CBased Environmental Pty Limited
ABN 62 611 924 264

Calga Quarry

Environmental Monitoring

Dust Deposition Gauges, Surface and Ground Waters and Meteorological Station

November 2016

Colin Davies BSc MEIA CEnvP
Environmental Scientist
Date: 23 December 2016

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 November 2016;
- Surface Water quality results for November 2016;
- Ground Water quality results for November 2016; and
- Meteorological report for November 2016.

The November 2016 dust deposition results for insoluble solids were generally low and free of major contamination. 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.

Surface water samples were collected on 2 December 2016 at sites A, C1, C2 and F. Site B and D were dry or not flowing and unable to be sampled this month 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 detected at site C2 in November 2016.

Bi-monthly groundwaters were sampled on 2 December 2016 and bimonthly groundwater is next due for sampling in January 2017. Groundwater depth generally increased compared to September 2016, indicating water moving away from the surface. pH at all sites is in the acidic to neutral range and generally remained varied when compared to the previous results. EC levels were similar or slightly decreased at a majority of groundwater sites when compared to the September 2016 results.

Data for November 2016 shows that rainfall recorded at the Calga Quarry was lower than the Gosford BOM mean rainfall and the Peats Ridge long term rainfall for November.

The rainfall comparison is provided below:

Calga Quarry	39.0 mm
BOM Peats Ridge*	NA
BOM Gosford*	44.0 mm
BOM Peats Ridge Long term mean for November*	100.7 mm

NA = Not Available

*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 November 2016 and the project 12 month rolling average. Results are in g/m^2.month.

Table 1: Dust Deposition results: 1 November 2016 – 2 December 2016 (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	3.3	2.6	0.7	79	1.2
CD2c	1.9	1.0	0.9	53	0.9
CD3	1.5	0.8	0.7	53	1.1
CD4	0.7	0.2	0.5	29	0.6
CD5	1.4	0.3	1.1	21	0.5
CD6	1.0	0.5	0.5	50	0.9

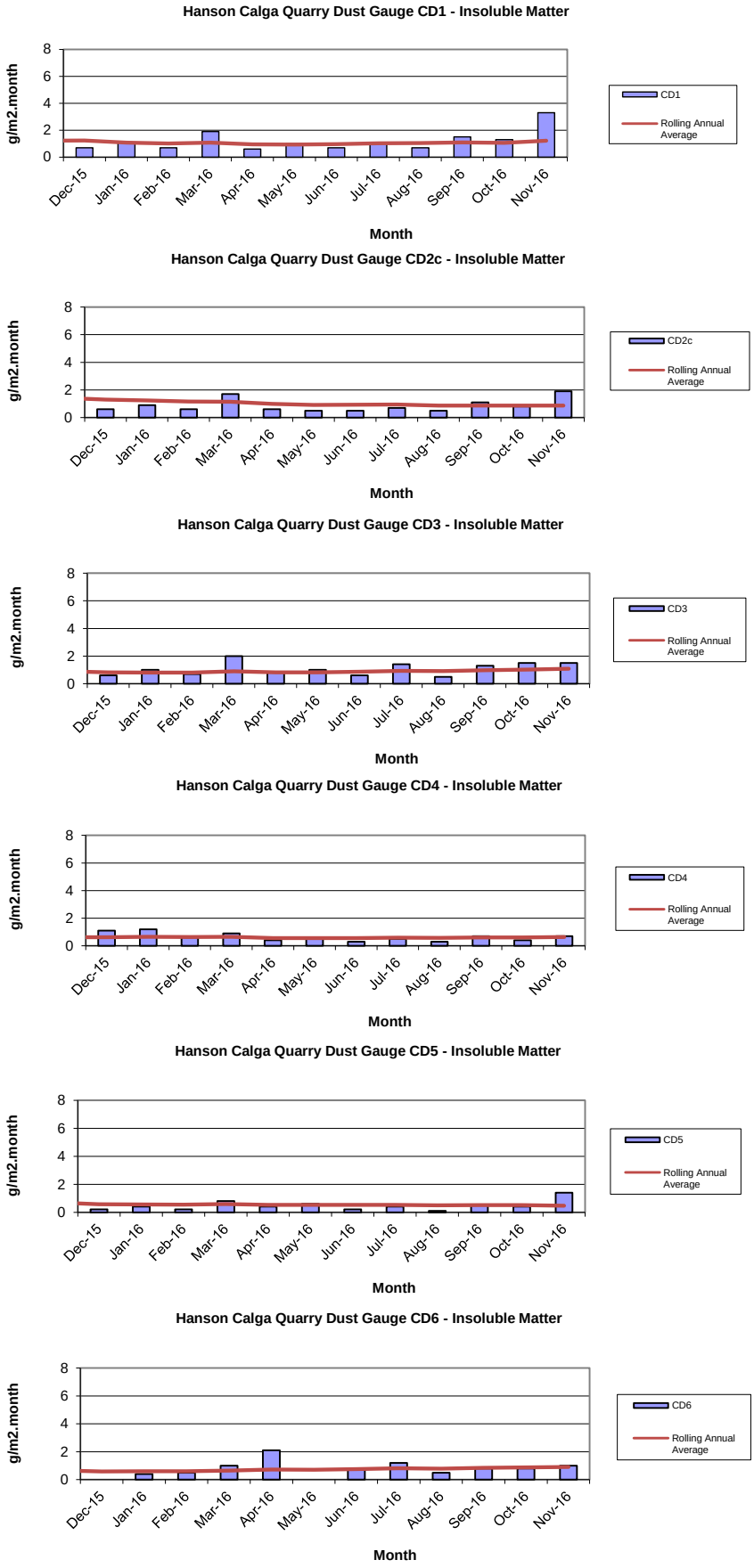
Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects. Results in bold indicate insoluble solids levels above 3.7 g/m^2.month; the Development Consent's annual average amenity criteria at residential locations. The current rolling annual average is calculated from July 2015 to June 2016.

NA= Not Available.

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 2 December 2016 and results are listed in **Table 2**. The laboratory analysis sheets are provided in **Appendix 1.**

Table 2: Monthly surface water monitoring – November 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	7.12	83	82	<5	<5
B	No flow							
C1	Dam	Clear	Clear	6.97	99	70	<5	<5
C2	Trickle	Clear	Clear	6.93	96	66	<5	9
D	Dry							
F	Dam	Clear	Clear	5.90	96	66	<5	<5

Samples were collected at sites A, C1, C2 and F. Site B and D were dry or not flowing and unable to be sampled this month 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 detected at site C2 in November 2016.

2.2.1 Non-Routine Surface Water Sampling

No non routine sampling was undertaken during November 2016.

2.3 Groundwater Monitoring

Bi- monthly groundwaters were sampled on 2 December 2016. Water quality tests for pH and electrical conductivity were conducted by Carbon Based 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 increased compared to September 2016, indicating water moving away from the surface. pH at all sites is in the acidic to neutral range and generally remained varied when compared to the previous results. EC levels were similar or slightly decreased at a majority of groundwater sites when compared to the September 2016 results.

Table 3: Groundwater Quality Data

Reference	Bore	Type	Depth to water TOC (m) April 06	Depth to water TOC (m) This report	pH This report	Electrical Conductivity (µS/cm) This report
CQ1	Voutos	* Monitor	20.59	Removed		
CQ3	Voutos	* Monitor	10.53	10.78	6.9	144
CQ4	Voutos	* Monitor	8.78	10.44	5.3	105
CQ5	Gazzana	DIP Only	8.69	7.35	4.3	172
CQ6	Gazzana	DIP Only	16.00	Removed		
CQ7	Gazzana	* Monitor	6.89	6.49	4.6	91
CQ8	Gazzana	* Monitor	11.03	6.44	4.4	124
CQ9	Gazzana	DIP Only	10.10	Unable to sample- pipe bent		
CQ10	Voutos	* Monitor	NI	25.17	5.0	126
CQ11S	Gazzana	* Monitor	NI	10.56	5.1	130
CQ11D	Gazzana	* Monitor	NI	11.76	5.0	141
CQ12	Gazzana	* Monitor	NI	4.70	4.5	119
CQ13	Kashouli	* Monitor	NI	13.74	4.4	180
CP3	Gazzana	Domestic	10.40	Destroyed		
CP4	Kashouli	Domestic	13.63	10.23	NM	
CP5	Kashouli	Domestic	16.61	8.75	5.0	142
CP6	Kashouli	Domestic	16.27	11.63	4.4	161
CP7	Kashouli	Production	8.56	3.81	5.0	105
CP8	Rozmanec	Domestic	22.17	20.84	4.5	117
MW7	Rocla Bore	* Monitor	15.76	15.66	4.6	103
MW8	Rocla Bore	* Monitor	9.82	7.34	4.5	90
MW9	Rocla Bore	* Monitor	22.44	23.50	4.8	76
MW10	Rocla Bore	* Monitor	15.41	No Access- track eroded		
MW13	Rocla Bore	DIP Only	NI	No Access- track eroded		
MW16	Rocla Bore	DIP Only	NI	No Access- tree across track		
MW17	Rocla Bore	DIP Only		No Access- tree across track		

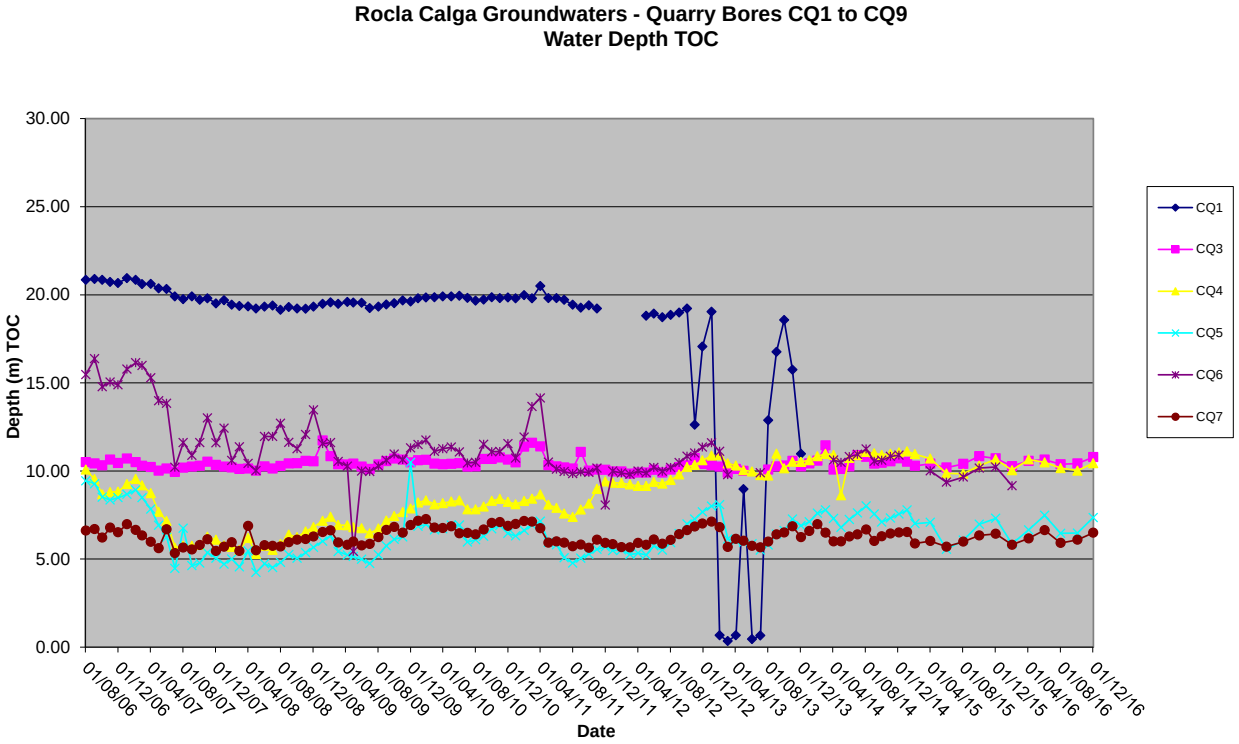
Notes:
TOC = Water level measured from top of bore case to water.
NM = Not Monitored – unable to sample water due to non-operational pump.
NR = Not Required by resident.
* = Logger Installed.
NI = These bores were not installed in April 2006 but are now operational. April 2006 was the first set of measurements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

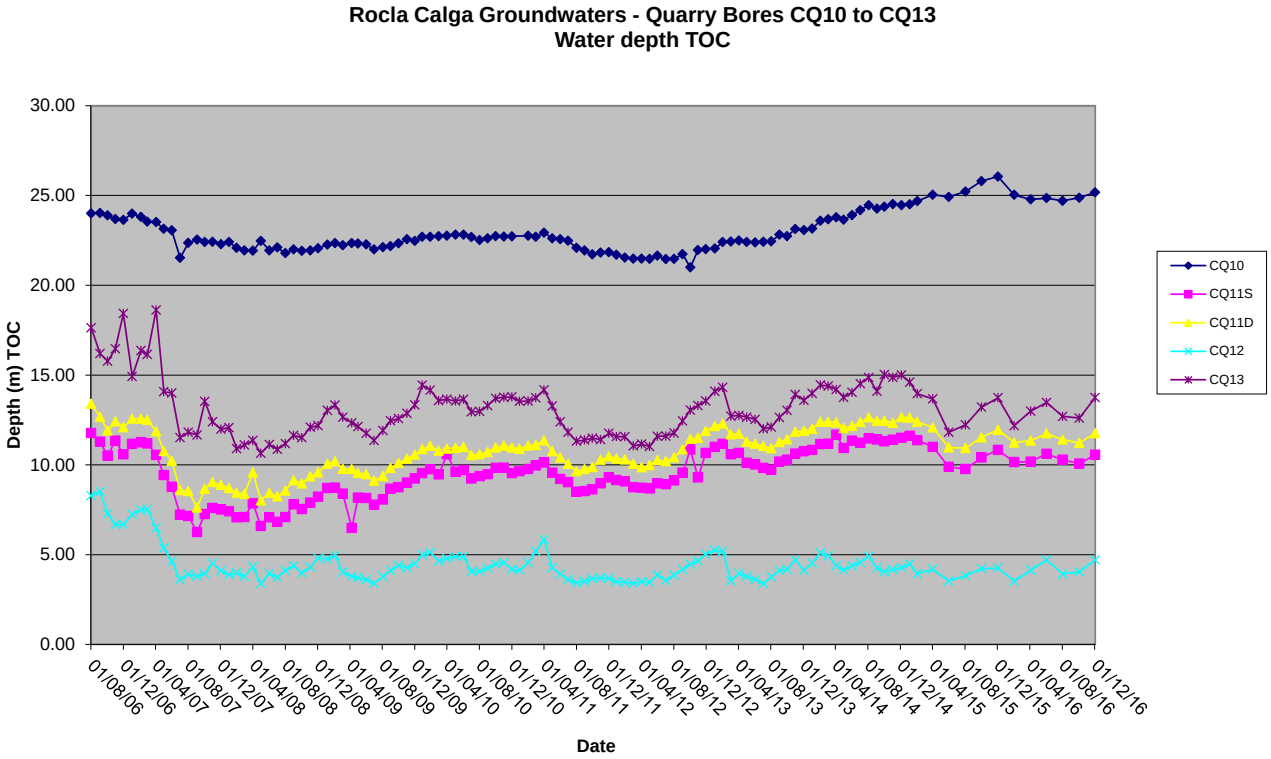
Shading is used to indicate the following trends in water depth (compared to the last reading):

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

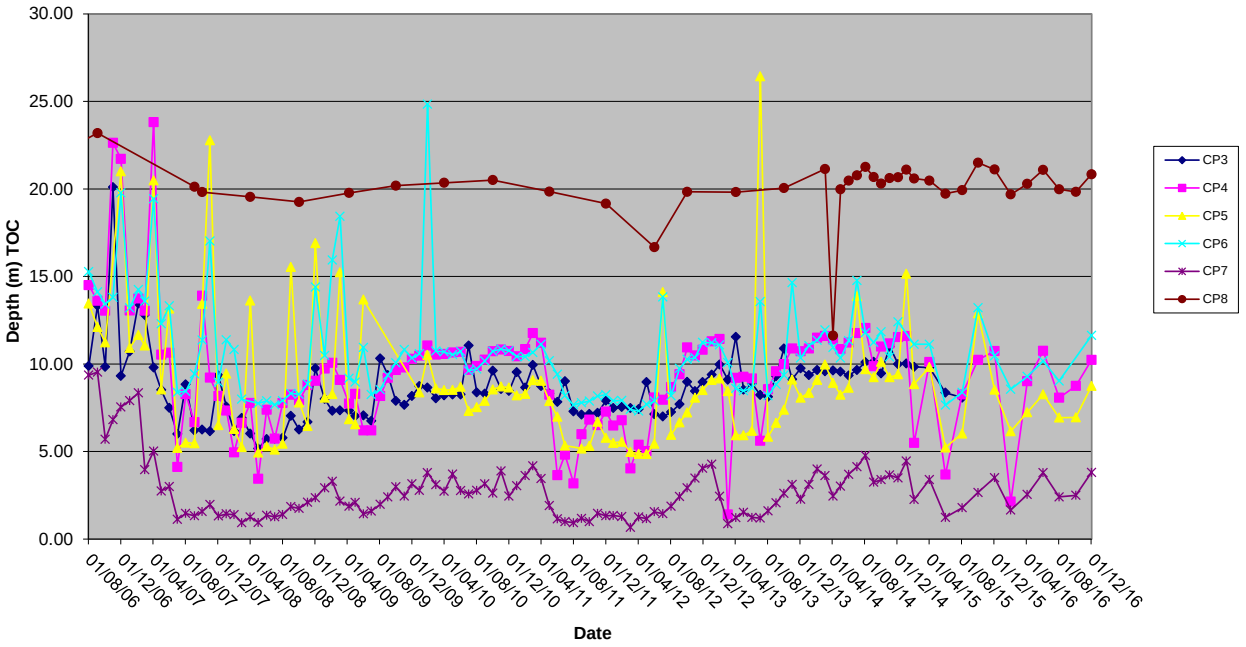
Available groundwater loggers were downloaded and will be forwarded to the Hanson Calga Quarry groundwater consultant.

Figures 3 to 6: Groundwater Depth Charts.

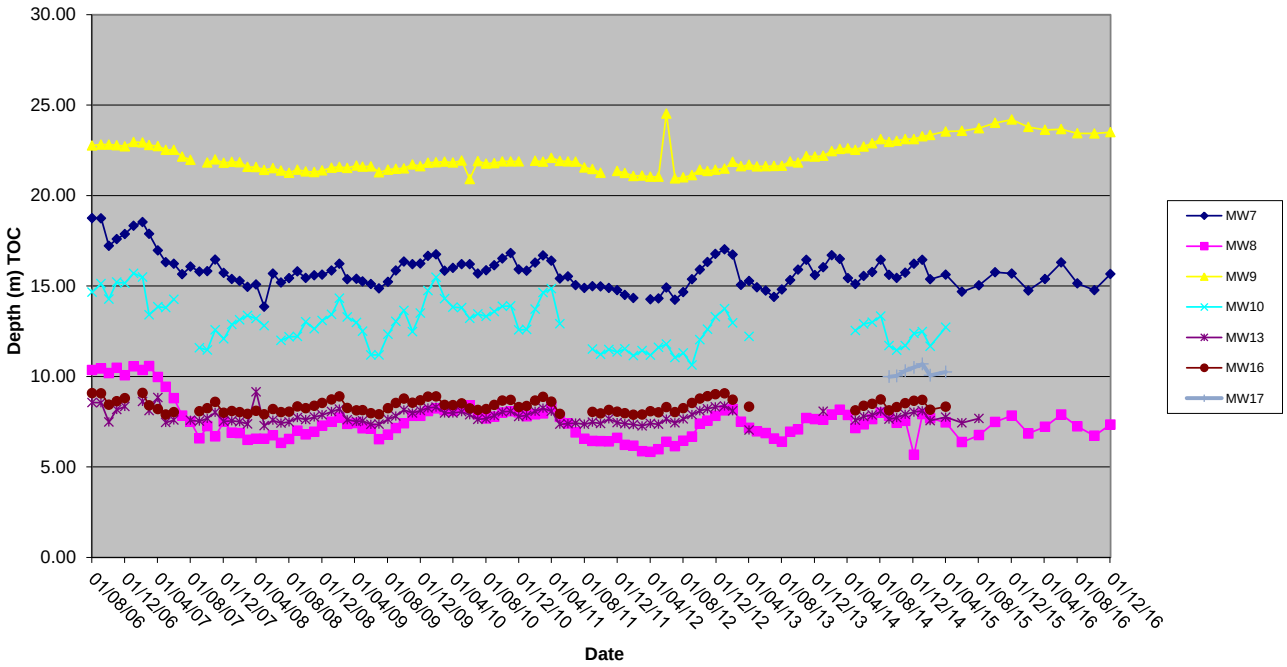




Rocla Calga Groundwaters - Quarry Bores CP3 to CP8
Water Depth TOC



Rocla Calga Groundwaters - Quarry Bores MW7 to MW17
Water Depth TOC



2.4 Meteorological Monitoring

The Calga Quarry weather station data recovery in November 2016 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).

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 November 2016 shows that rainfall recorded at the Calga Quarry was lower than the Gosford BOM mean rainfall and the Peats Ridge long term rainfall for November.

The rainfall comparison is provided below:

Calga Quarry	39.0 mm
BOM Peats Ridge*	NA
BOM Gosford*	44.0 mm
BOM Peats Ridge Long term mean for November*	100.7 mm

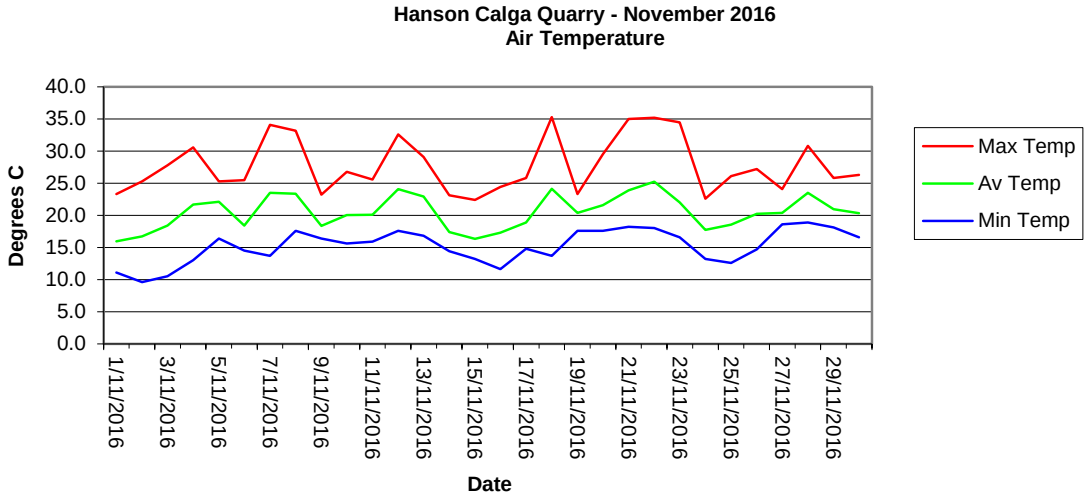
NA = Not Available
*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

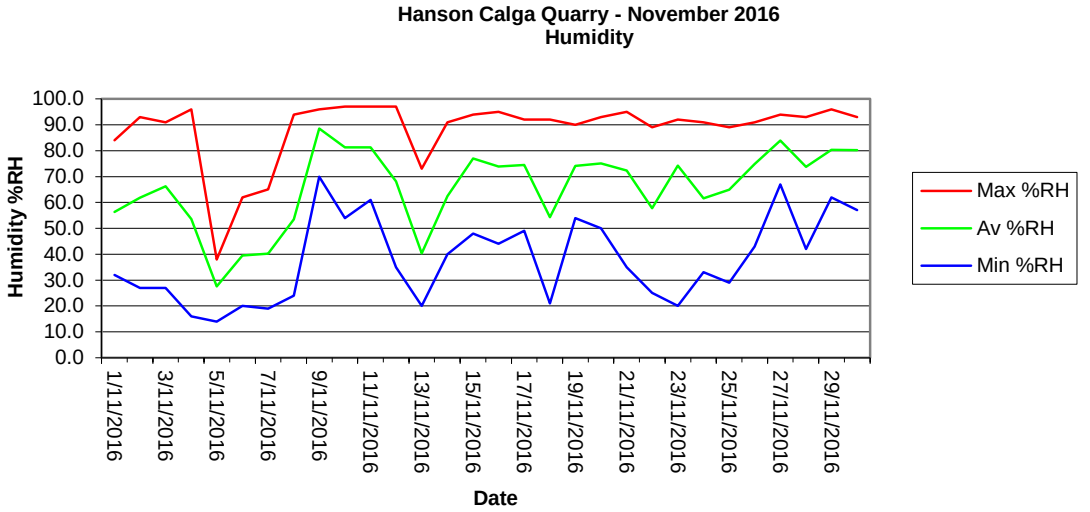
2.4.1 Monthly Meteorological Data Summary

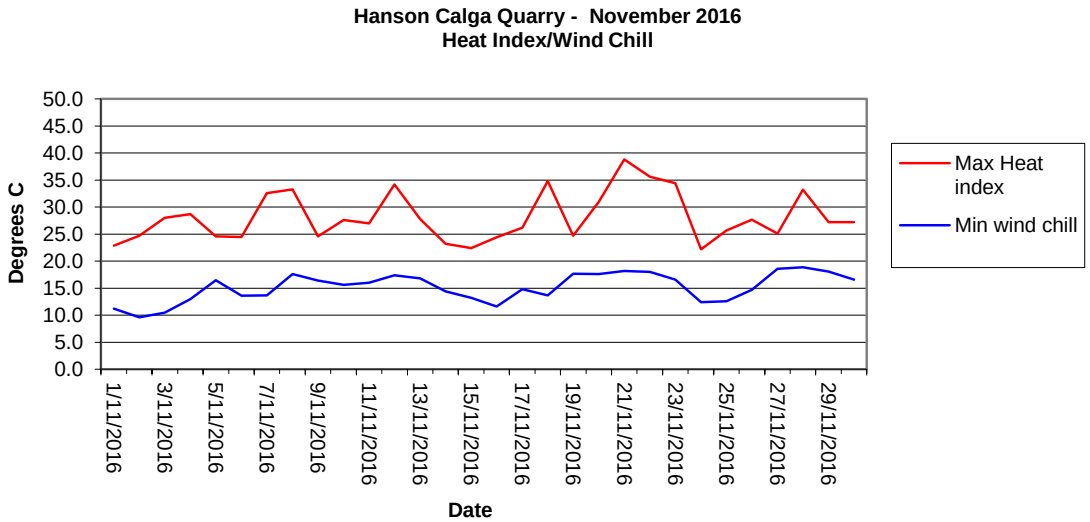
Summary **Nov-16** **Hanson - Calga**

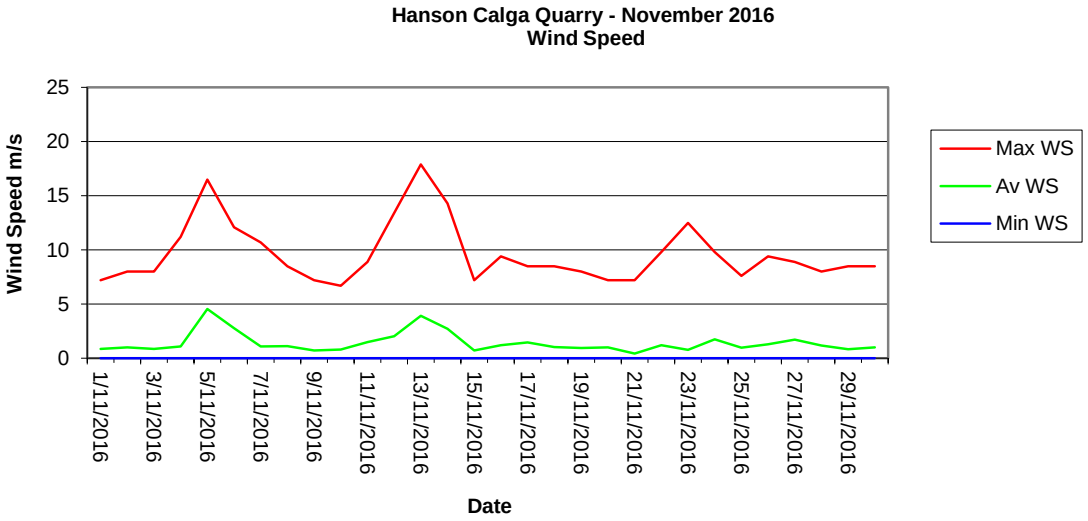
Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Data %	Av data %	Max Data %
1/11/2016	11.1	16.0	23.3	32.0	56.4	84.0	0.0	0.0	0.9	7.2	11.2	22.9	1009.2	1013.3	1015.9	86.8	96.4	98.0
2/11/2016	9.6	16.7	25.3	27.0	61.8	93.0	0.0	0.0	1.0	8.0	9.6	24.7	1013.0	1015.1	1018.3	85.4	95.0	98.0
3/11/2016	10.5	18.4	27.8	27.0	66.3	91.0	0.0	0.0	0.9	8.0	10.5	28.0	1014.7	1017.6	1019.9	64.9	92.0	98.0
4/11/2016	13.0	21.7	30.6	16.0	53.6	96.0	0.0	0.0	1.1	11.2	13.0	28.7	1007.9	1012.9	1017.9	77.5	95.3	98.0
5/11/2016	16.4	22.1	25.3	14.0	27.5	38.0	0.0	0.0	4.6	16.5	16.5	24.6	1002.6	1006.0	1011.0	91.2	97.7	98.0
6/11/2016	14.5	18.4	25.5	20.0	39.5	62.0	0.0	0.0	2.8	12.1	13.6	24.5	1007.8	1010.2	1013.7	97.1	97.9	98.0
7/11/2016	13.7	23.5	34.1	19.0	40.2	65.0	0.0	0.0	1.1	10.7	13.7	32.6	1005.0	1009.7	1013.6	88.9	97.4	98.0
8/11/2016	17.6	23.3	33.2	24.0	53.5	94.0	1.8	0.0	1.1	8.5	17.6	33.3	1006.2	1008.3	1013.6	89.2	97.1	98.0
9/11/2016	16.4	18.3	23.2	70.0	88.5	96.0	14.4	0.0	0.7	7.2	16.4	24.6	1009.2	1011.6	1013.8	93.3	97.5	98.0
10/11/2016	15.6	20.0	26.8	54.0	81.3	97.0	0.2	0.0	0.8	6.7	15.6	27.6	1006.5	1009.4	1011.3	90.6	97.2	98.0
11/11/2016	15.9	20.1	25.6	61.0	81.3	97.0	0.0	0.0	1.5	8.9	16.0	27.0	1009.2	1011.1	1013.5	86.3	97.0	98.0
12/11/2016	17.6	24.1	32.6	35.0	68.2	97.0	17.2	0.0	2.1	13.4	17.4	34.2	996.9	1002.1	1009.6	93.9	97.7	98.0
13/11/2016	16.8	22.9	29.1	20.0	40.3	73.0	0.0	0.0	3.9	17.9	16.8	27.8	996.0	998.8	1001.5	97.4	97.9	98.0
14/11/2016	14.4	17.4	23.1	40.0	62.4	91.0	0.4	0.0	2.7	14.3	14.4	23.2	999.7	1005.1	1013.9	86.5	97.5	98.0
15/11/2016	13.2	16.4	22.4	48.0	77.0	94.0	4.2	0.0	0.7	7.2	13.2	22.4	1013.8	1016.1	1019.1	90.4	97.4	98.0
16/11/2016	11.6	17.3	24.4	44.0	73.9	95.0	0.0	0.0	1.2	9.4	11.6	24.4	1017.6	1021.4	1026.0	88.6	97.2	98.0
17/11/2016	14.8	18.9	25.8	49.0	74.4	92.0	0.0	0.0	1.5	8.5	14.8	26.2	1020.5	1023.8	1026.8	90.1	97.3	98.0
18/11/2016	13.7	24.2	35.3	21.0	54.3	92.0	0.0	0.0	1.0	8.5	13.7	34.8	1013.8	1016.9	1020.9	85.4	97.0	98.0
19/11/2016	17.6	20.4	23.3	54.0	74.1	90.0	0.0	0.0	1.0	8.0	17.7	24.7	1013.9	1018.3	1022.8	90.1	97.7	98.0
20/11/2016	17.6	21.6	29.5	50.0	75.0	93.0	0.0	0.0	1.0	7.2	17.6	31.0	1017.2	1020.3	1022.3	89.8	97.8	98.0
21/11/2016	18.2	23.9	35.0	35.0	72.4	95.0	0.0	0.0	0.4	7.2	18.2	38.8	1014.8	1017.7	1020.1	88.6	97.5	98.0
22/11/2016	18.0	25.2	35.2	25.0	57.7	89.0	0.0	0.0	1.2	9.8	18.0	35.6	1011.6	1014.0	1016.0	88.9	97.2	98.0
23/11/2016	16.6	22.0	34.5	20.0	74.2	92.0	0.2	0.0	0.8	12.5	16.6	34.4	1005.0	1009.8	1012.8	82.7	96.8	98.0
24/11/2016	13.2	17.7	22.6	33.0	61.6	91.0	0.2	0.0	1.7	9.8	12.4	22.2	1010.5	1012.9	1015.2	86.3	95.5	98.0
25/11/2016	12.6	18.6	26.1	29.0	65.0	89.0	0.0	0.0	1.0	7.6	12.6	25.7	1012.4	1014.2	1017.4	92.1	97.1	98.0
26/11/2016	14.7	20.2	27.2	43.0	74.8	91.0	0.0	0.0	1.3	9.4	14.7	27.7	1013.0	1016.2	1018.5	94.2	97.6	98.0
27/11/2016	18.6	20.4	24.1	67.0	83.9	94.0	0.0	0.0	1.7	8.9	18.6	25.1	1015.7	1017.2	1018.7	91.2	97.9	98.0
28/11/2016	18.9	23.5	30.8	42.0	73.8	93.0	0.0	0.0	1.2	8.0	18.9	33.2	1009.3	1013.2	1018.3	66.1	93.6	98.0
29/11/2016	18.1	21.0	25.8	62.0	80.3	96.0	0.0	0.0	0.8	8.5	18.1	27.2	1008.7	1011.5	1014.5	82.7	96.0	98.0
30/11/2016	16.6	20.3	26.3	57.0	80.2	93.0	0.4	0.0	1.0	8.5	16.6	27.2	1008.6	1011.6	1013.9	88.9	97.3	98.0
Monthly	9.6	20.5	35.3	14	66	97	39.0	0	1.4	17.9	9.6	38.8	996	1012.9	1026.8	64.9	96.8	98

2.4.2 Monthly Weather Charts








Hanson Calga Quarry - November 2016
Wind Speed
Wind Speed m/s
25
20
15
10
5
0
1/11/2016
3/11/2016
5/11/2016
7/11/2016
9/11/2016
11/11/2016
13/11/2016
15/11/2016
17/11/2016
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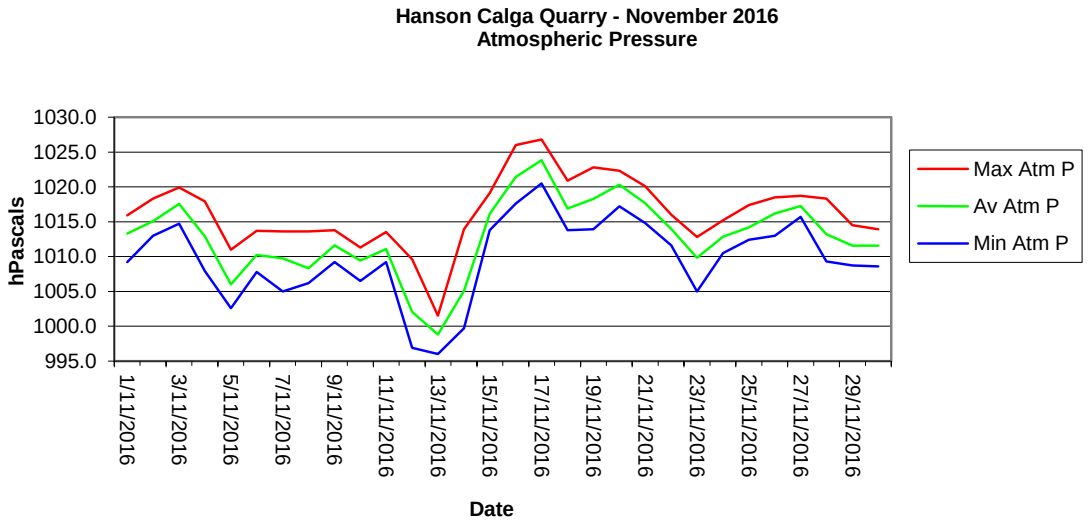
27/11/2016
29/11/2016
Date
Max WS
Av WS
Min WS


Hanson Calga Quarry - November 2016
Atmospheric Pressure
hPascals
1030.0
1025.0
1020.0
1015.0
1010.0
1005.0
1000.0
995.0
1/11/2016
3/11/2016
5/11/2016
7/11/2016
9/11/2016
11/11/2016
13/11/2016
15/11/2016
17/11/2016
19/11/2016
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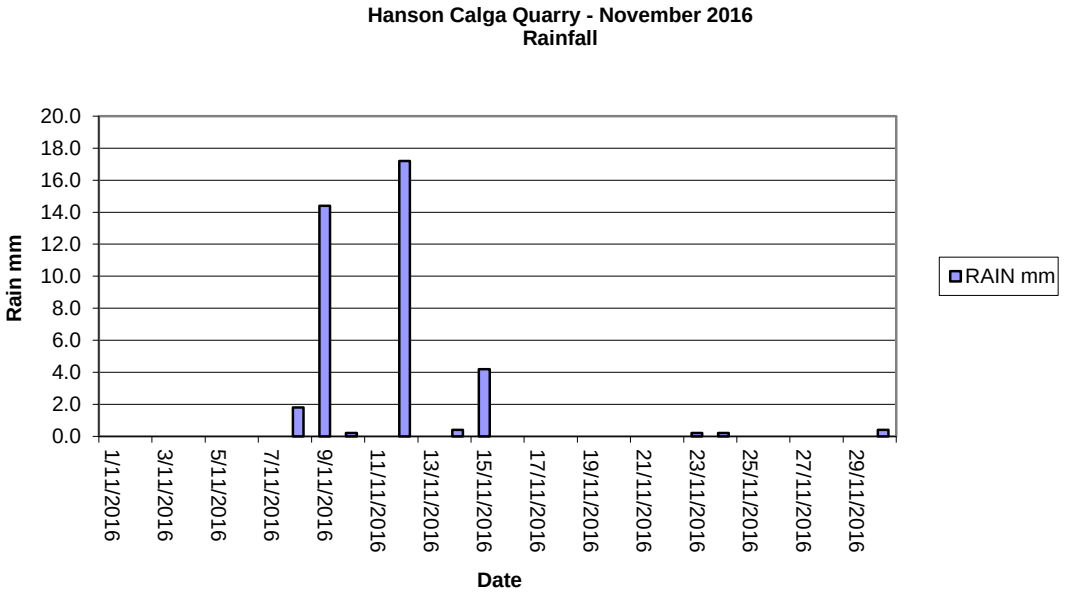
25/11/2016
27/11/2016
29/11/2016
Date
Max Atm P
Av Atm P
Min Atm P


Hanson Calga Quarry - November 2016
Rainfall
Rain mm
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1/11/2016
3/11/2016
5/11/2016
7/11/2016
9/11/2016
11/11/2016
13/11/2016
15/11/2016
17/11/2016
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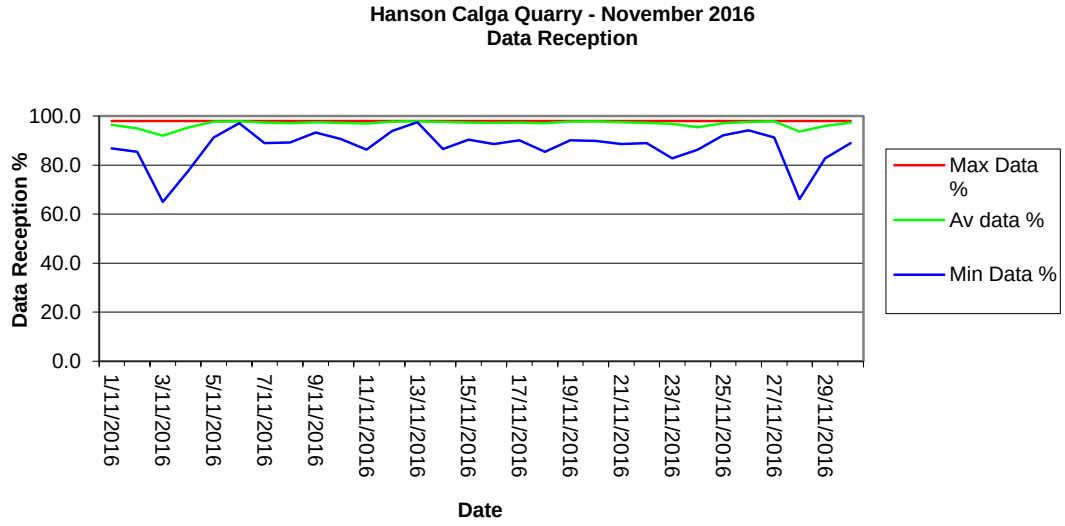
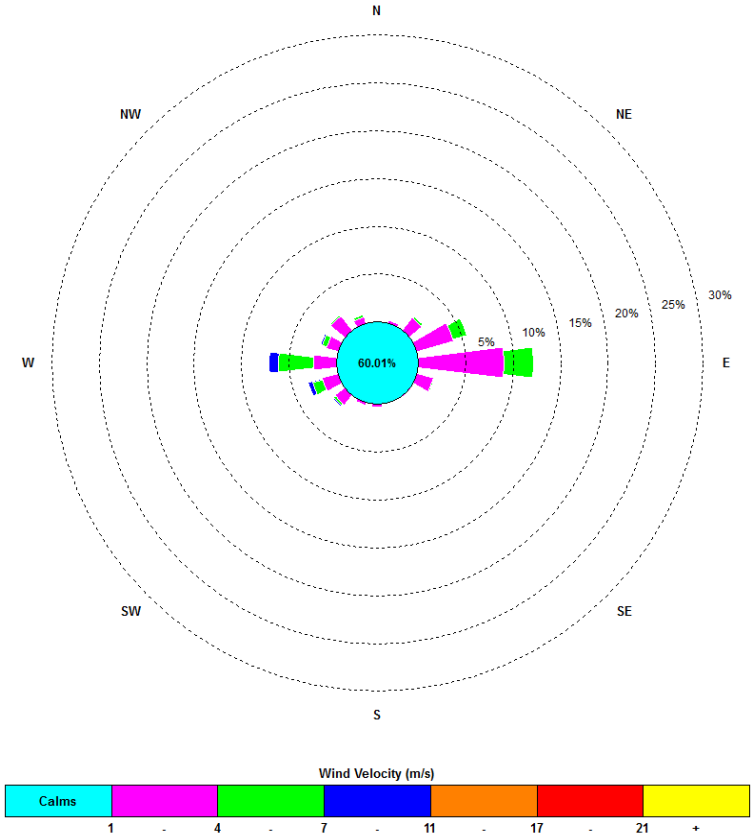
25/11/2016
27/11/2016
29/11/2016
Date
RAIN mm


Hanson Calga Quarry - November 2016
Data Reception
Data Reception %
100.0
80.0
60.0
40.0
20.0
0.0
1/11/2016
3/11/2016
5/11/2016
7/11/2016
9/11/2016
11/11/2016
13/11/2016
15/11/2016
17/11/2016
19/11/2016
21/11/2016
23/11/2016
25/11/2016
27/11/2016
29/11/2016
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.

00:15, 1 November 2016 – 23:45, 30 November 2016



The predominant winds were from the W and E, with most frequent, strongest winds from the W and SW. The maximum wind speed was 17.9 m/s from the W.

Appendix 1

Field Sheets

Chain of Custody

Laboratory Certificates

DEPOSITIONAL DUST MONITORING

Client: ..... **Hanson Calga Quarry** ..... Date Installed: 1.11.16 Collection Start Time: 8:00 Sampled By: HANSEN & ALEX

Date Collected: 2.12.16 Collection Stop Time: 11:30 Sampling ID: .....

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	11:45	900	✔		✔ ✔	✔	C (S) T	C (O) Bn Gn Gy	Y	Y		
CD2C	10:15	800	✔		✔ ✔	✔	C (S) T	C (O) Bn Gn Gy	Y	Y		
CD3	8:50	800	✔ ✔			✔	C (S) T	C (O) Bn Gn Gy	Y	Y		
CD4	9:40	600	✔		✔✔✔	✔	C (S) T	C (O) Bn Gn Gy	Y	Y		TREES ABOVE!
CD5	9:25	900	✔			✔	C (S) T	C (O) Bn Gn Gy	Y	Y		ANTS.
CD6	9:15	900	✔		✔	✔	C (S) T	C (O) Bn Gn Gy	Y	Y		
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				
							C S T	C O Bn Gn Gy				

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

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

Report broken funnels and replacement diameters

Signed: _____

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: Carbon Based Environmental Pty Ltd

POSTAL ADDRESS: 47 Boomerang St CESSNOCK NSW 2325

LABORATORY BATCH NO.:

SAMPLERS:Carbon Based Environmental Pty Ltd

SEND REPORT TO: monitoringresults@cbased.com.au

SEND INVOICE TO: cbased@bigpond.com, renae.mikka@cbased.com.au

PHONE: 0265713334 FAX: 0249904442 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.: SY/269/10

QC LEVEL: QCS1: QCS2: QCS3: Yes QCS4:

P.O. NO.:

COMMENTS/SPECIAL HANDLING/STORAGE OR DIPOSAL:

FOR LAB USE ONLY
COOLER SEAL
Yes ..... No
Broken ..... Intact ...
COOLER TEMP: 29.9 deg.C

Total unless specified

ANALYSIS REQUIRED

SAMPLE DATA				CONTAINER DATA		Insoluable Soldi	Ash Residue	Combustable Matt	NOTES
SAMPLE ID	MATRIX	DATE ON	DATE OFF	TYPE & PRESERVATIVE	NO.				
CD1	Dust	1-11-06	2-12-06			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
EN1604550

Telephone : + 61 2 4014 2500

RELINQUISHED BY:

NAME : Colin Davies
OF: Carbon Based Environmental
DATE: 2-12-06
TIME: 13:00

NAME :
OF:
DATE:
TIME:

RECEIVED BY

NAME :
OF: ALS
DATE: 2/12/06
TIME: 1pm

NAME :
OF:
DATE:
TIME:

METHOD OF SHIPMENT

CONSIGNMENT NOTE NO.

TRANSPORT CO. NAME.

*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 Acic 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	: **EN1604550**	Page	: 1 of 4
Client	: **CBASED ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR COLIN DAVIES (cbased)	Contact	:
Address	: 47 BOOMERANG ST CESSNOCK NSW, AUSTRALIA 2325	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 49904443	Telephone	: +61 2 4014 2500
Project	: Hanson Calga Dusts	Date Samples Received	: 02-Dec-2016 13:00
Order number	: ----	Date Analysis Commenced	: 06-Dec-2016
C-O-C number	: ----	Issue Date	: 09-Dec-2016 19:51
Sampler	: CARBON BASED ENVIRONMENTAL PTY LTD		
Site	:		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 6		

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*
Dianne Blane	Laboratory Coordinator (2IC)	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 AS3580.10.1-2003. 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 01/11/16 - 02/12/16	CD2c 01/11/16 - 02/12/16	CD3 01/11/16 - 02/12/16	CD4 01/11/16 - 02/12/16	CD5 01/11/16 - 02/12/16
				Client sampling date / time	[02-Dec-2016]	[02-Dec-2016]	[02-Dec-2016]	[02-Dec-2016]	[02-Dec-2016]
					EN1604550-001	EN1604550-002	EN1604550-003	EN1604550-004	EN1604550-005
					Result	Result	Result	Result	Result
EA120: Ash Content									
Ash Content	----	0.1	g/m².month		**2.6**	**1.0**	**0.8**	**0.2**	**0.3**
Ash Content (mg)	----	1	mg		**47**	**19**	**15**	**3**	**5**
EA125: Combustible Matter									
Combustible Matter	----	0.1	g/m².month		**0.7**	**0.9**	**0.7**	**0.5**	**1.1**
Combustible Matter (mg)	----	1	mg		**13**	**15**	**13**	**9**	**20**
EA141: Total Insoluble Matter									
Total Insoluble Matter	----	0.1	g/m².month		**3.3**	**1.9**	**1.5**	**0.7**	**1.4**
Total Insoluble Matter (mg)	----	1	mg		**60**	**34**	**28**	**12**	**25**

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)				Client sample ID	CD6 01/11/16 - 02/12/16	----	----	----	----
				Client sampling date / time	[02-Dec-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1604550-006	--------	--------	--------	--------
					Result	---	---	---	---
EA120: Ash Content									
Ash Content	----	0.1	g/m².month		**0.5**	----	----	----	----
Ash Content (mg)	----	1	mg		**9**	----	----	----	----
EA125: Combustible Matter									
Combustible Matter	----	0.1	g/m².month		**0.5**	----	----	----	----
Combustible Matter (mg)	----	1	mg		**10**	----	----	----	----
EA141: Total Insoluble Matter									
Total Insoluble Matter	----	0.1	g/m².month		**1.0**	----	----	----	----
Total Insoluble Matter (mg)	----	1	mg		**19**	----	----	----	----

CARBON BASED ENVIRONMENTAL PTY LIMITED

Date: 2.12.16

Todays Collection	
Time Start:	8:00
Time Finish:	11:00

Client : Hanson Calga

Project :

SURFACE WATERS

Site	Flow Rate	Odour	Sampling Time	Bottles	Water Turbidity	Water Colour	Comments
A	DAM	N	8:30	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
B	~~———~~	~~———~~	8:20	~~1x 250ml GP, 1x 500mL GP, 1x PG~~	~~C S T~~	~~C LO O B G~~	NO FLOW
C1	DAM	N	11:00	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
C2	TRICKLE	N	11:10	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
D	DRY	—	9:20	~~1x 250ml GP, 1x 500mL GP, 1x PG~~	~~C S T~~	~~C LO O B G~~	DRY
F	DAM	N	8:25	1x 250ml GP, 1x 500mL GP, 1x PG	C S T	C LO O B G	
					C S T	C LO O B G	
					C S T	C LO O B G	
					C S T	C LO O B G	
					C S T	C LO O B G	
					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: HAMISH & ALEX

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: Carbon Based Environmental Pty Ltd

POSTAL ADDRESS: 47 Boomerang St CESSNOCK NSW 2325

SEND REPORT TO: monitoringresults@cbased.com.au

SEND INVOICE TO: cbased@bigpond.com, renae.mikka@cbased.com.au

DATA NEEDED BY: 7 working days

REPORT NEEDED BY: 7 working days

PROJECT ID: Hanson Quarry

QUOTE NO.: SYBQ-222-15

P.O. NO.:

COMMENTS/SPECIAL HANDLING/STORAGE OR DIPOSAL:

FOR LAB USE ONLY
COOLER SEAL
Yes ..... No ... Intact ...
Broken 29.9
COOLER TEMP: deg.C

Total unless specified

LABORATORY BATCH NO.:

SAMPLERS:Carbon Based Environmental Pty Ltd

PHONE: 0265713334 FAX: 0249904442 E-MAIL: monitoringresults@cbased.com.au

REPORT FORMAT: HARD: Yes FAX: DISK: BULLETIN BOARD: E-MAIL: Yes

QC LEVEL: QCS1: QCS2: QCS3: Yes QCS4:

ANALYSIS REQUIRED

SAMPLE DATA				CONTAINER DATA		Ph	EC	TSS	TDS	O + G	NOTES
SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	NO.						
A	Water	2.12.16	8:30	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x	
~~B~~	~~Water~~			~~1x 250mlGP,1x 500mLGP,1xPG~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	
C1	Water		11:00	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x	
C2	Water		11:10	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x	
~~D~~	~~Water~~			~~1x 250mlGP,1x 500mLGP,1xPG~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	
F	Water		8:25	1x 250mlGP,1x 500mLGP,1xPG		x	x	x	x	x	
				TOTAL BOTTLES:							

Environmental Division
Sydney
Work Order Reference
ES1627633

Telephone : +61-2-8784 8555

RELINQUISHED BY:

NAME : Colin Davies
OF: Carbon Based Environmental
DATE: 2-12-16
TIME: 13:00

NAME :
OF:
DATE:
TIME:

RECEIVED BY

NAME : RH
OF: ALS
DATE: 2/12/16
TIME: 1pm

NAME :
OF:
DATE:
TIME:

METHOD OF SHIPMENT

CONSIGNMENT NOTE NO.

TRANSPORT CO. NAME.

*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	: **ES1627633**	Page	: 1 of 2
Client	: **CBASED ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS RENAE MIKKA	Contact	: Customer Services ES
Address	: 47 BOOMERANG ST CESSNOCK NSW, AUSTRALIA 2325	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 49904443	Telephone	: +61-2-8784 8555
Project	: HANSON QUARRY	Date Samples Received	: 02-Dec-2016 12:54
Order number	: ----	Date Analysis Commenced	: 02-Dec-2016
C-O-C number	: ----	Issue Date	: 09-Dec-2016 09:10
Sampler	: CARBON BASED ENVIRONMENTAL PTY LTD		
Site	:		
Quote number	: ----		
No. of samples received	: 4		
No. of samples analysed	: 4		

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, 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.

- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	A	C1	C2	F	----
			Client sampling date / time	02-Dec-2016 08:30	02-Dec-2016 11:00	02-Dec-2016 11:40	02-Dec-2016 08:25	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1627633-001**	**ES1627633-002**	**ES1627633-003**	**ES1627633-004**	--------
				Result	Result	Result	Result	---
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.12**	**6.97**	**6.93**	**5.90**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**83**	**99**	**96**	**96**	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**82**	**70**	**66**	**66**	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	----
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	**9**	<5	----

CARBON BASED ENVIRONMENTAL PTY LIMITED

Todays Collection	
Time Start:	8:30
Time Finish:	11:50

Date: 2.12.16

Client : Hanson Calga

Project :

GROUNDWATERS

Site	DEPTH	Odour	Water Turbidity	Water Colour	1		2		Bottles (Apr/Oct)	Downloaded Logger? (Y/N)
					pH	EC	pH	EC		
CQ3	10.78	N	C S T	C LO O B G	6.91	150.4 uS	6.87	143.8 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ4	10.44	N	C S T	C LO O B G	5.34	101.7 uS	5.33	104.6 uS	1x 250ml GP, 1x 500mL GP, 1RP	N
CQ5	7.35	N	C S T	C LO O B G	4.33	170.5 uS	4.32	172.1 uS	1x 250ml GP, 1x 500mL GP, 1RP	
CQ6			C S T	C LO O B G	COVERED OVER IN PADDOCK ??				1x 250ml GP, 1x 500mL GP, 1RP	
CQ7	6.49	N	C S T	C LO O B G	4.61	92.0 uS	4.62	91.3 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ8	6.44	N	C S T	C LO O B G	4.36	123.1 uS	4.37	123.5 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ9			C S T	C LO O B G	STAND PIPE BENT/BROKEN.				1x 250ml GP, 1x 500mL GP, 1RP	
CQ10	25.17	N	C S T	C LO O B G	5.12	123.8 uS	5.01	125.7 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ11S	10.56	N	C S T	C LO O B G	4.96	129.1 uS	5.08	129.6 uS	1x 250ml GP, 1x 500mL GP, 1RP	N
CQ11D	11.76	N	C S T	C LO O B G	4.97	144.0 uS	4.96	141.3 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ12	4.70	N	C S T	C LO O B G	4.46	117.2 uS	4.46	118.6 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
CQ13	13.74	N	C S T	C LO O B G	4.41	179.3 uS	4.38	180.1 uS	1x 250ml GP, 1x 500mL GP, 1RP	N
CP3			C S T	C LO O B G	GONE				1x 250ml GP, 1x 500mL GP, 1RP	
CP4	10.23		C S T	C LO O B G	PUMP NOT WORKING				1x 250ml GP, 1x 500mL GP, 1RP	
CP5	8.75	N	C S T	C LO O B G	4.98	144.7 uS	5.04	142.0 uS	1x 250ml GP, 1x 500mL GP, 1RP	
CP6	11.63	N	C S T	C LO O B G	4.45	159.4 uS	4.42	161.3 uS	1x 250ml GP, 1x 500mL GP, 1RP	
CP7	3.81	N	C S T	C LO O B G	5.08	105.5 uS	5.03	104.9 uS	1x 250ml GP, 1x 500mL GP, 1RP	
CP8	20.84	N	C S T	C LO O B G	4.50	117.2 uS	4.48	116.9 uS	1x 250ml GP, 1x 500mL GP, 1RP	
MW7	15.66	N	C S T	C LO O B G	4.62	102.7 uS	4.58	103.1 uS	1x 250ml GP, 1x 500mL GP, 1RP	Y
MW8	7.34	N	C S T	C LO O B G	4.54	89.8 uS	4.53	90.0 uS	1x 250ml GP, 1x 500mL GP, 1RP	N
MW9	23.50	N	C S T	C LO O B G	4.83	76.6 uS	4.80	76.2 uS	1x 250ml GP, 1x 500mL GP, 1RP	N
MW10			C S T	C LO O B G	NO ACCESS - UNSAFE TRACKS				1x 250ml GP, 1x 500mL GP, 1RP	
MW13			C S T	C LO O B G	"		"		1x 250ml GP, 1x 500mL GP, 1RP	
MW16			C S T	C LO O B G	"		"		1x 250ml GP, 1x 500mL GP, 1RP	
MW17			C S T	C LO O B G	NO ACCESS - TREES OVER TRACK.				1x 250ml GP, 1x 500mL GP, 1RP	

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

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

pH/EC meter #: 12

Signed:

Sampled by: HAMISH & ALEX.