

APPENDIX



R

Laboratory Certificates

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT



The Australian Government is delivering
Inland Rail through the Australian
Rail Track Corporation (ARTC), in
partnership with the private sector.

Inland Rail North Star to NSW/QLD Border

Appendix R: Laboratory
certificates

**Australian Rail Track
Corporation**

Reference: 2700

Document Number:
2-0001-270-EAP-10-RP-0417

Revision: 0

CERTIFICATE OF ANALYSIS

Work Order	: EB1821199	Page	: 1 of 9
Amendment	: 1		
Client	: TRILAB PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: THE ADMIN RESULTS	Contact	: Customer Services EB
Address	: 346A BILSEN RD	Address	: 2 Byth Street Stafford QLD Australia 4053
	GEEBUNG QLD, AUSTRALIA 4031		
Telephone	: +61 07 3265 5656	Telephone	: +61-7-3243 7222
Project	: Inland Rail - BG2	Date Samples Received	: 31-Aug-2018 09:29
Order number	: 1908029	Date Analysis Commenced	: 04-Sep-2018
C-O-C number	: ----	Issue Date	: 19-Sep-2018 10:36
Sampler	: ----		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 34		
No. of samples analysed	: 34		



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>
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



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.

- ED006(Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio for samples EB1821199-019 (18080329/270-01-DH2510 1.00-1.25m), EB1821199-029 (18080339/270-01-DH2521 1.00-1.25m), EB1821199-032 (18080342/270-01-DH2534 1.00-1.25m) and EB1821199-033 (18080343/270-01-DH2535 1.00-1.25m) as the required results for Magnesium/Potassium are below LOR
- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- Amendment (19/9/2018): This report has been amended as a result of a request to change sample depths for all samples as per the COC. All analysis results are as per the previous report.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H⁺ + Al³⁺).
- 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: SOIL
 (Matrix: SOIL)

Client sample ID

				18080311/270-01-DH2 509 0.00-0.25m	18080312/270-01-DH2 510 0.00-0.25m	18080313/270-01-DH2 511 0.00-0.25m	18080314/270-01-DH2 512 0.00-0.25m	18080315/270-01-DH2 513 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-001	EB1821199-002	EB1821199-003	EB1821199-004	EB1821199-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.7	6.4	6.7	6.4	5.9
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	3.89	0.81	0.42	0.24	0.91
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	135	25	85	42	62
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	----	----	----	----	<0.1
Exchangeable Aluminium	----	0.1	meq/100g	----	----	----	----	<0.1
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	17.4	6.2	3.6	3.6	7.3
Exchangeable Magnesium	----	0.1	meq/100g	14.4	2.5	1.1	1.3	2.8
Exchangeable Potassium	----	0.1	meq/100g	0.9	0.3	0.5	0.9	0.8
Exchangeable Sodium	----	0.1	meq/100g	1.2	<0.1	<0.1	<0.1	0.1
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	----	11.0
Cation Exchange Capacity	----	0.1	meq/100g	34.1	9.2	5.2	5.8	----
Exchangeable Sodium Percent	----	0.1	%	3.6	1.0	0.5	0.3	1.1
Calcium/Magnesium Ratio	----	0.1	-	1.2	2.5	3.3	2.8	2.6
Magnesium/Potassium Ratio	----	0.1	-	15.4	8.3	2.4	1.5	3.5



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080316/270-01-DH2 515 0.00-0.25m	18080317/270-01-DH2 516 0.00-0.25m	18080318/270-01-DH2 517 0.00-0.25m	18080319/270-01-DH2 518 0.00-0.25m	18080320/270-01-DH2 519 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-006	EB1821199-007	EB1821199-008	EB1821199-009	EB1821199-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.6	6.3	7.1	6.8	6.8
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	2.54	6.10	6.01	13.6	16.4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	177	53	41	61	117
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	12.2	----	----	----	----
Exchangeable Magnesium	----	0.2	meq/100g	5.2	----	----	----	----
Exchangeable Potassium	----	0.2	meq/100g	0.6	----	----	----	----
Exchangeable Sodium	----	0.2	meq/100g	0.3	----	----	----	----
Cation Exchange Capacity	----	0.2	meq/100g	18.3	----	----	----	----
Exchangeable Sodium Percent	----	0.2	%	1.8	----	----	----	----
Calcium/Magnesium Ratio	----	0.2	-	2.3	----	----	----	----
Magnesium/Potassium Ratio	----	0.2	-	8.8	----	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	3.6	6.5	4.9	6.3
Exchangeable Magnesium	----	0.1	meq/100g	----	3.7	2.8	3.8	6.2
Exchangeable Potassium	----	0.1	meq/100g	----	0.3	0.5	0.2	0.6
Exchangeable Sodium	----	0.1	meq/100g	----	0.5	0.5	1.2	1.9
Cation Exchange Capacity	----	0.1	meq/100g	----	8.3	10.3	10.2	15.1
Exchangeable Sodium Percent	----	0.1	%	----	6.1	4.6	11.8	12.7
Calcium/Magnesium Ratio	----	0.1	-	----	1.0	2.3	1.3	1.0
Magnesium/Potassium Ratio	----	0.1	-	----	10.8	5.5	21.6	10.4



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080321/270-01-DH2 520 0.00-0.25m	18080322/270-01-DH2 521 0.00-0.25m	18080323/270-01-DH2 522 0.00-0.25m	18080324/270-01-DH2 532 0.00-0.25m	18080325/270-01-DH2 534 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-011	EB1821199-012	EB1821199-013	EB1821199-014	EB1821199-015
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.4	8.1	8.4	6.6	7.0
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	8.80	4.23	17.0	10.1	8.03
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	307	415	172	57	59
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	9.1	11.7	9.7	----	----
Exchangeable Magnesium	----	0.2	meq/100g	5.8	3.4	4.9	----	----
Exchangeable Potassium	----	0.2	meq/100g	0.7	0.7	0.6	----	----
Exchangeable Sodium	----	0.2	meq/100g	1.5	0.3	1.5	----	----
Cation Exchange Capacity	----	0.2	meq/100g	17.0	16.1	16.7	----	----
Exchangeable Sodium Percent	----	0.2	%	8.8	2.1	9.1	----	----
Calcium/Magnesium Ratio	----	0.2	-	1.6	3.4	2.0	----	----
Magnesium/Potassium Ratio	----	0.2	-	8.7	5.0	8.6	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	12.0	6.7
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	6.6	2.2
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	0.6	0.5
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	2.0	0.6
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	21.3	10.0
Exchangeable Sodium Percent	----	0.1	%	----	----	----	9.3	5.8
Calcium/Magnesium Ratio	----	0.1	-	----	----	----	1.8	3.0
Magnesium/Potassium Ratio	----	0.1	-	----	----	----	10.7	4.3



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080326/270-01-DH2 535 0.00-0.25m	18080327/270-01-DH2 538 0.00-0.25m	18080328/270-01-DH2 509 0.00-0.25m	18080329/270-01-DH2 510 0.00-0.25m	18080330/270-01-DH2 511 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-016	EB1821199-017	EB1821199-018	EB1821199-019	EB1821199-020
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.2	6.5	9.1	7.6	8.0
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	11.4	12.3	32.8	6.42	8.74
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	111	104	291	24	47
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	10.6	5.9	9.3
Exchangeable Magnesium	----	0.2	meq/100g	----	----	15.7	2.4	3.2
Exchangeable Potassium	----	0.2	meq/100g	----	----	0.5	<0.2	0.4
Exchangeable Sodium	----	0.2	meq/100g	----	----	5.6	0.2	0.6
Cation Exchange Capacity	----	0.2	meq/100g	----	----	32.3	8.7	13.6
Exchangeable Sodium Percent	----	0.2	%	----	----	17.3	2.9	4.6
Calcium/Magnesium Ratio	----	0.2	-	----	----	0.7	2.4	2.9
Magnesium/Potassium Ratio	----	0.2	-	----	----	33.8	----	7.1
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	4.6	8.7	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	3.3	4.5	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.2	1.1	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	1.0	1.6	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	9.2	15.9	----	----	----
Exchangeable Sodium Percent	----	0.1	%	10.9	9.9	----	----	----
Calcium/Magnesium Ratio	----	0.1	-	1.4	1.9	----	----	----
Magnesium/Potassium Ratio	----	0.1	-	19.3	4.1	----	----	----



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080331/270-01-DH2 512 0.00-0.25m	18080332/270-01-DH2 513 0.00-0.25m	18080333/270-01-DH2 515 0.00-0.25m	18080334/270-01-DH2 516 0.00-0.25m	18080335/270-01-DH2 517 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-021	EB1821199-022	EB1821199-023	EB1821199-024	EB1821199-025
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.6	8.1	8.1	6.0	8.4
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	3.71	13.0	30.3	28.3	28.1
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	23	189	699	636	422
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	----	----	----	0.1	----
Exchangeable Aluminium	----	0.1	meq/100g	----	----	----	<0.1	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	3.8	10.4	6.5	----	6.9
Exchangeable Magnesium	----	0.2	meq/100g	1.6	4.0	7.4	----	7.0
Exchangeable Potassium	----	0.2	meq/100g	0.3	0.5	0.2	----	0.3
Exchangeable Sodium	----	0.2	meq/100g	<0.2	0.9	3.6	----	2.9
Cation Exchange Capacity	----	0.2	meq/100g	5.8	15.8	17.7	----	17.1
Exchangeable Sodium Percent	----	0.2	%	<0.2	5.8	20.3	----	16.8
Calcium/Magnesium Ratio	----	0.2	-	2.3	2.6	0.9	----	1.0
Magnesium/Potassium Ratio	----	0.2	-	5.5	7.4	33.8	----	20.8
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	2.4	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	4.1	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	0.2	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	1.1	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	7.9	----
Exchangeable Sodium Percent	----	0.1	%	----	----	----	14.1	----
Calcium/Magnesium Ratio	----	0.1	-	----	----	----	0.6	----
Magnesium/Potassium Ratio	----	0.1	-	----	----	----	25.8	----



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080336/270-01-DH2 518 0.00-0.25m	18080337/270-01-DH2 519 0.00-0.25m	18080338/270-01-DH2 520 0.00-0.25m	18080339/270-01-DH2 521 0.00-0.25m	18080340/270-01-DH2 522 0.00-0.25m
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00
Compound	CAS Number	LOR	Unit	EB1821199-026	EB1821199-027	EB1821199-028	EB1821199-029	EB1821199-030
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.9	5.8	7.1	8.5	4.9
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	37.4	32.5	45.6	51.2	52.4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	619	776	777	375	522
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	<0.1	<0.1	----	----	2.4
Exchangeable Aluminium	----	0.1	meq/100g	<0.1	<0.1	----	----	2.0
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	----	3.8	----
Exchangeable Magnesium	----	0.2	meq/100g	----	----	----	9.3	----
Exchangeable Potassium	----	0.2	meq/100g	----	----	----	<0.2	----
Exchangeable Sodium	----	0.2	meq/100g	----	----	----	6.9	----
Cation Exchange Capacity	----	0.2	meq/100g	----	----	----	20.2	----
Exchangeable Sodium Percent	----	0.2	%	----	----	----	34.2	----
Calcium/Magnesium Ratio	----	0.2	-	----	----	----	0.4	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	2.8	3.3	2.3	----	2.0
Exchangeable Magnesium	----	0.1	meq/100g	4.7	5.4	4.1	----	6.2
Exchangeable Potassium	----	0.1	meq/100g	0.1	0.2	0.1	----	0.2
Exchangeable Sodium	----	0.1	meq/100g	1.8	1.8	1.7	----	3.3
Cation Exchange Capacity	----	0.1	meq/100g	9.4	10.7	----	----	14.1
Cation Exchange Capacity	----	0.1	meq/100g	----	----	8.3	----	----
Exchangeable Sodium Percent	----	0.1	%	19.0	16.7	20.7	----	27.8
Calcium/Magnesium Ratio	----	0.1	-	0.6	0.6	0.6	----	0.3
Magnesium/Potassium Ratio	----	0.1	-	41.0	32.6	39.5	----	26.7



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18080341/270-01-DH2 532 0.00-0.25m	18080342/270-01-DH2 534 0.00-0.25m	18080343/270-01-DH2 535 0.00-0.25m	18080344/270-01-DH2 538 0.00-0.25m	----
Client sampling date / time				29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	29-Aug-2018 00:00	----
Compound	CAS Number	LOR	Unit	EB1821199-031	EB1821199-032	EB1821199-033	EB1821199-034	-----
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.0	8.4	8.4	4.9	----
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Adsorption Ratio	----	0.01	-	38.8	39.2	19.4	30.6	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	838	980	1220	1050	----
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	----	----	----	0.6	----
Exchangeable Aluminium	----	0.1	meq/100g	----	----	----	0.4	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	10.7	7.2	7.3	----	----
Exchangeable Magnesium	----	0.2	meq/100g	7.3	6.0	7.5	----	----
Exchangeable Potassium	----	0.2	meq/100g	0.4	<0.2	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g	4.8	5.0	2.7	----	----
Cation Exchange Capacity	----	0.2	meq/100g	23.1	18.2	17.6	----	----
Exchangeable Sodium Percent	----	0.2	%	20.6	27.4	15.4	----	----
Calcium/Magnesium Ratio	----	0.2	-	1.5	1.2	1.0	----	----
Magnesium/Potassium Ratio	----	0.2	-	19.4	----	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	11.1	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	9.1	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	0.3	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	3.5	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	24.6	----
Exchangeable Sodium Percent	----	0.1	%	----	----	----	14.4	----
Calcium/Magnesium Ratio	----	0.1	-	----	----	----	1.2	----
Magnesium/Potassium Ratio	----	0.1	-	----	----	----	28.8	----

QUALITY CONTROL REPORT

Work Order : **EB1821199**

Page : 1 of 6

Amendment : **1**

Client : **TRILAB PTY LTD**

Laboratory : Environmental Division Brisbane

Contact : THE ADMIN RESULTS

Contact : Customer Services EB

Address : 346A BILSEN RD
GEEBUNG QLD, AUSTRALIA 4031

Address : 2 Byth Street Stafford QLD Australia 4053

Telephone : +61 07 3265 5656

Telephone : +61-7-3243 7222

Project : Inland Rail - BG2

Date Samples Received : 31-Aug-2018

Order number : 1908029

Date Analysis Commenced : 04-Sep-2018

C-O-C number : ----

Issue Date : 19-Sep-2018

Sampler : ----

Site : ----

Quote number : EN/333

No. of samples received : 34

No. of samples analysed : 34



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 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
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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

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

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: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED008: Exchangeable Cations (QC Lot: 1914647) - continued									
EB1821199-028	18080338/270-01-DH2520 0.00-0.25m	ED008: Exchangeable Calcium	----	0.1	meq/100g	2.3	2.2	0.00	0% - 20%
		ED008: Exchangeable Magnesium	----	0.1	meq/100g	4.1	4.0	2.91	0% - 20%
		ED008: Exchangeable Potassium	----	0.1	meq/100g	0.1	<0.1	0.00	No Limit
		ED008: Exchangeable Sodium	----	0.1	meq/100g	1.7	1.6	0.00	0% - 50%



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 1909812)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98	102
				----	7 pH Unit	100	98	102
EA002: pH 1:5 (Soils) (QCLot: 1909813)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98	102
				----	7 pH Unit	100	98	102
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1912278)								
EA006: Sodium Adsorption Ratio	----	0.01	-	<0.01	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1912279)								
EA006: Sodium Adsorption Ratio	----	0.01	-	<0.01	----	----	----	----
EA010: Conductivity (1:5) (QCLot: 1909811)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.2	97	103
EA010: Conductivity (1:5) (QCLot: 1909814)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.4	97	103
ED005: Exchange Acidity (QCLot: 1914642)								
ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchange Acidity (QCLot: 1914646)								
ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 1914668)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	5.4 meq/100g	119	70	130
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	4.84 meq/100g	93.2	70	130
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	2.73 meq/100g	95.4	70	130
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	2.68 meq/100g	118	70	130
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	15.6 meq/100g	107	70	130
ED007: Exchangeable Cations (QCLot: 1914637)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	3.54 meq/100g	103	79	113
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.15 meq/100g	97.9	85	115
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.635 meq/100g	105	70	122
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.382 meq/100g	98.9	76	112
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	5.707 meq/100g	102	82	112
ED007: Exchangeable Cations (QCLot: 1914641)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	3.54 meq/100g	106	79	113



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
Method: Compound	CAS Number	LOR	Unit		Result	Spike	Spike Recovery (%)	Recovery Limits (%)	
						Concentration	LCS	Low	High
ED007: Exchangeable Cations (QCLot: 1914641) - continued									
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.15 meq/100g	101	85	115	
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.635 meq/100g	102	70	122	
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.382 meq/100g	96.5	76	112	
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	5.707 meq/100g	104	82	112	
ED008: Exchangeable Cations (QCLot: 1914644)									
ED008: Exchangeable Calcium	----	0.1	meq/100g	<0.1	3.2 meq/100g	103	91	109	
ED008: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.99 meq/100g	100	89	111	
ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.53 meq/100g	98.9	79	116	
ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.06 meq/100g	104	75	118	
ED008: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	4.77 meq/100g	102	88	110	
ED008: Exchangeable Cations (QCLot: 1914647)									
ED008: Exchangeable Calcium	----	0.1	meq/100g	<0.1	3.2 meq/100g	96.0	91	109	
ED008: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.99 meq/100g	96.6	89	111	
ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.53 meq/100g	94.0	79	116	
ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.06 meq/100g	80.0	75	118	
ED008: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	4.77 meq/100g	96.0	88	110	

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1821199	Page	: 1 of 7
Amendment	: 1		
Client	: TRILAB PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: THE ADMIN RESULTS	Telephone	: +61-7-3243 7222
Project	: Inland Rail - BG2	Date Samples Received	: 31-Aug-2018
Site	: ----	Issue Date	: 19-Sep-2018
Sampler	: ----	No. of samples received	: 34
Order number	: 1908029	No. of samples analysed	: 34

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

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



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: **SOIL**

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	
EA002: pH 1:5 (Soils)								
Snap Lock Bag (EA002)		29-Aug-2018	04-Sep-2018	05-Sep-2018	✔	04-Sep-2018	04-Sep-2018	✔
18080311/270-01-DH2509 0.00-0.25m, 18080312/270-01-DH2510 0.00-0.25m,								
18080313/270-01-DH2511 0.00-0.25m, 18080314/270-01-DH2512 0.00-0.25m,								
18080315/270-01-DH2513 0.00-0.25m, 18080316/270-01-DH2515 0.00-0.25m,								
18080317/270-01-DH2516 0.00-0.25m, 18080318/270-01-DH2517 0.00-0.25m,								
18080319/270-01-DH2518 0.00-0.25m, 18080320/270-01-DH2519 0.00-0.25m,								
18080321/270-01-DH2520 0.00-0.25m, 18080322/270-01-DH2521 0.00-0.25m,								
18080323/270-01-DH2522 0.00-0.25m, 18080324/270-01-DH2532 0.00-0.25m,								
18080325/270-01-DH2534 0.00-0.25m, 18080326/270-01-DH2535 0.00-0.25m,								
18080327/270-01-DH2538 0.00-0.25m, 18080328/270-01-DH2509 0.00-0.25m,								
18080329/270-01-DH2510 0.00-0.25m, 18080330/270-01-DH2511 0.00-0.25m,								
18080331/270-01-DH2512 0.00-0.25m, 18080332/270-01-DH2513 0.00-0.25m,								
18080333/270-01-DH2515 0.00-0.25m, 18080334/270-01-DH2516 0.00-0.25m,								
18080335/270-01-DH2517 0.00-0.25m, 18080336/270-01-DH2518 0.00-0.25m,								
18080337/270-01-DH2519 0.00-0.25m, 18080338/270-01-DH2520 0.00-0.25m,								
18080339/270-01-DH2521 0.00-0.25m, 18080340/270-01-DH2522 0.00-0.25m,								
18080341/270-01-DH2532 0.00-0.25m, 18080342/270-01-DH2534 0.00-0.25m,								
18080343/270-01-DH2535 0.00-0.25m, 18080344/270-01-DH2538 0.00-0.25m								



Matrix: **SOIL**

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

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA006: Sodium Adsorption Ratio (SAR)								
Snap Lock Bag (EA006)	29-Aug-2018	12-Sep-2018	25-Feb-2019	✔	12-Sep-2018	25-Feb-2019	✔	
18080311/270-01-DH2509 0.00-0.25m,								18080312/270-01-DH2510 0.00-0.25m,
18080313/270-01-DH2511 0.00-0.25m,								18080314/270-01-DH2512 0.00-0.25m,
18080315/270-01-DH2513 0.00-0.25m,								18080316/270-01-DH2515 0.00-0.25m,
18080317/270-01-DH2516 0.00-0.25m,								18080318/270-01-DH2517 0.00-0.25m,
18080319/270-01-DH2518 0.00-0.25m,								18080320/270-01-DH2519 0.00-0.25m,
18080321/270-01-DH2520 0.00-0.25m,								18080322/270-01-DH2521 0.00-0.25m,
18080323/270-01-DH2522 0.00-0.25m,								18080324/270-01-DH2532 0.00-0.25m,
18080325/270-01-DH2534 0.00-0.25m,								18080326/270-01-DH2535 0.00-0.25m,
18080327/270-01-DH2538 0.00-0.25m,								18080328/270-01-DH2509 0.00-0.25m,
18080329/270-01-DH2510 0.00-0.25m,								18080330/270-01-DH2511 0.00-0.25m,
18080331/270-01-DH2512 0.00-0.25m,								18080332/270-01-DH2513 0.00-0.25m,
18080333/270-01-DH2515 0.00-0.25m,								18080334/270-01-DH2516 0.00-0.25m,
18080335/270-01-DH2517 0.00-0.25m,								18080336/270-01-DH2518 0.00-0.25m,
18080337/270-01-DH2519 0.00-0.25m,								18080338/270-01-DH2520 0.00-0.25m,
18080339/270-01-DH2521 0.00-0.25m,								18080340/270-01-DH2522 0.00-0.25m,
18080341/270-01-DH2532 0.00-0.25m,								18080342/270-01-DH2534 0.00-0.25m,
18080343/270-01-DH2535 0.00-0.25m,	18080344/270-01-DH2538 0.00-0.25m							
EA010: Conductivity (1:5)								
Snap Lock Bag (EA010)	29-Aug-2018	04-Sep-2018	05-Sep-2018	✔	04-Sep-2018	02-Oct-2018	✔	
18080311/270-01-DH2509 0.00-0.25m,								18080312/270-01-DH2510 0.00-0.25m,
18080313/270-01-DH2511 0.00-0.25m,								18080314/270-01-DH2512 0.00-0.25m,
18080315/270-01-DH2513 0.00-0.25m,								18080316/270-01-DH2515 0.00-0.25m,
18080317/270-01-DH2516 0.00-0.25m,								18080318/270-01-DH2517 0.00-0.25m,
18080319/270-01-DH2518 0.00-0.25m,								18080320/270-01-DH2519 0.00-0.25m,
18080321/270-01-DH2520 0.00-0.25m,								18080322/270-01-DH2521 0.00-0.25m,
18080323/270-01-DH2522 0.00-0.25m,								18080324/270-01-DH2532 0.00-0.25m,
18080325/270-01-DH2534 0.00-0.25m,								18080326/270-01-DH2535 0.00-0.25m,
18080327/270-01-DH2538 0.00-0.25m,								18080328/270-01-DH2509 0.00-0.25m,
18080329/270-01-DH2510 0.00-0.25m,								18080330/270-01-DH2511 0.00-0.25m,
18080331/270-01-DH2512 0.00-0.25m,								18080332/270-01-DH2513 0.00-0.25m,
18080333/270-01-DH2515 0.00-0.25m,								18080334/270-01-DH2516 0.00-0.25m,
18080335/270-01-DH2517 0.00-0.25m,								18080336/270-01-DH2518 0.00-0.25m,
18080337/270-01-DH2519 0.00-0.25m,								18080338/270-01-DH2520 0.00-0.25m,
18080339/270-01-DH2521 0.00-0.25m,								18080340/270-01-DH2522 0.00-0.25m,
18080341/270-01-DH2532 0.00-0.25m,								18080342/270-01-DH2534 0.00-0.25m,
18080343/270-01-DH2535 0.00-0.25m,	18080344/270-01-DH2538 0.00-0.25m							



Matrix: **SOIL**

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	
ED005: Exchange Acidity								
Snap Lock Bag (ED005) 18080315/270-01-DH2513 0.00-0.25m, 18080321/270-01-DH2520 0.00-0.25m, 18080323/270-01-DH2522 0.00-0.25m, 18080329/270-01-DH2510 0.00-0.25m, 18080331/270-01-DH2512 0.00-0.25m, 18080333/270-01-DH2515 0.00-0.25m, 18080335/270-01-DH2517 0.00-0.25m, 18080337/270-01-DH2519 0.00-0.25m, 18080340/270-01-DH2522 0.00-0.25m, 18080342/270-01-DH2534 0.00-0.25m, 18080344/270-01-DH2538 0.00-0.25m	18080316/270-01-DH2515 0.00-0.25m, 18080322/270-01-DH2521 0.00-0.25m, 18080328/270-01-DH2509 0.00-0.25m, 18080330/270-01-DH2511 0.00-0.25m, 18080332/270-01-DH2513 0.00-0.25m, 18080334/270-01-DH2516 0.00-0.25m, 18080336/270-01-DH2518 0.00-0.25m, 18080339/270-01-DH2521 0.00-0.25m, 18080341/270-01-DH2532 0.00-0.25m, 18080343/270-01-DH2535 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	10-Sep-2018	26-Sep-2018	✔
Snap Lock Bag (ED005) 18080311/270-01-DH2509 0.00-0.25m, 18080313/270-01-DH2511 0.00-0.25m, 18080317/270-01-DH2516 0.00-0.25m, 18080319/270-01-DH2518 0.00-0.25m, 18080324/270-01-DH2532 0.00-0.25m, 18080326/270-01-DH2535 0.00-0.25m, 18080338/270-01-DH2520 0.00-0.25m	18080312/270-01-DH2510 0.00-0.25m, 18080314/270-01-DH2512 0.00-0.25m, 18080318/270-01-DH2517 0.00-0.25m, 18080320/270-01-DH2519 0.00-0.25m, 18080325/270-01-DH2534 0.00-0.25m, 18080327/270-01-DH2538 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	11-Sep-2018	26-Sep-2018	✔
ED006: Exchangeable Cations on Alkaline Soils								
Snap Lock Bag (ED006) 18080311/270-01-DH2509 0.00-0.25m, 18080313/270-01-DH2511 0.00-0.25m, 18080315/270-01-DH2513 0.00-0.25m, 18080318/270-01-DH2517 0.00-0.25m, 18080320/270-01-DH2519 0.00-0.25m, 18080325/270-01-DH2534 0.00-0.25m, 18080327/270-01-DH2538 0.00-0.25m, 18080336/270-01-DH2518 0.00-0.25m, 18080338/270-01-DH2520 0.00-0.25m, 18080344/270-01-DH2538 0.00-0.25m	18080312/270-01-DH2510 0.00-0.25m, 18080314/270-01-DH2512 0.00-0.25m, 18080317/270-01-DH2516 0.00-0.25m, 18080319/270-01-DH2518 0.00-0.25m, 18080324/270-01-DH2532 0.00-0.25m, 18080326/270-01-DH2535 0.00-0.25m, 18080334/270-01-DH2516 0.00-0.25m, 18080337/270-01-DH2519 0.00-0.25m, 18080340/270-01-DH2522 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	10-Sep-2018	26-Sep-2018	✔
Snap Lock Bag (ED006) 18080316/270-01-DH2515 0.00-0.25m, 18080322/270-01-DH2521 0.00-0.25m, 18080328/270-01-DH2509 0.00-0.25m, 18080330/270-01-DH2511 0.00-0.25m, 18080332/270-01-DH2513 0.00-0.25m, 18080335/270-01-DH2517 0.00-0.25m, 18080341/270-01-DH2532 0.00-0.25m, 18080343/270-01-DH2535 0.00-0.25m	18080321/270-01-DH2520 0.00-0.25m, 18080323/270-01-DH2522 0.00-0.25m, 18080329/270-01-DH2510 0.00-0.25m, 18080331/270-01-DH2512 0.00-0.25m, 18080333/270-01-DH2515 0.00-0.25m, 18080339/270-01-DH2521 0.00-0.25m, 18080342/270-01-DH2534 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	11-Sep-2018	26-Sep-2018	✔



Matrix: **SOIL**

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

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
ED007: Exchangeable Cations								
Snap Lock Bag (ED007) 18080315/270-01-DH2513 0.00-0.25m, 18080321/270-01-DH2520 0.00-0.25m, 18080323/270-01-DH2522 0.00-0.25m, 18080329/270-01-DH2510 0.00-0.25m, 18080331/270-01-DH2512 0.00-0.25m, 18080333/270-01-DH2515 0.00-0.25m, 18080335/270-01-DH2517 0.00-0.25m, 18080337/270-01-DH2519 0.00-0.25m, 18080340/270-01-DH2522 0.00-0.25m, 18080342/270-01-DH2534 0.00-0.25m, 18080344/270-01-DH2538 0.00-0.25m	18080316/270-01-DH2515 0.00-0.25m, 18080322/270-01-DH2521 0.00-0.25m, 18080328/270-01-DH2509 0.00-0.25m, 18080330/270-01-DH2511 0.00-0.25m, 18080332/270-01-DH2513 0.00-0.25m, 18080334/270-01-DH2516 0.00-0.25m, 18080336/270-01-DH2518 0.00-0.25m, 18080339/270-01-DH2521 0.00-0.25m, 18080341/270-01-DH2532 0.00-0.25m, 18080343/270-01-DH2535 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	10-Sep-2018	26-Sep-2018	✔
Snap Lock Bag (ED007) 18080311/270-01-DH2509 0.00-0.25m, 18080313/270-01-DH2511 0.00-0.25m, 18080317/270-01-DH2516 0.00-0.25m, 18080319/270-01-DH2518 0.00-0.25m, 18080324/270-01-DH2532 0.00-0.25m, 18080326/270-01-DH2535 0.00-0.25m, 18080338/270-01-DH2520 0.00-0.25m	18080312/270-01-DH2510 0.00-0.25m, 18080314/270-01-DH2512 0.00-0.25m, 18080318/270-01-DH2517 0.00-0.25m, 18080320/270-01-DH2519 0.00-0.25m, 18080325/270-01-DH2534 0.00-0.25m, 18080327/270-01-DH2538 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	11-Sep-2018	26-Sep-2018	✔
ED008: Exchangeable Cations								
Snap Lock Bag (ED008) 18080315/270-01-DH2513 0.00-0.25m, 18080321/270-01-DH2520 0.00-0.25m, 18080323/270-01-DH2522 0.00-0.25m, 18080329/270-01-DH2510 0.00-0.25m, 18080331/270-01-DH2512 0.00-0.25m, 18080333/270-01-DH2515 0.00-0.25m, 18080335/270-01-DH2517 0.00-0.25m, 18080337/270-01-DH2519 0.00-0.25m, 18080340/270-01-DH2522 0.00-0.25m, 18080342/270-01-DH2534 0.00-0.25m, 18080344/270-01-DH2538 0.00-0.25m	18080316/270-01-DH2515 0.00-0.25m, 18080322/270-01-DH2521 0.00-0.25m, 18080328/270-01-DH2509 0.00-0.25m, 18080330/270-01-DH2511 0.00-0.25m, 18080332/270-01-DH2513 0.00-0.25m, 18080334/270-01-DH2516 0.00-0.25m, 18080336/270-01-DH2518 0.00-0.25m, 18080339/270-01-DH2521 0.00-0.25m, 18080341/270-01-DH2532 0.00-0.25m, 18080343/270-01-DH2535 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	10-Sep-2018	26-Sep-2018	✔
Snap Lock Bag (ED008) 18080311/270-01-DH2509 0.00-0.25m, 18080313/270-01-DH2511 0.00-0.25m, 18080317/270-01-DH2516 0.00-0.25m, 18080319/270-01-DH2518 0.00-0.25m, 18080324/270-01-DH2532 0.00-0.25m, 18080326/270-01-DH2535 0.00-0.25m, 18080338/270-01-DH2520 0.00-0.25m	18080312/270-01-DH2510 0.00-0.25m, 18080314/270-01-DH2512 0.00-0.25m, 18080318/270-01-DH2517 0.00-0.25m, 18080320/270-01-DH2519 0.00-0.25m, 18080325/270-01-DH2534 0.00-0.25m, 18080327/270-01-DH2538 0.00-0.25m,	29-Aug-2018	10-Sep-2018	26-Sep-2018	✔	11-Sep-2018	26-Sep-2018	✔



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: **SOIL**

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)							
Electrical Conductivity (1:5)	EA010	4	34	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	2	6	33.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	3	13	23.08	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	6	33.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	4	34	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	2	34	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	13	15.38	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	6	33.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	4	34	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	2	34	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	2	6	33.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	13	15.38	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	6	33.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sodium Adsorption Ratio (SAR)	EA006	2	34	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Sodium Adsorption Ratio (SAR)	EA006	SOIL	In house: Referenced to USEPA 600/2 - 78 - 54. The concentration as meq of Ca, Mg and Na are determined on saturated soil by water leach. Results are used to calculate SAR.
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Exchange Acidity by 1M Potassium Chloride	ED005	SOIL	In house: referenced to Rayment and Lyons, (2011), method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Higginson (2011) Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Preparation Methods	Method	Matrix	Method Descriptions
SAR Prep	EA006PR	SOIL	In house: Referenced to USEPA 600/2. Soil is brought to saturation with distilled water by capillary action.
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons 2011 method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH ₄ Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.