLot: 4744895)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	103	90.0	106
				<1	12890 µS/cm	95.7	90.0	106
EA010P: Conductivity by PC Titrator (QCLot: 4745609)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2100 µS/cm	93.3	90.0	106
				<1	24800 µS/cm	96.5	90.0	106
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 4745880)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	293 mg/L	105	88.0	112
				<10	2000 mg/L	97.0	80.9	118
				<10	2340 mg/L	111	80.8	119
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4745882)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	104	88.0	112
				<5	1000 mg/L	94.2	88.0	112
				<5	987 mg/L	107	84.8	115
EA045: Turbidity (QCLot: 4744026)								
EA045: Turbidity	----	0.1	NTU	<0.1	4 NTU	104	90.0	110
				<0.1	40 NTU	101	90.0	110
				<0.1	400 NTU	106	90.0	110
ED037P: Alkalinity by PC Titrator (QCLot: 4744893)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	103	80.0	120
ED037P: Alkalinity by PC Titrator (QCLot: 4745610)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	99.1	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4745020)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	100	85.0	118
				<1	100 mg/L	96.3	85.0	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4748953)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	85.0	118
				<1	100 mg/L	98.0	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 4745023)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	94.7	90.0	115
				<1	1000 mg/L	98.4	90.0	115
ED045G: Chloride by Discrete Analyser (QCLot: 4748954)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.4	90.0	115
				<1	1000 mg/L	108	90.0	115



Sub-Matrix: **WATER**

Method: Compound				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
							Low	High
CAS Number	LOR	Unit	Result			LCS		
ED093F: Dissolved Major Cations (QCLot: 4744826)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	101	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	104	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	107	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	99.7	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4744825)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	100	79.0	118
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	100	70.0	130
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.2	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.7	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.2	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.7	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	102	82.0	114
EG020T: Total Metals by ICP-MS (QCLot: 4744830)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	101	80.0	114
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	99.2	70.0	130
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.5	88.0	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.4	84.0	114
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	101	82.0	118
EK010-1: Chlorine (QCLot: 4744027)								
EK010-1: Total Residual Chlorine	----	0.02	mg/L	<0.02	0.89 mg/L	94.4	88.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4745958)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	101	83.5	114
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4744168)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	1 mg/L	81.6	70.1	108
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4744167)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	0.442 mg/L	97.2	90.2	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4746092)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	50 mg/L	98.3	86.0	112
				<10	500 mg/L	104	86.0	112
EP071: Total Petroleum Hydrocarbons (QCLot: 4745998)								
EP071-SV: C10 - C14 Fraction	----	50	µg/L	<50	1192 µg/L	105	51.9	126
EP071-SV: C15 - C28 Fraction	----	100	µg/L	<100	1390 µg/L	112	51.4	124
EP071-SV: C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
EP071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4745998)								
EP071-SV: >C10 - C16 Fraction	----	100	µg/L	<100	1592 µg/L	106	53.2	125
EP071-SV: >C16 - C34 Fraction	----	100	µg/L	<100	932 µg/L	118	49.5	123
EP071-SV: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----



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**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4745020)							
EB2235967-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# 66.7	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4748953)							
EB2235685-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4745023)							
EB2235967-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	105	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4748954)							
EB2235685-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	113	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4744825)							
EB2236142-001	WT015D	EG020A-F: Barium	7440-39-3	1 mg/L	95.6	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	97.7	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	95.6	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	99.9	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	94.7	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4745958)							
EB2236118-012	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	95.4	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4744168)							
EB2235984-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	88.9	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4744167)							
EB2235984-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	106	70.0	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4746092)							
EB2235420-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	50 mg/L	94.8	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB2236142**

Page : 1 of 8

Client : **GEMCO**
Contact : MR JEREMY S BARNETT
Project : ALS_GEMCO_WATER_GROUNDWATER
Site : 60003
Sampler : JEREMY BARNETT
Order number : 4542424429

Laboratory : Environmental Division Brisbane
Telephone : +61 7 3552 8634
Date Samples Received : 02-Dec-2022
Issue Date : 07-Dec-2022
No. of samples received : 3
No. of samples analysed : 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.

Page : 2 of 8
 Work Order : EB2236142
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



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	EB2235967--001	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	66.7 %	70.0-130%	Recovery less than lower data quality objective
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB2235685--001	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK010-1: Chlorine							
Clear Plastic Bottle - Natural WT015D,		WT025D	----	----	----	02-Dec-2022	01-Dec-2022
							1

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Residual Chlorine by DPD Colourimetry	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	0	2	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Total Metals by ICP-MS - Suite A	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	0	2	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for **VOC in soils** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) WT015D,	F3 Quarry	01-Dec-2022	----	----	----	05-Dec-2022	29-Dec-2022	✓
Clear Plastic Bottle - Natural (EA010-P) WT025D		01-Dec-2022	----	----	----	06-Dec-2022	29-Dec-2022	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H) F3 Quarry		01-Dec-2022	----	----	----	06-Dec-2022	08-Dec-2022	✓
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H) F3 Quarry		01-Dec-2022	----	----	----	06-Dec-2022	08-Dec-2022	✓
EA045: Turbidity								
Clear Plastic Bottle - Natural (EA045) F3 Quarry		01-Dec-2022	----	----	----	02-Dec-2022	03-Dec-2022	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) WT015D		01-Dec-2022	----	----	----	05-Dec-2022	15-Dec-2022	✓
Clear Plastic Bottle - Natural (ED037-P) WT025D		01-Dec-2022	----	----	----	06-Dec-2022	15-Dec-2022	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) WT015D		01-Dec-2022	----	----	----	05-Dec-2022	29-Dec-2022	✓
Clear Plastic Bottle - Natural (ED041G) WT025D		01-Dec-2022	----	----	----	06-Dec-2022	29-Dec-2022	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) WT015D		01-Dec-2022	----	----	----	05-Dec-2022	29-Dec-2022	✓
Clear Plastic Bottle - Natural (ED045G) WT025D		01-Dec-2022	----	----	----	06-Dec-2022	29-Dec-2022	✓
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) WT015D,	WT025D	01-Dec-2022	----	----	----	03-Dec-2022	29-Dec-2022	✓
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) WT015D, F3 Quarry	WT025D,	01-Dec-2022	----	----	----	03-Dec-2022	30-May-2023	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) F3 Quarry		01-Dec-2022	03-Dec-2022	30-May-2023	✓	03-Dec-2022	30-May-2023	✓
EK010-1: Chlorine								
Clear Plastic Bottle - Natural (EK010-1) WT015D,	WT025D	01-Dec-2022	----	----	----	02-Dec-2022	01-Dec-2022	✗



Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) WT015D, WT025D	01-Dec-2022	----	----	----	05-Dec-2022	29-Dec-2022	✓	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) WT015D, WT025D	01-Dec-2022	02-Dec-2022	29-Dec-2022	✓	05-Dec-2022	29-Dec-2022	✓	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) WT015D, WT025D	01-Dec-2022	02-Dec-2022	29-Dec-2022	✓	05-Dec-2022	29-Dec-2022	✓	
EP026SP: Chemical Oxygen Demand (Spectrophotometric)								
Clear Plastic Bottle - Sulfuric Acid (EP026SP) WT015D, WT025D	01-Dec-2022	----	----	----	05-Dec-2022	29-Dec-2022	✓	
EP071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071-SV) F3 Quarry	01-Dec-2022	05-Dec-2022	08-Dec-2022	✓	07-Dec-2022	14-Jan-2023	✓	
EP071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071-SV) F3 Quarry	01-Dec-2022	05-Dec-2022	08-Dec-2022	✓	07-Dec-2022	14-Jan-2023	✓	
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006) WT015D, WT025D	01-Dec-2022	----	----	----	02-Dec-2022	02-Dec-2022	✓	
MW023: Enterococci by Membrane Filtration								
Sterile Plastic Bottle - Sodium Thiosulfate (MW023) WT015D, WT025D	01-Dec-2022	----	----	----	02-Dec-2022	02-Dec-2022	✓	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	3	19	15.79	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	3	17	17.65	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	4	34	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	0	7	0.00	10.00	✗	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	21	19.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	0	2	0.00	10.00	✗	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	19	10.53	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	17	23.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	4	34	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	21	19.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	17	17.65	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	15	20.00	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	3	3	100.00	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Chloride by Discrete Analyser	ED045G	2	17	11.76	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	34	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	21	9.52	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	11.76	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	21	9.52	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	1	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	0	2	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard



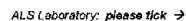
Brief Method Summaries

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
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of 'non-filterable' residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C. This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . 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 BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
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.
Residual Chlorine by DPD Colourimetry	EK010-1	WATER	In house: Referenced to APHA 4500-Cl G, using Palintest Chlorometer 1000



Analytical Methods	Method	Matrix	Method Descriptions
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ammonium as N	EK055G-NH4	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 4500-NH3 G. This method is compliant with NEPM Schedule B(3)
Organic Nitrogen as N (TKN - NH3) (discrete analyser)	EK060G	WATER	In house: Referenced to APHA 4500-Norg/4500-NH3. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloured and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
TRH - Semivolatile Fractions Only	EP071-SV	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM Schedule B(3).
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7
Enumeration of Enterococci by Membrane Filtration	MW023	WATER	AS4276.9
Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.



☐ **Perth:** 10 Hod Way, Malaga WA 6090
 Ph: 08 9209-7655 E: samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250
 Ph: 03 6331 2158 E: launceston@alsenviro.com

Telephone : +61-7-3243 7222

CERTIFICATE OF ANALYSIS

Work Order : **EB2306148**
Client : **GEMCO**
Contact : MR JEREMY BARNETT
Address : ENVIRONMENT DEPARTMENT ALYANGULA
 GROOTE EYLANDT NT, AUSTRALIA 0885
Telephone : +61 08 8987 4377
Project : ALS_GEMCO_WATER_GROUNDWATER
Order number : 4542424429
C-O-C number : ----
Sampler : JEREMY BARNETT
Site : 60003
Quote number : BN/189/19 V5
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 11
Laboratory : Environmental Division Brisbane
Contact : John Pickering
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61 7 3552 8634
Date Samples Received : 01-Mar-2023 09:10
Date Analysis Commenced : 01-Mar-2023
Issue Date : 08-Mar-2023 18:45



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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>
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Keegan Mullane	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Nibi Karl	Microbiologist	Brisbane Microbiological, Stafford, QLD
Stephen Tam	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

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

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

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

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

- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H⁺ to the Cations and Nitrate, SiO₂ and Fluoride to the Anions.
- MW006 is ALS's internal code and is equivalent to AS4276.5.
- Microbiological Comment: Membrane filtration result for EB2306148-02 is reported <10 CFU/100mL where the filtered sample at 100mL was overgrown and the presumptive colonies were not detected at 10mL sample filtered.
- Microbiological Comment: Membrane filtration result is reported <10 CFU/100mL where 10mL sample was filtered because the sample was turbid, insufficient for filtration at higher volume and there were no target organisms confirmed.
- Ammonium NH₄ could not be reported as field data was not supplied for the samples.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Sample ID

				WT025D	WT007	----	----	----
Sampling date / time				28-Feb-2023 00:00	28-Feb-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB2306148-001	EB2306148-002	-----	-----	-----
Result				Result	Result	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	140	434	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	91	282	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	7	183	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	7	183	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	36	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	34	10	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	3	88	----	----	----
Magnesium	7439-95-4	1	mg/L	2	5	----	----	----
Sodium	7440-23-5	1	mg/L	22	6	----	----	----
Potassium	7440-09-7	1	mg/L	<1	2	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Lead	7439-92-1	0.001	mg/L	0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.152	0.026	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.009	0.006	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.079	0.019	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	0.29	----	----	----
EK010-1: Chlorine								
Total Residual Chlorine	----	0.02	mg/L	<0.02	<0.02	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	----	----	----
EK060G: Organic Nitrogen as N (TKN-NH3) By Discrete Analyser								
Organic Nitrogen as N	----	0.1	mg/L	0.2	0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.2	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.04	0.01	----	----	----

Sub-Matrix: **GROUNDWATER**
(Matrix: **WATER**)

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	WT025D	WT007	----	----	----
Sampling date / time				28-Feb-2023 00:00	28-Feb-2023 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EB2306148-001	EB2306148-002	-----	-----	-----	
				Result	Result	----	----	----	
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	1.10	4.69	----	----	----	
∅ Total Cations	----	0.01	meq/L	1.27	5.11	----	----	----	
∅ Ionic Balance	----	0.01	%	----	4.35	----	----	----	
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L	<10	<10	----	----	----	
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.01	0.10	----	----	----	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.03	0.13	----	----	----	
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	----	----	----	
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	----	----	----	
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.04	----	----	----	
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	----	----	----	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	----	----	----	
EP231C: Perfluoroalkyl Sulfonamides									

Sub-Matrix: **GROUNDWATER**
(Matrix: **WATER**)

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	WT025D	WT007	----	----	----
Sampling date / time					28-Feb-2023 00:00	28-Feb-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2306148-001	EB2306148-002	-----	-----	-----
					Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		0.04	0.27	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		0.04	0.23	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		0.04	0.27	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Escherichia coli	----	1	CFU/100mL		<10	<10	----	----	----
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL		<10	<1	----	----	----
EP231S: PFAS Surrogate									



Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	WT025D	WT007	----	----	----
Sampling date / time					28-Feb-2023 00:00	28-Feb-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB2306148-001	EB2306148-002	-----	-----	-----
					Result	Result	----	----	----
EP231S: PFAS Surrogate - Continued									
13C4-PFOS	----	0.02	%		104	102	----	----	----
13C8-PFOA	----	0.02	%		102	90.6	----	----	----



Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)			Sample ID	WT015D	----	----	----	----
Sampling date / time				28-Feb-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2306148-003	-----	-----	-----	-----
Result				----	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	94	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	61	----	----	----	----
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	23	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	23	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	22	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	15	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	1.01	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.014	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.045	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.07	----	----	----	----
EK010-1: Chlorine								
Total Residual Chlorine	----	0.02	mg/L	0.02	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.10	----	----	----	----
EK060G: Organic Nitrogen as N (TKN-NH3) By Discrete Analyser								
Organic Nitrogen as N	----	0.1	mg/L	0.2	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.04	----	----	----	----



Analytical Results

Sub-Matrix: **SURFACE WATER**
 (Matrix: **WATER**)

Sample ID

WT015D

Sampling date / time				28-Feb-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2306148-003	-----	-----	-----	-----
Result				----	----	----	----	----

EN055: Ionic Balance

∅ Total Anions	----	0.01	meq/L	1.08	----	----	----	----
∅ Total Cations	----	0.01	meq/L	0.78	----	----	----	----

EP026SP: Chemical Oxygen Demand (Spectrophotometric)

Chemical Oxygen Demand	----	10	mg/L	<10	----	----	----	----
------------------------	------	----	------	-----	------	------	------	------

EP231A: Perfluoroalkyl Sulfonic Acids

Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----

EP231B: Perfluoroalkyl Carboxylic Acids

Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----

EP231C: Perfluoroalkyl Sulfonamides



Analytical Results

Sub-Matrix: **SURFACE WATER**
 (Matrix: **WATER**)

Sample ID

				WT015D	----	----	----	----
Sampling date / time				28-Feb-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2306148-003	-----	-----	-----	-----
Result				----	----	----	----	----

EP231C: Perfluoroalkyl Sulfonamides - Continued

Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----

EP231D: (n:2) Fluorotelomer Sulfonic Acids

4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	0.07	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----

EP231P: PFAS Sums

Sum of PFAS	----	0.01	µg/L	0.07	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	0.07	----	----	----	----

MW006: Faecal Coliforms & E.coli by MF

<i>Escherichia coli</i>	----	1	CFU/100mL	<10	----	----	----	----
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MW023: Enterococci by Membrane Filtration

<i>Enterococci</i>	----	1	CFU/100mL	<10	----	----	----	----
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EP231S: PFAS Surrogate



Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Sample ID	WT015D	----	----	----	----
				Sampling date / time	28-Feb-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2306148-003	-----	-----	-----	-----
					Result	----	----	----	----
EP231S: PFAS Surrogate - Continued									
13C4-PFOS	----	0.02	%		94.5	----	----	----	----
13C8-PFOA	----	0.02	%		97.0	----	----	----	----



Surrogate Control Limits

Sub-Matrix: GROUNDWATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Sub-Matrix: SURFACE WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

QUALITY CONTROL REPORT

Work Order	: EB2306148	Page	: 1 of 9
Client	: GEMCO	Laboratory	: Environmental Division Brisbane
Contact	: MR JEREMY BARNETT	Contact	: John Pickering
Address	: ENVIRONMENT DEPARTMENT ALYANGULA GROOTE EYLANDT NT, AUSTRALIA 0885	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 08 8987 4377	Telephone	: +61 7 3552 8634
Project	: ALS_GEMCO_WATER_GROUNDWATER	Date Samples Received	: 01-Mar-2023
Order number	: 4542424429	Date Analysis Commenced	: 01-Mar-2023
C-O-C number	: ----	Issue Date	: 08-Mar-2023
Sampler	: JEREMY BARNETT		
Site	: 60003		
Quote number	: BN/189/19 V5		
No. of samples received	: 3		
No. of samples analysed	: 3		



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Keegan Mullane	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Nibi Karl	Microbiologist	Brisbane Microbiological, Stafford, QLD
Stephen Tam	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA010P: Conductivity by PC Titrator (QC Lot: 4904573)									
EB2306043-014	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	21	21	0.0	0% - 20%
EB2306117-005	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	2940	2950	0.2	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4904575)									
EB2306043-014	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	8	13	47.9	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	8	13	47.9	0% - 50%
EB2306117-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	33	33	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	33	33	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4904781)									
EB2306117-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	376	376	0.0	0% - 20%
EB2306080-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4904784)									
EB2306117-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	397	395	0.4	0% - 20%
EB2306080-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	919	936	1.9	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4908830)									
ET2301162-008	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	85	85	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	70	70	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1170	1180	0.9	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EB2306148-002	WT007	ED093F: Calcium	7440-70-2	1	mg/L	88	88	0.0	0% - 20%

Page : 3 of 9
 Work Order : EB2306148
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED093F: Dissolved Major Cations (QC Lot: 4908830) - continued									
EB2306148-002	WT007	ED093F: Magnesium	7439-95-4	1	mg/L	5	5	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	6	6	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4908828)									
ET2301162-008	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.090	0.089	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2306148-002	WT007	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.026	0.026	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.005	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.019	0.020	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.29	0.29	0.0	No Limit
EK010-1: Chlorine (QC Lot: 4904340)									
EB2306148-001	WT025D	EK010-1: Total Residual Chlorine	----	0.02	mg/L	<0.02	<0.02	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4909167)									
EB2302653-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.08	0.0	No Limit
EB2306133-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.09	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4909168)									
ET2301178-006	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.19	0.19	0.0	0% - 50%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4907044)									
EB2302653-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	37.3	36.9	1.2	0% - 20%
EB2306142-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4907043)									
EB2302653-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	5.26	5.27	0.2	0% - 20%
EB2306142-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.0	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 4910335)									
EB2305153-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	39600	40000	1.0	0% - 20%
EB2306148-002	WT007	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	<10	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4906382)									
EB2306148-001	WT025D	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.01	0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.03	0.03	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EB2306148-003	WT015D	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit

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 Work Order : EB2306148
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4906382) - continued									
EB2306148-003	WT015D	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4906382)									
EB2306148-001	WT025D	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EB2306148-003	WT015D	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4906382)									
EB2306148-001	WT025D	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4906382) - continued									
EB2306148-001	WT025D	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EB2306148-003	WT015D	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4906382)									
EB2306148-001	WT025D	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EB2306148-003	WT015D	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	0.07	0.06	15.6	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4906382)									
EB2306148-001	WT025D	EP231X: Sum of PFAS	----	0.01	µg/L	0.04	0.04	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.04	0.04	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	0.04	0.04	0.0	No Limit
EB2306148-003	WT015D	EP231X: Sum of PFAS	----	0.01	µg/L	0.07	0.06	15.4	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	0.07	0.06	15.4	No Limit

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA010P: Conductivity by PC Titrator (QCLot: 4904573)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	4000 µS/cm	100	90.0	106
				<1	12890 µS/cm	104	90.0	106
ED037P: Alkalinity by PC Titrator (QCLot: 4904575)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	50 mg/L	102	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4904781)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	85.0	118
				<1	100 mg/L	95.6	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 4904784)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	94.4	90.0	115
				<1	1000 mg/L	108	90.0	115
ED093F: Dissolved Major Cations (QCLot: 4908830)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	110	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	101	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4908828)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.5	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.7	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	98.2	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.8	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	101	82.0	114
EK010-1: Chlorine (QCLot: 4904340)								
EK010-1: Total Residual Chlorine	----	0.02	mg/L	<0.02	0.89 mg/L	95.5	88.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4909167)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	94.2	83.5	114
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4909168)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	96.6	83.5	114
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4907044)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	87.4	70.1	108
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4907043)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	98.5	90.2	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4910335)								



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4910335) - continued								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	50 mg/L	98.7	86.0	112
				<10	500 mg/L	102	86.0	112
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4906382)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.2218 µg/L	117	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.2352 µg/L	116	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.2373 µg/L	115	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.238 µg/L	130	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.232 µg/L	135	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.241 µg/L	112	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4906382)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	112	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	114	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	108	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	114	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	115	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	121	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	125	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	120	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	117	72.0	134
EP231X: Perfluorotridecanoic acid (PFTriDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	110	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	119	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4906382)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	117	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	140	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	112	60.5	138
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	122	68.3	134
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	123	62.6	138
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	103	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	115	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4906382)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.2343 µg/L	94.5	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.2378 µg/L	122	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.24 µg/L	91.7	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.241 µg/L	132	64.2	133

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 Work Order : EB2306148
 Client : GEMCO
 Project : ALS_GEMCO_WATER_GROUNDWATER



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			LCS	Low
EP231P: PFAS Sums (QCLot: 4906382)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----

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**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4904781)							
EB2306148-003	WT015D	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	114	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4904784)							
EB2306148-003	WT015D	ED045G: Chloride	16887-00-6	400 mg/L	122	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4908828)							
EB2305565-002	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	102	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	114	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	110	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	115	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4909167)							
EB2302653-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	# Not Determined	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4909168)							
ET2301178-008	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	85.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4907044)							
EB2302653-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	86.8	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4907043)							
EB2302653-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	106	70.0	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 4910335)							
EB2305936-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	196 mg/L	102	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4906382)							
EB2306148-002	WT007	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.2218 µg/L	118	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.235 µg/L	107	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.2352 µg/L	104	68.0	131



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4906382) - continued							
EB2306148-002	WT007	EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.238 µg/L	118	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.232 µg/L	122	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.241 µg/L	111	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4906382)							
EB2306148-002	WT007	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	101	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	125	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	105	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	106	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	103	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	112	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	117	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	109	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	121	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTeDA)	72629-94-8	0.25 µg/L	111	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	111	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4906382)							
EB2306148-002	WT007	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	113	59.0	135
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	121	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	122	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	119	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	108	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	117	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	123	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4906382)							
EB2306148-002	WT007	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.234 µg/L	115	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.2378 µg/L	114	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.24 µg/L	111	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.2415 µg/L	126	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB2306148**

Page : 1 of 8

Client : **GEMCO**
Contact : MR JEREMY BARNETT
Project : ALS_GEMCO_WATER_GROUNDWATER
Site : 60003
Sampler : JEREMY BARNETT
Order number : 4542424429

Laboratory : Environmental Division Brisbane
Telephone : +61 7 3552 8634
Date Samples Received : 01-Mar-2023
Issue Date : 08-Mar-2023
No. of samples received : 3
No. of samples analysed : 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

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							
EK055G: Ammonia as N by Discrete Analyser	EB2302653--004	Anonymous	Ammonia as N	7664-41-7	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK010-1: Chlorine							
Clear Plastic Bottle - Natural WT025D, WT015D		WT007,	----	----	----	02-Mar-2023	28-Feb-2023
							2

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	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	03-Mar-2023	28-Mar-2023	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	03-Mar-2023	14-Mar-2023	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	02-Mar-2023	28-Mar-2023	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	02-Mar-2023	28-Mar-2023	✓
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	07-Mar-2023	28-Mar-2023	✓
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	07-Mar-2023	27-Aug-2023	✓
EK010-1: Chlorine								
Clear Plastic Bottle - Natural (EK010-1) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	02-Mar-2023	28-Feb-2023	✗
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	03-Mar-2023	28-Mar-2023	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) WT025D, WT015D	WT007,	28-Feb-2023	03-Mar-2023	28-Mar-2023	✓	06-Mar-2023	28-Mar-2023	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) WT025D, WT015D	WT007,	28-Feb-2023	03-Mar-2023	28-Mar-2023	✓	06-Mar-2023	28-Mar-2023	✓
EP026SP: Chemical Oxygen Demand (Spectrophotometric)								
Clear Plastic Bottle - Sulfuric Acid (EP026SP) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	06-Mar-2023	28-Mar-2023	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X) WT025D, WT015D	WT007,	28-Feb-2023	02-Mar-2023	27-Aug-2023	✓	06-Mar-2023	27-Aug-2023	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X) WT025D, WT015D	WT007,	28-Feb-2023	02-Mar-2023	27-Aug-2023	✓	06-Mar-2023	27-Aug-2023	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X) WT025D, WT015D	WT007,	28-Feb-2023	02-Mar-2023	27-Aug-2023	✓	06-Mar-2023	27-Aug-2023	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X) WT025D, WT015D	WT007,	28-Feb-2023	02-Mar-2023	27-Aug-2023	✓	06-Mar-2023	27-Aug-2023	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X) WT025D, WT015D	WT007,	28-Feb-2023	02-Mar-2023	27-Aug-2023	✓	06-Mar-2023	27-Aug-2023	✓
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	01-Mar-2023	01-Mar-2023	✓
MW023: Enterococci by Membrane Filtration								
Sterile Plastic Bottle - Sodium Thiosulfate (MW023) WT025D, WT015D	WT007,	28-Feb-2023	----	----	----	01-Mar-2023	01-Mar-2023	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	3	23	13.04	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	2	23	8.70	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	7.69	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . 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 BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45um 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.
Residual Chlorine by DPD Colourimetry	EK010-1	WATER	In house: Referenced to APHA 4500-Cl G, using Palintest Chlorometer 1000
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Organic Nitrogen as N (TKN - NH ₃) (discrete analyser)	EK060G	WATER	In house: Referenced to APHA 4500-Norg/4500-NH ₃ . This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO ₄ DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloured and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7
Enumeration of Enterococci by Membrane Filtration	MW023	WATER	AS4276.9
Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176
 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegem Rd, Warabrook NSW 2304
 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com

☐ **Brisbane:** 32 Shand St, Stafford QLD 4053
 Ph 07 3243 7222 E: samples.brisbane@aisenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818
 Ph.07 4796 0600 E: townsville.environmental@aisenviro.com

☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com

☐ **Adelaide:** 2-1 Burma Rd, Pocraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsenviro.com

☐ Perth: 10 Rod Way, Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsenviro.com

☐ Launceston: 27 Wellington St. Launceston TAS 7250
Ph: 03 6331 2158 E: launceston@alsenviro.com

Environmental Division
Brisbane

Work Order Reference
EB2306148



Telephone : + 61-7-3243 7222

CLIENT: GEMCO		TURNAROUND REQUIREMENTS: ☒ Standard TAT (List due date):		FOR LABO		Work Order Reference	
OFFICE:		(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		☐ Standard TAT (List due date):		EB2306148	
PROJECT: Groundwater	SITE: 60003	ALS QUOTE NO.: BN/189/19		COC SEQUENCE NUMBER (Circle)		Freeze / Dry Random / Same Other / Other	
ORDER NUMBER: 452132952				COC: 1 2 3 4 5 6 7			
PROJECT MANAGER: Jeremy Barnett		CONTACT PH: 0427 089167		OF: 1 2 3 4 5 6 7			
SAMPLER: Jeremy Barnett		SAMPLER MOBILE: 0427 089 167		RELINQUISHED BY:		RELINQUISHED B	
COC emailed to ALS? Yes		EDD FORMAT: South32 EQUiS Database Format		DATE/TIME:		Telephone : - 61-7-3243 7222	
Email Reports to: environmentaldata@south32.net; osuid2@south32.net; Jeremy.S.Barnett@south32.net; bec.mcintyre@south32.net				DATE/TIME: 1/3/23 0946			
Email Invoice to: EnviroCosting.Brisbane@alsglobal.com							
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:				Please name the results file: ALS_GEMCO_WATER_GROUNDWATER_(insert the workorder number here).CSV			

[illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; Y = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved; Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;



CERTIFICATE OF ANALYSIS

Work Order	: EB2315194	Page	: 1 of 4
Amendment	: 1		
Client	: GEMCO	Laboratory	: Environmental Division Brisbane
Contact	: MR JEREMY BARNETT	Contact	: John Pickering
Address	: ENVIRONMENT DEPARTMENT ALYANGULA GROOTE EYLANDT NT, AUSTRALIA 0885	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 08 8987 4377	Telephone	: +61 7 3552 8634
Project	: ALS_GEMCO_WATER_GROUNDWATER	Date Samples Received	: 19-May-2023 08:50
Order number	: 452132952	Date Analysis Commenced	: 19-May-2023
C-O-C number	: ----	Issue Date	: 04-Jul-2023 14:55
Sampler	: ALICE LORINCZ		
Site	: 60003		
Quote number	: BN/189/19 V5		
No. of samples received	: 2		
No. of samples analysed	: 2		



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Liz Heizmann	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

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

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

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

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

- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- MW006 is ALS's internal code and is equivalent to AS4276.5.
- Ionic Balance out of acceptable limits due to analytes not quantified in this report.
- Amendment (4/7/2023): This report has been amended and re-released to allow the reporting of additional analytical data, specifically method EK055G-NH4 for all samples on this workorder. All other analytical results are as per the previous report.
- Microbiological Comment: Membrane filtration result is reported <10 CFU/100mL where 10mL sample was filtered because the sample was turbid, insufficient for filtration at higher volume and there were no target organisms detected.
- EK055G-NH4 Ammonium could not be reported for samples WT025D (EB2315194_001) & WT015D (EB2315194_002) as the required field pH and temperature was not provided on the chain of custody. For future submissions, please provide this information on the COC for each sample that requires Ammonium.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Sample ID

				WT025D	WT015D	----	----	----
Sampling date / time				18-May-2023 00:00	18-May-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB2315194-001	EB2315194-002	-----	-----	-----
				Result	Result	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	145	105	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	94	68	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	10	15	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	10	15	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	1	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	31	22	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	<1	----	----	----
Magnesium	7439-95-4	1	mg/L	1	<1	----	----	----
Sodium	7440-23-5	1	mg/L	20	13	----	----	----
Potassium	7440-09-7	1	mg/L	<1	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.077	0.770	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.005	<0.005	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
EK010-1: Chlorine								
Total Residual Chlorine	----	0.02	mg/L	0.02	<0.02	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.15	----	----	----
EK055G-NH4: Ammonium as N by DA								
Ammonium as N	14798-03-9_N	0.01	mg/L	0.04	0.15	----	----	----
EK060G: Organic Nitrogen as N (TKN-NH3) By Discrete Analyser								
Organic Nitrogen as N	----	0.1	mg/L	0.5	0.2	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.3	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Sample ID

				WT025D	WT015D	----	----	----
Sampling date / time				18-May-2023 00:00	18-May-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB2315194-001	EB2315194-002	-----	-----	-----
Result				Result	Result	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.04	0.06	----	----	----
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	1.07	0.94	----	----	----
∅ Total Cations	----	0.01	meq/L	----	0.64	----	----	----
∅ Total Cations	----	0.01	meq/L	1.05	----	----	----	----
EP026SP: Chemical Oxygen Demand (Spectrophotometric)								
Chemical Oxygen Demand	----	10	mg/L	<10	<10	----	----	----
MW006: Faecal Coliforms & E.coli by MF								
<i>Escherichia coli</i>	----	1	CFU/100mL	<10	<10	----	----	----
MW023: Enterococci by Membrane Filtration								
<i>Enterococci</i>	----	1	CFU/100mL	<10	<10	----	----	----



QUALITY CONTROL REPORT

Work Order : **EB2315194**

Page : 1 of 7

Amendment : **1**

Client : **GEMCO**

Contact : MR JEREMY BARNETT

Address : ENVIRONMENT DEPARTMENT ALYANGULA
GROOTE EYLANDT NT, AUSTRALIA 0885

Telephone : +61 08 8987 4377

Project : ALS_GEMCO_WATER_GROUNDWATER

Order number : 452132952

C-O-C number : ----

Sampler : ALICE LORINCZ

Site : 60003

Quote number : BN/189/19 V5

No. of samples received : 2

No. of samples analysed : 2

Laboratory : Environmental Division Brisbane

Contact : John Pickering

Address : 2 Byth Street Stafford QLD Australia 4053

Telephone : +61 7 3552 8634

Date Samples Received : 19-May-2023

Date Analysis Commenced : 19-May-2023

Issue Date : 04-Jul-2023



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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	Position	Accreditation Category
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Liz Heizmann	Microbiologist	Brisbane Microbiological, Stafford, QLD



General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA010P: Conductivity by PC Titrator (QC Lot: 5070379)									
EB2315215-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1650	1630	1.2	0% - 20%
EB2315573-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	8610	8650	0.5	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 5070377)									
EB2315122-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	523	498	4.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	523	498	4.9	0% - 20%
EB2315215-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	206	213	3.3	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	206	213	3.3	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 5072968)									
EB2314942-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	35	35	0.0	0% - 20%
EB2315216-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	545	544	0.2	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 5072969)									
EB2314942-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	127	127	0.0	0% - 20%
EB2315216-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	37	38	3.9	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 5071294)									
EB2315117-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	3	3	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	12	12	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EB2315135-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	40	41	2.6	0% - 20%

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED093F: Dissolved Major Cations (QC Lot: 5071294) - continued									
EB2315135-001	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	69	68	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	911	903	0.8	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	5	5	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 5074055)									
EB2315224-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	194	192	1.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	201	198	1.8	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1540	1500	2.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	4	4	0.0	No Limit
EB2315438-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	198	199	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	197	200	1.4	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1820	1840	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	156	156	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5071293)									
EB2315117-005	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.031	0.031	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.007	0.006	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2315135-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.027	0.027	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.030	0.030	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.27	0.27	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5074053)									
EB2315224-002	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	1 µg/L	0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<5 µg/L	<0.005	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<50 µg/L	<0.05	0.0	No Limit
EB2315438-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.559	0.558	0.2	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.020	0.018	10.2	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.072	0.053	29.8	0% - 50%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.36	0.36	0.0	No Limit
EK010-1: Chlorine (QC Lot: 5061157)									
EB2315152-005	Anonymous	EK010-1: Total Residual Chlorine	----	0.02	mg/L	1.93	1.93	0.0	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5072987)									
EB2315173-008	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	213	219	2.7	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 5068267)									



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 5068267) - continued									
EB2315086-015	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.4	0.0	No Limit
EB2315178-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.5	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5068266)									
EB2315086-015	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.09	0.08	0.0	No Limit
EB2315178-003	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.35	0.35	0.0	0% - 20%
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 5068282)									
EB2314092-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	33	33	0.0	No Limit
EB2315338-002	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	23	24	5.6	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA010P: Conductivity by PC Titrator (QCLot: 5070379)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2100 µS/cm	98.5	90.0	106
				<1	24800 µS/cm	94.0	90.0	106
ED037P: Alkalinity by PC Titrator (QCLot: 5070377)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	50 mg/L	117	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5072968)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	100 mg/L	101	85.0	118
				<1	25 mg/L	104	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 5072969)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	107	90.0	115
				<1	10 mg/L	99.4	90.0	115
ED093F: Dissolved Major Cations (QCLot: 5071294)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	114	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	103	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	98.8	70.0	130
ED093F: Dissolved Major Cations (QCLot: 5074055)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	114	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	104	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	100	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5071293)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	99.5	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.7	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	100	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.5	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	104	82.0	114
EG020F: Dissolved Metals by ICP-MS (QCLot: 5074053)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.1	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	109	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	100	89.0	113



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020F: Dissolved Metals by ICP-MS (QCLot: 5074053) - continued								
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	102	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	105	82.0	114
EK010-1: Chlorine (QCLot: 5061157)								
EK010-1: Total Residual Chlorine	----	0.02	mg/L	<0.02	0.89 mg/L	94.4	88.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5072987)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	92.2	83.5	114
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5068267)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	91.1	70.1	108
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5068266)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	91.0	90.2	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 5068282)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	50 mg/L	101	86.0	112
				<10	500 mg/L	97.7	86.0	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**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5072968)							
EB2314988-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	103	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 5072969)							
EB2314988-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	114	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5071293)							
EB2315117-008	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	102	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	95.0	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	98.9	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	98.4	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5074053)							
EB2315224-003	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	76.8	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	102	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	103	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	102	70.0	130



Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5072987)							
EB2315173-009	Anonymous	EK055G: Ammonia as N	7664-41-7	200 mg/L	115	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5068267)							
EB2315086-016	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	85.7	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5068266)							
EB2315086-016	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	92.9	70.0	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 5068282)							
EB2314092-002	Anonymous	EP026SP: Chemical Oxygen Demand	----	50 mg/L	96.5	70.0	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB2315194**

Page : 1 of 7

Amendment : **1**

Client : **GEMCO**

Laboratory : Environmental Division Brisbane

Contact : MR JEREMY BARNETT

Telephone : +61 7 3552 8634

Project : ALS_GEMCO_WATER_GROUNDWATER

Date Samples Received : 19-May-2023

Site : 60003

Issue Date : 04-Jul-2023

Sampler : ALICE LORINCZ

No. of samples received : 2

Order number : 452132952

No. of samples analysed : 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

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



Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK010-1: Chlorine						
Clear Plastic Bottle - Natural WT025D, WT015D	----	----	----	19-May-2023	18-May-2023	1

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	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) WT025D, WT015D	18-May-2023	----	----	----	25-May-2023	15-Jun-2023	✓	
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) WT025D, WT015D	18-May-2023	----	----	----	25-May-2023	01-Jun-2023	✓	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) WT025D, WT015D	18-May-2023	----	----	----	25-May-2023	15-Jun-2023	✓	
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) WT025D, WT015D	18-May-2023	----	----	----	25-May-2023	15-Jun-2023	✓	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) WT025D	18-May-2023	----	----	----	25-May-2023	15-Jun-2023	✓	
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) WT015D	18-May-2023	----	----	----	26-May-2023	15-Jun-2023	✓	
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) WT025D	18-May-2023	----	----	----	25-May-2023	14-Nov-2023	✓	
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) WT015D	18-May-2023	----	----	----	26-May-2023	14-Nov-2023	✓	



Matrix: **WATER** Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EK010-1: Chlorine								
Clear Plastic Bottle - Natural (EK010-1) WT025D, WT015D	18-May-2023	----	----	----	19-May-2023	18-May-2023	✖	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) WT025D, WT015D	18-May-2023	----	----	----	25-May-2023	15-Jun-2023	✔	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) WT025D, WT015D	18-May-2023	24-May-2023	15-Jun-2023	✔	24-May-2023	15-Jun-2023	✔	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) WT025D, WT015D	18-May-2023	24-May-2023	15-Jun-2023	✔	24-May-2023	15-Jun-2023	✔	
EP026SP: Chemical Oxygen Demand (Spectrophotometric)								
Clear Plastic Bottle - Sulfuric Acid (EP026SP) WT025D, WT015D	18-May-2023	----	----	----	24-May-2023	15-Jun-2023	✔	
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006) WT025D, WT015D	18-May-2023	----	----	----	19-May-2023	19-May-2023	✔	
MW023: Enterococci by Membrane Filtration								
Sterile Plastic Bottle - Sodium Thiosulfate (MW023) WT025D, WT015D	18-May-2023	----	----	----	19-May-2023	19-May-2023	✔	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	23	17.39	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	19	21.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	19	10.53	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	19	10.53	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Residual Chlorine by DPD Colourimetry	EK010-1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification .

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Matrix Spikes (MS) - Continued							
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45µm filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Residual Chlorine by DPD Colourimetry	EK010-1	WATER	In house: Referenced to APHA 4500-Cl G, using Palintest Chlorometer 1000
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ammonium as N	EK055G-NH ₄	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 4500-NH ₃ G. This method is compliant with NEPM Schedule B(3)
Organic Nitrogen as N (TKN - NH ₃) (discrete analyser)	EK060G	WATER	In house: Referenced to APHA 4500-Norg/4500-NH ₃ . This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)



<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloured and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7
Enumeration of Enterococci by Membrane Filtration	MW023	WATER	AS4276.9
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)



CHAIN OF CUSTODY

ALS Laboratory: please tick →

□ Sydney: 277 Woodpark Rd, Smithfield NSW 2176
Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
□ Newcastle: 5 Rosegum Rd, Warahook NSW 2304
Ph: 02 4908 0433 E: samples.newcastle@alsenviro.com

□ Brisbane: 32 Shand St, Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
□ Townsville: 14-15 Desma Ct, Bohle QLD 4818
Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com

□ Melbourne: 2-4 Westall Rd, Springvale VIC 3171
Ph: 03 8549 9800 E: samples.melbourne@alsenviro.com
□ Adelaide: 2-1 Burma Rd, Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsenviro.com

□ Perth: 10 Hod Way, Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsenviro.com
□ Launceston: 27 Wellington St, Launceston TAS 7250
Ph: 03 6331 2158 E: launceston@alsenviro.com



Telephone : + 61-7-3243 7222

CLIENT: GEMCO		TURNAROUND REQUIREMENTS : ☒ Standard TAT (List due date):		FOR LABS	
OFFICE:		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		Custom Seal	
PROJECT: Groundwater	SITE: 60003	ALS QUOTE NO.: BN/189/19	COC SEQUENCE NUMBER (Circle)		Free Use / Issue
ORDER NUMBER: 452132952			COC: 1 2 3 4 5 6 7	Random Sample temperature on receipt °C	
PROJECT MANAGER: Jeremy Barnett		CONTACT PH: 0427 089167	OF: 1 2 3 4 5 6 7	Other comments:	
SAMPLER: Alice Lorincz	SAMPLER MOBILE: 0478120991	RELINQUISHED BY: Alice Lorincz	RECEIVED BY: <i>SW</i>	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? Yes		EDD FORMAT: South32 EQUiS Database Format	DATE/TIME: 18/05/2023	DATE/TIME: 19/5/23 0850	DATE/TIME:
Email Reports to: environmentaldata@south32.net; osuld2@south32.net; Jeremy.S.Barnett@south32.net; alice.lorincz@south32.net					
Email Invoice to: EnviroCosting.Brisbane@alsglobal.com					
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please name the results file: ALS_GEMCO_WATER_GROUNDWATER_(insert the workorder number here).CSV					
ALS USE ONLY	SAMPLE DETAILS	MATRIX:	CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)	Additional Information
	Solid(S) Water(W)			Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES
1	WT025D	18/05/2023	WG	2P, 1SP, 1 bacto	4 X
2	WT015D	18/05/2023	WS	2P, 1SP, 1 bacto	4 X
WG = Groundwater					
8					

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.