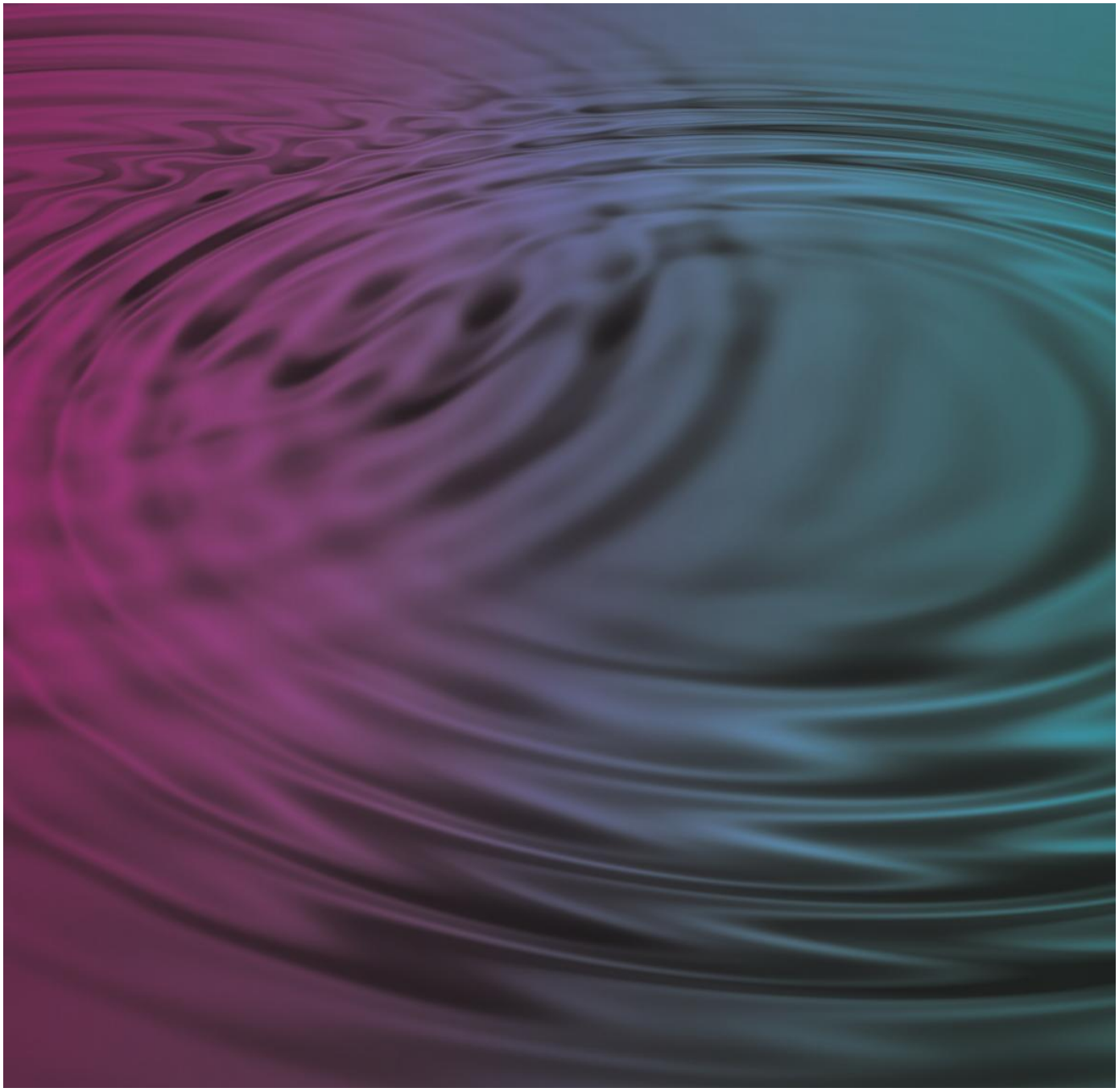
National Ceramic Industries Australia
10-Apr-2014

2013 Annual Environmental Management Report



2013 Annual Environmental Management Report

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1.0 Introduction

National Ceramic Industries Australia Pty Ltd (NCIA) operates a tile manufacturing facility located in Rutherford, New South Wales. On 19 January 2012 NCIA was granted Project Approval (MP 09_0006), which rationalised and consolidated the development as approved under the previous Development Consent (DA 449-12-2002-i), and the proposed expansion of the facility. Subsequently, NCIA formally relinquished the previous Development Consent (DA 449-12-2002-i) with effect from 19 January 2013. The facility is therefore currently operated under the conditions of Project Approval (MP 09_0006), issued by the Department of Planning and Infrastructure (DP&I).

This Annual Environmental Management Report (AEMR) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of NCIA in accordance with Schedule 4, Condition 60 of the Project Approval. The AEMR outlines the environmental compliance and performance of the NCIA facility in relation to the conditions of the Project Approval and NCIA's Environment Protection Licence (EPL) No. 11956.

The current reporting period for this AEMR is from 19 January 2013 – 18 January 2014 (hereafter referred to as the 2013 reporting period). The previous AEMR prepared for the facility was prepared under the previous consent requirements, and was for the reporting period 1 August 2011 – 31 July 2012. There was no AEMR prepared in 2013 as the new Project Approval resulted in a change to the AEMR reporting timeline, and an AEMR was not required under the Project Approval until after 19 January 2014. Consequently, there is a period of almost 6 months for which an AEMR has not been prepared (that is, 1 August 2012 – 18 January 2013). A summary of the monitoring results for this prior 6 month period are therefore provided in Appendix A of this AEMR.

Due to the change in the AEMR reporting timeline, there is some overlap in the timeline of environmental monitoring undertaken at NCIA. Environmental monitoring is undertaken in accordance with the EPL timeline requirements, which is from 1 August to 31 July of each year. Noise monitoring was last undertaken in May 2013 which covers both the AEMR and EPL timelines. The stack emission testing was undertaken in October 2012 and at the end of 2013 but this monitoring is still ongoing and the results are not yet available. Therefore, this AEMR does not include stack emission testing results from 2013, however all monitoring required by the EPL has been undertaken and is in accordance with EPL timeline requirements. NCIA intend to discuss with DP&I an alternative AEMR reporting timeline, in order to align it with the EPL timeline and avoid this issue of overlapping timeframes for future AEMRs.

The requirements of Condition 60 of the Project Approval and the cross-reference to the AEMR section where the requirement is addressed are provided in Table 1. The AEMR is distributed to the DP&I, the Office of Environment and Heritage (OEH), and Maitland City Council.

Table 1 Schedule 4, Condition 60 of Project Approval (MP 09_0006)

Condition	Requirement	AEMR Section
60	Every year from the date of this approval, unless the Director-General agrees otherwise, the Proponent shall submit an AEMR to the Director-General and relevant agencies. The AEMR shall:	This AEMR
60 (a)	be conducted by suitably qualified and independent team of whose appointment has been endorsed by the Director- General;	Quality Information
60 (b)	be submitted within 3 months of the period being assessed by the AEMR;	AEMR to be submitted by 18 April 2014
60 (c)	identify the standards and performance measures that apply to the development;	Section 2.0
60 (d)	include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;	Section 3.0
60 (e)	include a summary of the monitoring results for the development during the past year;	Section 4.0
60 (f)	include an analysis of these monitoring results against the relevant: - impact assessment criteria; - monitoring results from previous years; and - predictions in the EA;	Section 5.0
60 (g)	identify any trends in the monitoring;	Section 5.0

Condition	Requirement	AEMR Section
60 (h)	identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies;	Section 5.0
60 (i)	identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; and	Section 6.0
60 (j)	identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.	Section 7.0

1.1 Overview of Operations

NCIA manufactures ceramic wall and floor tiles for the Australian market from a mixture of clay, white granite, rhyolite, and glazes. The facility is located off Racecourse Road, Rutherford, within the Rutherford Industrial Estate. The facility operates 24 hours per day, 7 days per week, and 330 days over the reporting period. The operation currently comprises one spray drier, a clay mill, two tile production lines and two kilns, representing the first two of eight approved operational stages. Stages three and four were approved under the previous Development Consent. Stages five to eight are part of the expansion project and were approved under the current Project Approval. The timeline for construction of the remaining stages (that is, stages three to eight) is dependent upon market demand and remains uncertain.

It is noted that many of the requirements of the current Project Approval are required prior to commencement of construction of the expansion project (that is, stages five to eight). As this project has not yet commenced, these conditions have not yet been activated.

An Operation Environmental Management Plan (OEMP) was prepared in accordance with the previous Development Consent to provide an environmental management framework for the facility. The previous Development Consent has now been relinquished and the new Project Approval does not require an OEMP, but instead requires preparation of an Environmental Management Strategy prior to commencement of construction works for the expansion project. As this condition is not yet activated, NCIA continues to operate in accordance with the OEMP. The OEMP is reviewed on a three yearly basis, and was last reviewed in June 2011. The OEMP is therefore due to be reviewed in June 2014.

2.0 Standards and Performance Measures

The NCIA Operation Environmental Management Plan (OEMP) provides the environmental management framework to guide the operation of the tile manufacturing facility. The OEMP defines the environmental management practices, procedures and personnel responsibilities to ensure compliance with conditions of statutory approvals and licences.

Specific environmental standards and performance measures used to assess the achievement of environmental objectives are drawn from requirements, obligations and initiatives listed within:

- The Project Approval (MP 09_0006), granted by the Minister for Planning;
- EPL 11956, issued by the NSW Environment Protection Authority (EPA); and
- The *National Ceramic Industries Australia Expansion - Environmental Assessment* (AECOM, 5 July 2010) hereafter referred to as '2010 EA'.

Commitments made within the 2010 EA have been incorporated into the Project Approval and EPL for the facility as compliance criteria. These compliance criteria are used to assess the environmental performance of the facility and to monitor the environmental impact on the surrounding environment. Compliance criteria and the monitoring results for the reporting period are presented in Section 4.0 of this AEMR.

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3.0 Complaints

Condition 60(d) of the Project Approval requires that the AEMR include a summary of complaints received during the reporting period compared to complaints received in previous years.

During the current reporting period there was one complaint received by NCIA from a local community member. This complaint is summarised in Table 2 along with a comparison to historical complaints received.

Table 2 Historical complaints received by NCIA

Year	No. of Complaints	Issue	Details
2013	1	Air Quality	Complaint made via email on 24 July 2013 regarding air quality in Rutherford area.
2012-13	Nil	Nil	None Required
2011-12	Nil	Nil	None Required
2010-11	Nil	Nil	None Required
2009-10	1	Air Quality	Complaint made from neighbouring Heritage Green Residential Estate regarding non-compliances identified in the Environment Audit.
2008-09	Nil	Nil	None Required
2007-08	1	Air Quality	Anonymous complaint to EPA regarding visible black smoke. Report submitted to EPA on 25 March 2008. Visible black smoke unlikely to have originated from NCIA. No further action required.
2006-07	1	Odour	Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2005-06	2	Air Quality / Odour	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required. Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2004-05	1	Air Quality	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required.

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4.0 Environmental Monitoring Results

The following parameters are monitored for the facility in accordance with the conditions of the Project Approval and / or the EPL and / or for internal due diligence requirements:

- Ambient air monitoring (northwest and southeast of the facility):
  - Fine Particulates (PM_{10}); and
  - Fluoride (particulate, gaseous and total).
- Fluoride Impact on Vegetation:
  - Quarterly visual assessment of vegetation; and
  - Quarterly fluoride content in vegetation.
- Meteorological monitoring:
  - Wind speed at 10 metres;
  - Wind direction at 10 metres;
  - Temperature at 5 metres; and
  - Rainfall.
- Stack emission testing (all stacks):
  - Total particulates (TSP); and
  - Fine particulates (PM_{10}).
- Additionally, for the kiln stack:
  - Mercury (Hg);
  - Cadmium (Cd);
  - Nitrogen Oxides (NOx);
  - Hazardous substances (metals);
  - Hydrogen Fluoride (HF);
  - Sulfuric acid mist (H_2SO_4); and
  - Sulfur trioxide (SO_3).
- Noise testing:
  - LA_{eq}(15 minute); and
  - LA_1(1 minute).

A summary of the monitoring results for these parameters is provided below.

4.1 Ambient Air Monitoring Results

The ambient air quality monitoring program commenced on 12 March 2004 to record background data prior to commencement of Stage 1 operations. The program was designed and implemented in accordance with the requirements of NCIA's EPL and previous Development Consent which has since been relinquished. The monitoring program satisfies the requirements of the current Project Approval.

In accordance with EPL condition M2.1, PM_{10} (24-hour) and Fluoride (24-hour and weekly) are monitored at two locations: northwest and southeast of the facility (refer Figure 1).

For PM_{10} monitoring, two sampling locations have been established to determine concentrations at the NCIA property boundary, along the dominant southeast-northwest wind axis. The monitors are sited in accordance with *AS/NZS 3580.1.1:2007 Guide to siting air monitoring equipment*. Sampling and analyses of PM_{10} are undertaken as per *AS/NZS 3580.9.6:2003 Determination of suspended particulate matter*. Discrete 24-hour samples are collected every 6 days according to the NSW EPA schedule.

Two fluoride monitoring units (manual, double filter paper samplers) have been sited at each of the two locations identified for monitoring of PM_{10}, and are operated in accordance with *AS3580.13.2:2013 Determination of gaseous and acid-soluble particulate fluorides*. At each location, one monitor operates continuously over a 7-day period to provide weekly fluoride concentration averages. These units are designated 'Northwest HF_7' and 'Southeast HF_7'. The remaining unit at each site operates continuously for discrete 24-hour periods according to the NSW EPA 6-day cycle to provide 24-hour averages for sampler operation days. Units are designated 'Northwest HF' and 'Southeast HF'.

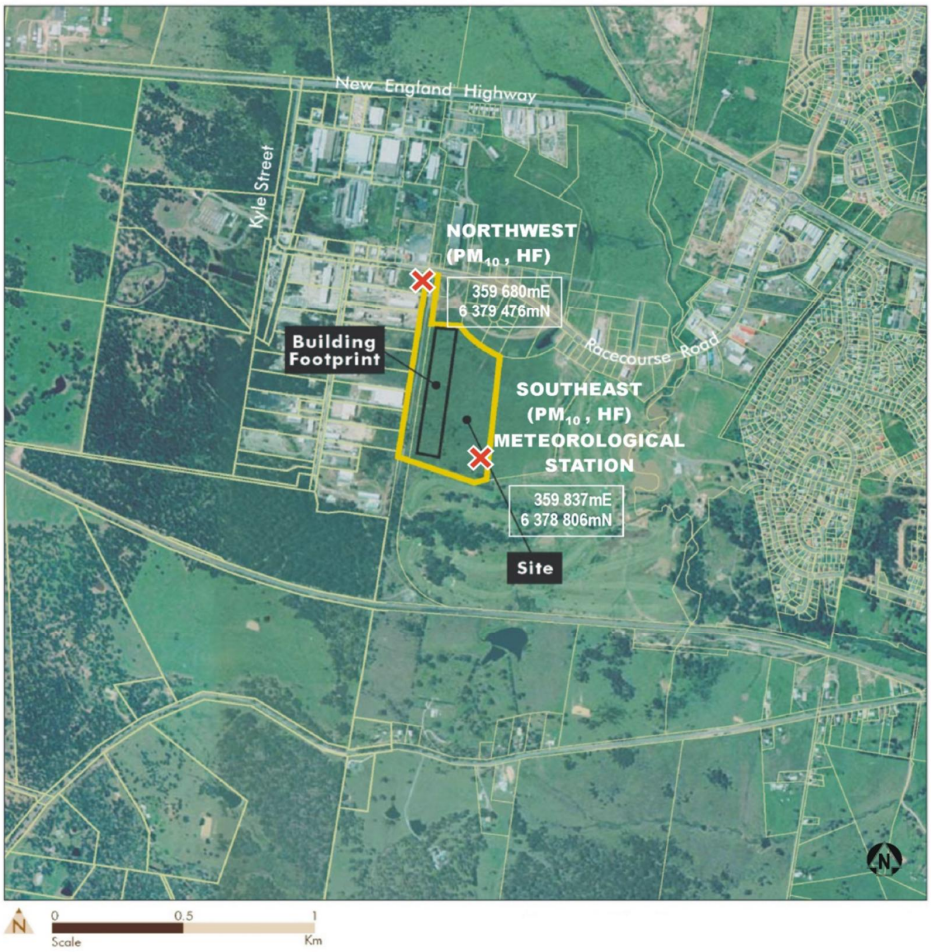

Figure 1 Ambient Air Monitoring Site Locations

4.1.1 PM_{10} – Monitoring Results

The EPL does not specify ambient air concentration limits, however Condition 15 of the Project Approval sets out criteria for PM_{10}. The criteria are the same as those set out in the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* NSW (DECC, 2005).

A summary of PM_{10} monitoring results from both monitoring locations for the current reporting period is provided in Table 3. The PM_{10} results for the NW and SE locations are also graphed in Figure 2 and Figure 3 respectively.

Table 3 Summary of ambient air monitoring: PM_{10} results

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	30	27.5	22.0
Standard Deviation (µg/m^3)	-	15.1	10.9
24-hour Minimum Concentration (µg/m^3)	-	3.5	4.1
24-hour Maximum Concentration (µg/m^3)	50	76.3	56.5

PM_{10} monitoring results at the NW location show five exceedances of the 24 hour PM_{10} criterion were recorded:

- 22 March 2013 – 59.5 µg/m^3;
- 19 August 2013 – 50.5 µg/m^3;
- 24 September 2013 – 72.4 µg/m^3;
- 24 October 2013 – 76.3 µg/m^3; and
- 23 December 2013 – 55.9 µg/m^3.

PM_{10} monitoring results at the SE location show two exceedances of the 24 hour PM_{10} criterion were recorded:

- 24 September 2013 – 50.1 µg/m^3; and
- 24 October 2013 – 56.5 µg/m^3.

A review of wind roses for these dates indicates the following:

- 22 March 2013 – winds were almost entirely from the west. The NW monitoring station was not downwind of the site and so it is unlikely that NCIA site operations contributed to this exceedance;
- 19 August 2013 – winds were predominantly from the southwest. The NW monitoring station was not downwind of the site and so it is unlikely that NCIA site operations contributed significantly to this exceedance;
- 24 September 2013 – during the morning there were light south easterly winds, with strong westerly winds from 2pm onwards. It is likely that these strong westerly winds contributed to the elevated particulate concentrations. With westerly winds, the NW monitoring station is not downwind of the site so it is unlikely that NCIA site operations contributed significantly to the measured concentration at this location. The SE monitoring location is downwind of the southern end of the site, however it is likely that ambient dust levels were elevated as a result of the strong westerly wind and not site operations;
- 24 October 2013 - winds were generally from the southwest, with strong westerly winds observed for a portion of the day. Widespread bushfire activity was present in the Hunter region in the week prior to this date and it is likely that smoke from these fires impacted the particulate concentrations measured; and
- 23 December 2013 – NCIA stopped operations for the Christmas period on 18 December 2013 and so this elevated concentration cannot be a result of NCIA's production.

The PM_{10} annual average concentration at both locations throughout the reporting period was below the PM_{10} annual average criterion.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

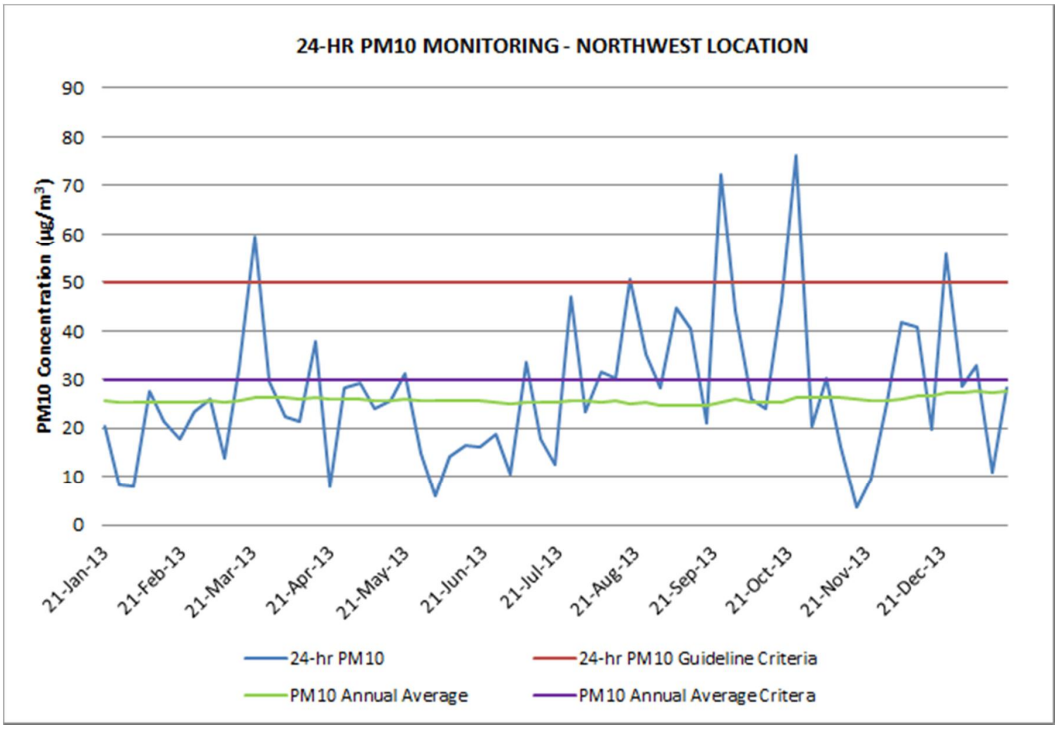

Figure 2 **PM_{10} Monitoring – Northwest Location**

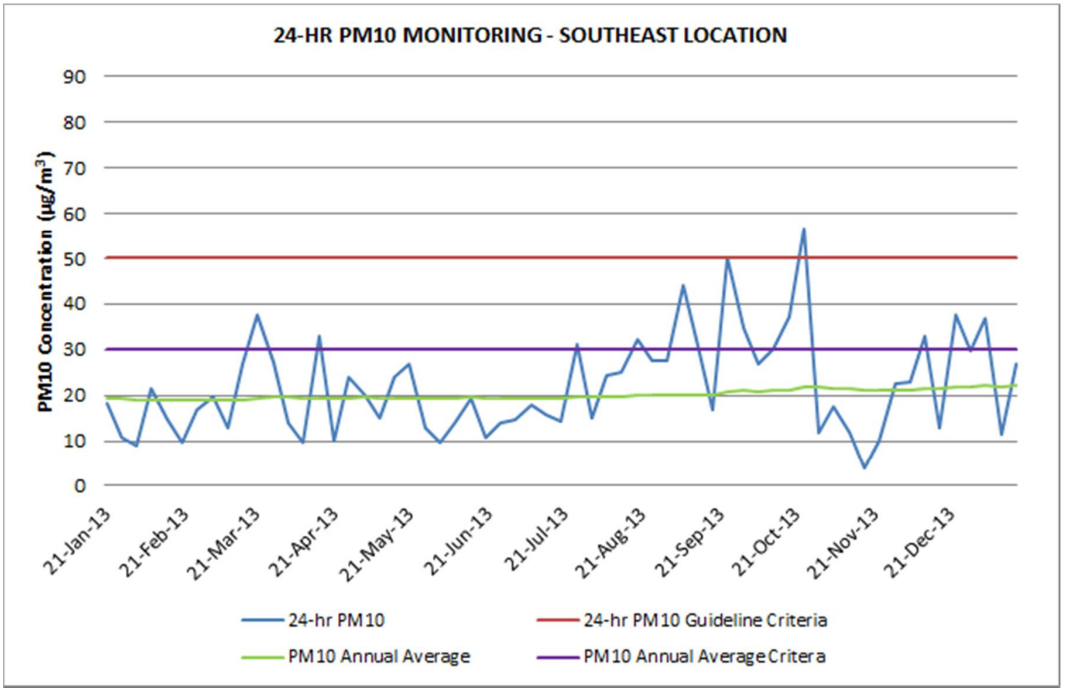

Figure 3 **PM_{10} Monitoring – Southeast Location**

4.1.2 Fluoride – 24 Hour Monitoring Results

There are no ambient air Fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, criteria have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* NSW (DECC, 2005).

A summary of 24-hour Fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 4. The 24-hour Fluoride monitoring results for the NW and SE locations are also graphed in Figure 4 and Figure 5 respectively.

Table 4 Summary of Ambient Air Monitoring: 24-hour Fluoride Results

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.4	0.6
Standard Deviation (µg/m^3)	-	0.5	0.5
24-hour Minimum Concentration (µg/m^3)	-	0.1	0.1
24-hour Maximum Concentration (µg/m^3)	2.9	2.7	2.8

Fluoride concentrations for all 24-hour monitoring events at both locations satisfied the 24-hour Fluoride criteria throughout the AEMR reporting period.

There were two instances in which 24-hour Fluoride data were not captured due to issues with the timer (on 16 March 2013 at both locations and 10 January 2014 at the NW location). In each case a make-up sample was taken as per the revised sampling procedures.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

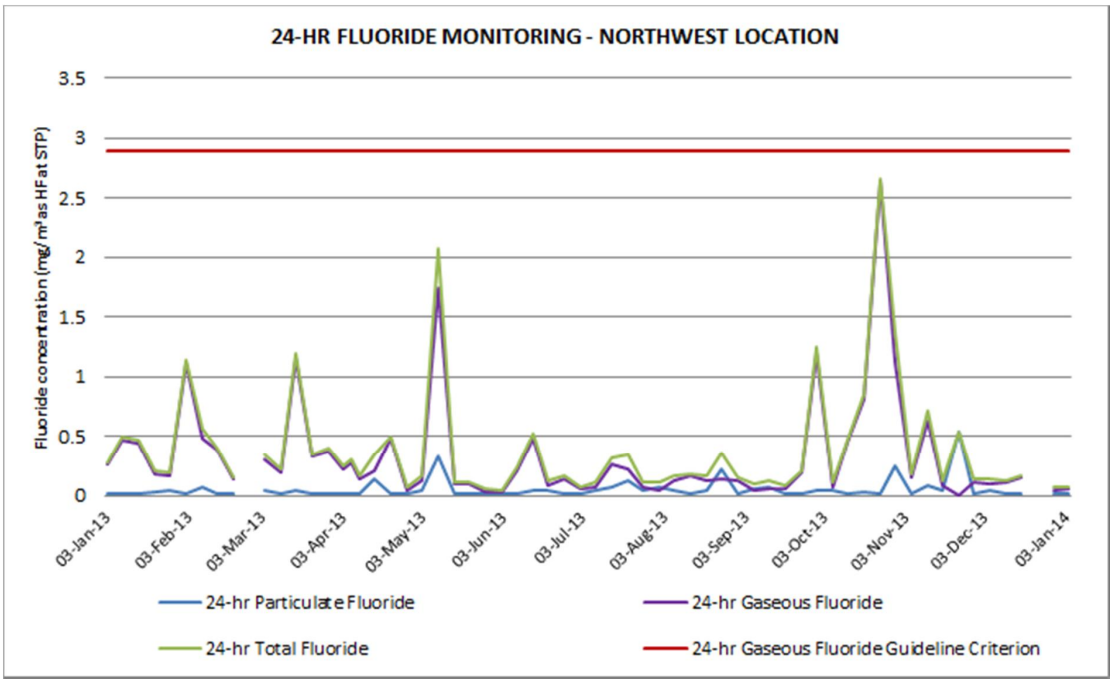

Figure 4 24-hour Fluoride Monitoring – Northwest Location

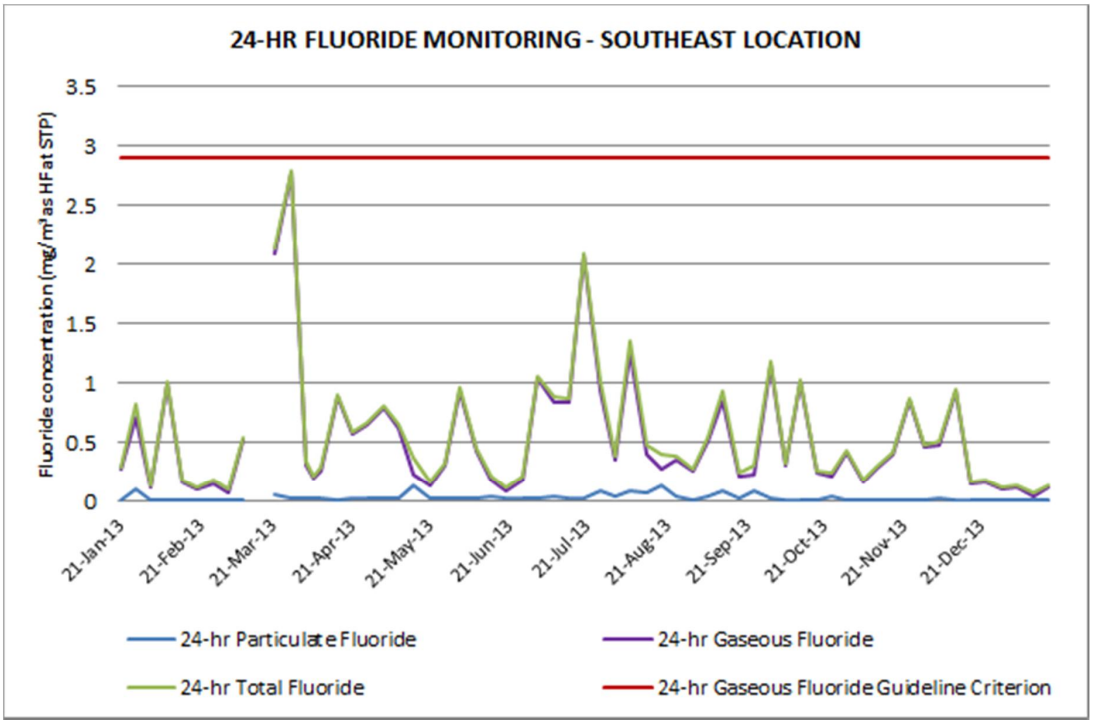

Figure 5 **24-hour Fluoride Monitoring – Southeast Location**

4.1.3 Fluoride – Weekly Monitoring Results

There are no ambient air Fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, criteria have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* NSW (DECC, 2005).

A summary of Weekly Fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 5. The 24-hour Fluoride monitoring results for the NW and SE locations are also graphed in Figure 6 and Figure 7 respectively.

Table 5 **Summary of Ambient Air Monitoring: Weekly Fluoride Results**

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.3	0.3
Standard Deviation (µg/m^3)	-	0.3	0.2
Weekly Minimum Concentration (µg/m^3)	-	0.0	0.0
Weekly Maximum Concentration (µg/m^3)	1.7	1.4	0.9

Fluoride concentrations for all Weekly Fluoride monitoring events at both locations satisfied the 7-day Fluoride criteria throughout the AEMR reporting period.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

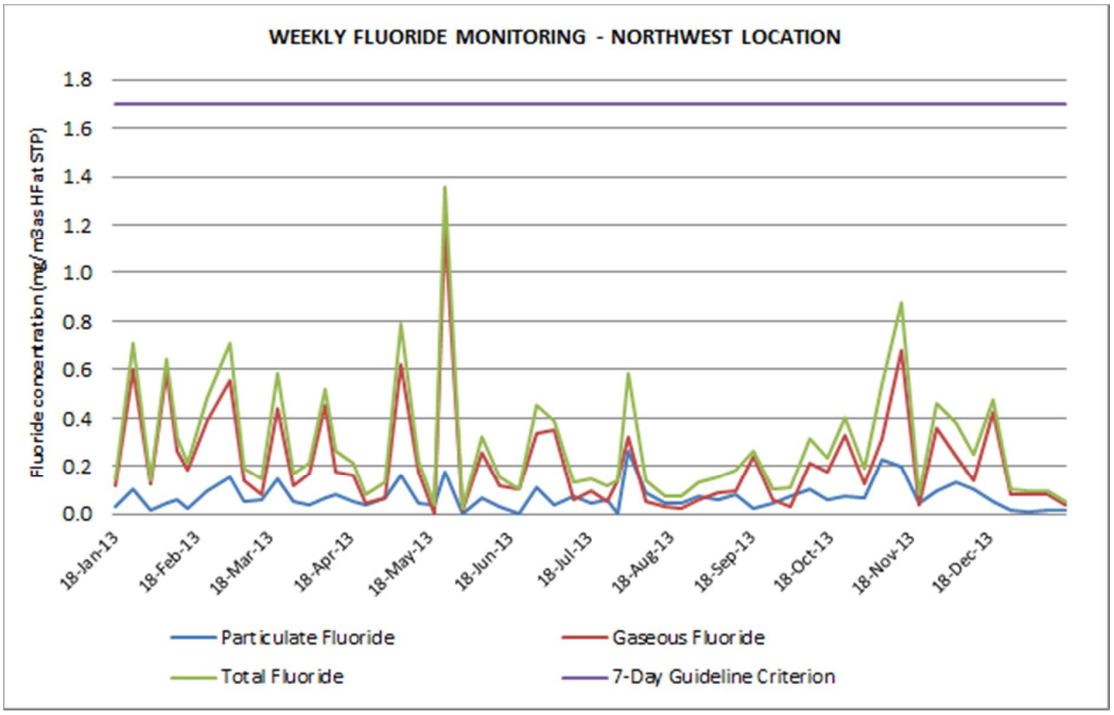

Figure 6 Weekly Fluoride Monitoring – Northwest Location

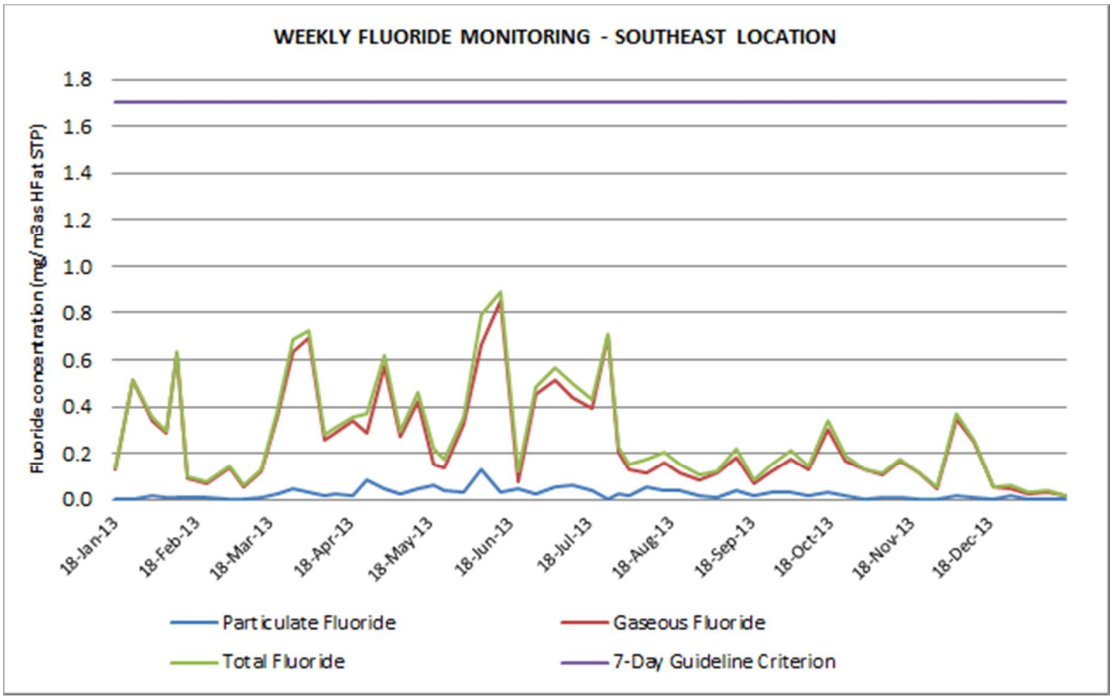

Figure 7 Weekly Fluoride Monitoring – Southeast Location

4.2 Fluoride Impact on Vegetation

In accordance with EPL condition M4.1, the potential impact of fluoride emissions on surrounding flora was monitored by undertaking visual inspection for flora condition and by foliage sampling for fluoride content.

AECOM conducted quarterly assessments during the reporting period as well as an Annual Vegetation Condition Assessment (December 2013). The quarterly surveys assess the condition of a shortlisted selection of fluoride sensitive species. The annual survey provides an opportunity to undertake a more comprehensive investigation and includes all specimens studied in the background survey. These assessments use the methodologies developed by Dr David Doley of the University of Queensland.

Foliage samples were collected from locations and vegetation types defined by background surveys for subsequent analysis. Samples chosen for fluoride content analysis were selected on the basis of species sensitivity toward fluoride, representation of certain species and vegetation type (over story, cultivated vegetation and forage crops).

The results of the quarterly and annual fluoride assessment for the reporting period are summarised below.

4.2.1 Flora Condition Assessment

Table 6 describes the injury categories used to simplify the assessment process. Vegetation was assessed at locations selected previously, including on the NCIA works site and at locations that could be viewed from public land, plus a control site on private property at 200 Anambah Road.

Table 6 Symptom code for visible injury to vegetation, with particular reference to fluoride

Category	Tip necrosis / chlorosis % length	Marginal necrosis / chlorosis % width / area	Undulation / cupping	Anthocyanin accumulation % area
0	nil	nil	nil	nil
1	very slight <2%	very slight <2%	very slight <2%	very slight <2%
2	slight <5%	slight <5%	slight <5%	slight <5%
3	distinct <10%	distinct <10%	distinct <10%	distinct <10%
4	marked <25%	marked <25%	marked <25%	marked <25%
5	severe <50%	severe <50%	severe <50%	severe <50%
6	very severe <75%	very severe <75%	very severe <75%	very severe <75%
7	extreme >75%	extreme >75%	extreme >75%	extreme >75%

The quarterly visual assessments found slight to severe chlorosis in a number of trees, which may be due to industrial emissions, including:

- *Angophora floribunda* (Site 6);
- *Corymbia maculata* (Site 2, Site 5 and Site 7);
- *Eucalyptus acmenoides* (Site 2);
- *Eucalyptus amplifolia* (Site 8);
- *Eucalyptus moluccana* (Site 1); and
- *Eucalyptus resinifera* (Site 8).

Appendix B provides the tabulated results for the species that were assessed for visible injury during the Annual Vegetation Condition Assessment. Results from the 2013 survey show a deterioration in foliage health condition for the specimens studied at Sites 5, 7 and 15. This may be attributable to prevailing environmental conditions and the lack of moisture for the vegetation. Despite above average rainfall in November, the area experienced very low rainfall in the late winter and early spring of 2013, which is likely to have affected the overall growth, health and condition of the vegetation, making it less resistant and resilient to atmospheric fluoride emission injuries. The deterioration in foliage health will be closely monitored in future surveys.

The distribution of injury in both current season and one year old foliage suggests a correlation between emission injury and proximity to the NCIA stacks. The data indicate an extension of the zones of impact towards the northwest and southeast from the centre of the site, which is consistent with the determination of the kiln stacks being an important source of fluoride emissions, as well as the occurrence of prevailing south-easterly winds during the growing season for fluoride sensitive species - principally eucalypts.

The data from the 2013 Annual survey also provide evidence that the sensitivity of vegetation to fluoride impacts greatly varies between and within species, with individuals showing varying degrees of resistance and resilience to atmospheric fluoride.

The extent of leaf-chewing and sap-sucking insect injury ranged from very slight to distinct. The occurrence and prevalence of insect attack appeared to be random and no pattern between location, species or foliage age could be established.

4.2.2 Fluoride Content Assessment

Foliage samples for fluoride content assessment were collected from various established locations. Where possible, both current and previous season leaves were collected for analysis and mixed to create a bulk sample for the site. Native grasses at Wollombi Road (Site11) were sampled in proportion to their representation or percentage ground cover at the sampling site and were collected at a height judged to be that at which cattle would graze (thereby avoiding the inclusion of soil).

Samples were sent to a NATA accredited laboratory for testing, and the results are provided in Table 7. A comparison of these results to previous years is provided in Section 5.2 of this AEMR.

Table 7 Sites and species within the survey area selected for foliage fluoride content assessment

Site	Location	Species	Foliage Season Sampled	Fluoride Content ($\mu g\ g^{-1}$, dry)
5	NCIA – SE corner of site	*Eucalyptus moluccana*	Mixed	92.8
11	Hill-top – Wollombi Rd	Native grasses	Current	<10
13	NCIA site entrance	*Corymbia maculata*	Mixed	136.0
13	NCIA site entrance	*Eucalyptus amplifolia*	Mixed	23.9
15	11 Gardiner Rd	*Corymbia maculata*	Mixed	40.3
19	200 Anambah Rd	*Vitis vinifera*	Current	<10.0

Meteorological Monitoring

Meteorological data is recorded at the meteorological station established at the southeast air monitoring site. The station is sited and operated in accordance with approved methodologies (NSW EPA, 2001) for the continuous measurement of wind speed (10 m), wind direction (10 m), sigma theta (10 m) and temperature (5 m). A tipping bucket rain gauge is also located at the site to provide daily average rainfall rates.

The dominant function of meteorological monitoring at NCIA is to gain an understanding of the influence that NCIA operations and background pollutant sources have on the results of the ambient air quality monitoring program. This is particularly important in relation to the analysis of ambient air monitoring results which exceed the relevant criteria (refer to Section 4.1) and possible air quality complaints (refer to Section 3.0).

The monthly data for temperature and rainfall are provided in Figure 8. Monthly wind roses presenting the wind speed and direction for the reporting period are provided in Appendix C. A summary of the dominant wind patterns throughout the 2013 reporting period is provided below.

It is noted that between January and April 2013 there were some intermittent issues with the wind speed and rainfall gauges which have since been resolved. Where appropriate this data has been substituted with data from the Bureau of Meteorology monitoring station (the Maitland Belmore Bridge station which is located approximately 2-3 km from Rutherford).

Review of the monthly wind roses indicated the following:

- In January and February 2013 winds were blowing predominantly from the east and southeast directions;
- In March 2013 winds were blowing predominantly from the west and south east directions;
- From April to August 2013 winds were blowing predominantly from the south west direction;
- In September and October 2013 winds were blowing predominantly from the west and south west directions;
- In November 2013 winds were variable, blowing predominantly from the south east direction as well as the east, south west and west directions;
- In December 2013 and January 2014 winds were predominantly from the east and south east directions; and
- Wind speeds recorded over the year from the NCIA on-site weather station were generally low to medium with an annual average wind speed of 1.94 m/s. The maximum hourly average wind gust was recorded at 11.29 m/s on 13 October 2013.

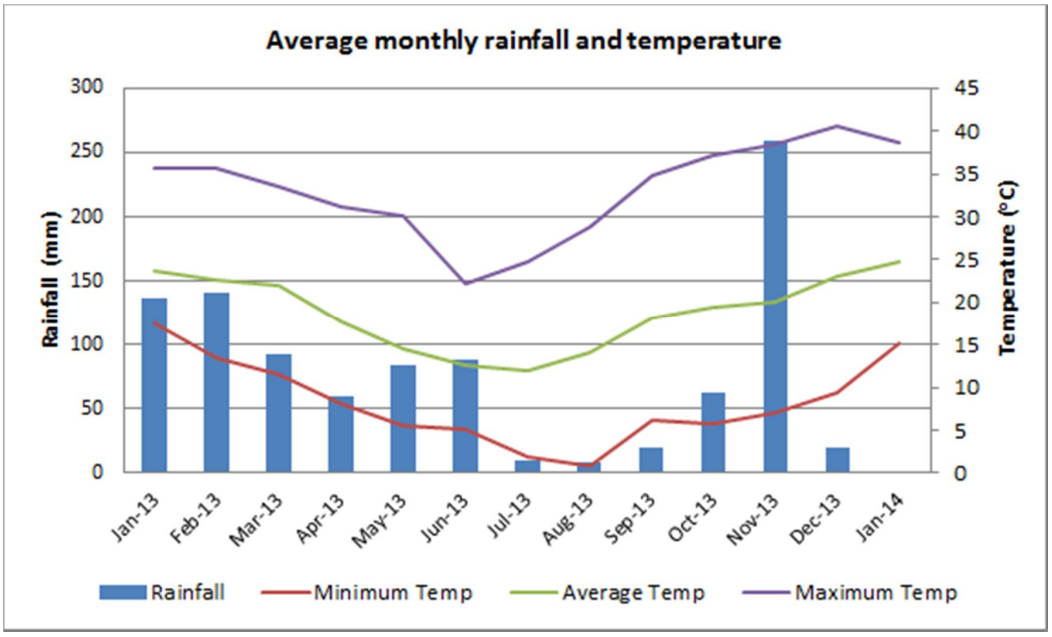

Figure 8 Average Monthly Rainfall and Temperature Range (19 January 2013 – 18 January 2014)

4.3 Stack Emissions Testing

Annual stack emissions testing of the facility was conducted during October – November 2013 and is still ongoing. These results have not yet been finalised and cannot be reported in this AEMR. Annual stack testing is scheduled in accordance with the Annual Return reporting timeline (1 August – 31 July of each year) and so this does not necessarily align with the AEMR reporting period. Stack emissions testing was undertaken in October 2012 and these results would have been reported in the 2012-13 AEMR but the AEMR reporting timeline has now changed. The October 2012 results now fall outside the current AEMR reporting timeline. However, given that the most recent stack testing results are not yet complete (and in accordance with the EPL are not required to be completed until 31 July 2014) the results from the October 2012 stack testing are reported here. Emission sources assessed during the testing period are defined in Table 8.

Table 8 Emission Source Descriptions

OEH Identification Number (EPL)	Emission Source Description
1	Clay Preparation (CP1)
3	Pressing and Drying (PD1)
5	Dryer (D1)
6	Dryer (D2)
9	Glaze Line
10	Selection Line (SL 1,2,3,4)
12	Spray Dryer (SD1)
14	Kiln 1 (KP1)
15	Kiln 2 (KP2)
18	Hot Air Cooler 1 (HAC1)
19	Hot Air Cooler 2 (HAC2)

All sources were tested for Total Particulate Matter and Fine Particulate (PM_{10}). Additional testing conducted on the Kiln 1 and Kiln 2 stacks measured concentrations of total fluoride (as HF), sulfuric acid mist (H_2SO_4 as SO_3), sulfur dioxide (SO_2 as SO_3), total hazardous substances (metals), oxides of nitrogen (NO, NO_2, NO_x), cadmium and mercury. All sampling was conducted in accordance with the applicable OEH test methods, with analyses conducted by a NATA-accredited laboratory.

The Project Approval does not specify pollutant concentration limits for the facility, however these are specified in Condition L3 of the EPL for the Site. Summaries of the emission testing results, along with the EPL pollutant discharge limits, are provided in Table 9 and Table 10.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits. In the past, the previous Consent and EPL required the NOx, Total Particulate and Fine Particulate (PM_{10}) emission concentrations to be corrected to 7% O_2. In March 2011 NCIA's previous Consent was modified to amend the oxygen correction factor to 18% to better reflect the design of equipment used in NCIA's operation. The EPL was accordingly updated (dated 7 November 2011) incorporating the 18% oxygen correction. The NO_x, Total Particulate and PM_{10} emission concentrations determined within Kiln stack exhausts have therefore been corrected to 18% O_2.

Concentrations of all pollutants were below the limits specified for each source in the EPL.

Table 9 Summary of Emission Monitoring Results (October 2012)

Source	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3) *
Clay Preparation (CP1) (EPL 1)	0.85	0.64	20
Pressing and Drying (PD1) (EPL 3)	1.3	0.47	20
Dryer (D1) (EPL 5)	0.84	2.0	20
Dryer (D2) (EPL 6)	0.8	1.3	20
Glaze Line (EPL 9)	<0.2	0.42	20
Selection Line (SL 1,2,3,4) (EPL 10)	<0.27	<0.21	20
Spray Dryer (SD1) (EPL 12)	0.62	5.1	20
Hot Air Cooler 1 (HAC1)	<0.19	0.28	5
Hot Air Cooler 2 (HAC2)	0.49	<0.21	5

** Note – Regulatory limit only applies to Total Particulate.*

Table 10 Summary of Emission Monitoring Results – Kiln 1 and Kiln 2

Pollutant	Kiln 1 (EPL 14)	Kiln 2 (EPL 15)	Regulatory Limit (mg/m^3) *
Fine Particulate (at 18% O_2) (PM_{10}) (mg/m^3)	1.1	0.78	N/A
Total Particulate (at 18% O_2) (mg/m^3)	0.68	0.48	20
Total Fluoride (as HF) (mg/m^3)	3.6	3.8	5
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	1.5	6.5	100
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	130	150	N/A
Total Hazardous Substances (Metals) mg/m^3)	0.26	0.80	1
Total Oxides of Nitrogen (at 18% O_2) (as equivalent NO_2) (mg/m^3)	33	36	100
Cadmium (mg/m^3)	0.0024	0.00085	0.1
Mercury (mg/m^3)	0.00079	0.00068	0.1

4.4 Noise Monitoring

Noise limits set out in NCIA's Project Approval are more stringent than those set out in the EPL and previous Development Consent and therefore the Project Approval limits are used to assess the Site's compliance with noise requirements. The Project Approval states that noise generated from NCIA should not exceed 35 dB(A), $L_{eq(15\ min)}$ during the day, evening or night periods, at the Kenvil Close and Wollombi Road noise monitoring locations. The Project Approval also sets a night time sleep disturbance criteria of 45 dB(A) L_{max}.

Noise levels are measured in accordance with NCIA's Project Approval, EPL, and the procedures in the *NSW Industrial Noise Policy* (INP) (NSW EPA, 2000). In accordance with the INP, the noise criteria apply under all meteorological conditions except during rain, wind speeds greater than 3m/s and intense temperature inversions between 6 pm and 7 am. Data obtained during these meteorological conditions were omitted.

The noise monitoring was undertaken by Spectrum Acoustics on 30 May 2013. A series of attended noise measurements, of 15 minutes duration, were made in Kenvil Close and in Wollombi Road on Thursday 30 May 2013 during the day, evening and night time periods. Measurements were also made during the day time period on the NCIA site.

The results of the attended noise measurements at each location and time are summarised in Table 11.

Table 11 Received noise levels during attended noise monitoring (30 May 2013)

Location	Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Close	12.08 pm (day)	52	3.0/N	Construction noise (50), traffic (45) birds (42), **NCIA not measureable**	n/a
Kenvil Close	8.54 pm (evening)	49	1.7/SSW	Train (47), traffic (43), frogs (37), **NCIA (35)**	n/a
Kenvil Close	10.05 pm (night)	44	1.1/SSW	Traffic (42), frogs (38), **NCIA (34)**	38
Wollombi Rd	12.30 pm (day)	65	3.0/N	Local traffic (64), construction noise (38), birds & insects (35), **NCIA not measureable**	n/a
Wollombi Rd	9.22 pm (evening)	64	2.5/SW	Local traffic (64), frogs (42), **NCIA (31)**	n/a
Wollombi Rd	10.30 pm (night)	54	Calm	Train (54), frogs (40), distant traffic (38), **NCIA (30)**	33

Results show that the received noise from the NCIA site was audible and measureable at each of the monitoring locations during the evening and night time periods. The noise from NCIA during these periods did not exceed the criterion of 35 dB(A) $L_{eq(15\ min)}$.

During the day time monitoring, the acoustic environment at the Kenvil Close location was significantly impacted by noise from the construction of the subdivision on the land between the monitoring location and NCIA (the old golf course site). At Kenvil Close during each of the monitoring periods there was also significant contribution from noise from traffic on the New England Highway.

Noise from construction of the subdivision was also audible at Wollombi Road. Noise from traffic on Wollombi Road is relatively acoustically continuous throughout the day and evening. During the night the traffic flow becomes more sporadic and the noise from individual vehicles can be isolated from the measurements prior to further analysis.

The noise emissions from NCIA are relatively constant and steady state with very few easily discernible L_{max} events. At both locations, the measured L_{max} noise levels attributed to NCIA show compliance with the sleep disturbance criterion of 45 dB(A) L_{max}.

L_{max} noise levels measured on the NCIA site (during the day) did not vary by more than 2 - 3 dB(A) from the measured Leq noise levels. Based on the results in Table 11 this means that the L_{max} noise at the closest receivers in Kenvil Close and Wollombi Road would be significantly lower than the 45 dB(A) criterion for the site.

The noise assessment report concluded that noise levels were in compliance with the noise criteria for all time periods. Compliance with the sleep disturbance criterion was also demonstrated.

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5.0 Analysis of Monitoring Results and Environmental Impact

This section provides an assessment of the monitoring results for the reporting period against the criteria set out in the Project Approval and EPL, the predictions made in the 2010 EA, and the monitoring results from previous years. Any trends observed in the monitoring results or discrepancies between predicted and actual impacts are discussed.

5.1 Ambient Air Quality

The 2010 EA predicted that, with the exception of PM_{10}, emissions from NCIA would meet all of the ambient air criteria. The 2010 EA stated that existing background 24-hour PM_{10} concentrations already exceeded the EPA criterion. While it was predicted that the annual average PM_{10} criterion would be met, the 2010 EA indicated that the 24 hour average PM_{10} concentrations may exceed the criteria under worst case dispersion conditions. Specifically, predictions made in the 2010 EA for the project included the following:

- The maximum cumulative 24 hour average PM_{10} concentration at the closest existing private receptor was predicted to be 53.4 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The maximum cumulative 24 hour average PM_{10} concentration for potential residential receptors within the proposed Heritage Green site was predicted to be 57.7 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The cumulative impact of predicted maximum PM_{10} concentrations at all existing residential receptors was considered to be minor despite the predicted cumulative results being above the guidelines. It was not expected that the predicted PM_{10} impacts would be beyond levels already experienced due to the minor contribution of the project when compared to the elevated background PM_{10} levels;
- No exceedances of 24 hour or weekly Fluoride concentrations at existing residential receptors were predicted;
- The maximum cumulative 24 hour Fluoride concentration for potential residential receptors within the proposed Heritage Green site was predicted to be 3.2 µg/m^3 (compared to the criterion of 2.9 µg/m^3); and
- The predicted exceedances of the Fluoride criterion represent a worst case scenario with NCIA operating at its fluoride licence limit of 5 mg/m^3. Stack emission testing has demonstrated that NCIA operates at levels much lower than this limit.

Monitoring results from the current AEMR reporting period are generally consistent with these predictions. There were some exeedances of the 24 hour PM_{10} criterion, while the annual average PM_{10}, the 24-hour Fluoride and the weekly Fluoride concentrations were all below the relevant criteria.

Historical ambient air monitoring results recorded since commencement of operations (15 March 2004 to current) are shown in Figure 9 to Figure 14. There are no discernible trends in PM_{10} concentrations, with variable results oscillating around a relatively stable annual average. There appears to be an increasing trend in gaseous Fluoride concentrations at both locations, which can be observed in the 24-hour monitoring results but is more apparent in the weekly monitoring results. However, 24 hour and weekly Fluoride concentrations during the 2013 reporting period remained below the EPA guideline criterion. Historically, 24-hour and weekly Fluoride concentrations are generally below the EPA guideline criterion, with the exception of occasional spikes and only a few exceedances recorded (in September 2012, June 2008, and September 2006).

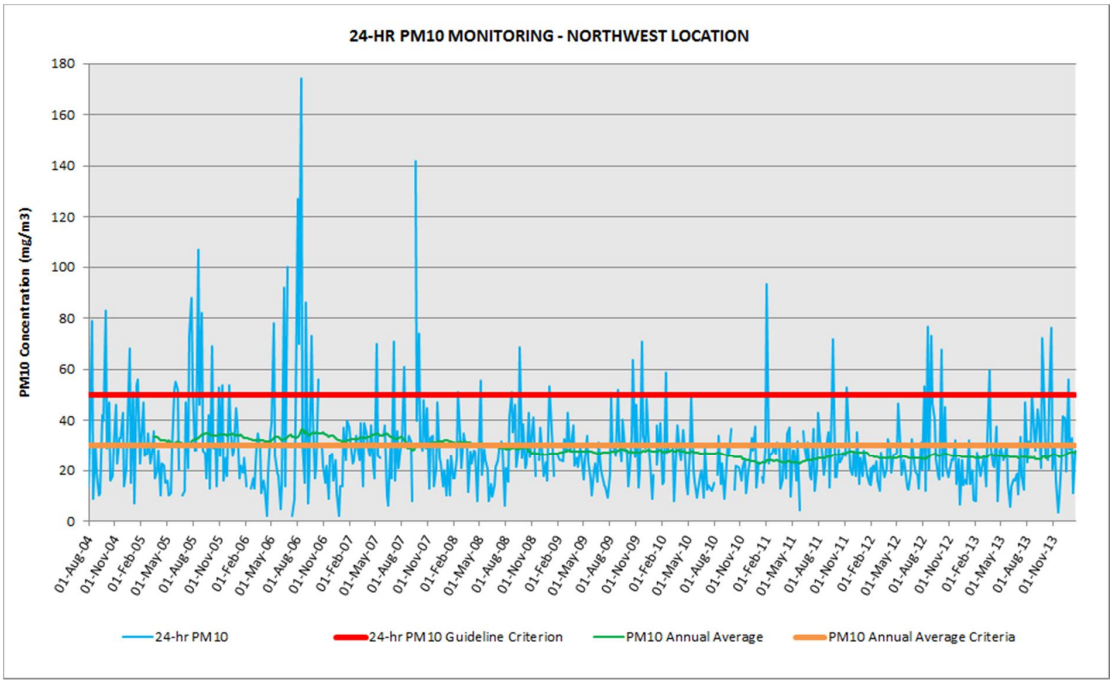

Figure 9 24-hour PM_{10} Monitoring – Northwest Location (2004 – 2014)

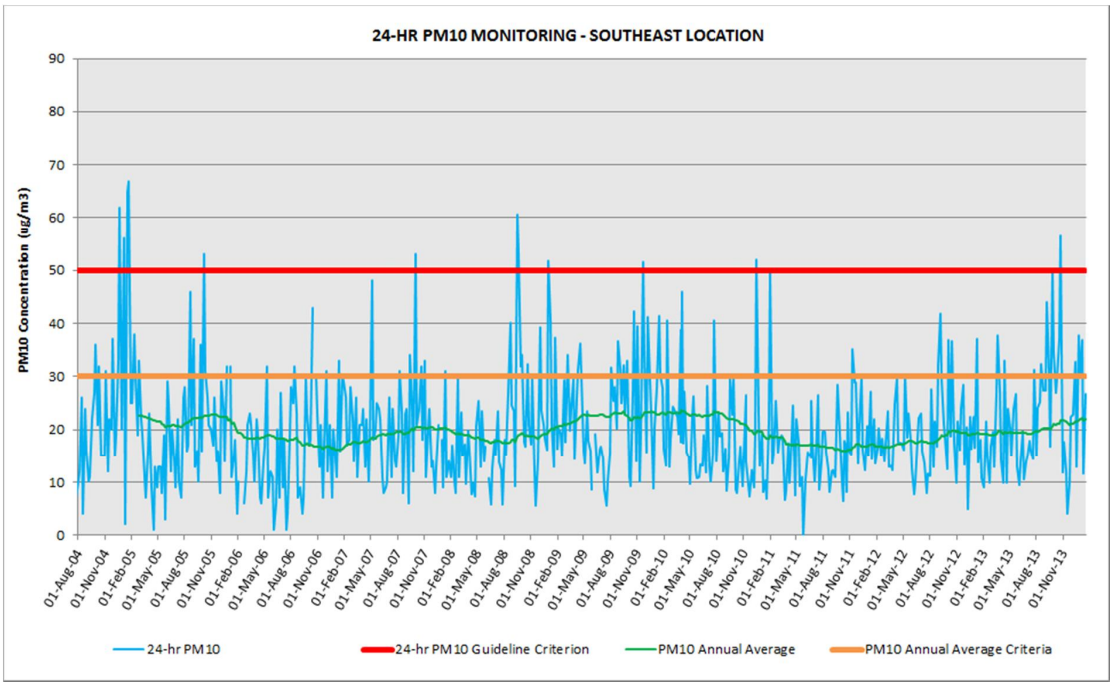

Figure 10 24-hour PM_{10} Monitoring – Southeast Location (2004 – 2014)

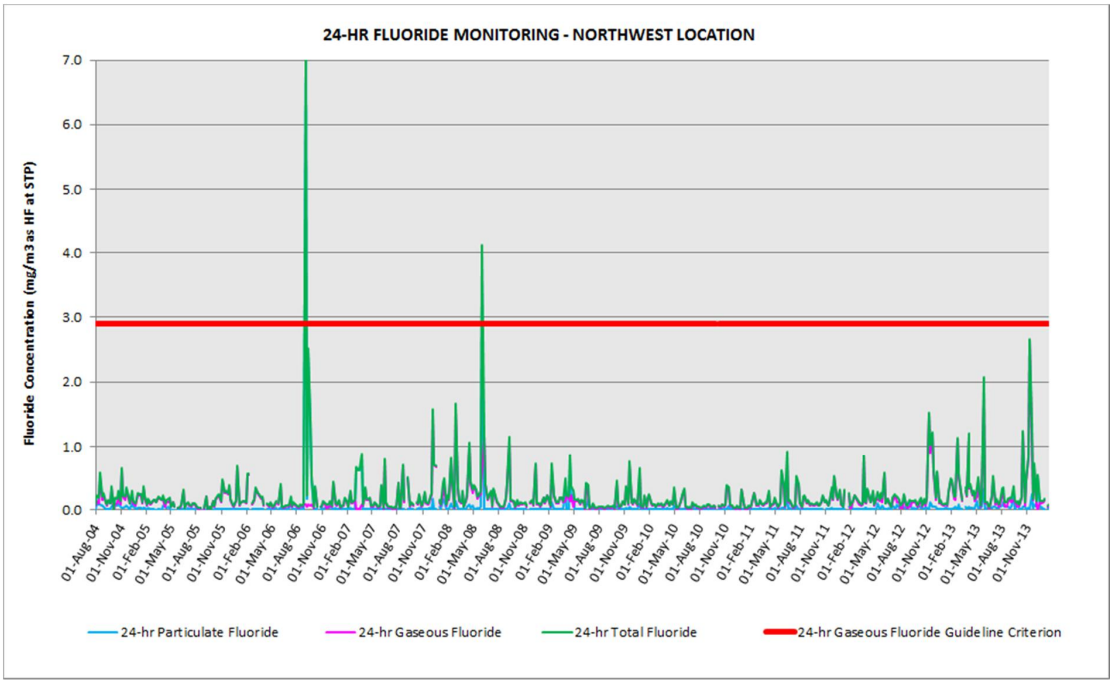

Figure 11 24-hour Fluoride Monitoring – Northwest Location (2004 – 2014)

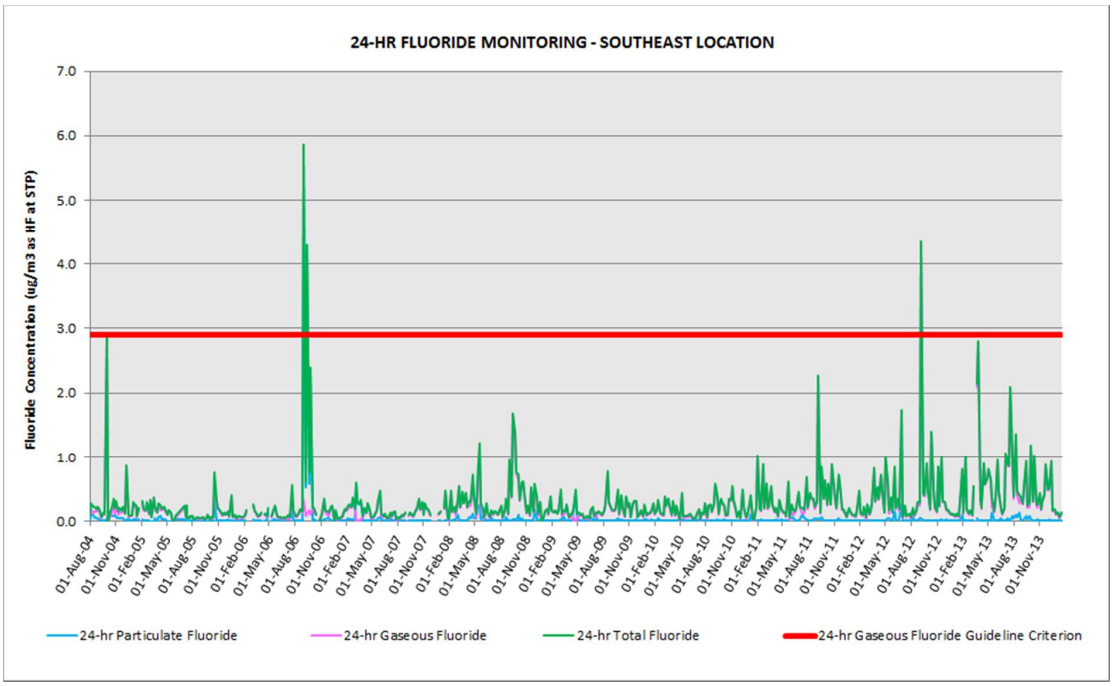

Figure 12 24-hour Fluoride Monitoring – Southeast Location (2004 – 2014)

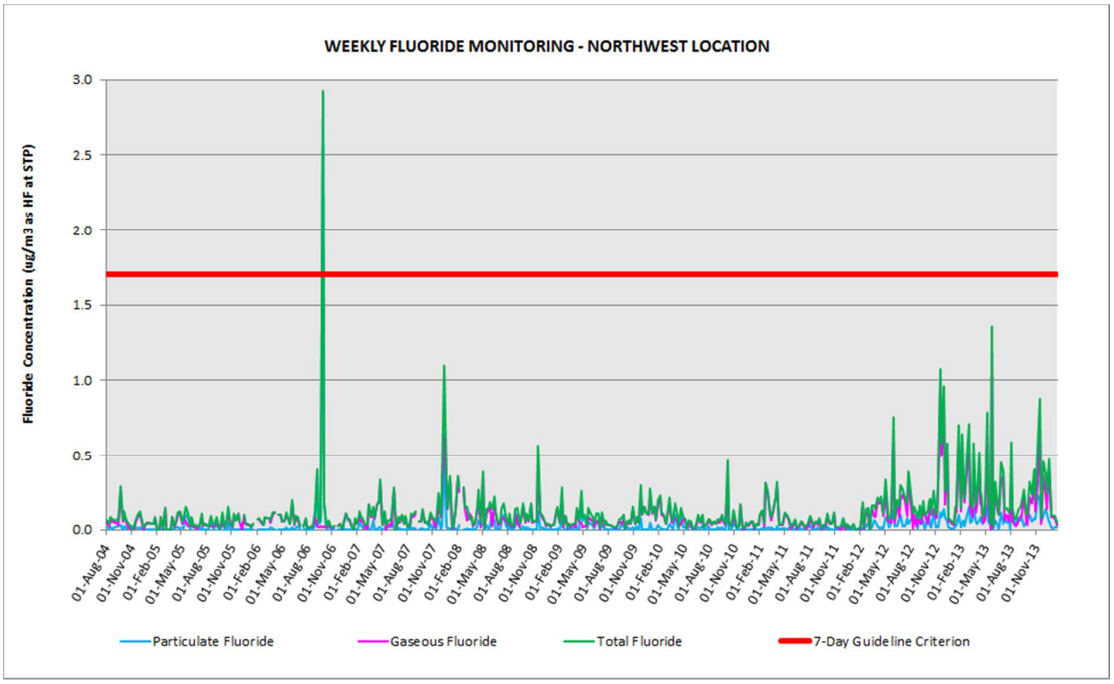

Figure 13 Weekly Fluoride Monitoring – Northwest Location (2004 – 2014)

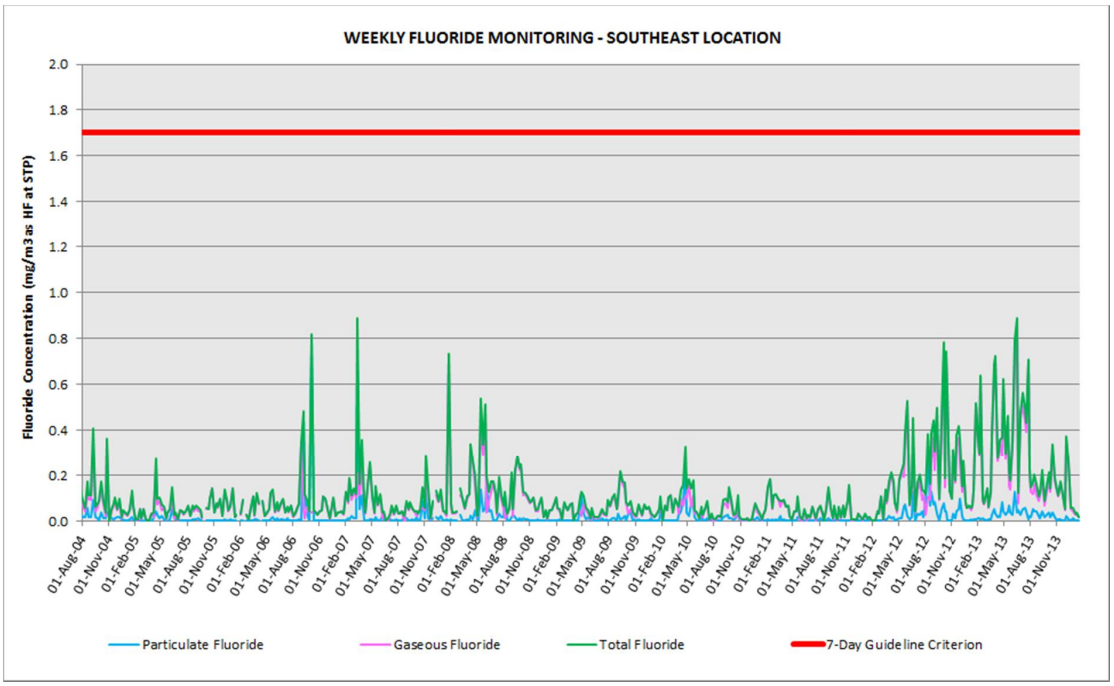

Figure 14 Weekly Fluoride Monitoring – Southeast Location (2004 – 2014)

5.2 Fluoride Impact on Vegetation

The 2010 EA concluded that the expansion project was unlikely to have a significant impact on threatened flora and fauna species. The site is highly modified and contains little habitat value for native species. The 2010 EA does not specifically discuss fluoride impact on vegetation and so no predictions are available for comparison.

As required by the EPL, the potential impact of NCIA's operations on vegetation surrounding the site is monitored through assessment of seasonal fluoride impacts on vegetation. There are no limits or criteria set out in the EPL or Project Approval (or previous Development Consent) by which to assess compliance. Instead the assessments are used to provide an indication of trends in fluoride injury at particular locations or in particular species.

5.2.1 Trends in Visual Impact on Vegetation

The annual variation in visible injury expression in selected fluoride-sensitive tree species at three locations – the NCIA monitoring site (Site 5), Gillette Close (Site 7), and Gardiner Road (Site 15), is provided in Table B1.5 of Appendix B. Although emission and total injury to foliage is relatively consistent over the long term (based on data from the previous annual surveys), the 2013 results show a deterioration in foliage health condition for the specimens studied at Site 5, Site 7 and Site 15.

The *Eucalyptus moluccana* at Site 5 has traditionally been showing slight emission related injuries over the past years. The tree recorded a distinct chlorosis index in 2013 which is the most severe chlorosis symptoms displayed by that tree since the start of the monitoring program, and the first time chlorosis was evident since 2007. Leaves also showed slight cupping, which is a symptom that was never noted in previous surveys. However the anthocyanin accumulation symptoms that were consistently recorded between 2008 and 2011 are no longer exhibited. Insect damage however, was the lowest since the beginning of records, and has decreased for the second consecutive year.

Between 2003 and 2007, the *Corymbia maculata* at Site 7 did not appear affected by fluoride symptoms. Since 2008 this tree has since consistently showed slight to distinct fluoride related injury. The slight chlorosis, tip necrosis and distinct cupping symptoms noted this year are in line with those recorded for that tree in the last few years. However, insect injury was absent in 2013 which represents an improvement from the previous year.

Similarly, no emission related impacts were observed between 2003 and 2006 in the *Corymbia maculata* at Gardiner Road (Site 15), and since 2007 slight to marked fluoride symptoms have been observed. Despite the apparent improvement in foliage health noted in the last two annual surveys (2011 and 2012), emission injury has markedly worsened in 2013 and the tree was in poor condition. It recorded marked chlorosis, cupping and distinct necrosis symptoms, constituting the most severe emission-related impacts ever recorded for this tree. In contrast, insect injury was absent in 2013, which is the first time no insect damage was evidenced.

5.2.2 Trends in Fluoride Content in Vegetation

Historical fluoride concentrations in vegetation sampled during the annual surveys are presented in Table 12. For the purposes of comparison, historical vegetation fluoride levels from each of the quarterly and annual surveys are shown graphically in Figure 15 to Figure 18. It is noted that laboratory analyses no longer measure the precise fluoride content in leaves where it is lower than 10 µg/g, and instead provide a reading of <10 µg/g.

Table 12 Historical Analytical Results of Fluoride Content in Vegetation

Site	Species Sampled	Foliar fluoride measure (µg/g*)									
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5	*Eucalyptus moluccana*	-	-	-	63.0	11.0	58.8	31.6	20.8	86.1	**92.8**
11	Native Grasses	<10.0	<1.0	11.0	7.0	10.0	10.0	<10.0	<10.0	12.7	**<10.0**
13	*Eucalyptus amplifolia*	-	-	-	132.0	22.0	150.0	54.1	114.0	33.5	**136.0**
	Corymbia maculata	-	-	-	33.0	<10.0	24.6	<10.0	13.5	38.2	**23.9**
15	*Corymbia maculata*	12.0	2.0	40.0	103.0	73.0	75.0	16.8	48.9	142.0	**40.3**
19	*Vitis vinifera*	<10.0	<1.0	3.0	6.0	<10.0	15.0	<10.0	<10.0	<10.0	**<10.0**

** µg/g are equivalent to mg/kg (as reported in the laboratory certificate of analysis)*
- indicates no sample was taken

Site 5: Fluoride concentration of *Eucalyptus moluccana* foliage at Site 5 was consistent with the previous quarterly survey (Q3 2013) as well as last year's value (Q4, 2012). Historical data for this tree shows that a peak in concentration commonly occurs in spring or summer (i.e. at the time and Q3 and Q4 surveys) before settling down at lower concentrations during autumn and winter (Q1 and Q2) (refer Figure 15). This seasonal fluctuation in foliar fluoride concentration is well correlated and explained by the dominant wind patterns in the area.

It is noted however that for the second consecutive quarter the foliar fluoride concentration returned is one of the highest levels recorded for that tree. It is also the first time that two very high fluoride concentrations are recorded in consecutive quarters. This will need to be closely monitored in future surveys.

Site 11: The sample of grasses collected at Site 11 during the 2013 annual survey recorded a fluoride concentration of <10.0 µg/g, which is consistent with the last three annual surveys and the overall historical pattern for this location. Historical records (refer to Figure 16) show that fluoride concentration in grasses at this location follow a regular pattern since 2008 whereby fluoride content usually peaks yearly during Q2 or Q3, i.e. during or following the winter months when wind patterns have been dominated by north-westerlies blowing towards this site from the NCIA emission stacks.

Site 13: Fluoride concentration of *Eucalyptus amplifolia* foliage at Site 13 was in the higher range of values for this tree at this time of the year and constitutes the fourth consecutive quarterly increase (Figure 17). Historical data show foliar fluoride concentrations to be highly variable in this species, with concentration generally peaking annually in Q3 or Q4, making this survey's result consistent with historical patterns.

The fluoride concentration in *Corymbia maculata* samples at Site 13 was in line with the trends observed for this tree. Foliage fluoride content has historically been low in this tree, with marginal and episodic increases occurring unpredictably (Figure 17). The lower foliar fluoride content in *Corymbia maculata* compared to that of *Eucalyptus amplifolia* at the same site suggests a lower sensitivity of the species to fluoride impacts.

Site 15: Fluoride concentration of *Corymbia maculata* leaves at Site 16 was in the lower to medium range of values for this tree at this site in Q4 surveys and is consistent with the results obtained during the previous two quarterly surveys. High variability in fluoride content has been observed for this tree since 2008 (Figure 18), with an unpredictable pattern that appears to be independent from seasonal wind patterns. The historical results from past vegetation surveys clearly indicate intra-species variability in sensitivity to atmospheric fluoride through both visible injury symptoms and foliar fluoride concentration.

Site 19: The foliar fluoride concentration in *Vitis vinifera* at this site was low and was consistent with the with the long term trend for this species. Site 19 provides the reference site for this monitoring program and routinely records fluoride concentrations of less than 10 µg/g and so the data for each of the quarterly results has not been presented graphically in this AEMR.

The following points are made from the collected long term data in comparison to the finding this year:

- The degradation in foliage health and the most severe fluoride symptoms recorded in 2013 may be (at least in part) attributable to prevailing environmental conditions and the lack of available moisture for the vegetation. Despite above average rainfall observed in November, the area experienced very little rainfall in the late winter / early spring of 2013, which would have affected the overall growth, health and condition of the vegetation, making it less resistant and resilient to atmospheric fluoride emission injuries;
- The lack of rainfall may result in the atmospheric fluoride being deposited onto leaves and not subsequently 'washed away' thereby remaining on foliage for longer periods of time, leading to greater bio-accumulation of fluoride within leaf tissue;
- There may be a link between fluoride impact to foliage and insect behaviour. For all sites this year the worsening of fluoride injury has been paralleled by a decrease in insect attack injury;
- There may be a lag in the expression of fluoride injury symptoms in the foliage of vegetation, and it may take a few years for trees to become visibly affected by atmospheric emissions; and
- There is an inherent level of unpredictability in the expression of visual symptoms and in foliar fluoride between monitoring events, as well as an obvious variability in sensitivity to fluoride impacts both inter and intra-species, with different individuals clearly being more resistant to emission related impacts than others.

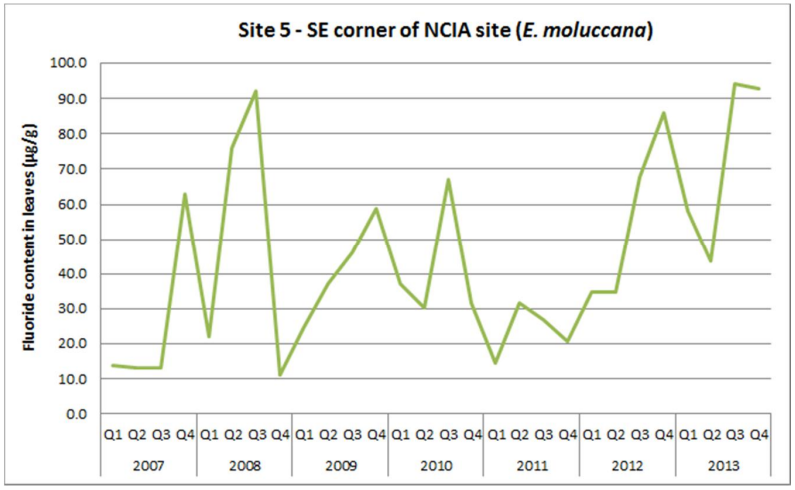

Figure 15 Fluoride Content in *E. mollucana* Foliage at Site 5 (Q1 2007 – Q4 2013)

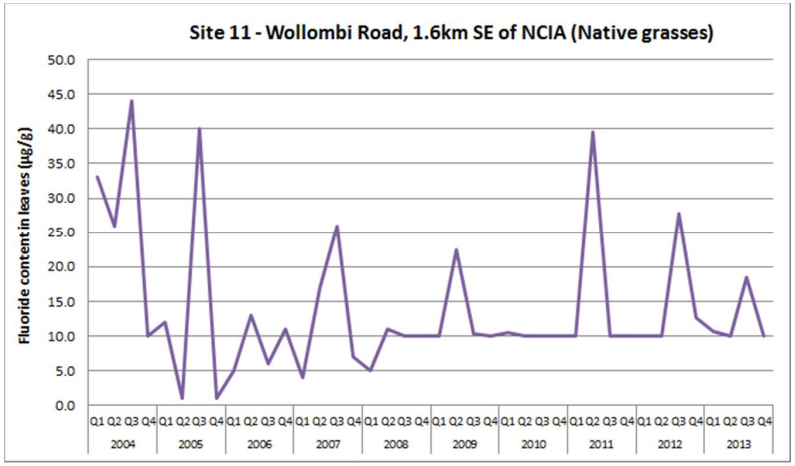

Figure 16 Fluoride Content in Native Grasses at Site 11 (Q1 2004 – Q4 2013)

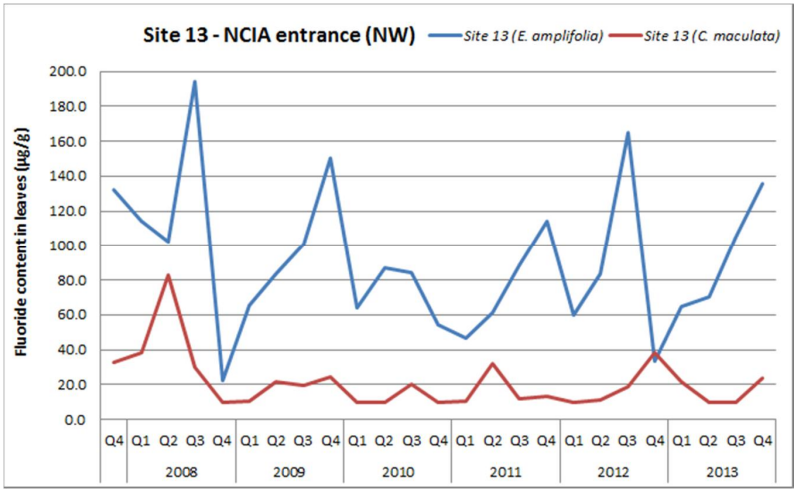

Figure 17 Fluoride Content in *E. amplifolia* and *C. maculate* Foliage at Site 13 (Q4 2007 – Q4 2013)

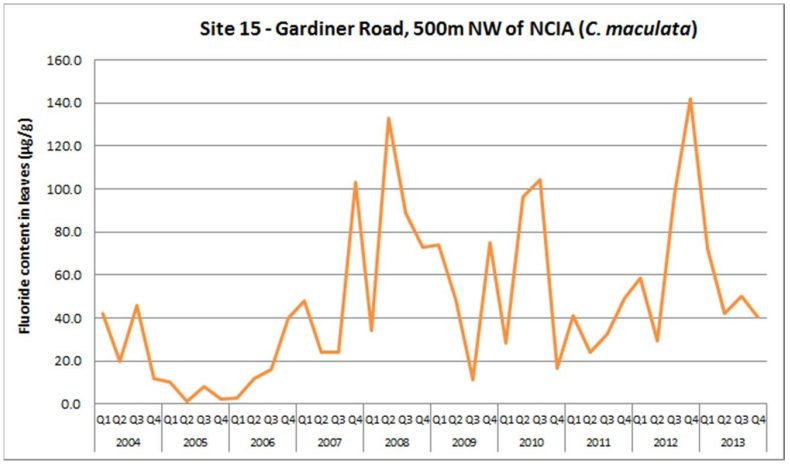

Figure 18 Fluoride Content in *C. maculate* Foliage at Site 15 (Q1 2004 – Q4 2013)

5.3 Air Pollutant Load Limits

The 2010 EA included dispersion modelling to predict ground levels pollutant concentrations. No source emission predictions were made in the 2010 EA, so stack emission monitoring results are not directly comparable to air quality impact predictions.

In order to analyse trends in the air quality pollutants discharged to air as a result of NCIA operations, previous AEMRs have assessed the air pollutant loads reported to the EPA in the Annual Returns. The Annual Returns are provided in accordance with the previous reporting timeline, that is, from 1 August to 31 July of each year. The AEMR reporting timeline is now based on 19 January to 18 January of each year, however for consistency in identifying trends in assessable pollutant loads, the AEMRs will continue to compare the information provided in the Annual Returns for each year.

The historical assessable pollutant loads are provided in Table 13 along with the maximum load limits set out in the EPL and Project Approval. The historical results are also presented graphically in Figure 19 to Figure 23. These graphs note the new limits set out in the Project Approval, which took effect in January 2013 in place of the Development Consent limits (fluoride and nitrogen oxide limits remain the same).

As reported in the 2012-13 Annual Return, the oxides of sulfur discharged to air exceeded the pollutant load limit specified in the EPL. This was the only exceedance of annual pollutant load limits in 2012-2013. The coarse particulates, fine particulates and nitrogen oxides were all at relatively low levels while the fluoride and sulphur oxides levels were higher than previous years.

While the assessable load for fluoride was higher than the previous three years, it was still well below the EPL limit and much lower than previously recorded during 2004 – 2007. These fluctuations are likely to be due to the normal variation in stack testing results.

Sulfur oxide levels were higher than the previous two years, and did exceed the EPL limit, however the levels are still much lower than those identified during 2008 – 2010. It was noted in the 2009 - 2010 AEMR that previous high levels of sulfur resulted from a higher than normal flow rate. The high flow rate was rectified, but the load level still exceeded the limit and further investigation was required. Sulfur oxide loads reported annually had previously included both sulfur trioxide and sulfur dioxide. In consultation with DP&I and OEH, as part of negotiating NCIA's Project Approval conditions, it was agreed that 'Sulfur Oxides' was to be specifically defined as sulphuric acid mist and sulphur trioxide (as SO_3). Close attention will be paid to the sulphur oxide levels during the next monitoring event and further investigation will be undertaken if required.

Table 13 Maximum Pollutant Load Limits and Assessable Pollutant Loads

Pollutant	Current Maximum Load Limit (kg)		Actual Load (kg)							
	EPL	Project Approval	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010*	2010-2011	2011-2012	2012-2013**
Fine particulates	26,629	74,210	25,751	7,289	4,449	5,476	6,524	2,902	997	1,249
Coarse particulates	14,338	32,073	11,986	12,657	3,881	2,564	475	1,774	5,550	1,640
Fluoride	1,850	3,701	4,085	1,989	336	1,529	621	295	91	1,109
Sulfur oxides	36,828	110,000	13,239	15,850	16,633	62,426	86,704	7,699	26,946	42,235
Nitrogen oxides	36,828	73,657	12,422	12,423	18,073	70,565	79,375	18,322	20,306	4,704

** 2009-2010 marked the commencement of stage 2 of the development.*

*** The Project Approval came into effect on January 2013 and the previous Consent was relinquished.*

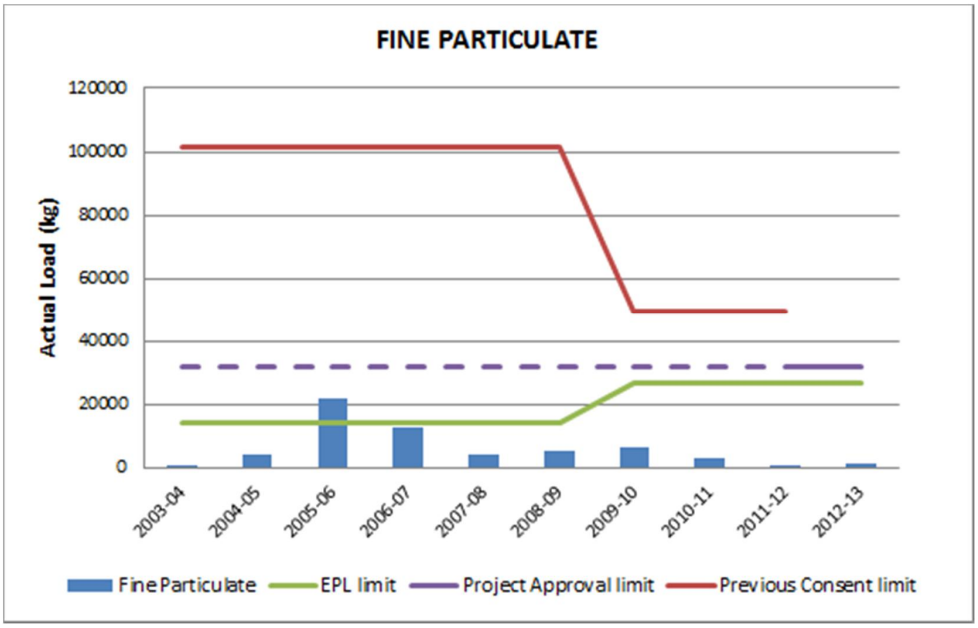

Figure 19 Fine Particulate Annual Load (2004 – 2013)

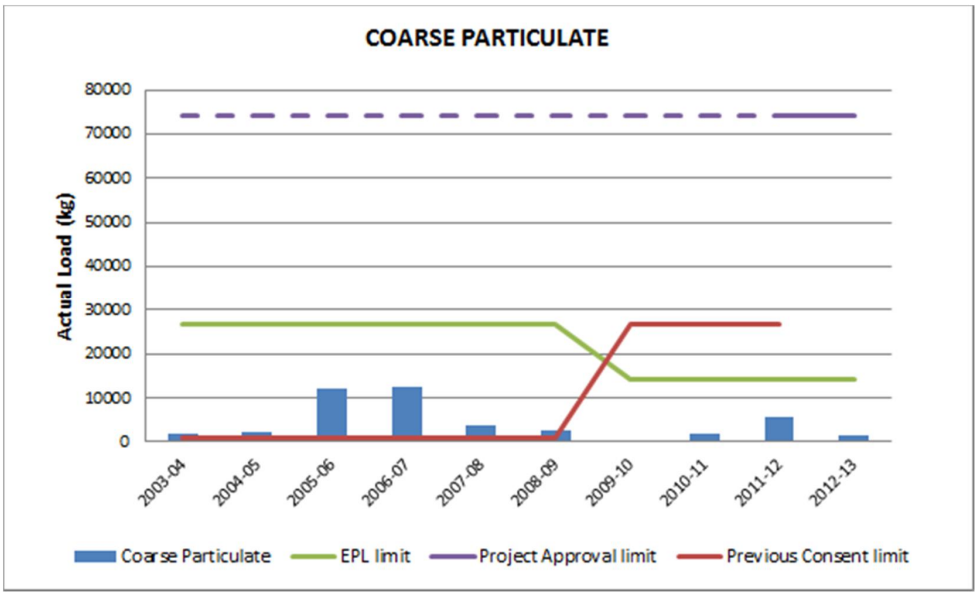

Figure 20 Coarse Particulate Annual Load (2004 – 2013)

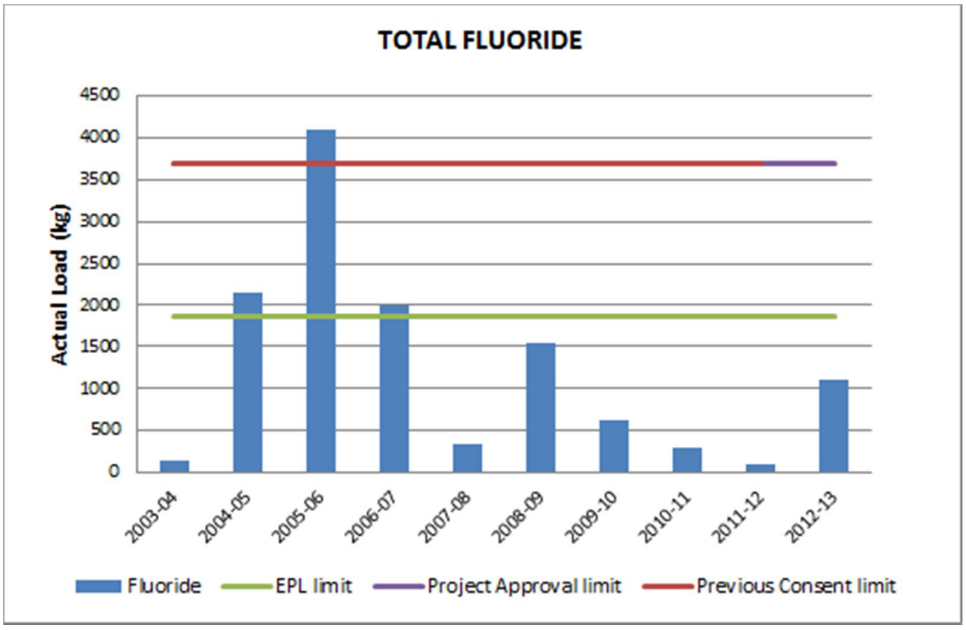

Figure 21 Fluoride Annual Load (2004 – 2013)

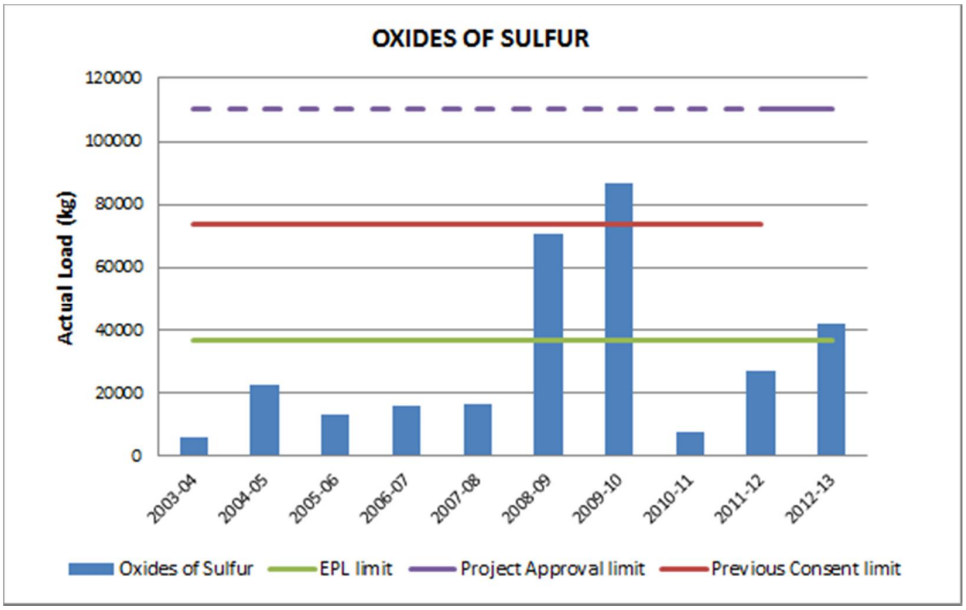

Figure 22 Sulfur Oxides Annual Load (2004 – 2013)

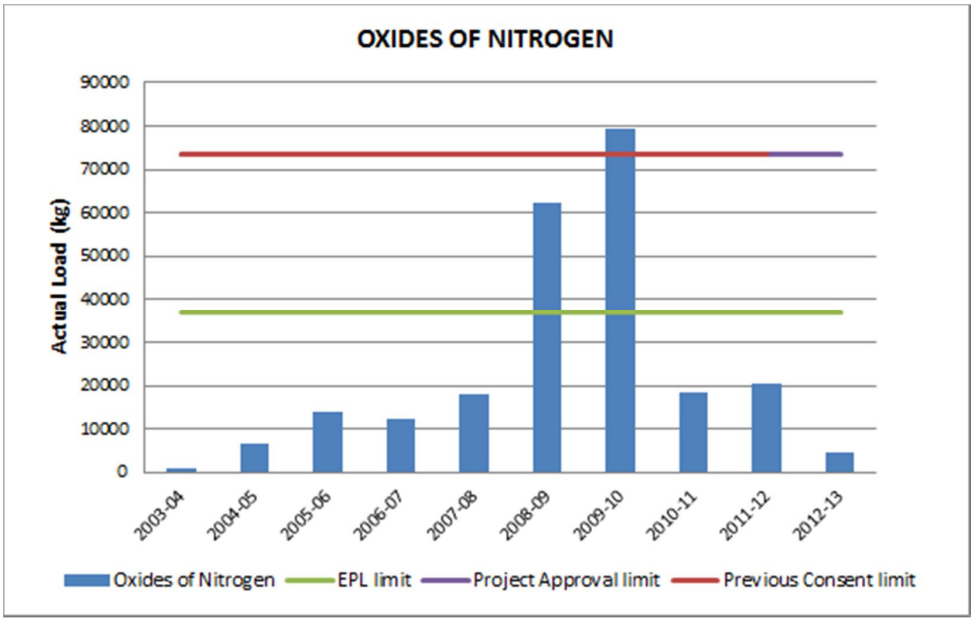

Figure 23 Nitrogen Oxides Annual Load (2004 – 2013)

5.4 Noise

The 2010 EA predicted that the operational noise levels from the expanded facility would not change significantly from that already approved, and would be significantly below the project specific noise criteria at all existing receptors under calm and prevailing weather conditions.

The new Project Approval specified more stringent noise limits than those set out in the EPL and the previous Development Consent (except for the night time period, which remained the same). Under the new Project Approval, the noise generated from the facility must not exceed 35 dB(A) for the day, evening and night periods.

Monitoring results for the 2013 reporting period indicate that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria.

Historical noise monitoring results at the closest sensitive residential receiver (Kenvil Close) are provided in Figure 24 – Figure 26. Noise levels from the facility for the day, evening and night periods were estimated based on operator notes taken during the noise survey and free field calculations. On many occasions the NCIA facility was not clearly audible over other dominant industrial and traffic noise sources nearby.

No trends in the noise monitoring are clearly discernible, with historical noise emissions generally complying with noise limits. During the daytime for the past five years, the NCIA noise contribution was audible but not measurable. The current noise monitoring report noted that the acoustic environment at both monitoring locations was significantly impacted by noise from the construction of the subdivision on the old golf course site. Traffic noise on the New England Highway also contributes to the background noise levels. The 2010 EA indicated that the increase in background levels in the Rutherford region was likely to be due to the development of new industrial facilities in the Rutherford Industrial Estate.

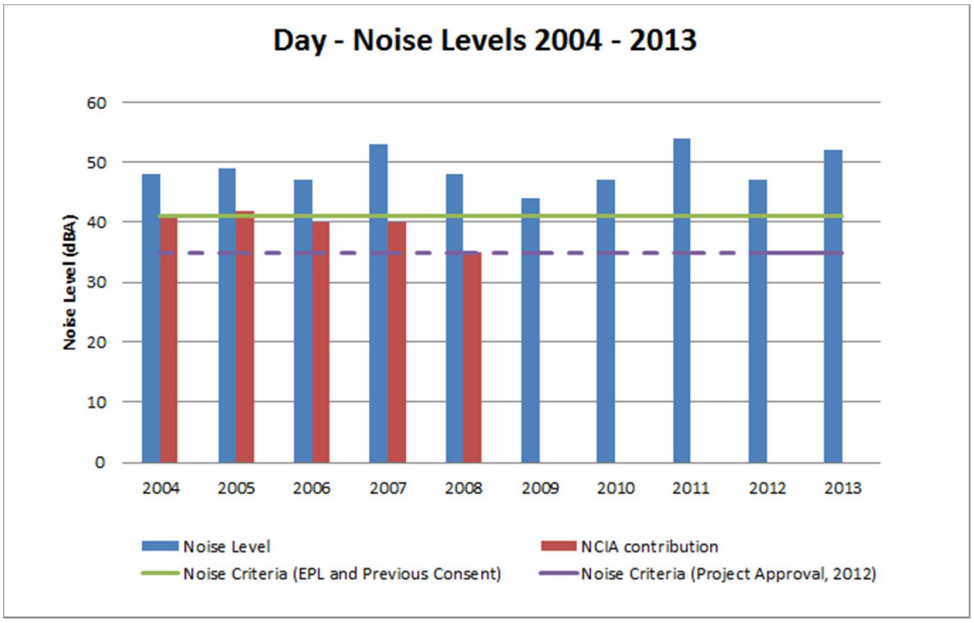

Figure 24 Day Noise Levels 2004 - 2013

Note 1: 2009, 2010, 2011, 2012 and 2013 – NCIA contribution audible but not measurable.

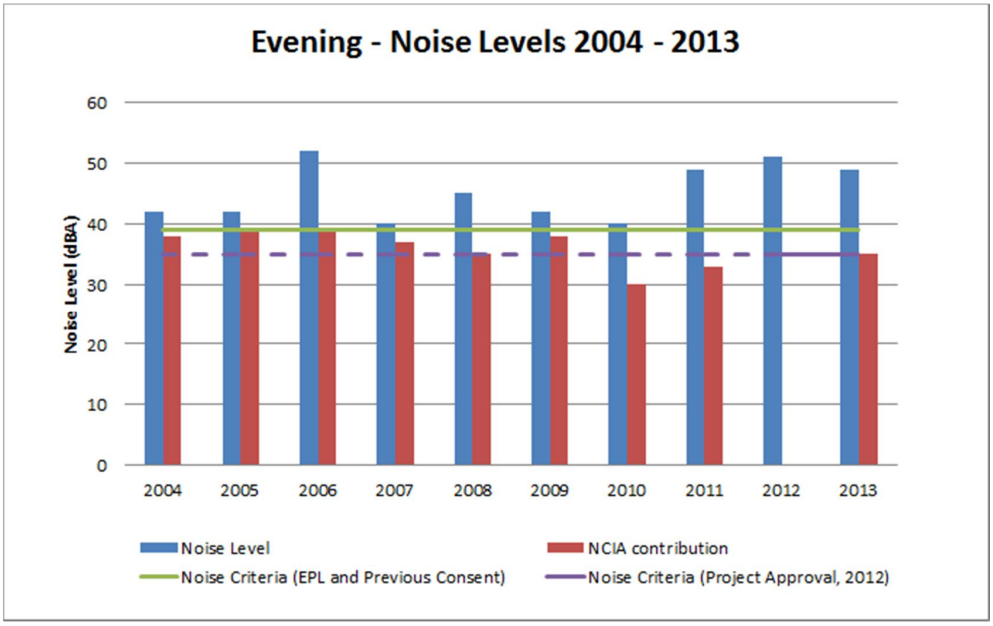

Figure 25 Evening Noise Levels 2004 - 2013

Note: 2012 – NCIA contribution audible but not measurable.

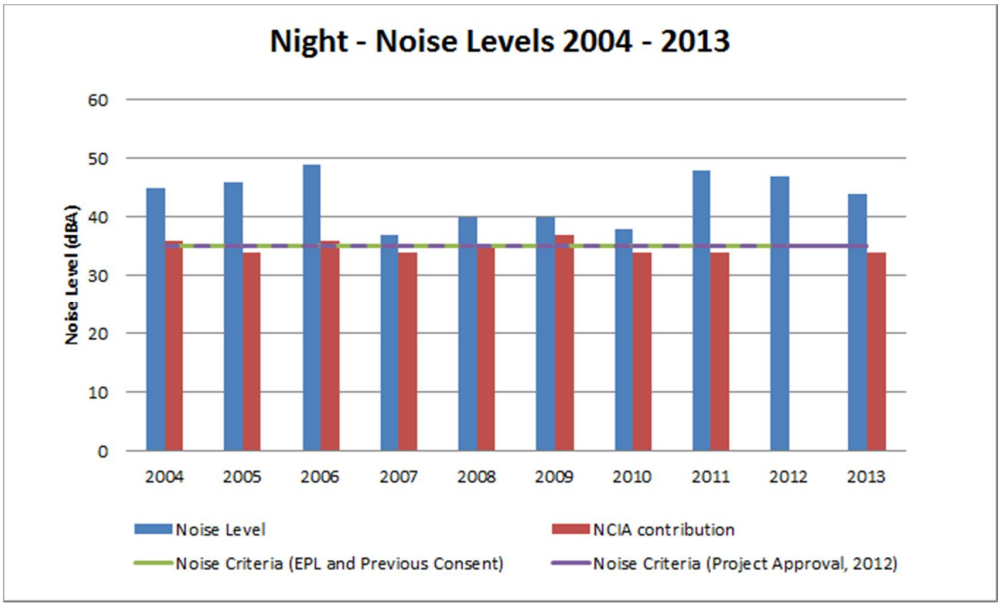

Figure 26 Night Noise Levels 2004 - 2013

Note: 2012 – NCIA contribution audible but not measurable.

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6.0 Non-Compliances

Eight non-compliances were recorded during the 2013 AEMR reporting period. Details relating to the non-compliance and the actions taken to prevent a recurrence are summarised in Table 14 below.

Table 14 Details of Non-compliance with Project Approval or EPL during the 2013 reporting period

Condition No. / Reference	Details of Non-compliance	Action Taken
Project Approval Condition 15	There were seven exceedances of the 24 hour PM_{10} criteria (50 µg/m^3): *NW monitoring station* - 22 March 2013 – 59.5 µg/m^3; - 19 August 2013 – 50.5 µg/m^3; - 24 September 2013 – 72.4 µg/m^3; - 24 October 2013 – 76.3 µg/m^3; and - 23 December 2013 – 55.9 µg/m^3. *SE monitoring station* - 24 September 2013 – 50.1 µg/m^3; and - 24 October 2013 – 56.5 µg/m^3.	Meteorological conditions obtained from the onsite meteorological station for these days indicate that the NCIA facility was unlikely to be a major contributor to the exceedances (as summarised in Section 4.1.1). NCIA will continue to monitor 24 hour PM10 concentrations and local meteorological conditions.
EPL Condition L2.1	As reported in the 2012-13 Annual Return, the assessable pollutant load for sulphur oxides discharged to air exceeded the pollutant load limit specified in this condition.	Pollutant fee calculated in accordance with the worksheets included in the Annual Return.

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7.0 Continuous Improvement Measures

Condition 60(j) of the new Project Approval requires the AEMR to identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.

Emission concentrations of pollutants were generally in accordance with EPL and Project Approval limits. There were seven exceedances of the 24 hour PM_{10} criterion and the sulphur oxide assessable pollutant load exceeded the maximum load limit specified in the EPL.

Noise monitoring results for the 2013 reporting period indicate that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria. Noise monitoring confirmed that background noise levels during the day in the Rutherford industrial area remain high, and the NCIA contribution was audible but was not measurable.

General environmental management actions that NCIA undertake are outlined in Table 15.

Table 15 Timetable for Environmental Improvement Actions

Area of Concern	Identified Action	Completion Date
Baghouse equipment life time	Enclose Kiln baghouse.	Complete.
Air quality.	During 2013 NCIA has reviewed the raw materials being used. NCIA continue to evaluate and modify the raw materials to reduce the fluoride content, which reduces the lime required for fluoride emission control.	Ongoing.
General stack maintenance	Install new components when necessary. During 2013 significant investment has been made in a new kiln stack.	Ongoing.
Vegetation planting	Native vegetation planting and maintenance as per the proposed landscape vegetation planting plan in the 2010 EA.	Ongoing for care and maintenance.
Plant maintenance	General housekeeping.	Ongoing.

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8.0 References

Australian Standard (2003) *AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM(sub)10(/sub) high volume sampler with size-selective inlet - Gravimetric method*. Retrieved from Australian Standards Online.

Australian Standard (2007) *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*. Retrieved from Australian Standards Online.

Australian Standard (2013) *AS/NZS 3580.13.2:2013 Methods for sampling and analysis of ambient air - Determination of gaseous and acid-soluble particulate fluorides - Manual, double filter paper sampling*. Retrieved from Australian Standards Online.

DECC (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

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Appendix A

Monitoring Results for Partial Year 2012-13 AEMR (1 August 2012 – 18 January 2013)

Appendix A Monitoring Results for Partial Year 2012-13 AEMR (1 August 2012 – 18 January 2013)

Appendix A: Monitoring Results for Partial 2012-13 AEMR (1 August 2012 – 18 January 2013)

A1.0 Ambient Air Monitoring

PM_{10} Monitoring Results

Table A1.1 provides the PM10 monitoring results for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013.

Table A1.1: Ambient Monitoring PM10 Results (1 August 2012 – 18 January 2013)

Monitoring Period	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	30	29.1	21.8
Standard Deviation (µg/m^3)	-	18.9	9.1
24-hour Minimum Concentration (µg/m^3)	-	6.8	5.0
24-hour Maximum Concentration (µg/m^3)	50	76.7	41.9

During the partial reporting period there were four exceedances of the 24 hour PM10 criterion at the NW location:

- 6 August 2012 (53.4 µg/m^3);
- 18 August 2012 (76.7 µg/m^3);
- 30 August 2012 (73.1 µg/m^3); and
- 5 October 2012 (67.5 µg/m^3).

Wind conditions obtained from the on-site meteorological station indicate that August 2012 was a particularly dry and windy month and this is likely to be a major contributing factor in the elevated results, with above average wind speeds occurring on the days that exceedances occurred. Local meteorological conditions recorded on the site on 5 October 2012 indicate that the exceedance was unlikely to be attributed to site operations, as the NW monitoring station was upwind of the plant.

24-hour Fluoride Monitoring Results

Table A1.2 provides the 24-hour Fluoride monitoring results for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013.

Table A1.2: Ambient Monitoring 24-hour Fluoride Results (1 August 2012 – 18 January 2013)

Monitoring Period	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.3	0.5
Standard Deviation (µg/m^3)	-	0.4	0.8
24-hour Minimum Concentration (µg/m^3)	-	0.1	0.1
24-hour Maximum Concentration (µg/m^3)	2.9	1.5	4.4

During the partial reporting period there was one exceedance of the 24-hour Fluoride criterion at the SE location:

- 5 September 2012 (4.35 µg/m^3).

Wind conditions obtained from the on-site meteorological station indicate that the plant was unlikely to be a major contributor to the exceedance as the SE monitoring station was upwind of the plant at this time.

Weekly Fluoride Monitoring Results

Table A1.3 provides the Weekly Fluoride monitoring results for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013.

Table A1.3: Ambient Monitoring Weekly Fluoride Results (1 August 2012 – 18 January 2013)

Monitoring Period	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.2	0.3
Standard Deviation (µg/m^3)	-	0.3	0.2
Weekly Minimum Concentration (µg/m^3)	-	0.0	0.1
Weekly Maximum Concentration (µg/m^3)	1.7	1.1	0.8

Fluoride concentrations for all Weekly Fluoride monitoring events at both locations satisfied the EPA criteria throughout the partial 2012-13 AEMR reporting period.

A2.0 Fluoride Impact on Vegetation

During the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013, a quarterly vegetation survey (October 2012) and the Annual Vegetation Condition Assessment (December 2012) was undertaken.

The quarterly visual assessment found very slight to distinct chlorosis in a number of trees, including:

- *Corymbia maculata* (Site 5 and Site 7);
- *Angophora floribunda* (Site 6); and
- *Eucalyptus paniculata* (Site 7).

Table A2.1 to Table A2.3 provide the results for the species that were assessed for visible injury during the Annual Vegetation Condition Assessment.

Table A2.1: Summary Condition Assessment of Selected Monitoring Sites Located within the NCIA Premises (December 2013)

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 1 – Access road north of office															
Acacia longifolia	**2**	**2**	1	2	0	0	0	0	0	0	0	0	✓	0	Along northern fence opposite RSPCA
Eucalyptus	**1**	**2**	0	0	1	0	0	0	2	0	1	0	✓	✓	North end of shed
	1	**2**	1	0	0	1	0	2	2	1					
Eucalyptus robusta 1	**1**	**2**	0	0	1	1	0	0	2	0	✓	0	0	✓	Clay shed entry
	3	**3**	1	3	1	0	0	0	1	1					
Eucalyptus robusta 2	**1**	**1**	0	0	0	1	0	0	1	0	✓	-	0	✓	~70m north of office
	5	**5**	1	5	1	2	0	1	0	1					
Site 2 – Office car park															
Corymbia maculata	**0**	**0**	0	-	-	-	-	-	-	-	0	0	0	0	
	3	**3**	1	3	2	3	0	0	0	1					
Eucalyptus robusta	**0**	**1**	0	0	0	0	0	0	1	0	1	0	0	0	New leaves very recent
	4	**4**	1	4	1	2	0	5	2	1					
Fraxinus pennsylvanica	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	
Site 3 – Access road south of office															
Acacia	**1**	**1**	mixed	1	0	0	0	0	0	0	0	0	✓	0	
Hakea Sp.			mixed	0	0	1	0	0	1	0	0	0	0	✓	New to this survey

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 4 – South-west corner of site															
Acacia fimbriata	**0**	**1**	1	0	0	0	0	0	1	0	0	1	0	0	
Bursaria spinosa	**1**	**1**	mixed	1	0	0	0	0	0	0	5	-	0	0	
Dianella sp.	**2**	**2**	mixed	0	0	2	0	0	0	0	-	-	0	0	
Eucalyptus amplifolia	**1**	**2**	0	0	1	0	0	0	1	2	0	0	✓	✓	
	1	**2**	1	0	1	1	0	0	2	1					
Site 5 – South-east corner of site															
Bursaria spinosa	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0		
Eucalyptus amplifolia	**2**	**2**	0	0	1	1	0	2	2	2	1	1	0	0	Coppice
	1	**2**	1	0	0	0	0	0	2	2					

- *Indicates no visual assessment was undertaken.*

Table A2.2: Summary Condition Assessment of Selected Monitoring Sites Located in the Rutherford and Farley Residential Areas (December 2013)

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 6 – 3 Palisade Street															
Corymbia maculata 2	**1**	**2**	0	0	1	0	0	0	2	1	1	0	0	0	Back of the allotment
	2	**2**	1	2	1	2	0	0	0	2					
Corymbia maculata 1	**-**	**-**	0	-	-	-	-	-	-	-	1	0	0	0	Front of the allotment (roadside)
	4	**4**	1	1	4	1	1	0	0	1					
Bursaria spinosa	**2**	**2**	mixed	2	0	0	0	0	0	0	1	-	0	0	New to this survey
Site 7 – Gillette Close															
Eucalyptus acmenoides	**0**	**0**	0	0	0	0	0	0	1	0	0	0	✓	✓	
	2	**2**	1	2	0	1	0	0	2	1					
Bursaria spinosa	**2**	**1**	mixed	2	0	0	0	0	0	0	0	-	0	0	
Corymbia maculata	**3**	**3**	0	3	2	2	0	0	2	1	2	1	0	0	
	2	**2**	1	1	1	2	2	0	1	0					
Lantana camara	**0**	**0**	mixed	0	0	0	0	0	0	0	0	-	0	0	Strong re-growth
Site 8 – Regiment Road east of Dumont Court															
Acacia fimbriata	**0**	**0**	0	-	-	-	-	-	-	-	0	0	0	✓	Pods
	0	**0**	1	0	0	0	0	0	0	0					
Corymbia maculata	**2**	**2**	0	0	2	0	0	0	2	1	2	1	0	0	Bark shedding
	2	**2**	1	1	1	2	2	1	1	1					
Eucalyptus resinifera	**0**	**0**	0	0	0	0	0	0	0	0	1	0	0	✓	Mostly juvenile specimens

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
	1	**1**	1	1	0	1	0	0	1	1					
Site 9 – Regiment Road south-east of Squadron Crescent															
Bursaria spinosa	**2**	**2**	mixed	2	0	0	0	0	0	0	0	-	0	0	
Corymbia maculata	**0**	**2**	0	0	0	0	0	0	2	0	1	1	0	0	Mistletoe infested
	2	**2**	1	0	0	2	0	0	1	1					
Eucalyptus resinifera	**0**	**2**	0	0	0	0	0	0	0	2	2	1	✓	✓	New growth recent
	2	**2**	1	0	0	2	0	0	1	2					
Site 10 – Wollombi Road between sewage works and creek															
Fraxinus excelsior	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	
Grevillea robusta	**0**	**2**	mixed	0	0	0	0	0	0	0	0	2	✓	0	Flowering. Trimmed lopped on fence side
Pinus radiata	**0**	**2**	mixed	0	0	0	0	0	0	0	2	0	0	1	
Populus nigra var. *italica*	**1**	**1**	mixed	1	0	0	1	0	0	0	1	-	0	0	
Casuarina glauca	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	New to this survey.
Site 11 – Hill top on Wollombi Road west of Owl Pen Lane, Farley															
Bursaria spinosa	**0**	**0**	mixed	0	0	0	0	0	0	0	2	-	0	✓	
Hakea gibbosa	**1**	**1**	mixed	0	0	1	0	0	0	0	0	-	0	✓	
Corymbia maculata	**0**	**0**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth
	0	**3**	1	0	0	0	0	0	3	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Eucalyptus paniculata	**0**	**1**	0	0	0	0	0	0	2	1	0	0	0	0	
	0	**2**	1	0	0	0	0	0	2	1					
Site 12 – Western end of Quarry Road, Farley															
Corymbia maculata	**0**	**2**	0	0	0	0	0	0	2	1	1	0	0	0	Summer bark shedding
	1	**3**	1	0	1	1	0	0	3	3					
Eucalyptus paniculata	**0**	**2**	0	0	0	0	0	0	2	2	0	0	0	✓	
	0	**1**	1	0	0	0	0	0	0	1					
Pinus radiata	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	✓	

Table A2.3: Summary Condition Assessment of Selected Monitoring Sites Located in Rutherford Industrial Area (December 2013)

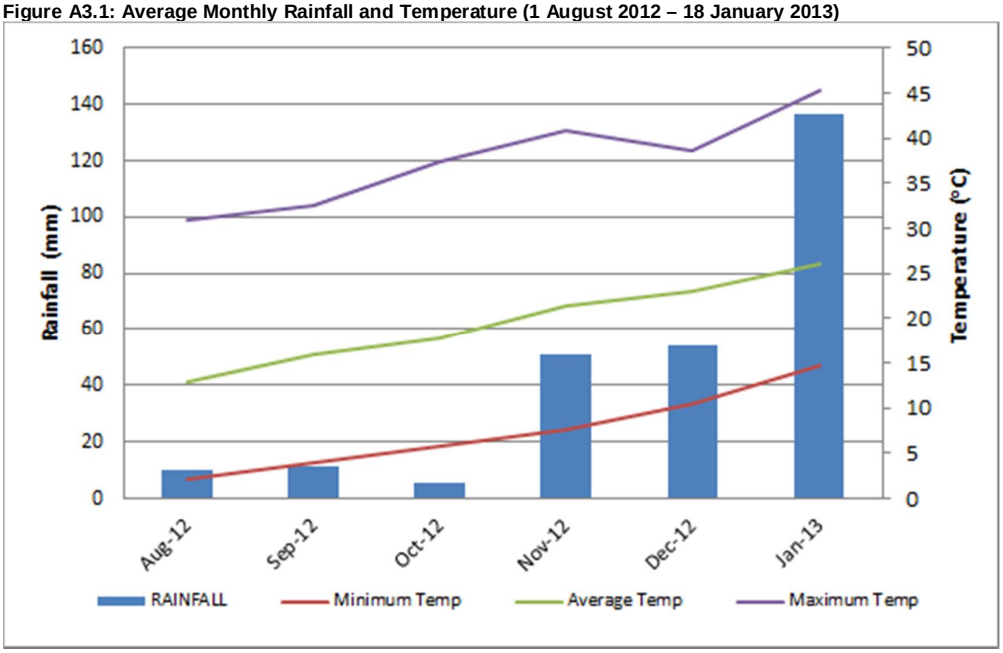
Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 13 – NCIA entrance, Racecourse Road															
Corymbia maculata	**1**	**2**	0	0	1	1	0	0	0	2	1	0	✓	0	Mistletoe infestation
	1	**2**	1	0	1	1	0	0	0	2					
Eucalyptus amplifolia	**1**	**1**	0	0	0	0	0	0	0	1	1	0	✓	✓	Mistletoe infestation
	1	**1**	1	0	0	1	0	0	1	1					
Site 14 – 100-104 Kyle Street															
Angophora floribunda	**1**	**0**	0	0	1	0	0	0	0	0	1	7	0	0	Mistletoe infestation
	1	**2**	1	0	1	1	0	0	0	2					
Eucalyptus amplifolia	**0**	**0**	0	0	0	0	0	0	0	0	1	4	✓	0	Mistletoe infestation
	1	**3**	1	0	0	0	0	0	3	1					
Site 15 – 11 Gardiner Road															
Eucalyptus paniculata	**0**	**0**	0	0	0	0	0	0	0	0	1	0	✓	✓	
	0	**1**	1	0	0	0	0	0	1	1					
Corymbia maculata	**3**	**3**	0	0	3	2	0	0	0	1	1	0	✓	0	
	3	**3**	1	2	1	3	1	0	0	2					
Site 16 – 56 Gardiner Road															
Corymbia maculata			0	-	-	-	-	-	-	-	0	0	✓	0	Mistletoe infestation
			1	3	2	3	0	0	1	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 17 – Gardiner Road, southern end															
Eucalyptus paniculata	**0**	**2**	0	0	0	0	0	0	2	1	1	0	✓	✓	Buds and flowers
	2	**2**	1	1	0	2	0	1	1	1					
Corymbia maculata 1	**1**	**1**	0	0	1	1	0	0	1	1	2	1	✓	0	Buds and flowers
	1	**1**	1	0	1	1	0	0	1	1					
Eucalyptus punctata	**1**	**2**	0	0	0	1	0	0	2	2	3	1	✓	✓	
	2	**2**	1	1	0	2	0	1	1	1					
Site 18 – Maitland Saleyards, Kyle Street															
Corymbia maculata	**3**	**3**	0	1	3	1	0	0	0	2	0	0	✓	0	
	3	**3**	1	1	3	2	1	0	0	1					
Eucalyptus amplifolia	**0**	**0**	0	-	-	-	-	-	-	-	1	0	✓	0	Buds and flowers. No new growth.
	1	**3**	1	0	1	1	0	0	3	3					
Eucalyptus moluccana	**0**	**1**	0	0	0	0	0	0	1	1	1	0	0	0	
	1	**3**	1	0	0	1	0	0	3	1					
Eucalyptus resinifera	**0**	**0**	0	-	-	-	-	-	-	-	1	0	0	✓	No new growth. In drainage line, 5m from road edge.
	2	**2**	1	0	1	2	0	0	1	1					

A3.0 Meteorological Monitoring

Figure A3.1 shows the average monthly rainfall and temperature for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013. Wind speed and direction for the same partial reporting period are presented in Figure A3.2 to Figure A3.7. It is noted that from November 2012 to January 2013 there were some intermittent issues with the wind speed and rainfall gauges which have since been resolved. Where appropriate this data has been substituted with data from the Bureau of Meteorology monitoring station (the Maitland Belmore Bridge station which is located approximately 2-3 km from Rutherford).

Figure A3.1: Average Monthly Rainfall and Temperature (1 August 2012 – 18 January 2013)



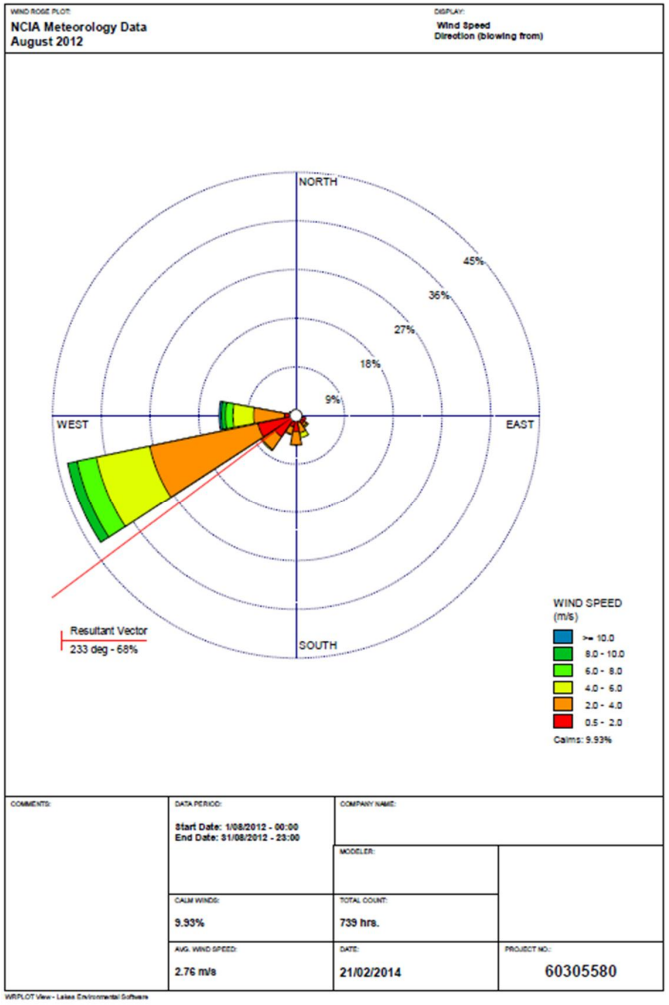


Figure A3.2: Wind Speed and Direction (August 2012)

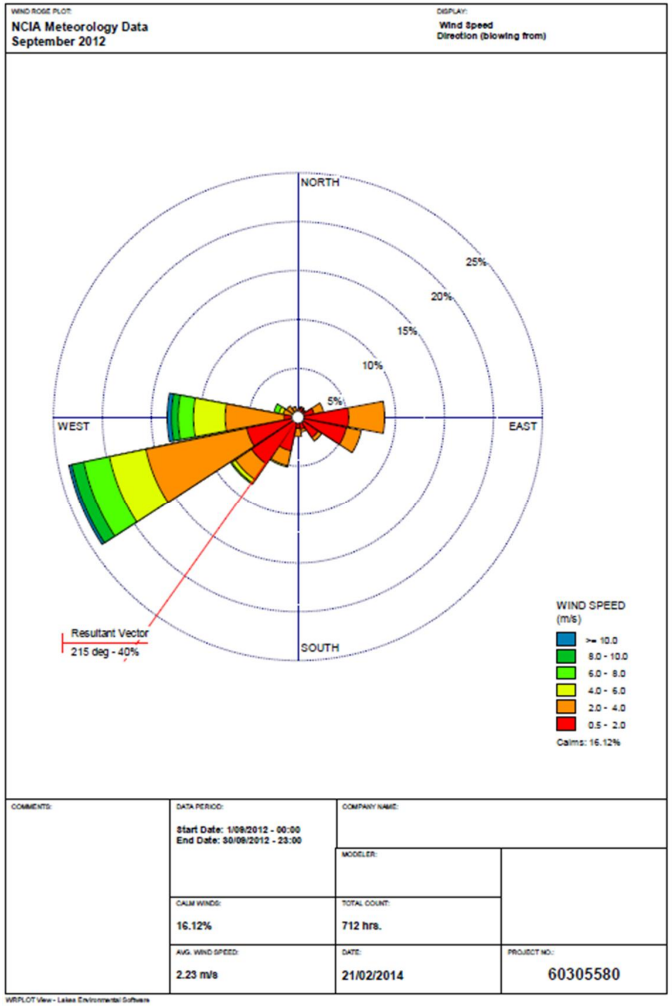


Figure A3.3: Wind Speed and Direction (September 2012)

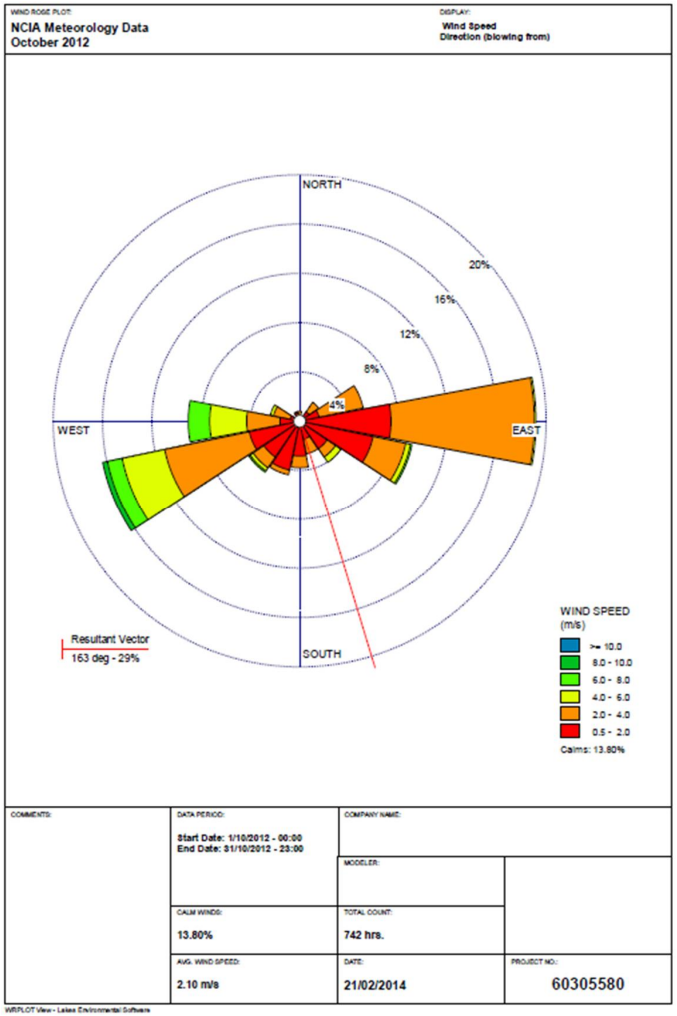


Figure A3.4: Wind Speed and Direction (October 2012)

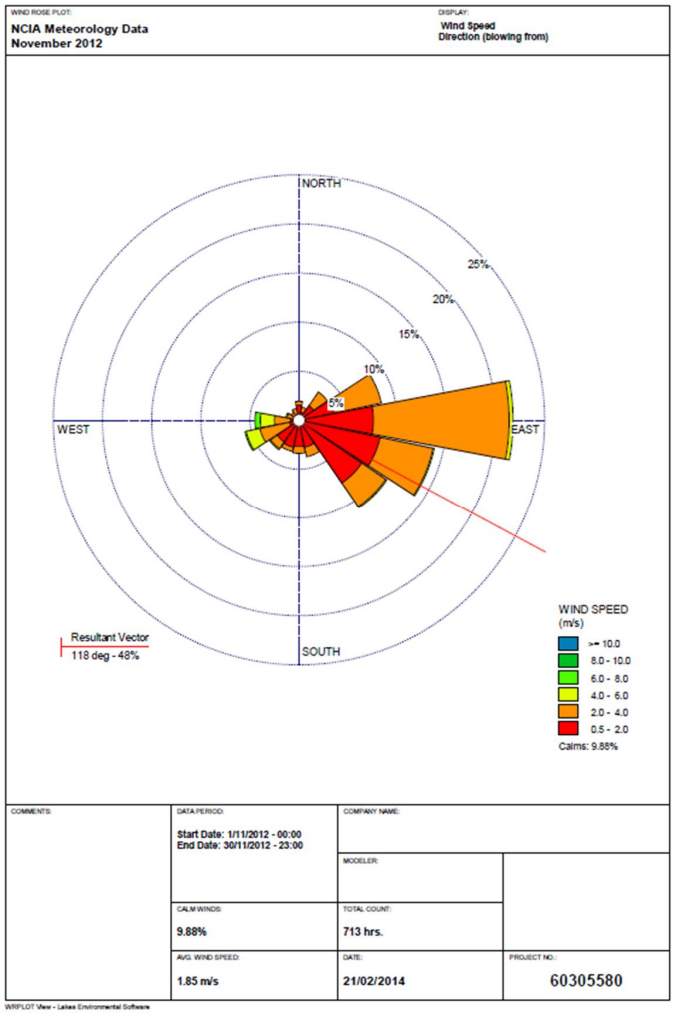


Figure A3.5: Wind Speed and Direction (November 2012)

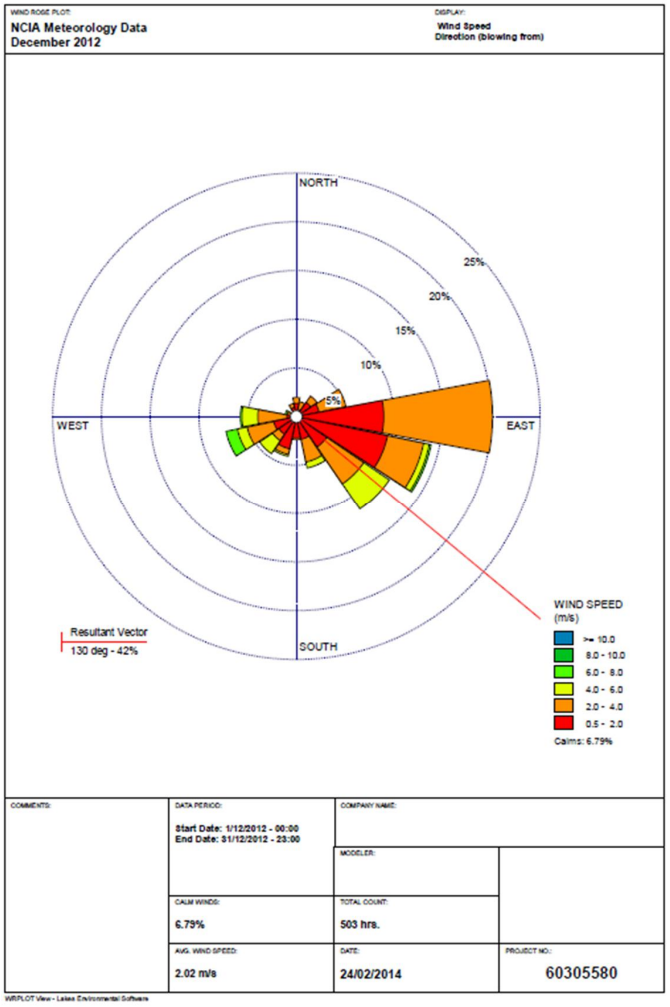


Figure A3.6: Wind Speed and Direction (December 2012)

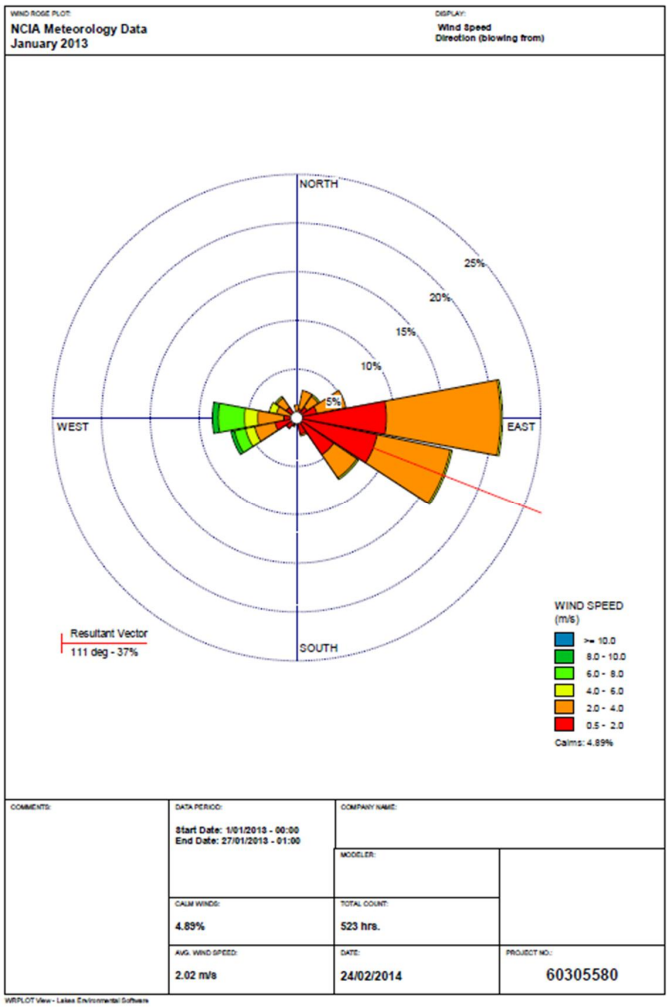


Figure A3.7: Wind Speed and Direction (January 2013)

A4.0 Stack Emissions Testing Results

Stack emission testing during this period was undertaken in October 2012. Due to the overlap in reporting timelines and the 2013/14 stack testing results not being finalised as yet, the results of the October 2012 stack emissions testing have been reported in Section 4.3 of this AEMR. Therefore, there is no data to present for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013.

A5.0 Noise Monitoring

Noise monitoring at NCIA is performed annually and the most recent noise monitoring undertaken was in May 2013. The May 2013 noise monitoring event falls within the previous 1 August 2012 – 31 July 2013 AEMR reporting period as well as the current 19 January 2013 – 18 January 2014 reporting period. The noise monitoring undertaken in May 2013 is reported in Section 4.4 of this AEMR and provides the information required for the noise monitoring as part of the 2012-2013 AEMR reporting period. Therefore, there is no data to present for the partial 2012-13 AEMR reporting period covering 1 August 2012 – 18 January 2013.

Appendix B

Fluoride Impact on Vegetation – Visible Injury Expression

Appendix B Fluoride Impact on Vegetation – Visible Injury Expression

Table B1.1 Condition Assessment of Selected Monitoring Sites Located within the NCIA Premises

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 1 – Access road north of office															
Acacia filicifolia	**0**	**0**	0	0	0	0	0	0	0	0	0	0	✓	0	Along northern fence opposite RSPCA
Acacia longifolia	**0**	**1**	1	0	0	0	0	0	0	1	0	0	0	0	Clay shed entry
Corymbia citriodora	**3**	**3**	0	0	3	3	0	0	1	0	0	0	0	0	Clay shed entry
	4	**4**	1	4	2	3	0	0	0	0					New to this survey
Eucalyptus moluccana	**0**	**2**	0	0	0	0	0	0	2	0	0	0	✓	✓	North end of shed
	2	**2**	1	0	2	1	0	2	1	1					
Eucalyptus robusta 1	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	Clay shed entry
	3	**3**	1	3	2	1	0	0	1	1					
Eucalyptus robusta 2	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	✓	~70m north of office
	3	**3**	1	3	1	1	0	0	1	1					
Site 2 – Office car park															
Corymbia maculata	**3**	**3**	0	0	3	1	0	0	1	1	0	0	0	0	Juvenile
	4	**4**	1	4	4	3	1	0	0	2					
Eucalyptus robusta	**1**	**1**	0	1	0	0	0	0	1	1	1	0	0	0	Juvenile
	4	**4**	1	4	3	2	0	0	1	1					
Fraxinus	**3**	**3**	0	0	0	1	0	3	0	0	0	0	0	0	Older leaves healthier than

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
pennsylvanica	**0**	**0**	1	0	0	0	0	0	0	0					younger foliage
Site 3 – Access road south of office															
Acacia parramattensis	**2**	**2**	mixed	2	0	0	0	0	0	0	0	0	0	0	
Hakea salicifolia	**1**	**1**	1	0	0	1	0	0	0	0	0	0	0	✓	
Site 4 – South-west corner of site															
Acacia longifolia	**3**	**3**	1	0	3	2	0	0	0	1	0	0	0	0	
Bursaria spinosa	**1**	**1**	1	1	0	0	0	0	0	0	4	-	0	0	
Typha sp.	**2**	**2**	mixed	0	0	2	0	0	0	0	-	-	0	✓	Previously incorrectly identified as *Daniella* sp.
Eucalyptus amplifolia	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth
	1	**3**	1	1	1	0	0	0	3	2					
Site 5 – South-east corner of site															
Acacia longifolia	**0**	**1**	mixed	0	0	0	0	0	1	1	0	0	0	✓	New to this survey
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	0	-	✓	0	Just coming into flower
Eucalyptus moluccana	**0**	**3**	0	0	0	0	0	0	3	2	1	1	0	0	Coppice surveyed
	3	**3**	1	3	2	0	0	0	2	2					

- Indicates no visual assessment was undertaken.

Table B1.2 Condition Assessment of Selected Monitoring Sites Located in Rutherford and Farley Residential Areas

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 6 – 3 Palisade Street															
Bursaria spinosa	**3**	**3**	1	3	0	0	0	0	0	0	2	-	✓	0	Just coming into flower
Corymbia maculata 1	**0**	**3**	0	0	0	0	0	0	2	3	0	0	0	0	Front of the allotment (road side)
	3	**3**	1	1	4	0	0	0	2	3					
Corymbia maculata 2	**2**	**3**	0	1	2	1	0	0	3	1	0	0	0	0	Back of the allotment
	2	**2**	1	1	2	2	0	0	0	2					
Site 7 – 3 Gillette Close															
Bursaria spinosa	**2**	**2**	1	2	0	0	0	0	0	0	0	0	0	0	
Corymbia maculata	**1**	**2**	0	0	1	0	0	0	2	2	1	1	0	0	
	3	**3**	1	2	3	2	0	0	0	0					
Eucalyptus acmenoides	**0**	**1**	0	0	0	0	0	0	1	0	0	0	✓	0	
	4	**4**	1	4	0	0	0	0	2	1					
Site 8 – Regiment Road east of Dumont Court															
Acacia baileyana	**0**	**0**	1	0	0	0	0	0	0	0	0	0	✓	0	Just coming into flower
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	1	0	0	0	No new growth
	3	**3**	1	3	1	1	0	0	2	2					
Eucalyptus resinifera	**-**	**-**	0	-	-	-	-	-	-	-	0	0	✓	0	No new growth
	3	**3**	1	3	0	0	0	0	2	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Grevillea robusta	**0**	**0**	mixed	0	0	0	0	0	0	0	2	0	0	0	New to this survey
Site 9 – Regiment Road south-east of Squadron Crescent															
Bursaria spinosa	**2**	**2**	1	2	0	0	0	0	0	0	2	-	✓	0	Just coming into flower
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	1	0	0	0	No new growth. Low level mistletoe infestation
	1	**1**	1	0	0	1	0	0	1	1					
Eucalyptus resinifera	**2**	**2**	0	0	0	2	0	0	1	0	1	0	✓	0	
	2	**2**	1	0	0	2	0	0	1	1					
Site 10 – Wollombi Road between sewage works and creek															
Casuarina glauca	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Fraxinus excelsior	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	
Grevillea robusta	**0**	**0**	mixed	0	0	0	0	0	0	0	0	3	✓	✓	Lopped on fence side
Pinus radiata	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	
Populus nigra var. *italica*	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	
Site 11 – Hill top on Wollombi Road west of Owl Pen Lane, Farley															
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	2	-	✓	0	
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth
	1	**2**	1	0	0	1	0	0	1	2					
Eucalyptus paniculata	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth
	0	**2**	1	0	0	0	0	0	2	0					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Hakea gibbosa	**0**	**0**	1	0	0	0	0	0	0	0	0	-	0	✓	
Site 12 – Western end of Quarry Road, Farley															
Corymbia maculata	**0**	**0**	0	0	0	0	0	0	0	0	1	1	0	0	Summer bark shedding
	2	**2**	1	0	2	0	0	0	0	2					
Eucalyptus paniculata	**0**	**1**	0	0	0	0	0	0	1	0	0	0	0	✓	
	0	**2**	1	0	0	0	0	0	2	0					
Pinus radiata	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	

- *Indicates no visual assessment was undertaken.*

Table B1.3 Summary Condition Assessment of Selected Monitoring Sites Located in Rutherford Industrial Area

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 13 – NCIA entrance, Racecourse Road															
Corymbia maculata	**2**	**2**	0	0	0	2	0	0	2	1	1	2	✓	0	Heavy mistletoe infestation
	2	**2**	1	2	1	2	0	0	1	2					
Eucalyptus amplifolia	**0**	**3**	0	0	0	0	0	0	3	1	1	2	✓	0	Heavy mistletoe infestation
	1	**1**	1	0	0	1	0	0	1	1					
Site 14 – 100-104 Kyle Street															
Angophora floribunda	**1**	**3**	0	0	1	0	0	0	0	3	0	5	✓	0	Mistletoe infestation. Tree recovering well from lopping
	2	**2**	1	2	2	1	0	0	0	0					
Eucalyptus amplifolia	**0**	**1**	0	0	0	0	0	0	1	1	0	0	✓	0	Mistletoe infestation
	4	**4**	1	0	4	1	0	0	1	2					
Site 15 – 11 Gardiner Road															
Corymbia maculata	**2**	**5**	0	0	2	0	0	0	0	5	0	0	0	0	Buds and flowers present
	3	**3**	1	3	3	3	0	0	0	2					
Eucalyptus fibrosa	**0**	**3**	0	0	0	0	0	0	1	3	0	0	✓	✓	New to this survey
	3	**3**	1	0	0	3	0	0	0	1					
Eucalyptus paniculata	**2**	**2**	0	2	0	0	0	0	1	0	0	0	✓	0	
	3	**3**	1	3	0	0	0	0	2	0					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 16 – 56 Gardiner Road															
Corymbia maculata	**1**	**1**	0	0	0	1	0	0	1	0	0	0	0	0	Mistletoe infestation
	3	**3**	1	3	2	3	0	0	1	3					
Site 17 – Gardiner Road, southern end															
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	2	-	0	0	New to this survey
Corymbia maculata 1	**0**	**1**	0	0	0	0	0	0	1	0	0	0	0	0	On road verge
	4	**4**	1	4	4	2	3	0	0	0					
Corymbia maculata 2	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	Deeper in bush, 'sheltered' by surrounding vegetation. New to this survey
	1	**2**	1	1	1	0	0	0	1	2					
Eucalyptus fibrosa	**1**	**1**	0	0	0	0	0	0	1	1	0	0	✓	0	Dieback of lower branches only, not affecting canopy. Previously misidentified as *Eucalyptus paniculata*
	1	**1**	1	1	0	0	0	0	1	1					
Eucalyptus punctata	**0**	**1**	0	0	0	0	0	0	1	0	3	0	✓	✓	
	3	**1**	1	1	0	3	0	1	1	1					
Site 18 – Maitland Saleyards, Kyle Street															
Corymbia maculata	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	
	2	**2**	1	2	1	2	1	0	1	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Eucalyptus amplifolia	**-**	**-**	0	-	-	-	-	-	-	-	1	0	✓	✓	New growth too recent to be assessed
	1	**2**	1	0	0	1	0	0	2	2					
Eucalyptus moluccana	**0**	**3**	0	0	0	0	0	0	3	0	0	0	0	0	New growth recent
	1	**2**	1	0	0	0	0	0	2	1					
Eucalyptus resinifera	**0**	**1**	0	0	0	0	0	0	1	0	1	1	0	✓	New growth very recent
	0	**1**	1	0	0	0	0	0	1	1					

- Indicates no visual assessment was undertaken.

Table B1.4 Summary Condition Assessment of Selected Tree Species at Anambah Homestead (reference site)

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 19 – 200 Anambah Road, reference site															
Angophora costata	**0**	**0**	mixed	0	0	0	0	0	0	0	2	2	0	0	Binocular assessment
Araucaria cunninghamii	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Brachychiton acerifolius	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	0	
Casuarina torulosa	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	
Corymbia citriodora	**0**	**2**	1	0	0	0	0	0	2	1	0	0	0	0	
Corymbia maculata	**3**	**3**	1	0	3	1	0	0	1	1	0	0	0	0	
Eucalyptus acmenoides	**0**	**2**	1	0	0	0	0	0	2	2	0	0	0	✓	Binocular assessment
Eucalyptus dives	**1**	**1**	1	0	1	0	0	0	1	1	0	0	0	✓	
Eucalyptus grandis	**0**	**3**	1	0	0	0	0	0	3	2	0	0	0	0	
Eucalyptus robusta	**1**	**1**	1	0	0	1	0	0	1	1	0	0	0	0	
Eucalyptus tereticornis	**1**	**2**	1	0	0	1	0	0	1	2	0	0	0	0	
Ficus macrophylla	**0**	**0**	mixed	0	0	0	0	0	0	0	0	0	0	✓	
Grevillea robusta	**0**	**0**	mixed	0	0	0	0	0	0	0	2	0	0	0	Dieback of lower branches
Lophostemum confertus	**2**	**2**	mixed	0	2	0	0	0	1	0	0	0	✓	0	Natural leaf cupping
Macadamia integrifolia	**2**	**2**	mixed	0	2	0	0	0	0	0	0	0	0	✓	Natural leaf cupping
Olea europea	**1**	**1**	mixed	0	1	0	0	0	0	0	0	0	0	✓	Natural leaf cupping
Vitis vinifera – upper block	**0**	**0**	mixed	0	0	0	0	0	0	0	0	-	0	✓	
Vitis vinifera – lower block	**0**	**0**	mixed	0	0	0	0	0	0	0	0	-	0	✓	

- *Indicates no visual assessment was undertaken.*

Table B1.5 Annual Comparison of Visible Injury Expression in one-year-old Foliage from Selected Tree Species in the Rutherford Area

Species	Date	Emissions injury	Total injury	Leaf age yrs	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction - buds	Reproduction - fruit
Site 5: NCIA air monitoring station															
Eucalyptus moluccana (previously misidentified as *Eucalyptus amplifolia*)	2007	2	2	0	2	0	0	0	0	2	0	0	0	✓	✓
	2008	0	5	1	0	0	0	0	3	4	2	0	0	0	0
	2009	0	4	1	0	0	0	0	3	4	2	0	0	0	0
	2010	2	3	1	0	0	2	0	3	3	0	0	0	0	0
	2011	2	2	1	2	1	0	0	1	1	2	1	0	0	0
	2012	1	2	1	0	0	0	0	0	2	2	1	1	0	0
	2013	**3**	**3**	**1**	**3**	**2**	**0**	**0**	**0**	**2**	**2**	**1**	**1**	**0**	**0**
Site 7: Gillette Close															
Corymbia maculata	2003	0	2	1	0	0	0	0	0	2	0	0	0	0	0
	2004	0	1	1	0	0	0	0	0	1	0	0	0	0	0
	2005	0	3	1	0	0	0	0	0	3	2	0	0	0	0
	2006	0	3	1	0	0	0	0	2	3	0	0	0	0	0
	2007	0	2	1	0	0	2	0	2	2	0	0	0	0	✓
	2008	3	3	0	3	0	0	0	0	2	3	0	0	0	0
	2009	3	3	1	3	0	2	1	3	3	3	0	2	0	0
	2010	3	3	1	3	0	2	1	3	3	3	0	2	0	0
	2011	2	3	1	2	2	1	1	0	3	2	1	0	✓	0
	2012	2	2	1	1	1	2	2	0	1	0	2	1	0	0
	2013	**3**	**3**	**1**	**2**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**✓**	**0**
Site 15: 11 Gardiner Road															
Corymbia maculata	2003	0	2	1	0	0	0	0	0	2	2	0	0	0	0
	2004	0	2	1	1	0	1	0	0	2	1	0	0	0	✓
	2005	0	3	1	0	0	0	0	0	3	2	0	0	0	0
	2006	0	3	1	0	0	2	0	3	3	0	0	0	0	✓
	2007	2	3	1	2	0	2	0	3	3	0	0	0	0	0
	2008	2	4	1	4	0	3	2	3	3	3	0	2	0	✓
	2009	3	3	1	3	2	3	0	2	3	2	0	0	0	0
	2010	3	3	1	3	2	3	0	0	3	1	0	0	0	✓
	2011	1	1	1	1	1	1	1	0	1	1	0	0	0	0
	2012	3	3	1	2	1	3	1	0	0	2	1	0	✓	0
	2013	**3**	**3**	**1**	**3**	**3**	**3**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**

Appendix C

Meteorological Monitoring - Wind Roses

Appendix C Meteorological Monitoring - Wind Roses

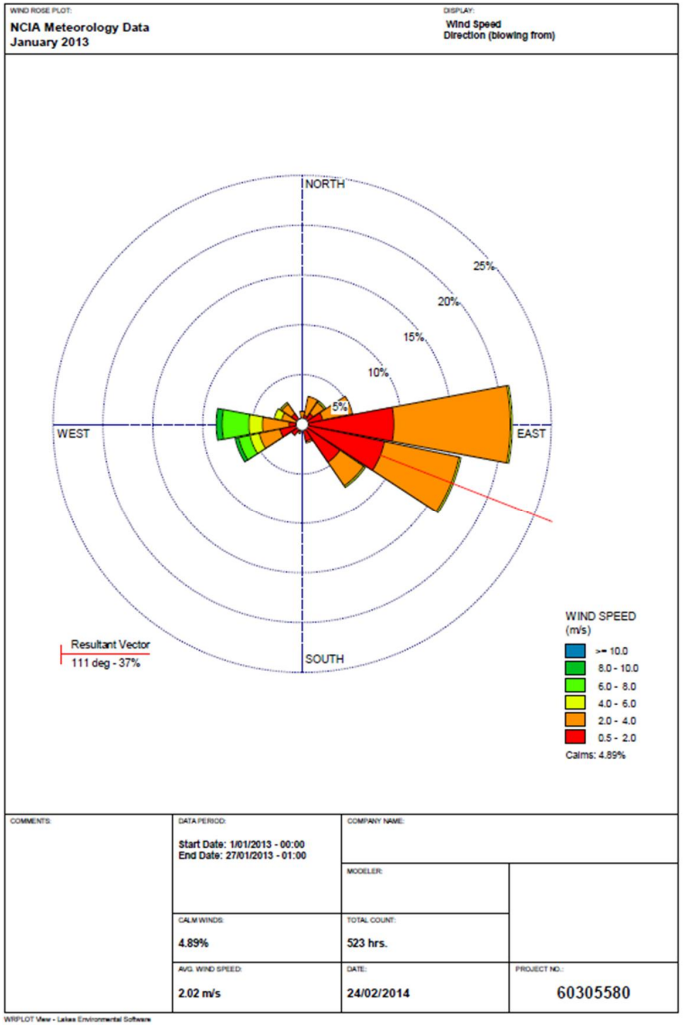


Figure C1.1 **Wind Speed and Direction (January 2013)**

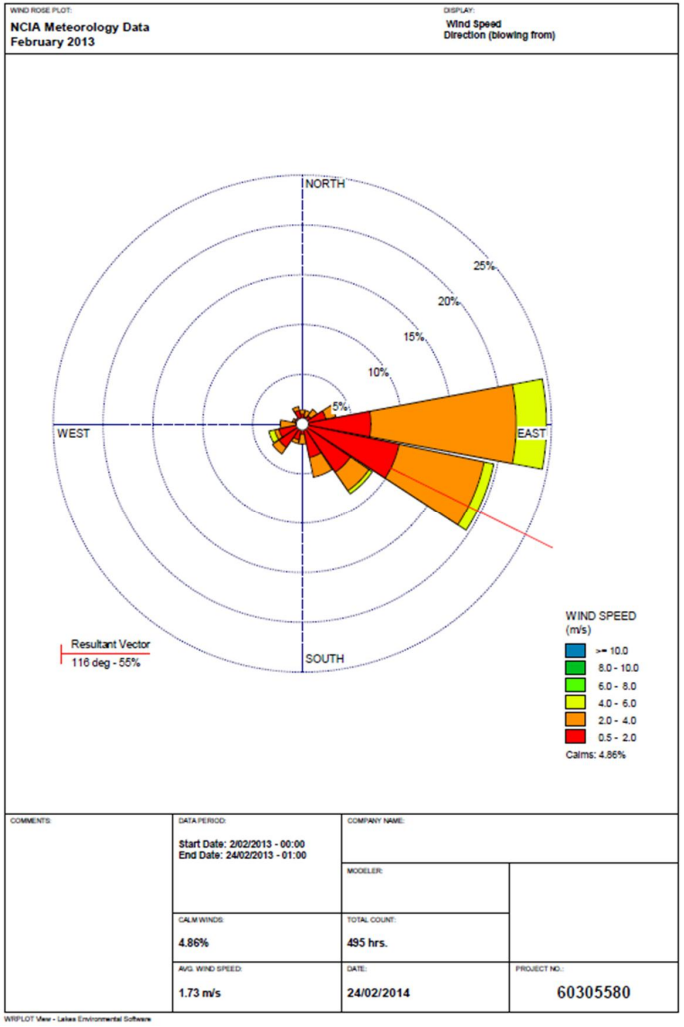


Figure C1.2 **Wind Speed and Direction (February 2013)**

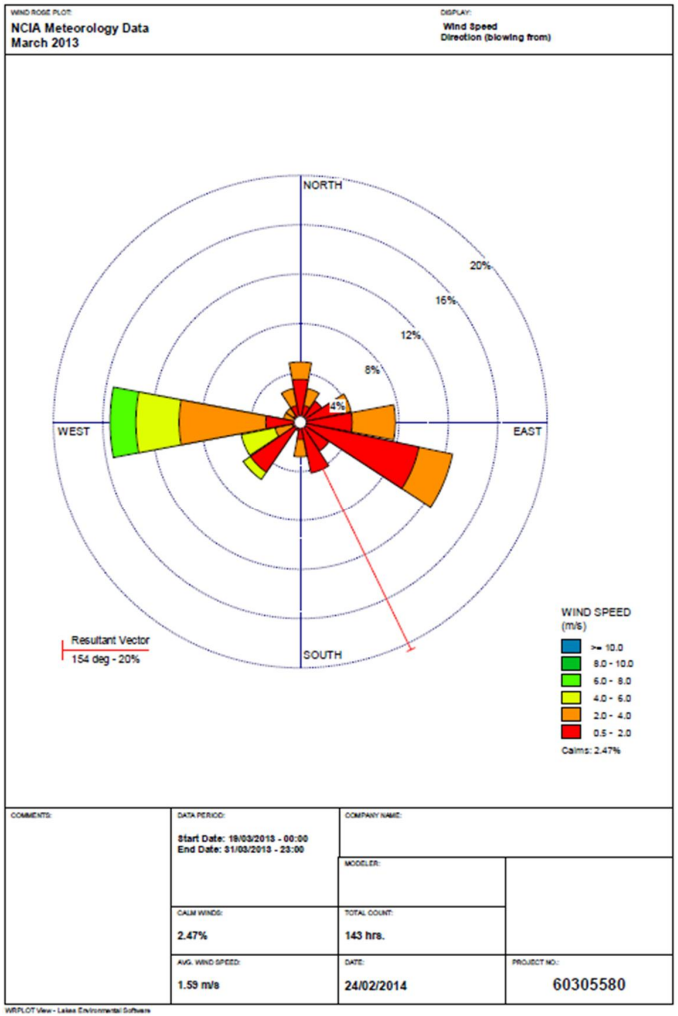


Figure C1.3 **Wind Speed and Direction (March 2013)**

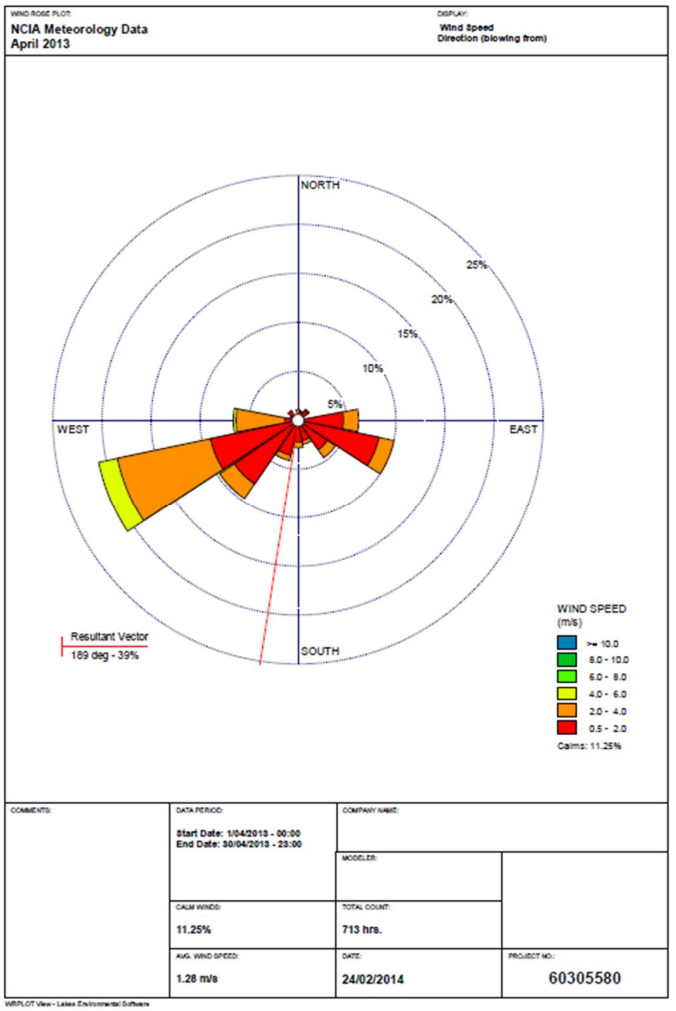


Figure C1.4 **Wind Speed and Direction (April 2013)**

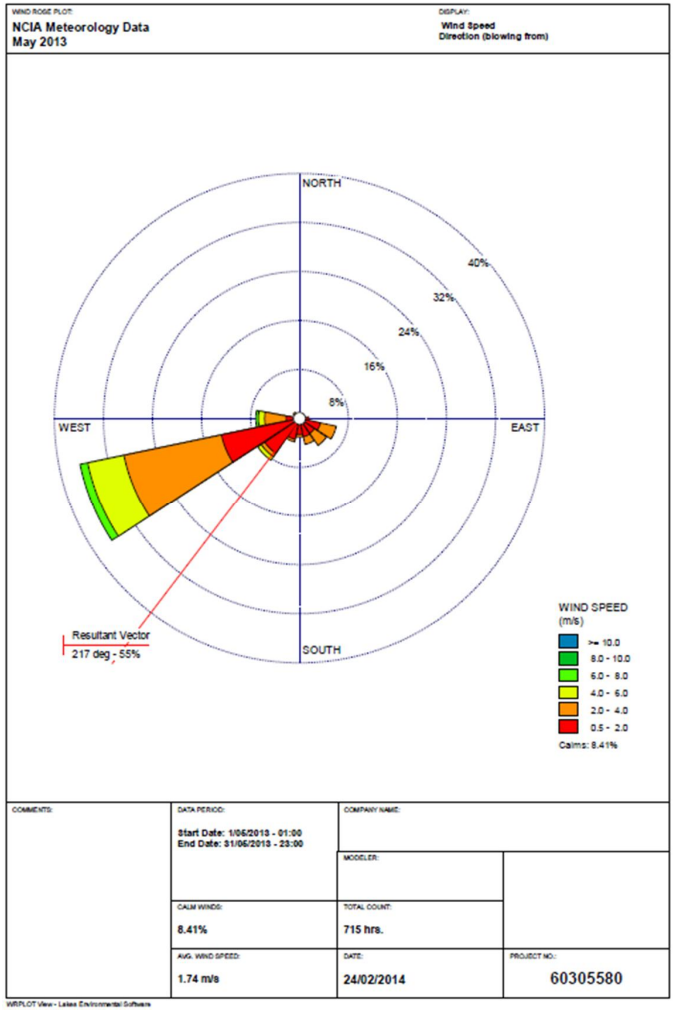


Figure C1.5 **Wind Speed and Direction (May 2013)**

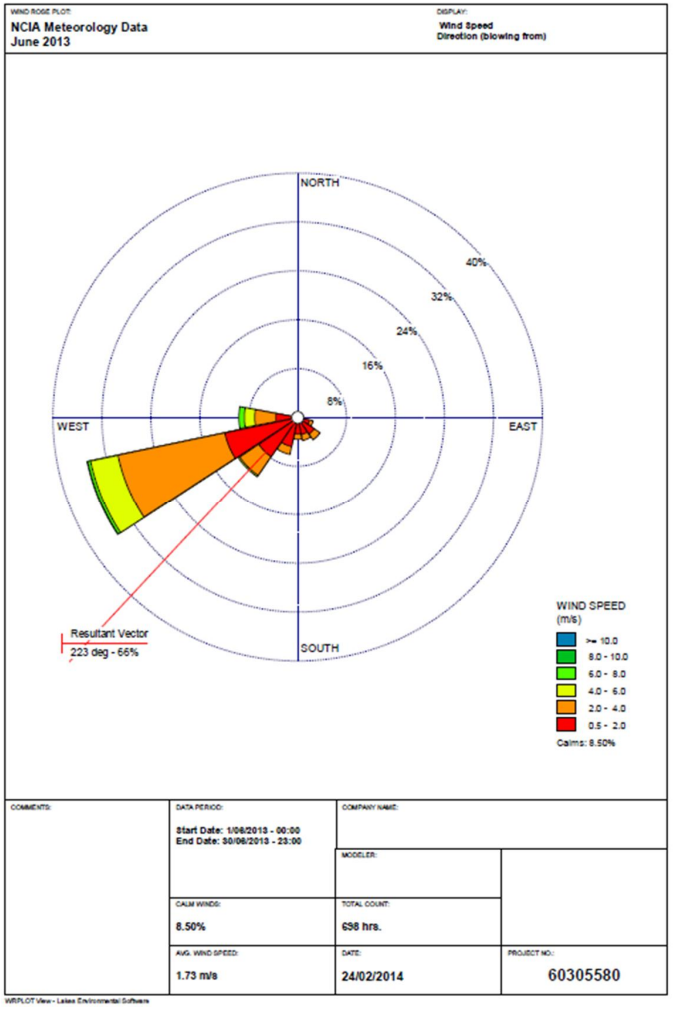


Figure C1.6 **Wind Speed and Direction (June 2013)**

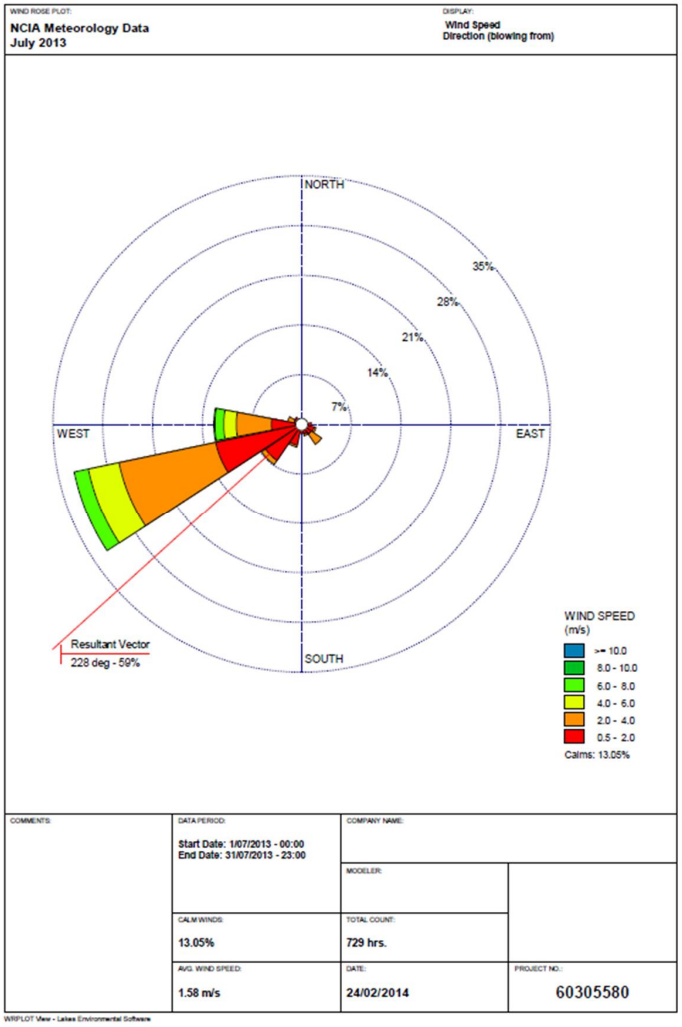


Figure C1.7 **Wind Speed and Direction (July 2013)**

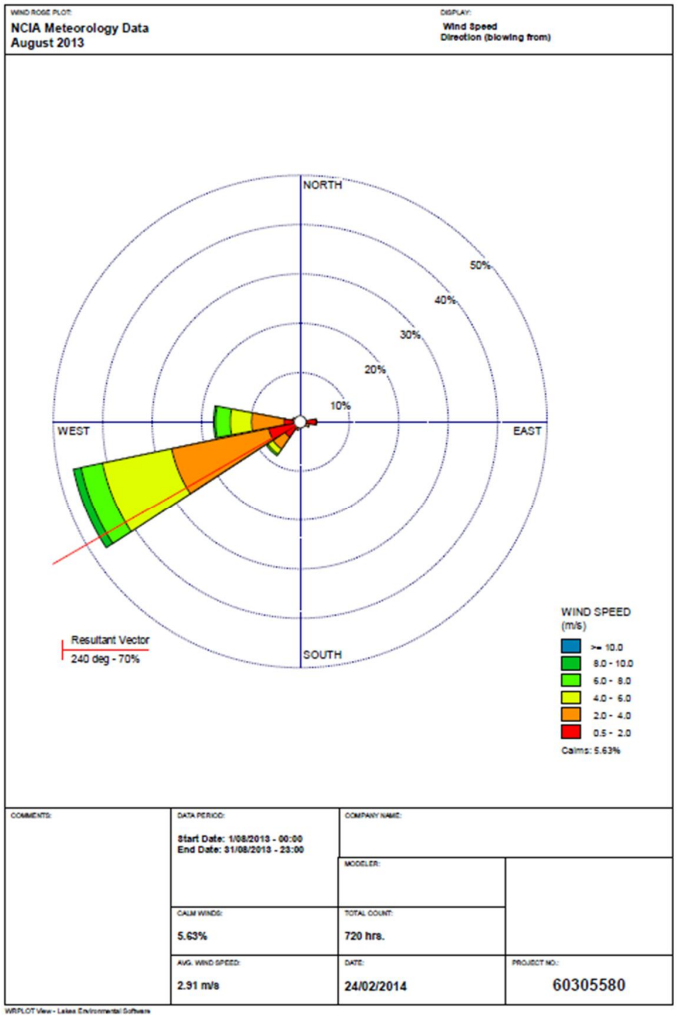


Figure C1.8 **Wind Speed and Direction (August 2013)**

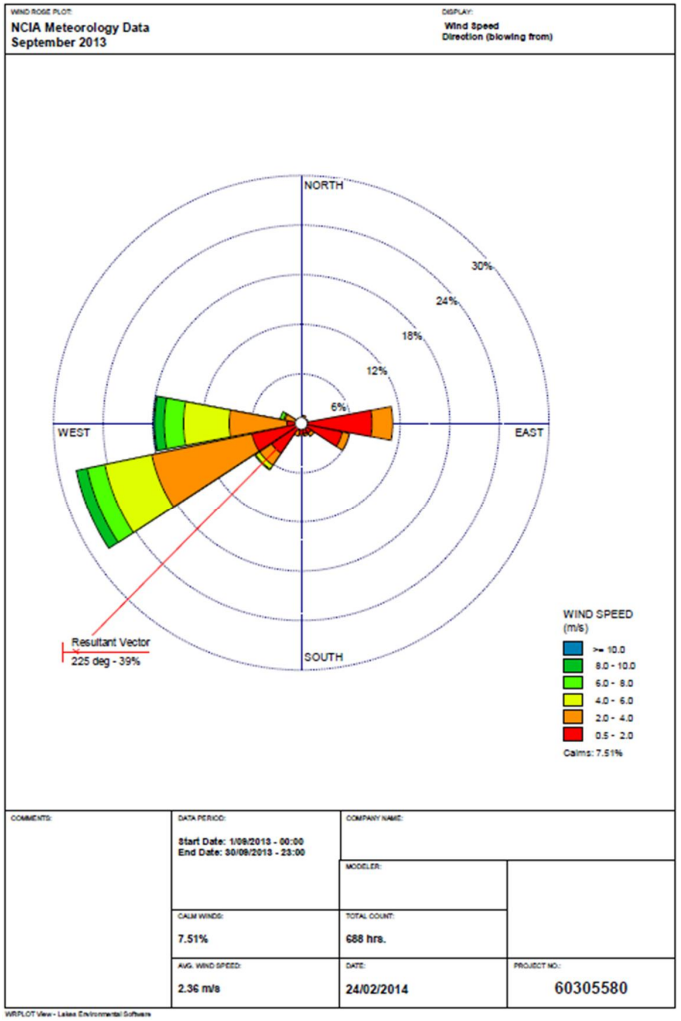


Figure C1.9 **Wind Speed and Direction (September 2013)**

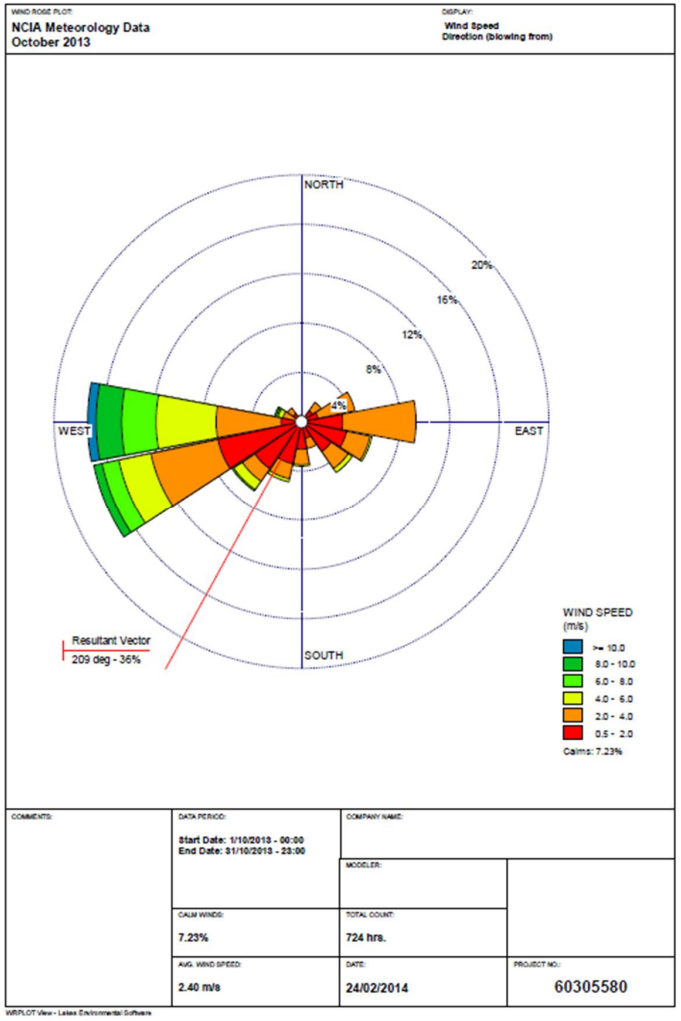


Figure C1.10 **Wind Speed and Direction (October 2013)**

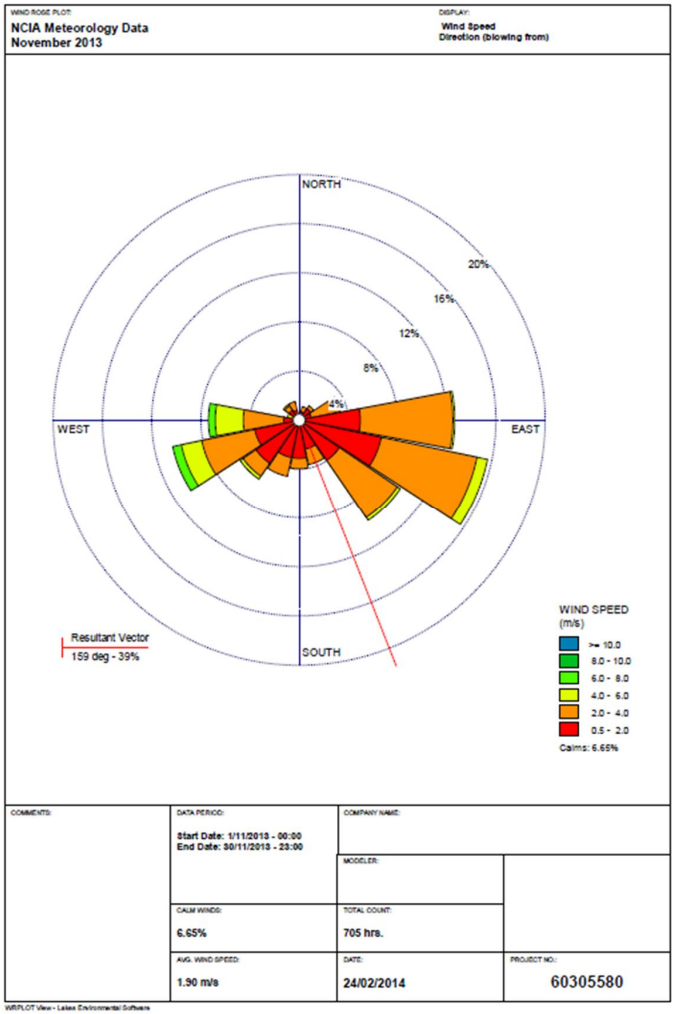


Figure C1.11 **Wind Speed and Direction (November 2013)**

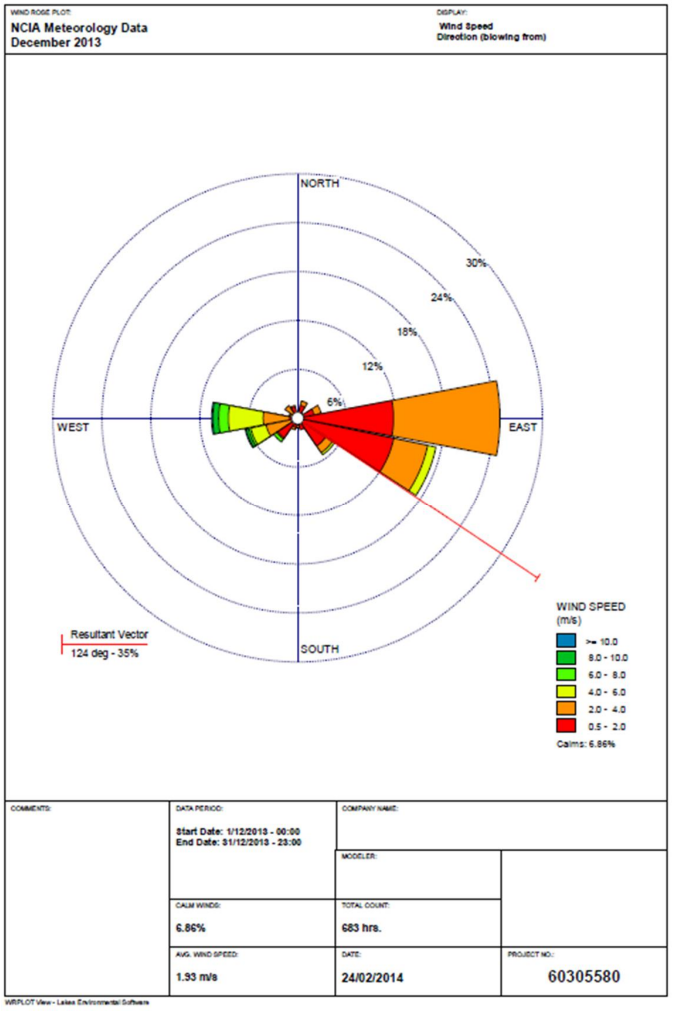


Figure C1.12 **Wind Speed and Direction (December 2013)**

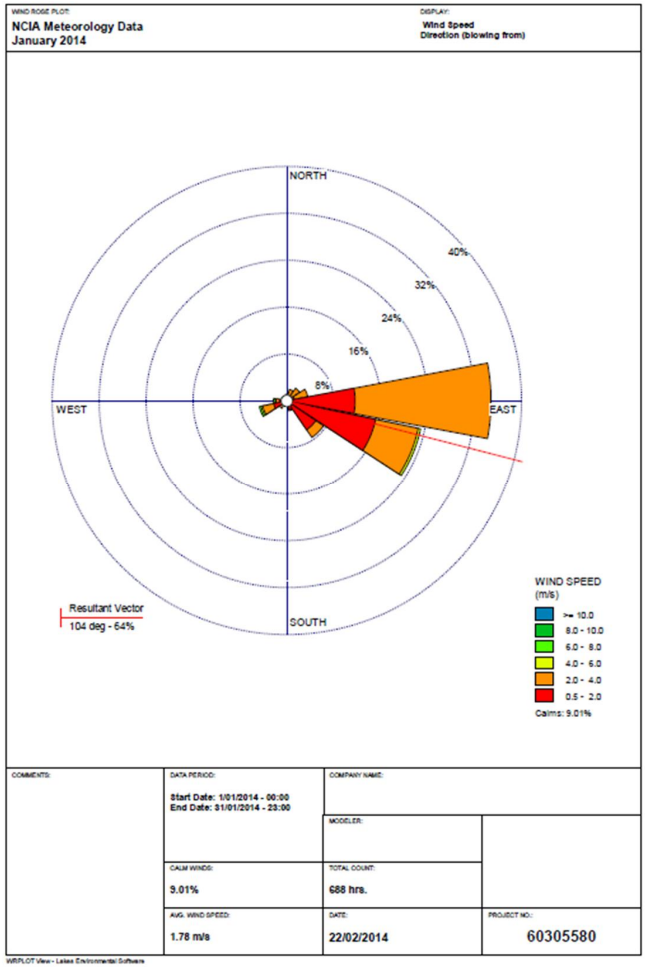


Figure C1.13 Wind Speed and Direction (January 2014)