ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1804611**	Page	: 1 of 7
Client	: **WOLLONGONG CITY COUNCIL**	Laboratory	: Environmental Division NSW South Coast
Contact	: DELLA KUTZNER	Contact	: Glenn Davies
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Telephone	: +61 02 4227 7111	Telephone	: 02 42253125
Project	: Whytes Gully Stage 3 Bores Quarterly	Date Samples Received	: 08-Nov-2018 16:00
Order number	: 3088330	Date Analysis Commenced	: 08-Nov-2018
C-O-C number	: ----	Issue Date	: 16-Nov-2018 13:56
Sampler	: Robert DaLio		
Site	: ----		
Quote number	: WO/005/18 TENDER		
No. of samples received	: 13		
No. of samples analysed	: 13		

ilac-MRA NATA

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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, NSW

General Comments

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

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

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

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

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

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

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

- TDS by method EA-015 may bias high for sample6 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- 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: WATER (Matrix: WATER)				Client sample ID	GMW102 (Point 9)	GMW103 (Point 10)	GMW104 (Point 11)	GMW105 (Point 12)	GMW106 (Point 13)
				Client sampling date / time	08-Nov-2018 12:05	08-Nov-2018 12:25	08-Nov-2018 11:45	08-Nov-2018 13:05	08-Nov-2018 13:00
Compound	CAS Number	LOR	Unit		EW1804611-001	EW1804611-002	EW1804611-003	EW1804611-004	EW1804611-005
					Result	Result	Result	Result	Result
EA005FD: Field pH									
pH	----	0.1	pH Unit		----	7.2	7.4	----	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	1970	1010	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		----	1230	616	----	----
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		----	372	318	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	372	318	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	136	46	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		----	372	72	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	172	47	----	----
Magnesium	7439-95-4	1	mg/L		----	58	30	----	----
Sodium	7440-23-5	1	mg/L		----	165	132	----	----
Potassium	7440-09-7	1	mg/L		----	<1	<1	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	10.8	----	----
Barium	7440-39-3	0.001	mg/L		----	----	0.072	----	----
Cadmium	7440-43-9	0.0001	mg/L		----	----	<0.0001	----	----
Cobalt	7440-48-4	0.001	mg/L		----	----	0.006	----	----
Chromium	7440-47-3	0.001	mg/L		----	----	0.006	----	----
Copper	7440-50-8	0.001	mg/L		----	----	0.016	----	----
Manganese	7439-96-5	0.001	mg/L		----	----	0.391	----	----
Lead	7439-92-1	0.001	mg/L		----	----	0.005	----	----
Zinc	7440-66-6	0.005	mg/L		----	----	0.030	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	0.04	0.03	----	----
EN67 PK: Field Tests									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW102 (Point 9)	GMW103 (Point 10)	GMW104 (Point 11)	GMW105 (Point 12)	GMW106 (Point 13)
				Client sampling date / time	08-Nov-2018 12:05	08-Nov-2018 12:25	08-Nov-2018 11:45	08-Nov-2018 13:05	08-Nov-2018 13:00
Compound	CAS Number	LOR	Unit		EW1804611-001	EW1804611-002	EW1804611-003	EW1804611-004	EW1804611-005
					Result	Result	Result	Result	Result
EN67 PK: Field Tests - Continued									
Field Observations	----	0.01	--		**DRY**	**----**	**----**	**DRY**	**DRY**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**----**	**2**	<1	**----**	**----**
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**----**	**7.67**	**8.06**	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW108S (Point 14)	GMW108D (Point 15)	GMW109S (Point 16)	GMW109D (Point 19)	GMW110 (Point 17)
				Client sampling date / time	08-Nov-2018 10:43	08-Nov-2018 11:00	08-Nov-2018 09:25	08-Nov-2018 09:40	08-Nov-2018 09:05
Compound	CAS Number	LOR	Unit		EW1804611-006	EW1804611-007	EW1804611-008	EW1804611-009	EW1804611-010
					Result	Result	Result	Result	Result
EA005FD: Field pH									
pH	----	0.1	pH Unit		7.0	6.8	6.3	6.9	6.9
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		1790	3250	1590	1830	4340
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1610	1870	974	1260	2820
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		319	424	254	207	506
Total Alkalinity as CaCO3	----	1	mg/L		319	424	254	207	506
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		107	199	115	23	329
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		331	739	353	492	1050
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		88	130	78	96	208
Magnesium	7439-95-4	1	mg/L		52	86	51	49	162
Sodium	7440-23-5	1	mg/L		211	416	166	190	480
Potassium	7440-09-7	1	mg/L		5	1	2	1	2
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	5.68	----	----
Barium	7440-39-3	0.001	mg/L		----	----	0.186	----	----
Cadmium	7440-43-9	0.0001	mg/L		----	----	0.0002	----	----
Cobalt	7440-48-4	0.001	mg/L		----	----	0.048	----	----
Chromium	7440-47-3	0.001	mg/L		----	----	0.006	----	----
Copper	7440-50-8	0.001	mg/L		----	----	0.016	----	----
Manganese	7439-96-5	0.001	mg/L		----	----	3.93	----	----
Lead	7439-92-1	0.001	mg/L		----	----	0.012	----	----
Zinc	7440-66-6	0.005	mg/L		----	----	0.074	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.08	0.04	0.34	0.11	0.02
EP005: Total Organic Carbon (TOC)									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW108S (Point 14)	GMW108D (Point 15)	GMW109S (Point 16)	GMW109D (Point 19)	GMW110 (Point 17)
				Client sampling date / time	08-Nov-2018 10:43	08-Nov-2018 11:00	08-Nov-2018 09:25	08-Nov-2018 09:40	08-Nov-2018 09:05
Compound	CAS Number	LOR	Unit		EW1804611-006	EW1804611-007	EW1804611-008	EW1804611-009	EW1804611-010
					Result	Result	Result	Result	Result
EP005: Total Organic Carbon (TOC) - Continued									
Total Organic Carbon	----	1	mg/L		**5**	<1	<1	<1	<1
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**2.96**	**2.56**	**3.29**	**3.17**	**4.28**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	GMW111 (Point 18)	GABH02 (Point 5)	BH6 (Point 20)	----	----
			Client sampling date / time	08-Nov-2018 08:20	08-Nov-2018 10:15	08-Nov-2018 09:50	----	----
Compound	CAS Number	LOR	Unit	EW1804611-011	EW1804611-012	EW1804611-013	--------	--------
				Result	Result	Result	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	7.1	6.6	7.0	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	3210	5490	2440	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	1920	3380	1560	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	466	983	650	----	----
Total Alkalinity as CaCO3	----	1	mg/L	466	983	650	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	180	163	315	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	708	1270	361	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	114	303	118	----	----
Magnesium	7439-95-4	1	mg/L	93	196	65	----	----
Sodium	7440-23-5	1	mg/L	418	645	312	----	----
Potassium	7440-09-7	1	mg/L	1	2	4	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.02	0.44	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	2	31	----	----
FWI-EN/001: Groundwater Sampling - Depth								
Depth	----	0.01	m	6.45	5.54	1.67	----	----