



Carbon Based Environmental Pty Limited

ABN 74 102 920 285

Rocla Quarry Products Calga Quarry

Environmental Monitoring

Dust Deposition Gauges, Surface and Ground Waters and Meteorological Station

July 2014

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Date: 27 August 2014

Executive Summary

Carbon Based Environmental is contracted by Rocla 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 Carbon Based Environmental and includes the following;

- Dust Deposition results for July 2014;
- Surface Water quality results for July 2014;
- Groundwater depth and quality results for July 2014; and
- Meteorological report for July 2014.

The July 2014 dust deposition results for insoluble solids were generally low and free of major contamination this month. All sites, on a rolling annual average basis, are currently below the Air Quality Management Plan exceedance level of 3.7g/m².month. Results were found to be representative of dust levels as determined by the Australian Standard.

Surface water samples were collected on 4 August 2014 at sites A and F. There was no flow at Site B, Site D was too low to sample and Site C was inaccessible 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 to neutral range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any site.

Groundwaters were sampled for normal monthly monitoring on 4 August 2014. Groundwater depth generally increased across the sampled groundwater bores when compared to last month. Groundwater pH increased slightly and EC decreased slightly across all bores this month.

Data for July 2014 shows that rainfall recorded at the Rocla Calga Quarry was higher than the Gosford BOM and lower than the Peats Ridge long term mean rainfall for July. The rainfall comparison is provided below:

Rocla Calga Quarry	23.1 mm
BOM Peats Ridge*	NA
BOM Gosford*	16.4 mm
BOM Peats Ridge Long term mean for July*	66.7 mm

NA = Not Available

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au). No data was available from the BOM Peats Ridge station for July 2014

Note: Differences in the daily rainfall readings between BOM and the Rocla station may occur due to BOM stations reporting rainfall at 9am and the Rocla station recording rainfall at midnight.

Sampling Program

Rocla Calga Quarry conducts environmental monitoring in accordance to Development Consent, OEH (EPA) licence and Environmental Management Plans. Carbon Based Environmental are contracted to undertake dust deposition gauge, surface and groundwater and meteorological monitoring for the project. Carbon Based 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 10.1 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/m².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 at least bi-monthly for water quality and at least quarterly for water level. 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. Wind parameters are measured according to Australian Standard AS 2923 “Ambient Air— Guide for Measurement of Horizontal Wind for Air Quality Applications”.

The weather stations have the following sensor configuration;

Air temperature

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

Carbon Based 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**.

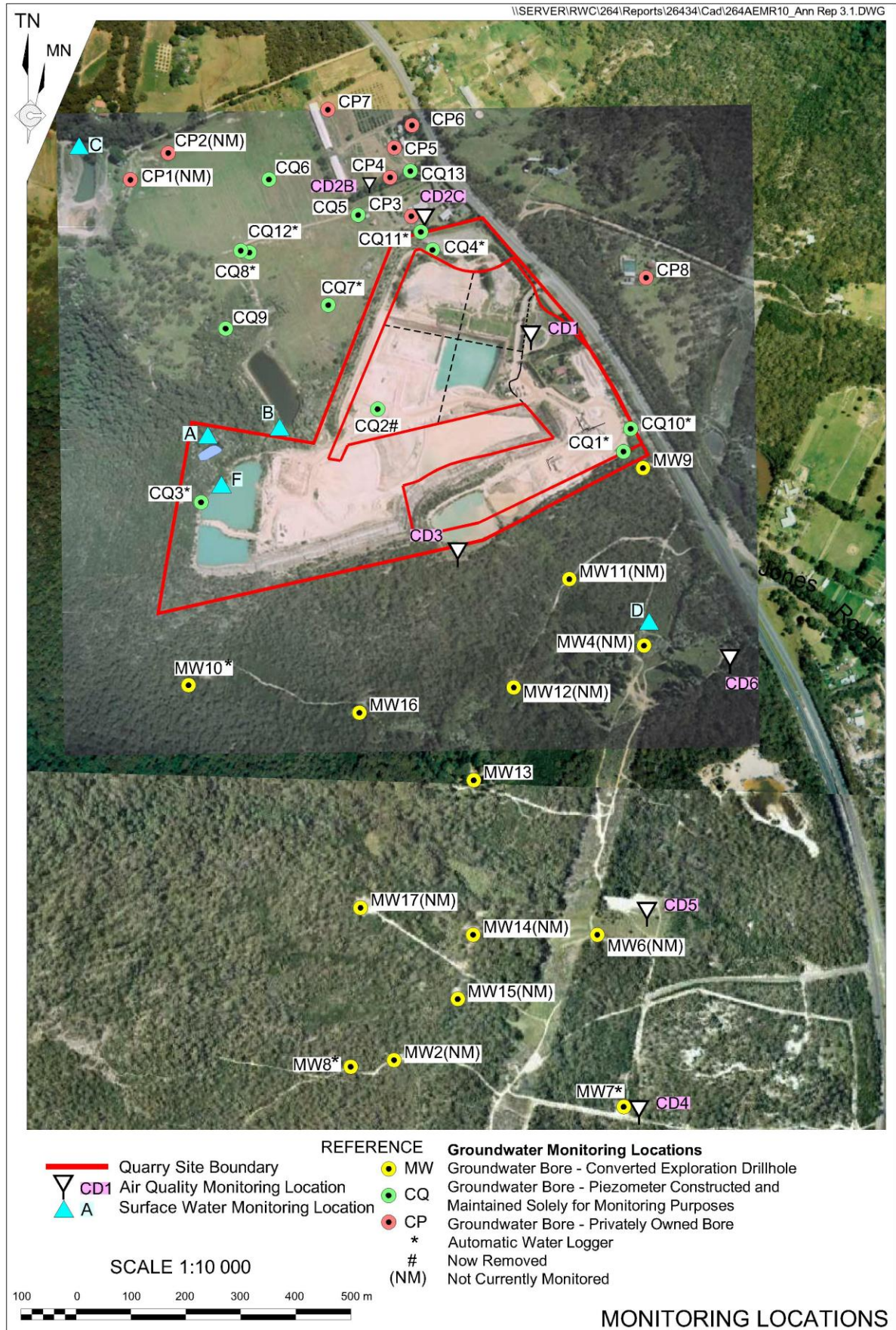


Figure 1: Rocla Calga Quarry environmental monitoring locations

2.0 Monthly Results

2.1 Dust Deposition Gauges

Table 1 displays the results for July 2014 and the project 12 month rolling average. Results are in g/m².month.

Table 1: Dust Deposition results: 3 July 2014 – 4 August 2014 (32 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	0.6	0.5	0.1	83	1.5
CD2c	1.0	0.8	0.2	80	1.3
CD3	0.6	0.5	0.1	83	2.6
CD4	0.3	0.1	0.2	33	0.6
CD5	0.1	0.1	<0.1	100	0.5
CD6	0.8	0.6	0.2	75	0.8

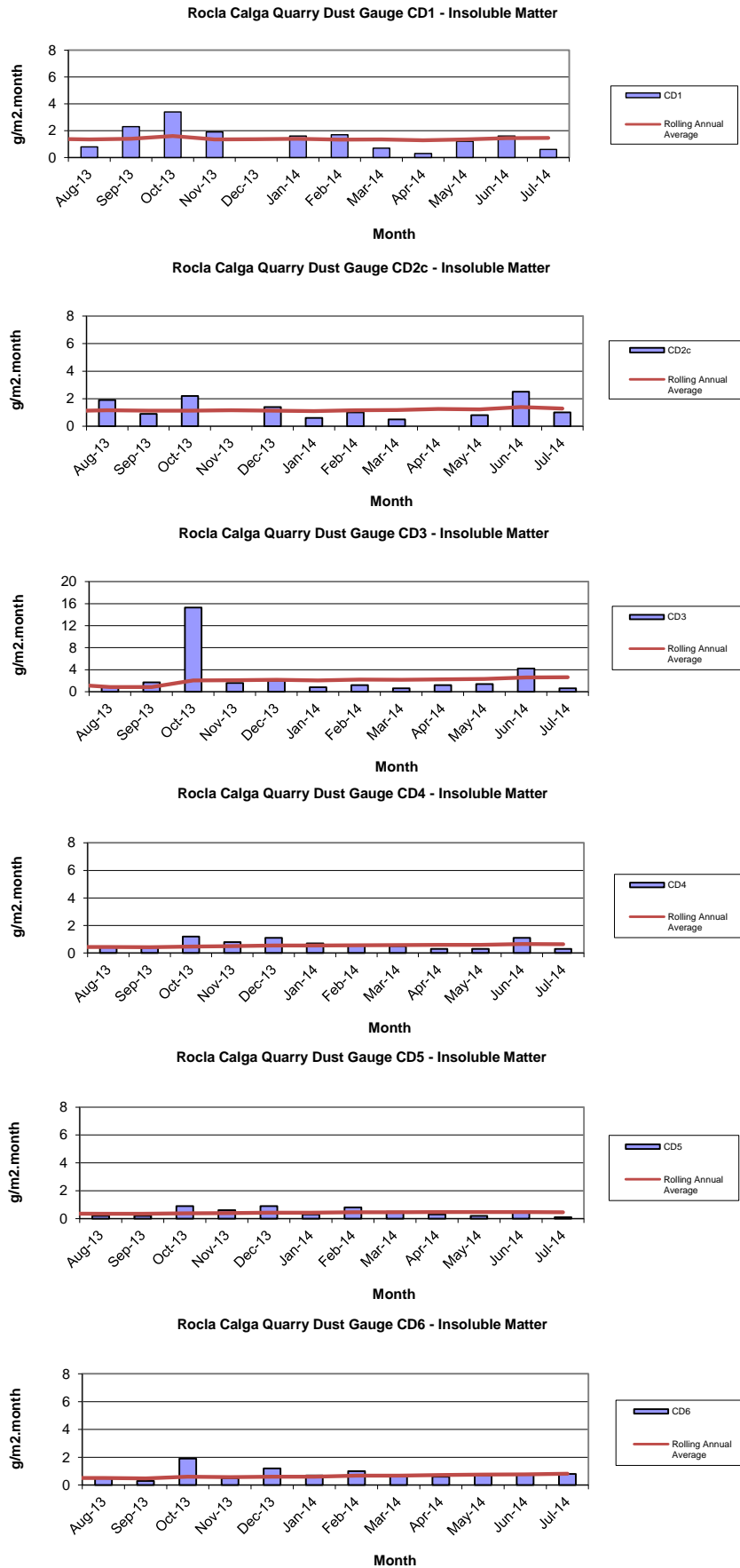
Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects. Results in bold indicate insoluble solids levels above 3.7 g/m².month; the Development Consent’s annual average amenity criteria at residential locations. The current rolling annual average is calculated from August 2013 to July 2014.

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 4 August 2014 and results are listed in **Table 2**. The laboratory analysis sheets are provided in **Appendix 1**.

Table 2: Monthly surface water monitoring – July 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	5.99	81	50	<5	<5
B	No Flow							
C	No access							
D	Too low to sample							
F	Dam	Clear	Clear	5.89	83	51	<5	<5

Samples were collected at sites A and F. There was no flow at Site B, Site D was too low to sample and Site C was inaccessible 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 to neutral range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any site in July 2014.

2.3 Groundwater Monitoring

Groundwaters were sampled on 4 August 2014. 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 increased at a majority of sites compared to last month, indicating water generally moving away from the surface. The exception was CQ3, CP5 and CP6 which showed a slight decrease in depth.

pH at all sites is in the acidic to neutral range. pH levels increased slightly across all sampled sites. EC levels decreased slightly when compared to the results obtained in July 2014.

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	10.80	6.3	167
CQ4	Voutos	* Monitor	8.78	11.07	4.7	126
CQ5	Gazzana	DIP Only	8.69	8.01	4.4	168
CQ6	Gazzana	DIP Only	16.00	11.24	4.5	207
CQ7	Gazzana	* Monitor	6.89	6.67	4.5	118
CQ8	Gazzana	* Monitor	11.03	6.29	4.7	150
CQ9	Gazzana	DIP Only	10.10	9.01	4.5	124
CQ10	Voutos	* Monitor	NI	24.46	4.5	182
CQ11S	Gazzana	* Monitor	NI	11.47	4.9	165
CQ11D	Gazzana	* Monitor	NI	12.63	4.7	173
CQ12	Gazzana	* Monitor	NI	4.91	4.4	148
CQ13	Kashouli	* Monitor	NI	14.86	4.4	243
CP3	Gazzana	Domestic	10.40	10.1	4.6	157
CP4	Kashouli	Domestic	13.63	12.06	NM	NM
CP5	Kashouli	Domestic	16.61	9.70	4.5	246
CP6	Kashouli	Domestic	16.27	11.79	4.6	205
CP7	Kashouli	Production	8.56	4.77	4.8	146
CP8	Rozmanec	Domestic	22.17	21.26	4.4	158
MW7	Rocla Bore	* Monitor	15.76	16.45	4.6	125
MW8	Rocla Bore	* Monitor	9.82	7.99	4.7	87
MW9	Rocla Bore	* Monitor	22.44	23.11	4.3	94
MW10	Rocla Bore	* Monitor	15.41	13.34	4.4	137
MW13	Rocla Bore	DIP Only	NI	8.07	4.3	114
MW16	Rocla Bore	DIP Only	NI	8.73	4.5	121

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.

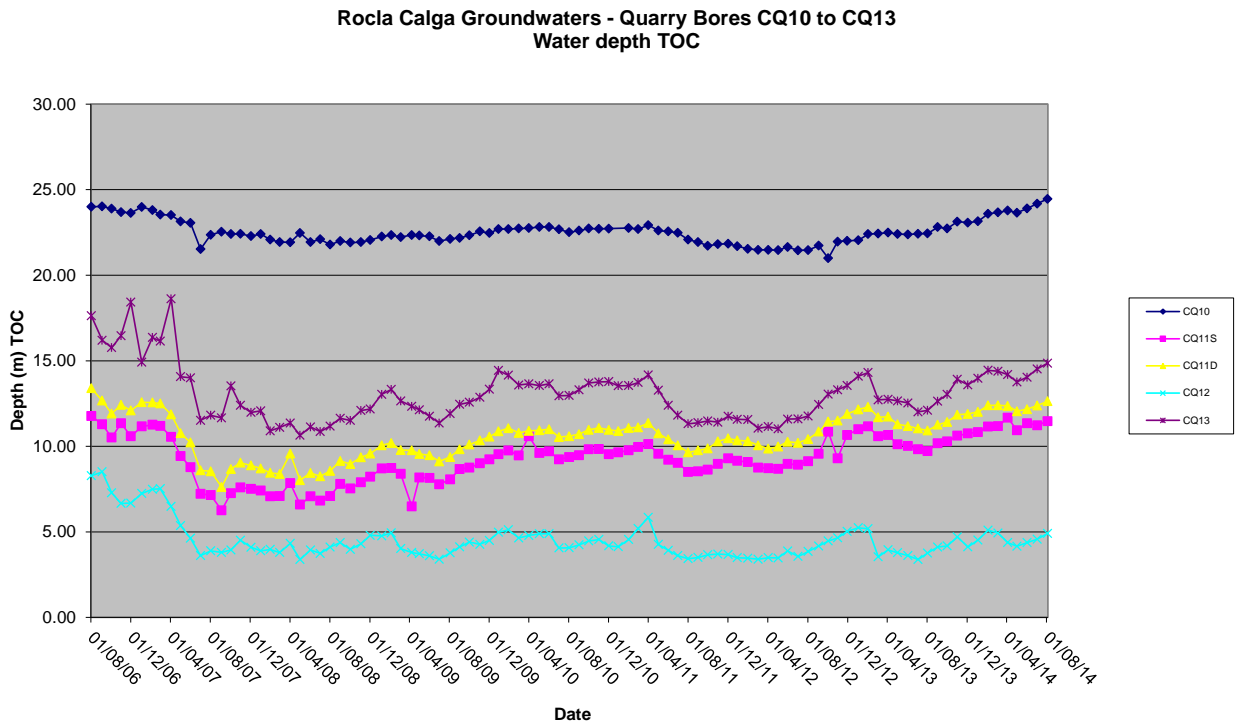
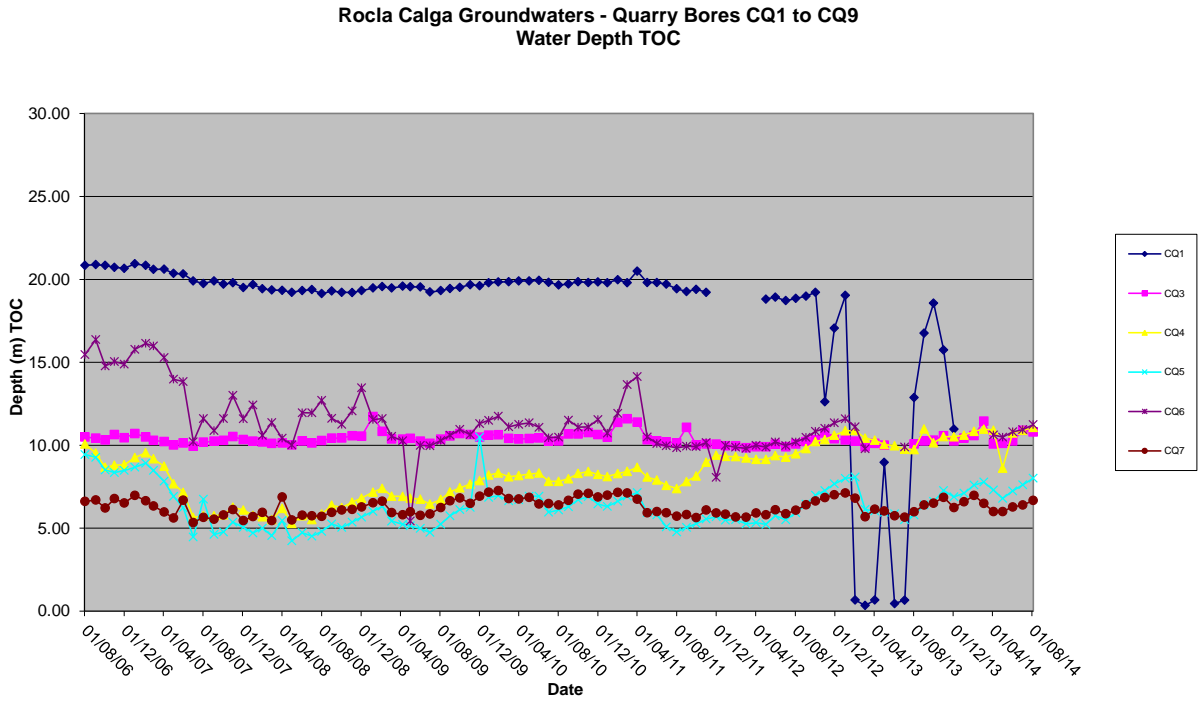
NI = These bores were not installed in April 2006 but are now operational. April 2006 was the first set of measurements taken by Carbon Based Environmental Pty Limited.

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

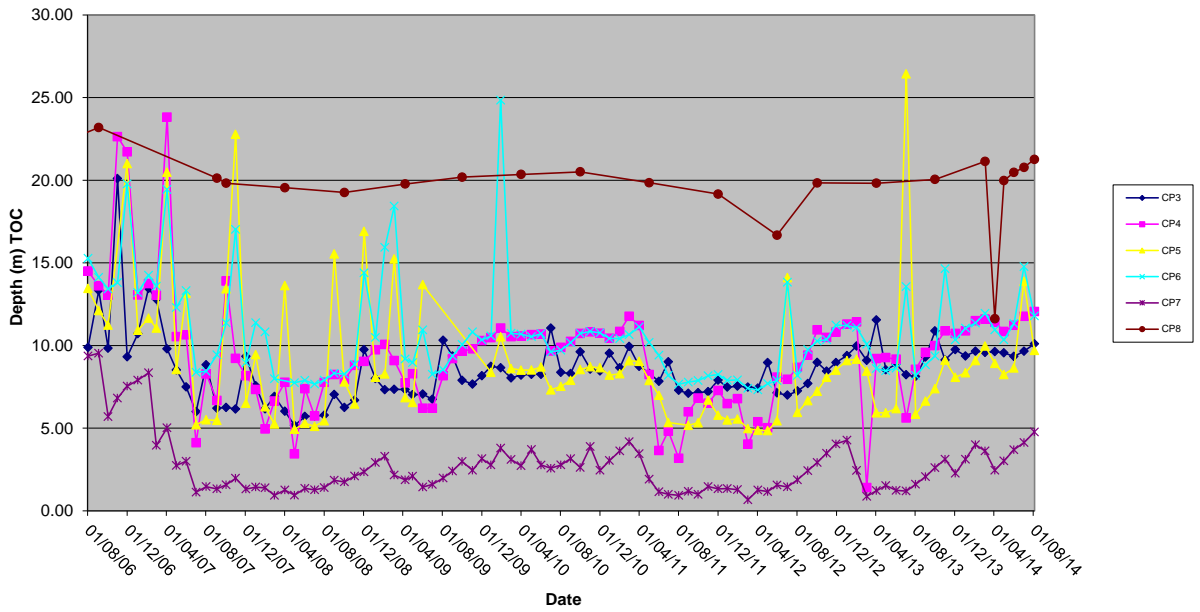
	Increase to ground water depth (water moved away from surface)
	Decrease to ground water depth (water moved towards surface)
	Stable water depth (+/- 0.01m)

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

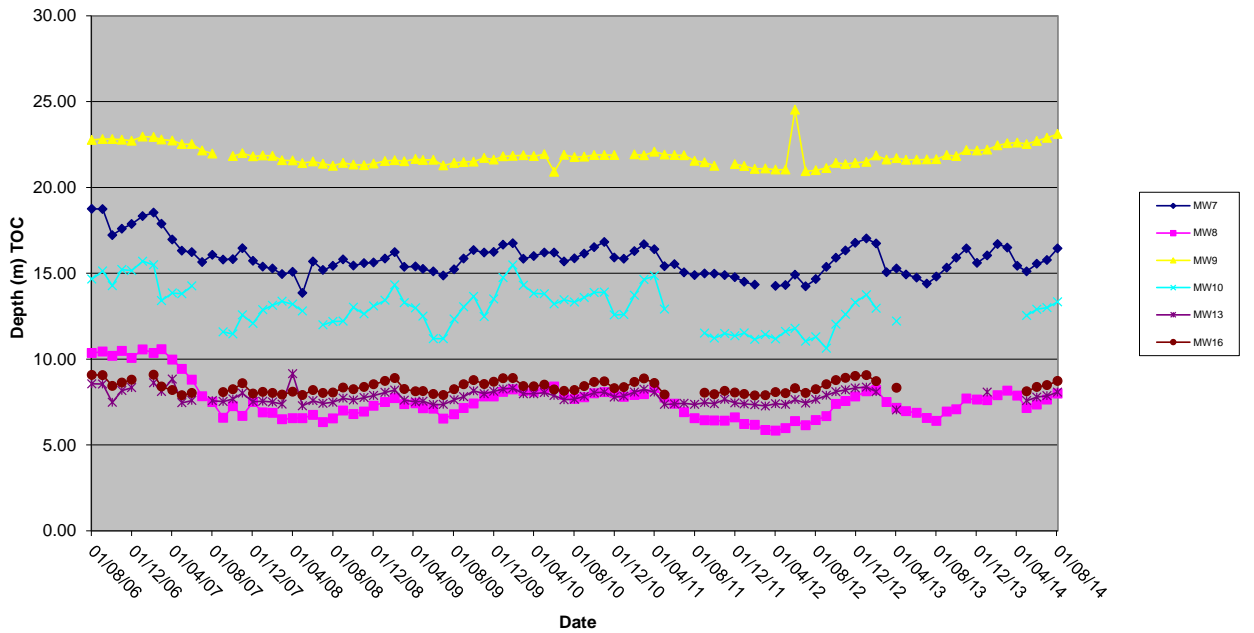
Figures 3 to 6: Groundwater Depth Charts.



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



Rocla Calga Groundwaters - Quarry Bores MW7 to MW16
Water Depth TOC



2.4 Meteorological Monitoring

The Rocla Calga Quarry weather station data recovery in July 2014 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 July 2014 shows that rainfall recorded at the Rocla Calga Quarry was higher than the Gosford BOM and lower than the Peats Ridge long term mean rainfall for July. The rainfall comparison is provided below:

Rocla Calga Quarry	23.1 mm
BOM Peats Ridge*	NA
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BOM Peats Ridge Long term mean for July*	66.7 mm

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*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

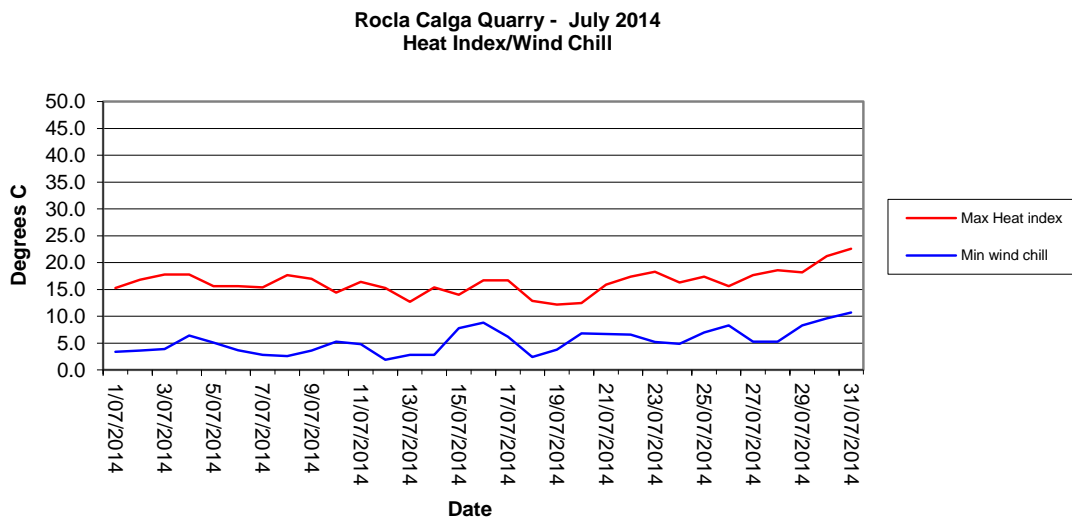
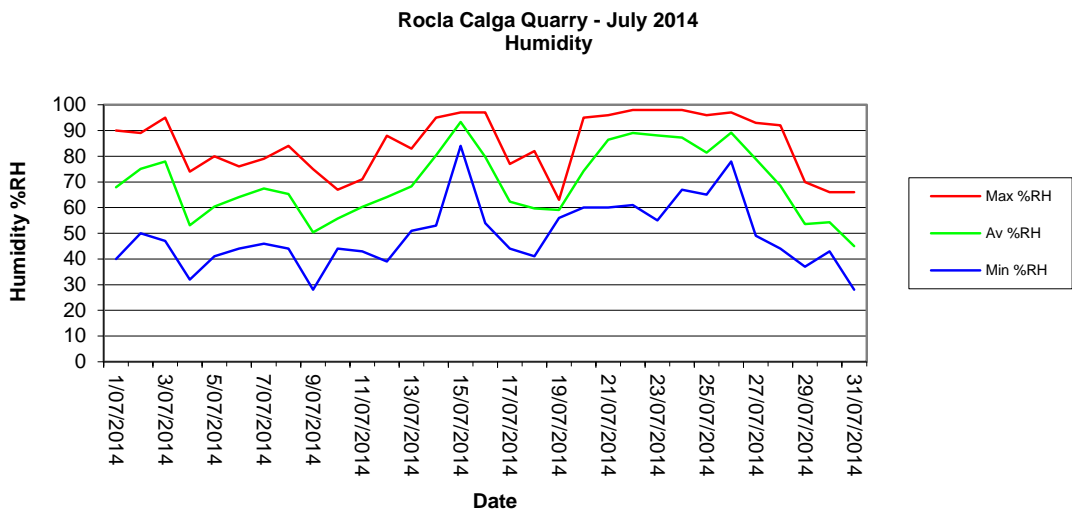
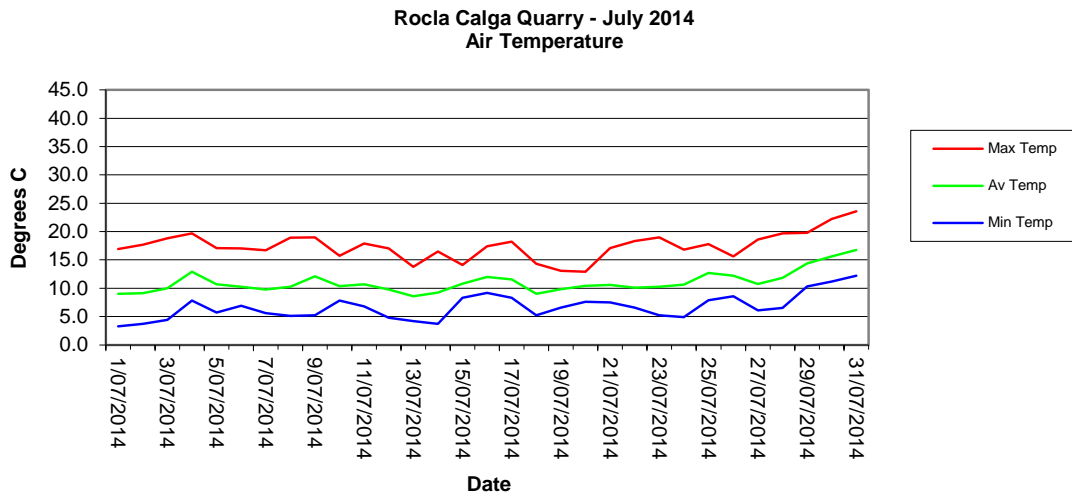
Results are displayed in the following table and figures.

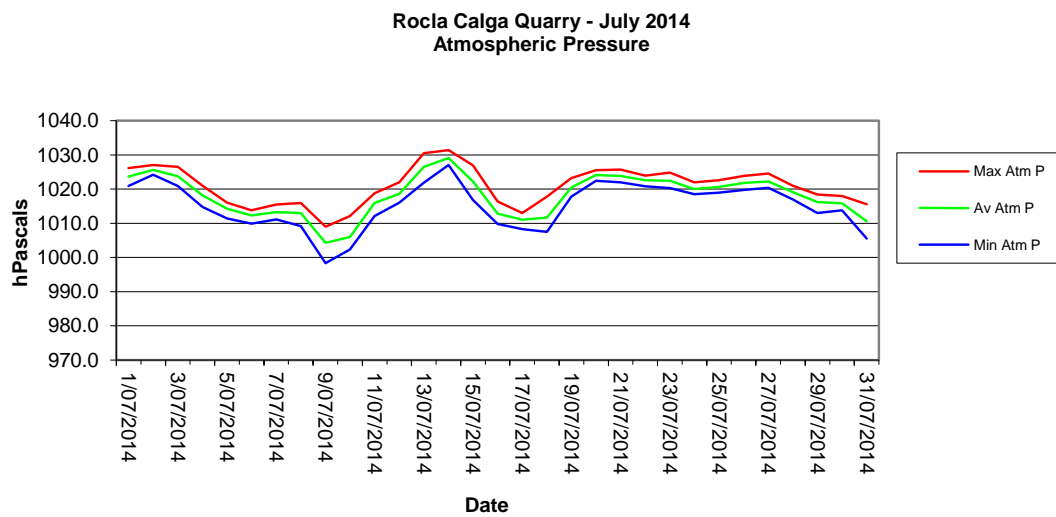
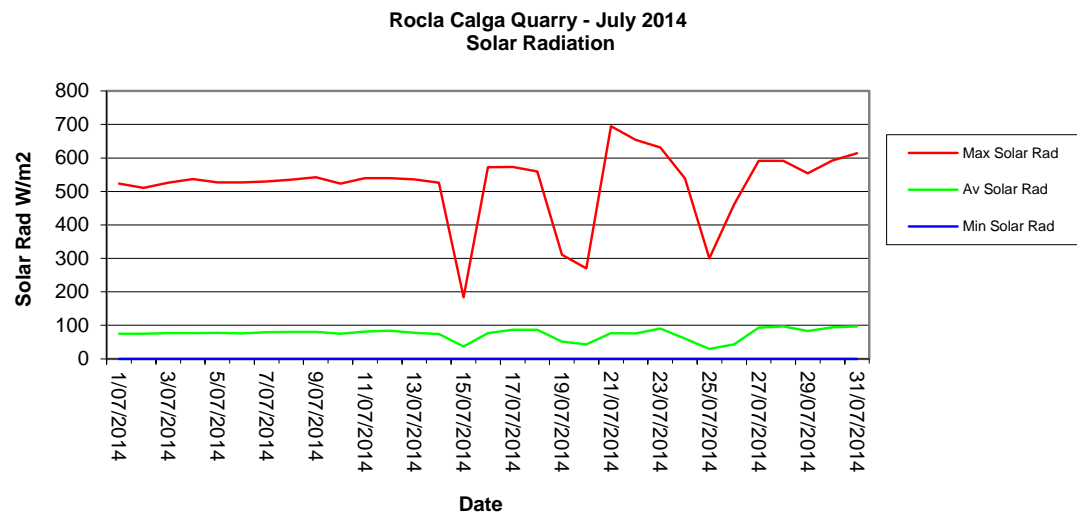
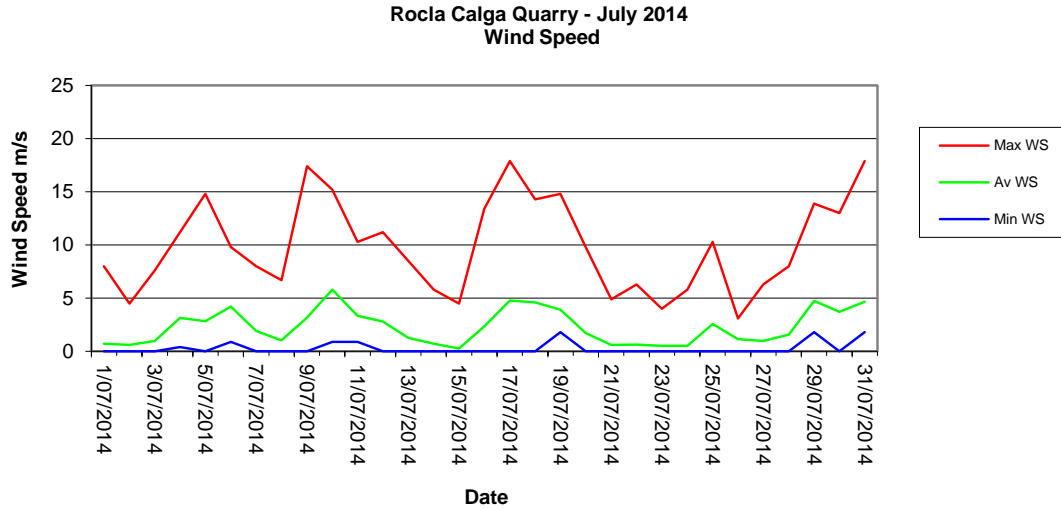
2.4.1 Monthly Meteorological Data Summary

Summary Jul-14 Rocla - Calga

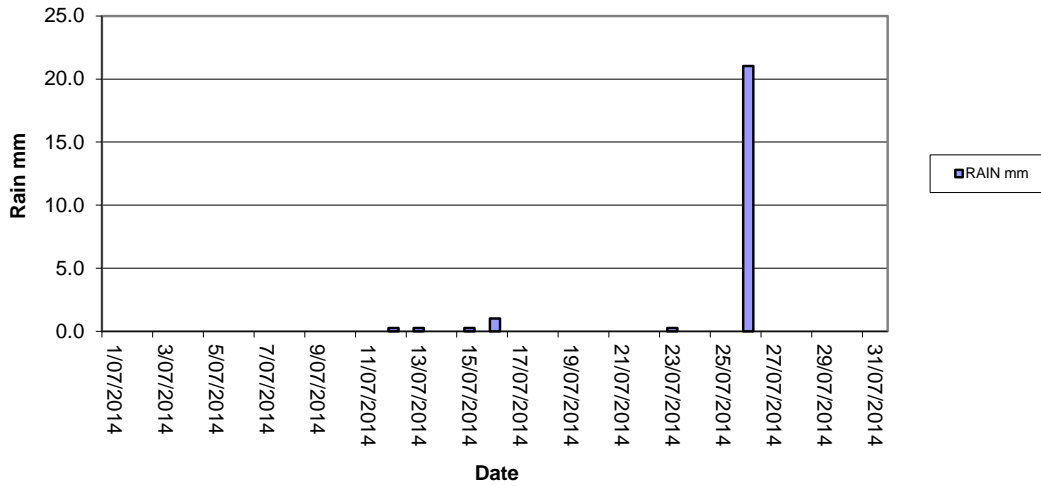
Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	ET mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Solar Rad	Av Solar Rad	Max Solar Rad	Min Data %	Av data %	Max Data %
1/07/2014	3.3	9.0	16.9	40	68	90	0.0	1.4	0	0.7	8	3.4	15.3	1020.9	1023.6	1026.1	0	75.1	523	89.8	95.9	98
2/07/2014	3.7	9.1	17.7	50	75	89	0.0	1.3	0	0.6	4.5	3.6	16.8	1024.2	1025.6	1027.0	0	75.0	511	90.1	95.8	98
3/07/2014	4.4	10.0	18.8	47	78	95	0.0	1.3	0	1.0	7.6	3.9	17.8	1020.9	1023.8	1026.5	0	76.6	526	92.4	96.8	98
4/07/2014	7.8	12.9	19.7	32	53	74	0.0	2.9	0.4	3.2	11.2	6.4	17.8	1014.8	1018.2	1021.0	0	77.1	537	91.2	96.8	98
5/07/2014	5.7	10.7	17.1	41	60	80	0.0	2.6	0	2.8	14.8	5.1	15.6	1011.4	1014.2	1016.0	0	77.3	527	87.1	96.9	98
6/07/2014	6.9	10.3	17.0	44	64	76	0.0	2.4	0.9	4.2	9.8	3.7	15.6	1009.9	1012.2	1013.8	0	76.2	527	96.2	97.8	98
7/07/2014	5.6	9.8	16.7	46	67	79	0.0	1.9	0	1.9	8	2.8	15.4	1011.1	1013.2	1015.5	0	79.6	530	95.3	97.5	98
8/07/2014	5.1	10.3	18.9	44	65	84	0.0	1.7	0	1.0	6.7	2.6	17.7	1009.2	1013.0	1015.9	0	80.3	535	95.6	97.5	98
9/07/2014	5.2	12.1	19.0	28	50	75	0.0	3.2	0	3.2	17.4	3.6	17.0	998.3	1004.3	1009.0	0	80.1	542	95	99.2	100
10/07/2014	7.8	10.4	15.7	44	56	67	0.0	3.4	0.9	5.8	15.2	5.3	14.4	1002.3	1006.0	1012.1	0	75.1	523	99.7	100.0	100
11/07/2014	6.8	10.7	17.9	43	60	71	0.0	2.5	0.9	3.4	10.3	4.8	16.4	1012.1	1015.9	1018.8	0	81.3	540	97.1	99.4	100
12/07/2014	4.8	9.8	17.0	39	64	88	0.3	2.4	0	2.8	11.2	1.9	15.3	1016.0	1018.5	1022.0	0	84.1	540	94.2	97.7	98
13/07/2014	4.2	8.6	13.8	51	68	83	0.3	1.5	0	1.3	8.5	2.8	12.7	1021.9	1026.5	1030.5	0	77.6	536	96.8	97.8	98
14/07/2014	3.7	9.2	16.5	53	80	95	0.0	1.1	0	0.7	5.8	2.8	15.4	1027.0	1029.1	1031.4	0	74.0	526	95.6	97.4	98
15/07/2014	8.3	10.8	14.1	84	93	97	0.3	0.5	0	0.3	4.5	7.8	14.0	1016.8	1022.2	1026.9	0	37.0	184	90.1	97.6	98
16/07/2014	9.2	12.0	17.4	54	80	97	1.0	1.8	0	2.4	13.4	8.8	16.7	1009.8	1012.8	1016.4	0	76.4	572	94.7	97.6	98
17/07/2014	8.3	11.5	18.2	44	62	77	0.0	3.1	0	4.8	17.9	6.2	16.7	1008.3	1011.1	1013.0	0	86.9	573	95.9	97.6	98
18/07/2014	5.2	9.0	14.3	41	60	82	0.0	3.0	0	4.6	14.3	2.4	12.9	1007.5	1011.7	1017.8	0	86.3	560	83.3	97.4	98
19/07/2014	6.6	9.8	13.1	56	59	63	0.0	2.3	1.8	3.9	14.8	3.8	12.2	1017.8	1020.4	1023.2	0	51.4	311	96.2	97.5	98
20/07/2014	7.6	10.4	12.9	60	74	95	0.0	1.2	0	1.7	9.8	6.8	12.5	1022.4	1024.1	1025.5	0	42.7	270	96.5	97.7	98
21/07/2014	7.5	10.6	17.1	60	86	96	0.0	1.1	0	0.6	4.9	6.7	15.9	1022.0	1023.8	1025.7	0	76.4	695	91.8	97.6	98
22/07/2014	6.6	10.1	18.3	61	89	98	0.0	1.0	0	0.6	6.3	6.6	17.4	1020.8	1022.6	1023.9	0	75.6	654	92.1	96.7	98
23/07/2014	5.2	10.3	19.0	55	88	98	0.3	1.2	0	0.5	4	5.2	18.3	1020.3	1022.4	1024.8	0	90.2	631	93	97.3	98
24/07/2014	4.9	10.7	16.8	67	87	98	0.0	1.0	0	0.5	5.8	4.9	16.3	1018.5	1020.0	1022.0	0	60.7	539	88	97.2	98
25/07/2014	7.9	12.7	17.8	65	81	96	0.0	1.2	0	2.6	10.3	7.0	17.4	1018.9	1020.7	1022.6	0	29.7	300	90.4	96.8	98
26/07/2014	8.6	12.2	15.6	78	89	97	21.1	0.7	0	1.1	3.1	8.3	15.6	1019.7	1021.8	1023.8	0	43.3	461	58.5	90.1	98
27/07/2014	6.1	10.8	18.6	49	79	93	0.0	1.4	0	1.0	6.3	5.3	17.7	1020.4	1022.3	1024.5	0	92.7	591	73.4	90.5	98
28/07/2014	6.5	11.8	19.7	44	68	92	0.0	2.0	0	1.6	8	5.3	18.6	1017.0	1019.1	1021.0	0	97.0	591	76.9	95.5	98
29/07/2014	10.3	14.4	19.8	37	54	70	0.0	3.7	1.8	4.7	13.9	8.3	18.2	1013.0	1016.2	1018.4	0	82.8	554	91.5	97.1	98
30/07/2014	11.2	15.6	22.2	43	54	66	0.0	3.5	0	3.7	13	9.6	21.2	1013.8	1015.9	1018.0	0	93.6	592	95	97.5	98
31/07/2014	12.2	16.8	23.6	28	45	66	0.0	4.5	1.8	4.7	17.9	10.7	22.6	1005.5	1010.6	1015.6	0	97.1	614	89.2	97.3	98
Monthly	3.3	11.0	23.6	28	70	98	23.1	62.5	0	2.3	17.9	1.9	22.6	998.3	1018.1	1031.4	0	74.5	695	58.5	96.9	100

2.4.2 Monthly Weather Charts

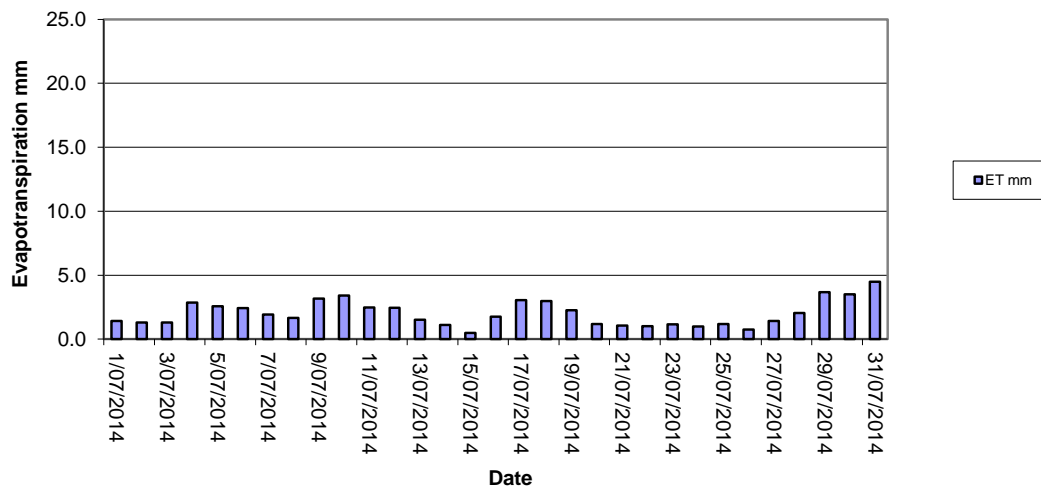




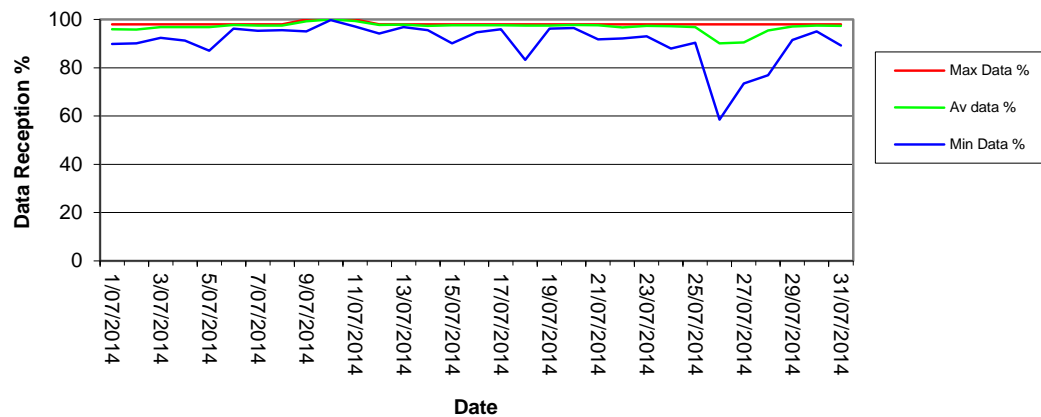
Rocla Calga Quarry - July 2014
Rainfall



Rocla Calga Quarry - July 2014
Evapotranspiration



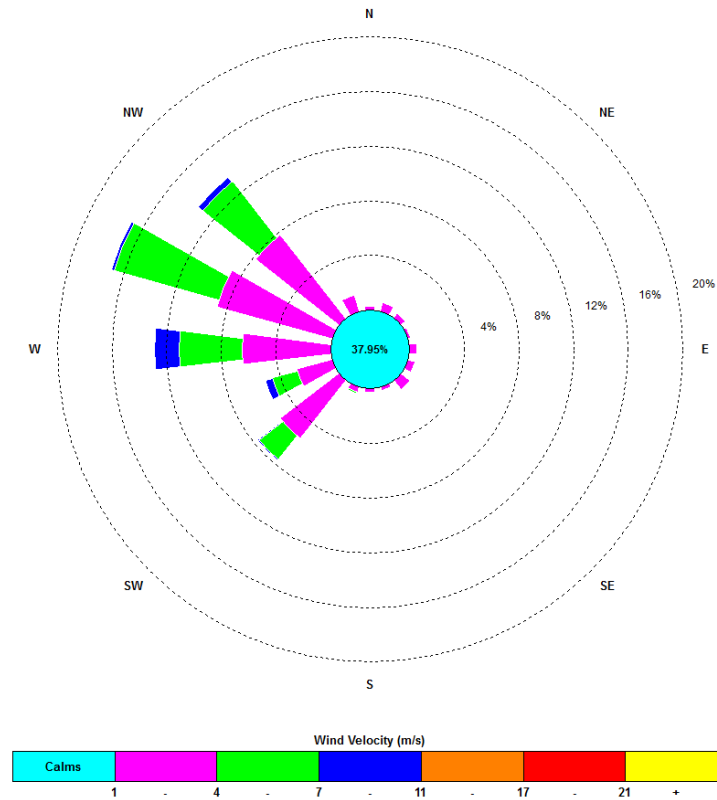
Rocla Calga Quarry - July 2014
Data Reception



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 less than a 15 minute average of 1m/s.

00:00, 1 July 2014 – 23:45, 31 July 2014



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

Appendix 1
Laboratory Certificates