Final Report

Air Quality Monitoring and Environmental Performance Assessment Report

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Table 1.1. *Document Control*

Version	Date	Comment	Prepared by	Reviewed by
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1 Introduction

In accordance with Newnes Kaolin Pty Ltd's (the 'Proponent') Development Consent (DA 329-7-2003), Pacific Environment has prepared an Air Quality Monitoring and Environmental Performance Assessment Report in support of this Annual Review for Newnes Kaolin Mine (the 'Project').

Monitoring parameters include deposited dust, total suspended particles (TSP) and particulate matter below 10 micrometres in aerodynamic diameter (PM_{10}). Monitoring results are available from 1 September 2016 to 28 February 2018 inclusive.

2 Monitoring Network

The Proponent's air quality monitoring network is shown in Figure 2.1.

Monthly dust deposition rates are measured at three dust deposition gauges (DDG1 to DDG3) located around the perimeter of the site. It should be noted this is not aligned with the Air Quality Monitoring Program (AQMP) **(PAE Holmes, 2011)** forming a part of the Proponent's current Environmental Monitoring Program (EMP).

As per the memorandum titled *Application to vary the Dust Monitoring component of Air Quality Monitoring Program* from Ron Goldbery to Chris Schultz on the 6 October 2017, it is understood that the Proponent has sought approval to remove an additional dust deposition gauge (DDG4) and amended their AQMP accordingly. The previous location of DDG4 is shown in Figure 2.1. Table 2.1 tabulates all current dust deposition gauges and their associated location description.

Table 2.1: *Dust deposition gauges currently installed*

Site ID	Description
DDG1	Adjacent to meteorological station on Sandham Road
DDG2	South east corner of the site
DDG3	North east corner of the site

Additionally, a Met One Instruments E-Sampler has been used to continuously measure PM_{10}. This same instrument has also been used to measure the TSP. As the instrument cannot measure both parameters simultaneously, the instrument has been intermittently alternated between the two parameters. It should be noted this also does not align with AQMP **(PAE Holmes, 2011)** forming a part of the Proponent's current EMP. This instrument is not shown in Figure 2.1 however is located next to the meteorological station on Sandham Road.

A meteorological station has been co-located with the E-sampler and a dust deposition gauge (DDG1). The meteorological station provides wind speed and wind direction.

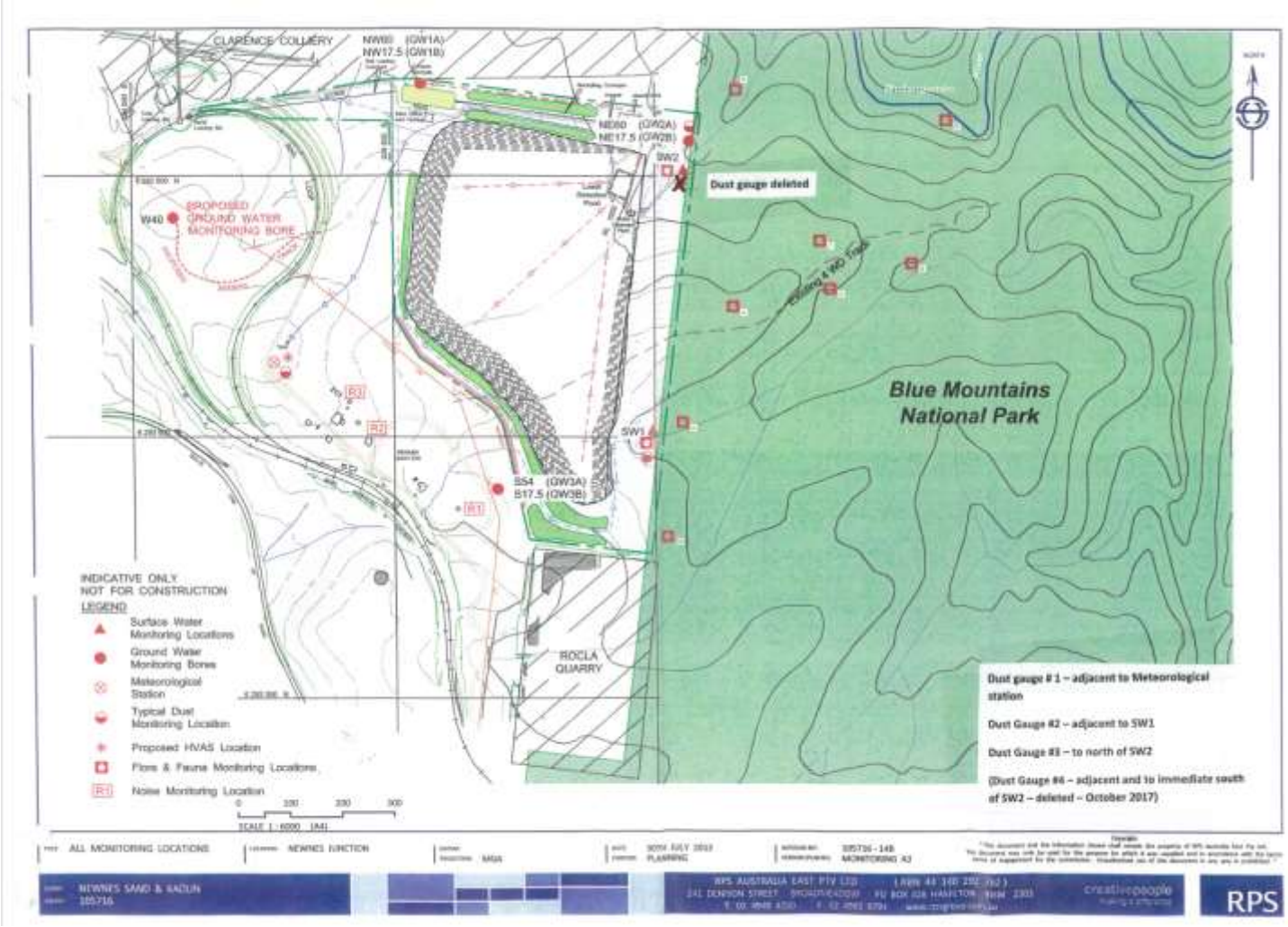

Figure 2.1: *Locations of ambient air quality and meteorological monitoring sites. Please Note: The E-sampler is co-located with the meteorological station.*

3 Results

3.1 Deposited Dust

Monthly and annual average dust deposition rates for dust deposition gauges DDG1 to DDG3 are shown in Table 3.1, Figure 3.1 and Figure 3.2.

46 of the potential 54 samples (3 sites over 18 months) were collected across the reporting period, representing 85% data availability for deposited dust.

Dust deposition rates were low (typically below 1 g/m^2/month) across all three dust deposition gauges. The highest monthly dust deposition rate observed at DDG1 was in June 2017 at 1.6g/m^2/month. The highest monthly dust deposition rate observed at DDG2 was in November 2017 at 1.4g/m^2/month. The highest monthly dust deposition rate observed at DDG3 was in August 2017 at 3.0g/m^2/month. The highest (calendar year 2017) annual average monthly deposition rate was recorded at DG3 at 1.3 g/m^2/month. Due to data gaps, no commentary is provided for 2016 and 2018 annual averages.

Table 3.1: *Monthly dust deposition rates measured at dust gauges DG1 to DG3 (g/m^2/month)*

Month	DDG1	DDG2	DDG3
Sep-16	0.5	-	-
Oct-16	0.2	0.5	1.8
Nov-16	-	-	1.8
Dec-16	0.2	0.7	1.4
Jan-17	0.3	0.2	1.1
Feb-17	0.8	1.4	2.4
Mar-17	-	-	-
Apr-17	0.8	0.3	0.6
May-17	0.1	0.1	0.2
Jun-17	1.6	0.1	0.1
Jul-17	0.6	0.2	0.8
Aug-17	0.7	0.3	3.0
Sep-17	0.9	0.7	2.5
Oct-17	1.5	1.2	2.0
Nov-17	1.4	1.4	1.1
Dec-17	0.7	-	0.4
Jan-18	1.0	0.8	2.1
Feb-18	0.9	0.9	0.7
2017 Annual Average	1.0	0.6	1.3

Figure 3.1 depicts the monthly dust deposition rates measured at dust gauges DG1 to DG3 (g/m^2/month) tabulated in Table 3.1. Overall, DDG3 in the north east corner of the site has higher values than DDG1 and DDG2. Despite having the highest recorded dust deposition

over the calendar year 2017, the dust deposition at DDG3 is below the performance criterion of 4g/m^2/month (Figure 3.2).

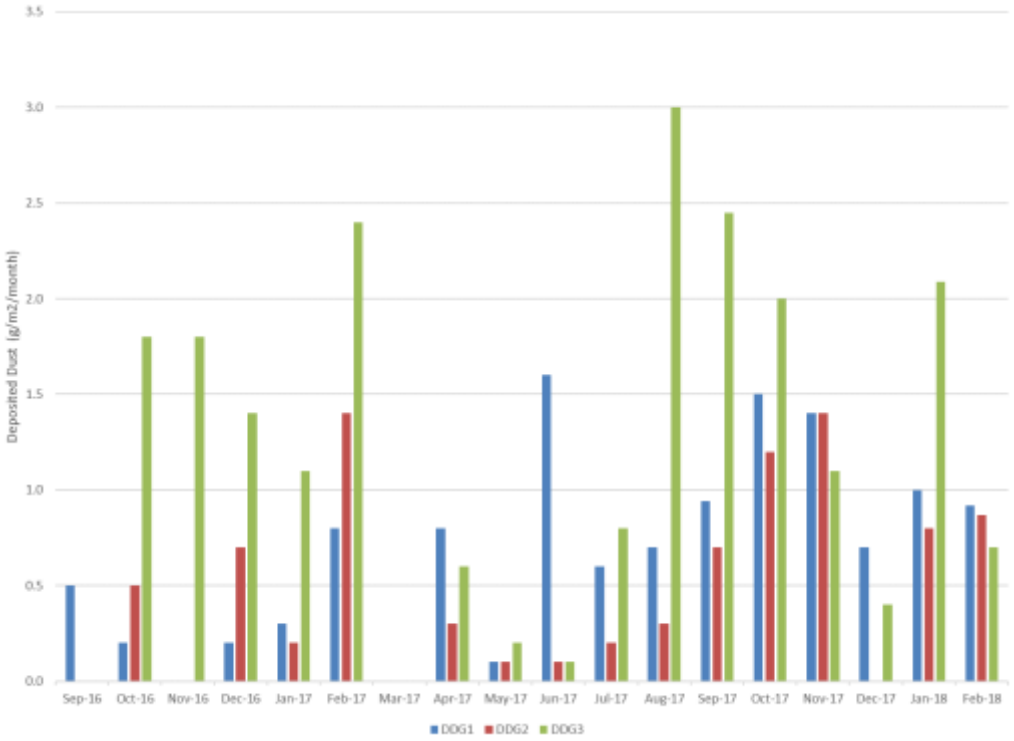

Figure 3.1: *Monthly dust deposition rates measured at dust gauges DDG1 to DDG3*

Figure 3.2: 2017 *Annual average dust deposition rates measured at dust gauges DDG1 to DDG3*

In future years, as the monitoring data base increases, inter-annual trends in the dust deposition data may be established.

3.2 Particulate Matter

As outlined in Section 2, a Met One Instruments E-Sampler has been used to continuously measure PM_{10}. This same instrument has also been used to continuously measure TSP. As the instrument cannot measure both parameters simultaneously, the instrument has been intermittently alternated between the two parameters.

3.2.1 PM_{10}

Figure 3.3 shows a graph of the 24-hour average PM_{10} concentrations during the reporting period. In total, valid data were available for five full days throughout the reporting period. The highest 24-hour average PM_{10} concentration during the reporting period was 12 µg/m^3 recorded on 1 December 2016. This value was below both the performance indicator of 37.5 µg/m^3 and performance criterion of 50 µg/m^3.

An annual average PM_{10} concentration could not be derived due to limited data capture.

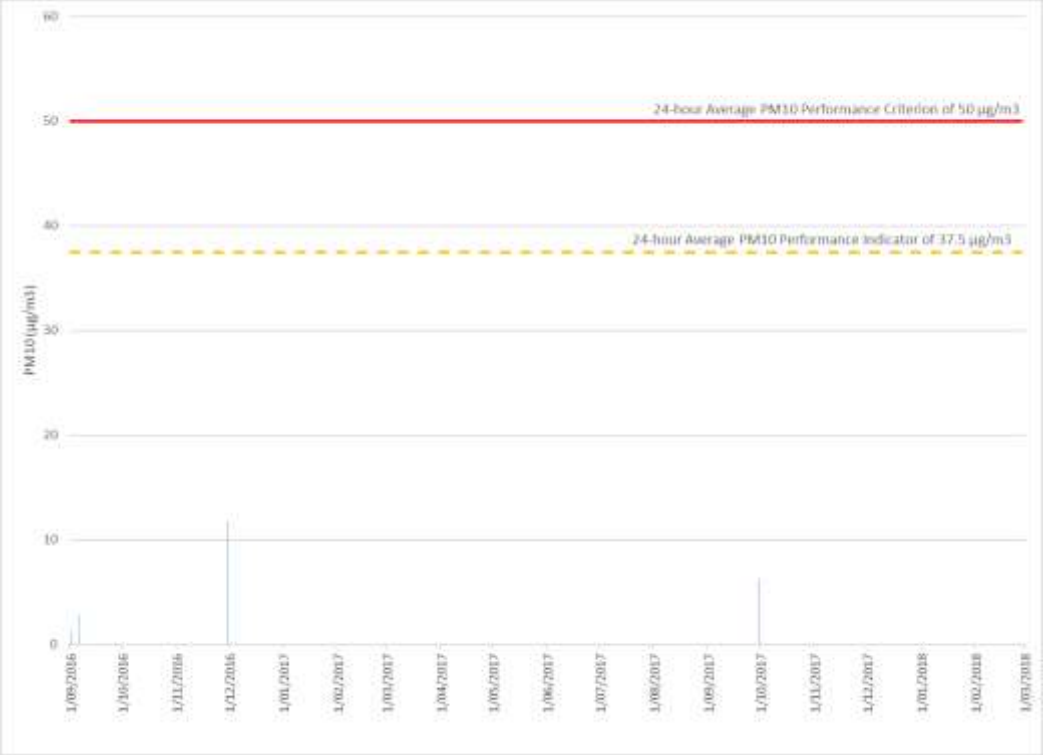

Figure 3.3: *24-hour average PM_{10} concentrations (E-Sampler)*

3.2.2 Total Suspended Particulates

Figure 3.4 shows a graph of the 24-hour average TSP concentrations during the reporting period. Valid data were available for nine days throughout the reporting period. The highest 24-hour average TSP concentration during the reporting period was 16 µg/m^3 recorded on 23 February 2017.

An annual average TSP concentration could not be derived due to limited data capture.

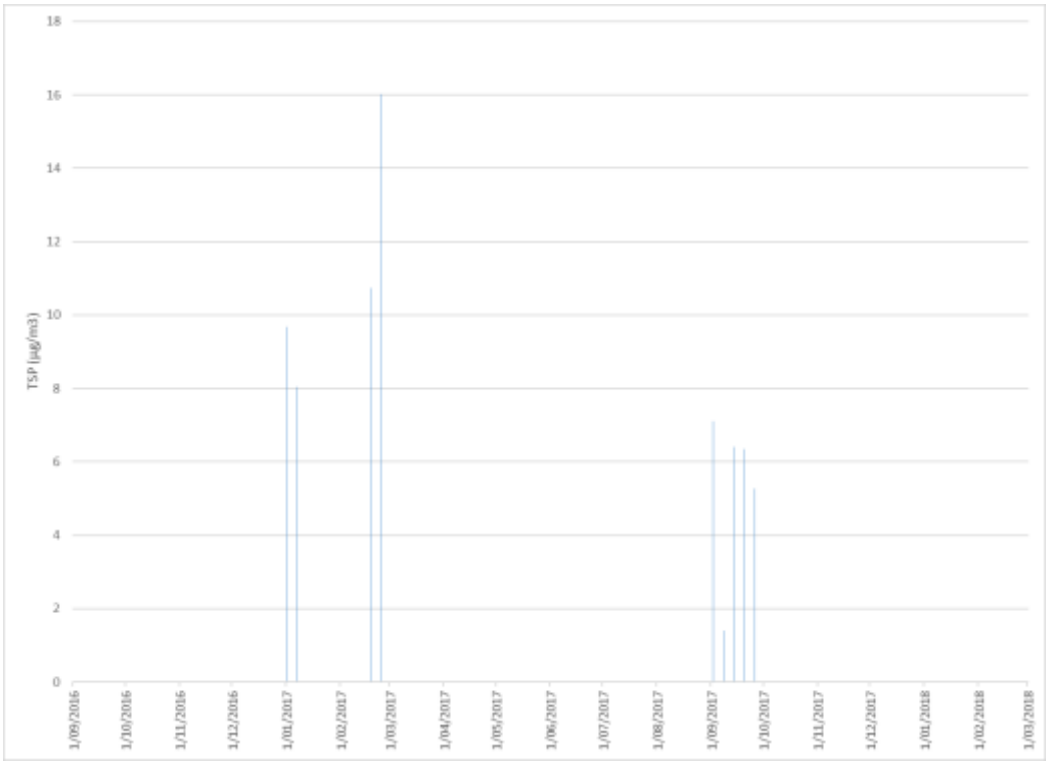

Figure 3.4: *24-hour average TSP concentrations (E-Sampler)*

3.3 Meteorological Data

Wind speed and wind direction data was collected from the meteorological station on Sandham Road (Figure 2.1). Low data capture rates were identified as shown in Table 3.2.

Table 3.2 Valid Data Recovery Rates

Parameter	Valid Data Recovery Rate
Wind Speed	0%
Wind Direction	0%

During the data validation process 88% of wind speeds were identified as below 0.5m/s. This is not considered representative of the Project location and as such, all the wind speed data were invalidated. For visualisation purposes, Pacific Environment has provided a wind rose that best illustrates the issue (Figure 3.5). Note that this wind rose represents invalidated data and should not be used in further reporting.

As the validity of wind direction data depends upon the validity of wind speed data, the wind direction data was invalidated. (AS/NZS 3580.14:2014)

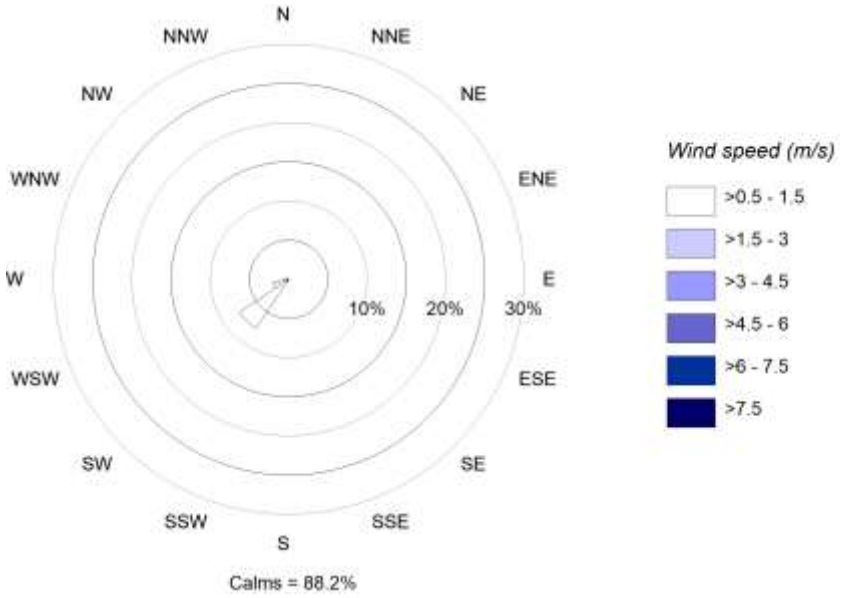

Figure 3.5 2017 Annual Wind Rose for data collected by the on-site meteorological station

As an alternative, within Appendix A, Pacific Environment has provided a wind rose of a weather station operated by Bureau of Meteorology (BoM) at Mount Boyce (AWS Number 63292) approximately 45km south of the site. While not site-representative, this provides an indication of the range and magnitude of wind speeds and directions that may be expected.

3.4 Assessment of Environmental Performance

Air quality performance indicators and impact assessment criteria have been developed in consideration of the predicted impacts of the Project on air quality. It is considered good practice to benchmark the Project using performance indicators that comprise a percentage of the impact assessment criteria outlined by the NSW EPA.

3.4.1 Assessment against Performance Indicators

Pacific Environment has assessed the Project against the air quality performance indicators outlined in Table 3.3.

Table 3.3 *Air Quality Performance Indicators*

Pollutant	Averaging Period	Monitoring point	Performance Indicator[1,2]
PM_{10}	24-hour	E-Sampler	37.5 µg/m^3
	Annual		25 µg/m^3
Deposited Dust	Annual	DDG1, DDG2, DDG3	3 g/m^2/month

* Indicative performance criteria only – to be reviewed and updated with ongoing monitoring results.

Dust Deposition

The annual average dust deposition rates for each of the sites presented in Table 3.1 indicate that compliance with the deposited dust performance indicator (3 g/m^2/month) was achieved at all of the monitoring sites during the reporting period.

Particulate Matter

The highest 24-hour average PM_{10} concentration during the reporting period was 12 µg/m^3 recorded on 1 December 2016. This value was below the performance indicator of 37.5 µg/m^3.

3.4.2 Assessment Against Development Consent

3.4.2.1 Air Quality Impact Assessment Criteria

Schedule 3, Condition 14 of the Development Consent states:

"The Applicant shall ensure that dust generated by the development does not cause additional exceedances of the criteria… at any residence on, or on more than 25% of any privately-owned land, or at the boundary of the Greater Blue Mountains WHA." **(DoP,2006)**

The performance criteria specified within the Development Consent are reproduced below as Table 3.4, Table 3.5 and Table 3.6, respectively.

Table 3.4 *Long term impact assessment criteria for particulate matter*

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate matter <10 µm (PM_{10})	Annual	30 µg/m^3

Assessment against the criteria outlined in Table 3.4 could not be made due to the limited data available.

Table 3.5: *Short term impact assessment criterion for particulate matter*

Pollutant	Averaging Period	Criterion
Particulate matter <10 µg (PM_{10})	24-hour	50 µg/m^3

Assessment against the criteria outlined in Table 3.5, based on the data available, indicates the Project is meeting its assessment criterion.

Table 3.6: *Long-term impact assessment criteria for deposited dust*

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter – Deposited Matter - Gravimetric Method, or its latest version.

Assessment against the criteria outlined in Table 3.6, based on the data available, indicates the Project is meeting this assessment criterion.

3.4.2.2 Meteorological Monitoring

Schedule 3, Condition 24 of the Development Consent states:

"Prior to carrying out any development, the Applicant shall establish and subsequently maintain a meteorological station in the vicinity of the development, in accordance with the requirements in Approved Methods for the Sampling and Analysis of Air Pollutants in NSW, and to the satisfaction of the DEC and the Director-General." **(DoP,2006)**

Assessment against Schedule 3, Condition 24 of the Development Consent could not be made due to the limited data available.

4 Recommendations and Conclusions

Assessment against the Development Consent's impact assessment criteria was inconclusive due to limited data available.

As per Schedule 3, Condition 15 of the Development Consent, it is recommended that the onsite activities of the Project align with the current AQMP (PAE Holmes, 2011). Alternatively it is recommended the Proponent seek to amend the current AQMP (PAE Holmes, 2011) in order to reflect the onsite activities. This should include the inclusion of an E-sampler to measure PM_{10} and omission of a High Volume Air Sampler (HVAS) to measure PM_{10}.

In view of the limited data capture achieved by the E-Sampler, it should be formally established whether the E-Sampler is for compliance monitoring or operational dust management purposes. Typically, such an instrument is not regarded as adequate for compliance purposes.

Assuming that the E-Sampler is used for operational dust management, it is suggested that monitoring of both PM_{10} and TSP is not required, and may indeed be the cause of some of the low data capture. Rather, a single parameter should be monitored (nominally PM_{10}) following a comprehensive instrument service, when a regular maintenance schedule should be initiated and upheld.

In view of the very limited data capture achieved by the on-site meteorological station, the Proponent has acknowledged the need to upgrade the current meteorological station. It is noted that the Proponent is currently evaluating the next course of action to resolve the issue with the aim of achieving high levels of quality data capture.

Another potentially feasible solution could be for the Proponent to enter into a formal data sharing agreement with the nearby colliery to access site-representative meteorological data, and the Project meteorological station should be decommissioned.

Despite the aforementioned shortcomings we note that the mine has not been operational during this reporting period. As such, this document provides opportunity for future improvements prior to operations recommencing.

5 References

PAE Holmes (2011). *Air Quality Monitoring Program - Newnes Kaolin Mine – Final.* Sydney, June 2011.

NSW Department of Planning (DoP) (2006). *Development Consent.* Development Application: DA 329-7-2003. Proposed Development: Development of a kaolin mining and sand quarrying operation. Frank Sartor, Minister for Planning.

Appendix A: Wind Roses for Mt Boyce BoM Automatic Weather Station

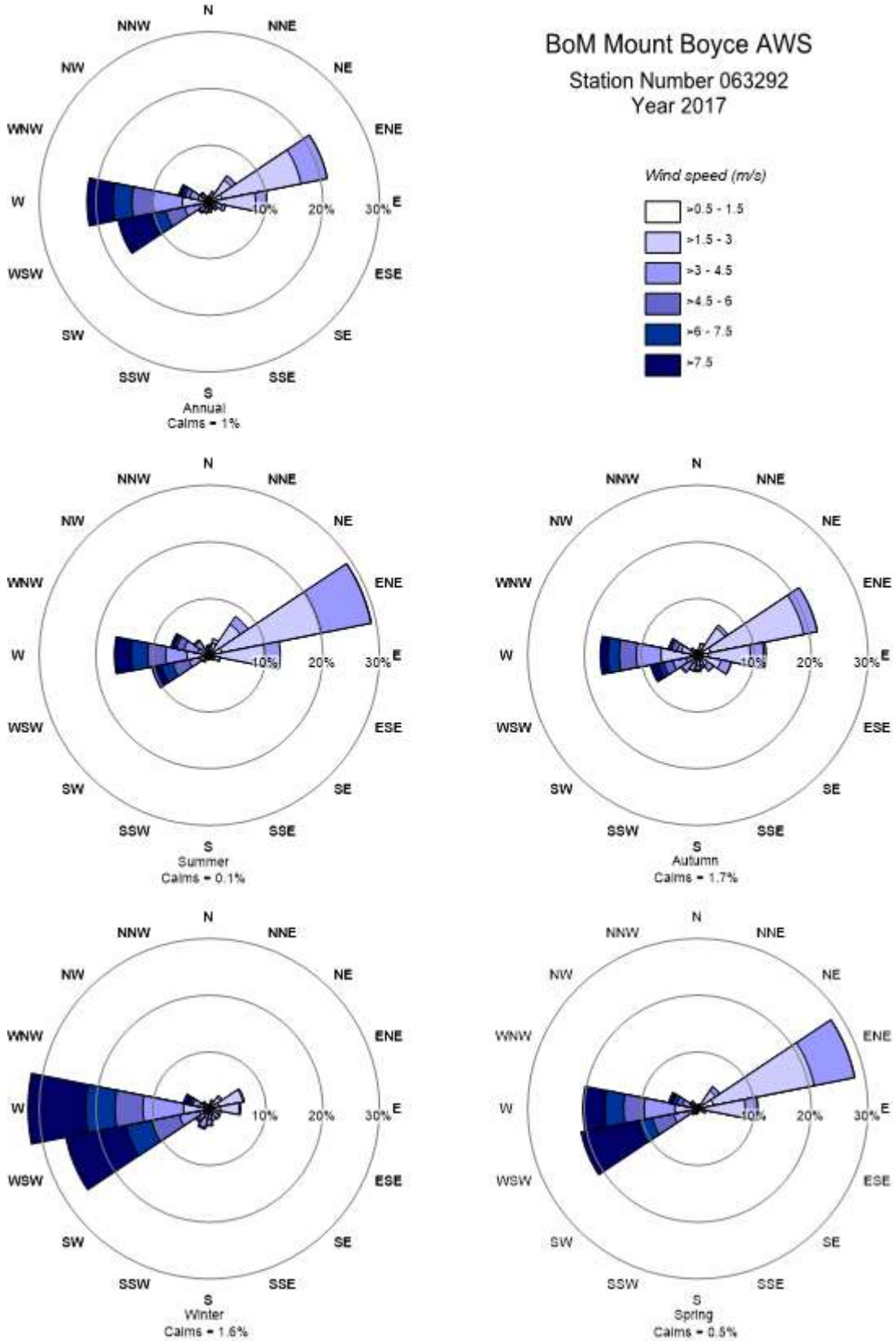

Figure A.1 2017 Mount Boyce AWS (63292) Wind Rose

How to read a wind rose

A wind rose shows the frequency of occurrence of winds by direction and strength, presented as 16 bars that correspond to the compass points (N, NNE, NE, etc). The length of each bar represents the frequency of occurrence of winds from that direction, and the colours of the bar sections correspond to wind speed categories, the darker colours representing stronger winds.

In this example, 30% of winds are from the ESE direction, and the winds from this direction have the following speed distribution:

- 10% between 1.5 m/s and 3 m/s
- 10% between 3 m/s and 4.5 m/s
- 7% between 4.5 m/s and 6 m/s
- 3% between 6 m/s and 7.5 m/s

Predominant wind direction

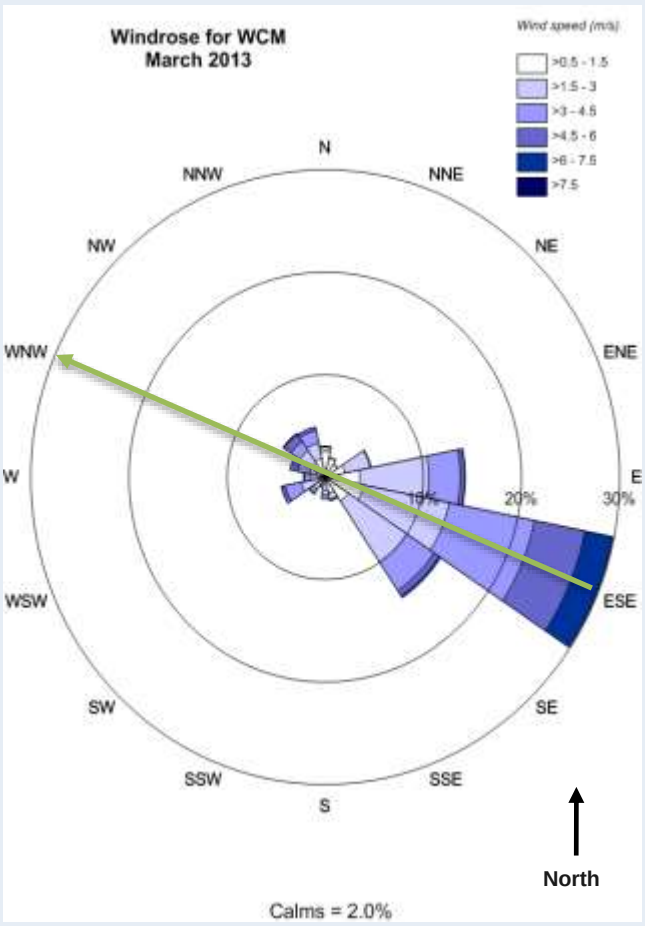

Figure A.2 Interpretation of a wind rose