To:	Stantec
From:	Agrimin Technical Team
Subject:	Groundwater sampling and analysis memo
Date:	19/08/2021

1. Overview

Brine sampling was a key focus of all exploration field work. Samples were collected and analysed as part of all trenching, drilling and shallow sampling programs across the project area. The objective of the brine sampling was to characterise the geochemical composition and concentration of ions hosted in the lake sediments

2. Sampling

Brine samples from trenches were collected from the pump discharge line and represent the average composition of brine within the aquifer zone intercepted by the trench. Test pit samples were taken immediately after excavation and represent the average composition of brine within the aquifer zone intercepted by the pit. Brine samples from monitoring bores were obtained using a PVC bailer and represent the average brine composition of the screened aquifer zone of the bore. Where required, an electric submersible pump was used to purge bores prior to sampling.

Samples were collected in sterile plastic bottles, labelled with the sample location ID and date, and stored in refrigeration. Samples were then transported to Perth in portable coolers by Agrimin employees before being dispatched to the relevant laboratories. Declaration and chain of custody forms were completed with each submission.

3. Analysis

Intertek and ALS were the primary laboratories used by Agrimin to analyse brine and leachate samples from the drilling, monitoring and trenching work programs from 2015 through to August 2018. Bureau Veritas was chosen as the primary laboratory for all DFS brine analysis test work from September 2018 to 2019, with check samples submitted to Intertek. In addition to these two primary laboratories, Agrimin had further specialist brine analysis completed at ALS, the University of Antofagasta, Hazen, and the University of Western Australia.

Samples submitted to Intertek, ALS and Bureau Veritas, the primary laboratories, underwent determination of Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg) and Sulphate (SO_4) by Inductively Coupled Plasma ("ICP") Optical Emission Spectrometry. Chlorine (Cl) was determined by UV Visible Spectrometry. Specific gravity ("SG") and total dissolved solids ("TDS") were also determined for the samples. A select number of samples underwent further analyses such as pH, isotopes, carbonate alkalinity, EC, and minor elements. The solutions were not treated other than by dilution.

A summary of geochemical methods and number of analysis completed is shown in Table 1.

Table 1: Groundwater analysis methods and detection limits

ANALYSIS METHODS & DETECTION						
Parameter	**ALS Method**	**Detection Limit**	**Intertek Method**	**Detection Limit**	**Bureau Veritas Method**	**Detection Limit**
Density			Gravimetric	0.001	Liquid picnometry	0.01 g/cc
Electrical Conductivity	EA010P: Conductivity by PC Titrator	1 µS/cm				
Total dissolved solids	EA015: Total Dissolved Solids @180oC	10 mg/L	Gravimetric	0.02 (g/kg)	Total Dissolved Solids @180oC	20 mg/kg
pH	EA005P: pH by PC Titrator	0.01				
Chloride	ED045G: Chloride by Discrete Analyser	1 mg/L	ICP Optical Emission Spectrometry		Colourimetrically	50 mg/l
Sulphate	ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	1 mg/L	ICP Optical Emission Spectrometry for S, SO4 calculated	0.3 mg/l	ICP Optical Emission Spectrometry for S, SO4 calculated	10 mg/l
Alkalinity	ED037P: Alkalinity by PC Titrator	0.01				
Ca, Mg, Na, K	ED093F: Dissolved Major Cations. ICP-AES or ICP-MS techniques.	1 mg/L	ICP Optical Emission Spectrometry	0.1 mg/l (Na, K); 0.01 mg/l Ca, Mg	ICP Optical Emission Spectrometry	10 mg/l (Na, K); 1 mg/l Ca, 5 mg/l Mg
As, Li, Mn, Sr	EG020T: Total Metals by ICP-MS	0.001 mg/l				
B, Fe	EG020T: Total Metals by ICP-MS	0.05 mg/l				

Table 2: Groundwater sample analysis summary

BRINE ANALYSIS SUMMARY			
Lab	**Location**	**Qty**	**Analysis**
Intertek	Perth, WA	591 (PFS) 4 (DFS)	Multi-element analysis
Bureau Veritas	Perth, WA	14 (PFS) 378 (DFS)	Multi-element analysis
ALS	Perth, WA	152 (PFS)	Multi-element analysis
University of Antofagasta	Antofagasta, Chile	19 (PFS)	Multi-element analysis
University of Western Australia	Perth, WA	8 (DFS)	C13 Isotope
Hazen	USA	4 (DFS)	Multi-element analysis

4. Quality Control

Intertek ALS, and Bureau Veritas are all NATA and ISO 9001 accredited minerals testing laboratories. Duplicate and blank samples were included in each analysis batch to ensure that reproducible results were being achieved. Certified reference material representative of the elements of interest and the expected range of concentrations were routinely tested. External quality control check samples were analysed at independent laboratories enabling the comparison of results.

Certificates of analysis, together with excel data files of the results were sent from the respective laboratory to Agrimin. Upon receipt, the data was checked by Agrimin hydrogeologists prior to being input into the assay database.

4.1 Standards

A suite of seven certified reference materials ("CRM") were analysed as part of each sample submission to Bureau Veritas. CRM standards are used to validate the analytical measurement methods and calibration of equipment for each ion being tested. Each standard corresponded to specific elements of interest in varying concentration ranges. A total of 125 CRM standards were analysed. Results of the standard analyses are shown as graphs in Figure 1. The black line represents the target concentration for the standard and the red lines indicate the ±10% error bounds.

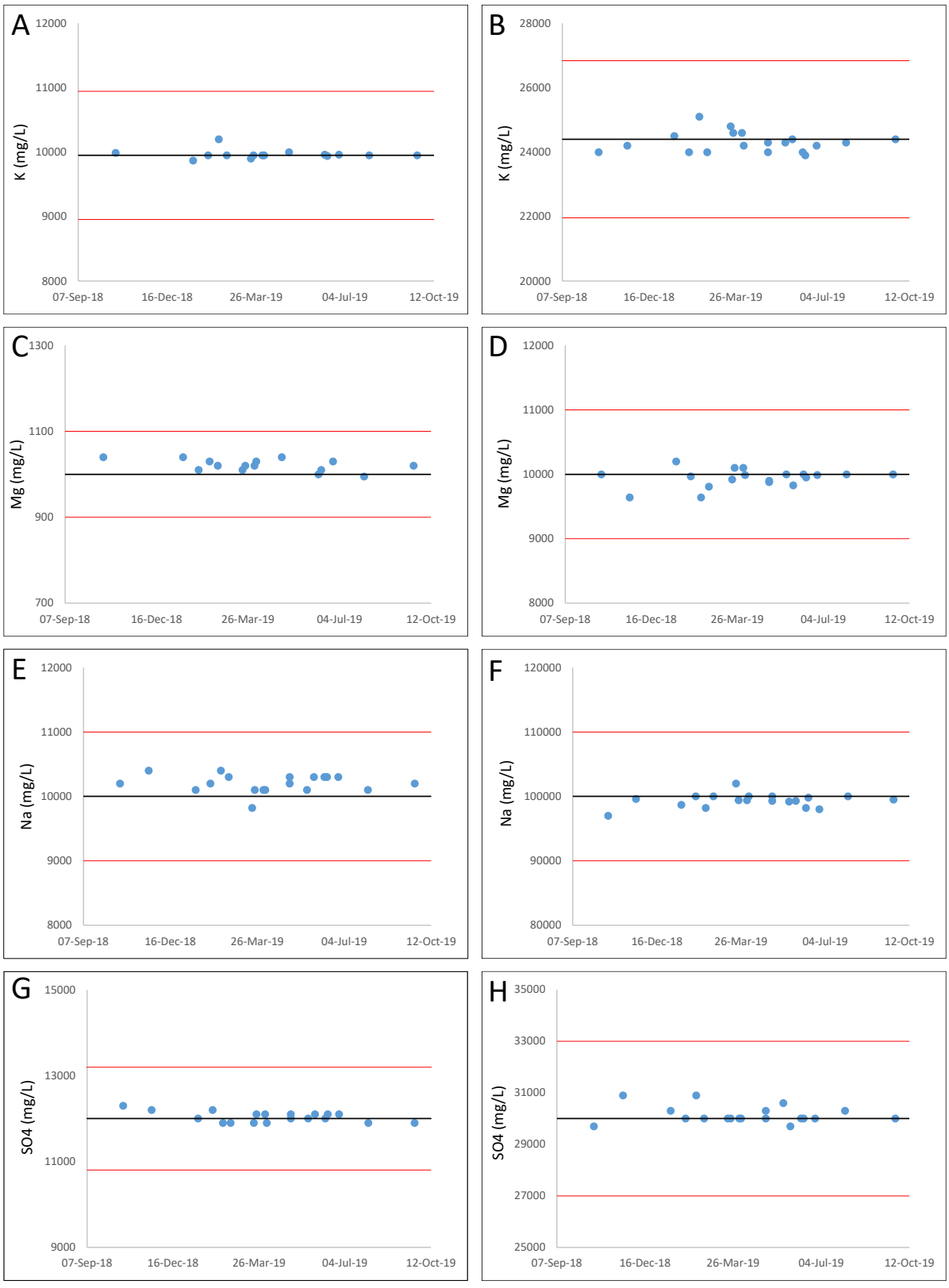

Figure 1: Assay standard analysis results for key ions in different concentration ranges. (A) Potassium, low range, (B) Potassium, high range (C) Magnesium, low range, (D) Magnesium, high range, (E) Sodium, low range, (F) Sodium, high range, (G) Sulphate, low range, (H) Sulphate, high range.

4.2 Duplicates

Thirty-four duplicate samples were analysed as part of the standard brine analysis procedures. The duplicate samples were taken from the same 50mL sample as the original. 34 duplicate samples represent 9% of all samples analysed. The results of the duplicate analyses are shown as graphs in Figure 2. The Red lines on the graphs indicate the ±10% error bounds. The results from the duplicate analysis shows that repeatability is good with no samples falling outside of the accepted 10% error bounds.

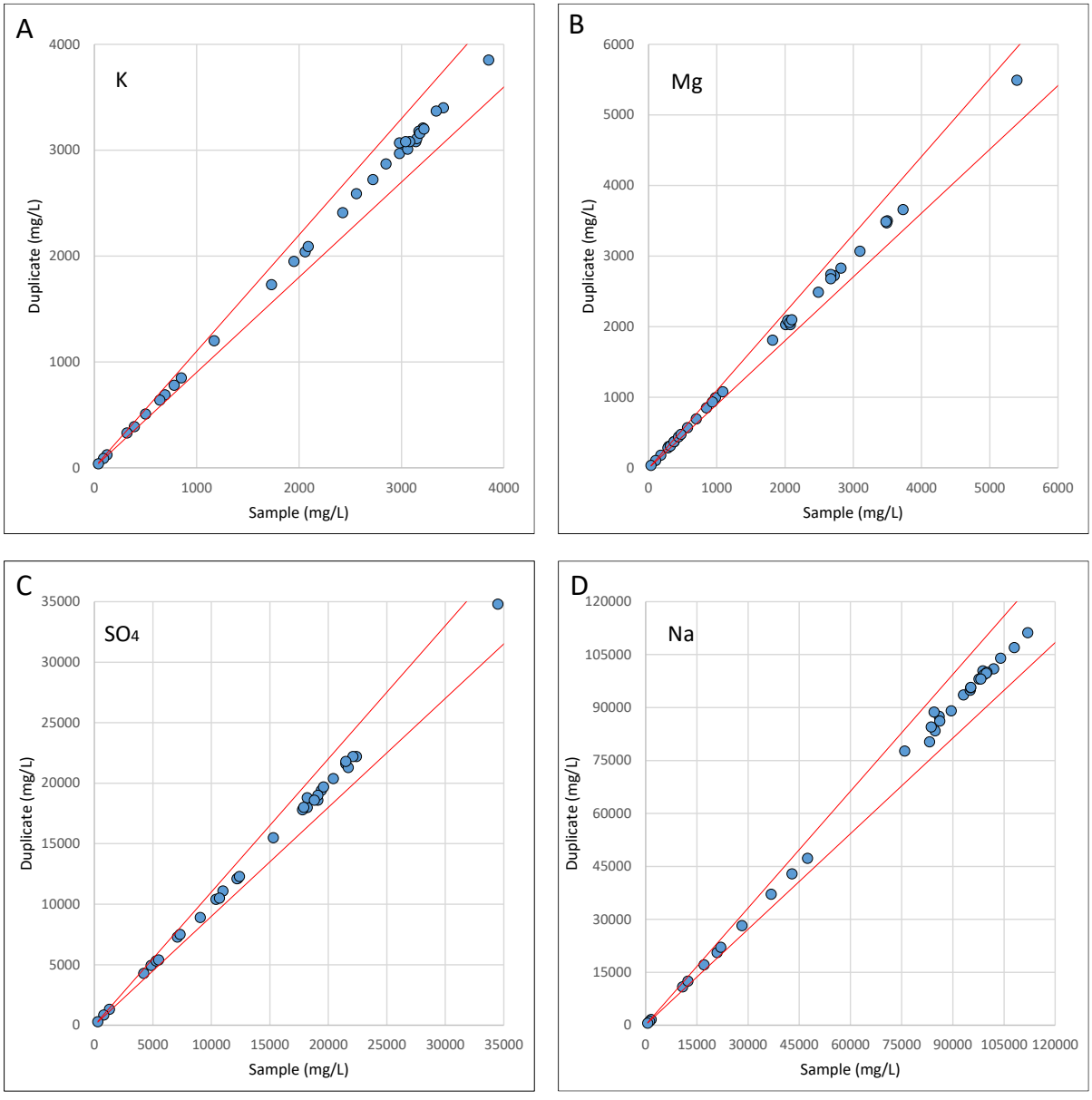

Figure 2: Duplicate sample analysis for target ions. (A) Potassium, K, (B)Magnesium, Mg, (C) Sulphate, SO_4, (D) Sodium, Na.

5. Chemistry Summary

The following section presents statical analysis of the assay results for samples taken from sample locations within the lake margins, lake islands and southern borefield. Analysis was completed on all sample assay results from the respective project areas

5.1 Lake groundwater chemistry

Groundwater samples taken from various bores and pilot trenches across the lake are summarised in Table 3 below.

Table 3: Lake groundwater analysis summary

Parameter	Records	Min.	Mean	Median	Max.
pH (units)	32	5.34	6.63	6.68	7.22
Salinity (TDS)	349	6,569	214,678	228,456	339,995
Magnesium	213	57	2,551	2,240	6,790
Calcium	213	140	598	602	1,220
Sodium	213	6,823	88,786	89062	134,348
Potassium	213	390	3,088	3080	9,640
Chloride	213	164	131,987	132050	186,950
Sulphate	213	3,870	19,688	19325	60,900
Bicarbonate	28	10	37	20	210
Nitrates	32	4	31	11	151

5.2 Lake island groundwater chemistry

Groundwater samples taken from monitoring bores located on large lake islands are summarised in Table 4 below.

Table 4: Island groundwater analysis summary

Parameter	Records	Min.	Mean	Median	Max.
pH (units)	2	6.83	6.87	6.87	6.90
Salinity (TDS)	2	41,864	48,988	48,989	56,113
Magnesium	2	373	446	446	520
Calcium	2	1,080	1,135	1,135	1,190
Sodium	2	12,450	14,675	14,675	16,900
Potassium	2	325	418	418	510
Chloride	2	20,425	24,738	24,738	29,050
Sulphate	2	5,295	5,573	5,573	5,850
Bicarbonate	2	40	105	105	170
Nitrates	2	8	38	38	68

5.3 Southern borefield chemistry

Groundwater samples from monitoring bores in the southern borefield are summarised in Table 5 below.

Table 5: Southern borefield groundwater analysis summary

Parameter	Records	Min.	Mean	Median	Max.
pH (units)	3	7.2	7.27	7.3	7.30
Salinity (TDS)	3	1,567	3,465	2,528	6,300
Magnesium	7	35	69	55	180
Calcium	7	55	118	95	264
Sodium	7	350	695	600	1,622
Potassium	7	30	49	40	124
Chloride	7	326	867	950	1,290
Sulphate	7	240	503	390	1,312
Bicarbonate	3	296	345	315	424

6. Appendix

Appendix A: Lake Mackay assay database (xlsx)