



Cudgen Lakes Sand Quarry

Environmental Monitoring - Groundwater

Project Approval (PA):	05_0103B
Environmental Protection Licence (EPL):	12385
Licensee:	Gales-Kingscliff Pty Limited
Licensee Address:	20 Ginahgulla Road Bellevue Hill, NSW 2023
Premises:	Cudgen Lakes Altona Drive Cudgen, NSW 2487
Licensee Website:	http://www.galeskingscliff.com.au/
Licensee Website - Monitoring Results:	https://www.galeskingscliff.com.au/reports
EPA Public Register:	https://www.epa.nsw.gov.au/licensing-and-regulation/public-registers
Date of Publication:	16/08/2023
Originator:	R.W. Corkery & Co. Pty Limited

Monitoring Requirements - Groundwater

EPL 12385 Requirements

Monitoring Points - Water and Land

EPL Condition	EPA Identification Number	Site ID	Type of Monitoring Point	Location Description*
P1.2	4	MB15	Groundwater Monitoring - MB15	Groundwater monitoring bore. Defined as MB15 in Gales-Kingscliff Pty Ltd, Soil and Water Management Plan for the Cudgen Lakes Sand Quarry, May 2017 (GKSWMP). Location described in Section 5.2.2 Figure 5.1.
	5	MB10	Groundwater Monitoring - MB10	Groundwater monitoring bore. Defined as MB10 in Gales-Kingscliff Pty Ltd, Soil and Water Management Plan for the Cudgen Lakes Sand Quarry, May 2017 (GKSWMP). Location described in Section 5.2.2 Figure 5.1.
	6	MB11	Groundwater Monitoring - MB11	Groundwater monitoring bore. Defined as MB11 in Gales-Kingscliff Pty Ltd, Soil and Water Management Plan for the Cudgen Lakes Sand Quarry, May 2017 (GKSWMP). Location described in Section 5.2.2 Figure 5.1.

* See 'Monitoring Map' tab.

Monitoring Conditions

EPL Condition	EPA Identification Number	Site ID	Pollutant	Units of Measure	Monitoring Frequency	Sampling Method
M2.2	4, 5 & 6	MB 15, MB10 & MB11	Ammonia	milligrams per litre (mg/L)	Yearly	Grab Sample
			Chloride	milligrams per litre (mg/L)	Yearly	Grab Sample
			Electrical Conductivity	milligrams per litre (mg/L)	Yearly	Grab Sample
			Oil and Grease	milligrams per litre (mg/L)	Yearly	Grab Sample
			pH	pH	Yearly	Grab Sample
			Standing Water Level	metres (Australian Height Datum)	Yearly	No method specified
			Sulfate	milligrams per litre (mg/L)	Yearly	Grab Sample
Total Suspended Solids	milligrams per litre (mg/L)	Yearly	Grab Sample			

Management Plan Requirements - Soil and Water Management Plan

Version: May-21

Note: The Soil and Water Management Plan (SWMP) fulfils the requirement for a Groundwater Monitoring Program under Condition 22 of Schedule 3 of PA 05_0103.

Groundwater Levels

Groundwater drawdowns are not to exceed 1.75m in any of the bores / piezometers over a 6-month (or shorter) period. Any decrease greater than 1.75 over a 6-month (or shorter) period is considered a 'significant decrease'.

Groundwater Quality Objectives

Parameters	Units of Measure	All Bores*	MB2**	MB10**	MB13**	GW62045**	GW300856**
pH	pH	6.5 - 8.5	5.2 - 6.5	-	-	5.5 - 6.8	6.1 - 7.0
Electrical Conductivity (EC)	microSiemens per centimeter (µS/cm)	<3000	-	37344	36384	-	-
Sodium (Na)	milligrams per litre (mg/L)	<500	-	7204	6884	-	-
Magnesium (Mg)	milligrams per litre (mg/L)	<100	-	1082	1146	-	-
Potassium (K)	milligrams per litre (mg/L)	<40	-	249	215	-	-
Chloride (Cl)	milligrams per litre (mg/L)	<1000	-	12811	12600	-	-
Sulfate (SO4)	milligrams per litre (mg/L)	<800	-	1878	2276	-	-
Bicarbonate (HCO3)	milligrams per litre (mg/L)	<400	-	1130	545	-	-
Aluminium (Al)	milligrams per litre (mg/L)	<0.5	1.67	-	-	-	0.72
Filterable Iron (Fe)	milligrams per litre (mg/L)	<20	20.92	-	-	-	-
Ammonia (NH3)	milligrams per litre (mg/L)	<20	-	150	-	-	-

*Unless value is otherwise specified in this table.

**Objectives based on 80th percentile of all previous data (to July 2019) except pH which is presented as the 20th to 80th percentile range.

Monitoring Points - Parameters, Locations & Frequency

Occurrence	Frequency	Parameters	Units of Measure	Measurement Type	Sampling Method	Location ID
Operational Periods ¹	Continuous	Standing Water Level	m (AHD)	Logger (Downloaded Quarterly)	Logger	MB1, MB2, MB10, MB14, CSP1, MB11, MB15
		Temperature	degrees Celsius (°C)			
		Electrical Conductivity (EC)	micro Siemens per centimetre (µS/cm)			
	Monthly	Standing Water Level	m (AHD)	Field	Probe	MB1, MB2, MB10, MB11, MB12, MB13, MB14, MB15, CSP1, CSP3, GW300856, GW062045
		Temperature	degrees Celsius (°C)			
		pH	pH			
		Electrical Conductivity (EC)	micro Siemens per centimetre (µS/cm)			
		Oxygen Reduction Potential (ORP)	millivolts (mV)			
		Major Cations*	milligrams per litre (mg/L)			
		Major Anions**	milligrams per litre (mg/L)			
		Filterable Iron	milligrams per litre (mg/L)			
	Quarterly	Aluminium	milligrams per litre (mg/L)	Laboratory	Grab Sample	MB1, MB2, MB10, MB11, MB12, MB13, MB14, MB15, CSP1, CSP3, GW300856, GW062045
		Arsenic	milligrams per litre (mg/L)			
		Total Phosphorous (P)	milligrams per litre (mg/L)			
Ammonia Nitrogen		milligrams per litre (mg/L)				
During Use of Makeup Water from Spear Point Extraction System	During Operation - Frequency Unspecified	NOx Nitrogen	milligrams per litre (mg/L)	Laboratory	Grab Sample	MB1, MB2, MB10, MB11, MB12, MB13, MB14, MB15, CSP1, CSP3, GW300856, GW062045
		Standing Water Level	m (AHD)			
		Temperature	degrees Celsius (°C)			
		pH	pH			
		Electrical Conductivity (EC)	micro Siemens per centimetre (µS/cm)			
Non-Operational Periods ²	Continuous	Oxygen Reduction Potential (ORP)	millivolts (mV)	Field	Probe	At the end of each line of spear points & a spear point within 10m of each end. At the centre of each line of spear points & a spear point within 10m either side of the centre.
		Standing Water Level	m (AHD)			
		Temperature	degrees Celsius (°C)			
	Quarterly	Electrical Conductivity (EC)	micro Siemens per centimetre (µS/cm)	Logger (Downloaded Quarterly)	Logger	MB1, MB2, MB10, MB14, CSP1, MB11, MB15
		Temperature	degrees Celsius (°C)			
		pH	pH			
		Electrical Conductivity (EC)	micro Siemens per centimetre (µS/cm)			
		Oxygen Reduction Potential (ORP)	millivolts (mV)			
	6-Monthly	Standing Water Level	m (AHD)	Field	Probe	MB1, MB2, MB10, MB11, MB12, MB13, MB14, MB15, CSP1, CSP3, GW300856, GW062045
		Major Cations*	milligrams per litre (mg/L)			
		Major Anions**	milligrams per litre (mg/L)			
		Filterable Iron	milligrams per litre (mg/L)			
		Aluminium	milligrams per litre (mg/L)			
		Arsenic	milligrams per litre (mg/L)			
Total Phosphorous (P)		milligrams per litre (mg/L)				
Ammonia Nitrogen	milligrams per litre (mg/L)					
NOx Nitrogen	milligrams per litre (mg/L)	Laboratory	Grab Sample	MB1, MB2, MB10, MB11, MB12, MB13, MB14, MB15, CSP1, CSP3, GW300856, GW062045		

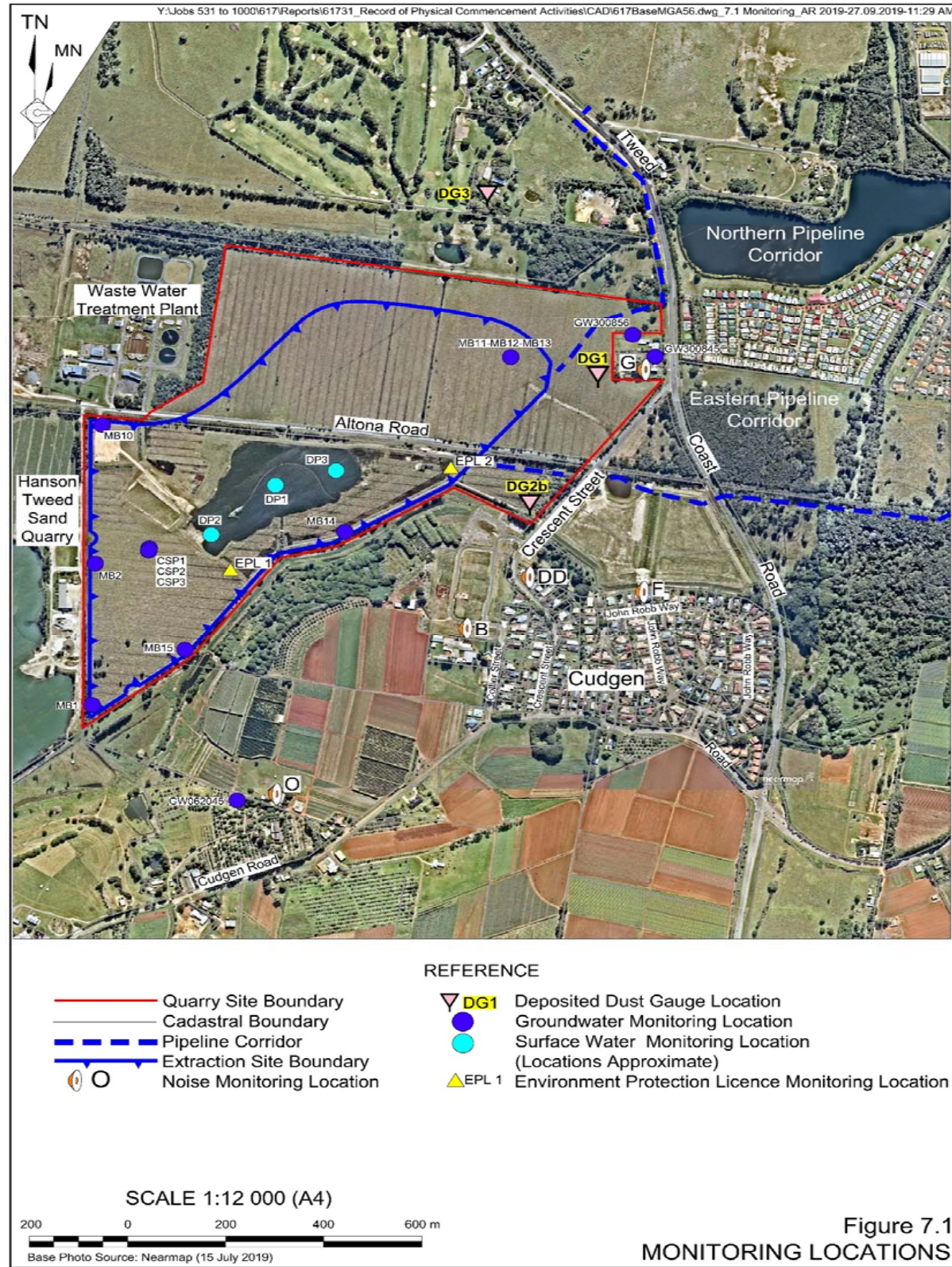
¹ Operational Periods = periods during which extraction and/or processing of material, and/or the placement of fines and/or VENM material, is occurring at the Quarry.

² Non-Operational Periods = periods during which no extraction, processing, fines placement or VENM placement activities are occurring. Note: for groundwater monitoring purposes, non-operational periods also include periods during which transportation activities alone occur.

*Major Cations = Sodium, Calcium, Magnesium & Potassium

**Major Anions = Chloride, Sulfate & Bicarbonate

Monitoring Location Map - Groundwater



Groundwater Monitoring Bore Location Descriptions

MB1: located at the southwestern boundary between the extraction area and the neighbouring (Hanson Tweed Sand Quarry) sand dredge pond.

MB2: located at the central western boundary between the extraction area and the neighbouring (Hanson Tweed Sand Quarry) sand dredge pond.

MB10: located at the north western boundary between the extraction area and the adjoining Waste Water Treatment Plant.

CSP1–CSP2–CSP3: nested monitoring bore located west of the initial dredge pond and south of the existing Altona Road. This bore has since been removed.

MB11–MB12–MB13: Nested monitoring location within the north-eastern part of the extraction area, north of the existing Altona Road. Noble Lake is located approximately 1km to the northeast.

MB14 and MB15: Replacement bores for MB8A, MB8, MB9 and MB6A, MB6, MB7 which have been damaged over time. Located on the southern boundary of the extraction area; these locations are closest to the two dams and spear points Julius West and Julius East located within the adjoining property owned by R. Julius to the southeast of the Quarry.

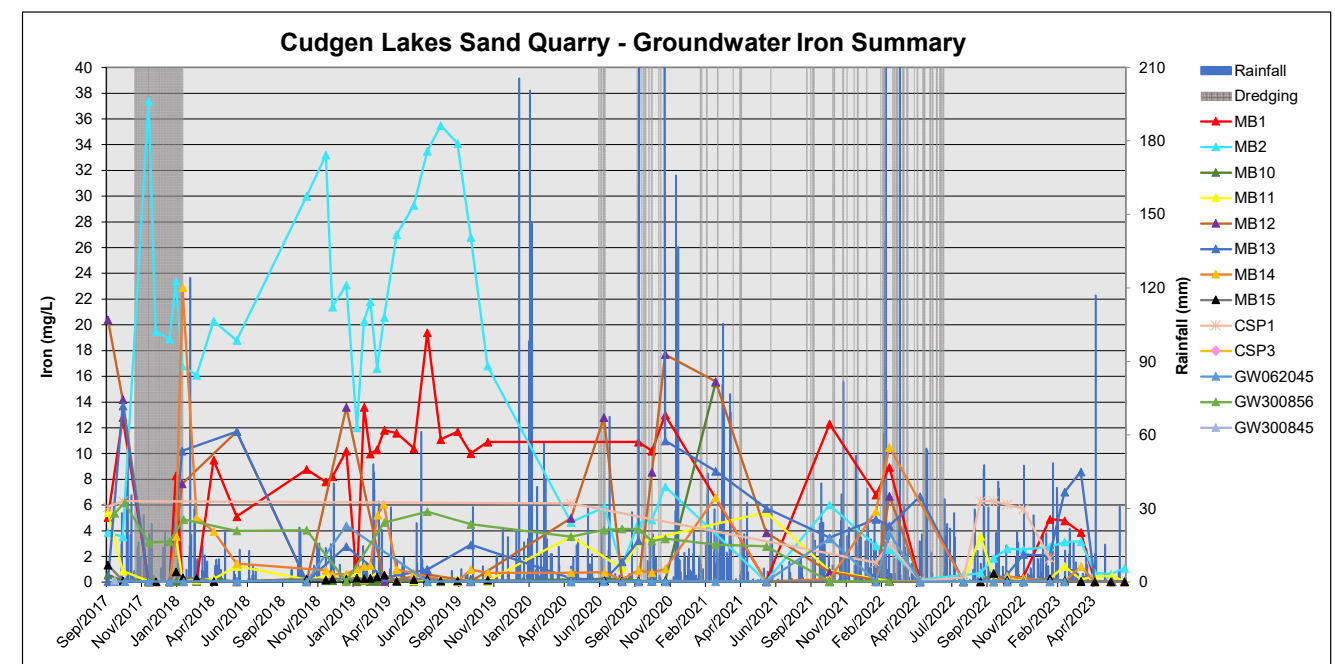
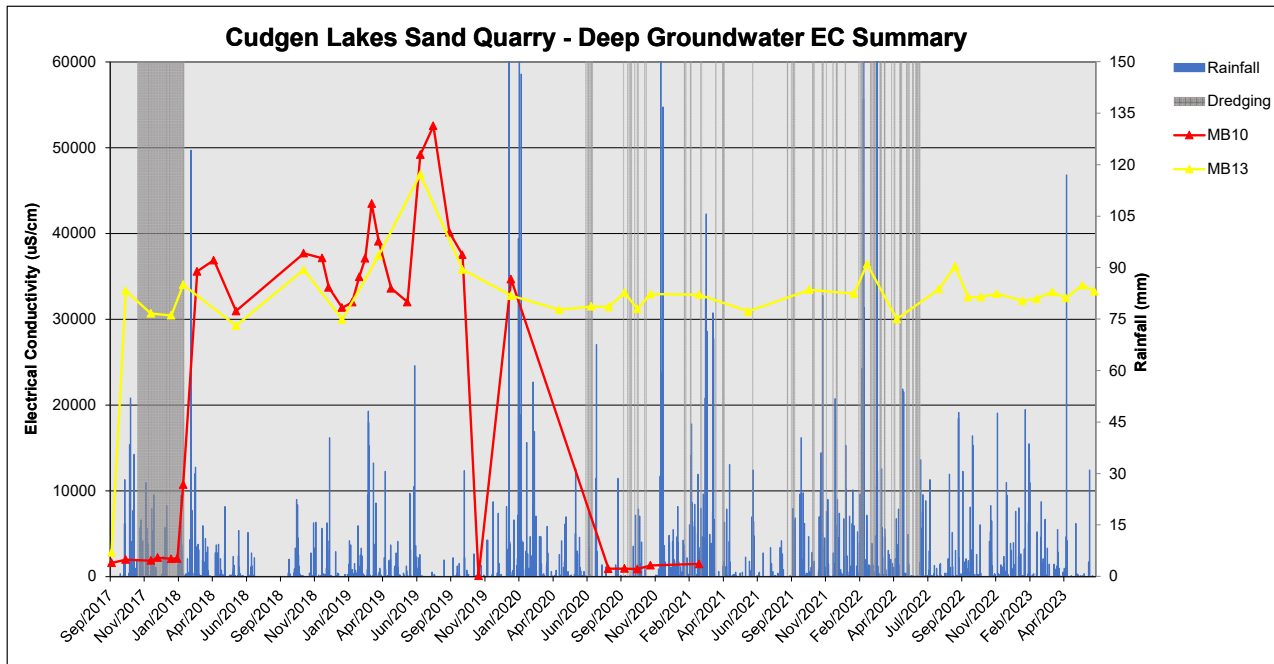
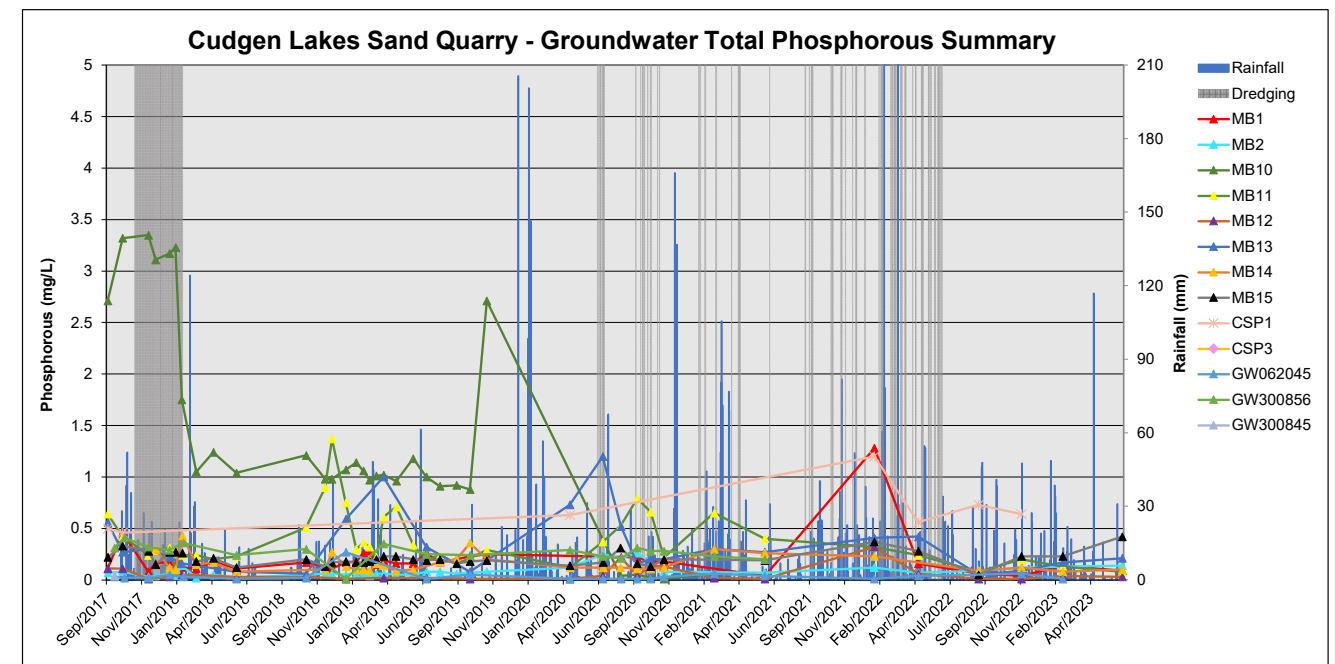
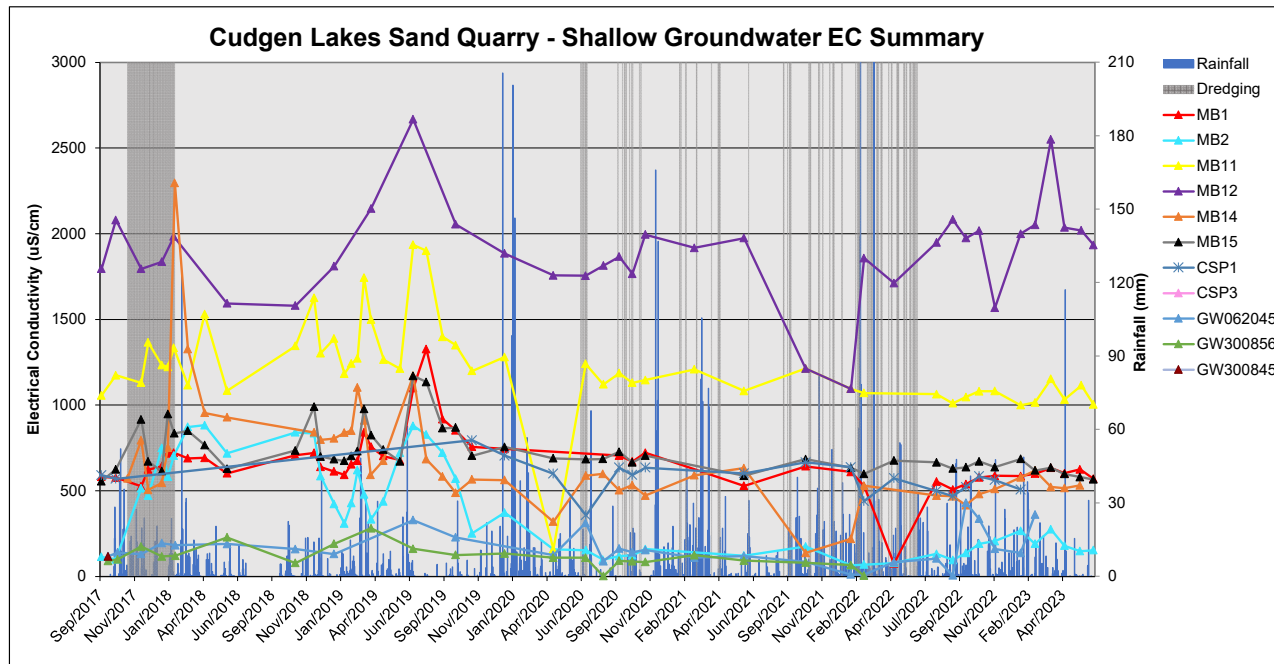
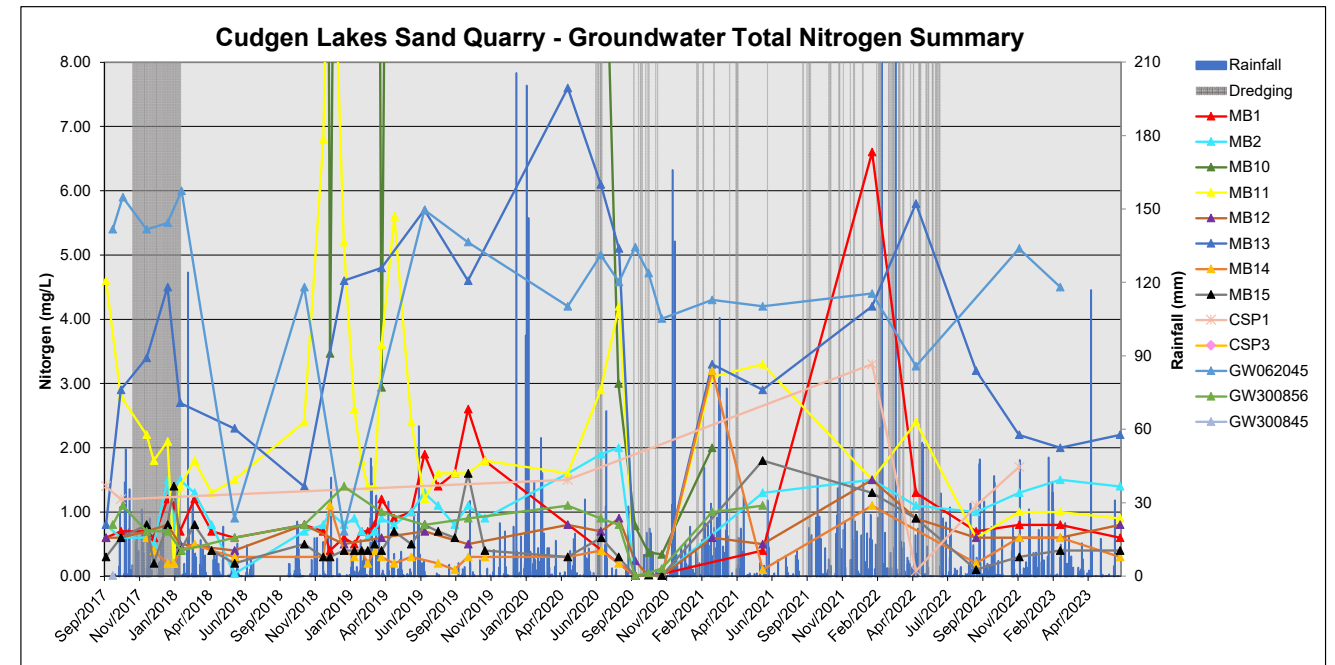
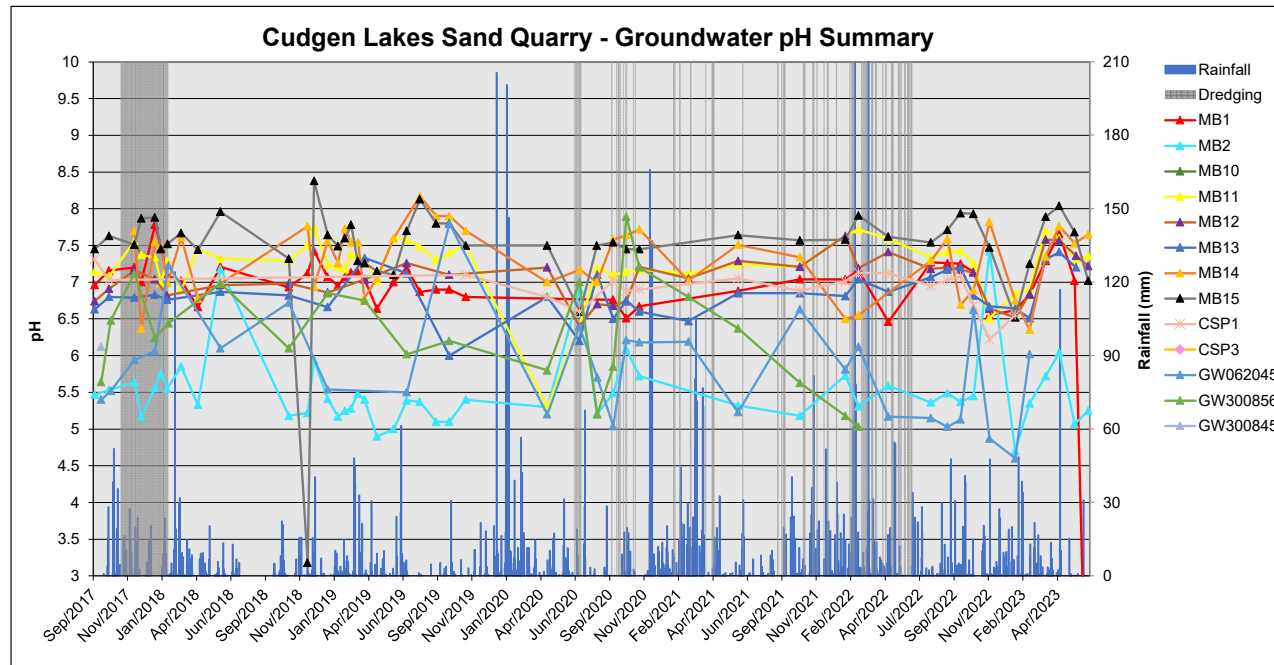
GW062045 and GW300856: Registered groundwater bores located south and east of the Quarry Site.

Spearpoint Monitoring Location Descriptions

The additional monitoring points would be spear points located:

- at the end of each row / line of spear points and a further spear within 10 metres of each end; and
- at the centre of the row / line of spear points and a further spear on either side within 10 metres of the line.

617 - CUDGEN LAKES SAND QUARRY
Groundwater Quality Monitoring Summary



617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB1

Site: MB1		Physical										Major Cations & Anions						Metals			Nutrients								
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity uS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L
	Objective	-	-	-	6.5-8.5	<3000	-	-	-	<10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01	
2/07/2002					6.98	1516									108	492		0.01		1.09									
18/07/2002					6.59	1854	0.91																						
19/07/2002															53	437		0.01		7.15									
28/08/2002					6.85	1364									35	425		0.01		15.7									
1/10/2002					6.84	1272	0.64																						
23/10/2002					6.54	1372	0.91																						
24/10/2002															55	227		0.09		3.14									
28/11/2002					6.66	1215	1.07																						
13/12/2002					7.32	1463	1.28																						
16/12/2002															59	271		0.01		0.69									
20/01/2003					7.31	1587									58	287		0.01		3.61									
24/06/2003					7.01		4.98	23				58	193	36	103	375	230	0.01		3.95									
22/07/2003					7.11		7.66																						
28/08/2003					6.79		2.03																						
29/09/2003					6.76		0.9																						
24/10/2003					6.96		3.53																						
30/11/2004					7	1536																							
16/12/2004					7.24	1087																							
13/01/2005					7	978																							
2/02/2005					6.9		0.14																						
8/03/2005					6.85	872	0.05	-85				40	139	25	5	55	216	153	0.04		18								
10/05/2005					6.85	880												143											
19/07/2005					7.07	1109	0.54				44	178	25	5	80	246	165	0.12		19									
5/08/2005					7.48	1066	0.68																						
10/11/2005					7.21	985	0.27				31	121	20	5	75	173	142	0.11		13									
12/01/2006					7.12	1214	0.29				36	136	22	5	63		170	0.11		14									
7/04/2006					7.18	1036	0.20																						
3/05/2006					7.12	1005	0.18										161												
10/05/2006					7.01	1002	0.20	-155			38	135	21	5	42	186	218	0.01		5.51									
19/05/2006					6.88	1008	0.66																						
26/05/2006					6.43	905	0.42																						
1/06/2006					6.92	948	0.48																						
8/06/2006					6.84	1016	0.36																						
15/06/2006					7.08	1029	0.21				37	176	25	5	124	191	110	0.14		12									
23/06/2006					6.71	1100	0.38	-113																					
29/06/2006					6.43	1006	0.20																						
6/07/2006					7.76	935	0.21	-168																					
13/07/2006																	183												
14/07/2006					7.05	978	0.35																						
8/02/2007					6.87	979	0.32	-102			45	143	20	5	80	171		0.04		22									
4/03/2007																													
29/08/2007					7.1	1026	0.31	-1398			33	113	15	5	40	103	160	0.01		6.51									
26/10/2007					7.02	733	0.20				32	100	16	5	52	102	181	0.01		0.24									
14/11/2007					6.74	828	0.26				37	105	17	5	38	96	180	0.01		11									
2/09/2008					7.4	840																							
4/09/2017		0.86	0.34	19.8	6.96	581	0.2	-81		1.4	5	43	81	15	4	48	12	292	0.02	0.001	5.04	0.11	0.010	0.60	0.01	0.01	0.6	0.39	0.01
5/10/2017		0.97	0.23	21.8	7.16	576	1.77	-18.1	32	35	5	36	77	13	4	50	10	275	0.12	0.001	12.8	0.46	0.010	0.70	0.01	0.01	0.7	0.28	0.01
30/10/2017	Commencement of extraction																												
28/11/2017		1.27	-0.07	23.6	7.2	526	1.2	11.5	12	4.9	5	38	77	13	4	41	7	287	0.01	0.001	0.05	0.08	0.010	0.70	0.01	0.21	0.5	0.14	0.22
13/12/2017		1.13	0.07	25.3	7	624	0.21	-83		4.5		31	87	10	3	32	4	268	0.01	0.001	0.05	0.16	0.010	0.60	0.01	0.01	0.6	0.43	0.01
11/01/2018		1.38	-0.18	24.8	7.78	642	0.46	-142		5.7	5	31	107	11	4	28	3	317	0.01	0.001	0.05	0.18	0.010	1.20	0.01	0.01	1.2	0.55	0.01
24/01/2018		1.76	-0.56	23.8	7.48	717	0.52	-32.7		15.8		27	105	9	4	24	6	295	0.01	0.001	8.29	0.14	0.010	1.10	0.01	0.02	1.1	0.78	0.03
6/02/2018		1.76	-0.56	25	7.09	722	1.15	-109		7.5	5	29	100	10	3	115	27	320	0.01	0.001	0.05	0.12	0.010	0.70	0.01	0.01	0.7	0.47	0.01
8/02/2018	Last day of first extraction campaign.																												
8/03/2018		0.75	0.45	23.9	7.02	689	0.18	-92		1.8		24	96	11	3	26	7	335	0.01	0.001	0.11	0.11	0.010	1.20	0.01	0.02	1.2	0.56	0.02
13/04/2018		0.92	0.28	25	6.66	692	2.73	-69		4.3		31	101	11	3	23	14	326	0.01	0.001	9.5	0.18	0.010	0.70	0.01	0.01	0.7	0.29	0.01
31/05/2018		0.93	0.27	20.7	7.21	601	0.72	-86		0.5	5	21	102	10	3	38	20	316	0.01	0.001	5.1	0.11	0.010	0.60	0.01	0.01	0.6	0.35	0.01
24/10/2018		0.81	0.39	19.3	6.93	707	1.08	-97.1	26	1.2	5	21	92	10	3	38	8	307	0.05	0.005	8.77	0.17	0.010	0.8	0.01	0.01	0.8	0.39	0.01
3/12/2018		1.08	0.12	21	7.12	721	0.6	-95.7	23	0.2		31	83	10	3	37	9	301	0.01	0.001	7.8	0.13	0.010	0.7	0.01	0.01	0.7	0.36	0.01
17/12/2018		1.05	0.15	20.8	7.42	639	0.39	-159	29	0.3		31	83	10	3	34	6	284	0.01	0.001	8.2	0.11	0.010	0.4	0.01	0.01	0.4	0.31	0.01
15/01/2019		1.18	0.02	24.4	7.07	612	0.35	-123.5	24	2.7	5	31	89	10	3	33	10	303	0.01	0.001	10.2	0.17	0.010	0.6	0.01	0.01	0.6	0.38	0.01
6/02/2019	Cap Missing	1.34	-0.14	23	6.95	593	0.51	-147.9	31	-0.2		37	99	12	3	32	7	298	0.01	0.001	0.05	0.18	0.080	0.5	0.01	0.01	0.5	0.31	0.01
21/02/2019	No Cattle Noted. MB1 logger dropped to bottom of bore - cattle?	1.41	-0.21	24.4	7.07	654	0.31	-186.9	30	44.6		33	90	11	3	32	4	277	0.01	0.001	13.6	0.26	0.010	0.7	0.01	0.01	0.7	0.44	0.01
6/03/2019	Cattle on site. Downloaded loggers (elevation & rain). Retrieved logger from MB1	1.41	-0.21	26	7.13	674	0.66	-145	33	9.4		34	92	11	3	41	3	596	0.01	0.001	9.97	0.28	0.003	0.7	0.01	0.02	0.7	0.33	0.02
20/03/2019		0.95	0.25	24.5	7.14	841	1.21	-21.4	34	0.41		32	100	10	4	28	3	309	0.01										

**617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB1**

2019/2020	3/07/2019		0.81	0.39	21.65	7.19	1098	0.18	-62.2	51	7.8	5	29	132	8	5	24	6	378	0.01	0.001	19.4	0.26	0.001	1.9	0.01	0.01	1.9	0.91	0.01		
	31/07/2019	Ants and eggs	0.9	0.3	20.4	6.87	1327	0.33	-114.4	35	14.7		32	116	10	4	39	6	348	0.01	0.001	11.1	0.17	0.045	1.4	0.01	0.01	1.4	0.91	0.01		
	4/09/2019	Logger removed on 04/09/19 and replaced on 06/09/19	0.98	0.22	22.1	6.9	918	0.7	-137	17	12.2		44	111	10	4	40	5	336	0.01	0.001	11.7	0.2	0.108	1.6	0.01	0.01	1.6	1.11	0.01		
	2/10/2019		1.13	0.07	21.9	6.9	852	1.7	-93.8	26	3.2	5	42	114	10	4	48	1	313	0.01	0.001	10	0.23	0.079	2.6	0.01	0.01	2.6	1.44	0.01		
	6/11/2019		1.3	-0.1	21.8	6.8	756	2.6	-72.1	86	6.1		32	105	10	4	36	2	364	0.01	0.001	10.9	0.25	0.011	1.8	0.01	0.01	1.8	0.97	0.01		
	15/01/2020	data logger would not sync. pH meter calibration issue - spurious data.	1.6	-0.4	22.1	8.4*	744	0.55	-67.9	5	1.3		43	103	10	4	43	2	302				0.19	0.01	1.4	0.01	0.01	1.4	0.62	0.01		
28/04/2020	Monitoring bore damaged (buried during drain cleaning) and requires repair. No sample could be obtained. Bore and logger recovered 10/07/20																															
2020/2021	16/09/2020		0.61	0.59	20.3	6.76	705	1.39	-113.3	47	2546.77	5	27	112	11	4	27	1	368	0.01	0.001	10.9	0.22	0.017	0.01	0.01	0.01	1.2	0.56	0.01		
	14/10/2020	Overcast	0.79	0.41	21.2	6.51	670	2.09	-92.6	30	25.4	5	26	119	11	4	28	1	355	0.01	0.001	10.2	0.18	0.001	0.01	0.01	0.01	1	0.47	0.01		
	11/11/2020		0.83	0.37	22	6.67	722	1.69	-94.7	29	4.9		28	117	11	4	27	5	332	0.01	0.001	13	0.18	0.044	0.04	0.01	0.04	1.2	0.62	0.04		
2021/2022	10/06/2021		0.47	0.73	18.9	6.88	528	2.4	7.5	20	48.38		23	93	9	3	26	4	280	0.01	0.001	0.05	0.04	0.001	0.4	0.01	0.05	0.3	0.01	0.05		
	20/10/2021		0.49	0.71	22.41	7.04	642	1.15	-14.1	NLM	63	NLM	22	100	7	3	28	1	297	0.01	0.001	12.3										
	25/01/2022		0.42	0.78	22.7	7.04	610	2.55	-34.5	NLM	63	NLM	23	107	8	9	22	1	308	0.01	0.004	6.79	1.28		6.6	0.01	0.01	6.6	4.99	0.01		
	22/02/2022		0.47	0.73	23.79	7.16	527	1.42	-36.3	NLM	66	NLM	23	99	7	5	29	1	290	0.01	0.001	8.93										
	27/04/2022		0.3	0.9	21.66	6.46	74	1.22	-11.5	NLM	83	NLM	12	6	3	3	20	7	24	0.01	0.001	0.05	0.16		1.3	0.01	0.31	1	0.08	0.31		
	23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																														
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022.																															
2022/2023	27/07/2022	Within a waterlogged area	0.42	0.78	17.6	7.27	554	0.44	107			47		27	78	9	3	24	4	241	0.01	0.001	0.05									
	31/08/2022		0.54	0.66	17.9	7.26	507	1.22	194.9			10.2		26	77	8	3	31	2	235	0.01	0.001	0.05	0.06		0.7	0.01	0.34	0.4	0.03	0.34	
	28/09/2022		0.46	0.74	19.9	7.25	539	1.46	-64.6			4.7		31	83	10	5	32	2	260	0.01	0.001	0.05									
	26/10/2022	Clear, waterlogged area	0.35	0.85	21.2	7.14	577	5.56	72.1					28	84	9	3	33	1	270	0.01	0.001	0.05									
	29/11/2022		0.67	0.53	19.6	6.55	587	2.91	84.5			4.5		28	90	9	4	32	1	266	0.01	0.001	0.43	0.04		0.8	0.01	0.33	0.5	0.03	0.33	
	23/01/2023		0.81	0.39	22.2	6.62	585	2.24	68.9			4.3		26	82	8	3	24	1	277	0.01	0.001	4.9									
	23/02/2023		0.72	0.48	22.1	6.83	599	2.55	-82.4			5.5		28	87	9	3	26	1	267	0.01	0.001	4.78	0.14		0.8	0.01	0.02	0.8	0.4	0.02	
	29/03/2023	Dead ants and slime in water	0.81	0.39	22.3	7.29	633	1.43	-128.4			41.3		30	87	10	5	30	1	255	0.01	0.001	3.87									
	27/04/2023		0.87	0.33	21.8	7.66	602	3.43	-24.2			33.5		28	91	10	4	32	1	262	0.01	0.001	0.05									
	30/05/2023		0.85	0.35	19.5	7.02	625	1.05	-13.9			74.9		33	86	11	4	39	2	285	0.01	0.001	0.05									
28/06/2023		0.80	0.40	18.5	7.49	569	5.2	-30.7			30.4		30	75	10	4	34	2	264	0.01	0.001	0.05	0.09		0.6	0.01	0.25	0.3	0.01	0.25		
Reporting Period (2022/2023)	Average		0.66	0.536	20.2	7.09	580	2.50	16.7	NLM	25.6	NLM	29	84	9	4	31	2	262	0.01	0.001	1.30	0.08	NLM	0.7	0.01	0.24	0.5	0.12	0.24		
	Maximum		0.87	0.850	22.3	7.66	633	5.56	194.9	NLM	74.9	NLM	33	91	11	5	39	4	285	0.01	0.001	4.90	0.14	NLM	0.8	0.01	0.34	0.8	0.40	0.34		
	Minimum		0.35	0.330	17.6	6.55	507	0.44	-128.4	NLM	4.3	NLM	26	75	8	3	24	1	235	0.01	0.001	0.05	0.04	NLM	0.6	0.01	0.02	0.3	0.01	0.02		
All Results	Average		0.92	0.283	22.0	7.00	853	1.21	-88.7	30	74.3	5	32	104	12	4	42	70	275	0.02	0.001	7.10	0.20	0.019	1.0	0.01	0.05	1.1	0.59	0.05		
	Maximum		1.76	0.900	26.0	7.78	1854	7.66	194.9	86	2546.8	5	58	193	36	9	124	492	596	0.14	0.005	22.00	1.28	0.108	6.6	0.01	0.34	6.6	4.99	0.34		
	80th Percentile		1.23	0.632	24.0	7.20	1060	1.82	-14.1	34	43.9	5	37	119	15	5	53	171	332	0.01	0.001	11.88	0.22	0.018	1.3	0.01	0.03	1.3	0.68	0.03		
	Median (50th Percentile)		0.87	0.335	22.0	7.01	750	0.66	-83.0	29	6.1	5	31	100	10	4	34	7	286	0.01	0.001	7.48	0.17	0.010	0.7	0.01	0.01	0.8	0.43	0.01		
	20th Percentile		0.57	-0.034	20.1	6.79	601	0.29	-129.3	22	1.3	5	26	84	9	3	26	2	211	0.01	0.001	0.05	0.11	0.006	0.6	0.01	0.01	0.5	0.29	0.01		
Minimum		0.30	-0.560	17.6	6.43	74	0.05	-1398.0	5	-8.6	5	12	6	3	3	20	1	24	0.01	0.001	0.05	0.04	0.001	0.0	0.01	0.01	0.1	0.01	0.01			

Red and bold values exceed the objective value for that analyte. IS - Insufficient data for statistical analysis. NS = No Sample Required. ND = No Data. NLM = No Longer Monitored

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB2

2020/2021	7/07/2020	Cloudy	1.35	0.6	21.8	6.9	153	0.9	9.2	5	153	5	19	2	1	4	25	10	7	0.46	0.071	5.84	0.25	0.22	1.9	0.01	0.01	1.9	0.2	0.01	
	12/08/2020	Clear	1.22	0.73	21	5.2	98	0.77	-47	16	431	5	14	1	1	3	8	7	17	0.39	0.027	1.2	0.21	0.028	2	0.01	0.01	2	0.15	0.01	
	16/09/2020		1.36	0.59	20.8	5.49	118.4	2.01	26.1	14	4009.23	5	16	2	1	4	15	8	13	0.62	0.058	4.6	0.26	0.026	0.01	0.01	0.01	2	0.28	0.01	
	14/10/2020		1.57	0.38	20.2	6.09	123.3	1.74	-26.7	6	724.5	5	15	2	1	4	25	10	11	0.58	0.051	4.85	0.17	0.006	0.01	0.01	0.01	2	0.29	0.01	
	11/11/2020	Cloudy, Odour	1.61	0.34	21.3	5.72	159.7	1.86	-13.9	5	133.7		18	2	1	4	31	8	5	0.49	0.047	7.44	0.08	0.013	0.01	0.01	0.01	1.3	0.24	0.01	
2021/2022	10/06/2021		1.25	0.7	20.6	5.32	121.2	1.23	80.33	10	13.5		17	2	1	4	21	8	11	0.32	0.001	0.05	0.07	0.002	1.3	0.01	0.01	1.3	0.31	0.01	
	20/10/2021		1.2	0.75	20.9	5.18	174	0.53	92.4		10		22	2	2	5	31	8	11	0.34	0.01	6.01									
	25/01/2022		1.13	0.82	24.4	5.73	65	3.05	51.3		15		15	2	1	6	20	2	17	0.13	0.008	2.83	0.12		1.5	0.01	0.03	1.5	0.61	0.03	
	22/02/2022		1.2	0.75	25.05	5.31	69	1.83	70.7		14		15	2	15	6	30	2	10	0.12	0.007	2.55									
	27/04/2022		0.98	0.97	22.73	5.59	78	1.68	38.4		45.7		18	2	1	7	32	10	12	0.1	0.007	0.2	0.07		1.1	0.01	0.28	0.8	0.09	0.28	
23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																														
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022																														
2022/2023	27/07/2022		1.12	0.83	18.6	5.36	131	0.41	117		53		17	2	1	15	21	11	27	0.13	0.017	0.56									
	31/08/2022		1.37	0.58	18.66	5.49	96	1.68	210.1		40.2		24	2	2	13	28	11	22	0.19	0.012	0.71	0.09		1	0.01	0.18	0.8	0.01	0.18	
	28/09/2022	Groundwater level lower than surrounding bores	1.2	0.75	19.89	5.37	136	1.33	49.1		32.9		17	2	1	16	22	10	26	0.14	0.056	1.85									
	26/10/2022	Clear	1.03	0.92	20.4	5.45	189.9	2.55	86.5				17	3	2	19	28	12	19	0.12	0.051	2.6									
	29/11/2022		1.46	0.49	19.94	7.42	206	1.49	-32.1		13.1		16	4	2	21	33	14	21	0.13	0.069	2.54	0.12		1.3	0.01	0.14	1.2	0.24	0.14	
	23/01/2023	Ants	1.61	0.34	22	4.7	266	2.4	37		22.5		16	3	2	23	23	13	25	0.15	0.15	2.75									
	23/02/2023		1.6	0.35	22.5	5.35	190.5	1.89	64.4		32.8		22	2	2	13	6	1	25	0.45	0.189	3.13	0.13		1.5	0.01	0.01	1.5	0.26	0.01	
	29/03/2023	Ants	1.64	0.31	22.93	5.72	274	0.64	-98.1		54.3		25	2	2	10	39	3	26	0.44	0.05	3.16									
	27/04/2023		1.76	0.19	22.92	6.04	179	5.59	62.7		88.9		22	3	2	10	27	8	26	0.33	0.009	0.72									
	30/05/2023		1.56	0.39	21.29	5.07	147	0.11	86.5		116		22	3	2	11	28	10	22	0.17	0.007	0.62									
28/06/2023		1.7	0.25	19.5	5.25	153	3.91	85.7		76.5		24	2	2	10	34	11	19	0.2	0.014	1.09	0.14		1.4	0.01	0.05	1.4	0.18	0.05		
Reporting Period (2022/2023)	Average		1.46	ND	20.8	5.57	179	2.00	60.8	NLM	53.0	NLM	20	3	2	15	26	9	23	0.22	0.057	1.79	0.12	NLM	1.3	0.01	0.10	1.2	0.17	0.10	
	Maximum		1.76	0.920	22.9	7.42	274	5.59	210.1	NLM	116.0	NLM	25	4	2	23	39	14	27	0.45	0.189	3.16	0.14	NLM	1.5	0.01	0.18	1.5	0.26	0.18	
	Minimum		1.03	0.190	18.6	4.70	96	0.11	-98.1	NLM	13.1	NLM	16	2	1	10	6	1	19	0.12	0.007	0.56	0.09	NLM	1.0	0.01	0.01	0.8	0.01	0.01	
All Results	Average		1.70	0.251	22.4	5.78	388	1.08	18.1	15	141.8	5	42	5	3	11	64	40	14	0.76	0.040	11.59	0.09	0.022	1.0	0.01	0.03	1.1	0.31	0.03	
	Maximum		2.89	0.970	26.1	7.72	2394	5.59	216.0	62	4009.2	5	119	25	15	26	189	159	60	6.37	0.189	37.40	0.26	0.220	2.0	0.01	0.28	2.0	0.77	0.28	
	80th Percentile		2.02	0.700	24.4	6.37	598	1.81	73.5	27	71.8	5	78	9	6	15	129	86	22	1.16	0.064	21.08	0.12	0.026	1.4	0.01	0.01	1.5	0.41	0.01	
	Median (50th Percentile)		1.64	0.310	22.3	5.59	179	0.63	14.3	8	13.8	5	22	3	2	10	33	16	12	0.21	0.027	7.41	0.07	0.014	0.9	0.01	0.01	0.9	0.29	0.01	
	20th Percentile		1.25	-0.070	20.8	5.27	126	0.26	-32.5	5	5.8	5	16	1	1	6	22	10	5	0.13	0.008	2.78	0.05	0.005	0.6	0.01	0.01	0.7	0.19	0.01	
Minimum		0.98	-0.940	18.6	4.62	65	0.11	-130.0	2	0.0	5	12	0	0	3	6	1	1	0.04	0.001	0.05	0.02	0.001	0.0	0.01	0.01	0.1	0.01	0.01		

Red and bold values exceed the objective value for that analyte. IS - Insufficient data for statistical analysis. NS = No Sample Required. ND = No Data. NLM = No Longer Monitored

**617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB10**

Site: MB10		Physical										Major Cations & Anions						Metals			Nutrients										
Sample Date	Comments	Water Level Top of casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity µS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L		
	<i>Objective</i>	-	-	-	6.5-8.5	<3000	-	-	-	-	10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01		
9/06/2005					7.41																										
16/06/2005					8.75	36300	1.96					7330	205	1130	292	12828	2490		0.09		1.61										
19/07/2005					7.09	38200	0.71					7440	233	1150	290	350	1740	302	0.34		1.96										
5/08/2005					7.71	33000	2.13																								
10/11/2005					7.43	36400	3.48					6860	139	169	213	13250	1600	852	0.12		0.88										
12/01/2006					7.34	43800	0.71					7460	161	1070	213	13086		806	0.15		0.81										
25/01/2006					7.43	74900																									
7/04/2006					7.51	28600	2.69																								
3/05/2006					7.25	31900	2.16										1890														
10/05/2006					7.64	36900	3.86	-187																							
19/05/2006					7.07	36300	1.40																								
26/05/2006					7.31	33600	2.69																								
1/06/2006					7.65	33800	1.12																								
8/06/2006					7.71	35100	3.15																								
15/06/2006					7.33	30000	2.01																								
23/06/2006								-129																							
29/06/2006					7.44	34400	2.28																								
6/07/2006					7.55	32000		-100																							
13/07/2006																		247													
14/07/2006					7.53	30800	1.81																								
30/01/2007					7.22	32300	0.57	-48																							
8/02/2007					7.46	28600	2.78	-80				758	136	107		1345	176		0.02		0.19										
29/08/2007					7.71	45200	4.11	13.5				7500	210	1010	251	14750	1780	570	0.01		0.02										
26/10/2007					7.28	32200	0.38					1170	162	444	245	13500	1200	766	0.01		0.01										
14/11/2007					7.58	3640	2.58					6807	198	1057	262	12800	1789		0.01		0.01										
2/09/2008					7.3	41300																									
4/09/2017		1.37	0.25	19.9	8.11	1605	3.9	107			109	33	18	26	195	78	651	0.15	0.002	0.57	2.71	2.56	152.00	3.2	0.18	149	136	3.38			
5/10/2017		1.46	0.16	23.7	8.07	1988	0.89	-159	5	5.97	5	94	30	17	24	194	77	684	0.03	0.002	0.1	3.32	3.22	162.00	4.39	1.2	157	158	5.59		
30/10/2017	Commencement of extraction																														
28/11/2017		2	-0.38	22.8	8.14	1866	0.33	-187	5	1.1	5	104	30	17	26	199	76	757	0.01	0.002	0.18	3.35	2.99	186.00	1.9	0.36	184	150	2.26		
13/12/2017		1.79	-0.17	23.7	8.13	2210	0.23	-214				113	35	19	28	204	71	650	0.02	0.001	0.09	3.11	3.41	145.00	0.01	0.01	0.5	0.23	0.01		
11/01/2018		2.23	-0.61	25.2	8.1	2065	0.26	-205				115	30	18	29	211	77	619	0.01	0.002	0.06	3.17	3.49	161.00	0.03	0.02	161	168	0.05		
24/01/2018		2.24	-0.62	24	8.11	2118	0.44	-111.8				103	33	18	25	230	75	614	0.03	0.001	0.06	3.23	3.86	155.00	1.12	0.17	154	174	1.29		
6/02/2018		2.07	-0.45	24.6	7.79	10724	0.86	-224				4470	166	675	152	7150	826	837	0.01	0.001	0.09	1.75	1.76	64.00	1.09	0.26	62.7	64.5	1.35		
8/02/2018	Last day of first extraction campaign.																														
8/03/2018		1.25	0.37	23.5	7.32	35568	0.08	-210				6800	224	1020	219	12000	1770	1090	0.05	0.005	0.06	1.05	1	33.40	0.01	0.04	33.4	22.8	0.04		
13/04/2018		1.67	-0.05	24.8	7.12	36887	1.84	-72				6590	236	1060	217	11800	1680	1140	0.05	0.005	0.23	1.24	1.26	36.10	0.01	0.01	36.1	31.2	0.01		
31/05/2018		1.53	0.09	21	7.46	30959	0.89	-187				6140	169	927	203	12200	1770	1170	0.05	0.005	0.05	1.04	1.13	25.80	0.01	0.01	25.8	30	0.01		
24/10/2018		1.31	0.31	20.6	7.71	37680	1.58	-119				6770	218	998	210	12300	1870		0.05	0.005	0.27	1.21	1.02	31.5	0.01	0.01	31.5	27.4	0.01		
3/12/2018		1.71	-0.09	23.1	7.59	37120	1.49	-118.9	38	3.2		6400	229	1000	207	11900	1780	1130	0.05	0.005	0.13	0.98	0.93	30.9	0.01	0.04	30.9	28	0.04		
17/12/2018		1.71	-0.09	21.5	7.09	33706	1.91	-135	8	4.1		6540	207	1070	225	10500	1670	1120	0.05	0.005	0.13	0.98	1.1	3.47	0.04	0.01	34.7	27	0.03		
15/01/2019		1.84	-0.22	23.6	7.21	31347	0.09	-260	5	0.1	5	6040	219	986	205	11700	1680	1120	0.05	0.005	0.21	1.07	0.99	29.5	0.01	0.02	29.5	30.1	0.02		
6/02/2019		1.91	-0.29	22.2	7.11	31974	4.7	-205	5	0.2		6840	232	1100	234	11800	1890	1120	0.05	0.005	0.08	1.14	0.987	29.3	0.01	0.01	29.3	27.1	0.01		
21/02/2019		2.06	-0.44	23.8	7.1	34927	0	-270.6	5	1.3		6490	214	1020	222	12000	1910	1100	0.05	0.005	0.11	1.06	1.06	30.7	0.04	0.02	30.6	27.6	0.06		
6/03/2019		1.98	-0.36	26.3	7.28	37096	5.4	-273	5	5.1		6090	204	952	198	12200	1890	1160	0.05	0.005	0.08	0.97	0.945	29.8	0.14	0.01	29.8	26.4	0.03		
20/03/2019		1.35	0.27	24.6	7.43	43460	0.65	-38.2	6	28.01		7120	272	1150	232	11800	1800	1140	0.1	0.005	0.08	1.01	1.04	28.8	0.01	0.05	28.8	26.6	0.05		
4/04/2019		1.24	0.38	24.09	7.45	39080	0.52	-40.9	10	24.89	5	7610	244	1140	254	11500	1710	1090	0.05	0.005	0.1	1.02	1.03	2.94	0.01	0.01	29.4	25.4	0.01		
1/05/2019		1.46	0.16	23.2	7.25	33600	2.34	-116	5	1.5		6850	227	1100	224	11900	1630	1100	0.05	0.005	0.07	0.96	1.04	29.2	0.43	0.01	28.8	25.1	0.44		
5/06/2019		1.55	0.07	21	7.5	32000	0.84	-10																							

**617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB10**

2022/2023	N/A	Monitoring bore broken. To be replaced.
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Pre-Extraction	Average	1.42	0.205	21.8	7.53	32513	2.15	-72.8	5	9.5	5	4553	151	617	202	8230	1282	610	0.09	0.002	0.62	3.02	2.890	157.0	3.80	0.69	153.0	147.00	4.49
	Maximum	1.46	0.250	23.7	8.75	74900	4.11	107.0	5	13.0	5	7500	233	1150	292	14750	2490	852	0.34	0.002	1.96	3.32	3.220	162.0	4.39	1.20	157.0	158.00	5.59
	Minimum	1.37	0.160	19.9	7.07	1605	0.38	-187.0	5	6.0	5	94	30	17	24	194	77	247	0.01	0.002	0.01	2.71	2.560	152.0	3.20	0.18	149.0	136.00	3.38
	80th Percentile	ID	ID	ID	7.71	37940	3.28	32.2	ID	ID	ID	7456	209	1118	290	13450	1870	815	0.15	ID	1.46	ID	ID	ID	ID	ID	ID	ID	ID
	20th Percentile	ID	ID	ID	7.28	30640	0.79	-163.8	ID	ID	ID	1088	138	157	213	1146	995	269	0.01	ID	0.01	ID	ID	ID	ID	ID	ID	ID	
Reporting Period (2022/2023)	Average	2.91	-1.288	21.9	6.87	1107	2.52	59.0	20	84.4	5	47	188	19	7	78	163	374	0.01	0.004	3.20	0.04	0.003	1.3	0.02	0.45	1.7	0.42	0.46
	Maximum	4.77	-0.540	24.4	7.50	1483	3.74	149.0	43	268.0	5	81	293	25	8	142	436	420	0.02	0.011	15.50	0.06	0.008	3.0	0.04	0.79	2.2	0.88	0.79
	Minimum	2.16	-3.150	19.5	6.50	885	1.97	-89.3	5	18.7	5	27	148	16	6	39	64	342	0.01	0.001	0.05	0.01	0.001	0.3	0.01	0.01	1.3	0.13	0.01
All Results	Average	1.89	-0.274	22.8	7.47	28124	1.76	-83.1	10	18.4	5	4625	182	701	168	8162	1244	845	0.05	0.004	0.64	1.35	1.297	50.9	0.45	0.16	47.8	43.55	0.60
	Maximum	4.77	0.380	26.3	8.75	74900	5.40	149.0	43	268.0	5	7610	293	1170	292	14750	2490	1170	0.34	0.011	15.50	3.35	3.860	186.0	4.39	1.20	184.0	174.00	5.59
	80th Percentile	2.19	0.196	24.5	7.71	37644	2.73	47.0	12	24.0	5	7104	235	1100	241	12280	1798	1124	0.05	0.005	0.27	2.71	2.080	104.9	0.75	0.29	68.8	44.52	0.99
	Median (50th Percentile)	1.79	-0.165	23.2	7.45	33600	1.81	-94.7	5	4.6	5	6515	209	999	213	11800	1675	955	0.05	0.005	0.09	1.03	1.010	30.2	0.02	0.02	30.2	27.20	0.05
	20th Percentile	1.42	-0.568	20.9	7.20	2136	0.48	-205.0	5	0.9	5	105	141	18	26	200	77	510	0.01	0.002	0.05	0.90	0.900	3.3	0.01	0.01	16.4	13.79	0.01
	Minimum	1.24	-3.150	19.5	6.50	73	0.00	-273.0	5	-11.1	5	27	30	16	6	39	64	247	0.01	0.001	0.01	0.01	0.001	0.3	0.01	0.01	0.5	0.13	0.01

Red and bold values exceed the objective value for that analyte. IS - Insufficient data for statistical analysis. NS = No Sample Required. ND = No Data. NLM = No Longer Monitored

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB11

Site: MB11		Physical										Major Cations & Anions							Metals			Nutrients									
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity µS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L		
Objective		-	-	6.5-8.5	<3000	-	-	-	-	10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01			
Pre-Extraction	16/06/2005				6.81	1625	0.65					220	211	72	19	300	484		3.13		11										
	19/07/2005				7.42	1553	1.00					127	289	65	11	311	456	302	0.64		3.57										
	5/08/2005				7.54	1492	1.13																								
	10/11/2005				7.37	1505	0.54					51	191	50	11	90	520	235	0.15		1.08										
	12/01/2006				7.25	1743	0.40					149	215	67	16	74		432	0.15		3.14										
	3/05/2006																360														
	8/02/2007				7.32	1312	2.11	-144																							
	2/09/2008				7.6	1552																									
	4/09/2017	Purged for 5 mins to clear debris - sulphide (black) particles & ants removed. Strong odour	1.39	0.2	19.1	7.14	1056	0.37	-74		43.1	5	39	180	49	10	47	328	351	0.39	0.001	5.42	0.64	0.01	4.60	0.01	0.01	4.6	1.48	0.01	
5/10/2017	Few black particles (sulphides)	1.29	0.3	20.8	7.08	1174	1.99	-104	5	11.3	5	34	168	45	9	54	346	345	0.01	0.001	0.87	0.42	0.27	2.80	0.01	0.01	2.8	1.8	0.01		
30/10/2017	Commencement of extraction																														
2017/2018	28/11/2017		1.21	0.38	24.5	7.56	1130	0.98	-36.4	5	0.1	5	37	173	48	10	48	335	352	0.01	0.001	0.09	0.24	0.16	2.20	0.33	0.39	1.5	0.54	0.72	
	13/12/2017		1.25	0.34	24.5	7.37	1365	0.18	-134		0.7	5	41	181	55	11	50	347	317	0.01	0.001	0.08	0.29	0.19	1.80	0.06	0.32	1.4	1.15	0.38	
	11/01/2018		1.48	0.11	27.1	7.34	1234	1.16	-139		9.4	5	38	192	51	11	46	324	326	0.01	0.001	0.06	0.31	0.28	2.10	0.02	0.02	2.1	1.66	0.04	
	24/01/2018		1.56	0.03	24.6	6.99	1222	0.37	-30		6.6	5	20	33	8	2	17	21	98	0.01	0.001	3.58	0.1	0.01	0.20	0.01	0.02	0.2	0.04	0.02	
	6/02/2018		1.37	0.22	25.5	7.29	1334	0.73	-88		3.7	5	39	172	47	10	49	334	341	0.01	0.001	0.38	0.24	0.22	1.40	0.04	0.11	1.3	0.94	0.15	
	8/02/2018	Last day of first extraction campaign.																													
	8/03/2018		0.77	0.82	23.9	6.89	1115	0.28	-42		7.8		35	170	42	10	55	338	324	0.02	0.001	0.16	0.24	0.16	1.80	0.03	0.56	1.2	0.47	0.59	
	13/04/2018		1.24	0.35	24	7.45	1531	3.1	-91		5.4		85	176	52	11	46	337	320	0.01	0.001	0.26	0.2	0.12	1.30	0.03	0.3	1	0.53	0.33	
2018/2019	31/05/2018		1.13	0.46	21.6	7.32	1083	2.02	41		8.8	5	33	160	41	9	43	326	336	0.01	0.001	1.25	0.23	0.03	1.50	0.01	0.07	1.4	0.66	0.08	
	24/10/2018		1.03	0.56	20.7	7.29	1345	0.14	-238	11	6.7	5	33	166	53	10	52	387	333	0.05	0.005	0.21	0.51	0.34	2.4	0.05	0.2	2.2	1.26	0.25	
	3/12/2018		1.48	0.11	22	7.51	1625	2.74	-285	20	9.1		39	201	45	10	83	222	466	0.02	0.001	0.45	0.9	1	6.8	0.01	0.03	6.8	5.9	0.03	
	17/12/2018		1.27	0.32	21.6	7.75	1303	0.64	-295	32	13.4		41	161	42	11	115	174	500	0.02	0.001	0.47	1.37	0.89	11.8	0.01	0.08	11.7	9.71	0.08	
	15/01/2019		1.56	0.03	24.2	7.24	1388	0.26	-334.6	6	3.7	5	38	177	45	10	81	203	460	0.01	0.001	0.08	0.75	0.63	5.2	0.01	0.01	5.2	5.22	0.01	
	6/02/2019		1.63	-0.04	24.8	7.21	1183	1.1	-309	35	2.7		36	165	42	9	54	280	364	0.01	0.001	0.72	0.3	0.261	2.6	0.01	0.01	2.6	1.15	0.01	
	21/02/2019		1.72	-0.13	23.4	7.18	1242	0.27	297.1	5	25.5		50	43	45	10	43	286	331	0.01	0.001	0.19	0.36	0.05	1.8	0.01	0.03	1.8	1.18	0.03	
	6/03/2019		1.65	-0.06	26.2	7.38	1272	7.07	-243	5	0.6		42	164	43	11	44	277	350	0.05	0.001	0.39	0.32	0.355	1.4	0.1	0.01	1.4	0.96	0.01	
	20/03/2019		0.89	0.7	25.5	7.36	1744	0.48	-34.8	8	0.88		44	180	54	12	46	303	343	0.01	0.001	0.73	0.22	0.098	1.4	0.01	0.01	1.4	0.6	0.01	
	4/04/2019		0.74	0.85	25.5	7.32	1498	0.34	-33.5	93	0.75	5	50	192	50	12	52	282	367	0.01	0.001	0.08	0.61	0.464	3.6	0.01	0.01	3.6	2.75	0.01	
2019/2020	1/05/2019		0.96	0.63	22.9	7.02	1264	0.1	-354	18	21.2		40	195	50	11	88	172	496	0.01	0.001	0.34	0.71	0.342	5.6	0.01	0.03	5.6	4.42	0.03	
	5/06/2019		1.2	0.39	21.2	7.6	1212	2	-288	9	-5.5		42	193	52	11	50	312	360	0.02	0.001	0.11	0.34	0.267	2.4	0.01	0.01	2.4	1.84	0.01	
	3/07/2019		0.9	0.69	19.83	7.58	1935	0.2	-145.1	5	25.1	5	45	198	54	11	50	319	348	0.01	0.001	0.26	0.19	1.75	1.2	0.01	0.01	1.2	0.78	0.01	
	31/07/2019		1.22	0.37	19.4	7.48	1901	2.92	-138.3	5	34.8		36	189	48	10	44	302	369	0.01	0.001	0.13	0.24	0.229	1.6	0.01	0.01	1.6	1.27	0.01	
	4/09/2019		1.34	0.25	20.4	7.3	1398	0.6	-100.9	5	40.6		32	167	42	9	42	310	340	0.01	0.001	0.23	0.16	0.1	1.6	0.01	0.01	1.6	1.67	0.01	
	2/10/2019		1.52	0.07	21.5	7.4	1349	1	-179.9	5	7.2	5	36	182	45	9	52	236	321	0.01	0.001	0.08	0.21	0.222	1.6	0.01	0.01	1.6	1.04	0.01	
	6/11/2019		1.64	-0.05	21	7.5	1199	2.6	-188.2	5	-3.4		39	164	43	10	49	284	357	0.01	0.001	0.1	0.29	0.266	1.8	0.01	0.01	1.8	1.47	0.01	
	15/01/2020	pH meter calibration issue - spurious data.	1.8	-0.21	24.8	12.9*	1280	1.6	-208	12	3.9		35	177	44	11	52	205	336	0.02	0.001	0.11	0.62	0.52	2.4	0.01	0.01	2.4	2.12	0.01	
	28/04/2020	Land-based extraction commenced 16/04/20.	1.24	0.35	24.7	5.3	157.8	0.94	-67.1	26	452.5	5	17	2	1	4	33	11	3	0.27	0.063	4.66	0.12	0.022	1.6	0.01	0.01	1.6	0.24	0.01	
	6/07/2020		1.12	0.47	19.9	6.4	1240	0.9	-130	65	29	5	32	170	45	10	40	259	360	0.01	0.001	1.01	0.37	0.259	2.9	0.01	0.03	2.9	1.58	0.03	
	2020/2021	13/08/2020	Clear	0.96	0.63	20.1	7.2	1121	1.9	-123	140	82.7	5	34	168	47	10	44	286	350	0.01	0.001	0.68	0.53	0.256	4.2	0.01	0.01	4.2	1.5	0.01
16/09/2020			1.08	0.51	19.4	7.1	1186	1.66	-170.7	14	178.03	5	34	169	45	13	46	263	372	0.02	0.001	0.07	0.79	0.605	0.01	0.01	0.01	3.4	2.75	0.01	
14/10/2020			1.43	0.16	20.5	7.14	1130	0.22	-297.8	7	19.5	5	34	181	46	12	52	254	373	0.01	0.001	0.08	0.66	0.653	0.01	0.01	0.01	3.6	3.26	0.01	
11/11/2020		Ants & Eggs, Very Dirty, Strong odour	1.39	0.2	20.5	7.17	1146	1.72	-108.4	11	7		31	184	43	10	42	279	320	0.01	0.001	1.41	0.22	0.2	0.01	0.01	0.01	1.2	0.83	0.01	
24/02/2021		Clear, Strong odour, ants	0.71	0.88	24.6	7.12	1208	0.68	-233.6	23	8.1		3																		

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB12

Site: MB12		Physical											Major Cations & Anions							Metals			Nutrients							
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity µS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L	
Objective		-	-	6.5-8.5	<3000	-	-	-	-	10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01		
16/06/2005					6.9	1588	0.68				66	433	54	13	147	706			0.74		2.98									
19/07/2005					6.8	1587	0.54				43	322	59	12	87	528	223		0.12		1.61									
5/08/2005					7.5	1619	1.02																							
10/11/2005					7.150	1531.000	0.110				47.00	219.000	54.000	11.000	62.000	643.000			0.18		1.310									
12/01/2006					7.110	1818.000	0.110				39.00	261.000	58.000	12.000	54.000		230.000			0.15		1.450								
3/05/2006																410														
8/02/2007					7.2	1433	1.55	-98.0																						
2/09/2008					7.4	1962																								
4/09/2017	Purged for 5 mins to clear debris	1.19	0.18	20.7	6.74	1795	0.09	-54		7.1	5	55	375	52	12	122	646	329	0.01	0.001	20.4	0.11	0.02	0.60	0.01	0.01	0.6	0.33	0.01	
5/10/2017		1.06	0.31	21.9	6.91	2080	1.65	-72.9	15	20.1	5	45	362	46	10	131	720	317	0.009	0.001	14.2	0.11	0.01	0.60	0.01	0.01	0.6	0.34	0.01	
30/10/2017	Commencement of extraction																													
28/11/2017		0.99	0.38	24.1	7.16	1795	3.75	8	14	32.7	5	49	363	49	11	138	728	340	0.01	0.001	0.05	0.01	0.01	0.70	0.01	0.3	0.4	0.12	0.3	
11/01/2018		1.24	0.13	25.6	7.04	1836	1.43	-69		21.8	5	44	373	49	11	112	719	304	0.01	0.001	0.05	0.03	0.01	0.80	0.01	0.02	0.8	0.34	0.02	
24/01/2018		1.32	0.05																											
6/02/2018		1.15	0.22	26.5	6.82	1984	0.74	-81		7.1	5	42	336	46	11	115	686	319	0.01	0.001	7.65	0.05	0.01	0.5	0.01	0.01	0.5	0.38	0.02	
8/02/2018	Last day of first extraction campaign.																													
31/05/2018		0.9	0.47	20.3	6.96	1593	2	45		47.9	5	38	324	40	10	111	658	324	0.01	0.001	11.7	0.03	0.01	0.40	0.01	0.05	0.4	0.36	0.05	
24/10/2018		0.79	0.58	19.9	6.98	1580	1.83	-69	5	9.9	5	29	324	43	10	122	771	290	0.05	0.005	0.05	0.03	0.01	0.8	0.02	0.44	0.3	0.1	0.46	
15/01/2019		1.33	0.04	24.4	6.86	1810	0.63	-124.1	32	32.4	5	49	342	42	10	115	653	314	0.01	0.001	13.6	0.01	0.01	0.5	0.01	0.02	0.5	0.38	0.02	
4/04/2019		0.52	0.85	25.03	7.04	2146	2.17	-17.5	43	1.09	5	55	371	43	11	91	664	313	0.01	0.001	0.06	0.02	0.007	0.6	0.01	0.02	0.6	0.38	0.02	
3/07/2019		0.69	0.68	20.49	7.26	2667	2.77	73.5	29	33.6	5	57	354	41	11	84	596	316	0.01	0.001	0.61	0.02	0.001	0.7	0.01	0.18	0.5	0.25	0.18	
2/10/2019		1.3	0.07	20.7	7.1	2055	3.1	1	5	74.4	5	67	350	41	11	89	666	278	0.01	0.001	0.05	0.01	0.001	0.5	0.01	0.36	0.1	0.01	0.36	
15/01/2020	pH meter calibration issue - spurious data.	1.58	-0.21	22.4	11.2*	1885	1.7	-80	5	7.4	5	76	334	39	12	72	673	268	0.01	0.001	0.01	0.01	0.01	0.2	0.01	0.04	0.2	0.03	0.04	
28/04/2020	Land-based extraction commenced 16/04/20.	0.82	0.55	23.3	7.2	1757	6.78	-75.2	28	19.9	5	79	259	35	11	72	675	288	0.01	0.001	4.98	0.01	0.003	0.8	0.01	0.08	0.7	0.37	0.08	
6/07/2020		0.9	0.47	20.2	6.4	1755	5.6	28	155	24	5	82	331	36	11	59	790	309	0.01	0.001	12.8	0.04	0.026	0.7	0.01	0.09	0.6	0.31	0.09	
13/08/2020	Clear	0.73	0.64	21.1	6.7	1814	3.8	77	12	138	5	94	302	38	12	64	759	310	0.01	0.001	0.05	0.22	0.001	0.9	0.01	0.06	0.8	0.28	0.06	
16/09/2020		0.87	0.5	19.7	6.68	1866	1.62	172	5	197.64	5	98	308	39	12	64	794	306	0.01	0.001	0.05	0.04	0.004	0.24	0.01	0.24	0.2	0.02	0.24	
14/10/2020		1.21	0.16	20.5	6.74	1766	0.52	-177.9	26	71.8	5	90	317	37	11	64	699	302	0.01	0.001	8.55	0.14	0.001	0.01	0.01	0.01	0.6	0.36	0.01	
11/11/2020	Ants & Eggs	1.16	0.21	20.7	7.21	1995	1.66	-117.1	42	10.4		82	309	36	10	81	756	378	0.01	0.001	17.7	0.13	0.001	0.01	0.01	0.01	0.6	0.31	0.01	
24/02/2021	Clear, ants	0.52	0.85	23.7	7.05	1917	1.33	-145.2	32	25.2		34	314	40	11	68	790	287	0.01	0.001	15.6	0.02	0.002	0.6	0.01	0.04	0.6	0.38	0.04	
10/06/2021		0.89	0.48	20.3	7.29	1974	5.83	2.8	23	5.49		88	318	42	12	86	814	285	0.01	0.001	3.86	0.01	0.001	0.5	0.01	0.43	0.1	0.05	0.43	
20/10/2021		0.89	0.48	19.4	7.21	1213	2.25	-23.3		4.1		32	165	44	9	41	255	353	0.01	0.001	0.8	0.01								
25/01/2022		0.88	0.49	24.42	7.63	1094	3.7	-70		67		31	190	42	10	35	256	357	0.01	0.001	0.19	0.32		1.5	0.01	0.29	1.2	0.67	0.3	
22/02/2022		0.72	0.65	24.27	7.19	1858	1.68	-38.2		6		79	317	46	12	248	650	246	0.01	0.001	6.69									
27/04/2022		0.56	0.81	21.6	7.41	1712	1.71	-66.3		13		87	265	40	9	318	430	193	0.01	0.007	0.05	0.06		0.9	0.01	0.4	0.5	0.03	0.4	
23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																													
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022.																													
27/07/2022		0.67	0.7	17.66	7.18	1948	0.37	132.1		22.4		69	266	45	9	260	482	206	0.01	0.001	0.05									
31/08/2022		0.86	0.51	7.48	7.2	2083	1.71	192.8		4.2		81	278	47	11	303	488	226	0.01	0.001	0.05	0.01		0.6	0.01	0.38	0.2	0.02	0.38	
28/09/2022		0.66	0.71	19.04	7.17	1974	1.8	-58.9		0.3		86	279	42	11	474	462	213	0.01	0.001	0.05									
26/10/2022	Clear	0.55	0.82	21.1	7.13	2017	3.92	179.8				89	302	42	11	311	481	259	0.01	0.001	0.05									
29/11/2022		1.06	0.31	19.94	6.64	1568	2.62	94.8		0.3		86	326	38	12	315	482	228	0.01	0.001	0.05	0.01		0.6	0.01	0.42	0.2	0.01	0.42	
23/01/2023		1.16	0.21	21.9	6.52	2000	1.58	129.3		8.62		87	277	39	11	281	486	258	0.01	0.001	0.05									
23/02/2023		0.81	0.56	23.1	6.84	2052	2.7	96.7		40.9		89	298	41	12	287	477	254	0.01	0.001	0.05	0.04		0.6	0.01	0.18	0.4	0.03	0.18	
29/03/2023		1.02	0.35	23.24	7.58	2551	1.68	-19.2		23.2		108	302	43	12	324	520	233	0.01	0.001	0.05									
27/04/2023		1.04	0.33	21.47	7.57	2036	5.34																							

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB13

Site: MB13		Physical										Major Cations & Anions							Metals			Nutrients								
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity uS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L	
Objective		-	-	-	6.5-8.5	<36384	-	-	-	-	10	<6884	-	<1146	<215	<12600	<2276	<545	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01	
Pre-Extraction	16/06/2005				6.87	32200	0.22					6940	1170	2040	215	15198	4000		0.75		19									
	19/07/2005				6.36	36800	0.24					6870	559	1050	217	247	2260	304	0.17		1.8									
	5/08/2005				7.18	33300	1.22																							
	10/11/2005				6.84	32300	0.24					6600	609	925	127	12600	2110	401	0.08			10								
	12/01/2006				6.77	35400	0.45					6040	2350	1370	240	11365		194	0.32			6.06								
	3/05/2006																2170													
	8/02/2007				7.1	21800	1.48	-250																						
	2/09/2008				7	38200																								
	4/09/2017	Purged for 5 mins to clear debris	1.46	0.25	20.7	6.63	2826	0.05	-34			5	6850	539	1090	200	12600	2240	534	0.05	0.005	0.05	0.56	0.02	0.80	0.01	0.3	0.5	0.14	0.3
	5/10/2017		1.63	0.08	24	6.8	33318	2.97	-52.3	26	1.6	5	5700	533	888	157	12200	2160	496	0.009	0.001	13.7	0.27	0.01	2.90	0.01	0.02	2.9	2.59	0.02
30/10/2017	Commencement of extraction																													
2017/2018	28/11/2017		1.53	0.18	24.5	6.79	30674	2.56	-58.2	33	24.2	5	6070	551	935	168	10900	2300	544	0.01	0.001	0.05	0.3	0.01	3.40	0.33	0.13	2.9	2.3	0.46
	11/01/2018		1.8	-0.09	24.4	6.83	30446	2.17	-81		39.6		7080	629	1060	189	11700	1540	466	0.05	0.005	0.05	0.22	0.01	4.50	0.35	0.33	3.8	2.36	0.68
	24/01/2018		1.88	-0.17																										
	6/02/2018		1.7	0.01	24.3	6.76	34036	2.42	-73		30.1	5	5970	541	908	163	12000	2170	495	0.01	0.001	10.2	0.16	0.01	2.7	0.18	0.09	2.4	2.41	0.27
	8/02/2018	Last day of first extraction campaign.																												
31/05/2018		1.6	0.11	22.1	6.87	29235	0.73	-41		3.8	5	5420	430	821	150	11400	1980	503	0.05	0.005	11.7	0.08	0.01	2.30	0.03	0.05	2.2	2.32	0.08	
2018/2019	24/10/2018		1.38	0.33	20.1	6.82	35760	1.33	-24	5	0.7	5	5860	530	892	155	11400	2270	468	0.05	0.005	0.05	0.06	0.01	1.4	0.01	0.01	1.4	1.03	0.01
	15/01/2019		1.9	-0.19	23.4	6.66	29980	0.38	-217.2	19	0.9	5	5200	503	845	147	11400	1990	547	0.05	0.005	2.79	0.59	0.01	4.6	0.01	0.01	4.6	4.49	0.01
2019/2020	4/04/2019	Very dark colour			25.42	7.33	37420	0.74	-34	22	23.7	5	6820	595	1020	186	10500	1860	582	0.05	0.005	0.34	1	0.848	4.8	0.01	0.01	4.8	3.63	0.01
	3/07/2019		1.24	0.47	20.72	7.12	46890	0.91	72	13	12.2	5	6530	609	1000	182	11100	2000	571	0.05	0.005	0.99	0.32	0.325	5.7	0.01	0.01	5.7	4.82	0.01
	2/10/2019		1.85	-0.14	20.4	6	35800	2.9	-68.9	6	24.3	5	6700	601	1070	183	11500	2050	488	0.05	0.005	2.91	0.08	0.076	4.6	0.01	0.01	4.6	3.47	0.01
	15/01/2020	pH meter calibration issue - spurious data.	2.12	-0.41	22.9	9*	32749	0.6	-267	7	5.4	5	6060	568	959	167	11000	1860	597	0.05	0.005	0.31	0.99	0.5	11.5	0.01	0.01	11.5	9.21	0.01
	28/04/2020	Land-based extraction commenced 16/04/20.	1.4	0.31	23.4	6.8	31094	1.14	-206.7	16	92.5	5	6520	592	1030	174	11500	2050	545	0.05	0.005	0.31	0.73	0.743	7.6	0.01	0.01	7.6	5.79	0.01
2020/2021	6/07/2020		1.47	0.24	20.8	6.2	31499	0.9	-156	5	9.4	5	6080	578	954	169	10700	2220	557	0.01	0.001	0.14	1.2	0.827	6.1	0.01	0.02	6.1	5.12	0.02
	13/08/2020	Clear	1.3	0.41	21.1	7.1	31437	0.9	-117	5	4.1	5	5830	519	944	158	11100	1880	581	0.05	0.005	1.6	0.52	0.492	5.1	0.01	0.01	5.1	4.7	0.01
	16/09/2020		1.41	0.3	19.1	6.5	33096	1.34	-70.3	11	112.75	5	6030	580	932	166	12100	2270	560	0.05	0.005	3.22	0.16	0.106	0.01	0.01	4.2	3.83	0.01	
	14/10/2020		1.78	-0.07	20	6.75	31185	0.53	-195	18	5.3	5	6050	576	955	174	11200	2040	491	0.05	0.005	855	0.2	0.001	0.01	0.01	0.01	3.6	3.51	0.01
	11/11/2020	Ants & Eggs	1.73	-0.02	21	6.6	32924	1.04	-66.4	22	0.4		6220	588	1040	168	11600	2040	476	0.01	0.005	11	0.2	0.152	0.01	0.01	0.01	3.3	2.94	0.01
	24/02/2021	Clear, ants	1.08	0.63	25.4	6.47	32870	1.02	-57.6	14	48.4		6090	621	949	171	11600	2320	504	0.05	0.005	8.64	0.3	0.276	3.3	0.01	0.01	3.3	3.38	0.01
	10/06/2021	Ants	1.41	0.3	20.6	6.85	30919	4.45	-47.7	10	97.61		5970	557	905	174	11300	2110	490	0.01	0.001	5.75	0.27	0.001	2.9	0.01	0.01	2.9	2.4	0.01
	20/10/2021	Ants	1.22	0.49	20.1	6.85	33440	1.1	-3.6		78		6770	617	1040	204	11000	1870	544	0.05	0.005	3.46								
	25/01/2022		1.2	0.51	23.66	6.81	32976	2.17	-23.1		92		6660	607	1020	180	11400	2060	540	0.05	0.005	4.9	0.41		4.2	0.03	0.38	3.8	3.23	0.41
	22/02/2022		1.28	0.43	23.5	7.04	36440	1.39	-29.7		94		5640	491	882	153	11100	1980	481	0.01	0.001	4.39								
27/04/2022		1.13	0.58	21.7	6.87	30010	1.24	-34.6		101		5070	452	768	139	10400	1720	452	0.05	0.005	6.67	0.42		5.8	0.01	0.45	5.3	4.75	0.45	
23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																													
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022.																													
2022/2023	27/07/2022		1.24	0.47	17.7	7.07	33500	0.19	152.4		36		6510	546	954	163	11000	1970	475	0.05	0.005	0.05								
	31/08/2022		1.41	0.3	17.45	7.17	36180	0.85	195.8		0.5		6190	544	947	168	10400	1900	466	0.05	0.005	0.05	0.05			2	1.2	0.71	2.05	
	28/09/2022		1.22	0.49	18.72	7.2	32580	1.57	-61.1		0.6		6420	532	961	157	10900	2070	506	0.05	0.005	0.05								
	26/10/2022	Clear	1.11	0.6	20.3	6.82	32593	1.97	187.2				5750	632	940	167	11000	2100	524	0.05	0.005	0.61								
	29/11/2022		1.6	0.11	19.2	6.67	32960	0.79	5.1		1.4		6100	548	940	164	11400	2080	497	0.05	0.005	2.16	0.09		2.2	0.03	0.49	1.7	1.19	0.49
	23/01/2023		1.71	0	22.1	6.64	32137	1.86	60.2		22.4		5830	557	906	161	11000	2040	480	0.05	0.005	2.07								
	23/02/2023		1.36	0.35	22.8	6.51	32378	1.96	-24.8		4.9		6350	596	935	169	10600	1820	480	0.05	0.005	7	0.17		2	0.01	0.19	1.8	1.22	0.2
	29/03/2023		1.57	0.14	23.04	7.31	33180	1.13	-4.6		17.4		6070	495	936	149	10500	1920	494	0.05	0.005	8.59								
	27/04/2023		1.6	0.11	21.59	7.41	32460	4.34	-11.4		16.4		6170	631	933	173	10700	2040	463	0.05	0.005	0.05								
	2/06/2023		1.49	0.22	19.3	7.2	33970	3.22	175		22.5		6000	598	924	162	10500	1890	49											

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB14

Site: MB14		Physical										Major Cations & Anions						Metals			Nutrients										
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity uS/cm	Dissolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium	Calcium	Magnesium	Potassium	Chloride	Sulfate	Bicarbonate	Aluminium	Arsenic	Iron (filterable)	Total Phosphorus	Reactive Phosphorus	Total Nitrogen	Nitrite	Nitrate	TKN	Ammonia	NOx		
												mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Objective	-	-	-	6.5-8.5	<3000	-	-	-	-	10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01		
	2017/2018																														
30/10/2017	Commencement of extraction																														
28/11/2017				21.1	7.7	572	0.3	-145	195		5	66	48	21	2	32	82	245	0.01	0.001	0.05	0.28	0.1	0.60	0.01	0.01	0.6	0.03	0.01		
13/12/2017		1.7	0.475	23.5	6.37	795	0.85	-42				50	77	26	3	33	94	284	0.01	0.001	0.05	0.3	0.01	0.40	0.01	0.01	0.4	0.15	0.01		
11/01/2018		2.08	0.095	25.6	7.55	505	0.51	-118				27	61	14	5	37	39	161	0.01	0.001	0.05	0.12	0.01	0.20	0.01	0.01	0.2	0.07	0.01		
24/01/2018		2.33	-0.155	28.3	7.5	545	0.39	-109.2				20	33	8	2	17	21	98	0.01	0.001	3.58	0.1	0.01	0.2	0.01	0.02	0.2	0.04	0.02		
7/02/2018		2.57	-0.395	22.4	6.99	751	5.91	-125.6				27	59	29	2	38	81	161	0.05	0.005	22.9	0.43	0.01	0.4	0.01	0.01	0.4	0.06	0.01		
8/02/2018	Last day of first extraction campaign.																														
8/03/2018		1.82	0.355	22.6	7.61	2296	2.05	61				182	154	39	8	491	181	218	0.01	0.001	5.03	0.15	0.01	0.50	0.01	0.02	0.5	0.11	0.02		
13/04/2018		1.78	0.395	23.7	6.78	1326	3.96	-95				122	94	24	7	277	92	197	0.02	0.001	3.96	0.17	0.01	0.40	0.01	0.01	0.4	0.06	0.01		
31/05/2018		1.75	0.425	21.6	6.98	954	0.61	-6				123	86	23	7	296	84	190	0.01	0.001	1.45	0.08	0.01	0.30	0.01	0.01	0.3	0.06	0.01		
	2018/2019																														
3/12/2018		1.92	0.255	21.5	7.76	928	0.81	-121.9	34	17		112	61	23	7	156	49	191	0.01	0.001	0.94	0.1	0.01	0.3	0.01	0.01	0.3	0.06	0.01		
17/12/2018		1.92	0.255	21.7	6.94	840	3.18	-100	42	26.8		85	60	18	6	151	54	185	0.01	0.001	0.63	0.27	0.01	1.1	0.01	0.15	0.9	0.1	0.16		
15/01/2019		2.12	0.055	22.1	7.56	797	0.7	-181.4	45	34	5	99	65	20	7	155	43	193	0.01	0.001	0.63	0.13	0.01	0.4	0.01	0.01	0.4	0.12	0.01		
6/02/2019		2.27	-0.095	22.6	7.26	805	0.32	-161.6	30	13.7		98	60	18	6	143	52	196	0.01	0.001	1.06	0.1	0.022	0.3	0.01	0.01	0.3	0.1	0.01		
21/02/2019		2.37	-0.195	21.9	7.73	838	0.6	210.7	6	217.4		100	143	20	7	143	45	185	0.01	0.001	1.23	0.1	0.01	0.4	0.01	0.01	0.4	0.1	0.01		
6/03/2019		2.36	-0.185	22.9	7.54	851	10.3	-206	14	3.3		83	60	19	6	149	47	194	0.01	0.001	1.29	0.09	0.021	0.2	0.1	0.01	0.2	0.07	0.01		
21/03/2019		7.54	-5.365	24.2	7.54	1102	1.94	-105	26	0.55		85	56	20	5	136	42	196	0.01	0.001	5.22	0.16	0.004	0.4	0.01	0.01	0.4	0.06	0.01		
3/04/2019		1.67	0.505	23.8	6.78	909	1.26	-67	25	8.7	5	80	63	22	5	102	43	205	0.01	0.001	6.06	0.14	0.006	0.3	0.01	0.01	0.3	0.08	0.01		
30/04/2019		1.7	0.475	22.7	7.05	593	-0.3	-244	7	3.1		68	44	14	5	90	33	172	0.01	0.001	0.99	0.09	0.033	0.2	0.01	0.01	0.2	0.06	0.01		
5/06/2019		1.73	0.445	22.1	7.6	675	1.15	-9.5	9	19.2		98	51	14	6	110	28	186	0.01	0.001	0.71	0.1	0.054	0.3	0.01	0.01	0.3	0.03	0.01		
	2019/2020																														
3/07/2019	Site inaccessible (too wet)																														
31/07/2019		1.71	0.465	21.1	8.17	1172	0.77	33.2	5	31.3		76	44	12	5	83	29	202	0.01	0.001	0.21	0.17	0.042	0.2	0.01	0.01	0.2	0.03	0.01		
4/09/2019		1.88	0.295	20.9	7.9	683	0.4	79.1	5	46		38	52	14	5	49	29	168	0.01	0.001	0.05	0.2	0.03	0.1	0.01	0.01	0.1	0.02	0.01		
2/10/2019		2.09	0.085	22.1	7.9	583	2.3	-131.9	14	10.8	5	42	53	15	5	56	29	155	0.01	0.001	0.99	0.36	0.054	0.3	0.01	0.01	0.3	0.01	0.01		
6/11/2019		2.28	-0.105	21.9	7.7	487	1.4	-119.3	18	14.2		30	46	13	5	42	33	169	0.01	0.001	0.73	0.2	0.029	0.3	0.01	0.01	0.3	0.04	0.01		
15/01/2020	Knocked over by cattle. pH meter calibration issue - spurious data.	2.55	-0.375	22.2	10.6*	566	1.7	-39	13	18.5		49	48	12	5	56	25	154				0.11	0.02	0.2	0.01	0.01	0.2	0.04	0.01		
28/04/2020	16/04/20. Land-based extraction commenced	1.59	0.585	23.4	7	562	0.84	-117.4	22	127.2	5	69	53	17	6	84	30	190	0.01	0.001	0.74	0.12	0.033	0.3	0.01	0.01	0.3	0.05	0.01		
	2020/2021																														
7/07/2020		1.66	0.515	21.3	7.17	319	2.57	-59	19	10.3	5	72	53	17	6	83	31	207	0.01	0.001	0.78	0.12	0.47	0.4	0.01	0.01	0.4	0.06	0.01		
12/08/2020	Clear	1.52	0.655	20.9	7	588	1.2	47	15	99	5	52	52	16	5	60	34	196	0.01	0.001	0.2	0.12	0.008	0.2	0.01	0.01	0.2	0.05	0.01		
16/09/2020		1.67	0.505	21.3	7.58	598	1.04	-18.8	8	203.55	5	45	54	16	5	58	43	192	0.01	0.001	0.93	0.11	0.067	0.01	0.01	0.01	0.2	0.04	0.01		
14/10/2020		0.191	1.984	21.5	7.64	502	0.97	-107.9	5	18.8	5	34	58	16	5	48	36	176	0.01	0.001	0.74	0.11	0.024	0.01	0.01	0.01	0.1	0.05	0.01		
11/11/2020		1.93	0.245	21.4	7.72	533	0.69	-156.1	12	21.6		27	62	22	6	46	39	168	0.01	0.001	1.03	0.12	0.052	0.01	0.01	0.01	0.1	0.03	0.01		
24/02/2021	Clear, no cap	1.31	0.865	23.5	7.02	471	2.08	-115.5	5	31.1		50	56	16	5	50	42	175	0.01	0.006	6.6	0.3	0.008	3.2	0.01	0.01	3.2	3.29	0.01		
10/06/2021	Ants	1.57	0.605	20.7	7.51	590	1.68	59.2	15	44.16		48	60	16	5	71	40	186	0.01	0.001	0.07	0.26	0.007	0.1	0.01	0.02	0.1	0.01	0.02		
	2021/2022																														
20/10/2021		1.58	0.595	20.5	7.34	632	0.71	-31.1		32		47	57	14	5	61	30	170	0.01	0.001	0.24										
25/01/2022		1.46	0.715	23.4	6.50	137	2.7	29				20	22	6	2	23	24	71	0.03	0.015	5.52	0.23		1.1	0.05	0.05	1.1	0.23	0.04		
22/02/2022		1.49	0.685	23.34	6.55	219	1.54	-1.1		43		24	28	19	5	29	20	87	0.04	0.022	10.5										
23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																														
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022.																														
	2022/2023																														
27/07/2022	Small orange flecks	1.48	0.695	18.18	7.29	529	3.8	131.8		24.8		41	49	13	5	42	30	159	0.01	0.001	0.05										
31/08/2022		1.65	0.525	18.25	7.59	471	1.54	205.1		7.9		38	51	15	10	46	28	166	0.01	0.001	0.05	0.09		0.2	0.01	0.05	0.2	0.01	0.05		
28/09/2022		1.5	0.675	19.77	6.69	468	1.52	-36.1		16.7		32	53	16	6	46	26	172	0.01	0.001	0.05										
26/10/2022	Clear	1.31	0.865	21	6.89	414.9	1.44	107.4				27	45	12	4	40	24	130	0.02	0.002	0.46										
29/11/2022		1.77	0.405	19.64	7.82</																										

617 - CUDGEN LAKES SAND QUARRY
Groundwater Monitoring Site MB15

Site: MB15		Physical											Major Cations & Anions							Metals			Nutrients								
Sample Date	Comments	Water Level Top of Casing	Water Level m AHD	Temp °C	pH	Electrical Conductivity uS/cm	Disolved Oxygen mol/L	Redox mV	Total Suspended Solids mg/L	Turbidity NTU	Oil & Grease mg/L	Sodium mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Chloride mg/L	Sulfate mg/L	Bicarbonate mg/L	Aluminium mg/L	Arsenic mg/L	Iron (filterable) mg/L	Total Phosphorous mg/L	Reactive Phosphorous mg/L	Total Nitrogen mg/L	Nitrite mg/L	Nitrate mg/L	TKN mg/L	Ammonia mg/L	NOx mg/L		
	Objective	-	-	-	6.5-8.5	<3000	-	-	-	10	<500	-	<100	<40	<1000	<800	<400	<0.5	<0.42	<20	0.01	<0.005	0.35	-	-	-	<20	0.01			
4/09/2017		1.06	0.375	20.6	7.45	555	0.01	-87	-	62	5	86	40	14	8	74	37	208	0.52	0.001	1.35	0.22	0.21	0.30	0.01	0.01	0.3	0.12	0.01		
5/10/2017		1.27	0.165	21.6	7.63	625	0.65	-152.6	14	10.9	5	116	25	10	6	83	48	217	0.03	0.002	0.13	0.33	0.22	0.60	0.01	0.01	0.6	0.26	0.01		
30/10/2017	Commencement of extraction																														
28/11/2017		1.84	-0.405	25.1	7.51	916	1.4	-31.3	8	18.7	5	132	30	14	11	99	91	217	0.01	0.001	0.05	0.28	0.19	0.80	0.03	0.02	0.7	0.51	0.05		
13/12/2017		1.47	-0.035	24.6	7.87	670	0.52	-107	-	48	-	68	41	15	8	60	47	176	0.01	0.001	0.05	0.15	0.16	0.20	0.01	0.01	0.2	0.19	0.01		
11/01/2018		1.87	-0.435	24.8	7.88	614	0.48	-183	-	6.9	5	106	28	12	11	66	53	189	0.01	0.001	0.05	0.27	0.18	0.80	0.02	0.01	0.8	0.48	0.02		
24/01/2018		2.43	-0.995	22.6	7.45	948	0.38	-67.7	-	23.9	-	144	32	15	14	119	138	181	0.01	0.001	0.81	0.27	0.14	1.40	0.01	0.01	1.4	0.66	0.01		
7/02/2018		2.39	-0.955	23.4	7.52	835	6.45	-55.3	-	8.4	5	107	40	18	13	88	83	199	0.01	0.001	0.36	0.26	0.14	0.40	0.01	0.01	0.4	0.39	0.01		
8/02/2018	Last day of first extraction campaign.																														
8/03/2018		0.79	0.645	24.5	7.67	850	0.52	-72	-	2.4	-	95	41	15	11	98	79	198	0.01	0.001	0.32	0.18	0.12	0.80	0.01	0.02	0.8	0.48	0.02		
13/04/2018		0.97	0.465	24.9	7.44	767	2.29	87	-	2.4	-	78	51	16	10	82	71	186	0.01	0.001	0.07	0.21	0.15	0.40	0.03	0.19	0.2	0.04	0.22		
31/05/2018		1.02	0.415	21.1	7.96	627	0.54	-85	-	32.9	5	76	42	13	9	79	62	194	0.01	0.001	0.05	0.12	0.11	0.20	0.01	0.03	0.2	0.17	0.03		
24/10/2018		0.86	0.575	19.9	7.32	735	0.03	-175	24	13.4	5	71	48	17	9	92	67	190	0.05	0.005	0.24	0.2	0.11	0.5	0.01	0.01	0.5	0.31	0.01		
3/12/2018		1.21	0.225	22.2	3.18	990	2.4	169	16	3.6	-	61	59	17	8	90	41	206	0.01	0.001	0.19	0.13	0.08	0.3	0.01	0.01	0.3	0.21	0.01		
17/12/2018		1.22	0.215	21.1	8.38	699	0.57	-157	6	1.8	-	60	56	16	8	89	41	206	0.01	0.001	0.28	0.17	0.11	0.3	0.01	0.01	0.3	0.22	0.01		
15/01/2019		1.44	-0.005	24.7	7.64	683	0.32	-200	5	8	5	64	52	17	9	87	41	203	0.01	0.001	0.24	0.18	0.12	0.4	0.01	0.01	0.4	0.29	0.01		
6/02/2019	Cap Missing	1.62	-0.185	23	7.49	674	0.65	-152.5	12	0	-	84	48	17	10	84	56	201	0.01	0.001	0.34	0.17	0.105	0.4	0.01	0.02	0.4	0.32	0.03		
21/02/2019		1.73	-0.295	22.7	7.6	703	0.53	203.7	5	1.4	-	78	83	16	10	83	53	190	0.01	0.001	0.27	0.17	0.14	0.4	0.01	0.01	0.4	0.28	0.01		
6/03/2019		1.68	-0.245	25	7.78	731	0.79	-197	12	1.1	-	75	45	17	9	87	53	198	0.01	0.001	0.33	0.18	0.136	0.4	0.1	0.01	0.4	0.24	0.01		
20/03/2019		1.03	0.405	24.84	7.29	978	1.06	-25.4	6	0.48	-	97	42	17	12	93	68	203	0.01	0.001	0.42	0.2	0.113	0.5	0.01	0.01	0.5	0.46	0.01		
4/04/2019		0.88	0.555	23.81	7.26	824	0.45	-30	19	0.4	5	124	46	17	13	98	91	202	0.01	0.001	0.58	0.23	0.134	0.4	0.01	0.01	0.4	0.28	0.01		
30/04/2019		0.99	0.445	22.6	7.15	740	0.64	-135	11	4	-	80	42	15	10	86	58	196	0.01	0.001	0.1	0.23	0.165	0.7	0.01	0.34	0.4	0.2	0.34		
5/06/2019		1.06	0.375	21.9	7.1	670	0.53	-148	20	-7.1	-	84	52	16	10	84	53	196	0.01	0.001	0.21	0.2	0.149	0.5	0.01	0.01	0.5	0.31	0.01		
3/07/2019		0.65	0.785	21.65	7.7	1170	0.2	32.2	8	20	5	87	50	17	11	86	45	213	0.01	0.001	0.28	0.19	0.169	0.8	0.01	0.01	0.8	0.63	0.01		
31/07/2019		0.99	0.445	20.1	8.13	1135	3.13	-136	5	22	-	71	60	17	9	85	35	228	0.02	0.001	0.11	0.2	0.188	0.7	0.01	0.01	0.7	0.65	0.01		
4/09/2019		1.14	0.295	21.7	7.8	865	0.7	-147.8	5	7.2	-	66	60	18	9	98	30	216	0.01	0.001	0.11	0.16	0.146	0.6	0.01	0.01	0.6	0.25	0.01		
2/10/2019		1.34	0.095	22.6	7.8	868	0.9	-180.4	5	0	5	70	69	20	9	121	29	203	0.01	0.001	0.06	0.18	0.154	1.6	0.01	0.01	1.6	0.35	0.01		
6/11/2019		1.58	-0.145	22.6	7.5	704	2	-90.7	20	-3.1	-	70	46	17	10	84	26	222	0.01	0.001	0.16	0.19	0.123	0.4	0.01	0.01	0.4	0.32	0.01		
15/01/2020	pH meter calibration issue - spurious data.	1.87	-0.435	24.1	8.5*	755	0.7	-149	5	0.9	-	77	49	17	11	86	4	178				0.21	0.22	4.8	0.01	0.01	4.8	0.28	0.01		
28/04/2020	Land-based extraction commenced																														
7/07/2020	Clear, Ants	0.84	0.595	21.1	6.6	683	0.9	-142	8	4.1	5	74	55	16	9	90	39	194	0.01	0.001	0.13	0.17	0.173	0.6	0.01	0.01	0.6	0.19	0.01		
12/08/2020	Clear	0.7	0.735	20.5	7.5	685	1.2	-162	5	6.8	5	71	55	16	9	96	37	200	0.01	0.001	0.11	0.31	0.17	0.3	0.02	0.01	0.3	0.18	0.02		
16/09/2020		0.79	0.645	20.8	7.54	727	1.8	-149.2	8	69.94	5	72	57	16	9	97	52	201	0.01	0.001	0.09	0.16	0.129	0.01	0.01	0.01	0.5	0.16	0.01		
14/10/2020		1.07	0.365	20	7.45	665	1.49	-180.6	6	4.4	5	68	64	15	8	98	40	196	0.01	0.001	0.06	0.13	0.126	0.02	0.01	0.02	0.6	0.15	0.02		
11/11/2020	Ants & Eggs, Odour	1.07	0.365	21.2	7.45	705	1.86	-142.9	5	3.9	-	63	60	18	9	97	40	188	0.01	0.001	0.12	0.2	0.162	0.01	0.01	0.01	1	0.21	0.01		
10/06/2021		0.74	0.695	19.4	7.64	587	1.34	-150.3	5	1.87	-	44	67	15	8	69	24	210	0.01	0.001	0.05	0.19	0.077	1.8	0.01	0.02	1.8	0.22	0.02		
20/10/2021	Ants	0.68	0.755	20.7	7.57	684	0.85	-45.8	-	3.7	-	47	68	16	8	76	14	224	0.01	0.001	0.05										
25/01/2022		0.6	0.835	23.4	7.58	634	4.16	-65.3	-	15	-	49	74	16	10	75	22	221	0.01	0.001	0.05	0.37		1.3	0.02	0.3	1	0.37	0.32		
22/02/2022	Ants	0.65	0.785	22.7	7.91	598	2.49	-78.1	-	17	-	58	64	23	10	102	33	193	0.01	0.001	0.06										
27/04/2022		0.55	0.885	21.39	7.62	676	2.12	-77.9	-	32	-	99	32	11	7	100	31	176	0.02	0.001	0.05	0.28		0.9	0.01	0.46	0.4	0.02	0.46		
23/05/2022	Due to major flood event, high rainfall, and poor drainage the site was deemed inaccessible to undertake sampling during May 2022.																														
22/06/2022	Due to previous major flood events, ongoing rain and slow drainage, the site was deemed inaccessible to undertake sampling during June 2022.																														
27/07/2022		0.63	0.805	17.5	7.54	666	0.38	117	-	3.6	-	87	33	11	7	81	34	151	0.01	0.001	0.05										
31/08/2022		0.77	0.665	18.95	7.71	629	2.12	197.4	-	3.7	-	85	33	10	6	89	34	162	0.01	0.001	0.05	0.05		0.1	0.01	0.04	0.1	0.01	0.04		
28/09/2022		0.65	0.785	20.8	7.94	637	1.68	-102.8	-	1.6	-	92	28	10	7	117	36	178	0.01	0.002	0.7										
26/10/2022	Clear, waterlogged area	0.51	0.925	21.7	7.93	671	5.65	83.8	-	-	-	92	37	11	7	82	35	183	0.01	0.002	0.16										
29/11/2022		0.9	0.535	21.22	7.47	638	2.57	72.5	-	3.2	-	86	32	9	6	60	36	128	0.01	0.001	0.05	0.23		0.3	0.01	0.11	0.2	0.04	0.11		
23/01/2023		1.09	0.345	24	6.52	685	2.23	-54.9	-	0.23	-	82	36	9	7	57	35	189	0.01	0.001	0.3										
23/02/2023		0.98	0.455	23.1	7.25	618	1.96	-117.8	-	-1.9	-	76	42	11	7	52	25	196	0.01	0.001	0.12	0.23		0.4	0.01	0.05	0.				