CBased Environmental Pty Limited
ABN 62 611 924 264

Calga Quarry

Environmental Monitoring

Dust Deposition Gauges, Surface and Ground Waters and Meteorological Station

May 2019

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Date: 19 June 2019

Executive Summary

CBased Environmental is contracted by Hanson Quarry Products to conduct environmental monitoring at the Calga Sand Quarry.

The monitoring includes;

- Dust Deposition Gauges;
- Surface Waters;
- Groundwaters; and
- Meteorological Station.

This report was prepared by CBased Environmental and includes the following;

- Dust Deposition results for May 2019;
- Surface Water quality results for May 2019;
- Ground Water quality results for May 2019; and
- Meteorological report for May 2019.

The May 2019 dust deposition results for insoluble solids were generally similar or decreased when compared to April 2019. There were no excessively contaminated dust gauges this month. All sites, on a rolling annual average basis, are currently below the Air Quality Management Plan exceedance level of 3.7g/m^2.month. Results were found to be representative of dust levels as determined by the Australian Standard.

Monthly surface water samples were collected at sites A, C1 and F. Sites B, C2 and D were dry at the time of sampling. The samples were collected and analysed for a monthly sampling event. Results show pH within the slightly acidic range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any sites in May 2019.

Bi-monthly groundwaters were sampled on 30 May 2019. Groundwater depth generally varied when compared to May 2019, with water both moving towards and away from the surface. pH at all sites is in the acidic range and generally remained similar or slightly decreased when compared to the previous results. EC levels were similar or increased slightly at a majority of groundwater sites when compared to the May 2019 results.

The Calga Quarry weather station data recovery in May 2019 was approximately 100%. Data for May 2019 shows that rainfall recorded at the Calga Quarry was below the Gosford BOM mean rainfall and well below the Peats Ridge long term rainfall for May.

The rainfall comparison is provided below:

Calga Quarry	6.0 mm
BOM Peats Ridge*	NA
BOM Gosford*	17.6 mm
BOM Peats Ridge Long term mean for May*	89.7 mm

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).
Note: Differences in the daily rainfall readings between BOM and the Calga station may occur due to BOM stations reporting rainfall at 9am and the Calga station recording rainfall at midnight.

Sampling Program

Hanson Calga Quarry conducts environmental monitoring in accordance to Development Consent, OEH (EPA) licence and Environmental Management Plans. CBased Environmental are contracted to undertake dust deposition gauge, surface and groundwater and meteorological monitoring for the project. CBased Environmental commenced monitoring from the April 2006 monitoring period.

Dust deposition gauges are operated to the Australian Standard AS3580.10.1 "*Methods for sampling and analysis of ambient air method. Determination of particulates- deposited matter- gravimetric Method*". Sampling is undertaken every 30 +/- 2 days and each gauge is analysed for insoluble solids and ash residue. The results are reported as g/m^2.month.

Surface waters are sampled in accordance with Australian Standards AS5667.1 "*Guidance on the design of sample programs, sampling techniques and the preservation and handling of samples*", AS5667.6 "*Water quality sampling—guidance on sampling of rivers and streams*" and AS5667.4 "*Water quality sampling—guidance on sampling from lakes, natural and man-made*". Surface water monitoring sites include local streams and dams. Basic analysis including pH, Electrical Conductivity, Total Suspended Solids, Total Dissolved Solids and Total Oil and Grease is conducted monthly at Sites A and F (dams) and when Sites B, C and D are flowing. Additional samples are collected when daily rainfall exceeds 50mm.

Groundwaters are sampled in accordance with Australian Standards AS5667.1 "*Guidance on the design of sample programs, sampling techniques and the preservation and handling of samples*" and AS5667.11 "*Water quality sampling—guidance on sampling of ground waters*". Groundwater monitoring sites are sampled bi-monthly for depth and water quality. Groundwater monitoring loggers continuously record water levels in a selection of bores.

Meteorological monitoring is conducted at the quarry and displayed on the site computer with a real-time display. Metrological parameters are measured according to Australian Standard AS3580.14 "*Methods for sampling and analysis of ambient air. Meteorological monitoring for ambient air quality monitoring applications*"

The weather stations have the following sensor configuration;

- Air temperature
- Humidity
- Rainfall
- Atmospheric pressure
- Evaporation
- Solar radiation
- Wind speed
- Wind direction

CBased Environmental continued to operate the monitoring equipment and utilise site collections at their existing locations.

The locations of monitoring points are provided in **Figure 1**.

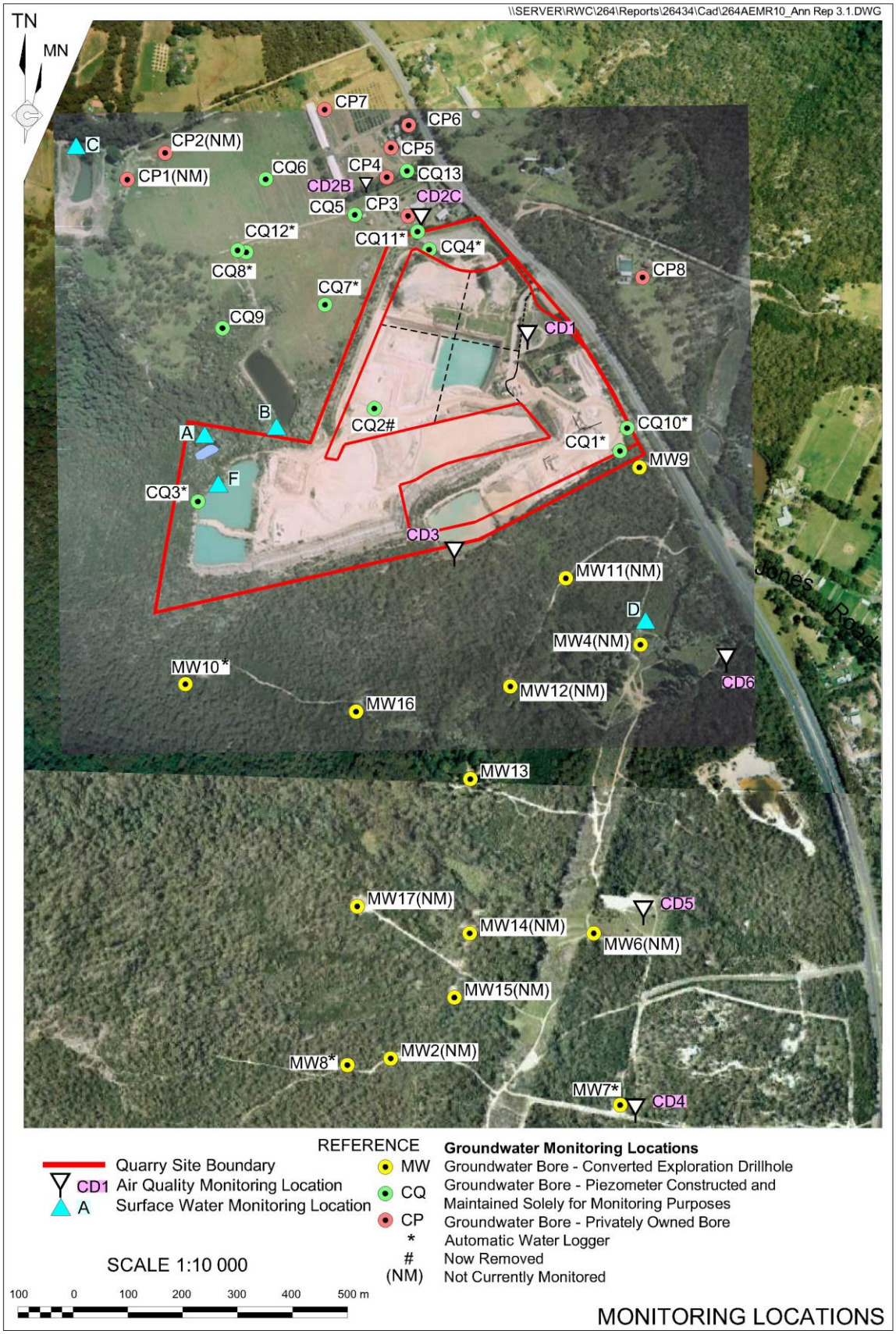


Figure 1: Hanson Calga Quarry environmental monitoring locations

2.0 Monthly Results

2.1 Dust Deposition Gauges

Table 1 displays the results for May 2019 and the project 12-month rolling average. Results are in g/m^2.month.

Table 1: Dust Deposition results: 29 April – 30 May 2019 (31 days)

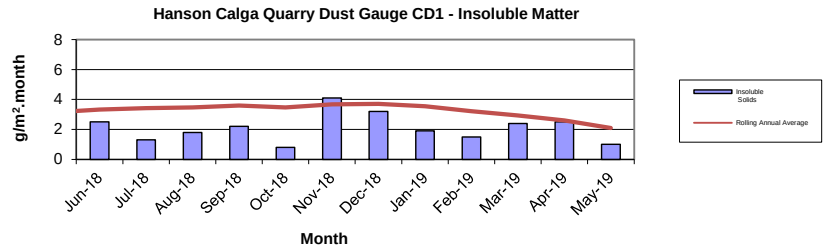
Site	Monthly Insoluble Solids *(g/m^2.month)*	Monthly Ash Residue *(g/m^2.month)*	Monthly Combustible Matter *(g/m^2.month)*	Monthly Ash Residue/ Insoluble Solids %	Rolling Annual Average Insoluble Solids *(g/m^2.month)*
CD1	1.0	0.9	0.1	90	2.1
CD2c	0.6	0.4	0.2	67	1.5
CD3	1.0	0.8	0.2	80	1.4
CD4	0.2	0.2	<0.1	100	1.2
CD5	0.3	0.3	<0.1	100	1.2
CD6	1.0	0.7	0.3	70	1.3

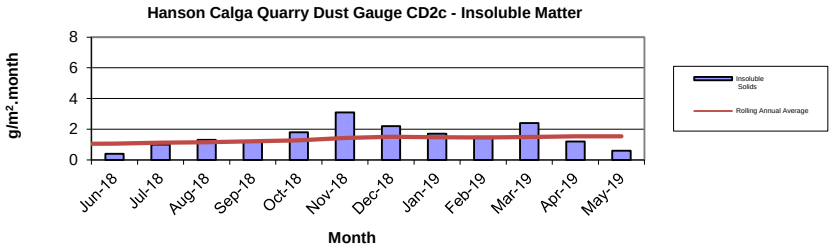
Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects. Results in bold indicate insoluble solids levels above 3.7 g/m^2.month; the Development Consent's annual average amenity criteria at residential locations. The current rolling annual average is calculated from April 2018 to March 2019.

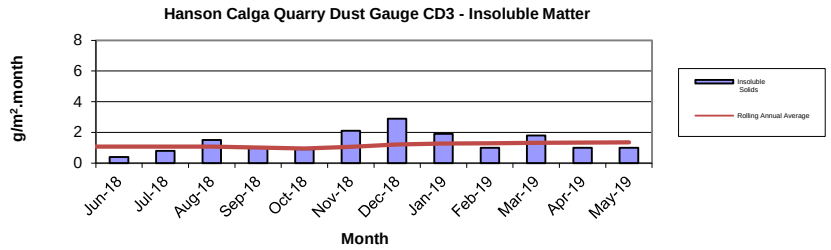
CD1 was installed on the 1 May 2006. CD2a was discontinued at the start of August 2006 due to quarry operations "mining out" the site of the gauge. The replacement gauge, Site CD2b, was located in a position adjacent to the boundary between B. Kashouli and F. & J. Gazzana in conformance with the Air Quality Management Plan. CD4 was installed on 3 October 2006, to gauge air quality impacts to the south of the site operations, as were CD5 and CD6 which were installed on the 14 December 2006. CD2b was discontinued at the end of January 2010 due to contamination of the gauge by non-quarry related vehicle movements on a track adjacent to the gauge. The replacement gauge, CD2c, was located on a rehabilitated section of land between the extraction area and adjacent resident.

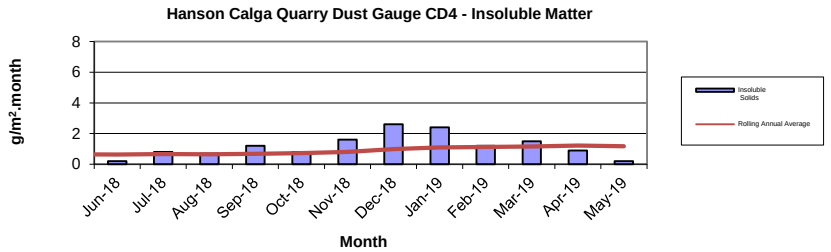
Dust deposition charts for all dust gauge sites appear in **Figure 2** below. The laboratory analysis is provided in **Appendix 1.**

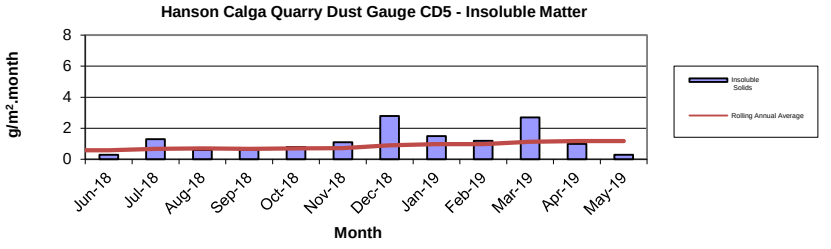
Figure 2: Dust Deposition Charts

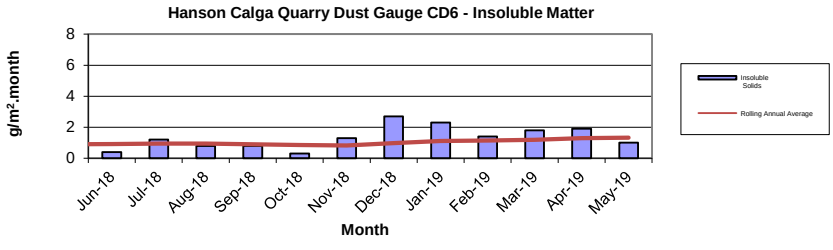












2.2 Surface Water Monitoring

Monthly surface water monitoring was conducted on the 30 May 2019 and results are listed in **Table 2**. The laboratory analysis sheets are provided in **Appendix 1.**

Table 2: Monthly surface water monitoring – May grab sample results

Site	Observed Flow Rate	Water Colour	Turbidity	pH	EC *(µS/cm)*	TDS *(mg/L)*	TSS *(mg/L)*	Oil and Grease *(mg/L)*
A	Dam	Clear	Clear	6.09	77	49	<5	<5
B	Dry/ No flow							
C1	Dam	Clear	Clear	6.28	92	52	10	<5
C2	Dry/ No flow							
D	Dry/ No flow							
F	Dam	Clear	Clear	5.63	79	58	<5	<5

Samples were collected at sites A, C1 and F. Sites B, D and C1 were dry/ no flow at the time of sampling. The samples were collected and analysed for a monthly sampling event. Results show pH within the slightly acidic range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any sites in May 2019.

2.2.1 Non-Routine Surface Water Sampling

Nil non-routine sampling was undertaken in May 2019.

2.3 Groundwater Monitoring

Bi-monthly groundwaters were sampled on 30 May 2019. Water quality tests for pH and electrical conductivity were conducted by CBased Environmental Pty Limited. For water quality purposes, water was purged from the bore until constant pH (+/- 0.1 pH units) and Electrical Conductivity (+/- 5%) was obtained between samples. Data is displayed in **Table 3** and **Figures 3 to 6.**

Groundwater depth generally varied when compared to May 2019, with water both moving towards and away from the surface. pH at all sites is in the acidic range and generally remained similar or slightly decreased when compared to the previous results. EC levels were similar or increased slightly at a majority of groundwater sites when compared to the May 2019 results.

Bi-monthly groundwater monitoring is next scheduled for July 2019.

Table 3: Groundwater Quality Data

Reference	Bore	Type	Depth to water TOC *(m)* April 2006	Depth to water TOC *(m)* This report	pH This report	Electrical Conductivity *(µS/cm)* This report
CQ3	Voutos	* Monitor	10.53	10.63	6.53	193
CQ4	Voutos	* Monitor	8.78	11.05	5.66	150
CQ5	Gazzana	DIP Only	8.69	7.69	5.33	185
CQ6	Gazzana	DIP Only	16.00	Covered over in paddock		
CQ7	Gazzana	* Monitor	6.89	6.58	4.51	116
CQ8	Gazzana	* Monitor	11.03	6.69	4.19	151
CQ9	Gazzana	DIP Only	10.10	Blocked / Damaged		
CQ10	Voutos	* Monitor	NI	25.68	4.35	148
CQ11S	Gazzana	* Monitor	NI	11.74	5.34	161
CQ11D	Gazzana	* Monitor	NI	12.72	5.04	157
CQ12	Gazzana	* Monitor	NI	5.09	5.71	130
CQ13	Kashouli	* Monitor	NI	14.23	4.24	178
CP3	Gazzana	Domestic	10.40	Destroyed		
CP4	Kashouli	Domestic	13.63	11.39	Blocked	
CP5	Kashouli	Domestic	16.61	8.32	5.81	122
CP6	Kashouli	Domestic	16.27	10.51	4.95	151
CP7	Kashouli	Production	8.56	3.96	5.58	66
CP8	Rozmanec	Domestic	22.17	22.06	4.33	136
CP13	W P White	Domestic		12.27	4.36	179
CP15	32 Polins Road Calga	Domestic		3.29	4.40	146
MW7	Rocla Bore	* Monitor	15.76	15.42	4.90	96
MW8	Rocla Bore	* Monitor	9.82	7.46	5.07	68
MW9	Rocla Bore	* Monitor	22.44	24.12	4.38	118
MW10	Rocla Bore	* Monitor	15.41	12.51	6.14	146
MW13	Rocla Bore	DIP Only	NI	7.85	4.04	121
MW16	Rocla Bore	DIP Only	NI	8.46	4.36	115
MW17	Rocla Bore	DIP Only		10.08	4.58	123

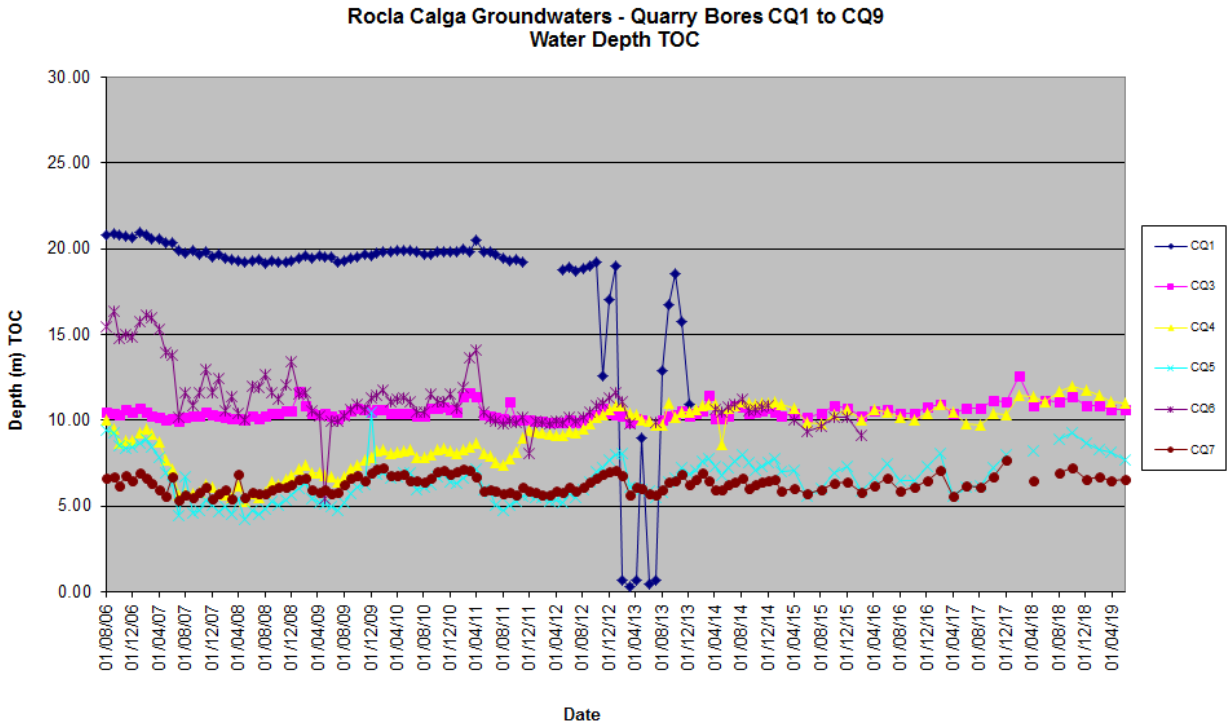
Notes:
TOC = Water level measured from top of bore case to water.
NM = Not Monitored – unable to sample water due to non-operational pump.
NR = Not Required by resident.
* = Logger Installed.
NI = These bores were not installed in April 2006 but are now operational. April 2006 was the first set of measurements taken by Carbon Based Environmental Pty Limited.

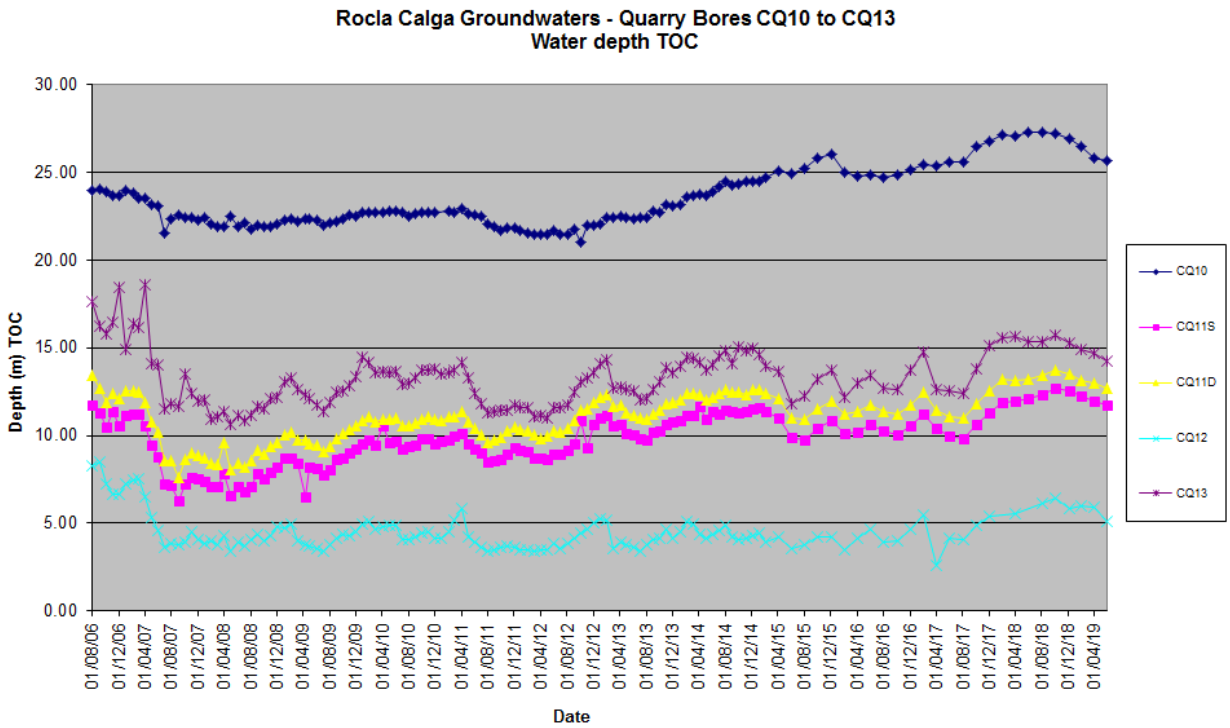
Shading is used to indicate the following trends in water depth (compared to the last reading):

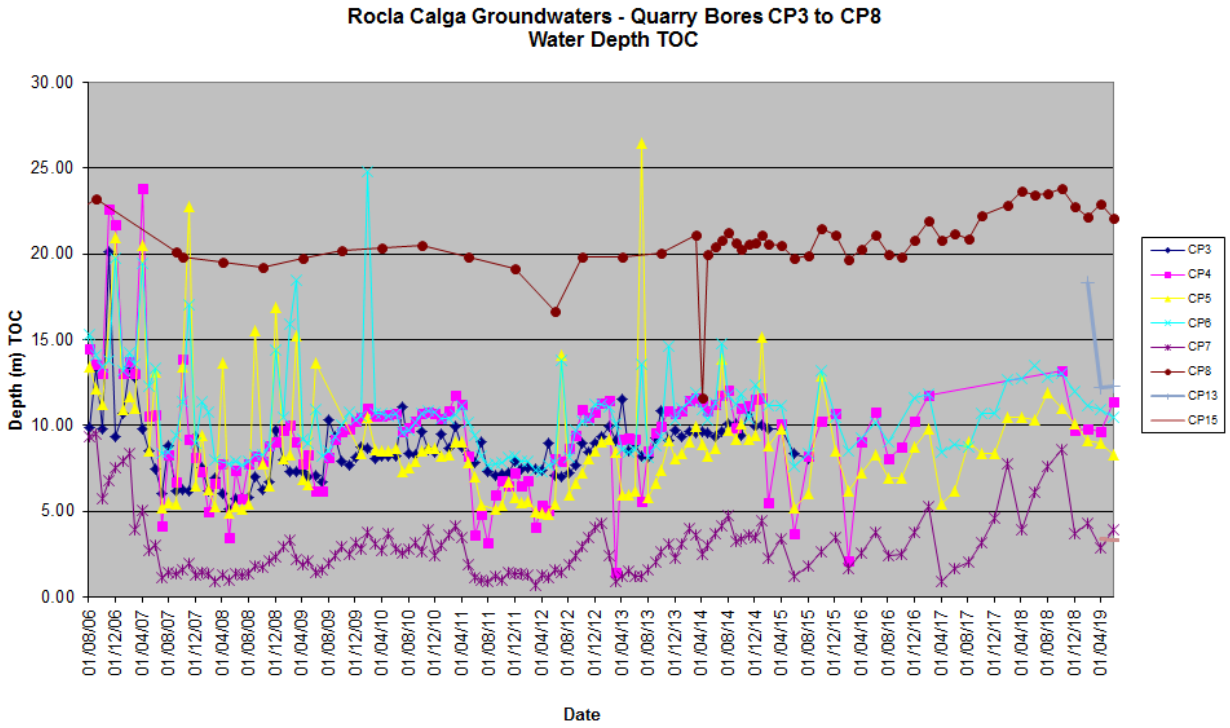
	Increase to ground water depth (water moved away from surface)
	Decrease to ground water depth (water moved towards surface)
	Stable water depth (+/- 0.01m)

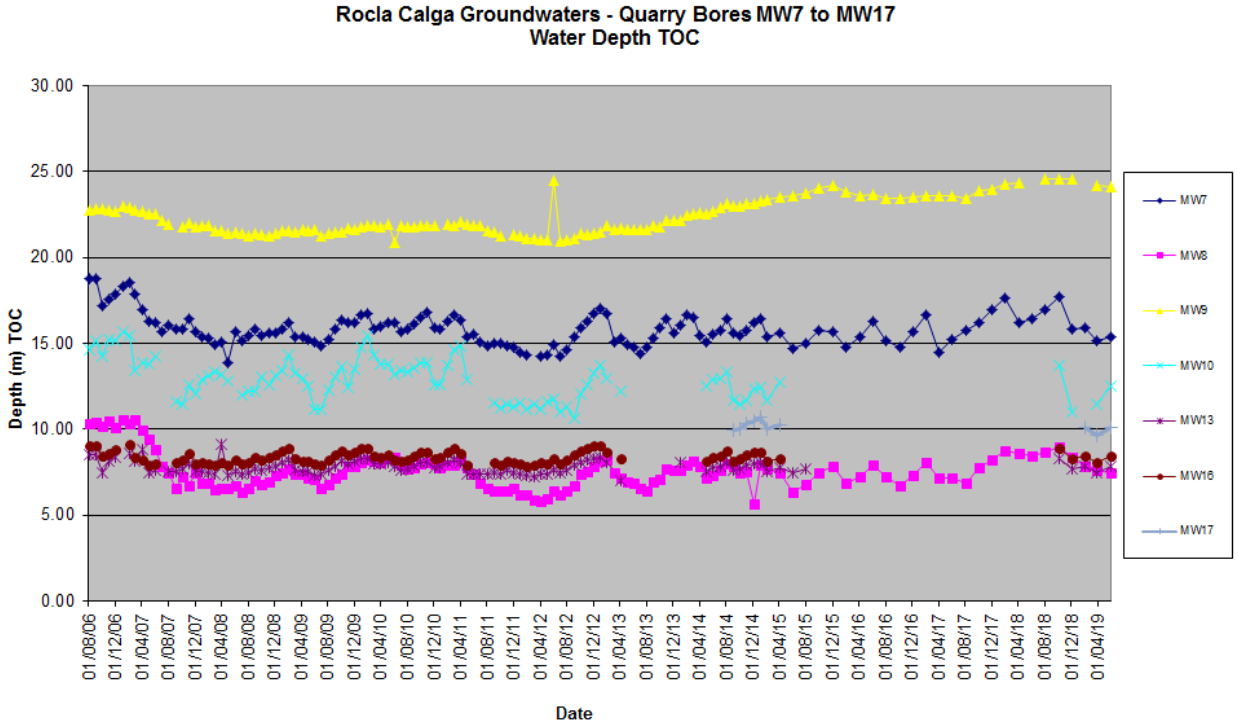
Available groundwater loggers were downloaded and will be forwarded to the Hanson Calga Quarry groundwater consultant.

Figures 3 to 6: Groundwater Depth Charts.






Rocla Calga Groundwaters - Quarry Bores CP3 to CP8
Water Depth TOC
Depth (m) TOC
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Date
CP3
CP4
CP5
CP6
CP7
CP8
CP13
CP15


Rocla Calga Groundwaters - Quarry Bores MW7 to MW17
Water Depth TOC
Depth (m) TOC
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Date
MW7
MW8
MW9
MW10
MW13
MW16
MW17

2.4 Meteorological Monitoring

The Calga Quarry weather station data recovery in May 2019 was approximately 100%.

The weather station data follows and includes;

- Monthly data numerical summary;
- Weather charts of air temperature, humidity, heat index and wind chill, atmospheric pressure, solar radiation, evapotranspiration, rain, wind speed and data reception; and
- Wind rose (frequency distribution diagram of wind speed and direction).

An annual calibration was undertaken on the weather station during September 2018 and is next due in September 2019.

Monthly weather statistics from the nearby Bureau of Meteorology (BOM) at Peats Ridge station are no longer available. However, the long-term rainfall mean is available via a link on the Gosford BOM Daily Weather Observation page.

Data for May 2019 shows that rainfall recorded at the Calga Quarry was below the Gosford BOM mean rainfall and well below the Peats Ridge long term rainfall for May.

The rainfall comparison is provided below:

Calga Quarry	6.0 mm
BOM Peats Ridge*	NA
BOM Gosford*	17.6 mm
BOM Peats Ridge Long term mean for May*	89.7 mm

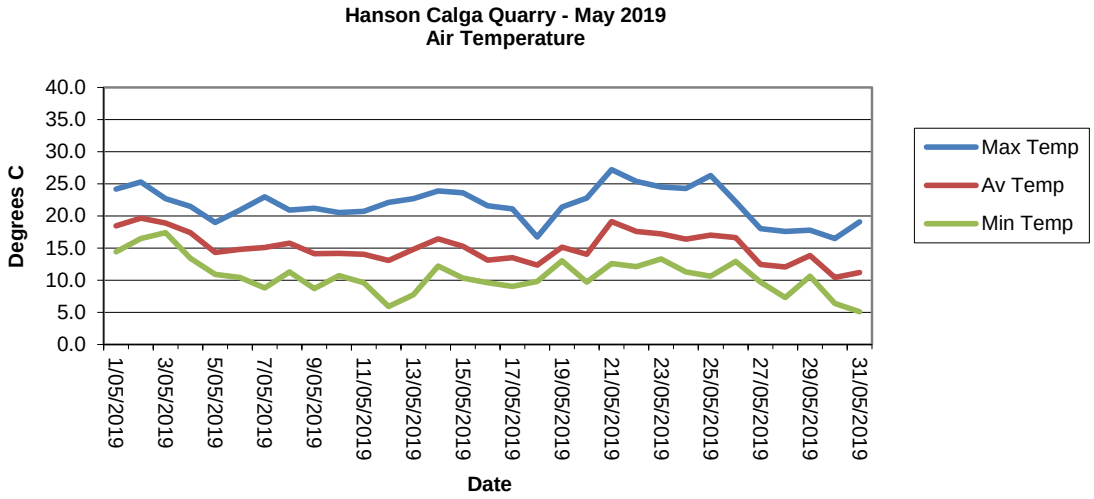
NA = Not Available
*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

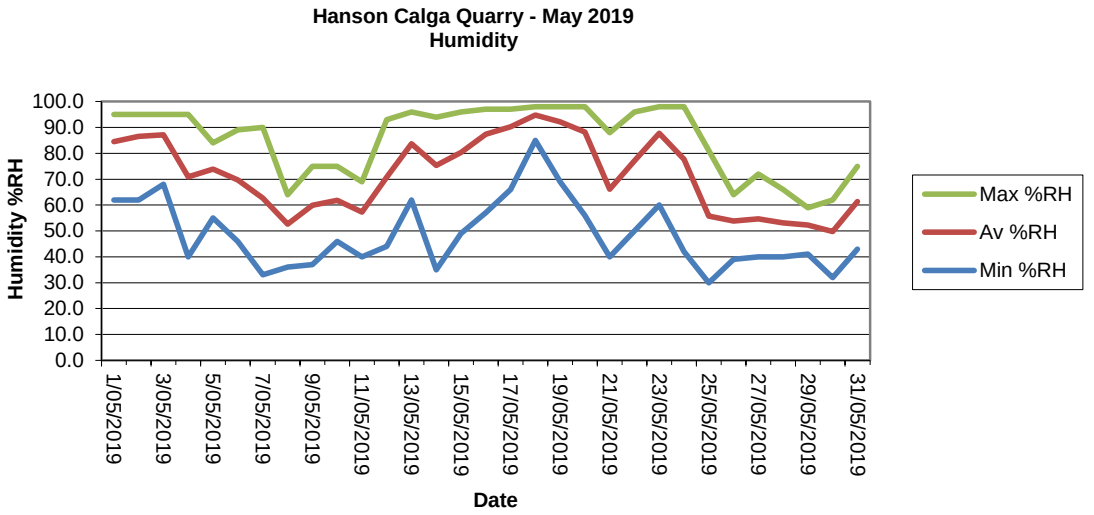
2.4.1 Monthly Meteorological Data Summary

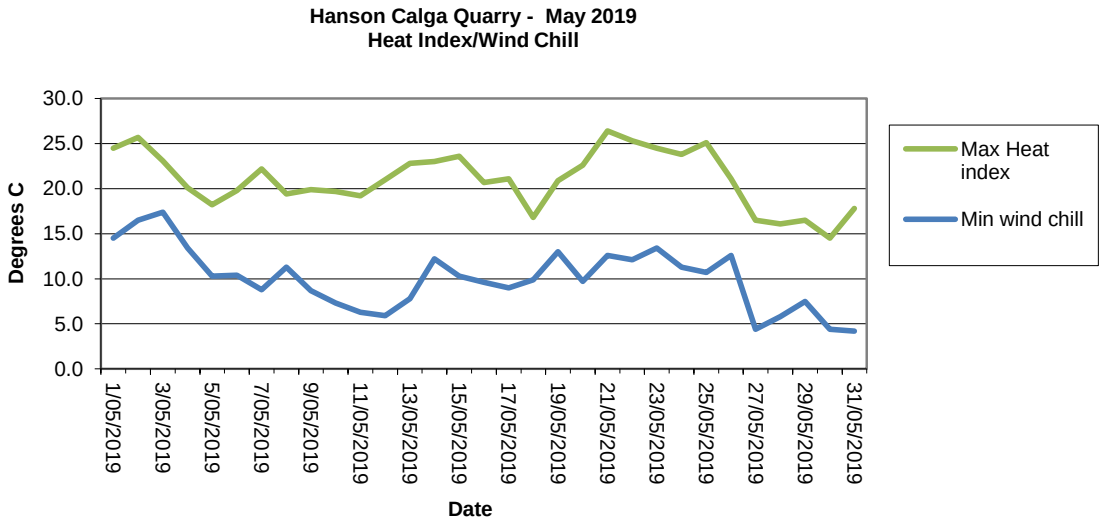
Summary May-19 Hanson - Calga

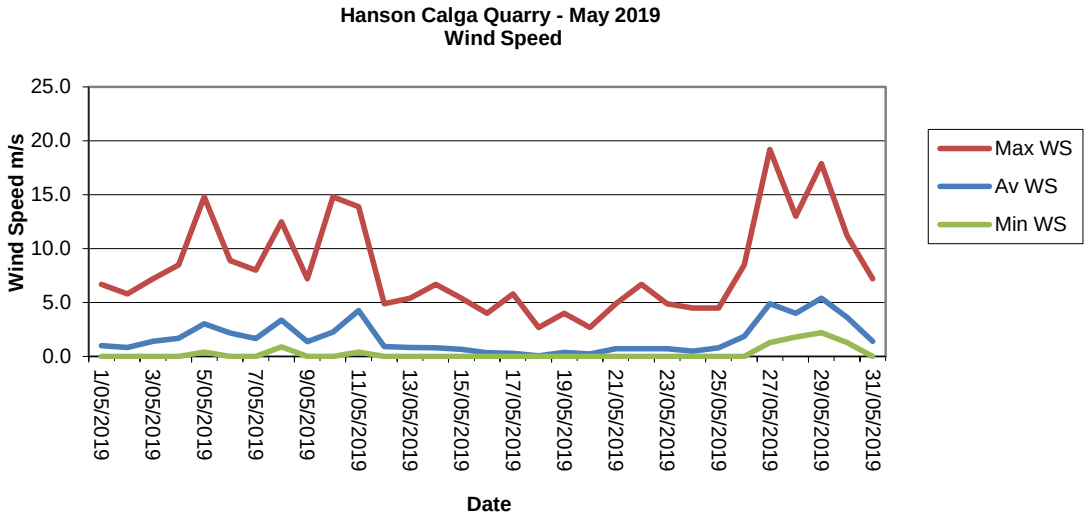
Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	ET mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Solar Rad	Av Solar Rad	Max Solar Rad	Min Data %	Av data %	Max Data %
1/05/2019	14.4	18.4	24.2	62.0	84.6	95.0	0.0	1.3	0.0	1.0	6.7	14.5	24.5	1016.0	1018.4	1020.1	0.0	75.2	634.0	0.0	76.6	100.0
2/05/2019	16.5	19.6	25.3	62.0	86.5	95.0	0.0	1.5	0.0	0.8	5.8	16.5	25.7	1018.2	1020.0	1022.6	0.0	88.4	621.0	0.0	65.4	87.7
3/05/2019	17.4	18.9	22.7	68.0	87.1	95.0	4.4	1.0	0.0	1.4	7.2	17.4	23.1	1011.6	1014.6	1018.0	0.0	42.5	361.0	45.7	71.5	86.8
4/05/2019	13.4	17.4	21.5	40.0	70.9	95.0	0.0	2.6	0.0	1.7	8.5	13.4	20.1	1010.2	1011.9	1014.5	0.0	126.7	703.0	35.3	66.0	84.9
5/05/2019	10.9	14.3	19.0	55.0	73.9	84.0	0.4	2.7	0.4	3.0	14.8	10.3	18.2	1012.8	1014.2	1015.4	0.0	121.3	774.0	26.8	49.5	75.7
6/05/2019	10.4	14.8	20.9	46.0	69.7	89.0	0.0	3.2	0.0	2.2	8.9	10.4	19.8	1012.5	1014.2	1016.0	0.0	164.8	645.0	19.9	39.9	65.0
7/05/2019	8.8	15.1	23.0	33.0	62.6	90.0	0.0	3.1	0.0	1.7	8.0	8.8	22.2	1008.7	1011.2	1013.5	0.0	162.5	659.0	0.0	37.4	99.1
8/05/2019	11.3	15.7	20.9	36.0	52.6	64.0	0.0	4.4	0.9	3.4	12.5	11.3	19.4	1008.1	1010.6	1015.0	0.0	158.9	693.0	26.5	40.7	74.1
9/05/2019	8.7	14.1	21.2	37.0	59.9	75.0	0.0	3.1	0.0	1.4	7.2	8.7	19.9	1011.3	1014.0	1017.0	0.0	160.8	653.0	26.5	52.0	93.7
10/05/2019	10.7	14.2	20.5	46.0	61.8	75.0	0.0	2.0	0.0	2.3	14.8	7.3	19.7	1008.7	1011.1	1013.4	0.0	74.9	669.0	0.0	49.6	100.0
11/05/2019	9.6	14.1	20.7	40.0	57.3	69.0	0.0	4.2	0.4	4.3	13.9	6.3	19.2	1010.7	1015.4	1022.2	0.0	150.8	634.0	18.9	38.4	65.3
12/05/2019	5.9	13.1	22.1	44.0	70.8	93.0	0.0	2.7	0.0	0.9	4.9	5.9	21.0	1021.8	1023.9	1026.1	0.0	157.9	621.0	27.4	47.4	59.6
13/05/2019	7.7	14.8	22.7	62.0	83.7	96.0	0.0	2.0	0.0	0.8	5.4	7.8	22.8	1022.8	1024.9	1027.7	0.0	120.4	745.0	44.5	70.7	94.0
14/05/2019	12.2	16.4	23.9	35.0	75.4	94.0	0.0	2.7	0.0	0.8	6.7	12.2	23.0	1022.0	1023.7	1025.9	0.0	156.1	621.0	28.7	68.4	94.3
15/05/2019	10.3	15.3	23.6	49.0	80.3	96.0	0.0	2.3	0.0	0.7	5.4	10.3	23.6	1024.6	1026.1	1027.8	0.0	166.8	665.0	0.0	46.3	100.0
16/05/2019	9.6	13.1	21.6	57.0	87.3	97.0	0.0	0.4	0.0	0.3	4.0	9.6	20.7	1022.7	1024.7	1026.5	0.0	46.9	612.0	0.0	13.5	56.2
17/05/2019	9.0	13.5	21.1	66.0	90.3	97.0	0.0	0.2	0.0	0.3	5.8	9.0	21.1	1022.3	1024.0	1025.5	0.0	15.5	325.0	0.0	16.7	88.3
18/05/2019	9.8	12.3	16.7	85.0	94.7	98.0	0.0	0.3	0.0	0.1	2.7	9.9	16.8	1024.8	1026.4	1027.9	0.0	62.1	443.0	0.0	16.8	57.7
19/05/2019	13.0	15.2	21.4	69.0	92.2	98.0	0.6	0.8	0.0	0.4	4.0	13.0	20.9	1025.3	1026.6	1028.7	0.0	44.5	654.0	0.0	13.5	28.1
20/05/2019	9.7	14.0	22.8	56.0	88.2	98.0	0.0	0.8	0.0	0.2	2.7	9.7	22.6	1020.6	1023.2	1025.4	0.0	93.3	589.0	0.0	12.9	52.1
21/05/2019	12.6	19.1	27.2	40.0	66.2	88.0	0.0	2.6	0.0	0.7	4.9	12.6	26.4	1019.4	1021.4	1022.8	0.0	162.5	581.0	0.0	44.6	81.7
22/05/2019	12.1	17.6	25.4	50.0	77.1	96.0	0.0	2.5	0.0	0.7	6.7	12.1	25.3	1022.3	1023.6	1024.9	0.0	128.3	637.0	55.8	79.3	100.0
23/05/2019	13.3	17.2	24.5	60.0	87.8	98.0	0.0	1.8	0.0	0.7	4.9	13.4	24.5	1021.3	1023.3	1025.5	0.0	111.2	650.0	73.2	88.7	100.0
24/05/2019	11.3	16.4	24.3	42.0	77.7	98.0	0.0	2.3	0.0	0.5	4.5	11.3	23.8	1016.9	1019.3	1021.7	0.0	134.4	574.0	63.1	84.2	100.0
25/05/2019	10.6	17.0	26.3	30.0	55.8	81.0	0.0	2.9	0.0	0.8	4.5	10.7	25.1	1012.3	1015.2	1018.0	0.0	143.8	583.0	70.3	86.6	93.4
26/05/2019	12.9	16.6	22.2	39.0	53.9	64.0	0.0	2.9	0.0	1.9	8.5	12.6	21.1	1008.7	1010.8	1013.1	0.0	107.8	597.0	79.2	86.1	95.3
27/05/2019	9.7	12.5	18.0	40.0	54.7	72.0	0.6	3.7	1.3	4.9	19.2	4.4	16.5	1003.1	1007.4	1011.5	0.0	103.8	574.0	66.6	82.9	100.0
28/05/2019	7.3	12.0	17.6	40.0	53.1	66.0	0.0	3.7	1.8	4.0	13.0	5.8	16.1	1007.2	1009.6	1011.5	0.0	138.8	570.0	46.7	74.8	98.7
29/05/2019	10.6	13.8	17.8	41.0	52.3	59.0	0.0	4.7	2.2	5.4	17.9	7.5	16.5	1000.9	1004.3	1008.4	0.0	140.2	614.0	60.9	74.5	100.0
30/05/2019	6.4	10.4	16.5	32.0	49.8	62.0	0.0	3.7	1.3	3.6	11.2	4.4	14.5	1008.2	1013.8	1019.0	0.0	139.8	574.0	72.6	81.9	94.6
31/05/2019	5.1	11.2	19.1	43.0	61.4	75.0	0.0	2.6	0.0	1.4	7.2	4.2	17.8	1017.5	1019.5	1022.7	0.0	134.4	556.0	49.2	83.4	94.0
Monthly	5.1	15.1	27.2	30	72	98	6.0	74.4	0	1.7	19.2	4.2	26.4	1000.9	1017.7	1028.7	0	117.3	774	0	56.8	100

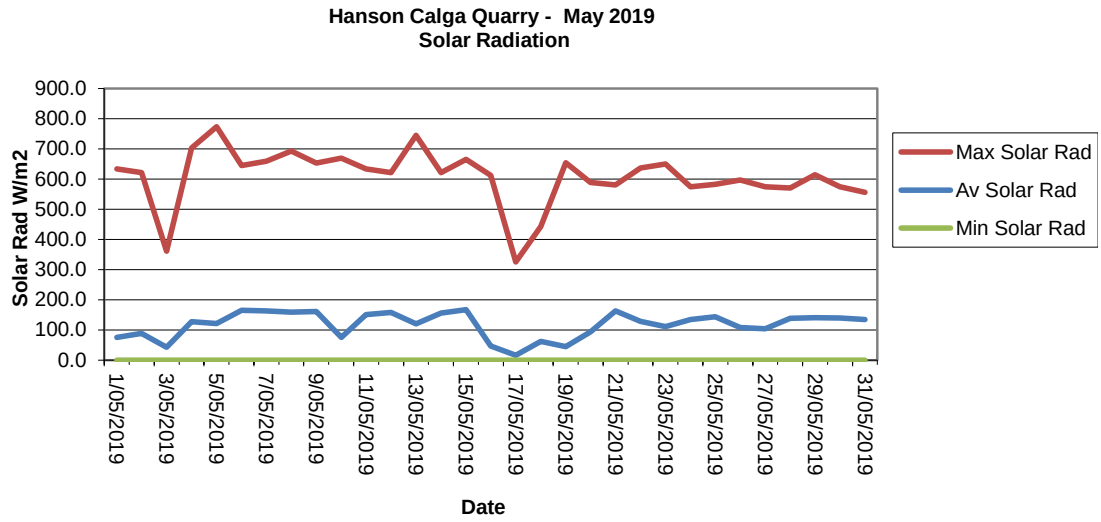
2.4.2 Monthly Weather Charts

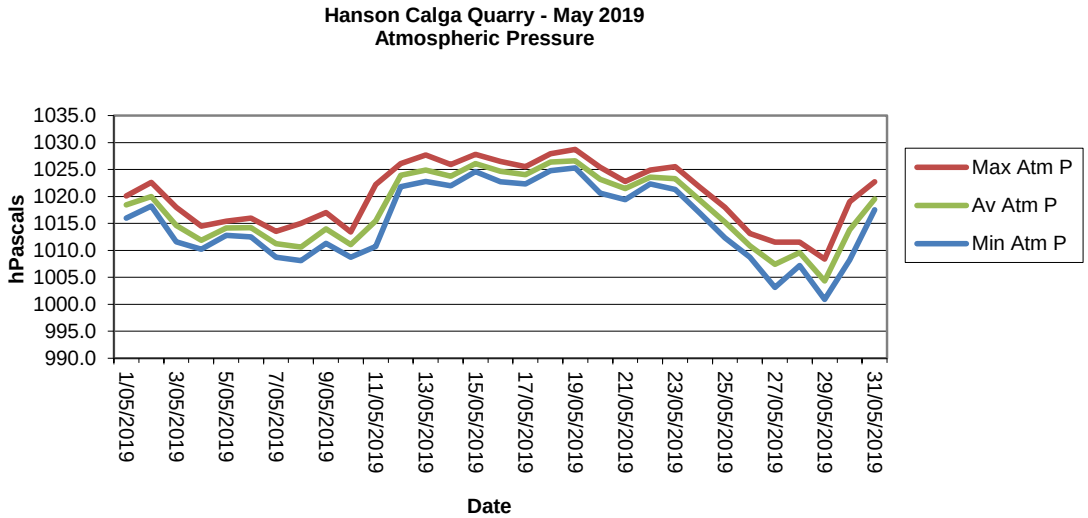


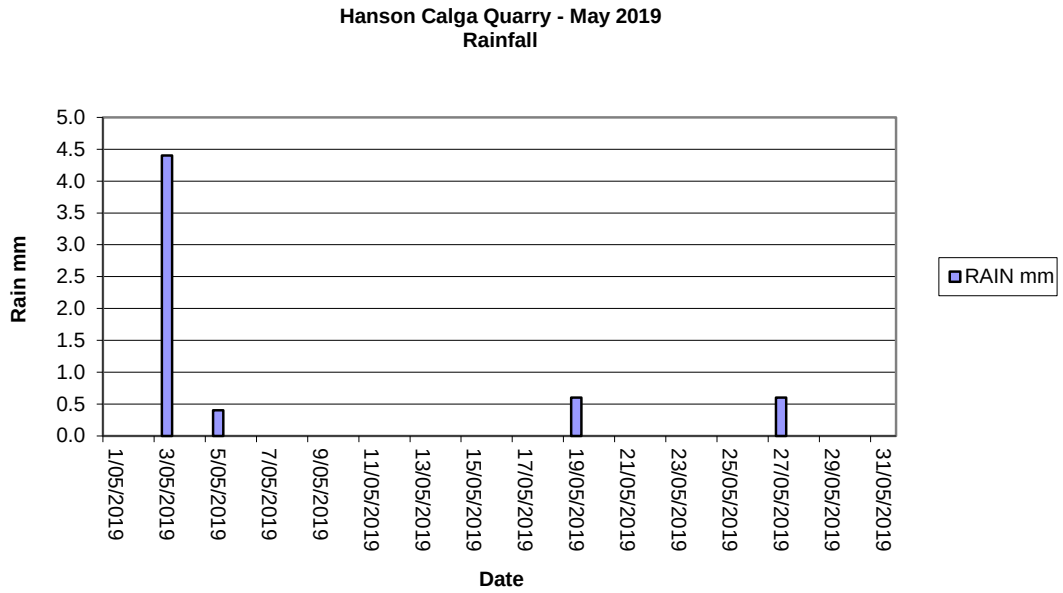


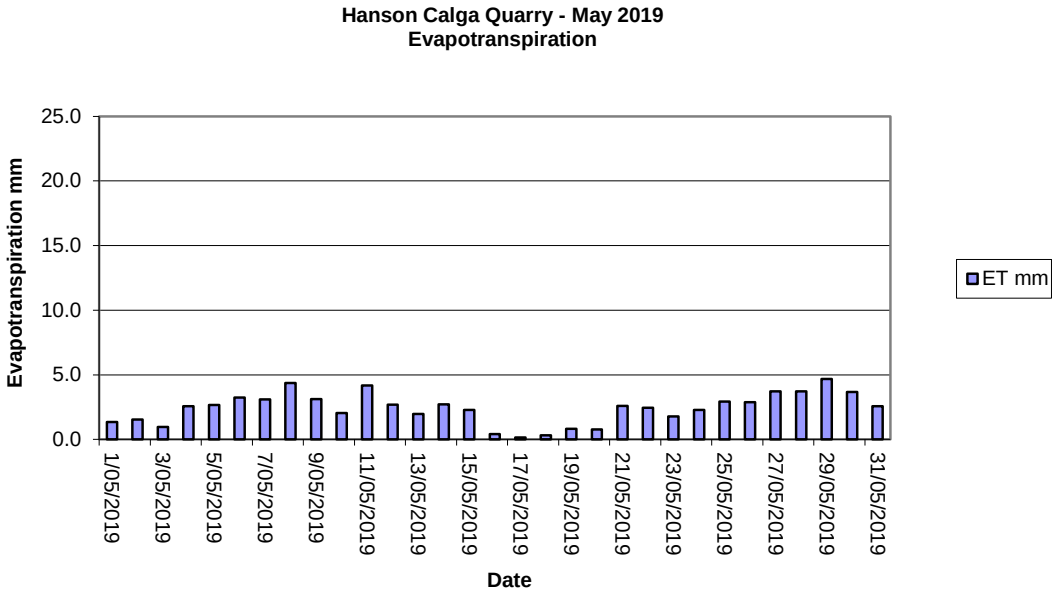


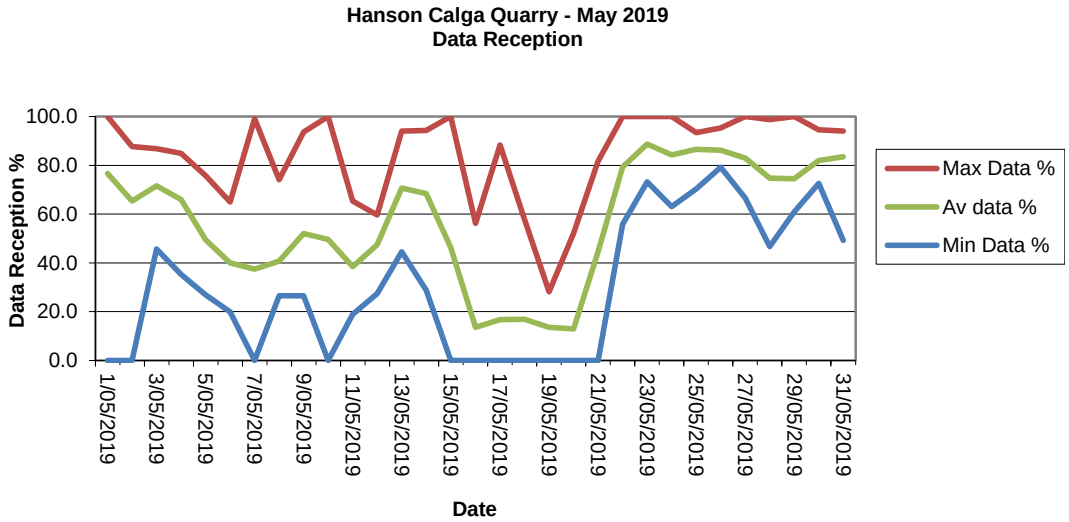

Hanson Calga Quarry - May 2019
Wind Speed
Wind Speed m/s
25.0
20.0
15.0
10.0
5.0
0.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
Max WS
Av WS
Min WS


Hanson Calga Quarry - May 2019
Solar Radiation
Solar Rad W/m2
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
Max Solar Rad
Av Solar Rad
Min Solar Rad


Hanson Calga Quarry - May 2019
Atmospheric Pressure
hPascals
1035.0
1030.0
1025.0
1020.0
1015.0
1010.0
1005.0
1000.0
995.0
990.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
Max Atm P
Av Atm P
Min Atm P

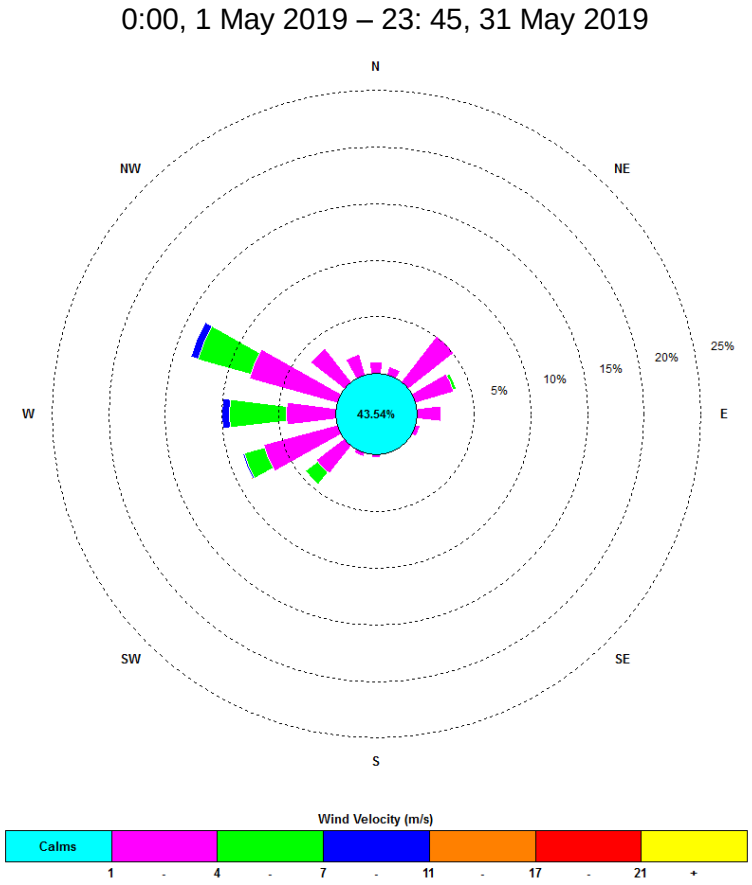

Hanson Calga Quarry - May 2019
Rainfall
Rain mm
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
RAIN mm


Hanson Calga Quarry - May 2019
Evapotranspiration
Evapotranspiration mm
25.0
20.0
15.0
10.0
5.0
0.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
ET mm


Hanson Calga Quarry - May 2019
Data Reception
Data Reception %
100.0
80.0
60.0
40.0
20.0
0.0
1/05/2019
3/05/2019
5/05/2019
7/05/2019
9/05/2019
11/05/2019
13/05/2019
15/05/2019
17/05/2019
19/05/2019
21/05/2019
23/05/2019
25/05/2019
27/05/2019
29/05/2019
31/05/2019
Date
Max Data %
Av data %
Min Data %

2.4.3 Monthly Windrose Plot

Frequency plot of the average wind speed and average direction over each 15-minute sampling period. Wind is considered to be calm when at less than a 15-minute average of 1m/s.



The predominant winds were from the WNW, with most frequent, strongest winds from the WNW. The maximum wind speed was 19.2 m/s from the SW.

Appendix 1

Field Sheets

Chain of Custody

Laboratory Certificates

DEPOSITIONAL DUST MONITORING

Client: ..... **Hanson Calga Quarry** ..... Date Installed: 29-4-19

Date Collected: 30-5-19

Sampled By: Leesa + Jones

Site	Time Collected	Water Level (mL)	Insoluble Material (✓ = slight, ✓✓ = mod etc)				Water Turbidity	Water Colour	Stand Level (Y/N)	Funnel Level (Y/N)	New Funnel Diameter (mm)	Comments
			Insects	Bird droppings	Vegetation	Dust						
CD1	12.35	100ml	✓✓			✓	C S T	C O Bn Gn Gy	Y	Y		
CD2C	2.10	100ml	✓		✓	✓	C S T	C O Bn Gn Gy	Y	Y		
CD3	9.10	200ml	✓		✓	✓	C S T	C O Bn Gn Gy	Y	Y		
CD4	10.20	200ml	✓		✓✓	✓	C S T	C O Bn Gn Gy	Y	Y		
CD5	10.45	200ml	✓		✓		C S T	C O Bn Gn Gy	Y	Y		
CD6	11.10	200ml	✓		✓	✓	C S T	C O Bn Gn Gy	Y	Y		

Turbidity: C=Clear, S= Slight, T=Turbid (CIRCLE)

Colour: C=Colourless, O=Orange, Bn=Brown, Gn=Green, Gy = Grey (CIRCLE)

Report broken funnels and replacement diameters

Signed: LK

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: CBased Environmental Pty Ltd	LABORATORY BATCH NO.:
POSTAL ADDRESS: 47 Boomerang St CESSNOCK NSW 2325	SAMPLERS:CBased Environmental Pty Ltd
SEND REPORT TO: monitoringresults@cbased.com.au SEND INVOICE TO: accounts@cbased.com.au, renae.mikka@cbased.com.au	PHONE: 0265713334 E-MAIL: monitoringresults@cbased.com.au
DATA NEEDED BY: 7 working days REPORT NEEDED BY: 7 working days	REPORT FORMAT: HARD: Yes FAX: DISK: BULLETIN BOARD: E-MAIL: Yes
PROJECT ID: Hanson Calga Dusts QUOTE NO.: SYBQ 222-16	QC LEVEL: QCS1: QCS2: QCS3: Yes QCS4:
P.O. NO.: COMMENTS/SPECIAL HANDLING/STORAGE OR DIPOSAL:	ANALYSIS REQUIRED
FOR LAB USE ONLY COOLER SEAL Yes ..... No ..... Broken ..... Intact ..... COOLER TEMP: deg C Total unless specified	Insoluable Solids; Ash Residue; Combustable Matte; NOTES

SAMPLE DATA				CONTAINER DATA					
SAMPLE ID	MATRIX	DATE ON	DATE OFF	TYPE & PRESERVATIVE	NO.				
CD1	Dust	29.4.19	30.5.19			x	x	x	
CD2c	Dust	"	"			x	x	x	
CD3	Dust	"	"			x	x	x	
CD4	Dust	"	"			x	x	x	
CD5	Dust	"	"			x	x	x	
CD6	Dust	"	"			x	x	x	

Environmental Division
Newcastle
Work Order Reference
EN1903801

Telephone : +61 2 4014 2500

RELINQUISHED BY:		RECEIVED BY		
NAME: Leesa King	DATE: 30.5.19	NAME:	DATE: 31/5/19	METHOD OF SHIPMENT
OF: CBased Environmental	TIME: 17.00	OF:	TIME: 2-25pm	CONSIGNMENT NOTE NO.
NAME:	DATE:	NAME:	DATE:	TRANSPORT CO. NAME.
OF:	TIME:	OF:	TIME:	

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

AUSTRALIAN LABORATORY SERVICES P/L

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1903801**	Page	: 1 of 4
Client	: **CBASED ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: All Deliverables	Contact	:
Address	: Unit 3 2 Enterprise Cres Singleton NSW 2330	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 6571 3334	Telephone	: +61 2 4014 2500
Project	: Hanson Calga Dusts	Date Samples Received	: 31-May-2019 14:25
Order number	: ----	Date Analysis Commenced	: 04-Jun-2019
C-O-C number	: ----	Issue Date	: 07-Jun-2019 16:32
Sampler	: CARBON BASED ENVIRONMENTAL PTY LTD		
Site	:		
Quote number	: SYBQ/222/16 and PLANNED EVENTS		
No. of samples received	: 6		
No. of samples analysed	: 6		

ilac-MRA NATA
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.

Signatories	*Position*	*Accreditation Category*
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)

Compound	CAS Number	LOR	Unit	Client sample ID	CD1 29/04/19 - 30/05/19	CD2c 29/04/19 - 30/05/19	CD3 29/04/19 - 30/05/19	CD4 29/04/19 - 30/05/19	CD5 29/04/19 - 30/05/19
				Client sampling date / time	30-May-2019 00:00	30-May-2019 00:00	30-May-2019 00:00	30-May-2019 00:00	30-May-2019 00:00
					EN1903801-001	EN1903801-002	EN1903801-003	EN1903801-004	EN1903801-005
					Result	Result	Result	Result	Result
EA120: Ash Content									
Ash Content	----	0.1	g/m².month		**0.9**	**0.4**	**0.8**	**0.2**	**0.3**
Ash Content (mg)	----	1	mg		**16**	**7**	**14**	**4**	**6**
EA125: Combustible Matter									
Combustible Matter	----	0.1	g/m².month		**0.1**	**0.2**	**0.2**	<0.1	<0.1
Combustible Matter (mg)	----	1	mg		**3**	**4**	**4**	<1	<1
EA141: Total Insoluble Matter									
Total Insoluble Matter	----	0.1	g/m².month		**1.0**	**0.6**	**1.0**	**0.2**	**0.3**
Total Insoluble Matter (mg)	----	1	mg		**19**	**11**	**18**	**4**	**6**

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)				Client sample ID	**CD6 29/04/19 - 30/05/19**	**----**	**----**	**----**	**----**
				Client sampling date / time	30-May-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EN1903801-006**	**--------**	**--------**	**--------**	**--------**
					Result	----	----	----	----
EA120: Ash Content									
Ash Content	----	0.1	g/m².month		**0.7**	**----**	**----**	**----**	**----**
Ash Content (mg)	----	1	mg		**13**	**----**	**----**	**----**	**----**
EA125: Combustible Matter									
Combustible Matter	----	0.1	g/m².month		**0.3**	**----**	**----**	**----**	**----**
Combustible Matter (mg)	----	1	mg		**6**	**----**	**----**	**----**	**----**
EA141: Total Insoluble Matter									
Total Insoluble Matter	----	0.1	g/m².month		**1.0**	**----**	**----**	**----**	**----**
Total Insoluble Matter (mg)	----	1	mg		**19**	**----**	**----**	**----**	**----**

CBased Environmental Pty Limited

Date: 30.5.19

Todays Collection	
Time Start:	8.45
Time Finish:	1.35

SURFACE WATERS

Client : Hanson Calga

Project :

Site	Flow Rate	Odour	Sampling Time	Bottles	Water Turbidity	Water Colour	Comments
A	DAM	NO	9.55	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
B	~~DAM~~	~~NO~~	8.40	~~1x 250ml GP, 1x 500mL GP, 1x PG~~	~~C S T~~	~~C LO O B G~~	DRY / no flow
C1	DAM	NO	1.30	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
C2	~~DAM~~	~~NO~~	1.35	~~1x 250ml GP, 1x 500mL GP, 1x PG~~	~~C S T~~	~~C LO O B G~~	DRY / no flow
D	~~DAM~~ DRY	~~NO~~	11.15	~~1x 250ml GP, 1x 500mL GP, 1x PG~~	~~C S T~~	~~C LO O B G~~	DRY / no flow
F	DAM	NO	8.45	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	

Turbidity: C=Clear, S= Slight, T=Turbid (CIRCLE)

Colour: C=Clear, LO=Light Orange, O=Orange, B=Brown, G=Green (CIRCLE)

Signed: _____

Sampled by: Leesa + Jonas

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: CBased Environmental Pty Ltd | LABORATORY BATCH NO.:

POSTAL ADDRESS: PO Box 245 CESSNOCK NSW 2325 | SAMPLERS:CBased Environmental Pty Ltd

SEND REPORT TO: monitoringresults@cbased.com.au | SEND INVOICE TO: renae.mikka@cbased.com.au; accounts@cbased.com.au | PHONE: 0265713334 | E-MAIL: monitoringresults@cbased.com.au

DATA NEEDED BY: 5 working days | REPORT NEEDED BY: 5 working days | REPORT FORMAT: HARD: Yes FAX: DISK: BULLETIN BOARD: E-MAIL: Yes

PROJECT ID: Hanson Quarry SW | QUOTE NO.: SYBQ-222-16 | QC LEVEL: QCS1: QCS2: QCS3: Yes QCS4:

P.O. NO.: | COMMENTS/SPECIAL HANDLING/STORAGE OR DIPOSAL:

FOR LAB USE ONLY
COOLER SEAL
Yes 5 No
Broken 0 Intact
COOLER TEMP: deg.C

Total unless specified

SAMPLE DATA				CONTAINER DATA		ANALYSIS REQUIRED																				NOTES
SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	NO.	pH	EC	TSS	TDS	O + G																
A	Water	30-5-19	9-55	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x																
~~B~~	~~Water~~			~~1x 250mlGP,1x 500mLGP,1xPG~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~																
C1	Water	30-5-19	1-30	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x																
~~C2~~	~~Water~~			~~1x 250mlGP,1x 500mLGP,1xPG~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~																
~~D~~	~~Water~~	~~30-5-19~~		~~1x 250mlGP,1x 500mLGP,1xPG~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~																
F	Water	30-5-19	8-45	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x																
				TOTAL BOTTLES:																						

Environmental Division
Sydney
Work Order Reference
ES1916737

Telephone : + 61-2-8784 8555

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
NAME: Leesa King	DATE: 30.5.19	NAME:	DATE: 31/5/19 2-24pm	CONSIGNMENT NOTE NO.
OF: CBased Environmental	TIME: 14.00	OF:	TIME:	
NAME:	DATE:	NAME:	DATE:	TRANSPORT CO. NAME.
OF:	TIME:	OF:	TIME:	

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

AUSTRALIAN LABORATORY SERVICES P/L

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1916737**	Page	: 1 of 2
Client	: **CBASED ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: All Deliverables	Contact	: Customer Services ES
Address	: Unit 3 2 Enterprise Cres Singleton NSW 2330	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 6571 3334	Telephone	: +61-2-8784 8555
Project	: Hanson Quarry SW	Date Samples Received	: 31-May-2019 13:09
Order number	:	Date Analysis Commenced	: 31-May-2019
C-O-C number	: ----	Issue Date	: 07-Jun-2019 13:50
Sampler	: CBased Environmental Pty Ltd		
Site	:		
Quote number	: SYBQ/222/16 and PLANNED EVENTS		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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- 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.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

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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.

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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.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**A**	**C1**	**F**	**----**	**----**
			Client sampling date / time	30-May-2019 09:55	30-May-2019 13:30	30-May-2019 08:45	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1916737-001**	**ES1916737-002**	**ES1916737-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.09**	**6.28**	**5.63**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**77**	**92**	**79**	**----**	**----**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**49**	**52**	**58**	**----**	**----**
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	**10**	<5	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	**----**	**----**

C Based Environmental Pty Limited

Todays Collection	
Time Start:	9.00
Time Finish:	2-00

Date: 30-5-19

GROUNDWATERS

Client : Hanson Calga
Project : Bi-Monthly Bores

Site	DEPTH	Typical Depth (m)	Odour	Water Turbidity	Water Colour	1		2		Downloaded Logger? (Y/N)*	Comments
						pH	EC	pH	EC		
CQ3	10.63	10.94	NO	C S T	C LO O B G	6.54	192.8us	6.53	192.7us	yes	New logger seal
CQ4	11.05	10.52	NO	C S T	C LO O B G	5.70	148.2uS	5.66	149.5uS	yes	
CQ5	7.69	7.06	NO	C S T	C LO O B G	5.24	185.1uS	5.33	184.7uS		
CQ6				C S T	C LO O B G						Covered over in paddock
CQ7	6.58	6.46	No	C S T	C LO O B G	4.53	117.6us	4.51	116.1us	yes	
CQ8	6.69	6.24	NO	C S T	C LO O B G	4.19	152.5us	4.19	151.0us	yes	
CQ9				C S T	C LO O B G						Blocked
CQ10	25.68	26.41	NO	C S T	C LO O B G	4.41	145.1us	4.35	147.9uS	yes	New logger seal
CQ11S	11.74	11.02	yes	C S T	C LO O B G	5.36	163.5us	5.34	161.2us	yes	New logger seal
CQ11D	12.72	12.19	yes	C S T	C LO O B G	4.98	157.5us	5.04	156.8us	yes	
CQ12	5.09	4.44	yes	C S T	C LO O B G	5.68	128.9	5.71	130.4	yes	new logger seal
CQ13	14.23	14.14	NO	C S T	C LO O B G	4.27	175.5uS	4.24	178.3uS	yes	
CP3				C S T	C LO O B G						removed
CP4	11.39			C S T	C LO O B G		large bailer doesn't fit small bailer gets no water Blocked.				
CP5	8.32	8.59	NO	C S T	C LO O B G	5.76	118.9us	5.81	121.7us		
CP6	10.51	10.79	NO	C S T	C LO O B G	5.02	145.8us	4.95	150.9us		
CP7	3.96	3.78	NO	C S T	C LO O B G	5.62	64.8us	5.58	65.5us		
CP8	22.06	22.15	NO	C S T	C LO O B G	4.33	133.1us	4.33	135.7us		
CP13	12.27		NO	C S T	C LO O B G	4.37	179.8uS	4.36	178.7uS		Winston property.
CP15	3.29		NO	C S T	C LO O B G	4.43	135.3uS	4.40	146.4uS		
MW7	15.42	16.11	N	C S T	C LO O B G	4.70	97.1us	4.90	95.5us	yes	new logger seal
MW8	7.46	7.86	N	C S T	C LO O B G	5.14	70.1uS	5.07	68.3uS	yes	
MW9	24.12	23.87	N	C S T	C LO O B G	4.40	108.2us	4.38	118.1us	yes	new logger seal
MW10	12.51		N	C S T	C LO O B G	6.12	148.4uS	6.14	146.0uS	yes	
MW13	7.85		N	C S T	C LO O B G	4.06	115.9uS	4.04	120.5uS		
MW16	8.46		N	C S T	C LO O B G	4.33	115.6us	4.36	115.1us		
MW17	10.08		N	C S T	C LO O B G	4.63	124.1uS	4.58	123.0uS		

*If unable to download logger please provide comment/ explanation above

Turbidity: C=Clear, S= Slight, T=Turbid (CIRCLE)
pH/EC meter #: 8

Colour: C=Clear, LO=Light Orange, O=Orange, B=Brown, G=Green (CIRCLE)

Signed: LKJ

Sampled by: Leesa + Jonas