

CERTIFICATE OF ANALYSIS

Work Order	: EW1903700	Page	: 1 of 11
Amendment	: 1	Laboratory	: Environmental Division NSW South Coast
Client	: KIAMA COUNCIL	Contact	: Glenn Davies
Contact	: MR PAUL CZULOWSKI	Address	: 1/19 Ralph Black Dr, North Wollongong 2500
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Project	: Gerroa Landfill Annual	Date Samples Received	: 28-Aug-2019 16:00
Order number	: 126590	Date Analysis Commenced	: 28-Aug-2019
C-O-C number	: ----	Issue Date	: 19-Sep-2019 16:29
Sampler	: Duncan McIntosh		
Site	: Gerroa Landfill		
Quote number	: WO/016/18		
No. of samples received	: 21		
No. of samples analysed	: 21		



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, 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.

- EK061G/EK06G LOR raised for TKN/TN on sample No 16 & 17 due to sample matrix.
- EA015, TDS, results has been confirmed for samples 6 and 15 by re-analysis.
- EG020/ED093: Some samples were diluted and rerun due to matrix interference and LOR's have been raised accordingly. (High Total Dissolved Solids)
- EK055G/EK061G: It has been noted that Ammonia is greater than TKN for sample 1, however this difference is within the limits of experimental variation.
- Amendment (19/09/2019): This report has been amended following minor LIMS report formatting corrections. All analysis results are as per the previous report
- Sampling and sample data supplied by ALS Wollongong.
- Sampling completed as per FWI-EN001 Groundwater Sampling.
- Field tests completed on day of sampling/receipt.
- 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	MW1D	MW1S	MW3	MW4	MW5
Client sampling date / time				28-Aug-2019 13:05	28-Aug-2019 13:15	28-Aug-2019 11:55	28-Aug-2019 09:40	28-Aug-2019 11:30	
Compound	CAS Number	LOR	Unit	EW1903700-001	EW1903700-002	EW1903700-003	EW1903700-004	EW1903700-005	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.2	----	7.3	6.9	7.7	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	1800	----	590	842	440	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	878	----	380	488	240	
EA075FD: Field Redox Potential									
Redox Potential	----	0.1	mV	-123	----	-113	94.0	-62.8	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	425	----	182	290	134	
Total Alkalinity as CaCO3	----	1	mg/L	425	----	182	290	134	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	101	----	<1	25	8	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	243	----	61	45	44	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	94	----	77	130	55	
Magnesium	7439-95-4	1	mg/L	50	----	6	10	5	
Sodium	7440-23-5	1	mg/L	119	----	25	19	18	
Potassium	7440-09-7	1	mg/L	41	----	4	5	2	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.021	----	0.107	0.283	0.005	
Iron	7439-89-6	0.05	mg/L	4.53	----	3.93	10.4	0.09	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	----	0.2	0.2	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	27.3	----	0.42	0.08	0.08	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	0.02	----	<0.01	0.02	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.03	----	<0.01	<0.01	<0.01	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1D	MW1S	MW3	MW4	MW5
Client sampling date / time					28-Aug-2019 13:05	28-Aug-2019 13:15	28-Aug-2019 11:55	28-Aug-2019 09:40	28-Aug-2019 11:30
Compound	CAS Number	LOR	Unit		EW1903700-001	EW1903700-002	EW1903700-003	EW1903700-004	EW1903700-005
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.05	----	<0.01	0.02	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		26.5	----	1.4	0.8	0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		26.6	----	1.4	0.8	0.5
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.20	----	0.03	0.91	0.13
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		17.4	----	5.36	7.58	4.08
∅ Total Cations	----	0.01	meq/L		15.0	----	5.52	8.26	3.99
∅ Ionic Balance	----	0.01	%		7.45	----	1.55	4.29	1.18
EN67 PK: Field Tests									
Field Observations	----	0.01	--		GOING IN	DRY	GOING OUT	GOING OUT	GOING OUT
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		17	----	9	4	3
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		1.98	----	2.44	3.02	2.21
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		3.84	----	4.21	4.73	3.95



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW6D	MW6S	MW7D	MW7S	MW9
Client sampling date / time				28-Aug-2019 10:15	28-Aug-2019 10:00	28-Aug-2019 10:50	28-Aug-2019 11:05	28-Aug-2019 14:45	
Compound	CAS Number	LOR	Unit	EW1903700-006	EW1903700-007	EW1903700-008	EW1903700-009	EW1903700-010	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.0	----	7.1	7.5	6.2	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	1880	----	1090	794	28400	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	930	----	552	412	19500	
EA075FD: Field Redox Potential									
Redox Potential	----	0.1	mV	-132	----	-121	-65.1	83.1	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	614	----	388	162	38	
Total Alkalinity as CaCO3	----	1	mg/L	614	----	388	162	38	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	23	----	12	21	1600	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	156	----	73	122	10300	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	148	----	103	66	230	
Magnesium	7439-95-4	1	mg/L	24	----	18	9	672	
Sodium	7440-23-5	1	mg/L	91	----	44	60	4930	
Potassium	7440-09-7	1	mg/L	53	----	24	4	168	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.139	----	0.085	0.020	0.013	
Iron	7439-89-6	0.05	mg/L	10.2	----	8.73	0.60	<0.05	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.5	----	0.3	0.1	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	40.0	----	20.5	0.27	0.12	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	<0.01	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	<0.01	<0.01	1.23	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW6D	MW6S	MW7D	MW7S	MW9
Client sampling date / time				28-Aug-2019 10:15	28-Aug-2019 10:00	28-Aug-2019 10:50	28-Aug-2019 11:05	28-Aug-2019 14:45	
Compound	CAS Number	LOR	Unit	EW1903700-006	EW1903700-007	EW1903700-008	EW1903700-009	EW1903700-010	
				Result	Result	Result	Result	Result	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	<0.01	<0.01	1.23	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	40.4	----	15.1	1.0	1.2	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	40.4	----	15.1	1.0	2.4	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	2.48	----	0.74	0.36	0.24	
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	17.1	----	10.1	7.12	325	
∅ Total Cations	----	0.01	meq/L	14.7	----	9.15	6.75	286	
∅ Ionic Balance	----	0.01	%	7.77	----	4.75	2.66	6.41	
EN67 PK: Field Tests									
Field Observations	----	0.01	--	GOING OUT	DRY	GOING OUT	GOING OUT	GOING IN	
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L	26	----	9	5	11	
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	2.30	----	2.26	2.44	4.50	
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m	4.97	----	4.73	4.57	1.38	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW10	MW11	MW12	MW13	MW14
Client sampling date / time				28-Aug-2019 15:00	28-Aug-2019 14:30	28-Aug-2019 14:00	28-Aug-2019 13:35	28-Aug-2019 12:25	
Compound	CAS Number	LOR	Unit	EW1903700-011	EW1903700-012	EW1903700-013	EW1903700-014	EW1903700-015	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	4.7	5.6	7.1	7.2	7.1	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	31700	23300	2280	1990	2750	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	20500	15400	978	910	1210	
EA075FD: Field Redox Potential									
Redox Potential	----	0.1	mV	154	89.5	-121	-122	-119	
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	6	43	540	473	651	
Total Alkalinity as CaCO3	----	1	mg/L	6	43	540	473	651	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1810	1320	49	108	77	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	11300	8030	314	208	384	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	251	180	106	77	100	
Magnesium	7439-95-4	1	mg/L	723	503	56	57	60	
Sodium	7440-23-5	1	mg/L	5650	4070	160	123	175	
Potassium	7440-09-7	1	mg/L	194	142	62	62	79	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.017	0.032	0.023	0.018	0.025	
Iron	7439-89-6	0.05	mg/L	7.19	4.33	6.92	4.30	6.66	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.3	0.3	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.32	1.15	43.8	41.8	68.4	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.01	0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW10	MW11	MW12	MW13	MW14
Client sampling date / time					28-Aug-2019 15:00	28-Aug-2019 14:30	28-Aug-2019 14:00	28-Aug-2019 13:35	28-Aug-2019 12:25
Compound	CAS Number	LOR	Unit		EW1903700-011	EW1903700-012	EW1903700-013	EW1903700-014	EW1903700-015
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	0.01	0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		1.0	3.4	44.0	49.2	175
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		1.0	3.4	44.0	49.2	175
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.13	0.14	0.18	0.26	0.28
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		356	255	20.7	17.6	25.4
∅ Total Cations	----	0.01	meq/L		----	----	----	----	24.4
∅ Total Cations	----	0.01	meq/L		323	231	18.4	15.5	----
∅ Ionic Balance	----	0.01	%		----	----	----	----	2.02
∅ Ionic Balance	----	0.01	%		4.98	4.90	5.68	6.35	----
EN67 PK: Field Tests									
Field Observations	----	0.01	--		GOING IN	GOING IN	GOING IN	GOING IN	GOING OUT
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		11	19	21	18	28
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		3.51	3.34	2.04	1.99	1.97
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		1.80	1.85	3.54	3.78	3.28



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ML-2	ML-5	Blank	ML-1	ML-3
Client sampling date / time				28-Aug-2019 15:30	28-Aug-2019 15:15	28-Aug-2019 12:45	28-Aug-2019 00:00	28-Aug-2019 00:00	
Compound	CAS Number	LOR	Unit	EW1903700-016	EW1903700-017	EW1903700-018	EW1903700-019	EW1903700-020	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.5	7.0	----	----	----	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	51200	48800	----	----	----	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	38000	36500	----	----	----	
EA075FD: Field Redox Potential									
Redox Potential	----	0.1	mV	37.8	36.1	----	----	----	
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	102	102	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	102	102	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	----	----	<1	----	----	
Magnesium	7439-95-4	1	mg/L	----	----	<1	----	----	
Sodium	7440-23-5	1	mg/L	----	----	<1	----	----	
Potassium	7440-09-7	1	mg/L	----	----	<1	----	----	
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L	427	406	----	----	----	
Magnesium	7439-95-4	1	mg/L	1360	1250	----	----	----	
Sodium	7440-23-5	1	mg/L	11200	10400	----	----	----	
Potassium	7440-09-7	1	mg/L	412	387	----	----	----	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	----	----	<0.001	----	----	
Iron	7439-89-6	0.05	mg/L	----	----	<0.05	----	----	
EG020T: Total Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.019	0.035	----	----	----	
Iron	7439-89-6	0.05	mg/L	0.14	<0.10	----	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.12	0.07	----	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ML-2	ML-5	Blank	ML-1	ML-3
Client sampling date / time				28-Aug-2019 15:30	28-Aug-2019 15:15	28-Aug-2019 12:45	28-Aug-2019 00:00	28-Aug-2019 00:00	
Compound	CAS Number	LOR	Unit	EW1903700-016	EW1903700-017	EW1903700-018	EW1903700-019	EW1903700-020	
				Result	Result	Result	Result	Result	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.01	0.09	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.09	----	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<1.0	<1.0	----	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	<1.0	<1.0	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.16	0.31	----	----	----	
EN67 PK: Field Tests									
Field Observations	----	0.01	--	GOING IN	GOING IN	----	NO ACCESS	NO ACCESS	
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	3.43	3.36	----	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	ML-4	----	----	----	----
			Client sampling date / time	28-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EW1903700-021	-----	-----	-----	-----
				Result	----	----	----	----
EN67 PK: Field Tests								
Field Observations	----	0.01	--	NO ACCESS	----	----	----	----