AECOM Imagine it Delivered

National Ceramic Industries Australia
27-Oct-2017

2017 Annual Environmental Management Report

1 August 2016 - 31 July 2017

2017 Annual Environmental Management Report

1 August 2016 - 31 July 2017

Client: National Ceramic Industries Australia

ABN: 83100467267

Prepared by

AECOM Australia Pty Ltd
17 Warabrook Boulevard, Warabrook NSW 2304, PO Box 73, Hunter Region MC NSW 2310, Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

27-Oct-2017

Job No.: 60551495

AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

Quality Information

Document 2017 Annual Environmental Management Report

Ref 60551495

Date 27-Oct-2017

Prepared by Alison O'Neill & Matt Catteau

Reviewed by James McIntyre

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	27-Oct-2017	Final	James McIntyre Associate Director Environment - IAP Team Leader	

This page has been left blank intentionally.

Table of Contents

1.0 Introduction

National Ceramic Industries Australia Pty Ltd (NCIA) operates a tile manufacturing facility located in Rutherford, New South Wales. This Annual Environmental Management Report (AEMR) describes and discusses NCIA's environmental performance for the period between 1 August 2016 and 31 July 2017 (hereafter referred to as the '2017 reporting period').

1.1 NCIA Background

1.1.1 Current Operations

NCIA manufactures ceramic wall and floor tiles for the Australian market from its facility located off Racecourse Road, Rutherford, within the Rutherford Industrial Estate, NSW. The facility has been operating since its commissioning in 2004. Prior to the development of the facility at Rutherford, the majority of Australia's domestic ceramic tile consumption was imported from China, South East Asia, Italy, Spain and Brazil.

Tiles are manufactured from raw materials including a mixture of clay, white granite, rhyolite and glazes. Clay, granite and rhyolite are naturally occurring and are supplied by quarries within Australia, whilst glazes and other consumables are either supplied locally or imported. The tile manufacturing process involves mixing and preparing raw materials in specified proportions, pressing the prepared mix into the desired shape, and then drying prior to decorating and glazing. The tiles are then fired in the facility's kilns prior to sorting, packaging and dispatch. Finished tiles are stored and loaded for distribution outside of the building in the south western corner of the site. All transport to and from the site is via road, with semi-trailers and B-double trucks transporting the raw materials and finished product.

The operation currently comprises one spray drier, a clay mill, two tile production lines and two kilns, all housed within a single factory building approximately 488 m long and 80 m wide. The current operations represent the first two of eight approved stages of the facility. With these two operational stages active, the maximum production of the facility is approximately 6.4 million m^2 of ceramic tiles per annum. The facility operates 24 hours per day, 7 days per week, and currently employs 52 full time staff.

1.1.2 Future Planned Operations

NCIA currently holds approval for the development of Stages Three–Eight of the facility, none of which are yet constructed or commissioned. Stages Three–Four would see the commissioning of an additional two production lines within the existing factory building for an increased production of up to 12.8 million m^2 of tiles per annum. Stages Five–Eight would involve the construction and operation of a second factory building with four additional production lines on the adjacent parcel of land to the east of the existing facility. Once all eight development stages are operational, the facility's production capacity would increase to 25.6 million m^2 of tiles per annum.

The approval for the facility's expansion was sought by NCIA in response to the anticipated continuing increase in tile demand, both domestically and internationally. The timeline for construction of the remaining stages (i.e. Stages Three–Eight) is dependent upon market demand and remains uncertain at the time this AEMR has been prepared.

1.1.3 Historic and Current Production Volume

Tile production volume since commissioning and inclusive of the 2017 reporting period is presented in Figure 1. Production volume is reported (and presented here) annually in accordance with the Environmental Protection Licence (EPL) annual reporting period, that is 1 August to 31 July each year.

NCIA's Project Approval (MP 09_0006) provides a staged approach to production limit in m^2 per annum, while NCIA's EPL No. 11956 provides for production in tonnes per annum.

Between 1 August 2016 and 31 July 2017 the facility operated 330 days, for a total output of 80,630 tonnes of ceramic tiles (or approximately 5.09 million m^2). These production levels are below the maximum production authorised under NCIA's current approvals (refer to Section 1.2) and are commensurate to the current stage of development of the facility (i.e. Stage Two).

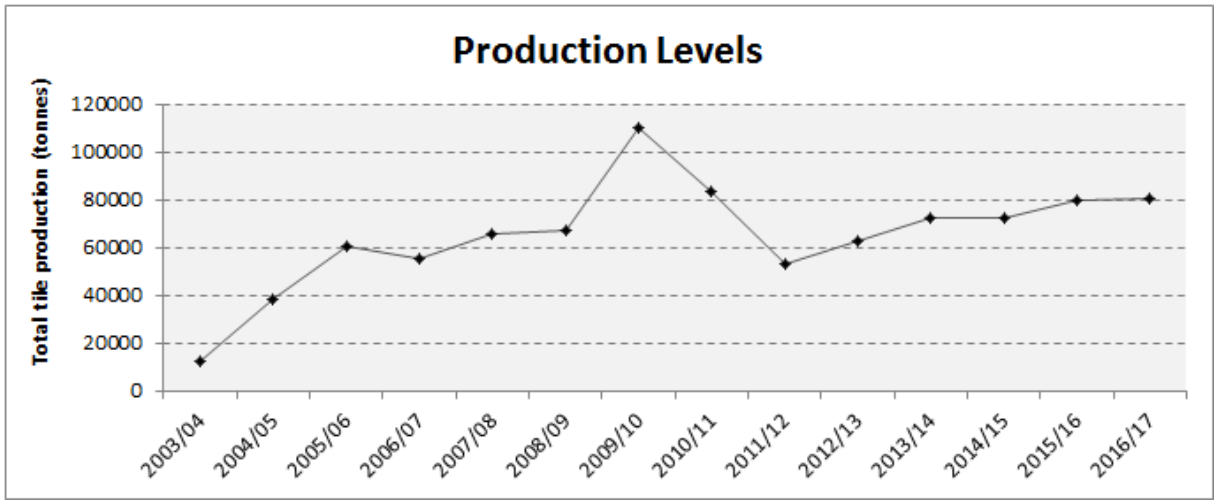

Figure 1 Production volume since 2004

1.2 Regulatory Context

1.2.1 Current Approvals

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 relinquished the previous Development Consent (DA 449-12-2002-i) with effect from 19 January 2013.

The NCIA facility is therefore currently operating in accordance with the conditions of Project Approval (MP 09_0006), issued by the Department of Planning and Environment (DP&E).

The facility also operates in accordance with EPL No. 11956 issued by the NSW Environment Protection Authority (EPA), which authorises NCIA to produce 50,000 - 200,000 tonnes of ceramic tiles per annum.

It is noted that many of the requirements of the Project Approval are required prior to commencement of construction of the next stage of the approved operation (i.e. Stages Three–Eight). As commencement of construction of the next stage of the approved operation has not yet commenced, these conditions have not yet been activated.

Notably, 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 current Project Approval does not require an OEMP, but instead requires the preparation of an Environmental Management Strategy (EMS) prior to commencement of construction works associated with development Stages Three–Eight. As this condition is not yet activated, NCIA continues to operate in accordance with the OEMP.

1.2.2 AEMR Requirement

This AEMR has been prepared 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 EPL No. 11956. The AEMR is distributed to DP&E.

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.

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[1], 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 team 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;	See comment 1 below
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
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 8.0

Note on timeline

NCIA sought DP&E's approval (during a meeting with Leah Cook of DP&E held on 15 July 2015) to amend the AEMR reporting timeframes to align it with that of the EPL. The request was granted by DP&E on 17 July 2015. Therefore this AEMR and all subsequent AEMRs will cover the same reporting periods as the EPL, and report on NCIA's environmental performance between 1 August and 31 July each year.

[1] This condition is now superseded by DP&E's approval to amend the AEMR reporting period so that it is aligned with that of the EPL reporting timeline. The AEMR now covers the period between 1 August and 31 July.

This page has been left blank intentionally.

2.0 Standards and Performance Measures

The NCIA OEMP provides the environmental management framework to guide the operation of the 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:

- Project Approval (MP 09_0006), granted by the Minister for Planning;
- EPL 11956, issued by the NSW 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 current reporting period are presented in Section 4.0 of this AEMR.

This page has been left blank intentionally.

3.0 Complaints

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

The history of complaints received by NCIA is presented in Table 2. For the fourth consecutive reporting period, no complaints were received. Overall, the history of complaints shows that very few community complaints are received in relation to NCIA operations.

Table 2 Historical complaints received by NCIA

Year	Number of Complaints	Issue	Details
2017	Nil	Nil	None Required.
2016	Nil	Nil	None Required.
2015 (partial)	Nil	Nil	None Required.
2014	Nil	Nil	None required.
2013	1	Air Quality	Complaint made via email on 24 July 2013 regarding air quality in Rutherford area.
2012-13	1	1	Complaint made from neighbouring Heritage Green Residential Estate regarding storage of waste tiles causing visual nuisance. It is noted that this was previously considered to be a legal issue and therefore not previously recorded as a complaint.
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.

This page has been left blank intentionally.

4.0 Environmental Monitoring Results

The following environmental parameters are monitored 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; and
  - Fine particulates (PM_{10}).
- Additionally, for the kiln stacks:
  - 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 monitoring:
  - L_{Aeq}(15 minute); and
  - L_{A1}(1 minute).

In addition to the above-listed parameters, NCIA also keeps internal records of water usage and waste production. Water quality monitoring is also undertaken of the stormwater contained in the water retention basins.

A summary of the monitoring results for these parameters during the current reporting period 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 One operations. The program was designed and implemented in accordance with the requirements of NCIA's EPL. The monitoring program also satisfies the requirements of the 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 2).

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 3580.9.6:2015 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'.

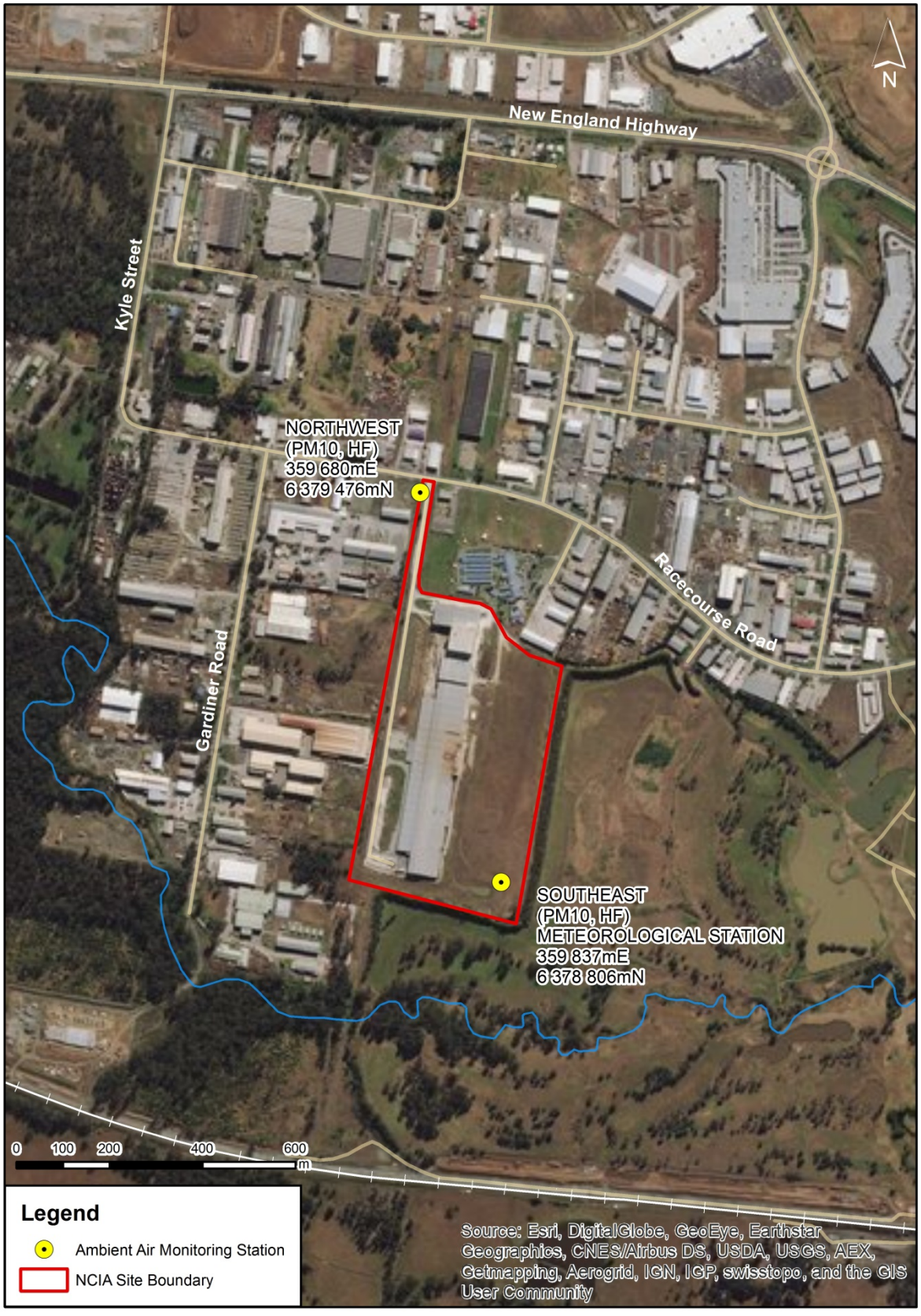

Figure 2 Ambient air monitoring locations

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}.

A summary of PM_{10} monitoring results from both monitoring locations for the current reporting period is provided in Table 3, alongside the relevant criteria. The PM_{10} results for the NW and SE locations are also graphed in Figure 3 and Figure 4 respectively.

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

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	30.0	27.2	17.6
Standard Deviation (µg/m^3)	-	13.6	8.9
24-hour Minimum Concentration (µg/m^3)	-	3.5	1.7
24-hour Maximum Concentration (µg/m^3)	50.0	**88.6**	48.7

*Note: **Bold** font indicates an exceedance of the criteria*

There were three exceedances of the 24-hour maximum concentration at the NW monitoring location:

- 13 December 2016 – PM_{10} concentration of 57.9 µg/m^3;
- 18 January 2017 – PM_{10} concentration of 88.6 µg/m^3; and
- 24 January 2017 – PM_{10} concentration of 52.3 µg/m^3.

Ambient and meteorological conditions on these days were reviewed. On 13 December 2016 there were high temperatures of up to 38 degrees with moderate south easterly winds. The NCIA facility was shut down for its annual maintenance period from 7am on 13 December 2016 and as such is not considered to be the source of the elevated PM_{10} results on this day.

On 18 and 24 January 2017 there were high temperatures of 42 and 40 degrees respectively, with strong north westerly wind gusting above 50km/h on both days. The SE monitoring station (upwind of the NCIA facility) recorded PM_{10} concentrations of 48.7 µg/m^3 and 37.7 µg/m^3 respectively, which indicates elevated background PM_{10} levels on these days. The EPA monitoring station at Beresfield (approximately 17km southeast of the NCIA facility) recorded 24 hour average PM_{10} concentrations of 38.5 µg/m^3 and 34.2 µg/m^3 respectively. The EPA monitoring station at Singleton (approximately 35km northeast of the NCIA facility) recorded 24 hour average PM_{10} concentrations of 52.0 µg/m^3 and 32.7 µg/m^3 respectively. These results demonstrate the elevated background PM_{10} levels within the region on these days. It is also noted that bushfires were burning in the Hunter region (e.g. Kurri Kurri) on both of these days. Given the meteorological conditions and elevated background levels on these days, the NCIA facility is not considered to be a major contributor to these exceedances.

Apart from these isolated exceedances, the remainder of PM_{10} monitoring results for the NW and SE monitoring locations during the reporting period were below the 24-hour and annual average guideline criteria.

Each of these elevated PM10 monitoring results were promptly notified to DP&E upon receipt of the validated laboratory results, in accordance with the reporting requirements specified in the Project Approval.

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

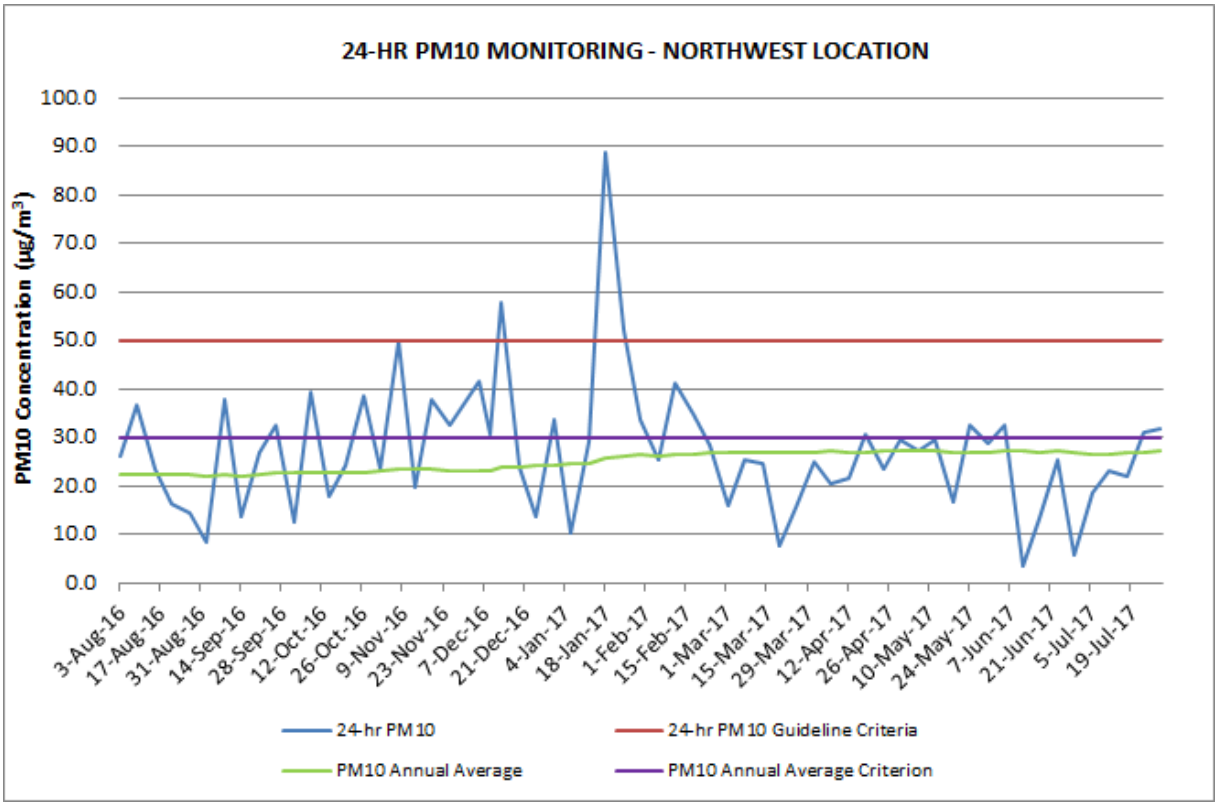

Figure 3 PM_{10} monitoring – northwest location

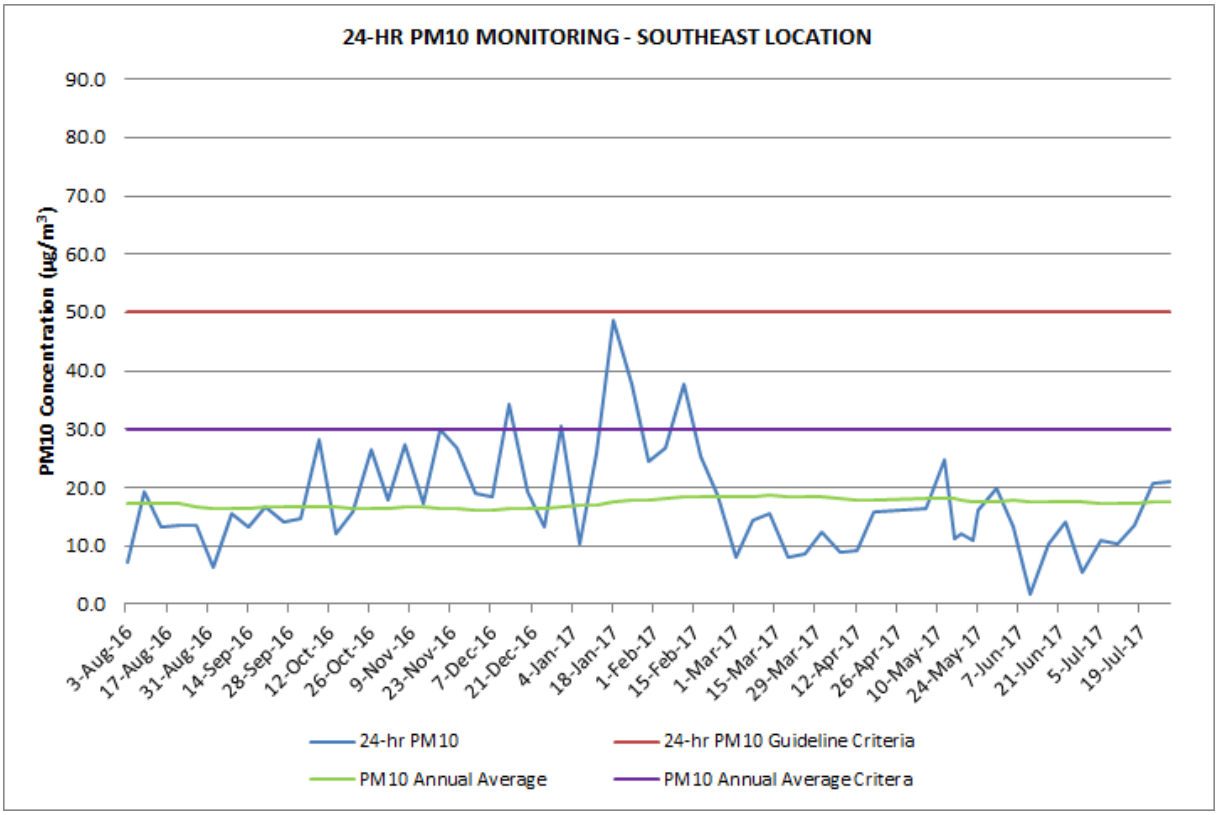

Figure 4 PM_{10} monitoring – southeast location

4.1.2 Fluoride – 24 Hour Monitoring Results

There is no ambient air fluoride concentration limit specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

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 5 and Figure 6 respectively.

Table 4 Summary of ambient air monitoring: 24-hour fluoride results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.27	0.29
Standard Deviation (µg/m^3)	-	0.29	0.31
24-hour Minimum Concentration (µg/m^3)	-	0.04	0.07
24-hour Maximum Concentration (µg/m^3)	2.9	1.36	2.18

The results in Table 4 indicate that for both the NW and SE monitoring locations the 24-hour total fluoride emissions satisfied the EPA (2016) guideline criterion for the entire reporting period.

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

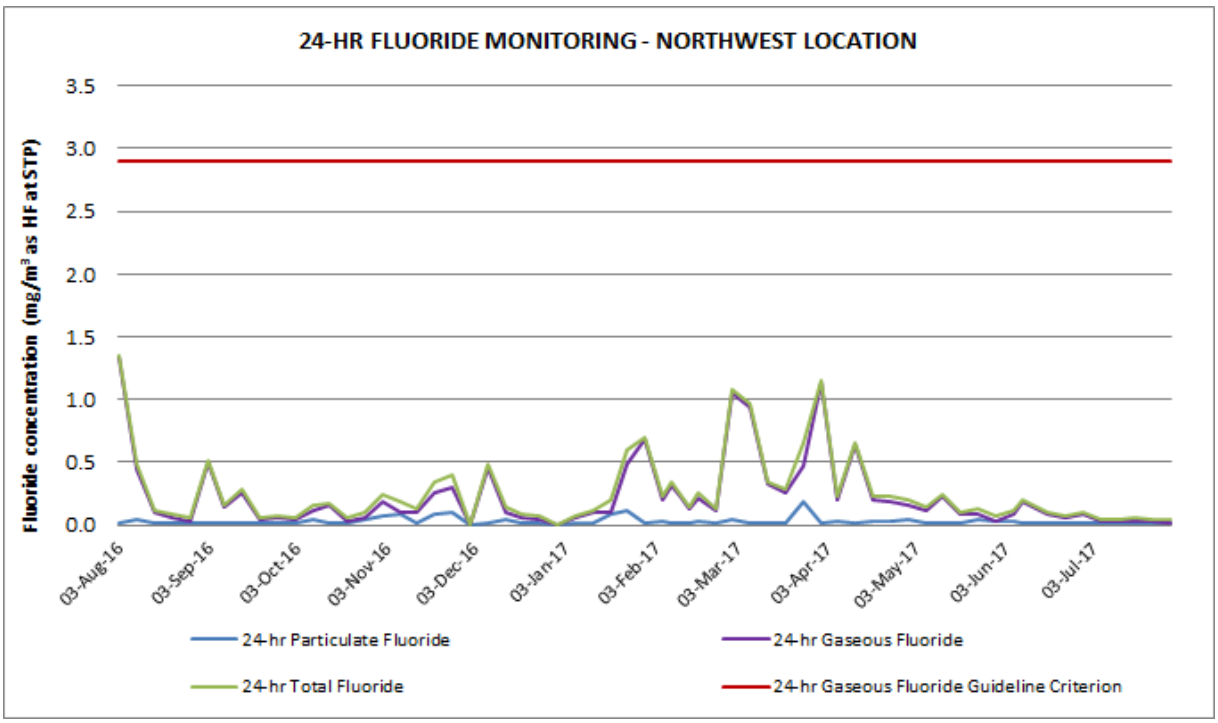

Figure 5 24-hour fluoride monitoring – northwest location

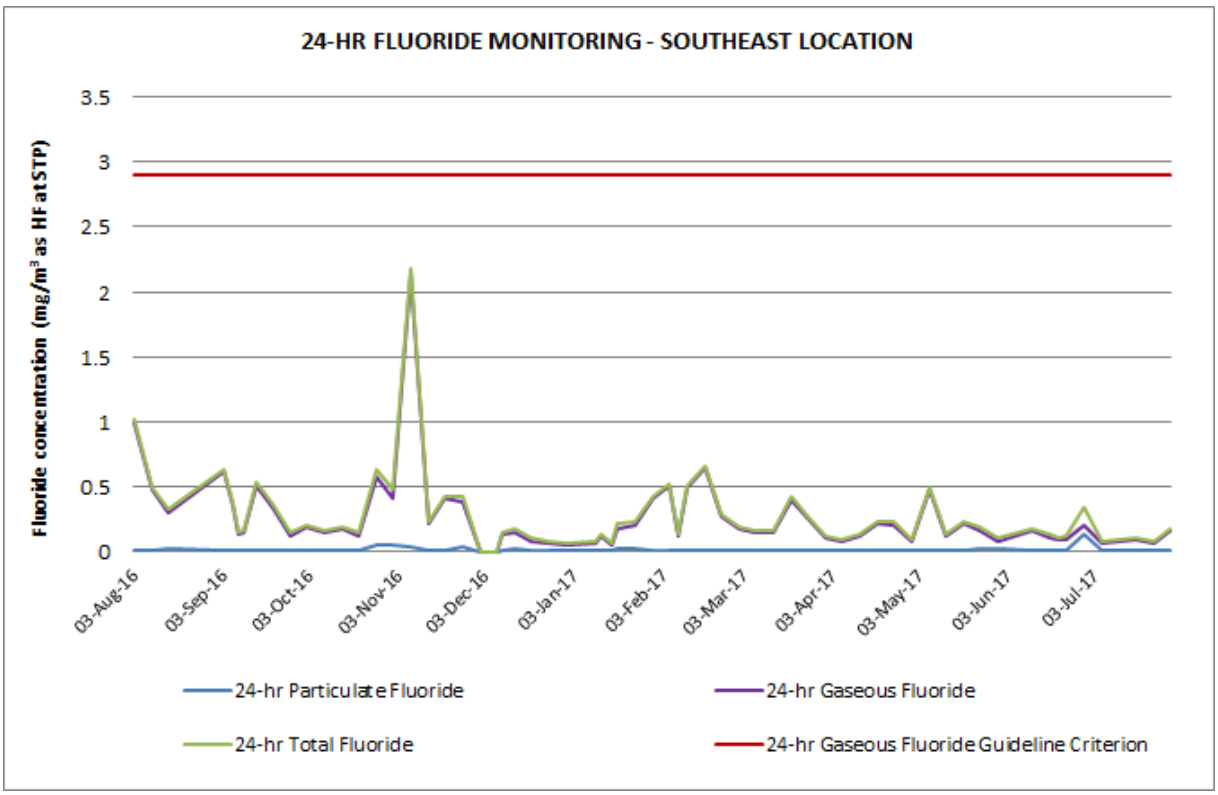

Figure 6 24 hour fluoride monitoring – southeast location

4.1.3 Fluoride – Weekly (7-Day) Monitoring Results

There is no ambient air fluoride concentration limit specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

A summary of weekly fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 5. The weekly Fluoride monitoring results for the NW and SE locations are also graphed in Figure 7 and Figure 8 respectively.

Table 5 Summary of ambient air monitoring: weekly fluoride results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.10	0.15
Standard Deviation (µg/m^3)	-	0.09	0.12
Weekly Minimum Concentration (µg/m^3)	-	0.002	0.04
Weekly Maximum Concentration (µg/m^3)	1.7	0.48	0.83

The results in Table 5 indicate that for both the NW and SE monitoring locations the weekly Fluoride levels satisfied the EPA (2016) guideline criterion for the entire reporting period.

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

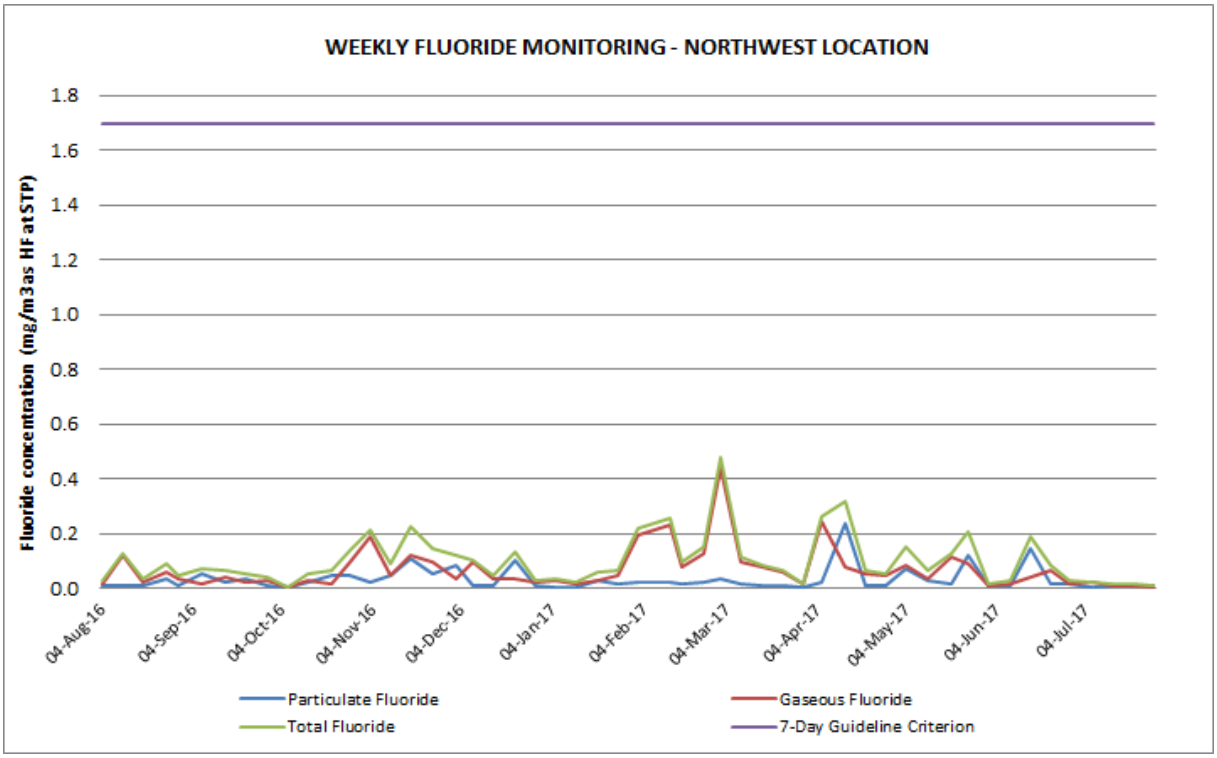

Figure 7 Weekly fluoride monitoring – northwest location

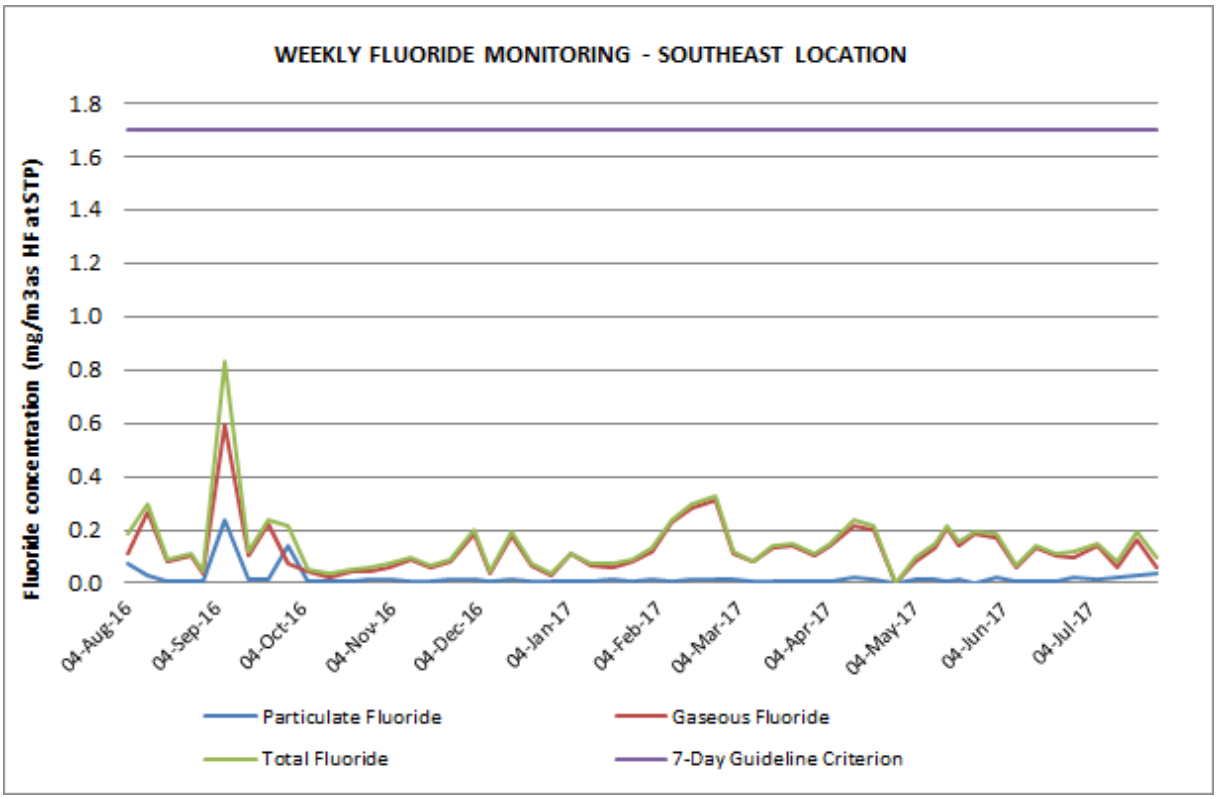

Figure 8 Weekly fluoride monitoring – southeast location

4.2 Fluoride Impact on Vegetation

Monitoring the impact of atmospheric fluoride on vegetation in the area surrounding the NCIA facility commenced in 2004. The monitoring program was designed by AECOM based on the assessment methods developed by Dr David Doley of the University of Queensland.

In accordance with condition M4.1 of the EPL, the impact of fluoride on vegetation was monitored by undertaking visual assessments of the condition of local vegetation surrounding the NCIA facility and by foliar sampling of selected flora species for laboratory analysis of fluoride content. Samples chosen for fluoride content analysis were selected on the basis of known species sensitivity toward fluoride, representation of certain species and vegetation type (over storey, cultivated vegetation and forage crops). Generally, the species assessed in the monitoring program were selected based on their known sensitivity to atmospheric fluoride impacts.

Quarterly vegetation assessments were conducted during the reporting period (Q3 September 2016, Q1 March 2017, and Q2 June 2017) as well as an Annual Vegetation Condition Assessment (Q4 December 2016). The results of these surveys are summarised below.

The sites monitored for vegetation condition assessments during the reporting period are shown in Figure 9. Details on the monitoring sites as well as a photograph of each monitoring site location (at the time of the annual Q4 2016 survey) are provided in Appendix A1. The monitoring locations included eighteen 'impact' sites (comprising eight sites monitored quarterly plus an additional ten sites monitored during the annual survey only) and one 'reference' site. All impact sites were selected to be generally within the areas of highest predicted ambient fluoride concentration – i.e. within the prevailing wind directions for the region (northwest-southeast axis), whilst the reference site location was selected to be outside the prevailing winds.

At each monitoring site and for each of the monitored flora species, the visible injury symptoms to leaves were classified in accordance with the scoring criteria and injury categories presented in Table 6.

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

Injury Symptom	Emission injury			Insect attack injury
	Chlorosis / Marginal necrosis	Tip necrosis	Cupping	Leaf chewing / sap sucking
Category	**% of leaf width / area**	**% of leaf length**	**Entire leaf or tree**	**% of leaf area**
0	nil	nil	nil	nil
1	very slight <2%	very slight <2%	very slight	very slight <2%
2	slight <5%	slight <5%	slight	slight <5%
3	distinct <10%	distinct <10%	distinct	distinct <10%
4	marked <25%	marked <25%	marked	marked <25%
5	severe <50%	severe <50%	severe	severe <50%
6	very severe <75%	very severe <75%	very severe	very severe <75%
7	extreme >75%	extreme >75%	extreme	extreme >75%

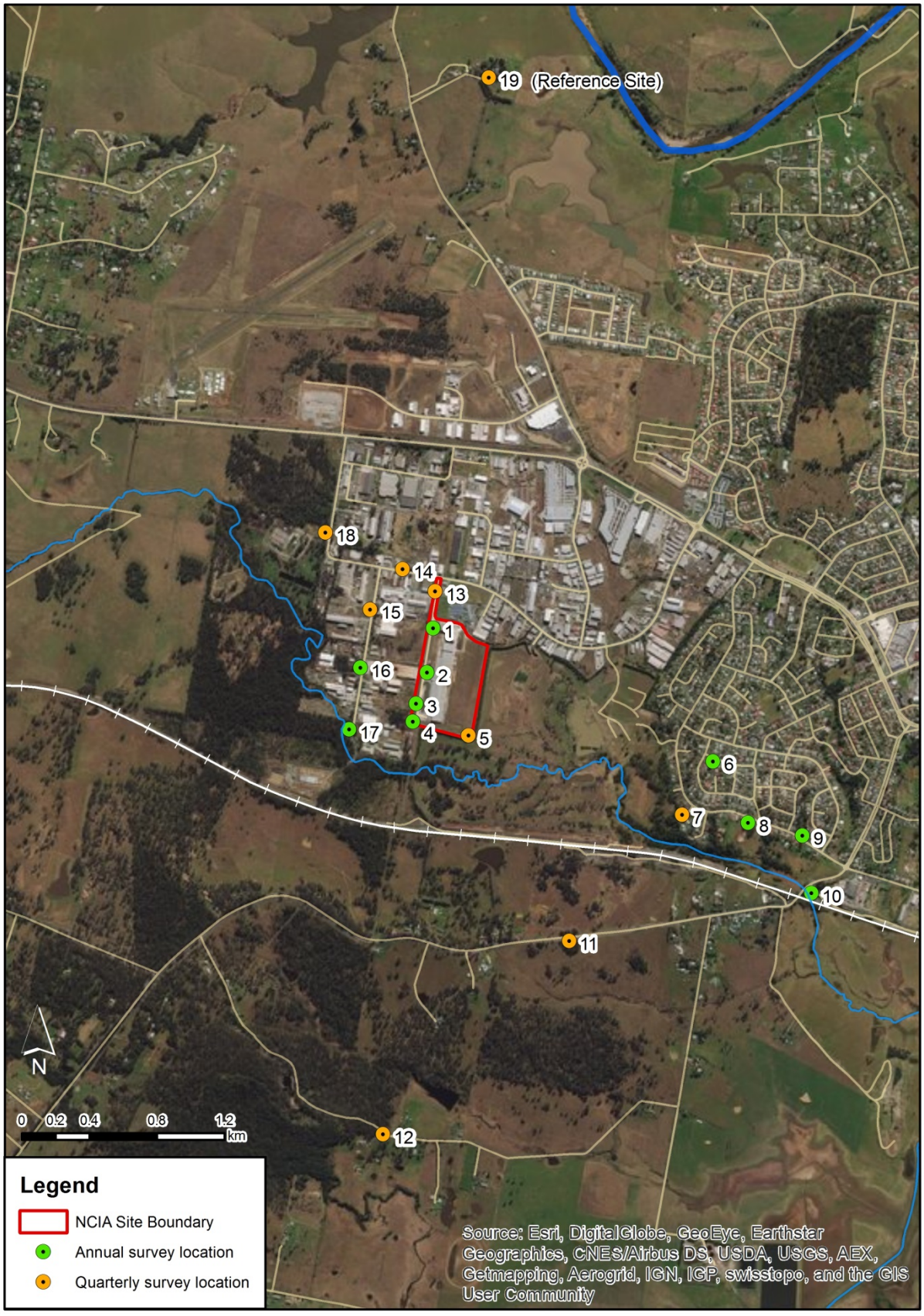

Figure 9 Vegetation survey monitoring location

4.2.1 Visual Condition Assessment Results – Impact Sites

The complete tabulated results of the visible injury assessments performed during the quarterly and annual surveys are provided in Appendix A2 and a selection of photographs of impacted foliage included in Appendix A3. The results have been summarised below and supported graphically in Figure 10 to Figure 12.

The visual assessments found that inclusive of all quarterly surveys during the reporting period, emission related injury symptoms (i.e. chlorosis, cupping, necrosis, anthocyanin accumulation) were present in the foliage of approximately 81% of all species assessed, whilst approximately 71% of all species assessed displayed some level of insect attack injury symptoms (refer to Table 7). The lower prevalence of emissions and insect attack injury symptoms recorded during the Q4 annual survey is largely due the inclusion in this survey of several species that are known to be less sensitive to injury symptoms (e.g. *acacia*, *casuarina*, *pinus*, and *hakea* spp.), whereas quarterly surveys only include sensitive eucalypt species.

Table 7 Proportion of surveyed species showing injury symptoms

	Emission related injury symptoms					Insect injury symptoms				
	Q3 2016	**Q4 2016**	**Q1 2017**	**Q2 2017**	**TOTAL**	**Q3 2016**	**Q4 2016**	**Q1 2017**	**Q2 2017**	**TOTAL**
No. species assessed	17 (100%)	68 (100%)	17 (100%)	17 (100%)	**119 (100%)**	17 (100%)	68 (100%)	17 (100%)	17 (100%)	**119 (100%)**
Injury symptoms present	16 (94%)	48 (71%)	16 (94%)	16 (94%)	**96 (81%)**	17 (100%)	36 (53%)	17 (100%)	15 (88%)	**85 (71%)**
Injury symptoms absent	1 (6%)	20 (29%)	1 (6%)	1 (6%)	**23 (19%)**	0 (0%)	32 (47%)	0 (0%)	2 (12%)	**34 (29%)**

Figure 10 shows the prevalence of each visual foliage injury symptom observed in all species during the surveys. It indicates that tip necrosis, leaf undulation / cupping, and chlorosis were the most commonly occurring symptoms (with 26 - 28% of all observations), followed by marginal necrosis (12%), whilst symptoms of anthocyanin accumulation were generally uncommon (7% of all observations).

The severity of recorded emission related injury symptoms overall ranged from very slight to very severe (i.e. between 2% and 75% of leaf area affected – refer to Table 6). For each quarterly survey during the reporting period, Figure 11 depicts the distribution of injury severity classes recorded in all flora species surveyed. The results indicate the following:

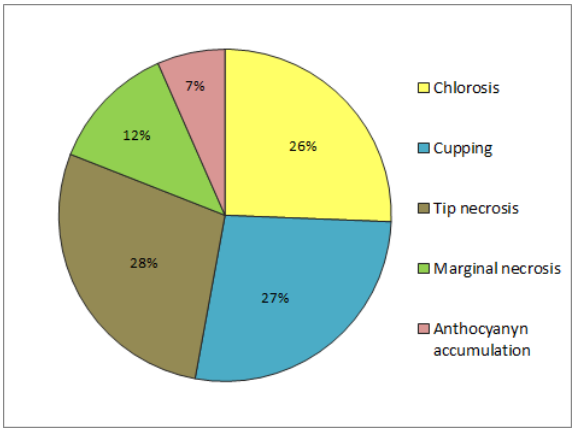

Figure 10 Relative prevalence of fluoride related symptoms

- For each survey between 59% and 75% of plants surveyed were affected at worst by slight injury symptoms (i.e. injury class 2 and less, maximum of 5% leaf area impacted);
- For each survey between 21% and 41% of plants surveyed were affected by distinct or marked injury symptoms (i.e. injury class 3 or 4, 10-25% of leaf area impacted);
- During the annual Q4 2016 survey only, 4% of plants surveyed displayed severe to very severe visual injury symptoms (i.e. injury class 5 or 6, 50-75% of leaf area impacted); and
- No species displayed extreme injury symptoms (i.e. injury class 7, >75% of leaf area impacted) during any of the four surveys.

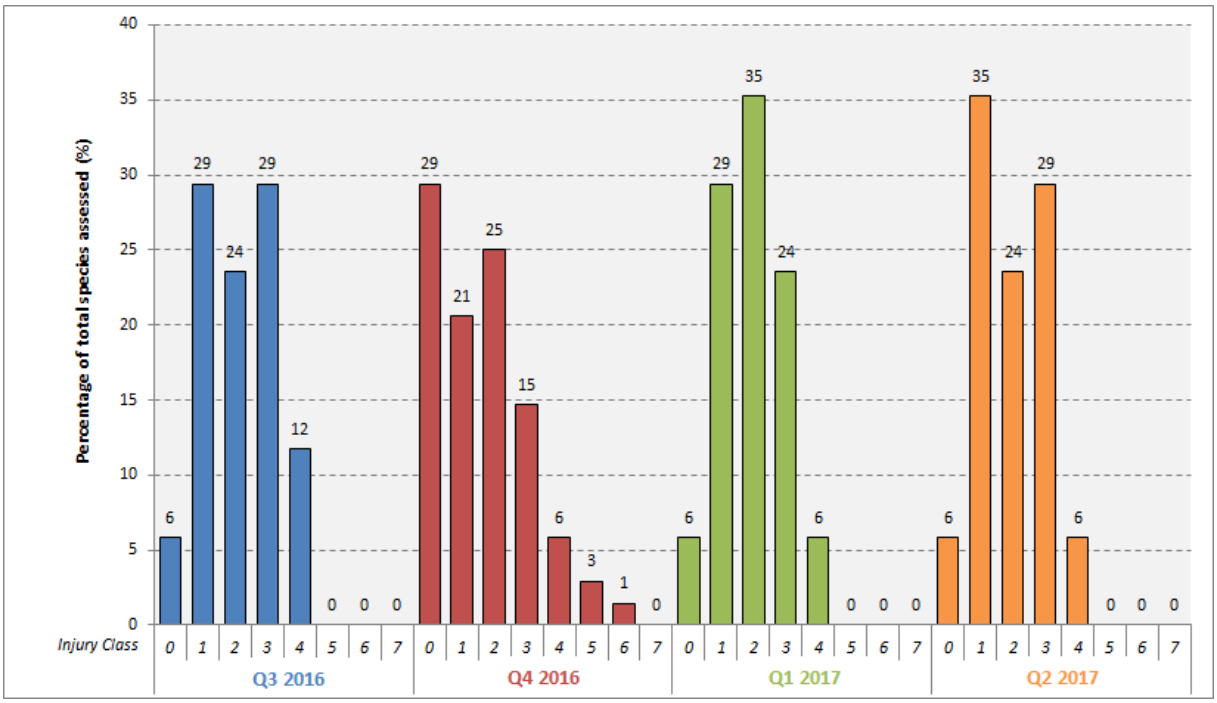

Figure 11 Proportion of flora species affected by emissions related visual injury symptoms during the surveys

In relation to insect attack injury, approximately 42% of all symptoms recorded were very slight (i.e. less than 2% leaf area affected), approximately 45% were slight (i.e. 2–5% leaf area affected), approximately 9% were distinct (i.e. 5–10% leaf area affected), and 4% (three instances) were marked (~10–25% leaf area affected). No severe (or higher) insect injury symptoms were recorded.

Figure 12 depicts the relationship between the maximum emission related visual injury score recorded for each species (inclusive of all surveys) and their distance from the kiln stacks at NCIA. The results showed little correlation between foliage injury and the distance to the emission source ($r^2 = 0.07$), indicating that emission impacts to foliage may spread further from the NCIA site than the furthest monitoring site. For instance, category 5 injury symptoms were observed up to ~1,400m away from the NCIA facility at Site 6 and Site 7, while category 3 symptoms occurred as far as Site 12 (~2,300m from the NCIA facility). This also suggests that within the current suite of monitoring sites, variables such as flora species type or the sensitivity of specific individuals are more relevant than the distance from emission source in determining atmospheric fluoride impacts on local vegetation. However and importantly, there are several other air pollution sources in the region which may impact vegetation and foliage condition. Therefore the geographical extent of fluoride impacts to foliage attributable to NCIA activities alone cannot be confidently determined.

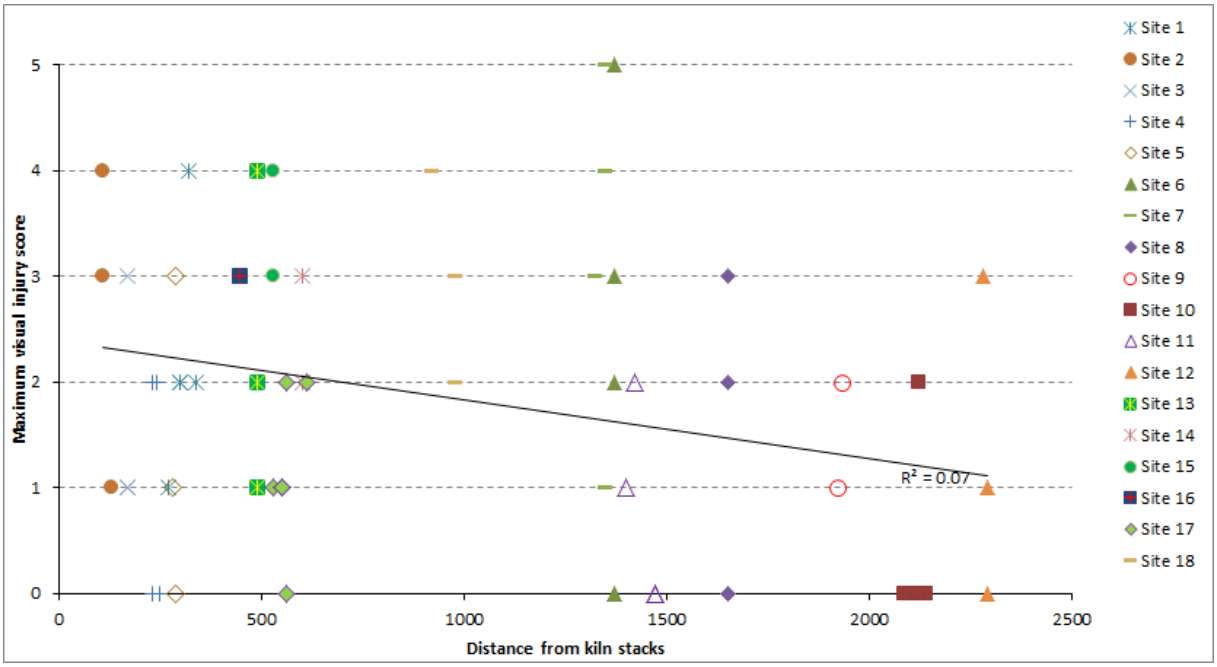

Figure 12 Relationship between distance from kiln stacks and maximum visual injury score in foliage of species assessed

4.2.2 Visual condition Assessment Results – Reference Site

A broad diversity of species was assessed at this site, which is located approximately 3km north of the kiln stacks at NCIA. Generally the surveyed vegetation was in a good and healthy condition with species not showing signs of chlorosis, marginal necrosis or anthocyanin accumulation. Some foliage injury symptoms were recorded including leaf cupping and tip necrosis, however those were only detected in a minority of the species surveyed and their severity was typically limited to class 1 (very slight) or class 2 (slight) injuries (with two exceptions in the *Corymbia maculata* and *macadamia integrifolia* individuals which showed marked (class 3) cupping symptoms during the Q4 2016 and Q2 2017 surveys).

Insect attack injury symptoms were recorded in 40% of all species assessed at the reference site (mostly in eucalypt species) with their severity ranging from very slight to distinct (class 3 injury).

4.2.3 Fluoride Content Assessment Results

Foliage samples for fluoride content assessment were collected from various established locations during each of the surveys undertaken during the reporting period. Where possible both current and previous season leaves were collected for analysis and mixed to create a bulk sample for the site. Grasses at Wollombi Road (Site 11) were sampled in approximate 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 and roots).

Samples were sent to a NATA accredited laboratory for analysis and the results are provided in Table 8. Detailed results as provided by the laboratory (certificates of analysis) have been included in Appendix A4.

Foliar fluoride content results generally show that:

- Individual species and plants show varying degrees of resistance and/or sensitivity to impacts caused by atmospheric fluoride impacts with recorded foliar fluoride concentrations ranging from <10.0mg/kg to 91.9mg/kg; and
- For each individual species sampled, foliar fluoride concentrations show seasonal variations, reflecting the dominant wind patterns in the area – i.e. with concentrations increasing (or

decreasing) as the dominant winds blow toward (or away from) the monitoring sites from the NCIA kiln stacks.

A comparison of these results to previous years and further discussion are provided in Section 5.2 of this AEMR.

Table 8 Sites and species within the survey area selected for foliage fluoride content assessment

Site #	Species	Foliage Season Sampled	Fluoride Content (µg/g, dry)			
			Q3 2016	Q4 2016	Q1 2017	Q2 2017
5	*Eucalyptus moluccana*	Mixed	35.4	33.6	11.2	33
11	Grasses	Current	<10.0	<10.0	<10	<10.0
13	*Corymbia maculata*	Mixed	58	91.9	<10	56.9
13	*Eucalyptus amplifolia*	Mixed	11.4	<10	40	<10
15	*Corymbia maculata*	Mixed	33	28.1	56.7	37.6
19	*Vitis vinifera*	Current	<10.0	<10.0	<10	*Not sampled*[#]

[#] *being a deciduous species, vitis vinifera had no foliage present at the time of the Q2 2016 survey and hence could not be sampled for analysis.*

4.3 Meteorological Monitoring

Meteorological data is recorded at the meteorological station established at the southeast air monitoring location. The station is sited and operated in accordance with approved methodologies (EPA, 2016) 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 deployed to record daily rainfall rates.

The monthly data for temperature and rainfall are provided in Figure 13. Monthly wind roses representing the wind speed and direction for the reporting period are provided in Appendix B. A summary of the dominant wind patterns throughout the reporting period is provided below.

An issue with the wind sensor was identified in March 2017 and the wind sensor was replaced. As such, the wind sensor was offline between 2 March 2017 and 16 March 2017 and wind speed and direction data during this period is not available. There may also be uncertainties as to the reliability of wind data obtained prior to replacement.

Review of the monthly wind roses for the reporting period indicates the following:

- In August 2016 winds were blowing predominantly from the southwest and southeast;
- In September 2016 winds were blowing predominantly from the south to southeast;
- In October 2016 winds were predominantly from the south with some winds from the southeast;
- Between November 2016 and February 2017 winds were predominantly from the southeast to east;
- In March 2017 winds were variable but generally from the southwest to southeast; and
- During April to July 2017 winds were predominantly from the northwest with some winds from the west, southwest, south and southeast.

Wind speeds recorded over the year were generally low to medium with an average wind speed of 1.9 m/s during the reporting period. The maximum hourly average wind gust during the reporting period was recorded at 13.5 m/s on 3 September 2016.

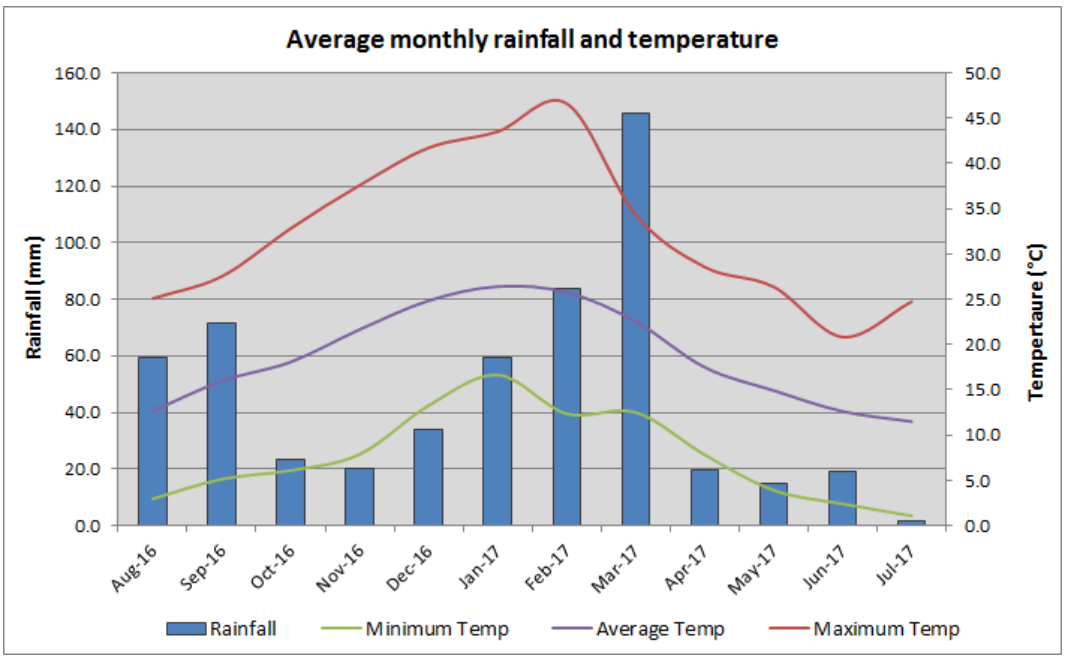

Figure 13 Average monthly rainfall and temperature range (1 August 2016 – 31 July 2017)

4.4 Stack Emissions Testing

Stack emissions testing is undertaken annually in accordance with the EPL requirements. Stack emissions testing was conducted during May - July 2017. Emission sources assessed during the testing period were those defined in the EPL and listed in Table 9.

Table 9 Emission source descriptions

EPL Identification Number	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)

Each source was tested for Total Particulates and Fine Particulates (PM_{10}). Testing conducted on the Kiln 1 and Kiln 2 stacks also 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), Nitrogen Oxides (NO, NO_2, NO_x and Equivalent NO_2), Cadmium and Mercury. All sampling was conducted in accordance with the applicable EPA test methods with analyses conducted by a NATA-accredited laboratory.

The Project Approval does not specify pollutant concentration limits for the facility. Pollutant concentration limits are specified in Condition L3 of the EPL. Summaries of the emission testing results, along with the EPL pollutant discharge limits, are provided in Table 10 and Table 11.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits. The Nitrogen Oxides, Total Particulate and PM_{10} emission concentrations from the Kiln stacks are corrected to 18% O_2.

During the reporting period there was an exceedance of the Total Fluoride discharge limit at EPL point 14 (Kiln 1). All other pollutant concentrations were below the limits specified for each source in the EPL. This one elevated monitoring result was notified to DP&E in accordance with the requirements of the Project Approval.

Table 10 Summary of particulate emission monitoring results (May 2017 – July 2017)

Source	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3)*
Clay Preparation (CP1) (EPL 1)	4.0	11	20
Pressing and Drying (PD1) (EPL 3)	3.9	4.1	20
Dryer (D1) (EPL 5)	5.2	9.2	20
Dryer (D2) (EPL 6)	7.8	11	20
Glaze Line (EPL 9)	2.1	6.5	20
Selection Line (SL 1,2,3,4) (EPL 10)	4.5	8.5	20
Spray Dryer (SD1) (EPL 12)	2.5	4.8	20
Hot Air Cooler 1 (HAC1) (EPL 18)	3.3	3.3	5
Hot Air Cooler 2 (HAC2) (EPL 19)	1.1	1.2	5

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

Table 11 Summary of emission monitoring results – Kiln 1 and Kiln 2 (May – July 2017)

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)	10	13	N/A
Total Particulate (at 18% O_2) (mg/m^3)	16	13	20
Total Fluoride (as HF) (mg/m^3)	**9.7**	1.28	5
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	<70	34	100
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	200	180	N/A
Total Hazardous Substances (Metals) (mg/m^3)	0.078	0.052	1
Total Oxides of Nitrogen (at 18% O_2) (as Equivalent NO_2) (mg/m^3)	29	48	100
Cadmium (mg/m^3)	0.0040	0.0011	0.1
Mercury (mg/m^3)	0.00080	0.00077	0.1

*Note: **Bold** font indicates an exceedance of the criteria.*

4.5 Noise Monitoring

Noise limits set out in NCIA's Project Approval are more stringent than those set out in the EPL and therefore the Project Approval limits are used to assess 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 (as specified in Condition 26 of the Project Approval). 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 set out in the *NSW Industrial Noise Policy* (INP) (EPA, 2000). In accordance with the INP the noise criteria apply under all meteorological conditions except during rain, wind speeds greater than 3m/s (at 10 m above ground level) and intense temperature inversions (greater than +3°/100) between 6 pm and 7 am. Data obtained during these meteorological conditions were omitted.

The noise monitoring was undertaken by Spectrum Acoustics in May 2017. A series of attended noise measurements of 15 minutes duration were made in Kenvil Close and in Wollombi Road on Friday 12 May 2017 during the day, evening and night time periods. Measurements were also made during

the day time period on the NCIA site. Operator field notes allow for individual noise sources and events to be isolated and the contributions of the various noise sources can then be quantified. At the time of the monitoring activities at NCIA were being carried out under typical operating conditions.

The results of the attended noise measurements at each location and time are summarised in Table 12.

Table 12 Received noise levels during attended noise monitoring (12 May 2017)

Location	Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Close	3:22 pm	49	3.1/S	Planes (48), birds (40), **NCIA inaudible**	n/a
Kenvil Close	9:01 pm	42	1.1/W	Traffic (42), **NCIA inaudible**	n/a
Kenvil Close	10:06 pm	38	Calm	Train (36), traffic (31), insects (30), **NCIA (<29)**	<30
Wollombi Rd	3:59 pm	73	3.6/S	Traffic (73), **NCIA inaudible**	n/a
Wollombi Rd	9:42 pm	59	Calm	Traffic (59), train (40), **NCIA inaudible**	n/a
Wollombi Rd	10:48 pm	37	Calm	Traffic (35), **NCIA (32)**, insects (30)	33

The results show that the received noise from the NCIA facility was inaudible during the day and evening periods. Received noise from the NCIA site was audible and measureable at each of the monitoring locations during the night time period. On all occasions and at all times the noise from NCIA did not exceed the relevant criterion, including the sleep disturbance criterion.

During each of the monitoring periods at the Kenvil Close location there was significant contribution from traffic noise on the New England Highway.

At the Wollombi Road monitoring location noise from traffic on Wollombi Road was the most significant contributor to the measured noise. Analysis of data from those times when the traffic noise was low allowed for the determination of the contribution of other noise sources to the overall acoustic environment.

Generally, noise emissions from NCIA are relatively constant and steady with very few easily discernible L_{max} events. L_{max} noise levels measured on the NCIA site (during the day) did not vary by more than 2-4 dB(A) from the measured L_{eq} noise levels. Therefore the results shown in Table 12 indicate that the sleep disturbance criteria at the closest receivers in Kenvil Close and Wollombi Road would be significantly lower than the 45 dB(A) criterion.

4.6 Water

4.6.1 Water Usage

Water usage at NCIA is principally for use in the tile manufacturing process and wash down requirements. Water is also required for staff amenities, landscaping and firefighting if required.

Although there is no regulatory limit on water usage, Schedule 3 Condition 44 of the Project Approval stipulates that NCIA needs to seek approval from Hunter Water Corporation (HWC) before its water consumption is expected to exceed 92ML/year.

NCIA used a total of approximately 47 ML of process water during the current reporting period. This is well below the threshold value of 92ML/year for which HWC approval is required.

4.6.2 Stormwater Quality

Stormwater quality is monitored on a weekly basis within Pond 4, which is located in the south-east corner of the site. The channel outlet connected to Pond 4 is the location of potential stormwater discharge from the site. Monitoring is therefore undertaken within Pond 4 in order to ascertain water quality data in the event of such discharge occurring. Monitoring started in 2009 and is ongoing with the following parameters monitored: pH value, Electrical Conductivity (EC) (as a measure of salinity) and water temperature, as well as visual observations of turbidity levels, odour and colour.

There were no observed discharges of stormwater from Pond 4 throughout the reporting period. The results of the stormwater quality monitoring during the reporting period for pH and EC are presented in Figure 14 and Figure 15 respectively. For assessment purposes the monitoring results are compared against the *ANZECC Guidelines for Fresh and Marine Water Quality* (ANZECC 2000). The adopted ANZECC 2000 guidelines for pH and conductivity are the default trigger values for slightly disturbed aquatic ecosystems in NSW lowland rivers. The data for the current monitoring period shows that:

- pH values oscillated between 7.0 and 8.5 with an increasing trend throughout the reporting period, and were generally within the ANZECC guidelines with the exception of five monitoring events:
    - 6 October 2016 – pH of 6.3;
    - 22 December 2016 – pH of 8.53;
    - 2 February 2017 – pH of 8.69;
    - 8 June 2017 – pH of 8.84; and
    - 28 June 2017 – pH of 8.68.
- EC values were low and show a very slight increasing trend throughout the reporting period with levels generally around 500 µS/cm indicating that the water is non-saline. The EC values were within the ANZECC guidelines for the entire reporting period.

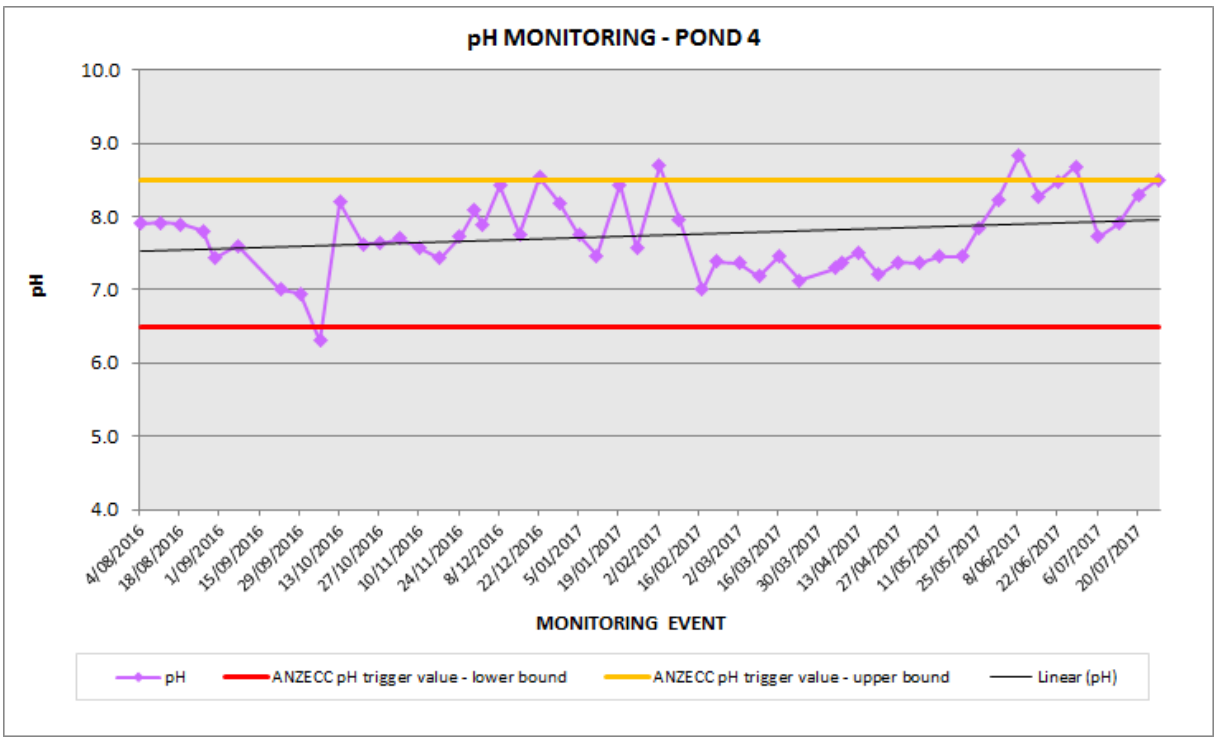

Figure 14 Stormwater quality monitoring – pH

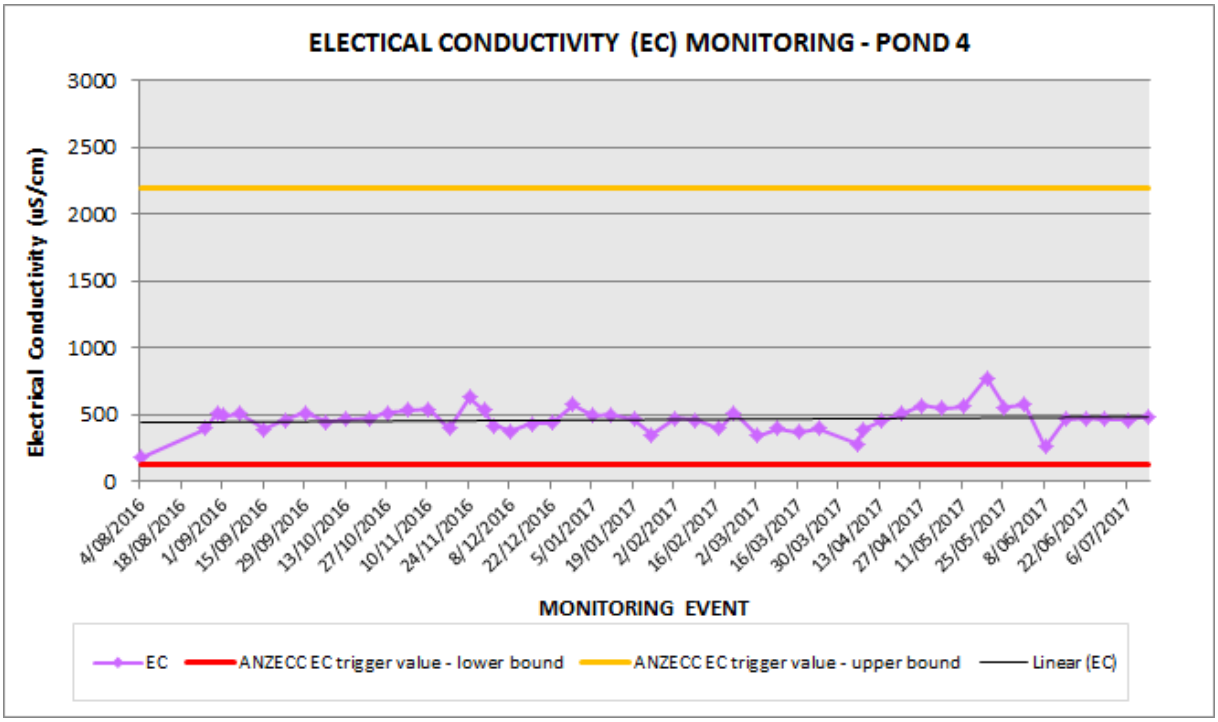

Figure 15 Stormwater quality monitoring – EC

4.7 Waste Generation

There are no regulatory requirements in terms of waste generation quantities, types or production efficiency targets pertaining to NCIA's operations. The Project Approval simply stipulates that a designated area for the storage and collection of waste and recyclable material must be provided at the facility (Schedule 3 Condition 52). Designated areas are provided on site for the storage of fired waste and other wastes (e.g. general office and packaging wastes) in accordance with the requirements of the Project Approval.

The main waste generated from the operation includes tile waste and baghouse waste. Tile waste comprises both green tiles (i.e. raw material waste from unfired tiles) and broken fired tiles. Baghouse waste largely consists of the fine grade lime that is used to filter the kiln exhaust stream and neutralise the emitted fluoride. Other types of waste generated from the facility include consumables, packaging waste and general domestic waste generated within the office and lunchroom, however these wastes represent an extremely minor part of the total waste stream.

The amounts of tile waste generated during the current reporting period (shown as a proportion of the total tile production) is presented in Figure 16.

NCIA's targets for tile wastes are to not exceed 2% (for green tile waste) and 10% (for fired tile waste) of the total tile production, respectively. The green tile waste target was achieved every month throughout the reporting period. The amount of fired tile waste exceeded the target for eight months of the reporting period, with a monthly average of 10.9%. However, approximately 5% of total production is currently reused in the manufacturing process (i.e. milled again and re-sent through the production line), bringing the actual waste levels down by 5%. Consequently, the fired waste target was achieved for eleven months and the average monthly waste reduced from 10.9% to 5.9% therefore achieving the fired tile waste target.

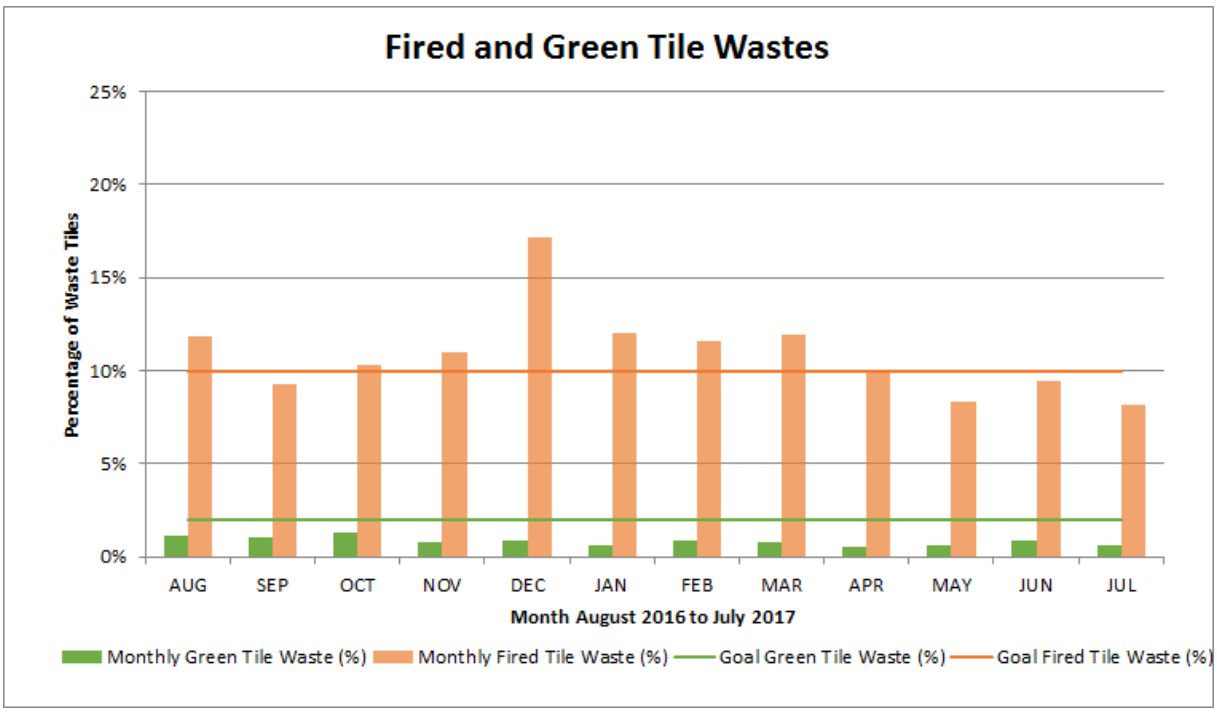

Figure 16 Tile waste (green and fired) generation during 2016-2017

This page has been left blank intentionally.

5.0 Discussion of Environmental Performance

This section provides an assessment of the monitoring results for the reporting period against the criteria set out in the Project Approval and EPL, predictions made in the 2010 EA, and the monitoring results from previous years. 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 residential receptors within the Heritage Parc subdivision (located at 99 Racecourse Road, Rutherford) 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 future residential receptors within Heritage Parc was predicted to be 3.2 µg/m^3 (compared to the criterion of 2.9 µg/m^3); and
- The above exceedance of the 24 hour Fluoride criterion was predicted during a worst case scenario with NCIA operating all eight Stages. Only two Stages of the development are currently operational.

Ambient air quality monitoring during the reporting period (presented in Section 4.1) indicated that the levels of 24 hour PM_{10}, annual average PM_{10}, 24 hour fluoride and weekly fluoride were generally compliant with the relevant guidelines criteria, with only three exceedances of the 24 hour PM_{10} criteria (recorded PM_{10} concentrations of 57.9 µg/m^3, 88.6 µg/m^3 and 52.3 µg/m^3 compared to the criteria of 50 µg/m^3). NCIA were not considered to be a major contributor to any of these exceedances (as discussed in Section 4.1.1). The monitoring results for the reporting period are considered to be consistent with the predictions made in the 2010 EA.

Historical ambient air monitoring results recorded since commencement of operations (15 March 2004 to current) are shown in Figure 17 to Figure 22. An analysis of historical trends in air pollutant concentrations (and where relevant comparisons against the current reporting period) reveals the following:

- Historical PM_{10} concentrations are variable with results generally oscillating around a relatively stable annual average and isolated elevated concentrations occurring episodically. PM_{10} concentrations during the 2017 reporting period were consistent with historical data and there is a decreasing linear trend in PM_{10} concentrations, which is more apparent at the NW monitoring location compared to the SE monitoring location.
- Following seven years of relatively low and steady levels of fluoride emissions between 2004 and 2011 (despite isolated and episodic increases), gaseous fluoride levels have slightly increased since 2012 in both the 24-hour and weekly fluoride levels. Fluoride emissions during the 2017 reporting period were similar to or lower than the previous four years. Nonetheless, there is an overall increasing linear trend in 24 hour and weekly fluoride levels at both monitoring locations.

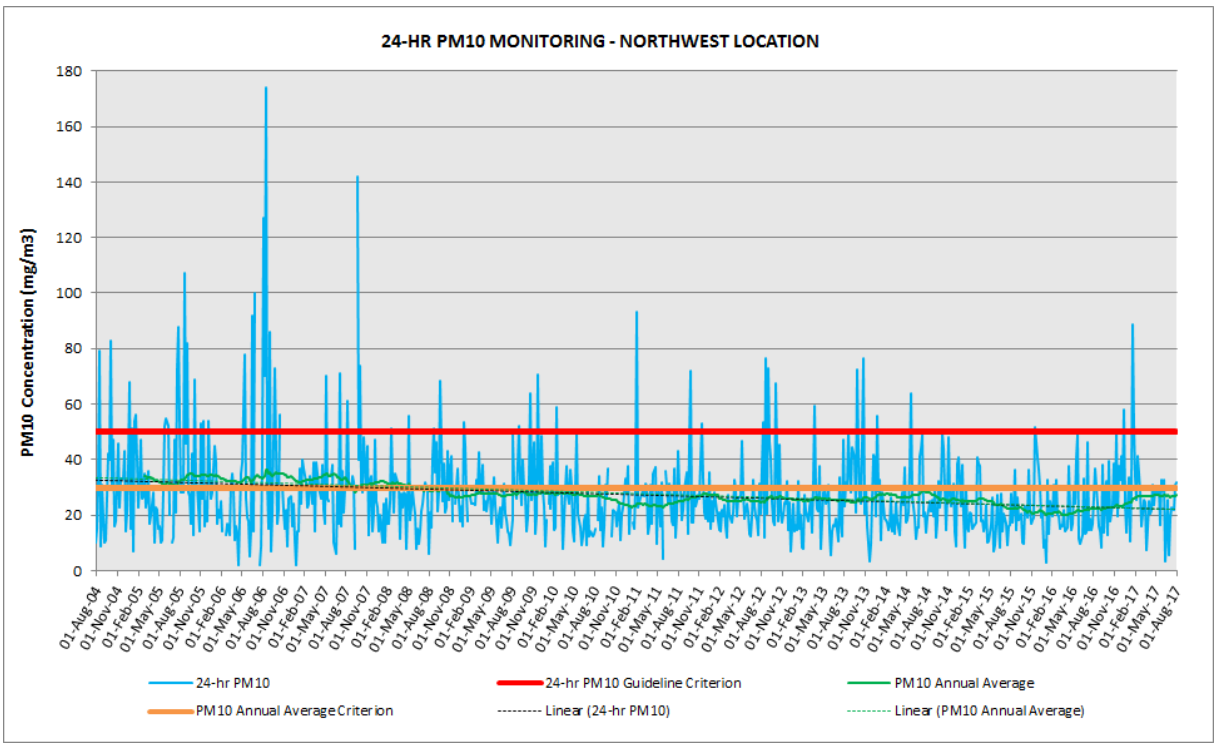

Figure 17 24-hour PM_{10} monitoring – northwest location (2004 – 2017)

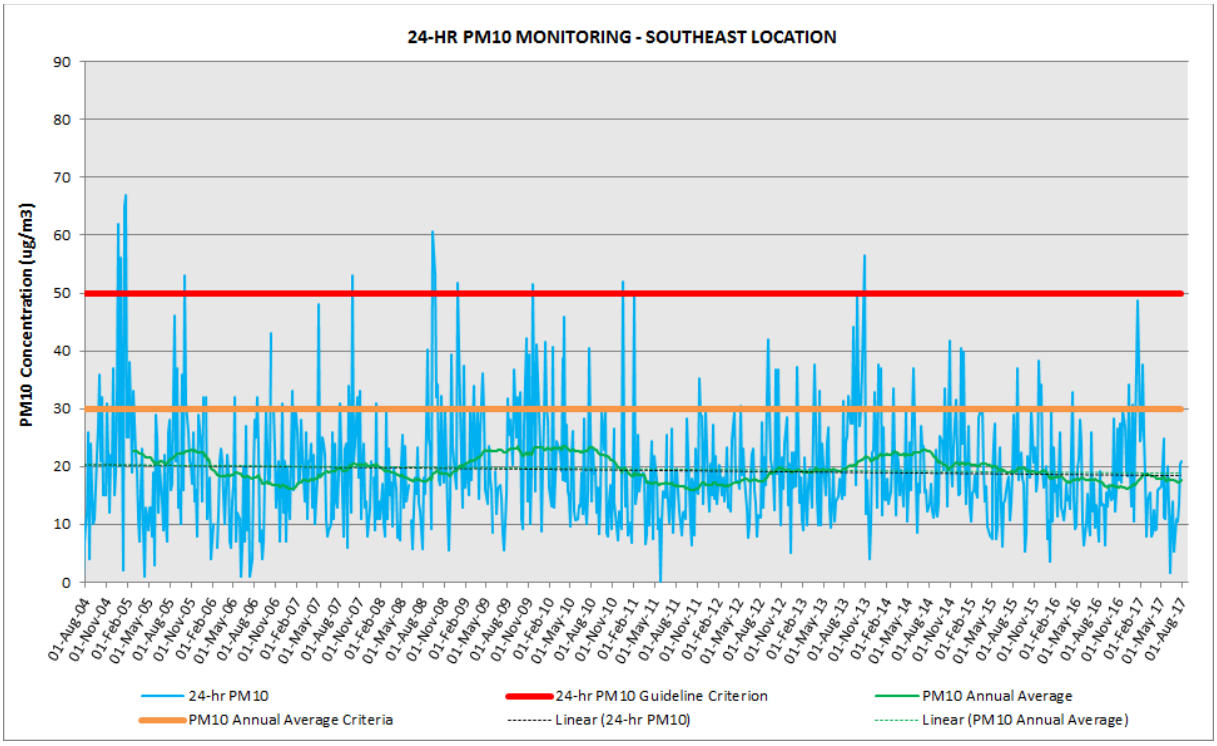

Figure 18 24-hour PM_{10} monitoring – southeast location (2004 – 2017)

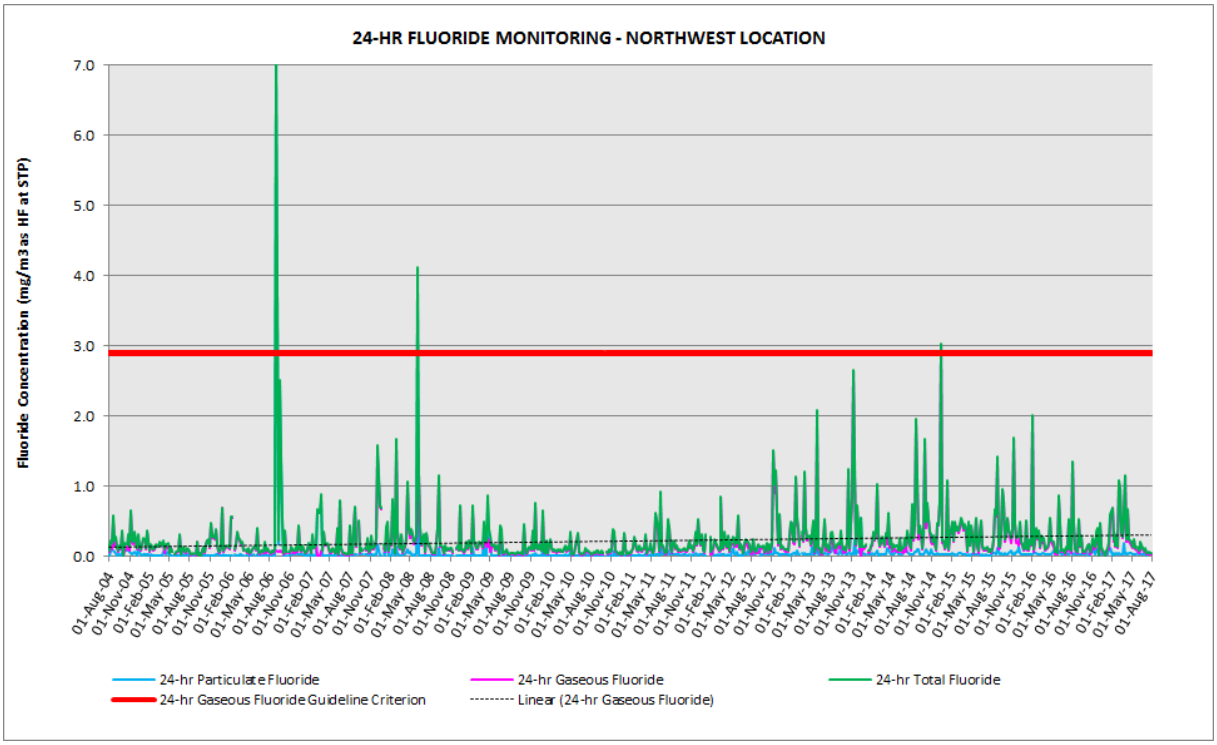

Figure 19 24-hour fluoride monitoring – northwest location (2004 – 2017)

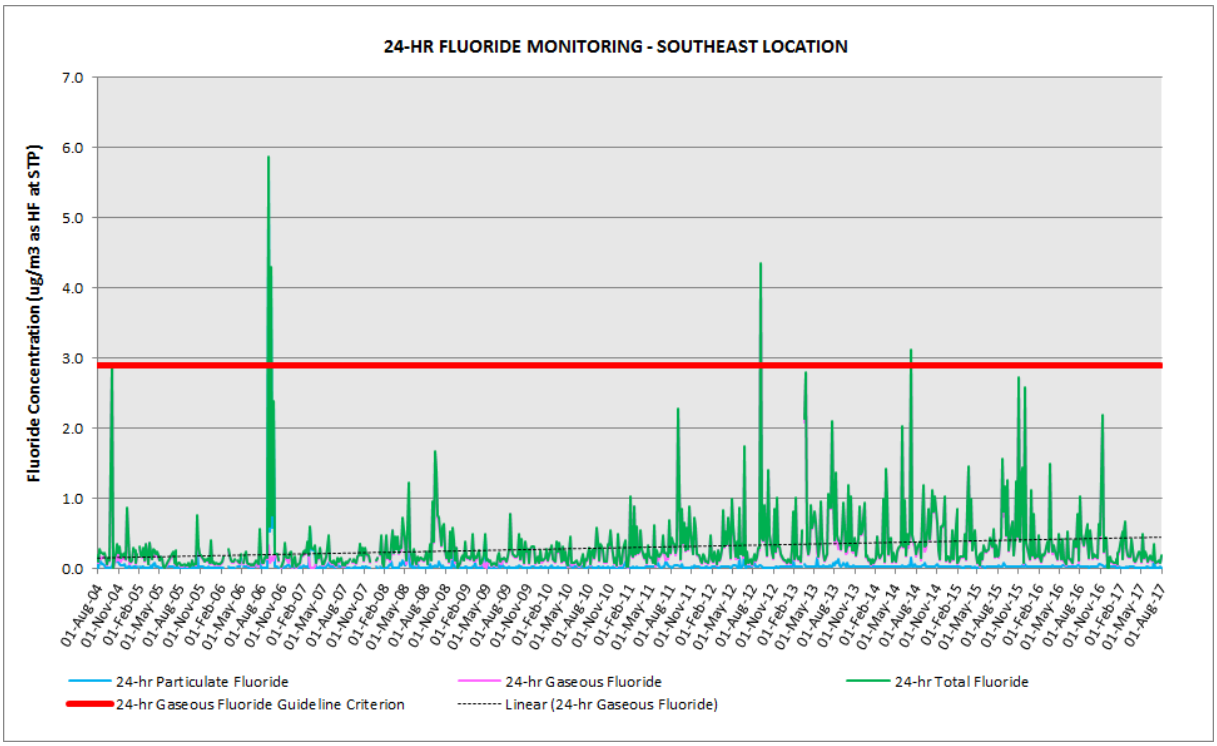

Figure 20 24-hour fluoride monitoring – southeast location (2004 – 2017)

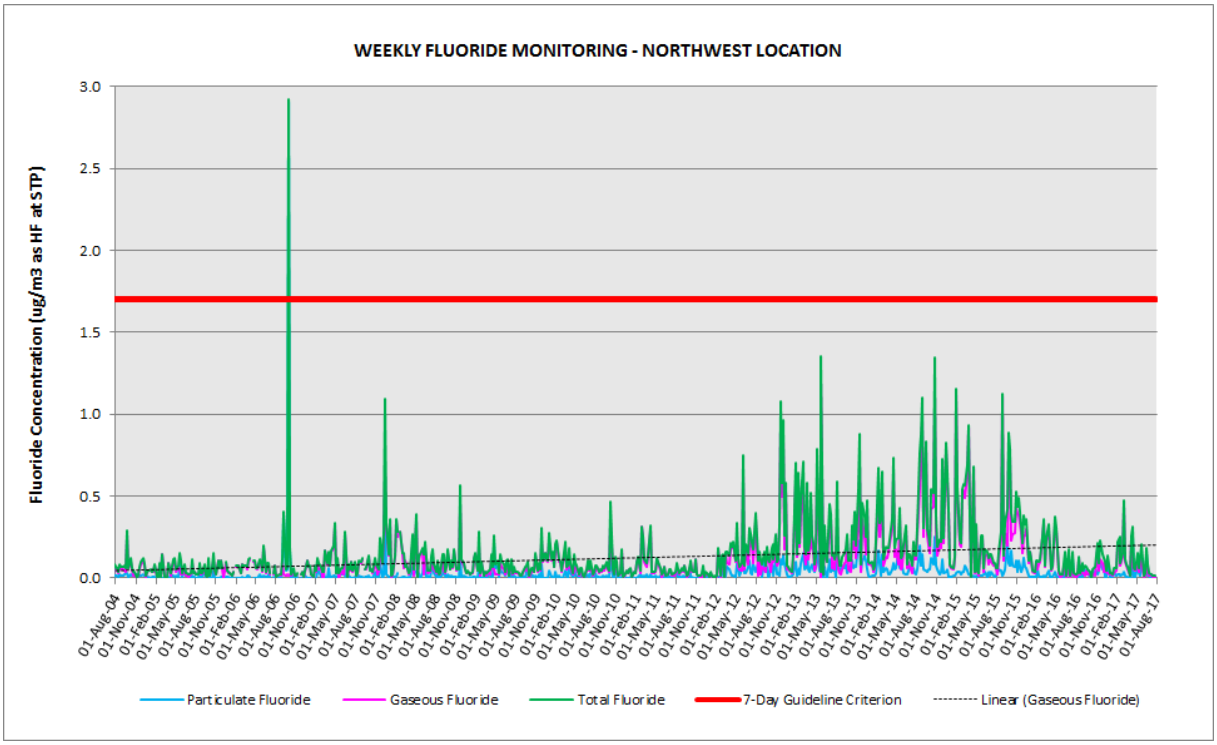

Figure 21 Weekly fluoride monitoring – northwest location (2004 – 2017)

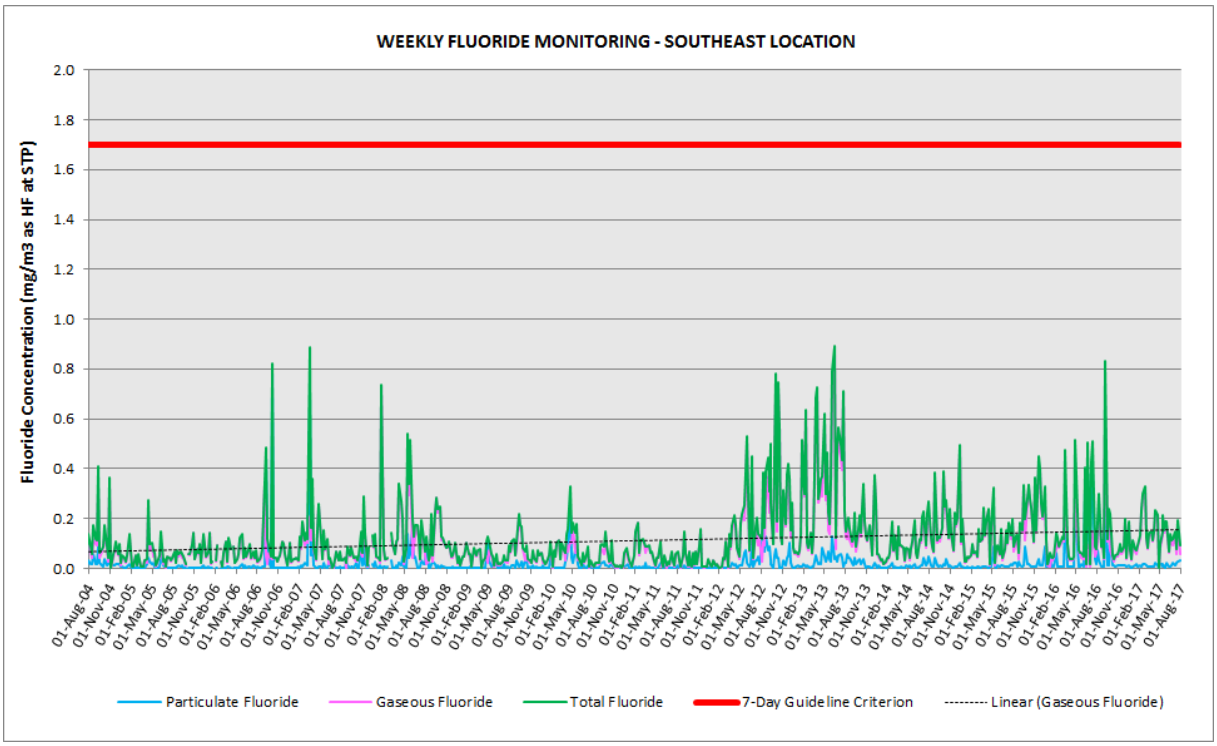

Figure 22 Weekly fluoride monitoring – southeast location (2004 – 2017)

5.2 Fluoride Impact on Vegetation

As required by the EPL the potential impact of NCIA's operations on vegetation surrounding the facility is monitored through assessment of fluoride impacts on local vegetation, including visual assessments of injury symptoms to leaves and foliar fluoride content. There are no limits or criteria set out in the EPL or Project Approval by which to assess compliance. Likewise, the 2010 EA did not specifically discuss fluoride impact on vegetation and therefore no predictions are available for comparison. Instead, the assessments are used to provide an indication of trends in fluoride injury and concentrations at set locations surrounding the facility and for a suite of particular species.

5.2.1 Trends in Visual Impact on Vegetation

Historical results for vegetation visual assessments since the start of the monitoring program are presented in Figure 23. For each quarterly survey the data has been presented to show the proportion of total species assessed that were impacted by fluoride related injury symptoms of varying severity. The results were grouped into the following four categories (also refer to Table 6 in Section 4.2 for definitions of injury classes):

- Species showing no visible fluoride injury symptoms;
- Species displaying at worst class 1 (very slight) or class 2 (slight) injury symptoms;
- Species displaying at worst class 3 (distinct) or class 4 (marked) injury symptoms; and
- Species displaying class 5 injury symptoms and above (severe to extreme).

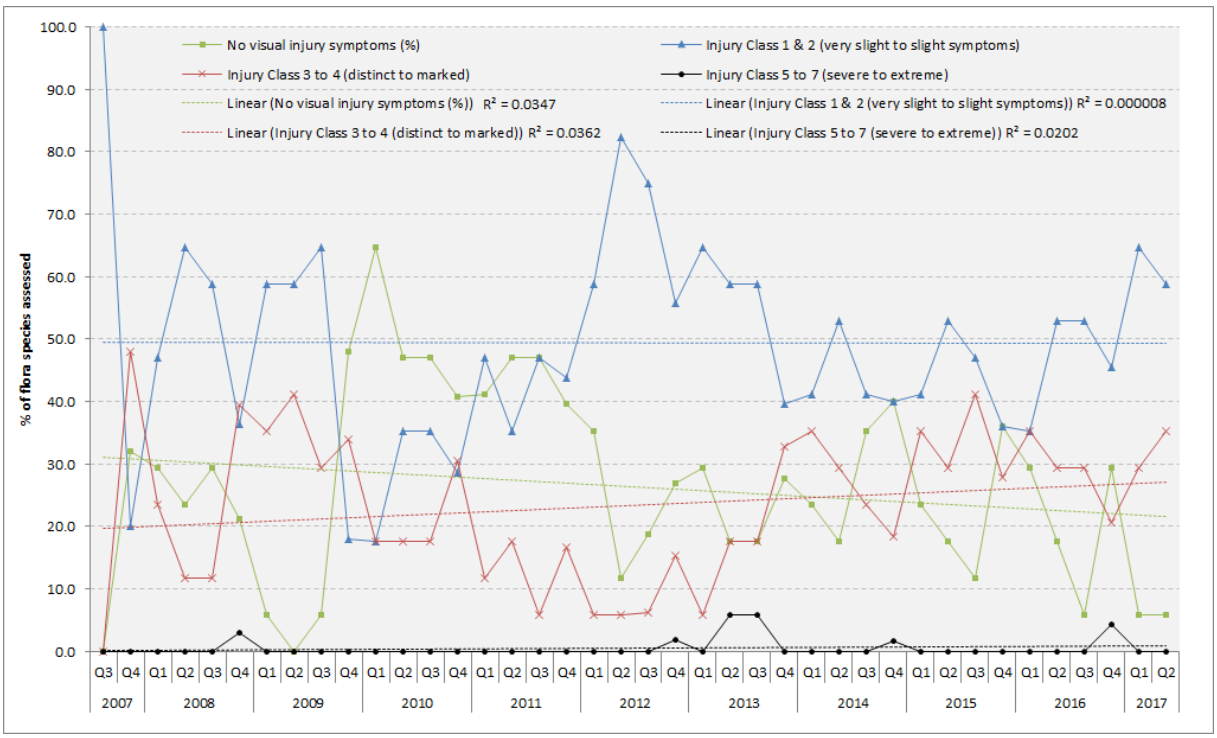

Figure 23 Proportion of flora species affected by emission related visual injury symptoms (2007-2017)

Despite clear seasonal variations, historical data show little long-term variability in the severity of fluoride impacts to vegetation surrounding the NCIA facility. The data supports no statistically significant increase or decrease in the severity of injury symptoms since the start of the monitoring program (as justified by the correlation r^2 values for all severity classes being <0.036).

Interrogation of the long term monitoring data indicates the following:

- The majority of flora species assessed since the start of the monitoring program have commonly displayed at least some level of fluoride related injury symptom (74% on average during each quarterly survey). Of all plants showing emission related impacts to foliage:
  - On average 49% displayed very slight or slight visual injury symptoms (i.e. less than 5% of leaf area affected) and 23% displayed distinct or marked fluoride injuries (i.e. between 10% and 25% of leaf area affected);
  - Severe injury symptoms (i.e. 25–50% of leaf area impacted) have rarely been recorded during the monitoring program (seven instances in a total of 1006 observations since 2007) and where this has been the case, injury symptoms did not persist; and
  - Only one instance of very severe injury symptoms (i.e. 50-75% of leaf area impacted) has been recorded throughout the monitoring program and extreme injury symptoms (i.e. greater than 75% of leaf area impacted) have never been recorded.
- The majority of flora species assessed since the start of the monitoring program have commonly displayed at least some level of insect attack injury symptoms (approximately 79% of all species affected on average). Of all plants showing impacts from insect attack: injury severity was very slight in 32% of cases, slight in 28% of cases, distinct in 15% of cases, marked in 4% of cases and severe in less than 1% of cases.

The monitoring data obtained during the current reporting period (as presented in Section 4.2) are generally well aligned with these long term trends. As is commonly observed, this year's results have shown some minor variations in foliage condition against previous year's results, with some specimens showing either slight deteriorations or slight improvements in foliage condition (whilst most showed relatively consistent symptoms). None of this year's survey results could be flagged as exceptional in the context of the long-term monitoring program and associated historical data.

5.2.2 Trends in Fluoride Content in Vegetation

Historical fluoride concentrations in vegetation sampled during each of the quarterly and annual surveys are presented in Figure 24 to Figure 27.

Overall foliar fluoride concentrations for the samples collected during this monitoring period's surveys were consistent with the long-term range of data for all species at all locations. The following comments apply to this year's results when compared against previous year's data:

- Historic data for *E. moluccana* at Site 5 indicates that there is typically a seasonal increase in foliar fluoride concentrations during spring (Q3) or summer (Q4) before levels settle down during autumn (Q1) and winter (Q2), which reflects changing dominant wind patterns occurring with the change of season. Overall this year's foliar fluoride concentrations values in this species were within the lower range of historical values. The observed seasonal concentration increase in spring was only marginal, whilst the Q1 2017 survey returned one of the lowest fluoride concentrations ever recorded in this species since the start of the monitoring program (Figure 24).
- Samples of grasses collected at Site 11 consistently returned low fluoride contents (i.e. ≤17.0µg/g) during the current reporting period, which is consistent with the long term results (Figure 25). Seasonal increases in fluoride concentration are commonly observed in grasses at this location in response to changing wind patterns. Historical records show that fluoride concentrations often peak during Q2 or Q3 (i.e. in late spring or winter when winds have been dominated by north-westerlies blowing towards the monitoring site from the NCIA kiln stacks).
- Sampling results of *E. amplifolia* at Site 13 during the current reporting period were within the medium to low range of historical values for this species (Figure 26). Foliage fluoride content returned for the Q1 2017 survey was the lowest ever recorded in this species since the start of monitoring. The long term trend in this specimen emphasises the high seasonal / annual variability and relative unpredictability in foliar fluoride concentrations in individual species.
- Consistent with long term data, fluoride concentrations in the foliage of *C. maculata* at Site 13 have been relatively low throughout the current reporting period (i.e. generally below 12.0 µg/g).

One seasonal increase was experienced in Q1 2017 (40 µg/g), which historical data show is common occurrence in this species (Figure 26).

- Foliar fluoride concentrations in *C. maculata* at Site 15 were within the medium to low range of historical values for this species. Historical records indicate a very high variability in fluoride content for this species since 2007, with a seemingly stochastic and unpredictable pattern that appears independent from seasonal wind changes. Despite episodic fluoride concentration peaks being common in this species, none occurred during the current reporting period (Figure 27).

Historical data show wide fluctuations in foliar fluoride content between quarterly surveys, and it is common for fluoride concentrations to experience and display episodic increases on a seasonal basis, usually reflecting the changing dominant wind patterns occurring with the change of season. On the longer term however, there seems to be a distinguishable annual pattern in fluctuating fluoride concentrations and historical data shows that for each species fluoride concentrations tend to oscillate within a set range of values.

The long-term data shows that there is an obvious variability in the sensitivity of tree species and individuals to the impacts of atmospheric fluoride with different individuals clearly absorbing varying levels of atmospheric fluoride through their leaf tissue.

It is also possible that environmental and climatic conditions play a role in foliar fluoride concentration levels – for instance higher rainfall may lead to emission particulates deposited on leaves being quickly washed from the leaf surface, and therefore not able to be absorbed and accumulated in the leaf tissue.

This page has been left blank intentionally.

Figure 24 Fluoride content in *E. moluccana* foliage at Site 5 (Q1 2007 – Q2 2017)

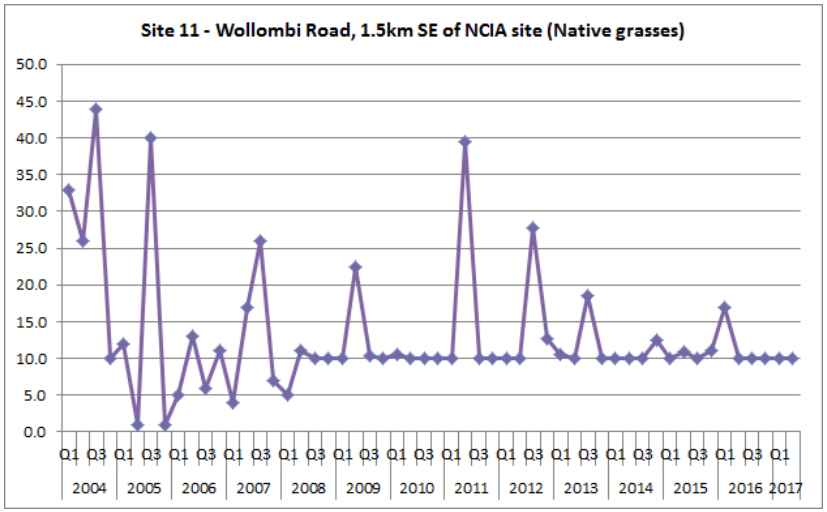

Figure 25 Fluoride content in grasses at Site 11 (Q1 2004 – Q2 2017)

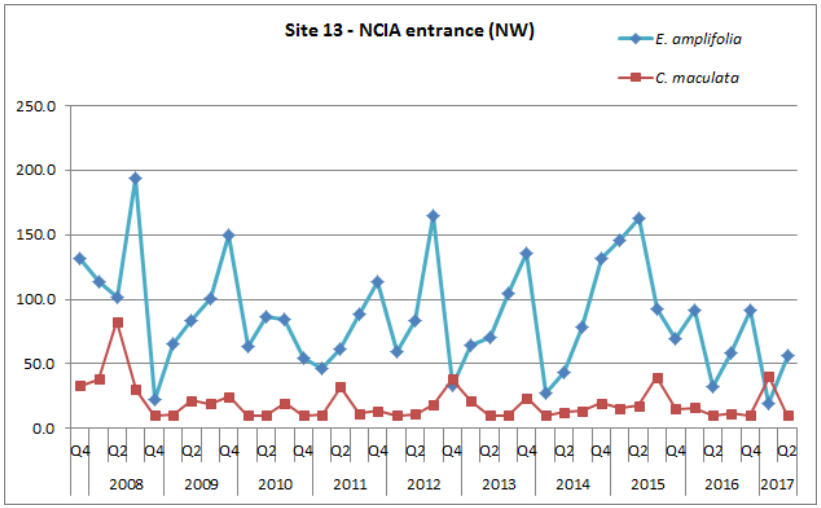

Figure 26 Fluoride content in *E. amplifolia* and *C. maculata* foliage at Site 13 (Q4 2007 – Q2 2017)

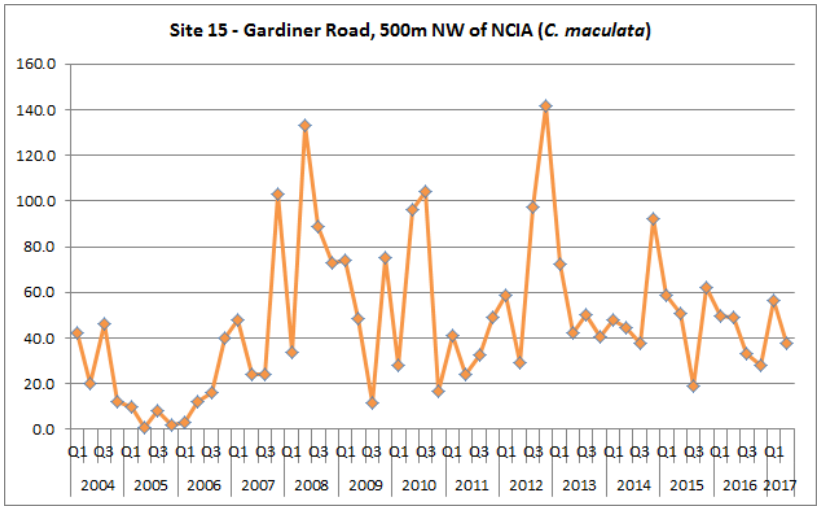

Figure 27 Fluoride content in *C. maculata* foliage at Site 15 (Q1 2004 – Q2 2017)

This page has been left blank intentionally.

5.2.3 Reference Site

The reference site is located approximately 3 km to the north of the NCIA facility thus outside the prevailing wind direction. Given its location, it is expected that there should be no impacts to the vegetation as a result of fluoride emissions.

Long term results of the visual assessments of foliage injury symptoms undertaken at this location show that vegetation has historically been in good and healthy condition. However, some injury symptoms have commonly been recorded over the years, particularly symptoms of cupping and tip necrosis, albeit of very slight severity, as well as insect attack injuries. The link to fluoride emission as a cause for these symptoms cannot be confidently determined for this monitoring location. It is possible that some species will exhibit foliar injury symptoms under 'natural' conditions. Other factors may play a role in the expression of injury, which may include environmental conditions, stress (e.g. drought, wind, diseases, etc.), pollutants from other sources or impacts from insects.

Given the social and economic importance of the viticultural industry in the Hunter Valley the potential impact of atmospheric pollutant emissions from industrial sources on the health of the grape vine *Vitis vinifera* (a known sensitive species) has traditionally been a concern for the industry. Consequently, foliar sampling and analysis of *Vitis vinifera* foliage from the reference site has historically been included as part of this vegetation monitoring program. Historical concentrations since the commencement of the monitoring programme are presented in Figure 28.

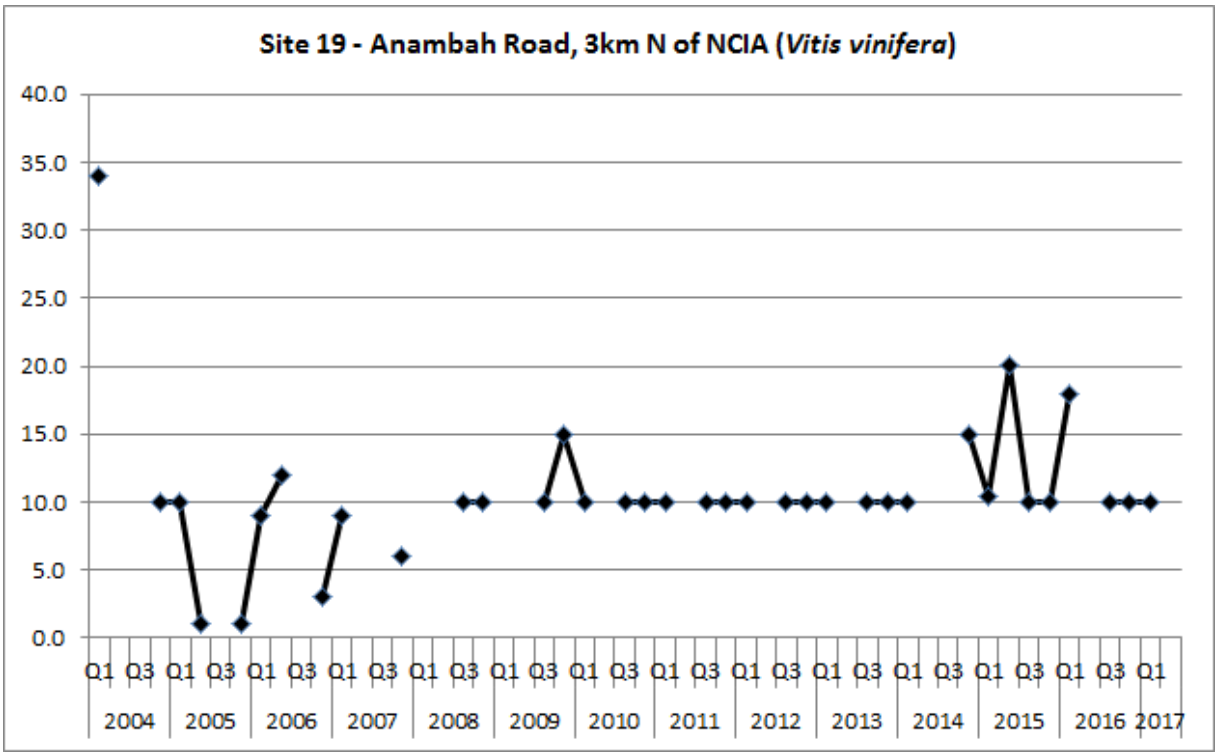

Figure 28 Fluoride content in *Vitis vinifera* foliage at Site 19 (Q1 2004 – Q2 2017)[2]

Long term data show that foliar fluoride has consistently returned very low concentrations for this species (<10.0 µg/g).

Recurrent elevated fluoride levels were recorded in the species between Q4 2014 and Q1 2016 (Figure 28). As noted in last year's AEMR, the property at the reference site underwent significant maintenance during that period, including the re-instatement of a functional irrigation system. Some scientific literature suggests that the use of municipal water injected with fluoride (which is the case in Australia) used for irrigation can result in toxicity symptoms on sensitive plants such as grape vines

[2] Note that the breaks in the line result from leaf samples not being collected and analysed for a particular quarter due to the absence of foliage on the vine (i.e. the species is deciduous).

(Psheidt, 2015). In this regard the elevated fluoride levels returned during that period may have been linked to the maintenance activities (and irrigation) undertaken on site. However, fluoride concentrations levels recorded in the grape vine appear to have stabilised during the current reporting period. This indicates that the species may have adjusted to the new irrigation water.

5.2.4 Relationship between Visual Symptoms and Foliar Fluoride Content

The results of the vegetation surveys undertaken during the reporting period together with historical data seem to indicate a poor correlation between foliar fluoride content and the visible expression of injury symptoms in foliage. For instance, although the *E. amplifolia* at Site 13 commonly returns the highest fluoride concentrations its foliage only shows very slight visible injury symptoms (and notably no chlorosis symptoms). Conversely, the foliage of *C. maculata* at the same location consistently exhibits distinct fluoride visual injury symptoms while the laboratory results show that its foliar fluoride concentrations are the lowest of all tree species sampled. The discrepancy between visual injury symptoms and foliar fluoride concentrations may be due to:

- A lag in the visible expression injury symptoms following exposure to atmospheric fluoride emissions;
- Varying sensitivity of individual specimens in exhibiting visible injury symptoms; and/or
- Emissions related visual injury symptoms being ‘mimicked’ by natural environmental impacts such as climatic conditions and insect attack.

Overall, there is an inherent level of unpredictability in the expression of visual symptoms 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 or sensitive to emission related impacts than others.

5.3 Meteorological Monitoring

NCIA have been monitoring the local meteorological conditions in accordance with Condition M5 – Weather Monitoring of the EPL. Table 13 demonstrates the percentage uptime of monitoring equipment achieved throughout the reporting period. The meteorological monitoring equipment achieved continuous monitoring greater than 95% of the reporting period. It is noted that there were issues with the wind sensor during the reporting period, however these were rectified in March 2017 and percentage uptime of the wind sensor during the reporting period was approximately 96%.

Table 13 Meteorological station up-time

Meteorological Parameter	Frequency	Percentage up-time during reporting period
Wind speed @10m (m/s)	Continuously	>95%
Wind direction @ 10m (degrees)	Continuously	>95%
Sigma theta @ 10m (degrees)	Continuously	>95%
Ambient temperature @ 5m (degrees Celsius)	Continuously	>95%
Rainfall (mm)	Continuously	>95%

5.4 Air Pollutant Load Limits

The 2010 EA included dispersion modelling to predict ground level pollutant concentrations. The source emission concentrations used in the modelling (Table 17 of the 2010 EA) were based on the results of stack emission testing conducted between 2007 and 2009. A comparison of the measured in stack emission concentrations for the reporting period and the emission concentrations used in the 2010 EA modelling is provided in Table 14. The results are variable - some of the measured emission concentrations during the reporting period are lower than the emission concentrations used in the 2010 EA modelling, and some are higher than those used in the 2010 EA modelling. However, where measured stack concentrations were higher than those used in the 2010 EA, these did not result in an exceedance of the EPL criteria (refer to Section 4.4) with the exception of total fluoride for Kiln 1.

Trends in the air quality pollutants discharged to air as a result of NCIA operations over time can be established using the assessable pollutant loads reported to the EPA in the Annual Returns since 2003. The actual load of assessable pollutants reported in the Annual Returns is calculated in accordance with the relevant Load Calculation Protocol for ceramics production. Table 15 provides the assessable pollutant loads discharged by NCIA during the reporting period. The maximum load limits set out in both the EPL and Project Approval and the historical pollutant loads discharged (2004-present) have also been included for comparison purposes and are presented graphically in Figure 29 to Figure 33.

The load limits specified in the Project Approval and EPL differ. Condition 16 of the Project Approval states:

> *Unless the OEH specifies otherwise, the Proponent shall ensure that the annual total load discharged from the site does not exceed the load limit specified for that pollutant in Table 3.*

As the EPA has 'specified otherwise' by specifying different load limits in the EPL (that are equivalent to Stage Two operations), the load limits in the EPL prevail over those in the Project Approval.

For the current reporting period, fine particulates (PM_{10}), coarse particulates, sulfur oxides and nitrogen oxides were all within the pollutant load limits. However fluoride discharged to air exceeded the EPL load limit during the reporting period. This is likely to be due to the normal variability in process and annual stack testing results. It is noted that all weekly and 24 hour fluoride ambient monitoring to the northwest and southeast of the facility returned results below the relevant EPA guideline criteria. This exceedance of the EPL load limit (along with the elevated stack emission monitoring result for fluoride) was notified to DP&E in accordance with the requirements of the Project Approval.

Historical data show that there is a high level of variability in pollutant emissions between reporting years with no clear trend or consistency in results. These fluctuations are likely due to the normal variation in stack emission testing results. This renders difficulty any comparison of this year's emission results against the long term data. The following points are made in relation to the current load limit results:

- PM_{10} emissions were the highest levels recorded since 2005-2006, however levels remained well below the permitted EPL load limit;
- Coarse particulate emissions were lower than those reported last year and were consistent with previous reporting years with levels less than half the permitted EPL load limits;
- The total amount of fluoride discharged during reporting period exceeded the EPL load limit. However fluoride emission levels were much lower than the previous spike in fluoride levels reported last year (2015-2016) and in 2005-2006.
- The sulfur oxides pollutant load was similar to or lower than previous reporting periods and was less than half that permitted under the EPL; and
- The nitrogen oxides pollutant load was lower than previous three reporting periods and well below the permitted load limits.

Table 14 Comparison of emission concentrations used in 2010 EA modelling and measured in stack emission concentrations for the current reporting period

Source	Emission Concentration (mg/m^3)							
	Fine particulate (PM_{10})	Total Particulate	Total Fluoride (as HF)	Sulfuric acid mist (H_2SO_4 as SO_3)	Total Hazardous substances (Metals)	Total Oxides of Nitrogen	Cadmium	Mercury
Kiln 1 (EPL 14)	**10.0** (5.3)	**16.0** (5.3)	**9.7** (5.0)	**<70.0** (9.6)	0.078 (0.2)	29.0 (50.0)	**0.0040** (0.003)	0.00080 (0.01)
Kiln 2 (EPL 15)	**13.0** (5.3)	**13.0** (5.3)	1.3 (5.0)	**34.0** (9.6)	0.052 (0.2)	48.0 (50.0)	0.0011 (0.003)	0.00077 (0.01)
Clay preparation (CP1) (EPL 1)	**4.0** (2.0)	**11.0** (2.3)	-	-	-	-	-	-
Pressing and Drying (PD1) (EPL 2)	**3.9** (2.5)	4.1 (4.8)	-	-	-	-	-	-
Dryer (D1) (EPL 5)	5.2 (8.4)	9.2 (12.8)	-	-	-	-	-	-
Dryer (D2) (EPL 6)	7.8 (8.4)	11.0 (12.8)	-	-	-	-	-	-
Glaze Line (EPL 9)	**2.1** (1.9)	**6.5** (4.3)	-	-	-	-	-	-
Selection Line (SL 1,2,3,4) (EPL 10)	4.5 (6.3)	**8.5** (6.3)	-	-	-	-	-	-
Spray Dryer (SD1) (EPL 12)	2.5 (13.1)	4.8 (13.1)	-	-	-	-	-	-
Hot Air Cooler 1 (HAC1) (EPL 18)	**3.3** (0.3)	**3.3** (2.3)	-	-	-	-	-	-
Hot Air Cooler 2 (HAC2) (EPL 19)	**1.1** (0.3)	1.2 (2.3)	-	-	-	-	-	-

Note – Emissions concentrations used in 2010 EA modelling are shown in parentheses.
Bold text identifies where measured in stack emission concentrations during the reporting period are greater than emission concentrations used in 2010 EA modelling.

This page has been left blank intentionally.

Table 15 Maximum pollutant load limits and assessable pollutant loads

Pollutants loads		Pollutant				
		Fine particulates (PM10)	Coarse particulates	Fluoride	Sulfur oxides[3]	Nitrogen oxides
Current Maximum Load Limit (kg)	EPL	26,629	14,338	1,850	36,828	36,828
Actual Load (kg) in reporting period	2016-2017	13,028	5,800	**2,411**	14,835	19,023
	2015-2016	5,816	11,310	**4,146**	16,835	21,360
	2014-2015	4,963	2,302	1,400	15,240	24,016
	2013-2014	5,369	3,289	928	4.280[4]	25,059
	2012-2013 [1]	1,249	1,640	1,109	1,235[4]	4,704
	2011-2012	997	5,550	91	26,946	20,306
	2010-2011	2,902	1,774	295	7,699	18,322
	2009-2010 [2]	6,524	475	621	**86,704**	**79,375**
	2008-2009	5,476	2,564	1,529	**70,565**	**62,426**
	2007-2008	4,449	3,881	336	16,633	18,073
	2006-2007	7,289	12,657	**1,989**	15,850	12,423
	2005-2006	21,751	11,986	**4,085**	13,239	13,887
	2004-2005	4,034	2,100	**2,154**	21,335	6,721
	2003-2004	1,028	1,089	150	5,813	1,151

Bold represents an exceedance

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

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

[3] *Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO3)).*

[4] *Sulfur oxide loads for the 2012-13 and 2013-14 reporting years have been corrected to only include sulfuric acid mist and sulfur trioxide, as agreed with regulatory authorities, and not sulfur dioxide as previously calculated and reported.*

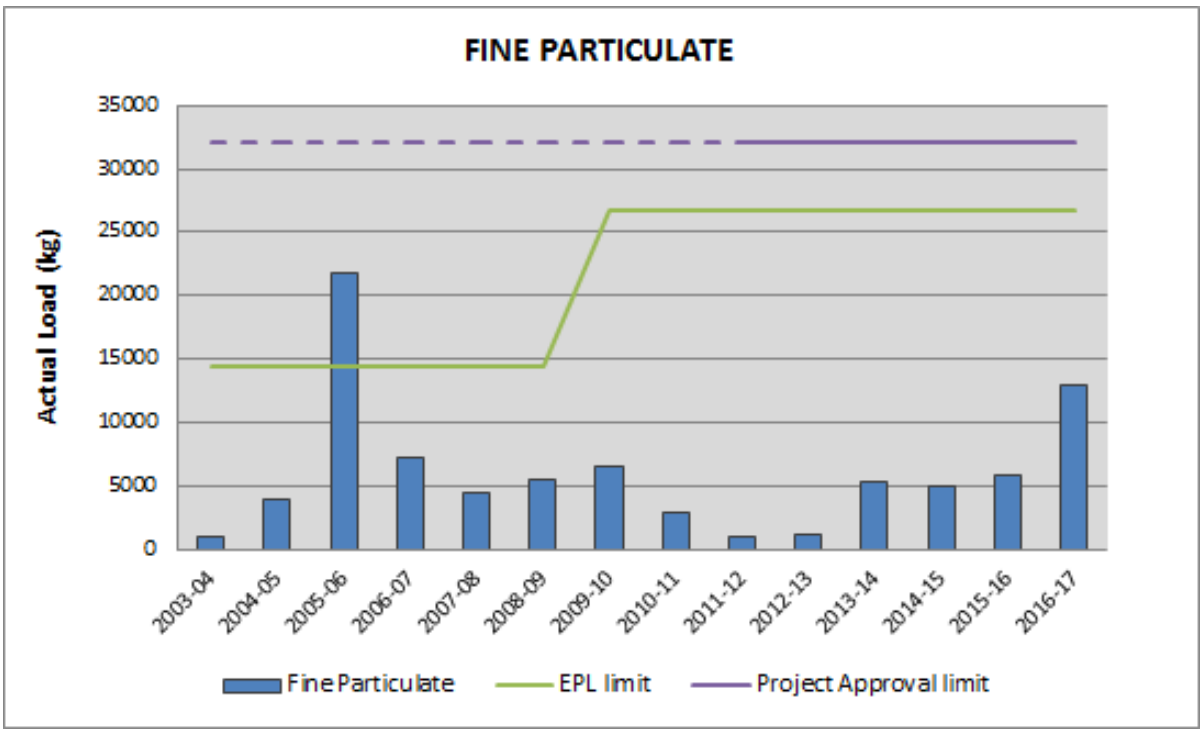

Figure 29 Fine particulate annual load (2004 – 2017)

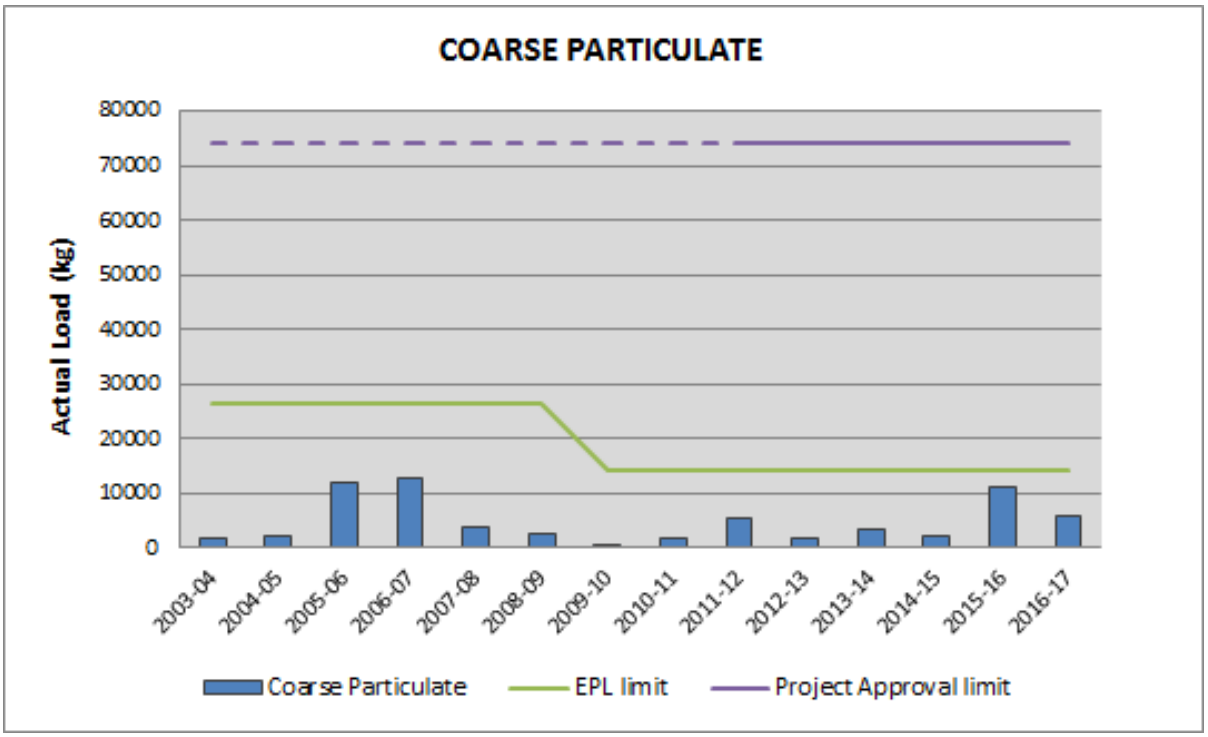

Figure 30 Coarse particulate annual load (2004 – 2017)

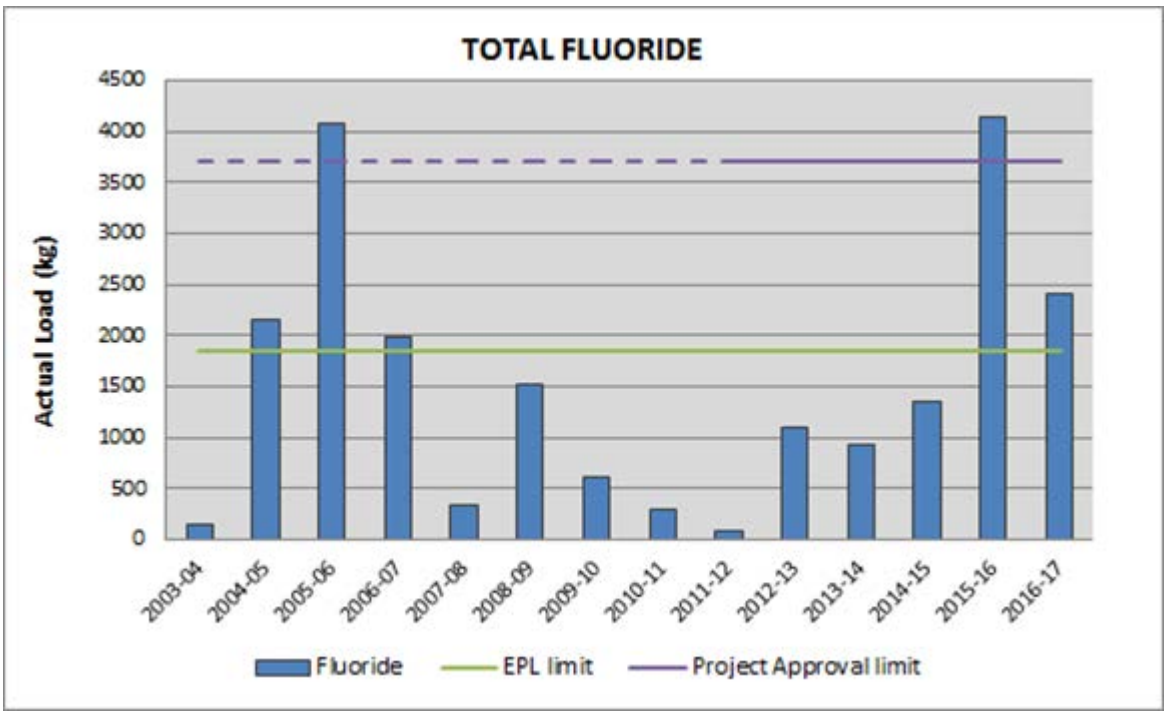

Figure 31 Fluoride annual load (2004 – 2017)

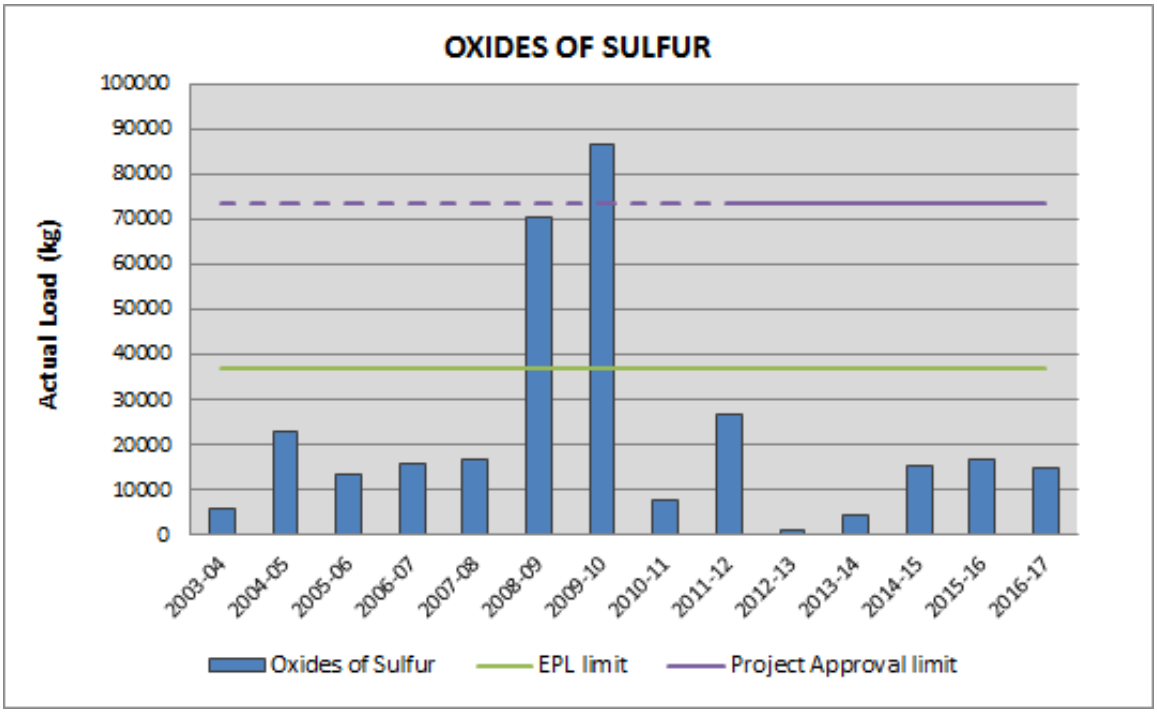

Figure 32 Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO_3)) annual load (2004 – 2017)

Note: Sulfur oxide loads for the 2012-13 and 2013-14 reporting years have been corrected to only include sulfuric acid mist and sulfur trioxide, as agreed with regulatory authorities in 2012, and not sulfur dioxide as previously calculated.

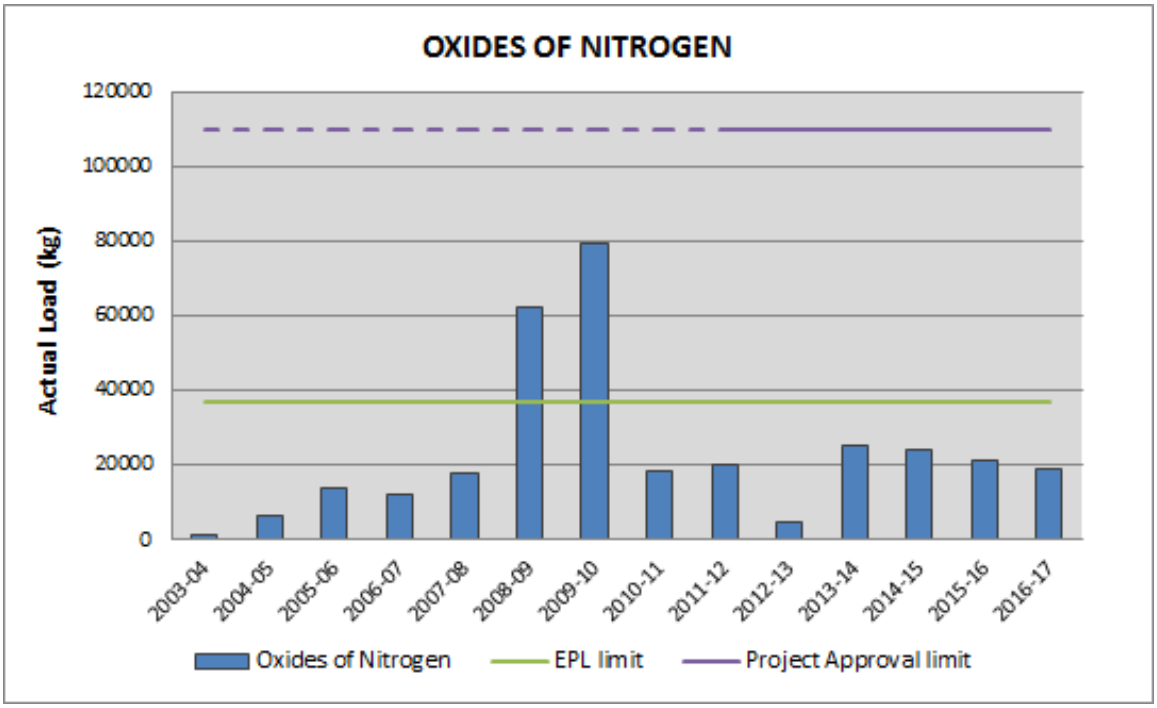

Figure 33 Nitrogen oxides annual load (2004 – 2017)

5.5 Noise

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

The Project Approval specifies more stringent noise limits than those set out in the EPL. Under the Project Approval noise generated from NCIA must not exceed 35 dB(A) for the day, evening and night periods.

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

Historical noise monitoring results at the Kenvil Close monitoring location are provided in Figure 34 – Figure 36 for the day, evening and night periods respectively. On many occasions NCIA was not clearly audible over other dominant nearby industrial and traffic noise sources.

No trends in the noise monitoring are clearly discernible with historical noise emissions generally complying with noise limits. No exceedance of the day, evening or night criteria has been recorded since 2009.

During the daytime for the past nine years the NCIA noise contribution was either inaudible or audible but not measurable. The current noise monitoring report noted that traffic noise from the New England Highway contributed significantly to the background noise levels at Kenvil Close.

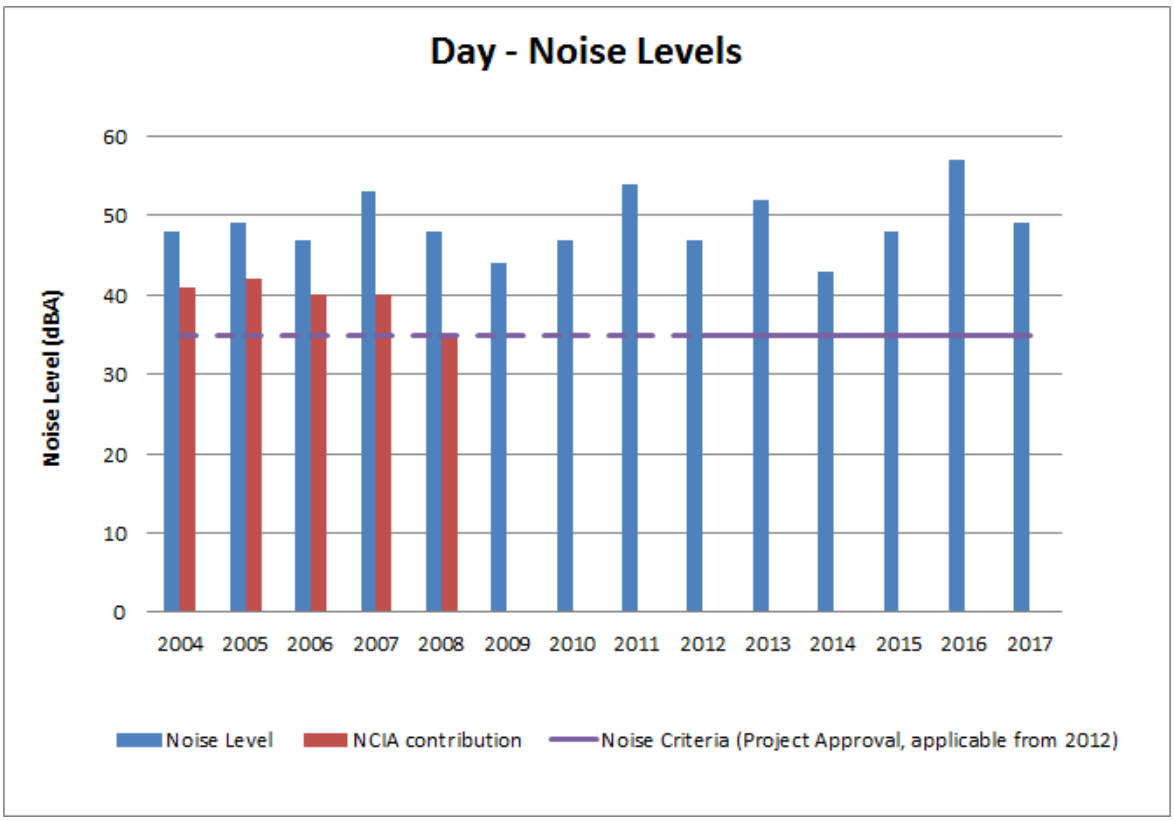

Figure 34 Day noise levels 2004 – 2017

Note 1: 2009 - 2017: NCIA contribution was either inaudible or not measurable.

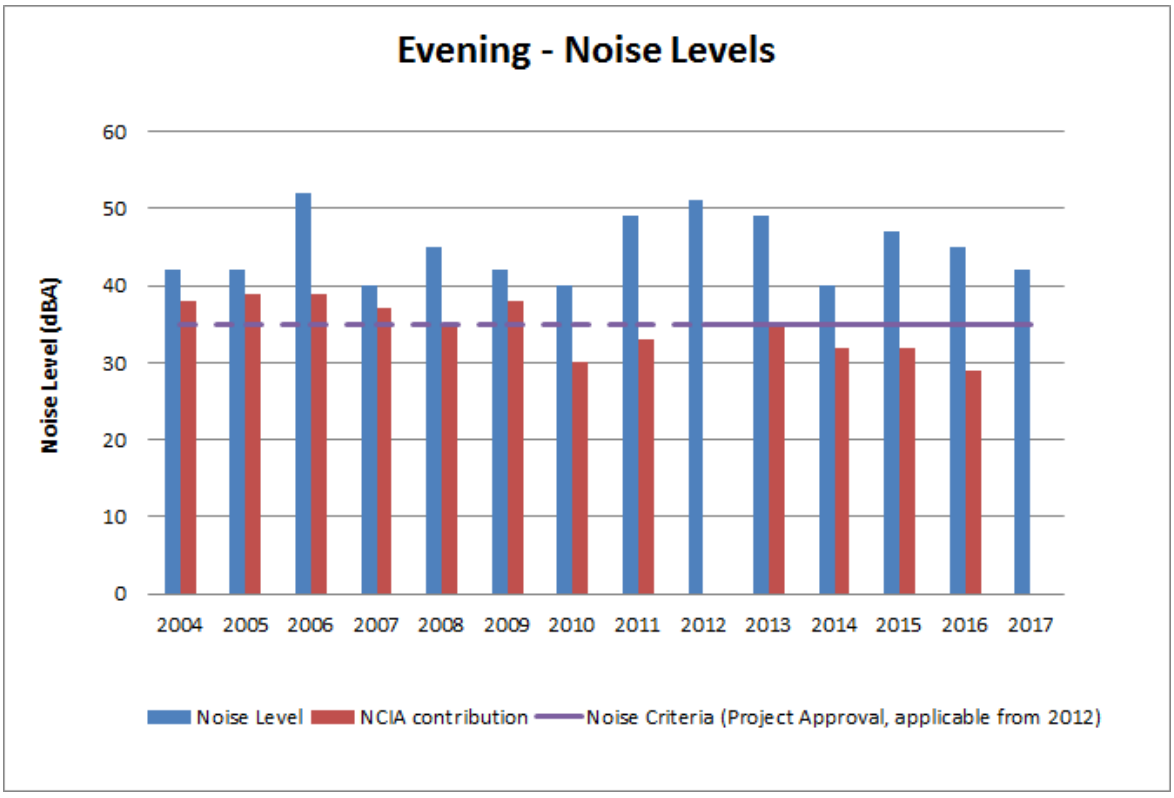

Figure 35 Evening noise levels 2004 – 2017

Note: 2012 and 2017: NCIA contribution was either inaudible or not measurable.

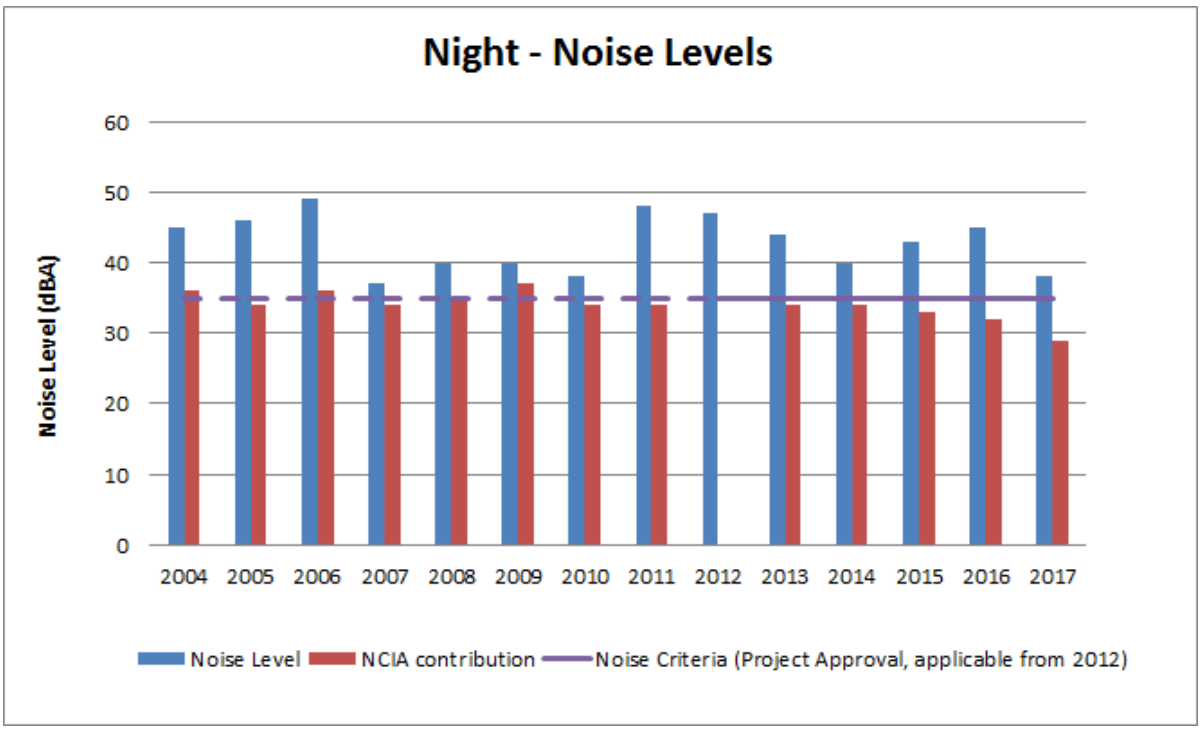

Figure 36 Night noise levels 2004 – 2017

Note: 2012: NCIA contribution audible but not measurable.

5.6 Water

5.6.1 Water Usage

The 2010 EA indicated that water consumption for the facility during Stages One–Four of the development would be approximately 1,772kL per week (approximately 92ML per annum). Stages Five–Eight of the development would be expected to use an equivalent volume of potable water as Stage One–Four for a cumulative expected consumption of up to 3,544kL per week (approximately 184ML per annum).

Consumption of potable water during the reporting period was approximately 47 ML, which is proportionally within the predictions of the EA given that only Stages One–Two were operational.

It is anticipated that the 92ML/year threshold usage over which NCIA will require HWC approval will not be reached until further stages of development are constructed and commissioned. Regardless, consultation with HWC was started during the 2010 EA process in provision of future developments. NCIA will resume the consultation process as required when further development stages are planned.

5.6.2 Process Water Management

As the requirement for water from NCIA has the potential to place stress on the town-water reticulation system (particularly during periods of drought), NCIA has endeavoured to minimise its reliance and demand for town water. Particularly, all process and wash-down water is recycled within the operation of the facility.

The NCIA facility does not result in the discharge of process or washdown water to the storm water system. Water used for process requirements is discharged in the form of steam to the atmosphere. Approximately 95% of all washdown water is captured within an internal reticulation system and recirculated for reuse as process water. The remaining 5% of washdown water evaporates.

Apart from discharges to the sewer from staff amenities there is no discharge of process or washdown water from the site other than as steam. Materials stored for the manufacturing process are housed within the building to ensure that there are no spills from the site.

Plant equipment operated at NCIA is maintained regularly and in accordance with manufacturer's specifications to ensure that water use, reuse and recycling efficiencies are optimised. The consumption of water is continually monitored via metering systems associated with plant equipment.

5.6.3 Stormwater Quality

Historical trends (2009-present) in water quality for pH and EC are presented in Figure 37 and Figure 38, respectively. The 2010 EA made no provision of stormwater quality performance measures or indicators.

Long term data shows that pH levels in pond 4 have generally been on a slowly increasing trend since 2009. On occasion since 2009 recorded pH values occurred beyond the ANZECC pH trigger values, with the upper threshold limit exceeded more often than the lower limit (refer to Figure 37), highlighting a trend towards alkalinity. This trend has continued during the current reporting period with four monitoring events showing pH results higher than the ANZECC trigger values (refer to Section 4.6.2). The previous two reporting periods showed a decreasing trend in pH levels however this trend has not continued in the current reporting period.

EC results since 2011 and inclusive of the current reporting period have remained relatively constant, oscillating around a relatively low average of 500 µS/cm (refer to Figure 38). A review of historical EC values indicates an overall decreasing trend. EC values are generally within the ANZECC guidelines trigger values and indicate that the stormwater is non-saline.

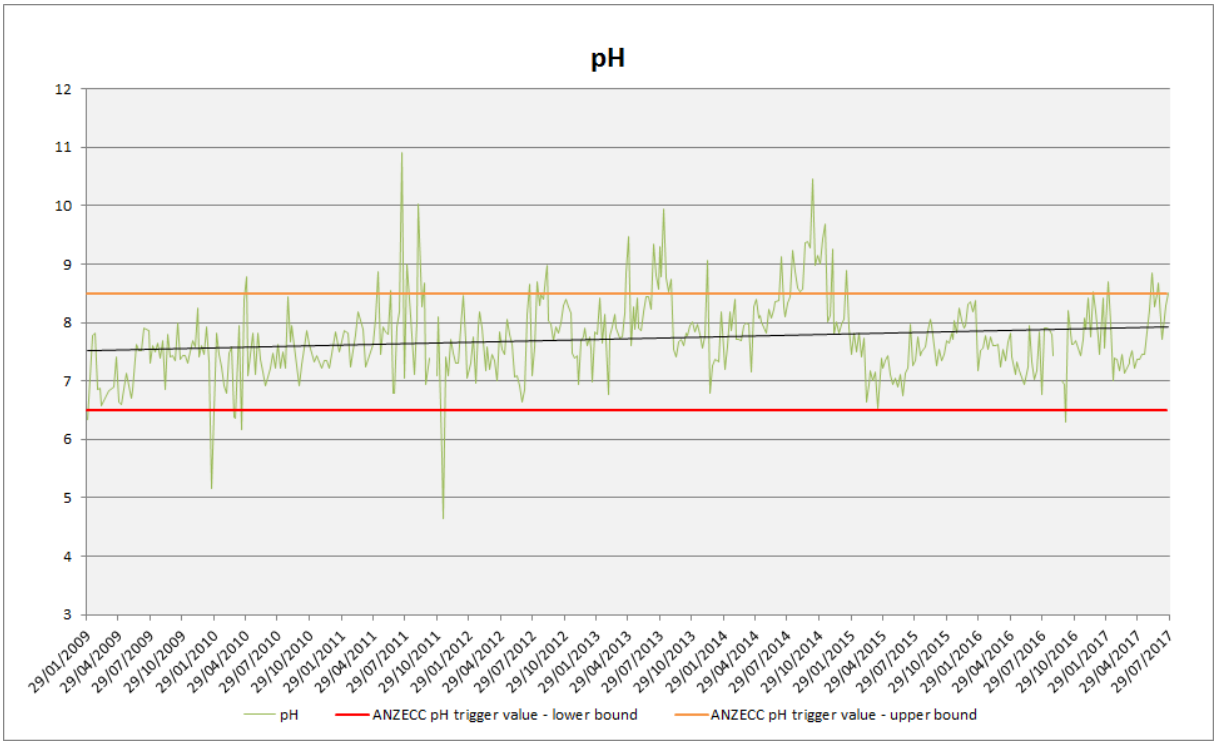

Figure 37 Stormwater quality, pH – Pond 4 (2009-2017)

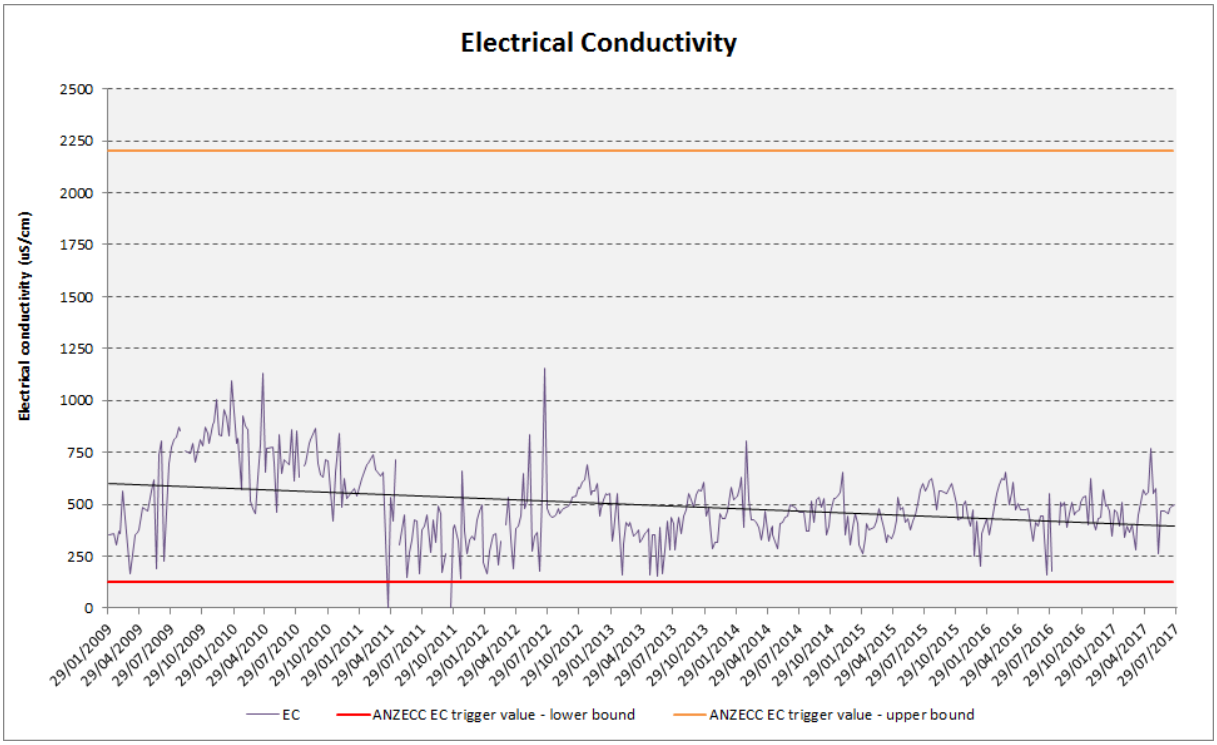

Figure 38 Stormwater quality, EC – Pond 4 (2009-2017)

5.6.4 Stormwater Management

The stormwater management system was designed to minimise the changes to the flow regime from Stages One–Four of the project. The management of stormwater at NCIA is achieved via four water detention basins which are connected by grass swales (managing surface water flows from roof, roadway and landscaped areas) and a series of pits and pipe work (servicing the car park and hardstand areas).

The grass swales have been designed to control surface flow velocities from runoff areas to no greater than 2 m/s. Final low flow stormwater discharges from the site occur at the channel outlet, located at the south eastern corner of the site (connected to Pond 4). Discharged storm water then connects directly to the existing neighbouring artificial wetland. To date there have been no observed discharges of stormwater from Pond 4.

The detention basins have been designed with sufficient retention to reduce peak stormwater flows and improve the quality of water ultimately discharged from the site. The combined surface area of the four water detention basins is approximately 6,600 m^2, which represents approximately 6.6% of the total catchment area. This exceeds the minimum requirement of 2% permanent water area defined in the *Constructed Wetlands Manual* (DLWC, 1998). As such, the level of water treatment offered by the wet detention system surpasses the guideline requirements.

As detailed in the 2010 EA, the existing stormwater management system will be modified and expanded if and when development Stages Five–Eight are constructed and commissioned.

5.7 Waste

5.7.1 Waste Generation

The 2010 EA stated that based on production levels at the time, approximately 1% of all fired tiles were not eligible for sale (either as broken tiles or not passing NCIA's strict quality assurance process). That figure was used to estimate the total amount of fired waste tile at maximum production rate (i.e. with Stages One – Eight operational), and predicted that approximately 2,720 tonnes of fired tiles waste would be generated per annum. The 2010 EA did not predict or specify the amount of green tile waste to be generated by the project.

The amount of fired tile waste during the reporting period (monthly average of 5.9% of total production) was higher than the predictions made in the EA, however close to NCIA's current operation targets. Overall, monthly fired tile waste levels were lower than the previous two reporting periods (monthly average of 9.5% and 12% of total tile production in 2016 and 2015 respectively).

Fired tile waste levels were at a record low in July 2017 (8.13% of total production) and NCIA has revised its KPI targets from 9.5% to 7% for the 2018 reporting year. NCIA continues to focus on waste as its biggest opportunity.

Monthly green tile waste levels have consistently been low and continued to remain below the 2% target throughout the reporting period, consistent with previous reporting years.

5.7.2 Waste Management

The totality of green tile waste generated during production is reused in the manufacturing process and as such does not enter the overall waste stream leaving the site. Likewise, since 2013 approximately 5% of the total amount of fired waste has been reused in the manufacturing process (i.e. milled again and re-sent through production line). The remaining fired waste is stored in a bunker on site ensuring that it is free of cardboard and other debris. Management and removal of this waste is handled by a licenced waste contractor. It is ultimately reused in the construction industry for road base material and other developments which greatly minimises the total amount of waste NCIA sends to landfill.

All fluoride compound waste is collected and disposed at an off-site licensed landfill.

All other waste (i.e. packaging waste, general office waste and lunch room waste) is collected by a licenced recycling or waste contractor. Incoming packaging waste such as pallets are reused wherever possible.

This page has been left blank intentionally.

6.0 Non-Compliances

6.1 2017 Non-Compliances Record

Five non-compliances were recorded during the 2017 reporting period. Details relating to the non-compliances and the actions taken to investigate or to prevent a recurrence are summarised in Table 16.

Table 16 Details of non-compliance with EPL or Project Approval conditions during the 2017 reporting period

Condition No / Reference	Details of Non-compliance	Action taken
Non-compliances recorded during the reporting period		
EPL Condition L2.2	The assessable pollutant load for fluoride discharged to air (2,411 kg) exceeded the pollutant load limit (1,850 kg) specified in this condition.	DP&E were notified of the non-compliance by telephone on receipt of the laboratory analytical results. The pollutant fee was calculated in accordance with the Load Calculation Protocol for ceramics production, as set out in the Annual Return worksheets. The cause of the non-compliance is considered to be variability in process and annual stack testing results. As a comparison, the fluoride emission result for Kiln 2 (EPL Point 15) using the same source material was 1.28 mg/m^3. All weekly and 24 hour ambient fluoride monitoring to the north west and south east of the facility returned results below relevant EPA guideline values.
EPL Condition L3.4	Annual stack emissions testing identified one exceedance of the Fluoride concentration limit of 5 mg/m^3: • 9.7 mg/m^3 at EPL Point 14 (Kiln 1).	As per EPL Condition L2.2 above.
Project Approval Condition 15	There were three exceedances of the 24 hour PM_{10} criterion (50 µg/m^3) at the NW monitoring station: • 57.9 µg/m^3 on 13 December 2016; • 88.6 µg/m^3 on 18 January 2017; and • 52.3 µg/m^3 on 24 January 2017.	DP&E were notified of the non-compliance upon receipt of the laboratory analytical results. The NCIA facility was shut down for annual maintenance from 7am on 13 December 2017 and is not likely to be the cause of this exceedance. Review of meteorological and ambient conditions for the 18 and 24 January indicate that the NCIA facility was unlikely to be a major contributor to the exceedance due to the presence of north westerly winds and elevated background levels on these days (refer Section 4.1.1).

6.2 Incident Notification

As required by DP&E, NCIA duly notifies any incident occurring on site or exceedance of regulatory criteria that causes, or may cause, harm to the environment. Wherever possible notification to DP&E is required within 24 hours of the incident / exceedance occurring (or being aware of the exceedance), detailing the nature of the incident and the response applied.

There were no reportable incidents during the 2017 reporting period, however there were a number of exceedances of EPL or Project Approval criteria (refer to Table 16). The exceedances were reported to DP&E by telephone upon receipt of laboratory analysis.

6.2.1 Show Cause Notice

NCIA received a Show Cause Notice from DP&E (correspondence dated 3 February 2017) with regard to one exceedance of the 24-hour PM_{10} criterion and one exceedance of the fluoride load limit as reported in the 2015-2016 AEMR. DP&E indicated that a number of breaches of the Project Approval may have occurred as a result of these exceedances and failure to report these as incidents.

NCIA provided a response to DP&E (AECOM, dated 17 February 2017) which outlined why these exceedances were not considered to have caused or to be likely to cause material harm to the environment and were therefore not considered to be reportable incidents. As NCIA did not consider that these exceedances caused or would cause material harm to the environment, they were not reported as incidents in accordance with Schedule 4 Condition 58 of the Project Approval. The exceedances were duly disclosed and reported in the AEMR for that reporting period (and to the NSW EPA through the Annual Return for that period). NCIA believed that it had acted in accordance and in compliance with the incident reporting requirements of the Project Approval.

DP&E accepted these representations and no further enforcement actions were taken. No breach of the conditions of consent was recorded.

As agreed through further discussions with DP&E, NCIA now reports all exceedances of performance criteria to the DP&E compliance team upon receipt of verified laboratory analysis.

6.2.2 DP&E review of previous AEMR

As part of the DP&E's Show Cause Notice, DP&E included a review of the 2015-2016 AEMR and noted that the report generally satisfies the requirements of the Project Approval. Three observations were made and these are outlined in Table 17 along with a response and action taken by NCIA to address the issue.

Table 17 DP&E observations on previous AEMR

DP&E Observation	NCIA response / Action taken
It is noted that only 94% of data capture was obtained during the 2015-2016 period for temperature. Please ensure that the unit is maintained to ensure at least 95% data capture if not greater.	NCIA committed to work with its supplier of meteorological monitoring services to achieve a 95% minimum data capture. As described in Section 5.3, meteorological monitoring equipment achieved continuous monitoring greater than 95% of the reporting period.
It is recommended that the NCIA Pollution Incident Response Management Plan (PIRMP) is reviewed to ensure that the Department is notified of all incidents as required by the approval under Schedule 4, Condition 58.	Review of the OEMP and its appendices (including the PIRMP and Emergency Plan has commenced and is due for completion in the 2017-2018 reporting period.
It is noted in section 7.0 Table 17 (IEA reference 83.55) that the Emergency Plan is to be updated to incorporate the use of spill prevention measures, however no timeframe for this update is provided. Please provide a timeframe when the update to the Emergency Plan will be completed.	Review of the OEMP and its appendices (including the PIRMP and Emergency Plan has commenced and is due for completion in the 2017-2018 reporting period.

7.0 Audit Recommendations and Action Plan

In 2015, an Independent Environmental Compliance Audit of the NCIA facility was undertaken by Graham A Brown and Associates (Final Report dated October 2015 – revised March 2016). The audit found that NCIA is generally in compliance with the conditions of its regulatory documents. A total of 138 compliance requirements were audited, of which NCIA achieved an overall compliance rate of 72%.

The audit identified 19 non-compliances and five administrative non-compliances. The auditors made recommendations against each non-compliance, as well as recommendations where compliance was achieved but an improvement in performance could be made. A full summary of the non-compliances identified, recommendations made by the auditors, and the action taken by NCIA to address each of the recommendations is provided in the 2016 AEMR. Recommendations which were considered to be completed in the 2016 AEMR (that is, the status was listed as 'action completed' in Table 17 of the 2016 AEMR) have not been reproduced within this 2017 AEMR.

Table 18 lists the outstanding audit recommendations and provides an update of the actions taken by NCIA to address the recommendation. Relevant observations by DP&E in its review of the 2016 AEMR (refer to Section 6.2.2) and the actions taken by NCIA to address these recommendations have also been incorporated into the action plan detailed in Table 18.

This page has been left blank intentionally.

Table 18 Audit recommendations and NCIA action plan

Audit Reference	Requirement	Audit Recommendation	Action Required / Undertaken	Responsibility	Status
Project Approval 09_0006					
S3.17	The Proponent shall: a) design, construct, operate and maintain the project in a manner that minimises or prevents the emission of dust from the site; b) take all practicable measures to ensure that all vehicles entering or leaving the site and carrying a load that may generate dust are covered at all times, except during loading and unloading. Any such vehicles shall be covered or enclosed in a manner that will prevent emissions of dust from the vehicle at all times; c) maintain all trafficable areas and vehicle manoeuvring areas on the site in a condition that will minimise the generation or emission of wind-blown or traffic generated dust from the site; and d) ensure each kiln is fitted with a dust collection system to capture emissions, to the satisfaction of the Secretary	**Complies** **3.17.1**. It is recommended that when the OEMP is replaced by an Environmental Management Strategy (prior to the commencement of any construction works) as required by Schedule 4 Condition 57 of this Approval, wording in a "Transport Code of Conduct" or similar section includes a requirement for all loads of bulk granular material delivered to the site to be covered in accordance with the "Load Restraint Guide".	Apply recommendation when OEMP is replaced by an Environmental Management Strategy.	NCIA	*Not yet required.* Implement recommendation prior to commencement of construction works associated with the next phase of the development.
S3.18	Unless otherwise specified by the Secretary, the Proponent shall: a) comply with all monitoring (points) requirements and pollutant discharge concentrations as specified by the OEH in the EPL; and b) ensure that the stack discharge design requirements comply with the EPL.	**Complies** **3.18.1** The terminology in the NCIA Emissions Testing Reports in future should refer to EPL 3, not EPL 2, and the second listing of EPL 10 in Table 4 should reference EPL 12 Spray Dryer (SD1).	Updated in the Emissions Testing Report 2016-2017.	NCIA	Action completed.

Audit Reference	Requirement	Audit Recommendation	Action Required / Undertaken	Responsibility	Status
S3.55	The Proponent shall ensure that the fuel storage tank is surrounded by a bund with a capacity to contain 110% of the largest tank within the bund. The bund(s) must be designed and installed in accordance with the requirements of the relevant Australian Standards and/or the OEH's Environmental Protection Manual Technical Bulletin Bunding and Spill Management.	**Complies** **3.55.1** The Emergency Plan should be revised if necessary to incorporate the use of any spill prevention measures established for the diesel tank.	NCIA maintains a bund that is well in excess of the 110% diesel tank storage that is required in 3.55. Consideration will be given to amending the Emergency Plan the next time an update is performed.	NCIA	*Not yet required* Implement recommendation when the Emergency Plan is next updated. To be completed in the 2017-2018 reporting period.
S4.58	Within 24 hours of the occurrence of an incident that causes (or may cause) harm to the environment, the Proponent shall notify the Department and any other relevant agencies of the incident.	**Not Triggered** **4.58.1** It is recommended that the Draft Emergency Plan be finalised and its requirements (e.g. for training) be implemented. The Emergency Plan should reference the PIRMP which could be included as an Appendix. The Notifications in the Emergency Plan should include, or make reference to, Table 2 in the PIRMP.	There have been no instances requiring notification and management believe they have appropriate systems in place for notifying the Department should an incident occur. The recommended amendments to the Emergency Plan will be actioned.	NCIA	*Not yet required* Implement recommendation when the Emergency Plan is next updated. To be completed in the 2017-2018 reporting period.
EPL 11956					
L5.1	Noise limits (refer to table in EPL)	**Complies** **L5.1.1** Spectrum Acoustics should ensure that future Noise Compliance reports reference the correct date for the Project Approval, i.e. 19 January 2012.	Updated in Noise Compliance Study (May 2017).	NCIA	Action completed.

Audit Reference	Requirement	Audit Recommendation	Action Required / Undertaken	Responsibility	Status
L5.2	Noise from the premises is to be measured at the most affected point on or within the receptor site boundary to determine compliance with this condition.	**Administrative Non-compliance** **L5.2.1** NCIA should request a variation of Condition L5.2 to obtain approval for the current noise monitoring to be conducted in the reserve at the western end of Kenvil Close and in a clearing adjacent to a residence in Wollombi Road, instead of on or within the receptor site boundary.	Request submitted to the NSW EPA on 25 October 2016.	NCIA	*Ongoing* Request submitted to the EPA 25/10/2016. No response received from the EPA.
L5.3	Noise from the premises shall not exceed the L A1(1 minute) noise level of 45 dB(A) at the nearest residential receiver most affected by noise from activities at the premises. The noise limit applies 1 metre from the dwelling façade and shall apply during the night period only.	**Non-compliance** **L5.3.1** NCIA should request a variation of Condition L5.3 to obtain approval for the noise monitoring to be conducted at a more accessible location, e.g. at the receptor site boundary as required in L5.2, or for a calculation method to be approved.	Request submitted to the NSW EPA on 25 October 2016.	NCIA	Ongoing Request submitted to the EPA 25/10/2016. No response received from the EPA.
L5.4	The noise emission limits specified above apply under all meteorological conditions except: a) during rain and wind speeds greater than 3 m/s; and b) from 6pm to 7am during intense inversions, which are indicated by cloud cover less than 40 per cent and wind speeds less than 1.0 m/s. Note: Wind data should be collected at 10m height.	**Complies** **L5.4.1** It is recommended that the validity of meteorological conditions applicable to compliance monitoring be investigated by interrogating the onsite weather station and not from the Bureau of Meteorology weather station at Cessnock.	This issue has been discussed with the noise consultants and data from the on-site meteorological monitoring station will be used during the next round of noise monitoring (2017-2018).	NCIA	To be completed in the 2017-2018 reporting period.

Audit Reference	Requirement	Audit Recommendation	Action Required / Undertaken	Responsibility	Status
M2.2	Requirement to monitor concentration of pollutants discharged.	**Complies** **M2.2.1** (repeat of Project Approval Recommendation 3.18.1)	Updated in the Emissions Testing Report 2016-2017.	NCIA	Action completed.
R1.5	**Annual return documents** The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').	**Administrative Non-compliance** **R1.5.1**. NCIA should review the requirements set out in the box in Section G of the Annual Return Form to determine if an alternative form of signature can be provided.	Management emailed the 2015 Annual Return to the EPA and followed later with the hard copy document with two directors having signed at the NCIA board meeting. Management have requested to the EPA that only one Director's signature be appropriate for future annual returns (request submitted to the NSW EPA on 25 October 2016).	NCIA	Ongoing Request submitted to the EPA 25/10/16. No response received from the EPA.

8.0 Continuous Improvement Measures

Condition 60(j) of the 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 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 throughout the 2017 reporting period. There were three exceedances of the PM_{10} 24 hour criterion, however review of processing and meteorological conditions on those days indicate that NCIA was not a major contributor to the exceedance. Stack emissions testing identified one exceedance of the Total Fluoride discharge limit at one emission source location (Kiln 1). Consequently the air pollutant load limit for fluoride was exceeded during the current reporting period. However it is noted that ambient air quality monitoring showed that fluoride levels were within the EPA (2016) guideline criteria for the entire reporting period.

Noise monitoring results for the current reporting period indicated 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 inaudible.

Environmental improvement measures recently implemented by NCIA are summarised in the following sections.

8.1 General Environmental Management

General environmental management actions undertaken by NCIA are outlined in Table 19.

Table 19 Timetable for environmental improvement actions

Area of Concern	Identified Action	Completion Date
Air quality	NCIA continues to research and test extensively to improve its raw material usage and emissions. Particular attention is given to fluoride and sulphur content when investigating new materials. An onsite laboratory has been established and is used for testing of inputs and outputs. NCIA aim to implement daily testing of raw materials and finished product and management of real time environmental monitoring information.	Ongoing
General stack maintenance	Install new components and perform repairs when necessary.	Ongoing
Plant maintenance	General housekeeping and investment in industry standard practice.	Ongoing
Lighting review	Changed all factory lighting in 2014 for lower energy LED lights.	Monitoring electricity efficiency improvements
Vegetation planting	Native vegetation planting and maintenance as per the proposed landscape vegetation planting plan in the 2010 EA.	Ongoing for care and maintenance
Solar photovoltaic (PV) project	NCIA is in the process of applying for Council approval to install a 1MW solar PV system on the roof of the facility. This is expected to reduce energy consumption by up to 15%. If successful, NCIA may install an additional 2MW system on the facility roof.	Expected to be operational mid-2018

Area of Concern	Identified Action	Completion Date
Heat recovery project	NCIA is in the process of installing a heat recovery system whereby waste hot air is piped from the kilns to the spray dryer. This is expected to reduce gas consumption between 15-20%.	Expected to be installed in February 2018
Kiln emission project	NCIA is investigating a project to direct kiln emission air through a filter system and input directly into the tile dryers. This would reduce emissions and reduce gas consumption.	Ongoing
Continuous pollution monitors	NCIA successfully trialled continuous fluoride monitors during the reporting period and were able to reconcile results obtained to the stack testing performed. NCIA is currently sourcing devices to install permanently.	Ongoing

8.2 Energy Efficiencies

As noted in previous AEMRs, a lot of NCIA's focus in recent times has been on achieving greater efficiencies. The objective is to achieve a greater tile production output for the same amount of power consumption and raw material input. For example, NCIA currently endeavours to improve the gas efficiency of the manufacturing process. Figure 39 shows the evolution since 2011 of the amount of gas required (in gigajoules GJ) to produce one square metre of tiles, with data showing an overall improving trend in gas efficiency.

NCIA is currently in the process of reducing the size and weight of tiles with a view to reduce the amount of raw material inputs, energy and transport components whilst still achieving the same amount of saleable product output (m^2 of tiles).

NCIA has installed a Quality Assurance (QA) machine before the kiln on each of its production lines. This effectively reduces waste tiles going through the kiln and being fired, creating both a reduction in waste and a saving in energy consumption.

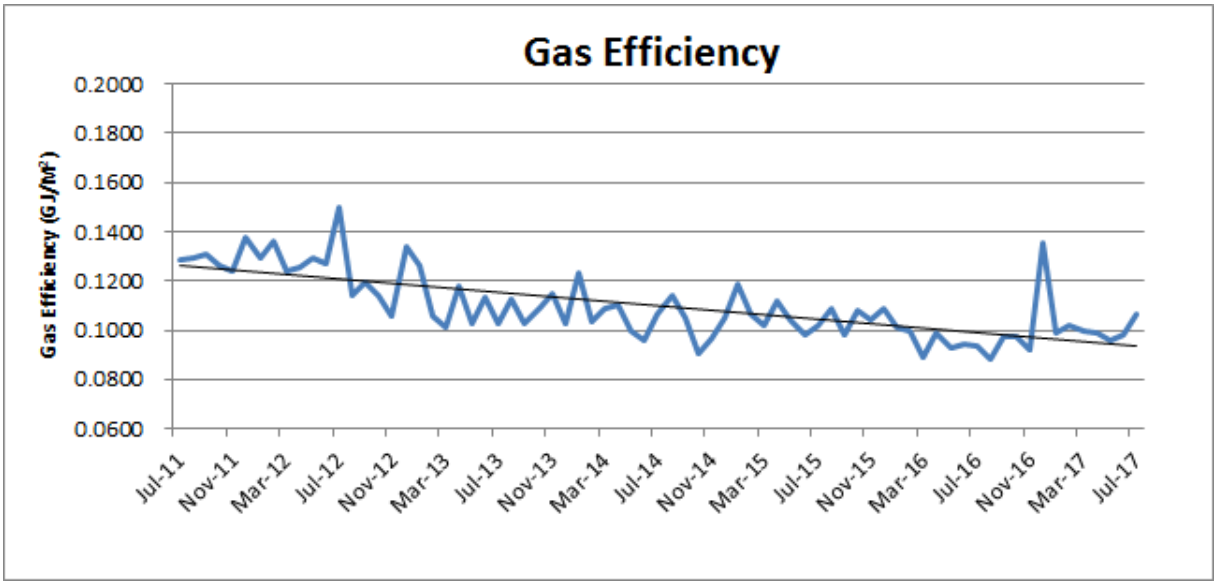

Figure 39 Gas efficiency in tile manufacturing process

In early 2015 NCIA engaged with the NSW EPA to identify potential opportunities in relation to energy efficiency and research. A summary of identified opportunities and associated potential savings are provided in Table 20. A number of these projects have been implemented or are in the process of being completed (as discussed in Table 19), including the solar PV project and the heat recovery project.

Other identified opportunities are being evaluated with some initiatives currently being trialled or rolled out in some of the National Ceramic Industries group's other facilities in South Africa (for example the efficiency gas burners). NCIA will closely monitor the progress of these initiatives being implemented and will consider adopting measures accordingly and where consistent with business objectives.

Table 20 Efficiency reviews – summary of opportunities

Description of Opportunity	Potential Electricity Savings (MWh per annum)	Potential Gas Savings (GJ per annum)	Potential GHG Savings (tonnes CO_2 per annum)
Notched V belts	151	-	160
Avoid leaving glazing line equipment running	155	-	164
Turn off second air wipe after press and install blower wipes	44	-	47
Install timer and switch to turn off warehouse induction lights at night	24	-	25
Install cooling chamber for tile cooling prior to inkjet	43	-	46
VSD on Comb air fan	234	-	248
Stop running scrap line v belt conveyor after kiln 1 (programming)	4	-	4
Install switches to allow switching off of T8 fluorescent lights	54	-	57
Purchasing policy for High Efficiency (E3) Motors	113	-	120
High efficiency burners (half replaced)	0	9,933	651
Poppi heat recovery option	-474	50,473	2,804
Stop bucket elevator when not required, resolve mechanical issues first	11	-	12
OEM Kiln heat recovery	76	26,488	1,816
Alternative combustion air preheat	0	8,500	557
Solar PV	139		147
TOTAL	**498**	**68,906**	**5,041**

This page has been left blank intentionally.

9.0 References

AECOM (2016) 2016 Annual Environmental Management Report 1 August 2015 – 31 July 2016, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, 28 October 2016.

AECOM (2015) 2015 Annual Environmental Management Report 19 January 2015 to 31 July 2015, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, 20 October 2015,

AECOM (2014) *Operational Environmental Management Plan*, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, 18 September 2014.

ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* – October 2000.

Australian Standard (2015) *AS/NZS 3580.9.6:2015 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM_{10} high volume sampler with size-selective inlet - Gravimetric method*. 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.

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.

EPA (2016) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Environment Protection Authority, NSW Government, Sydney.

EPA (2000) *NSW Industry Noise Policy.* Environment Protection Authority, NSW Government, Sydney.

Pscheidt, J.W. (2015) *Fluorine Toxicity in Plants*, Pacific Northwest Plant Disease Management Handbook, Oregon State University.

This page has been left blank intentionally.

Appendix A

Fluoride Impact on Vegetation Data

Appendix A1 – Vegetation Monitoring Sites

Area	Site #	Site location	Monitoring frequency	Location from the kiln stack
NCIA premises	1	Access road north of office	Annual	280m NW
	2	Office car park	Annual	120m W
	3	Access road south of office	Annual	160m W
	4	South-west corner of site	Annual	220m SW
	5	South-east corner of site	Quarterly	300m SE
Rutherford and Farley residential areas	6	3 Palisade Street	Annual	1.4km E
	7	3 Gillette Close	Quarterly	1.4km SE
	8	Regiment Road east of Dumont Court	Annual	1.5km SE
	9	Regiment Road south-east of Squadron Crescent	Annual	1.8kmSE
	10	Wollombi Road between sewage works and creek	Annual	2km SE
	11	Hill top on Wollombi Road, Farley	Quarterly	1.5km SE
	12	Western end of Quarry Road, Farley	Quarterly	2.3km S
Rutherford industrial estate	13	NCIA entrance, Racecourse Road	Quarterly	480m N
	14	99 Kyle Street	Quarterly	570m NW
	15	20 Gardiner Road	Quarterly	500m NW
	16	56 Gardiner Road	Annual	450m W
	17	Gardiner Road, southern end	Annual	550 SW
	18	Maitland Saleyards, Kyle Street	Quarterly	920m NW
Anambah homestead	19	200 Anambah Road – Reference site	Quarterly	3km N

Site 1 – Access road north of office

Site 2 – Office car park

Site 3 – Access road south of office

Site 4 – South-west corner of site

Site 5 – South-east corner of site

Site 6 – 3 Palisade Street

Site 7 – 3 Gillette Close

Site 8 – Regiment Road east of Dumont Court

Site 9 – Regiment Road south-east of Squadron Crescent

Site 10 – Wollombi Road between sewage works and creek

Site 11 – Hill top on Wollombi Road, Farley

Site 12 – Western end of Quarry Road, Farley

Site 13 – NCIA entrance, Racecourse Road

Site 14 – 99 Kyle Street

Site 15 – 20 Gardiner Road

Site 16 – 56 Gardiner Road

Site 17 – Gardiner Road, southern end

Site 18 – Maitland Saleyards, Kyle Street

Site 19 – 200 Anambah Road (Reference site)

Appendix A2 – Visual Injury Expression Survey Results

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Site 1 – Access road north of office															
Acacia filicifolia	Q4 2016	**2**	**2**	old	2	0	0	0	0	0	0	0	0	✓	0
Acacia longifolia	Q4 2016	**2**	**2**	old	0	2	0	0	0	0	0	0	0	0	0
Corymbia citriodora	Q4 2016	**4**	**4**	new	3	4	2	0	0	1	1	0	0	0	0
		6	**6**	old	6	2	3	0	0	1	2				
Eucalyptus moluccana	Q4 2016	**1**	**3**	new	0	2	0	0	0	3	1	0	0	✓	✓
		2	**2**	old	0	2	2	1	0	0	1				
Eucalyptus robusta 1	Q4 2016	**2**	**2**	new	2	2	1	0	0	1	1	0	0	0	0
		4	**4**	old	4	3	3	0	0	0	1				
Eucalyptus robusta 2	Q4 2016	**1**	**2**	new	0	1	0	0	0	2	1	0	0	0	✓
		1	**2**	old	1	1	1	1	0	2	1				
Site 2 – Office car park															
Corymbia maculata	Q4 2016	**4**	**4**	new	4	2	2	1	0	1	0	5	5	0	0
		4	**4**	old	3	4	3	3	0	4	0				
Eucalyptus robusta	Q4 2016	**1**	**2**	new	0	1	0	0	0	2	1	0	0	0	0
		3	**3**	old	3	2	1	0	0	1	1				
Fraxinus pennsylvanica	Q4 2016	**1**	**1**	old	1	0	1	0	0	0	0	0	0	0	0
Site 3 – Access road south of office															
Acacia parramattensis	Q4 2016	**1**	**1**	old	1	0	0	0	0	0	0	0	0	✓	0
Hakea salicifolia	Q4 2016	**1**	**1**	old	0	0	1	0	0	0	0	0	0	0	✓
Eucalyptus sp.	Q4 2016	**3**	**3**	new	3	3	2	1	0	0	0	0	0	0	0
		3	**3**	old	2	1	3	3	0	0	0				
Site 4 – South-west corner of site															
Acacia longifolia	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Bursaria spinosa	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	-	✓	0
Typha sp.	Q4 2016	**2**	**2**	old	0	0	2	0	0	0	0	0	0	0	✓
Eucalyptus amplifolia	Q4 2016	**1**	**2**	new	0	1	0	0	0	2	2	0	0	0	✓
		2	**2**	old	0	2	0	0	0	2	2				
Site 5 – South-east corner of site															
Eucalyptus moluccana	Q3 2016	**-**	**-**	new	**-**	**-**	**-**	**-**	**-**	**-**	**-**	0	0	0	0
		3	**1**	old	0	2	1	0	3	1	1				
	Q4 2016	**1**	**3**	new	0	1	0	0	0	3	0	0	0	0	0
		2	**2**	old	2	2	1	0	0	2	2				
	Q1 2017	**1**	**1**	new	0	1	0	0	0	1	0	0	0	0	0
		2	**3**	old	0	2	1	1	0	1	3				

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
	Q2 2017	**2**	**2**	new	0	2	1	0	0	1	0	0	0	0	0
		2	**2**	old	2	2	1	0	1	1	1				
Bursaria spinosa	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	✓	0
Acacia longifolia	Q4 2016	**1**	**1**	old	0	0	1	0	0	1	0	0	0	0	✓
Site 6 – 3 Palisade Street															
Corymbia maculata 1	Q4 2016	**2**	**3**	new	0	2	0	0	0	3	0	0	0	0	0
		5	**5**	old	1	5	0	1	0	0	0				
Corymbia maculata 2	Q4 2016	**2**	**2**	new	0	2	0	0	0	1	1	0	0	0	0
		3	**3**	old	1	3	1	0	0	1	3				
Bursaria spinosa	Q4 2016	**2**	**2**	old	2	0	0	0	0	0	0	0	-	0	0
Olea europaea	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Ficus macrophylla	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
Site 7 – 3 Gillette Close															
Eucalyptus acmenoides	Q3 2016	**0**	**1**	new	0	0	0	0	0	1	1	0	0	✓	✓
		3	**3**	old	2	0	3	0	0	1	2				
	Q4 2016	**0**	**2**	new	0	0	0	0	0	2	0	0	0	0	✓
		4	**4**	old	4	0	0	0	0	1	1				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	0	0	0	0	✓
		2	**2**	old	2	0	1	0	0	0	1				
	Q2 2017	**1**	**1**	new	1	0	1	0	0	1	1	0	0	✓	✓
		2	**2**	old	2	0	1	0	0	1	1				
Corymbia maculata	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	2	0	0	0
		2	**2**	old	0	2	2	1	1	1	1				
	Q4 2016	**0**	**2**	new	0	0	0	0	0	2	1	1	1	0	0
		3	**3**	old	3	2	1	0	0	0	0				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	0	2	0	0	0
		3	**3**	old	3	3	2	0	0	0	1				
	Q2 2017	**1**	**1**	new	0	1	1	0	0	1	1	2	0	0	0
		3	**3**	old	3	3	2	0	0	1	2				
Bursaria spinosa	Q4 2016	1	1	old	1	0	0	0	0	0	0	0	-	0	0
Acacia podalyriifolia	Q4 2016	3	3	new	3	0	0	0	0	0	0	0	0	0	0
		5	5	old	5	0	0	1	0	0	0				
Site 8 – Regiment Road east of Dumont Court															
Acacia baileyana	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	✓	0
Corymbia maculata	Q4 2016	**3**	**3**	new	3	3	1	0	0	0	0	0	0	0	0

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
		3	**3**	old	1	3	2	1	0	1	2				
Eucalyptus resinfera	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	✓
		2	**2**	old	2	1	1	0	0	1	1				
Bursaria spinosa	Q4 2016	**2**	**2**	old	2	0	0	0	0	0	0	0	-	0	0
Eucalyptus acmenoides	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	✓
		3	**3**	old	3	0	3	0	0	1	1				
Lophostemon confertus	Q4 2016	**0**	**1**	old	0	0	0	0	0	1	0	0	0	0	0
Grevillea robusta	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
Site 9 – Regiment Road south-east of Squadron Crescent															
Bursaria spinosa	Q4 2016	**2**	**2**	old	2	0	0	0	0	0	0	2	-	0	0
Eucalyptus resinfera	Q4 2016	**0**	**1**	new	0	0	0	0	0	1	0	0	0	0	✓
		1	**1**	old	0	0	1	0	0	1	1				
Site 10 – Wollombi Road between sewage works and creek															
Casuarina glauca	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Fraxinus excelsior	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Grevillea robusta	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Populus nigra	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Acacia podalyriifolia	Q4 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	0	0	0
		2	**2**	old	2	0	0	0	0	0	0				
Bursaria spinosa	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	1	0	0	0
Site 11 – Hill top on Wollombi Road, Farley															
Corymbia maculata	Q3 2016	**0**	**1**	new	0	0	0	0	0	1	0	0	0	✓	✓
		1	**1**	old	0	1	1	0	0	1	1				
	Q4 2016	**0**	**2**	new	0	0	0	0	0	2	1	0	0	0	0
		2	**2**	old	0	2	1	0	0	1	1				
	Q1 2017	**0**	**2**	new	0	0	0	0	0	2	1	0	0	✓	✓
		1	**1**	old	0	0	1	0	0	0	1				
	Q2 2017	**1**	**1**	new	0	1	0	0	0	1	1	0	0	0	0
		1	**2**	old	0	1	1	0	0	2	2				
Eucalyptus paniculata	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		0	**2**	old	0	0	0	0	0	2	1				
	Q4 2016	**0**	**4**	new	0	0	0	0	0	4	1	0	0	0	✓
		0	**3**	old	0	0	0	0	0	3	1				
	Q1 2017	**0**	**2**	new	0	0	0	0	0	2	0	0	0	0	0
		1	**2**	old	0	1	0	0	0	2	0				

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	0
		1	**1**	old	0	0	0	0	1	1	0				
Bursaria spinosa	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	-	0	✓
Hakea gibbosa	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
Site 12 – Western end of Quarry Road, Farley															
Corymbia maculata	Q3 2016	**0**	**3**	new	0	0	0	0	0	3	1	0	0	✓	0
		2	**4**	old	0	2	0	0	0	4	2				
	Q4 2016	**3**	**3**	new	0	3	0	0	0	1	0	0	0	0	0
		1	**2**	old	0	1	0	0	0	2	1				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	1	0	0	✓	0
		2	**2**	old	0	2	1	0	0	2	2				
	Q2 2017	**1**	**1**	new	0	1	0	0	0	1	1	0	0	0	0
		1	**2**	old	0	1	1	0	0	1	2				
Eucalyptus paniculata	Q3 2016	**0**	**2**	new	0	0	0	0	0	0	2	0	0	0	✓
		1	**1**	old	0	1	0	0	1	1	1				
	Q4 2016	**0**	**3**	new	0	0	0	0	0	3	1	0	0	0	✓
		0	**1**	old	0	0	0	0	0	1	0				
	Q1 2017	**0**	**2**	new	0	0	0	0	0	2	0	0	0	0	0
		1	**1**	old	0	1	0	0	0	1	0				
	Q2 2017	**1**	**1**	new	0	1	0	0	0	1	1	0	0	0	0
		1	**1**	old	0	1	0	0	1	1	0				
Pinus radiata	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Site 13 – NCIA entrance, Racecourse Road															
Corymbia maculata	Q3 2016	**3**	**3**	new	0	3	0	0	0	0	0	2	2	✓	0
		4	**4**	old	4	2	2	0	0	1	1				
	Q4 2016	**2**	**2**	new	0	2	1	0	0	0	2	2	2	0	0
		3	**3**	old	3	3	3	1	0	0	1				
	Q1 2017	**3**	**3**	new	3	2	2	0	0	2	1	2	2	0	0
		3	**3**	old	1	3	2	0	0	1	2				
	Q2 2017	**0**	**0**	new	0	0	0	0	0	0	0	2	2	0	0
		3	**3**	old	3	2	1	0	0	0	0				
Eucalyptus amplifolia	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	2	2	0	0
		1	**1**	old	0	0	1	0	0	1	1				
	Q4 2016	**0**	**1**	new	0	0	0	0	0	1	1	2	2	✓	0
		1	**2**	old	0	0	1	0	0	1	2				

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	1	2	2	✓	0
		0	**2**	old	0	0	0	0	0	2	1				
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	2	2	0	0
		1	**2**	old	0	0	1	0	1	2	1				
Olea Europea	Q4 2016	**2**	**2**	old	0	2	0	0	0	0	0	0	0	✓	0
Site 14 – 99 Kyle Street															
Angophora floribunda	Q3 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	3	0	0
		1	**1**	old	1	1	1	1	1	0	1				
	Q4 2016	**1**	**1**	new	0	0	1	0	0	1	0	0	3	✓	0
		2	**2**	old	1	2	1	1	0	0	1				
	Q1 2017	**2**	**2**	new	2	1	1	0	0	0	0	0	3	0	✓
		3	**3**	old	1	3	1	0	0	0	1				
	Q2 2017	**3**	**3**	new	0	3	0	0	0	1	0	0	3	0	0
		3	**3**	old	2	3	1	0	1	0	0				
Eucalyptus amplifolia	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		2	**2**	old	0	2	1	0	0	1	1				
	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		2	**2**	old	1	2	2	0	0	0	2				
	Q1 2017	**1**	**1**	new	0	1	1	0	0	1	1	0	0	✓	0
		2	**3**	old	0	2	2	0	0	1	3				
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		2	**2**	old	0	2	2	0	1	0	2				
Site 15 – 20 Gardiner Road															
Corymbia maculata	Q3 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	0	0	0
		3	**3**	old	3	2	2	1	0	1	1				
	Q4 2016	**3**	**3**	new	3	3	3	0	0	0	0	0	0	0	0
		4	**4**	old	2	3	4	0	0	0	0				
	Q1 2017	**4**	**4**	new	3	4	3	0	0	1	1	0	0	0	0
		3	**3**	old	2	3	3	2	0	0	1				
	Q2 2017	**2**	**2**	new	2	2	0	0	0	0	1	0	0	0	0
		4	**4**	old	4	3	4	0	0	0	1				
Eucalyptus paniculata	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		3	**3**	old	0	0	3	0	0	0	1				
	Q4 2016	**0**	**1**	new	0	0	0	0	0	1	0	0	0	✓	0
		0	**2**	old	0	0	0	0	0	2	1				

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	1	0	0	✓	0
		1	**2**	old	0	0	1	0	0	1	2				
	Q2 2017	**1**	**1**	new	0	0	1	0	0	0	1	0	0	✓	0
		3	**3**	old	0	0	3	1	0	1	2				
Site 16 - 56 Gardiner Road															
Corymbia maculata	Q4 2016	**1**	**1**	new	0	1	1	0	0	0	1	0	0	✓	0
		3	**3**	old	3	2	3	1	0	0	1				
Site 17 – Gardiner Road, Southern end															
Bursaria spinosa	Q4 2016	**1**	**1**	old	1	0	0	0	0	0	0	1	0	0	0
Olea europaea	Q4 2016	**1**	**1**	old	0	1	0	0	0	0	0	0	0	0	0
Corymbia maculata 1	Q4 2016	**1**	**2**	new	0	1	1	0	0	2	1	0	0	0	0
		2	**2**	old	1	2	2	2	0	1	1				
Corymbia maculata 2	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	0
		2	**2**	old	0	2	0	0	0	2	1				
Eucalyptus fibrosa	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		0	**2**	old	0	0	0	0	0	2	0				
Eucalyptus punctata	Q4 2016	**1**	**1**	new	0	1	1	0	0	1	0	0	0	✓	✓
		1	**1**	old	0	1	1	0	0	1	0				
Site 18 – Maitland Saleyards, Kyle Street															
Corymbia maculata	Q3 2016	**1**	**1**	new	0	1	0	0	0	0	0	0	0	0	0
		4	**4**	old	1	2	4	0	0	0	1				
	Q4 2016	**3**	**3**	new	0	3	2	0	0	0	0	0	0	0	0
		2	**2**	old	0	1	2	0	0	0	2				
	Q1 2017	**3**	**3**	new	2	1	3	0	0	0	1	0	0	✓	0
		2	**2**	old	0	1	2	0	0	1	1				
	Q2 2017	**1**	**1**	new	0	1	0	0	0	0	1	0	0	0	0
		2	**2**	old	1	1	2	0	0	1	1				
Eucalyptus amplifolia	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	✓
		1	**2**	old	0	0	1	0	0	2	1				
	Q4 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	0	0	0
		1	**2**	old	0	0	1	0	0	2	1				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	0	0	0	✓	0
		2	**2**	old	0	2	1	0	0	2	1				
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	0
		1	**1**	old	0	0	1	0	0	0	1				

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Eucalyptus moluccana	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	0
		3	**3**	old	0	0	1	0	3	2	1				
	Q4 2016	**0**	**3**	new	0	0	0	0	0	3	1	0	0	0	0
		1	**2**	old	0	1	1	0	0	2	1				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	0	0	0	0	0
		1	**1**	old	0	1	1	0	0	1	0				
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	0	0	0	0
		0	**2**	old	0	0	0	0	0	2	1				
Eucalyptus resinfera	Q3 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	✓
		2	**2**	old	0	1	2	0	0	1	1				
	Q4 2016	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		1	**1**	old	0	1	0	0	0	1	0				
	Q1 2017	**0**	**1**	new	0	0	0	0	0	1	0	0	0	✓	0
		2	**2**	old	0	2	0	0	0	1	0				
	Q2 2017	**-**	**-**	new	-	-	-	-	-	-	-	0	0	✓	0
		3	**3**	old	0	3	0	0	0	0	0				
Site 19 – 200 Anambah Road – Reference site															
Angophora costata	Q4 2016	**0**	**0**	mix	0	0	0	0	0	0	0	2	2	0	0
Araucaria cunninghamii	Q3 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
	Q1 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
	Q2 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Brachychiton acerifolius	Q4 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	0	0	0

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Casuarina torulosa	Q3 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
	Q1 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
	Q2 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	✓
Corymbia citriodora	Q4 2016	**2**	**2**	mix	0	2	2	0	0	2	2	0	0	0	0
Corymbia maculata	Q3 2016	**2**	**2**	old	0	2	2	0	0	1	1	0	0	0	0
	Q4 2016	**3**	**3**	mix	0	3	1	0	0	0	0	0	0	0	0
	Q1 2017	**2**	**2**	mix	0	2	0	0	0	2	0	0	0	0	0
	Q2 2017	**3**	**3**	old	0	3	0	0	0	3	1	3	3	0	0
Ficus microphylla	Q3 2016	**0**	**1**	old	0	0	0	0	0	1	0	0	0	✓	0
	Q4 2016	**0**	**1**	old	0	0	0	0	0	1	0	0	0	0	✓
	Q1 2017	**0**	**0**	mix	0	0	0	0	0	0	0	0	0	0	0
	Q2 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	✓	0
Grevillea robusta	Q3 2016	**0**	**0**	old	0	0	0	0	0	0	0	2	0	0	0
	Q4 2016	**0**	**0**	old	0	0	0	0	0	0	0	1	0	0	0
	Q1 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
	Q2 2017	**0**	**0**	old	0	0	0	0	0	0	0	0	0	0	0
Macadamia integrifolia	Q4 2016	**3**	**3**	old	0	3	0	0	0	0	0	0	0	0	✓
Eucalyptus acmenoides	Q3 2016	**1**	**1**	old	0	1	0	0	0	1	1	0	0	0	0
	Q4 2016	**1**	**2**	old	0	1	1	0	0	2	0	0	0	0	✓
	Q1 2017	**1**	**1**	mix	0	0	1	0	0	1	0	0	0	0	0
	Q2 2017	**0**	**3**	old	0	0	0	0	0	3	1	0	0	0	✓
Eucalyptus dives	Q4 2016	**2**	**2**	mix	0	2	0	0	0	2	1	0	0	0	✓
Eucalyptus grandis	Q4 2016	**1**	**2**	mix	0	1	1	0	0	2	0	0	0	0	✓
Eucalyptus robusta	Q4 2016	**0**	**1**	mix	0	0	0	0	0	1	0	0	0	0	✓
Eucalyptus tereticornis	Q3 2016	**1**	**1**	old	0	1	1	0	0	0	1	0	0	0	0
	Q4 2016	**2**	**2**	old	0	2	2	0	0	2	2	0	0	0	0
	Q1 2017	**1**	**1**	mix	0	1	1	0	0	1	0	0	0	0	0
	Q2 2017	**2**	**3**	old	0	2	2	0	0	3	1	0	0	0	0
Olea europaea	Q3 2016	**1**	**1**	old	0	1	0	0	0	0	0	0	0	0	0
	Q4 2016	**1**	**1**	old	0	1	0	0	0	0	0	0	0	0	✓
	Q1 2017	**1**	**1**	old	0	1	0	0	0	0	0	0	0	0	✓
	Q2 2017	**1**	**1**	old	0	1	0	0	0	0	0	0	0	0	✓
Vitis vinifera	Q3 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	0	✓	0

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
	Q4 2016	**0**	**0**	new	0	0	0	0	0	0	0	0	-	0	✓
	Q1 2017	**0**	**0**	new	0	0	0	0	0	0	0	0	0	0	0
	Q2 2017	**-**	**-**	-	-	-	-	-	-	-	-	-	-	-	-

Table key:

* *'new' = assessment undertaken on current season leaves, 'old' = assessment undertaken on previous seasons leaves, 'mix' = assessment undertaken on both current and previous season leaves.*

For the assessment of reproductive strictures, '✓' means presence and 'x' means absence

\- *Indicates no visual assessment was undertaken due to the absence of foliage.*

This page has been left blank intentionally.

Appendix A3 – Foliage Condition Photographs

Site 1 – Access road north of office	
***Eucalyptus robusta* 1 (Q4 2016)**	***Eucalyptus robusta* 2 (Q4 2016)**
	
***Corymbia citriodora* (Q4 2016)**	***Eucalyptus moluccana* (Q4 2016)**
	
Site 2 – Office car park	
***Corymbia maculata* (Q4 2016)**	***Eucalyptus robusta* (Q4 2016)**
	

Site 3 – Access road south of office	
***Hakea salicifolia* (Q4 2016)**	***Eucalyptus sp.* (Q4 2016)**
	
Site 4 – South-west corner of site	
***Acacia longifolia* (Q4 2016)**	***Eucalyptus amplifolia* (Q4 2016)**
	
Site 5 – South-west corner of site	
***Eucalyptus moluccana* (Q3 2016)**	***Bursaria spinosa* (Q4 2016)**
	

Site 6 – 3 Palisade Street	
***Corymbia maculata 1* (Q4 2016)**	***Bursaria spinosa* (Q4 2016)**
	
Site 7 – 3 Gillette Close	
***Eucalyptus acmenoides* (Q1 2017)**	***Corymbia maculata* (Q3 2016)**
	
Site 8 – Regiment Road east of Dumont Court	
***Corymbia maculata* (Q4 2016)**	***Eucalyptus acmenoides* (Q4 2016)**
	

Site 8 – Regiment Road east of Dumont Court (continued)	
***Eucalyptus resinfera* (Q4 2016)**	***Bursaria spinosa* (Q4 2016)**
	
Site 9 – Regiment Road south-east of Squadron Crescent	
***Bursaria spinosa* (Q4 2016)**	***Eucalyptus resinfera* (Q4 2016)**
	
Site 10 – Wollombi Road between sewage works and creek	
***Fraxinus excelsior* (Q4 2016)**	***Populus nigra* (Q4 2016)**
	

Site 11 – Hill top on Wollombi Road, Farley	
***Corymbia maculata* (Q3 2016)**	***Eucalyptus paniculata* (Q2 2017)**
	
Site 12 – Western end of Quarry Road, Farley	
***Corymbia maculata* (Q1 2017)**	***Eucalyptus paniculata* (Q1 2017)**
	
Site 13 – NCIA entrance, Racecourse Road	
***Corymbia maculata* (Q2 2017)**	***Eucalyptus amplifolia* (Q1 2017)**
	

Site 14 – 99 Kyle Street	
***Angophora floribunda* (Q1 2017)**	***Eucalyptus amplifolia* (Q2 2017)**
	
Site 15 – 20 Gardiner Road	
***Corymbia maculata* (Q1 2017)**	***Eucalyptus paniculata* (Q3 2016)**
	
Site 16 - 56 Gardiner Road	
***Corymbia maculata* (Q4 2016)**	
	

Site 17 – Gardiner Road, Southern end	
Corymbia maculata 1 **(Q4 2016)**	***Corymbia maculata 2*** **(Q4 2016)**
	
Eucalyptus fibrosa **(Q4 2016)**	***Eucalyptus punctata*** **(Q4 2016)**
	
Site 18 – Maitland Saleyards, Kyle Street	
Corymbia maculata **(Q1 2017)**	***Eucalyptus moluccana*** **(Q3 2016)**
	

Site 18 – Maitland Saleyards, Kyle Street (continued)	
***Eucalyptus amplifolia* (Q1 2017)**	***Eucalyptus resinfera* (Q2 2017)**
	
Site 19 – 200 Anambah Road – Reference site	
***Corymbia citriodora* (Q4 2016)**	***Corymbia maculata* (Q1 2017)**
	
***Eucalyptus acmenoides* (Q1 2017)**	***Eucalyptus robusta* (Q4 2016)**
	

Site 19 – 200 Anambah Road – Reference site (continued)	
***Eucalyptus tereticoris* (Q1 2017)**	***Vitis vinifera* (Q3 2016)**
	
***Eucalyptus dives* (Q4 2016)**	***Ficus macrophylla* (Q2 2017)**
	

Appendix A4 – Analytical Laboratory Documentation

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1603378**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MATTHIEU CATTEAU	Contact	: Hayley Worthington
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +612 4014 2500
Project	: 60512988 - Task 1.2	Date Samples Received	: 22-Sep-2016 15:17
Order number	: 60512988 - Task 1.2	Date Analysis Commenced	: 26-Sep-2016
C-O-C number	: ----	Issue Date	: 04-Oct-2016 17:14
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)				Client sample ID	E. Moluccana Site 5	Native grasses Site 11	E. Amplifolia Site 13	C. Maculata Site 13	C Maculata Site 15
				Client sampling date / time	[22-Sep-2016]	[22-Sep-2016]	[22-Sep-2016]	[22-Sep-2016]	[22-Sep-2016]
Compound	CAS Number	LOR	Unit		EN1603378-001	EN1603378-002	EN1603378-003	EN1603378-004	EN1603378-005
					Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation									
Fluoride	16984-48-8	10	mg/kg		**35.4**	<10.0	**58.0**	**11.4**	**33.0**

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)				Client sample ID	Vitis vinifera Site 19	----	----	----	----
				Client sampling date / time	[22-Sep-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1603378-006	--------	--------	--------	--------
					Result	----	----	----	----
EK040V: Fluoride in Vegetation									
Fluoride	16984-48-8	10	mg/kg		<10.0	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1604860**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MATTHIEU CATTEAU	Contact	: Hayley Worthington
Address	: PO BOX 73 HUNTER REGION MC HRMC NSW NSW 2310	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +612 4014 2500
Project	: 60512988 - Task 1.3	Date Samples Received	: 20-Dec-2016 15:17
Order number	: 60512988 - Task 1.3	Date Analysis Commenced	: 20-Dec-2016
C-O-C number	: ----	Issue Date	: 28-Dec-2016 11:12
Sampler	: AECOM		
Site	: ----		
Quote number	: EN/004/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **VEGETATION** (Matrix: **BIOTA**)				Client sample ID	E. Moluccana Site 5	Grasses Site 11	E. Amplifolia Site 13	C. Maculata Site 13	C. Maculata Site 15
				Client sampling date / time	20-Dec-2016 00:00	20-Dec-2016 00:00	20-Dec-2016 00:00	20-Dec-2016 00:00	20-Dec-2016 00:00
Compound	*CAS Number*	*LOR*	*Unit*		**EN1604860-001**	**EN1604860-002**	**EN1604860-003**	**EN1604860-004**	**EN1604860-005**
					Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation									
Fluoride	16984-48-8	10	mg/kg		**33.6**	<10.0	**91.9**	<10.0	**28.1**

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)				Client sample ID	Vitis vinifera Site 19	----	----	----	----
				Client sampling date / time	20-Dec-2016 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1604860-006	--------	--------	--------	--------
					Result	----	----	----	----
EK040V: Fluoride in Vegetation									
Fluoride	16984-48-8	10	mg/kg		<10.0	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1701249**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MATTHIEU CATTEAU	Contact	: Hayley Worthington
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW, AUSTRALIA 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60512988 Task 1.1	Date Samples Received	: 29-Mar-2017 15:53
Order number	: 60512988 Task 1.3	Date Analysis Commenced	: 30-Mar-2017
C-O-C number	: ----	Issue Date	: 31-Mar-2017 15:48
Sampler	: ----		
Site	: ----		
Quote number	: EN/004/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alison Graham	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)			Client sample ID	E. Moluccana Site 5 Leaves	Native grasses Site 11 Grasses	E. Amplifolia Site 13 Leaves	C. Maculata Site 13 Leaves	C. Maculata Site 15 Leaves
			Client sampling date / time	29-Mar-2017 00:00	29-Mar-2017 00:00	29-Mar-2017 00:00	29-Mar-2017 00:00	29-Mar-2017 00:00
Compound	CAS Number	LOR	Unit	EN1701249-001	EN1701249-002	EN1701249-003	EN1701249-004	EN1701249-005
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**11.2**	<10.0	<10.0	**40.0**	**56.7**

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)				Client sample ID	Vitis vinifera Site 19 Leaves	----	----	----	----
				Client sampling date / time	29-Mar-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1701249-006	--------	--------	--------	--------
					Result	----	----	----	----
EK040V: Fluoride in Vegetation									
Fluoride	16984-48-8	10	mg/kg		<10.0	**----**	**----**	**----**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1702761**	Page	: 1 of 2
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MATTHIEU CATTEAU	Contact	: Hayley Worthington
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW, AUSTRALIA 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60512988 - Task 1.3	Date Samples Received	: 29-Jun-2017 13:45
Order number	: 60512988 task 1.3	Date Analysis Commenced	: 03-Jul-2017
C-O-C number	: ----	Issue Date	: 05-Jul-2017 15:31
Sampler	: ----		
Site	: ----		
Quote number	: EN/004/16		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **VEGETATION** (Matrix: **BIOTA**)			*Client sample ID*	**E. Moluccana Site 5 Leaves**	**Grasses Site 11 Grasses**	**E. Amplifolia Site 13 Leaves**	**C. Maculata Site 13 Leaves**	**C. Maculata Site 15 Leaves**
			Client sampling date / time	29-Jun-2017 00:00	29-Jun-2017 00:00	29-Jun-2017 00:00	29-Jun-2017 00:00	29-Jun-2017 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**EN1702761-001**	**EN1702761-002**	**EN1702761-003**	**EN1702761-004**	**EN1702761-005**
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**33.0**	<10.0	**56.9**	<10.0	**37.6**

Appendix B

Meteorological Monitoring - Wind Roses

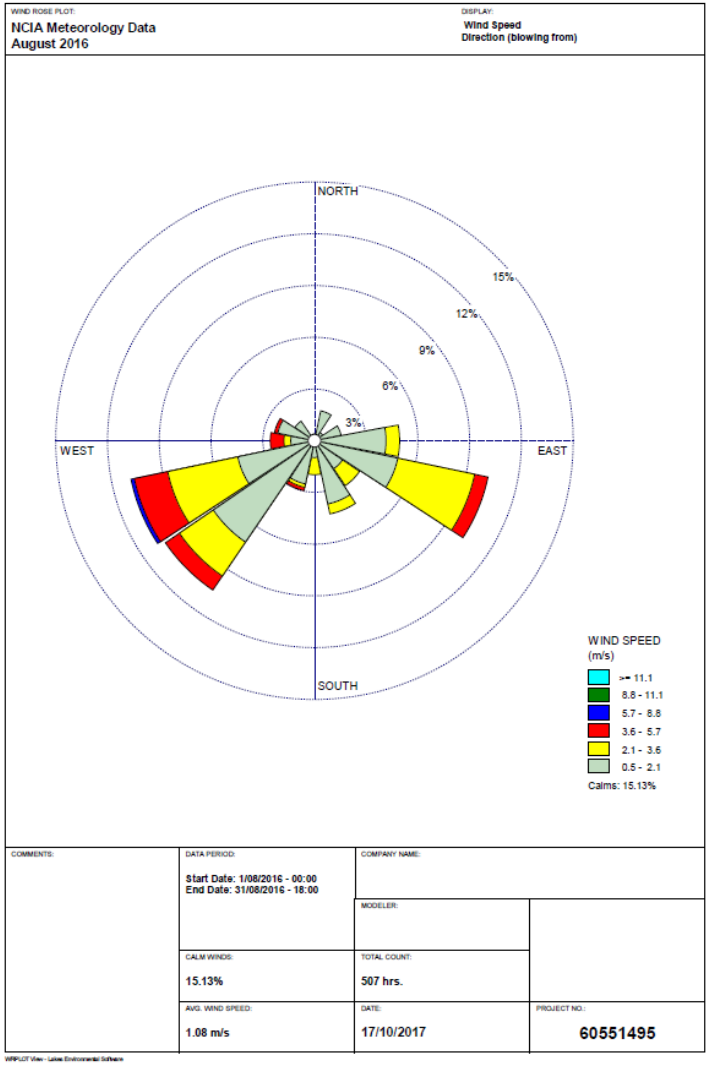

Figure B 1 Wind Speed and Direction (August 2016)

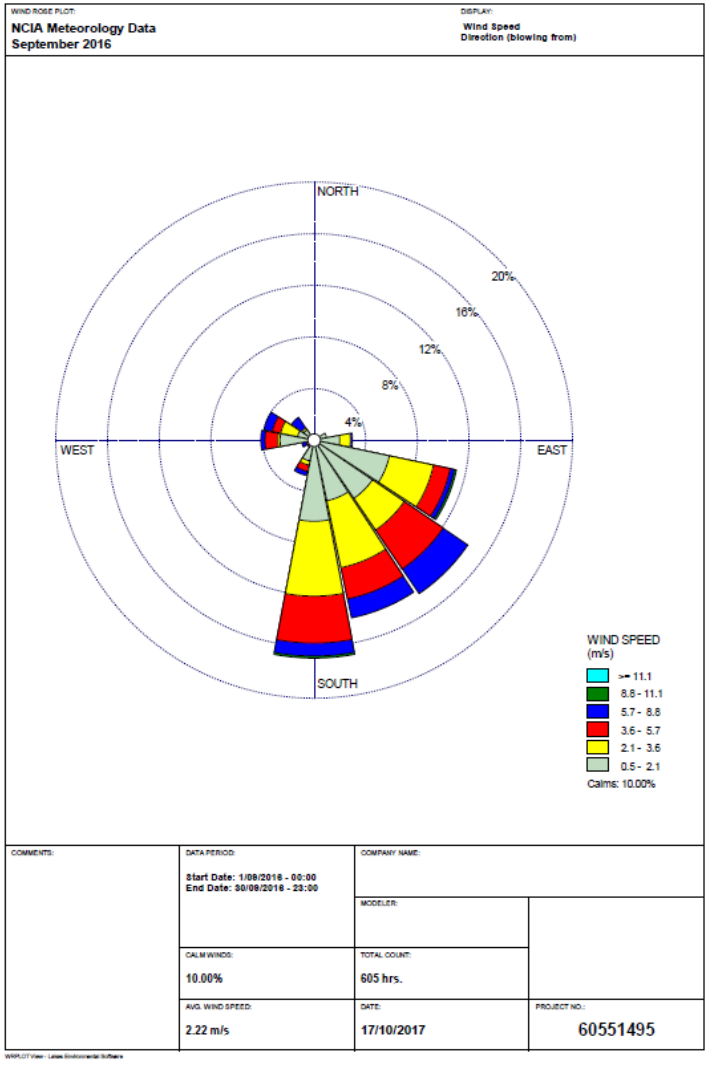

Figure B 2 Wind Speed and Direction (September 2016)

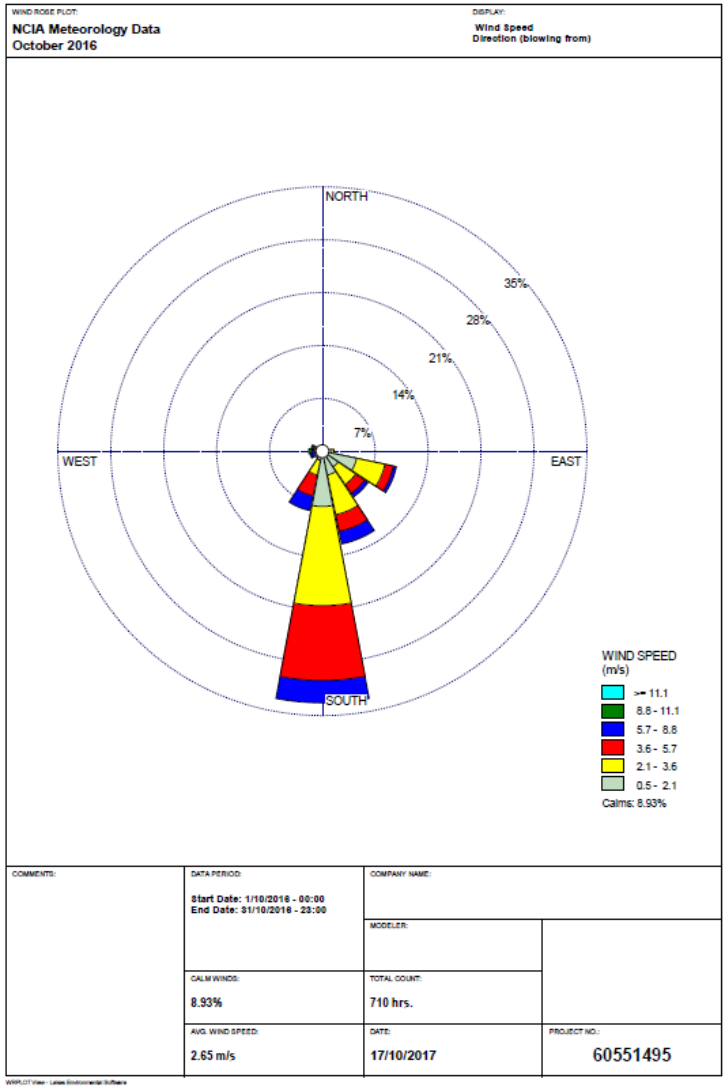

Figure B 3 Wind Speed and Direction (October 2016)

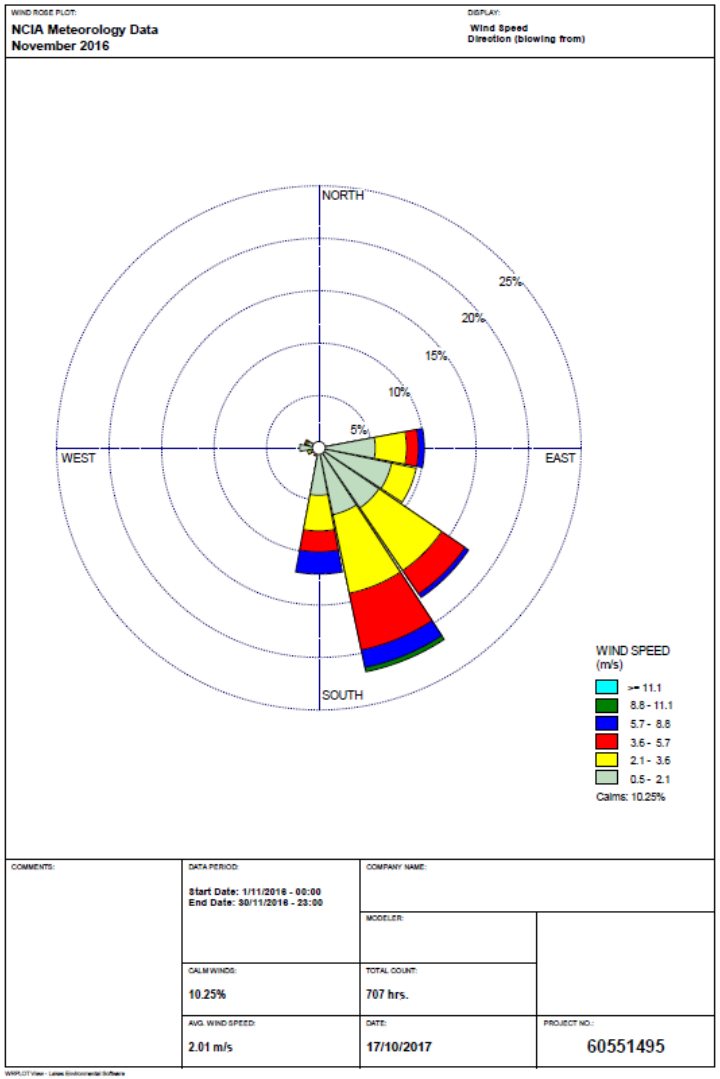

Figure B 4 Wind Speed and Direction (November 2016)

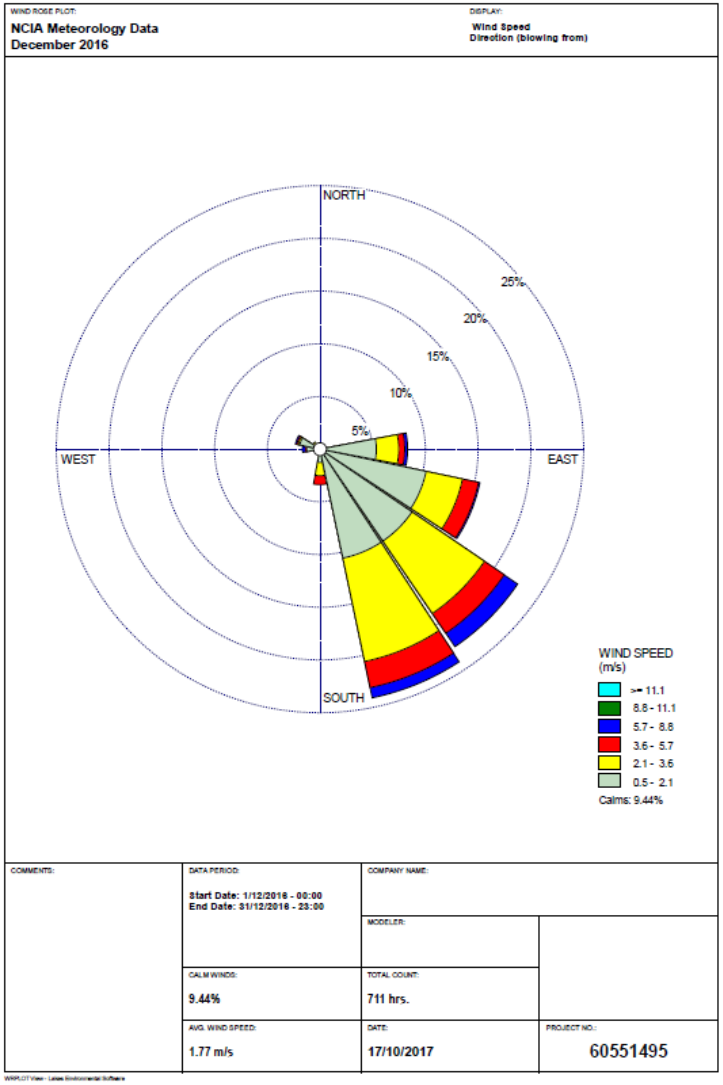

Figure B 5 Wind Speed and Direction (December 2016)

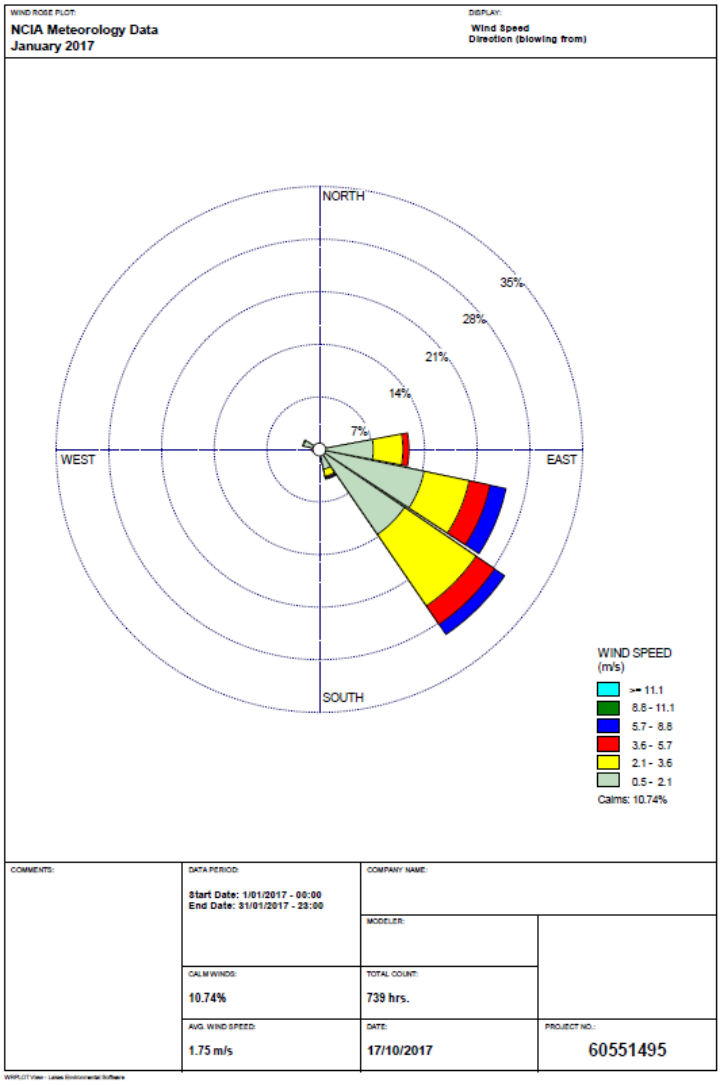

Figure B 6 Wind Speed and Direction (January 2017)

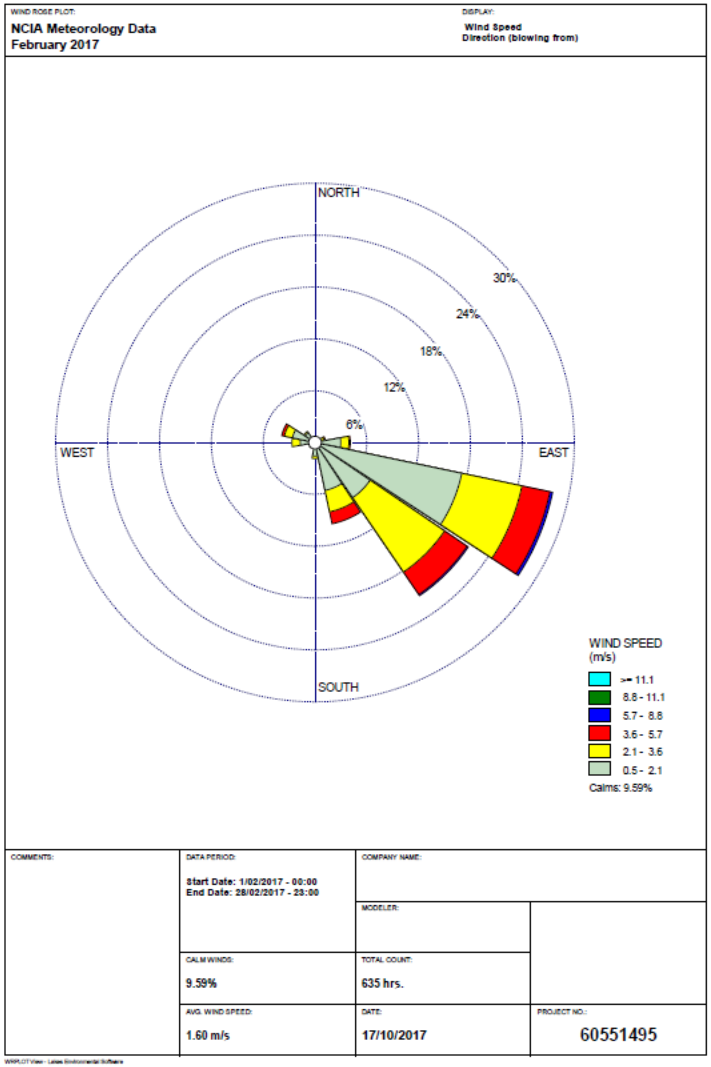

Figure B 7 Wind Speed and Direction (February 2017)

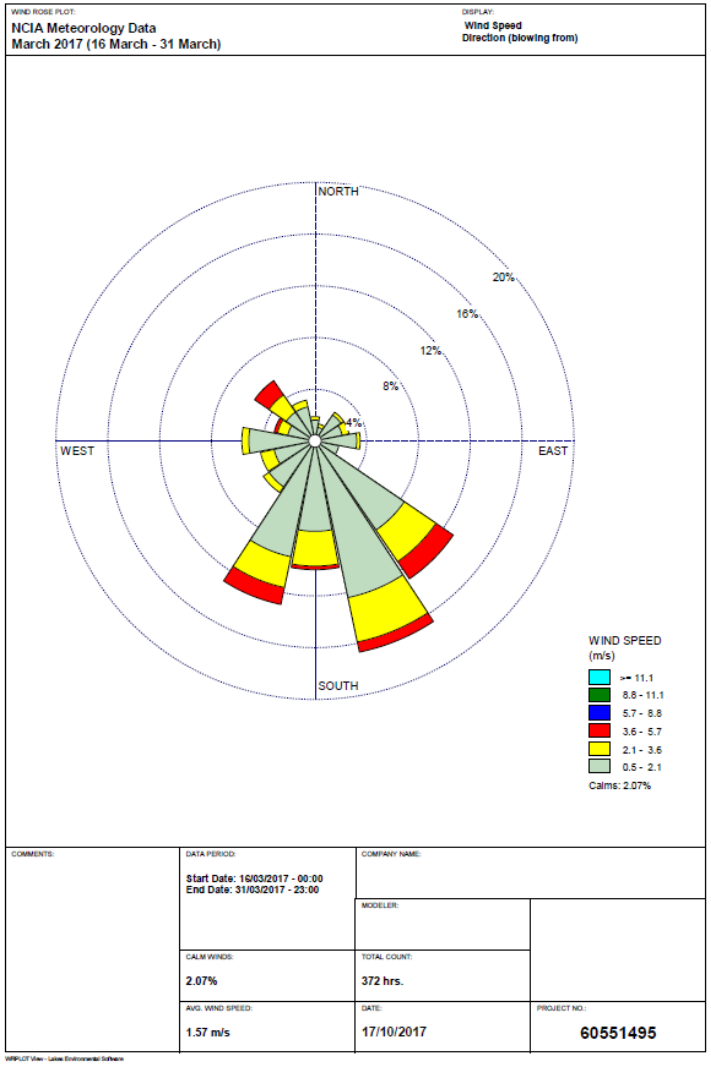

Figure B 8 Wind Speed and Direction (16 March to 31 March 2017)

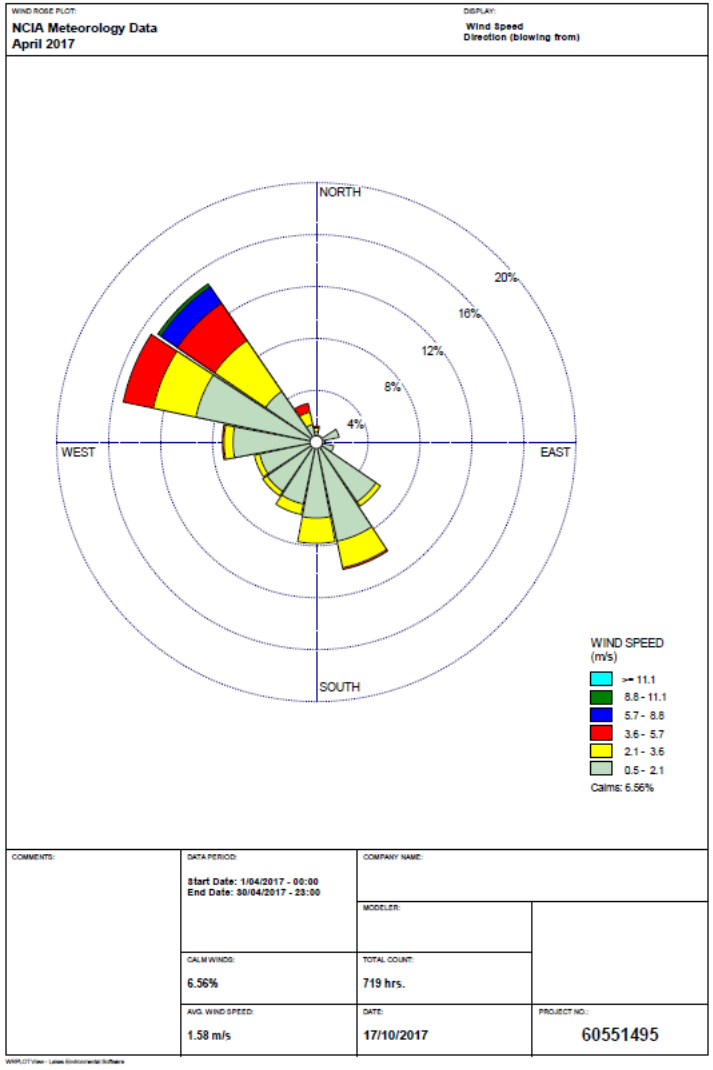

Figure B 9 Wind Speed and Direction (April 2017)

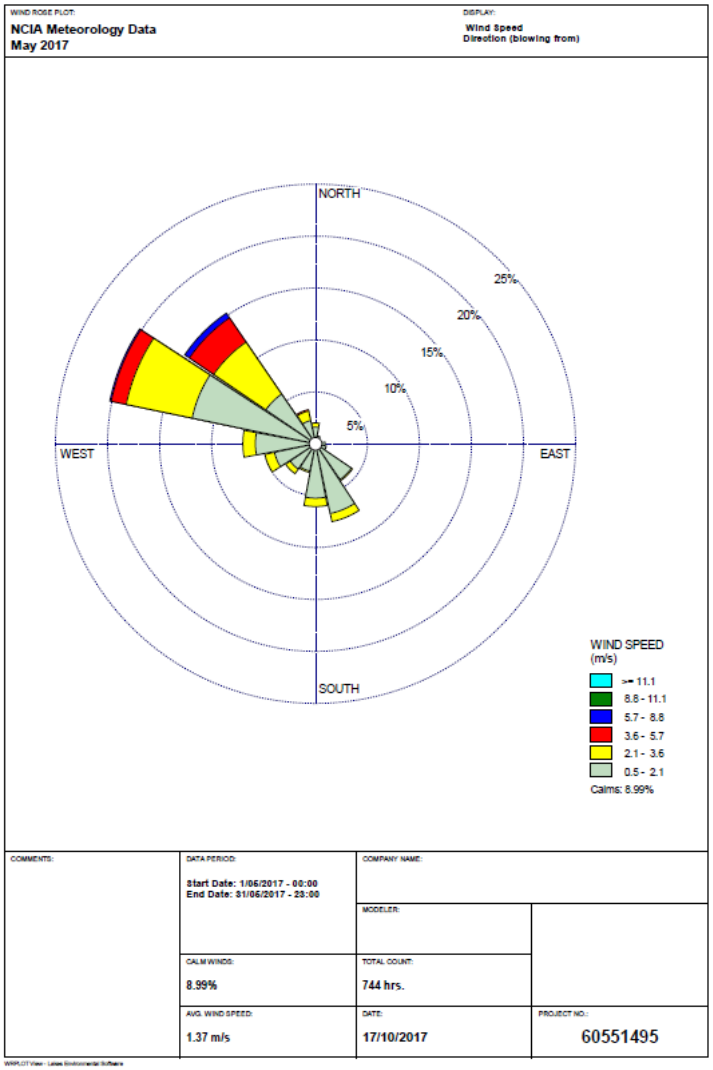

Figure B 10 Wind Speed and Direction (May 2017)

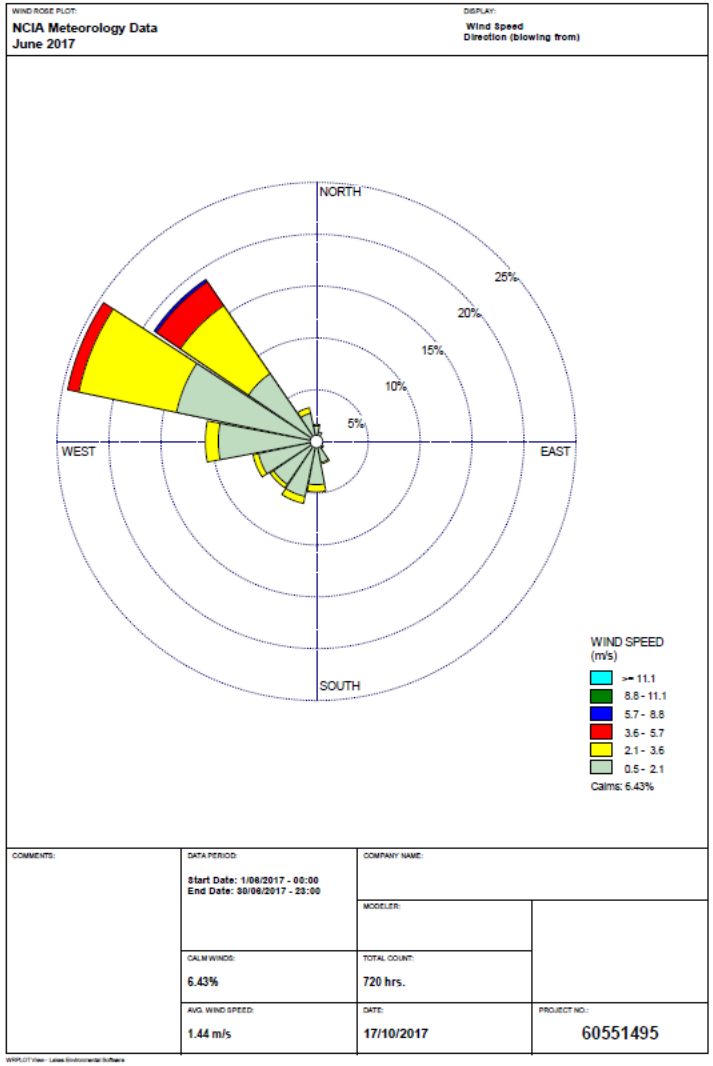

Figure B 11 Wind Speed and Direction (June 2017)

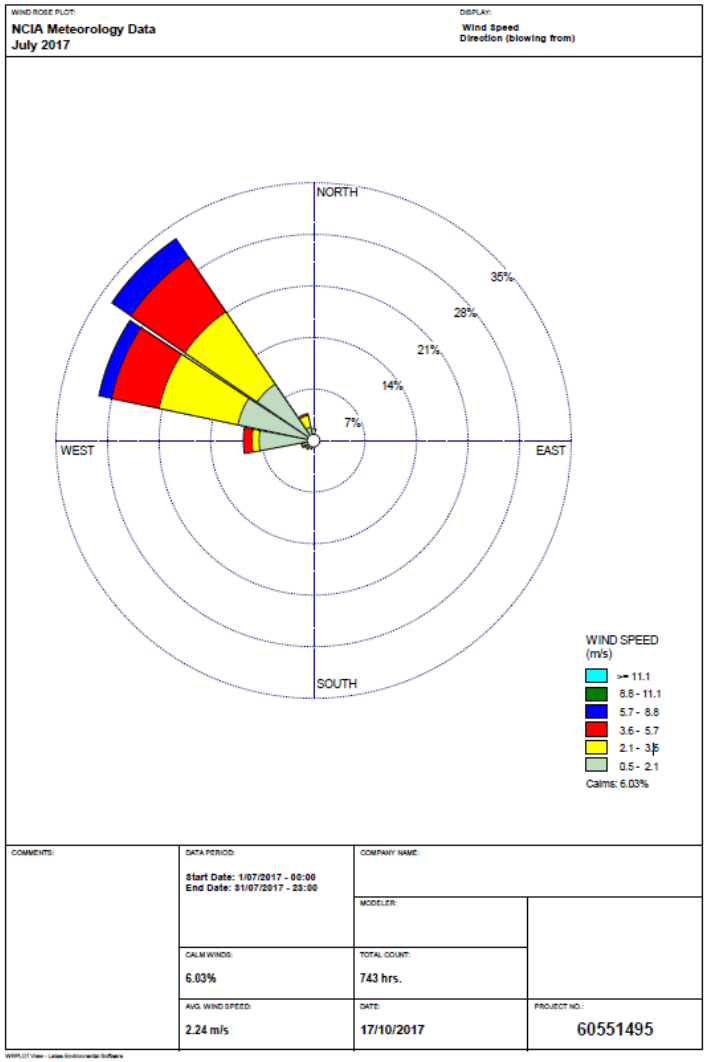

Figure B 12 Wind Speed and Direction (July 2017)

17 Warabrook Boulevard, Warabrook, NSW 2304
PO Box 73 Hunter Region MC NSW 2310
T +61 2 4911 4900 F +61 2 4911 4999

www.aecom.com