



**CBased Environmental  
Pty Limited**

ABN 62 611 924 264



**Calga Quarry**

**Environmental Monitoring**

**Dust Deposition, Surface Water,  
Groundwater and Meteorological Data**

**November 2021**

A handwritten signature in black ink that reads 'Colin Davies'.

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Colin Davies BSc MEIA CENVP  
Environmental Scientist  
Date: 17 December 2021

## Executive Summary

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

The monitoring includes:

- Dust deposition;
- Surface water;
- Ground water and
- Meteorological data.

This report was prepared by CBased Environmental and includes the following results for November 2021:

- Dust deposition;
- Surface water quality; and
- Meteorological parameters.

The November 2021 dust deposition results for insoluble solids showed:

- Decreased levels when compared to October 2021.
- No dust gauges were deemed contaminated; and
- Rolling annual averages below the Air Quality Management Plan criteria of 3.7g/m<sup>2</sup>.month.

Monthly surface water samples were collected at sites A, C1 C2 and F. The samples that were collected were 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 were not detected at sites A, C1, C2 or F in November 2021.

The Calga Quarry weather station data recovery in November 2021 was approximately 100%.A summary of rainfall comparison is provided below.

Location	Rainfall (mm)
Calga Quarry	91.1mm
BOM Gosford*	190.2mm

**Notes:** NA = Not Available

*\*Data sourced from Bureau of Meteorology (BOM) website: [www.bom.gov.au](http://www.bom.gov.au)*

*BOM stations report rainfall at 9am*

*Calga Quarry station reports rainfall at midnight.*

## 1.0 Sampling Programme

Hanson Calga Quarry conducts environmental monitoring in accordance with Development Consent, OEH (EPA) licence and Environmental Management Plans. CBased Environmental are contracted to undertake dust deposition gauge, surface water, 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<sup>2</sup>.month.

Six (6) dust deposition gauges are monitored as follows:

- CD1 – installed 1 May 2006. Gauges air quality impacts to the east of site operations;
- CD2c – located on a rehabilitated section of land between the extraction area and adjacent resident. Gauges air quality impacts to the north of site operations. Replaces former gauges CD2a and CD2b;
- CD3 – installed prior to May 2006. Gauges air quality impacts to the south of site operations;
- CD4 – installed 3 October 2006. Gauges air quality impacts to the south of site operations;
- CD5 – installed 14 December 2006. Gauges air quality impacts to the south of site operations; and
- CD6 installed 14 December 2006. Gauges air quality impacts to the south of the operations.

Dust gauge CD2a was discontinued at the start of August 2006 due to quarry operations “mining out” the site of the gauge. The replacement gauge, 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. 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. CD2b was replaced by dust gauge CD2c.

Surface water is 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. Laboratory analysis includes pH, electrical conductivity, total suspended solids, total dissolved solids and total oil and grease. Monitoring 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.

Groundwater is 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 station has the following sensor configuration:

- Air temperature;
- Humidity;
- Rainfall;
- Atmospheric pressure;
- Evaporation;
- Solar radiation;
- Wind speed; and
- 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**.

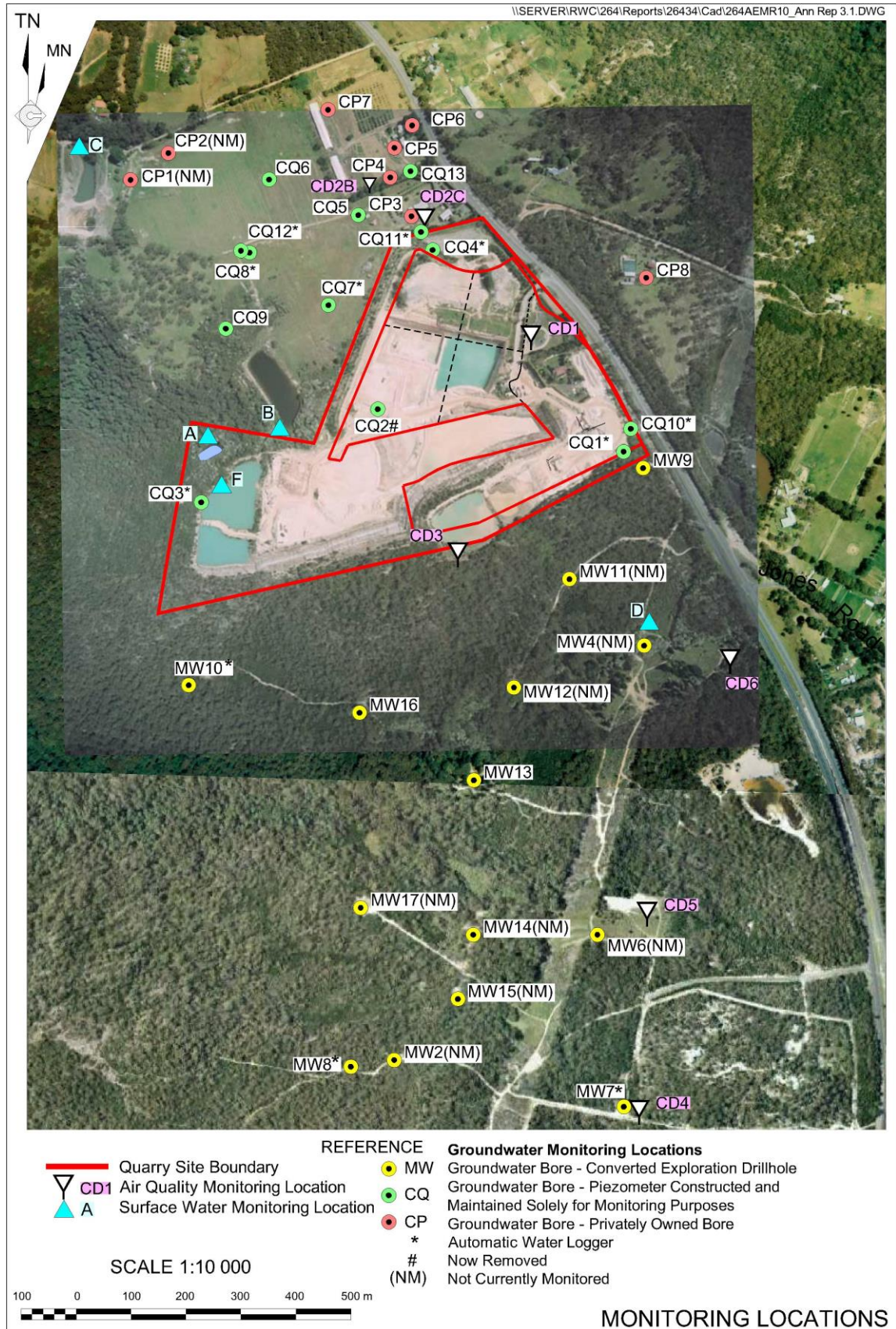


Figure 1: Hanson Calga Quarry Environmental Monitoring Locations

## 2.0 Results

### 2.1 Dust Deposition

The results for November 2021 and the project 12-month rolling average are provided **Table 1**.

Dust deposition charts for all dust gauge sites appear in **Figure 2** below. The field sheet, Chain of Custody documentation and laboratory analysis certificates are provided in **Appendix 1**.

**Table 1:** Dust Deposition Results: 1 November 2021 – 3 December 2021 (32 days)

Site	Monthly Insoluble Solids	Monthly Ash Residue	Monthly Combustible Matter	Monthly Ash Residue/ Insoluble Solids %	Rolling Annual Average Insoluble Solids
CD1	3.5	1.1	2.4	31	1.7
CD2c	1.1	0.5	0.6	45	0.8
CD3	1.1	0.3	0.8	27	1.2
CD4	1.3	0.3	1.0	23	0.5
CD5	0.6	0.3	0.3	50	0.6
CD6	0.4	0.2	0.2	50	0.5

**Notes:**

Units in g/m<sup>2</sup>.month unless indicated

Insoluble solid results 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 3.7g/m<sup>2</sup>.month; the Development Consent's annual average amenity criteria at residential locations

The current rolling annual average is calculated from December 2020 to November 2021



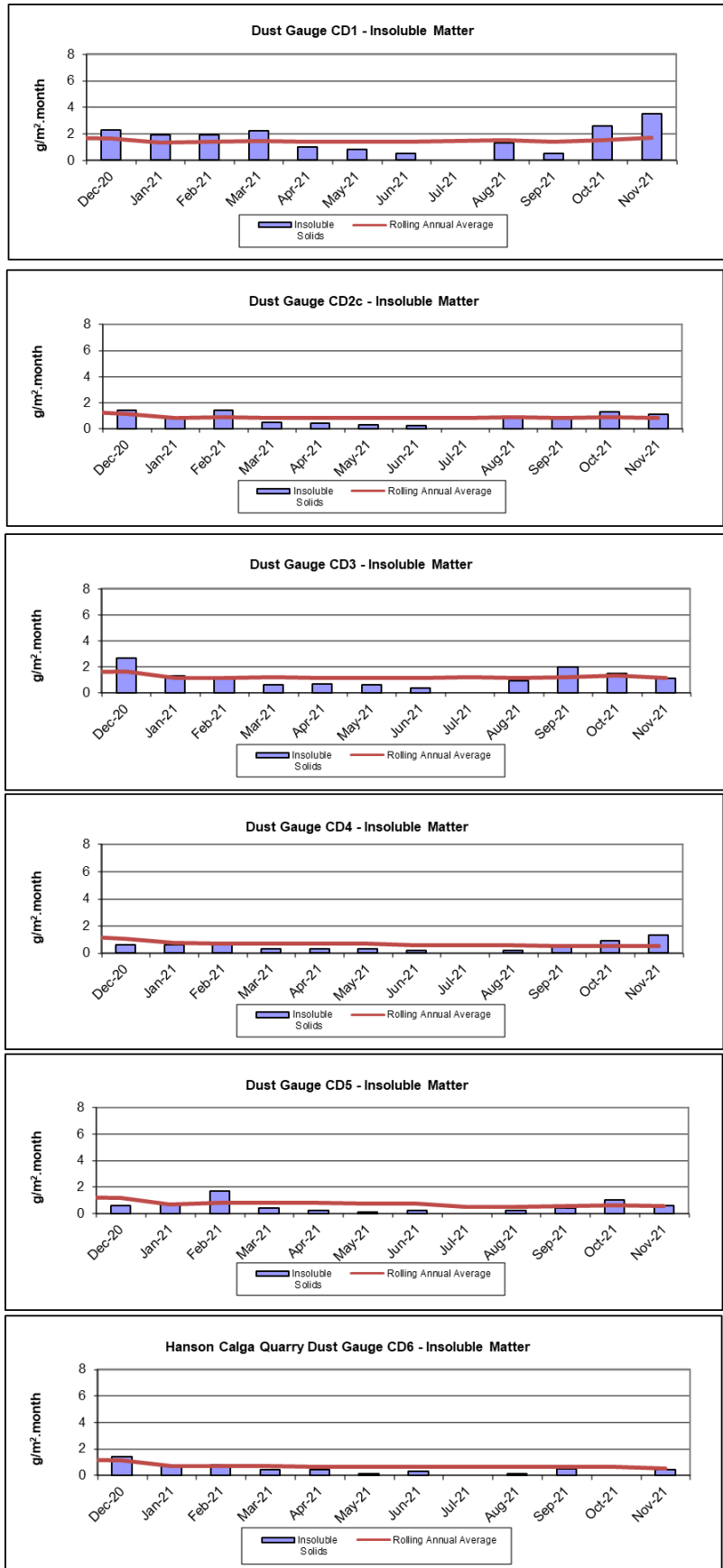


Figure 2: Summary Monthly/Annual Dust Deposition Results for Insoluble Solids

## 2.2 Surface Water (Monthly)

Monthly surface water monitoring was conducted on 1 November 2021 and results are provided in **Table 2**. The field sheet, chain of custody documentation and laboratory analysis certificates are provided in **Appendix 1**.

Samples were collected at sites A, C1, C2 and F.

**Table 2:** Monthly Surface Water Monitoring Results – November 2021

Site	Observed Flow Rate* (visual)	Water Colour* (visual)	Turbidity* (visual)	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Oil and Grease (mg/L)
A	Dam	Clear	Clear	6.28	74	68	8	<5
B	Dry							
C1	Dam	Clear	Clear	6.61	89	58	9	<5
C2	Trickle	Clear	Clear	6.83	89	56	<5	<5
D	Dry							
F	Dam	Clear	Clear	6.24	66	66	18	<5

\* Indicates field measurements. All other results are laboratory analysed

EC = Electrical conductivity

TDS = Total dissolved solids

TSS = Total suspended solids

### 2.2.1 Non-Routine Surface Water Sampling

No non-routine surface water sampling was completed in November 2021.



## 2.3 Meteorological Data

The Calga Quarry weather station data recovery for November 2021 was approximately 100%.

The weather station data follows and includes:

- Monthly rainfall comparison between quarry data and BOM data. Refer to **Table 3**;
- Monthly data summary. Refer to **Table 4**;
- Weather charts of air temperature, humidity, heat index and wind chill, atmospheric pressure, solar radiation, evapotranspiration, rain, wind speed and data reception. Refer to **Figures 3 - 5**; and
- Wind rose (frequency distribution diagram of wind speed and direction). Refer to **Figure 6**.

A summary of rainfall comparison is provided in **Table 3**.

**Table 3:** Comparison of Local Rainfall – November 2021

Location	Rainfall (mm)
Calga Quarry	91.1mm
BOM Gosford*	190.2mm

**Notes:** NA = Not Available

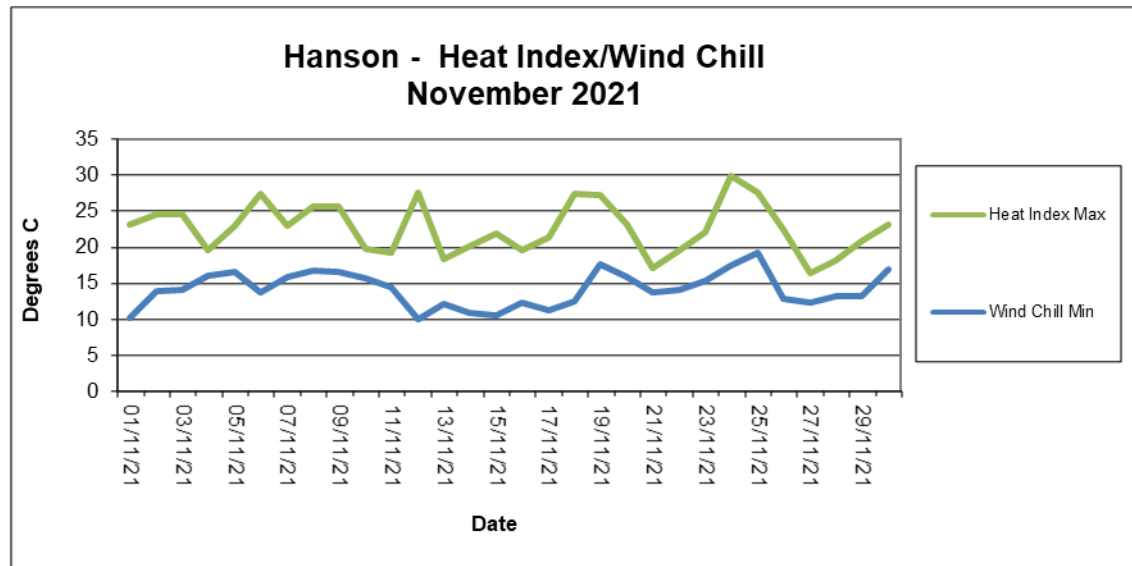
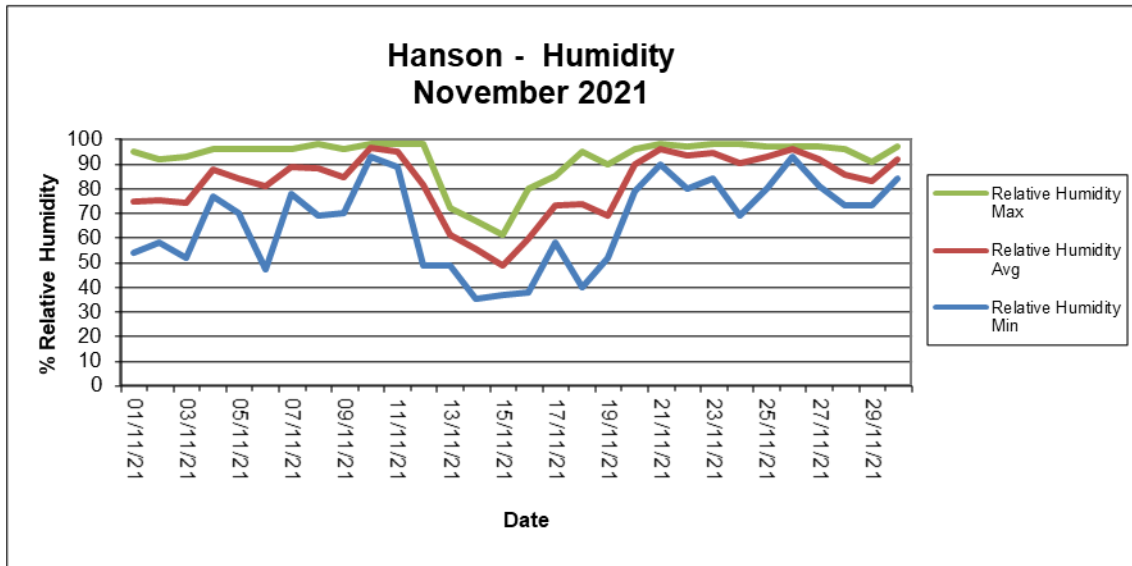
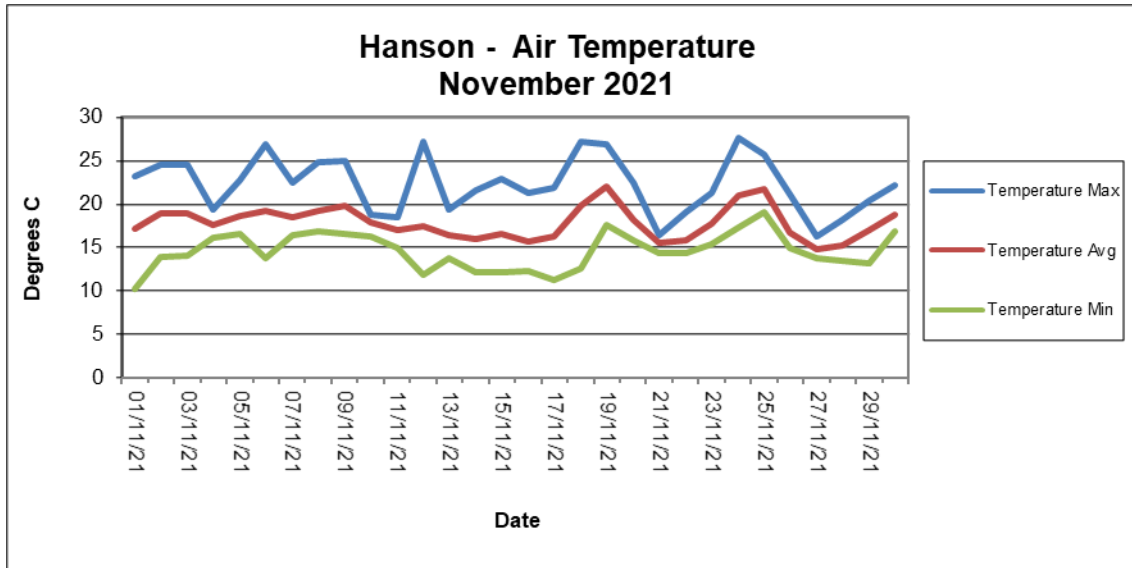
\*Data sourced from Bureau of Meteorology (BOM) website: [www.bom.gov.au](http://www.bom.gov.au)

BOM stations report rainfall at 9am

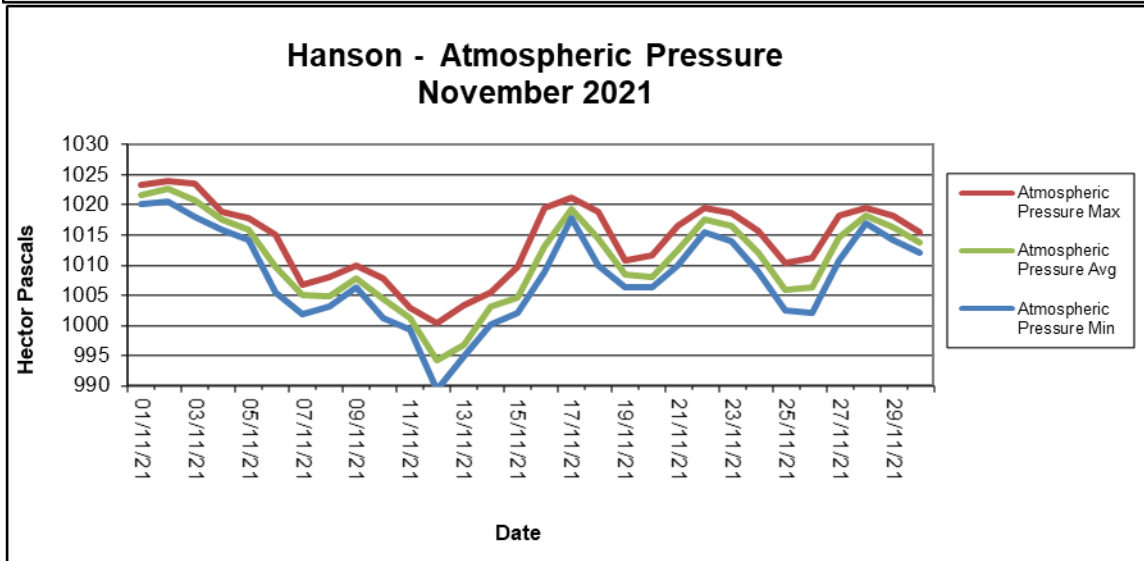
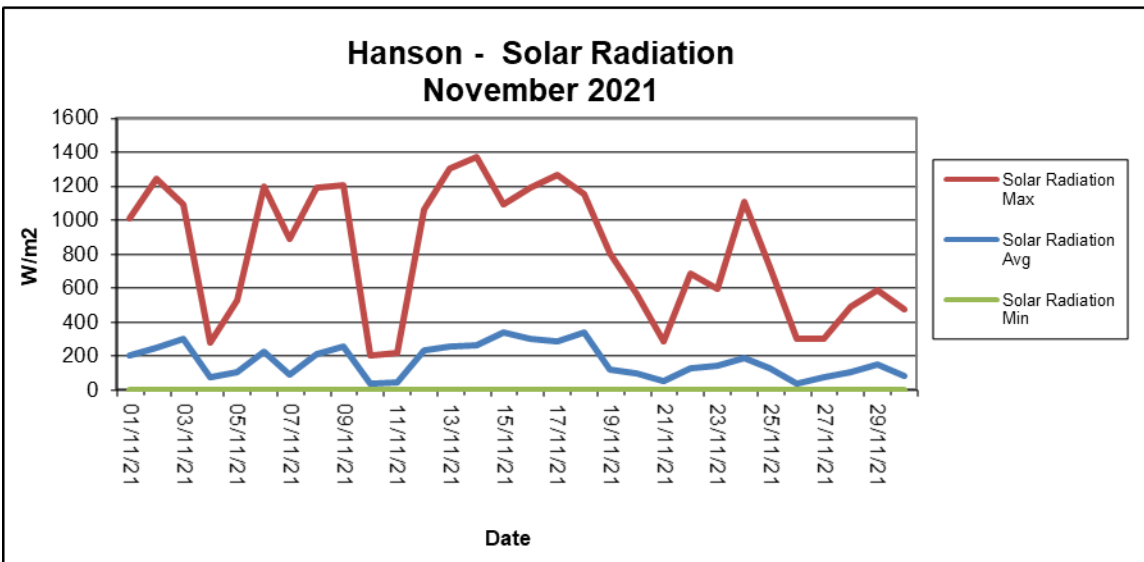
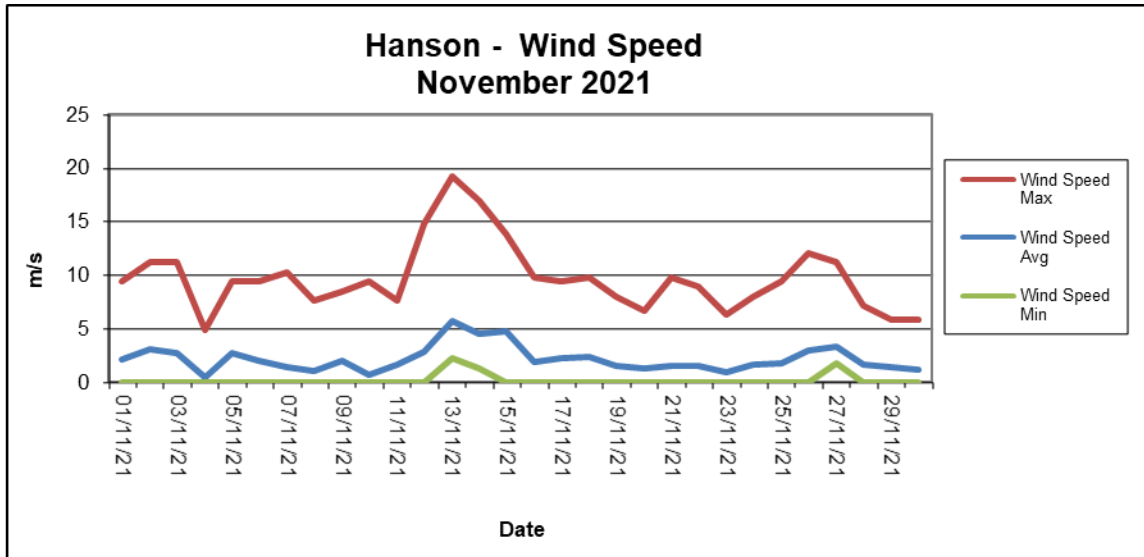
Calga Quarry station reports rainfall at midnight.

**Table 4:** Summary of Monthly Meteorological Data – November 2021

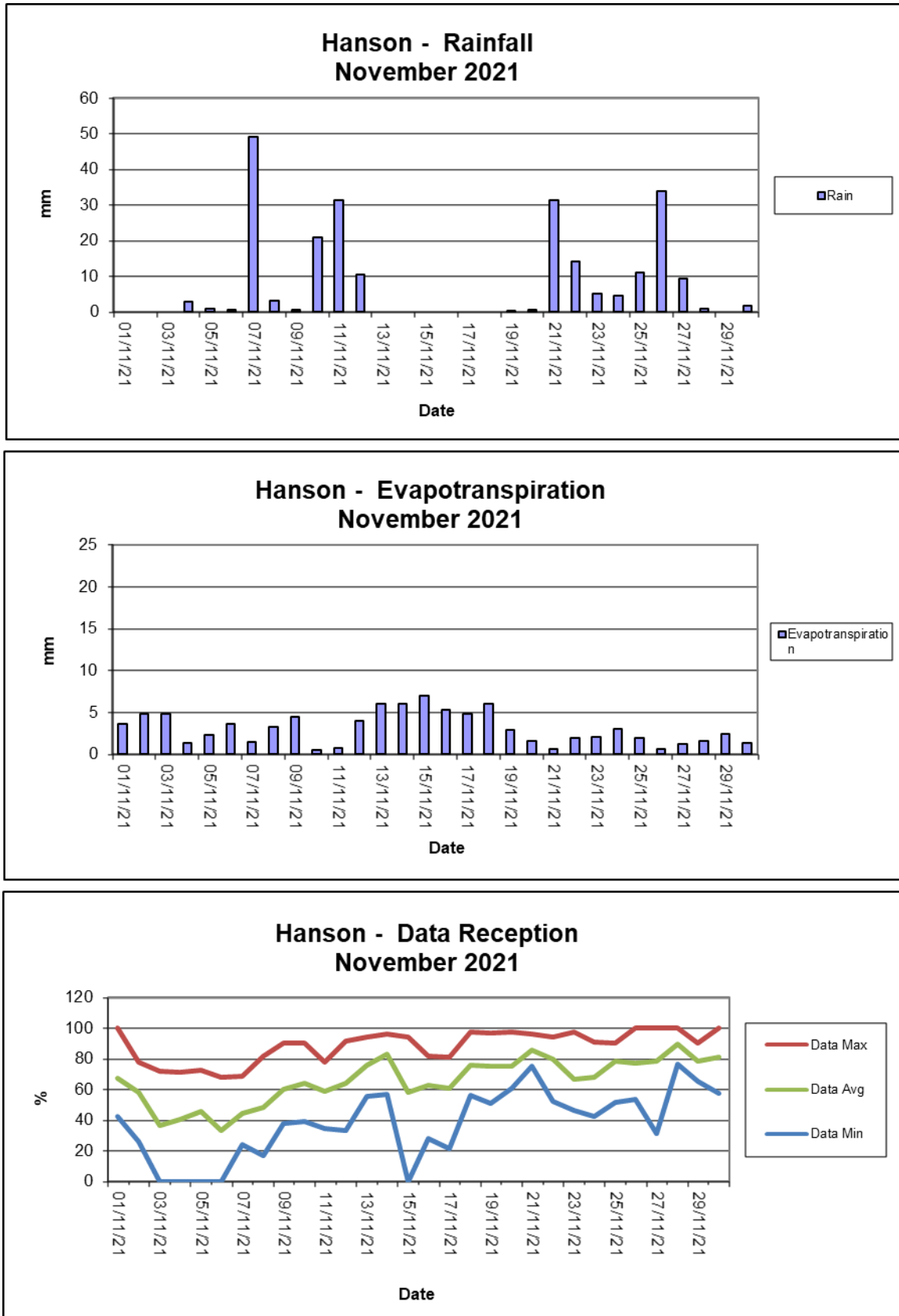
Date	Temperature Min	Temperature Avg	Temperature Max	Relative Humidity Min	Relative Humidity Avg	Relative Humidity Max	Rain	Evapotranspiration	Wind Speed Min	Wind Speed Avg	Wind Speed Max	Wind Chill Min	Heat Index Max	Atmospheric Pressure Min	Atmospheric Pressure Avg	Atmospheric Pressure Max	Solar Radiation Min	Solar Radiation Avg	Solar Radiation Max	Data Min	Data Avg	Data Max
1/11/2021	10.2	17.1	23.1	54.0	74.9	95.0	0.0	3.7	0.0	2.1	9.4	10.2	23.1	1020.0	1021.6	1023.2	0.0	203.8	1008.0	42.6	67.2	100.0
2/11/2021	13.9	18.9	24.5	58.0	75.4	92.0	0.0	4.9	0.0	3.1	11.2	13.9	24.6	1020.5	1022.6	1024.0	0.0	246.8	1241.0	25.9	58.2	77.9
3/11/2021	14.1	18.9	24.5	52.0	74.3	93.0	0.0	4.8	0.0	2.8	11.2	14.1	24.6	1018.0	1020.7	1023.5	0.0	301.4	1092.0	0.0	36.5	71.6
4/11/2021	16.1	17.6	19.3	77.0	87.7	96.0	2.8	1.3	0.0	0.5	4.9	16.1	19.5	1015.8	1017.5	1018.8	0.0	78.2	280.0	0.0	40.1	71.0
5/11/2021	16.5	18.6	22.7	70.0	84.3	96.0	0.8	2.3	0.0	2.7	9.4	16.5	23.0	1014.2	1015.9	1017.8	0.0	102.9	528.0	0.0	45.5	72.6
6/11/2021	13.7	19.2	26.8	47.0	80.9	96.0	0.6	3.6	0.0	2.0	9.4	13.7	27.4	1005.5	1009.6	1014.9	0.0	224.4	1199.0	0.0	33.1	67.8
7/11/2021	16.4	18.5	22.4	78.0	88.9	96.0	49.0	1.4	0.0	1.4	10.3	15.9	23.0	1001.9	1005.0	1006.7	0.0	87.1	888.0	23.7	44.2	68.8
8/11/2021	16.8	19.2	24.8	69.0	88.2	98.0	3.0	3.3	0.0	1.1	7.6	16.8	25.6	1003.1	1004.8	1008.0	0.0	209.0	1187.0	16.7	48.0	81.7
9/11/2021	16.5	19.8	24.9	70.0	84.4	96.0	0.6	4.4	0.0	2.0	8.5	16.5	25.6	1006.3	1007.7	1009.8	0.0	254.8	1206.0	37.5	60.2	90.2
10/11/2021	16.3	17.9	18.7	93.0	96.4	98.0	20.8	0.5	0.0	0.6	9.4	15.7	19.8	1001.2	1004.4	1007.8	0.0	36.3	201.0	38.8	64.0	90.2
11/11/2021	14.9	16.9	18.4	89.0	95.0	98.0	31.2	0.7	0.0	1.6	7.6	14.4	19.2	999.2	1001.1	1002.9	0.0	48.5	219.0	34.4	58.4	77.6
12/11/2021	11.9	17.4	27.1	49.0	81.3	98.0	10.4	4.0	0.0	2.8	14.8	10.0	27.6	989.4	994.2	1000.3	0.0	234.9	1059.0	33.1	64.2	91.2
13/11/2021	13.8	16.4	19.3	49.0	61.4	72.0	0.0	6.0	2.2	5.8	19.2	12.1	18.3	994.9	996.8	1003.3	0.0	258.1	1302.0	55.5	75.9	94.0
14/11/2021	12.1	16.0	21.6	35.0	55.4	67.0	0.0	6.0	1.3	4.5	17.0	10.8	20.1	1000.2	1003.2	1005.4	0.0	262.0	1373.0	56.8	82.9	96.2
15/11/2021	12.2	16.5	22.8	37.0	48.7	61.0	0.0	6.9	0.0	4.8	13.9	10.5	21.9	1002.0	1004.7	1009.7	0.0	336.7	1093.0	0.0	58.3	94.0
16/11/2021	12.3	15.7	21.3	38.0	59.4	80.0	0.0	5.3	0.0	1.9	9.8	12.3	19.6	1008.9	1013.1	1019.5	0.0	304.6	1187.0	27.8	62.9	81.4
17/11/2021	11.2	16.3	21.8	58.0	73.2	85.0	0.0	4.8	0.0	2.3	9.4	11.3	21.4	1017.8	1019.3	1021.1	0.0	282.8	1265.0	21.1	61.0	81.1
18/11/2021	12.5	19.7	27.2	40.0	73.8	95.0	0.0	6.0	0.0	2.3	9.8	12.5	27.3	1009.8	1014.4	1018.9	0.0	336.1	1156.0	55.8	75.9	97.2
19/11/2021	17.6	21.9	26.9	52.0	68.8	90.0	0.2	2.9	0.0	1.5	8.0	17.6	27.2	1006.2	1008.4	1010.7	0.0	124.0	805.0	50.8	75.3	96.8
20/11/2021	15.8	18.1	22.4	79.0	89.6	96.0	0.6	1.6	0.0	1.3	6.7	15.9	23.2	1006.3	1007.9	1011.5	0.0	100.8	563.0	60.6	74.9	97.5
21/11/2021	14.3	15.5	16.4	90.0	96.1	98.0	31.4	0.6	0.0	1.5	9.8	13.8	17.0	1009.8	1012.3	1016.4	0.0	49.0	289.0	74.8	85.7	96.2
22/11/2021	14.3	15.9	19.1	80.0	93.6	97.0	14.0	1.9	0.0	1.5	8.9	14.1	19.6	1015.4	1017.6	1019.5	0.0	128.3	687.0	52.1	79.6	94.0
23/11/2021	15.3	17.7	21.3	84.0	94.6	98.0	5.0	2.0	0.0	1.0	6.3	15.3	22.1	1013.9	1016.4	1018.6	0.0	139.5	592.0	46.1	66.4	97.5
24/11/2021	17.3	20.9	27.6	69.0	90.2	98.0	4.4	3.1	0.0	1.6	8.0	17.4	29.8	1008.9	1011.9	1015.6	0.0	185.8	1107.0	42.3	67.9	90.9
25/11/2021	19.1	21.6	25.7	80.0	92.8	97.0	11.0	1.9	0.0	1.8	9.4	19.2	27.6	1002.4	1005.8	1010.3	0.0	127.1	721.0	51.7	78.2	90.2
26/11/2021	14.9	16.8	21.1	93.0	96.1	97.0	33.8	0.6	0.0	2.9	12.1	12.8	22.4	1002.0	1006.3	1011.1	0.0	41.2	300.0	53.6	77.0	99.7
27/11/2021	13.8	14.8	16.3	81.0	92.2	97.0	9.4	1.3	1.8	3.3	11.2	12.3	16.3	1010.8	1014.6	1018.2	0.0	78.0	298.0	31.2	78.3	100.0
28/11/2021	13.4	15.2	18.2	73.0	85.5	96.0	0.8	1.6	0.0	1.6	7.2	13.1	18.2	1017.0	1018.2	1019.5	0.0	106.5	487.0	76.7	89.3	100.0
29/11/2021	13.2	16.9	20.4	73.0	82.8	91.0	0.0	2.4	0.0	1.5	5.8	13.2	20.9	1014.1	1016.2	1018.1	0.0	147.1	584.0	65.0	78.6	90.2
30/11/2021	16.8	18.7	22.2	84.0	91.9	97.0	1.6	1.3	0.0	1.1	5.8	16.9	23.1	1012.1	1013.7	1015.5	0.0	86.0	475.0	57.7	81.2	100.0
<b>Monthly</b>	10.2	17.8	27.6	35	82	98	231.4	91.1	0.0	2.2	19.2	10.0	29.8	989.4	1010.9	1024.0	0.0	170.7	1373.0	0.0	65.6	100.0
<b>Unit</b>	Degrees Celcius (°C)			Percentage Relative Humidity			mm	mm	Metres per second (m/s)			°C	°C	Hectopascals (hPa)			Watts per square metre (W/m <sup>2</sup> )			Percentage (%)		



**Figure 3:** Summary of Monthly Temperature, Humidity and Heat Index Results

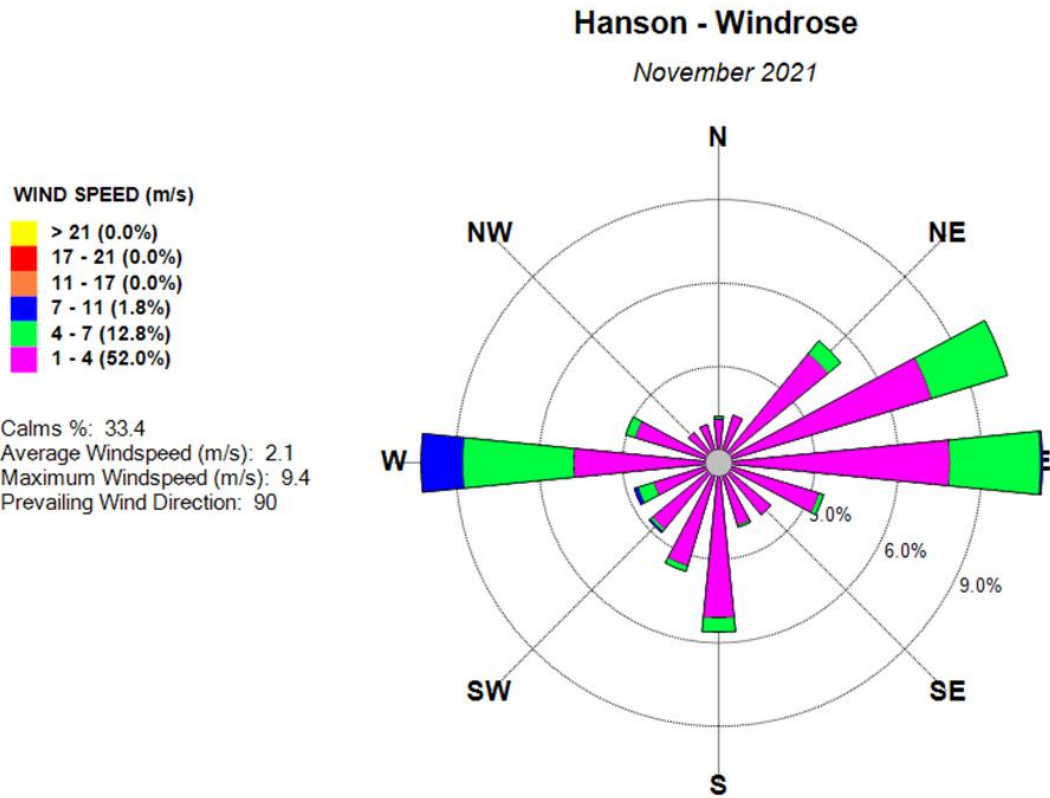


**Figure 4:** Summary of Monthly Wind Speed, Solar Radiation and Atmospheric Pressure Results



**Figure 5:** Summary of Monthly Rainfall, Evapotranspiration and Data Reception Results

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.



**Figure 6:** Monthly Windrose Plot – November 2021

The predominant wind for November was from the West with most frequent, strongest winds, also from the East. The maximum wind speed was 19.2 m/s from the West.

## **Appendix 1**

Field Sheets

Chain of Custody Documentation

Laboratory Analysis Certificates























