MEMO

To:	Stantec
From:	Agrimin Technical Team
Subject	Consolidated Island Information
Date	16 November 2020

1. Overview

The following memo combines data and results from fieldwork and reports relating to the islands on Lake Mackay. The data supporting the current understanding of the lake islands is sourced from seven monitoring bores drilled on islands varying in size and location (Figure 1).

The following technical memorandums form the basis for this consolidated report:

- Island Drilling Memo, Agrimin 2019
- Island Characterisation Memo, Stantec 2020
- Regional Groundwater Monitoring Memo, Agrimin 2020

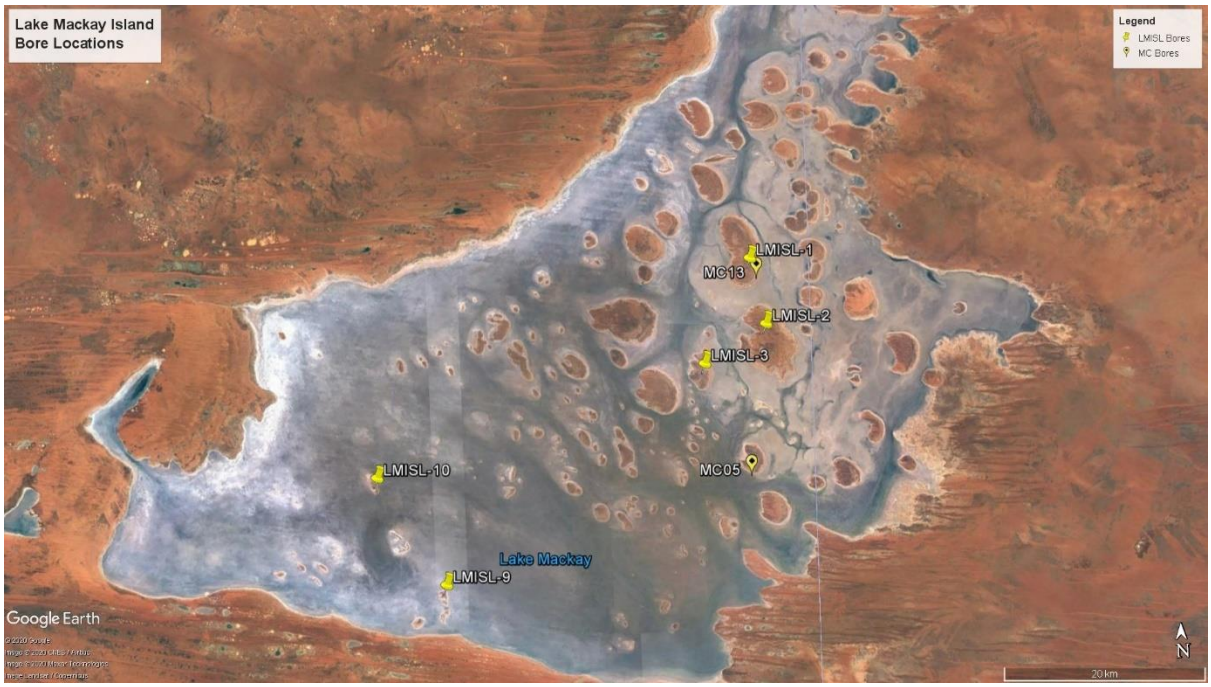


Figure 1 – Lake island monitoring bore locations.

2. Island Geology

Geological information for the lake islands has been obtained from several exploration programs. Two bores were drilled as part of a lake wide drilling program in 2016 (MC05 and MC13). In 2019, five bores were installed on islands varying in size across the lake. Drilling methodology and bore construction details for the 2019 drilling program are summarised in *Island Drilling Memo, Agrimin, 2019* (Appendix A).

The lake islands are composed of unconsolidated aeolian sand at surface which is underlain by calcrete and gypsiferous sand. Clay content increases with depth and typically marks the transition from island sediments to lake sediments. The thickness of the island sequences varies depending on

the size of the island and the elevation of the bore collar relative to the elevation of the surrounding lake. Summarised lithology logs for the bores are presented in Tables 1 to 7 below.

Table 1 – MC05 Lithology log

Depth (m)	Lithology	Description
0.0 – 1.80	**Aeolian sand**	Yellow-red fine-grained sand, loose, unconsolidated, dry
1.80 – 3.0	**Sandy clay**	Red-brown sandy clay, firm
3.0 – 3.75	**Clay**	Red brown clay with minor sandy clay, moist, firm, high plasticity
3.75 – 7.5	**Clay**	Red brown clay with minor 5mm band of gypsum sand, firm, high plasticity
7.5 - 9.75	**Clay**	Red brown clay, firm, high plasticity

Table 2 – MC13 Lithology log

Depth (m)	Lithology	Description
0.0 – 1.50	**Aeolian sand**	Yellow, poorly graded sand, loose, unconsolidated sand
1.50 – 2.25	**Sand**	Yellow, well graded sand, loose
2.25 – 3.0	**Sand** with minor clay	Red-brown gypsum sand with minor red brown clay, firm
3.0 – 3.75	**Sandy clay** with minor sand	Red-brown sandy clay with minor fine gypsum sand, firm, high plasticity
3.75 – 5.25	**Clay**	Red-brown clay, firm, high plasticity
5.25 – 10.5	**Clay** with minor crystalline gypsum	Red-brown clay with minor crystalline gypsum bands, firm, high plasticity
10.5 – 11.25	**Clay** with minor sand	Red-brown clay with minor fine sand interval at base of run, firm, high plasticity

Table 3 – LMISL-001 Lithology log

Depth (m)	Lithology	Description
0 – 0.6	**Aeolian sand**	Very fine grained, dry, well sorted sand transitioning to dry beige-red.
0.6 – 1.7	**Calcrete**	Pale beige calcareous material with minor sand, moderately cemented in parts, dry.
1.7 – 2.0	**Calcrete** with minor clay	Pale beige calcareous material with minor red brown clay, damp.
2.0 – 2.4	**Sandy clay** with minor cemented calcrete	Pale red sand with nodules of moderately consolidated sand and calcrete nodules.
2.4 – 3.0	**Sandy clay** with minor calcrete	Red brown clayey sand (>5%), minor calcrete with increasing gypsum sand.
3.0 – 3.4	**Gypsum sand**	Gypsum sand, fine grained, well sorted, damp to moist.
3.4 – 4.0	**Gypsum sand** with minor clay	Gypsum sand, well sorted, minor clay, first water.
4.0 – 4.5	**Gypsum sand** with minor clay and gypsum crystals	Gypsum sand with increasing clay content, saturated
4.5 – 5.0	**Gypsum sand**	Gypsum sand with minor gypsum crystals (1-8mm)
5.0 – 6.0	**Gypsum sand** with minor clay	Gypsum sand with minor clay, saturated
6.0 – 8.0	**Clay**	Red brown clay, with minor green-beige clay in parts, saturated
8.0 – 12.7	**Clay** with minor gypsum crystals	Red brown clay with minor gypsum crystals 1-10mm, saturated

Table 4 – LMISL-002 Lithology log

Depth (m)	Lithology	Description
0.0 – 0.6	**Aeolian sand**	Pale red brown gypsum sand, unconsolidated, dry, increasing moisture at base of run.
0.6 – 1.7	**Gypsum Sand** with minor calcrete	Red-brown gypsum sand with minor beige white calcrete, moderately consolidated
1.7 – 2.5	**Gypsum Sand** with minor clay	Red-brown to beige medium gypsum sand with minor red brown clay
2.5 – 3.5	**Clay** with minor crystalline gypsum	Red brown clay with minor gypsum crystals 1-40mm, damp
3.5 – 4.0	**Clay** with minor gypsum crystals	Red-brown clay with minor gypsum crystals 1-20mm, wet.

Table 5 – LMISL-003 Lithology log

Depth (m)	Lithology	Description
0.0 – 0.4	**Aeolian sand** with minor calcrete	Pale red brown gypsum sand, well sorted, fine grained, unconsolidated, dry, minor beige calcrete at base of run.
0.4 – 1.0	**Calcrete**	Pale beige-white calcrete, hard, well consolidated, dry, slow drilling
1.0 – 2.1	**Calcrete**	Pale beige-white calcrete, minor red-brown discolouration, hard, well consolidated, damp
2.1 – 2.6	**Calcrete** with minor gypsum sand	Pale beige-white calcrete with minor gypsum sand, damp-moist
2.6 – 3.6	**Gypsum sand** with minor clay	Red-brown gypsum sand transitioning to red-brown clay at base of run, minor dark grey organic mud, moist-wet
3.6 – 4.6	**Clay**	Red-brown clay, moist-wet

Table 6 – LMISL-009 Lithology log

Depth (m)	Lithology	Description
0.0 – 0.7	**Aeolian sand** with minor calcrete	Pale red brown gypsum sand, well sorted, fine grained, unconsolidated, dry
0.7 – 1.7	**Gypsum sand** with minor clay and organic mud	Pale red-brown gypsum sand, minor dark grey-brown organic layer, transition to red-brown clay at base of run, moist-wet.
1.7 – 2.5	**Clay**	Red-brown clay, minor interspersed gypsum crystals
2.5 – 4.0	**Clay** with crystalline gypsum	Red-brown clay with bands of crystalline gypsum

Table 7 – LMISL-010 Lithology log

Depth (m)	Lithology	Description
0.0 – 0.5	**Aeolian sand** with minor calcrete	Pale red brown gypsum sand, well sorted, fine grained, unconsolidated, minor consolidated nodules 1-50mm, dry
0.5 – 0.7	**Calcrete**	Pale beige-white to light brown calcrete, hard, well consolidated, dry, slow drilling
0.7 – 1.0	**Calcrete**	Pale beige-white calcrete, hard, well consolidated
1.0 – 1.4	**Calcrete** with minor gypsum sand	Pale beige-white calcrete with minor gypsum sand
1.4 – 2.9	**Gypsum sand** with minor clay	Pale red-brown gypsum sand, well sorted, medium-fine grained, damp-moist

Depth (m)	Lithology	Description
2.9 -3.5	**Clay**	Red-brown clay, minor green-grey mottle, moist
3.5 – 3.8	**Clay** with minor gypsum crystal	Red-brown clay, minor gypsum crystals

3. Water Quality

A summary of water quality samples from the island bore locations are presented in Table 8

Table 8 – Island bore water quality

Bore ID	Sample Date	Water Quality (Assay TDS (mg/L))	Comments
LMISL-001	06/07/2019	6331	Sample taken @ 4.5m while drilling
	31/07/2019	160727	Bore purged prior to sampling
	14/10/2020	4275	Manual salinity meter reading (6.68 mS)
LMISL-002	31/07/2019	56113	
LMISL-003	31/07/2019	41864	
	14/10/2020	38016	Manual salinity meter reading (59.4 mS)
LMISL-009	14/10/2020	91392	Manual salinity meter reading (142.8 mS)
MC05	29/11/2017	101306	ICP TDS
	18/01/2019	113000	
	03/03/2019	128510	
	20/06/2019	152309	
	14/10/2020	59904	Manual salinity meter reading (93.6 mS)
MC13	29/11/2017	63184	ICP TDS
	12/10/2018	32835	ICP TDS
	5/02/2019	39489	
	6/03/2019	42075	
	3/04/2019	41489	
	14/04/2019	89040	Anomalous result due to sampling technique
	30/04/2019	40939	
	12/05/2019	61171	Anomalous result due to sampling technique
	28/05/2019	39918	
	9/06/2019	84992	Anomalous result due to sampling technique
	25/06/2019	39451	
	14/10/2020	24256	Manual salinity meter reading (37.9 mS)

4. Hydrogeology

4.1 Water Level Data

Manual water level measurements for the island bores are presented in Table 9.

Table 9 – Island bore manual water level measurements

Bore ID	Date	SWL (m bgl)
LMISL-001	31/7/2019	3.715
	27/08/2020	4.1
	14/10/2020	4.1
LMISL-002	27/08/2020	Dry
	14/10/2020	Dry
LMISL-003	27/08/2020	3.95
	14/10/2020	4
LMISL-009	27/08/2020	1.04
	14/10/2020	1.42
LMISL-010	14/10/2020	2.96
MC05	14/03/2019	2.73
	29/08/2019	2.88
	28/08/2020	2.82

	14/10/2020	2.93
MC13	27/12/2018	2.69
	16/01/2019	2.73
	22/01/2019	2.74
	5/02/2019	2.76
	20/02/2019	3.16
	3/04/2019	3.20
	14/04/2019	3.22
	30/04/2019	3.23
	12/05/2019	3.25
	28/05/2019	3.27
	9/06/2019	3.27
	25/06/2019	3.29
	16/07/2019	3.30
	29/08/2019	3.32
	7/10/2019	3.33
	14/10/2020	3.54

4.2 Island Hydrographs

Hydrographs for two island bores equipped with data loggers are presented below in Figure 2 and Figure 3.

Figure 2 – MC05 Hydrograph

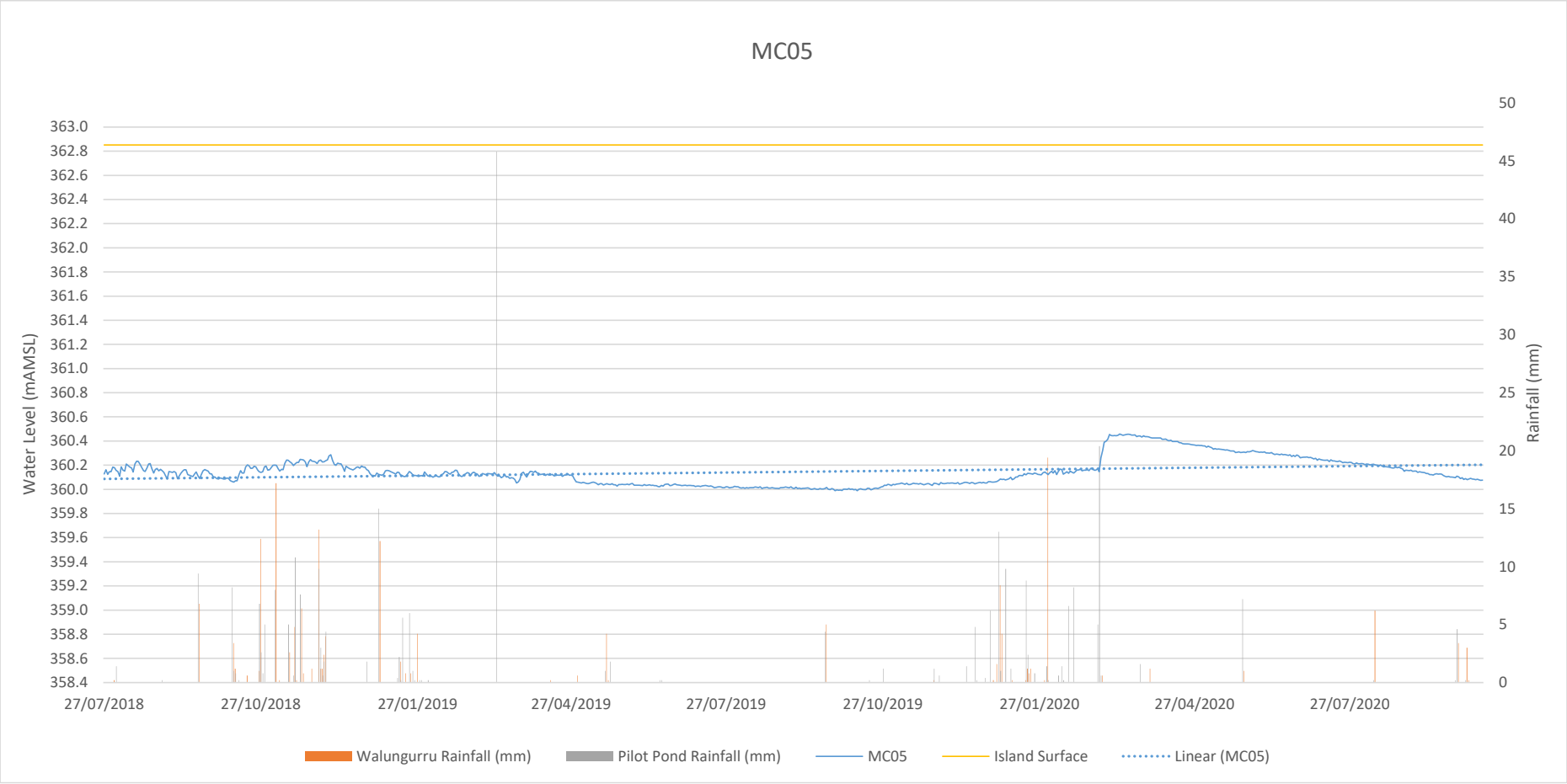
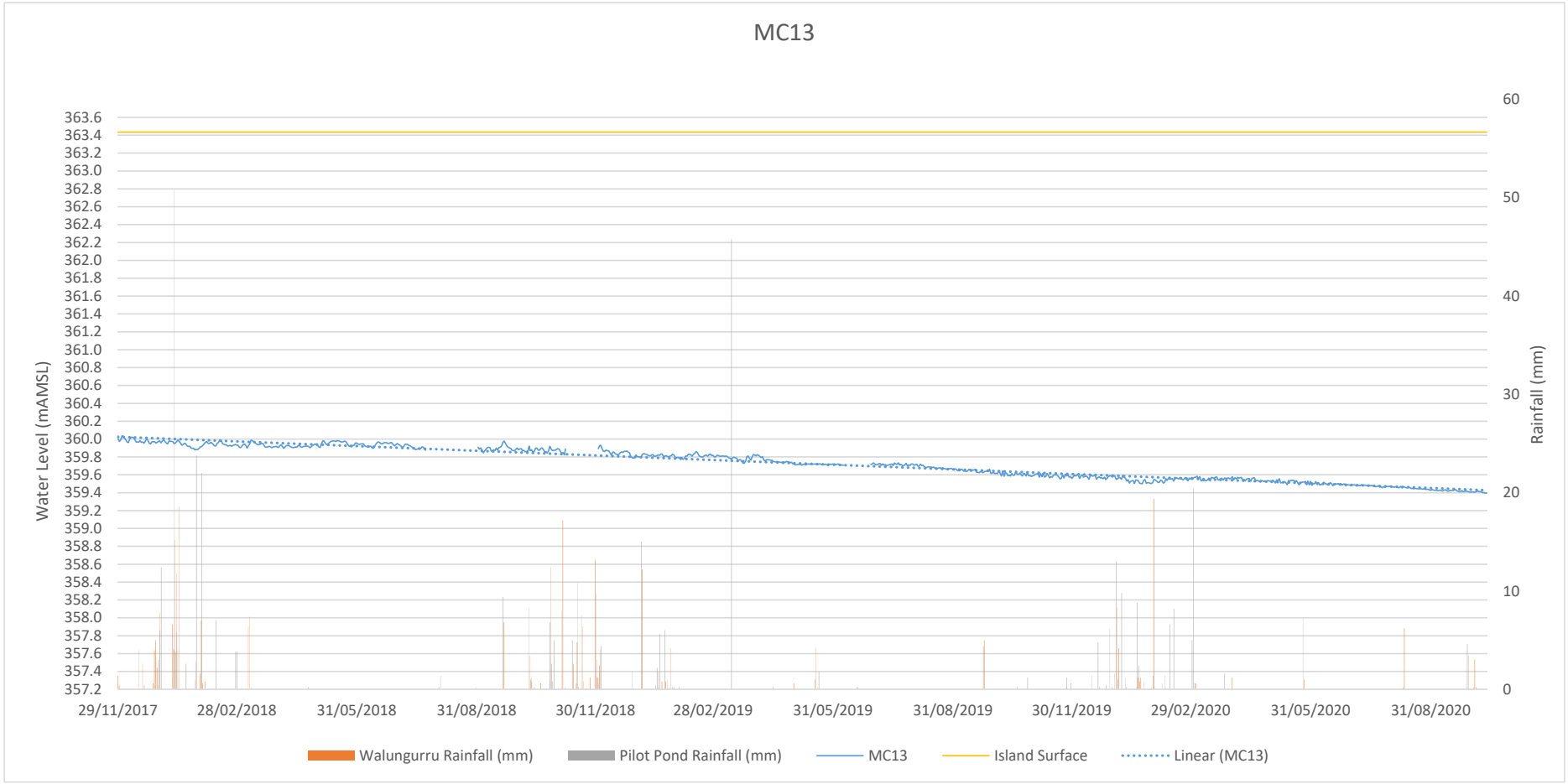


Figure 3 – MC13 Hydrograph



5. Island Characterisation

Preliminary lake island characterisation was completed by Stantec Australia. Island size, topography, geology, hydrogeology, and ecology were considered when completing the assessment. A summary of the methodology and results from this work is presented in the Island Characterisation Memorandum (Stantec 2020), Appendix C. There are 271 islands on the surface of Lake Mackay. The majority of these islands are located in the eastern region of the lake and the islands have been characterised into six categories, summarised in Table 10 below.

Table 10 – Island characterisation summary (Stantec, 2020)

Island Category	Number of Islands	Area (ha) of Islands/class.	% of Islands/Class.	Size Range (ha)	Max Elevation range (m)	Surface Geology	Associated Monitoring Bore
Landform Island	3	7052	1.10	>2000	10 – 12	Aeolian sand, quartz and alluvial deposits, calcrete	MC13, LMISL-001, LMISL-002
Large Island	20	17392	7.33	>500 - 1500	7 – 13	Aeolian sand, quartz and alluvial deposits, calcrete	MC05, LMISL-003
Intermediate Island (elevated Dunes	24	6208	8.79	>100 – 500	7 – 10	Aeolian sand, quartz and alluvial deposits, calcrete	
Intermediate Island (Low Dunes)	8	1379	2.39	> 100 – 50	5 – 9	alluvial deposits, some eolian sand, calcrete	
Small Island (Alluvial)	211	3715	77.66	<100	1 – 7	alluvial deposits, some eolian sand, minor calcrete	LMISL-009, LMISL-010
Small Island (Gypsiferous)	5	116	1.83	<100	2 – 6	alluvial deposits, gypsiferous/clay deposits, minor calcrete	
Totals	**271**	**35862**	**100**				

6. Appendices

Appendix A - Island Drilling Memo, Agrimin, 2019

Appendix B – Long-term Groundwater Monitoring Memo, Agrimin 2020

Appendix C – Island Characterisation Memorandum, Stantec, 2020