



Arnott's Huntingwood Processing Facility Expansion Modification

Air Quality Impact Assessment

FDC Building Services

22 – 24 Junction Street, Forest Lodge
NSW 2037

Prepared by:

SLR Consulting Australia

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Basis of Report

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Appendix D	Meteorological Year
Appendix E	Isopleth Plots



Acronyms and Abbreviations

Table 1 below shows the glossary of terms and their definitions used in this air quality and odour impact assessment.

Table 1 Glossary

Term	Definition
The Site	Existing and proposed food processing facility at 65 Huntingwood Drive
The Project	The proposed activities to modify SSD-17352813.
Approved AQIA	The Air Quality Impact Assessment conducted by SLR Consulting for the approved development (SSD-17352813).
Approved SSDA	The approved expansion activities under the approved Stage Significant Development Application of SSD-17352813.

Table 2 below shows the abbreviations and their definitions used in this air quality and odour impact assessment.

Table 2 Abbreviations

Term	Definition
AGL	above ground level
AHD	Australian Height Datum
AQIA	Air Quality Impact Assessment
AQMS	Air Quality Monitoring Station
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CO	carbon monoxide
DPIE	NSW Department of Planning, Industry and Environment
DPHI	NSW Department of Planning, Housing and Infrastructure (previously DPIE)
EPA	NSW Environment Protection Authority
IAQM	Institute of Air Quality Management
IN-1	General industrial (planning zone)
IN-2	Light industrial land (planning zone)
km	kilometres
m/s	metres per second
NH ₃	ammonia



Term	Definition
NH ₄ HCO ₃	ammonium bicarbonate
NO _x	oxides of nitrogen
NO ₂	nitrogen dioxide
O ₃	ozone
OEH	Office of Environment and Heritage
OSD	on-site detention
PM	particulate matter
PM _{2.5}	particulate matter with an aerodynamic diameter of 2.5 microns or less
PM ₁₀	particulate matter with an aerodynamic diameter of 10 microns or less
ppb	parts per billion (volume)
pphm	parts per hundred million (volume)
RE-2	Private recreational (planning zone)
SO ₂	sulfur dioxide
VOC	Volatile Organic Compounds



1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by FDC Building Services to prepare an air quality impact assessment (AQIA) report to inform the proposed modification to the approved SSDA (SSD-17352813) relating to the expansion works to the existing food processing facility (the Project) at 65 Huntingwood Drive, Huntingwood (the Site). The facility is occupied by Arnott's Biscuits.

This report summarises the potential construction and operational air quality impacts associated with the Project.

1.1 Planning Secretary's Environmental Assessment Requirements (SEARs)

From our understanding, this SSDA modification does not invoke any new specific SEARs. Therefore, the previously issued SEARs as part of SSDA (SSD-17352813) issued on 12 May 2021 has been adopted for this assessment.

Items relevant to this assessment and where they have been addressed has been summarised in [Table 3](#).

Table 3 Previously issued SEARs for SSDA (SSD-17352813)

Item In SEARS	Where Addressed
Air Quality and Odour – including: - a description of all potential sources of odour and emissions during the construction and operational phases of the development - an assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines and - details of dust control during site preparation and civil works.	Section 4.0 Section 8.0 Section 9.0

1.2 Background

SLR Consulting Australia Pty Ltd (SLR) prepared the Air Quality Impact Assessment (the Approved AQIA) for the approved expansion of the food processing facility at the Site (Approved SSDA) in in 2022¹. As requested by NSW Department of Planning, Industry and Environment (DPIE) this report included dispersion modelling of operational combustion gas and ammonia emissions and qualitative assessment of odour and construction activities.

This report adopts the same assessment methodology.

¹ <https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-30307456%2120220324T103512.662%20GMT>



2.0 Project Description

2.1 Project Location

The proposed expansion is to be located within the existing Arnott's Site at 65 Huntingwood Drive (see [Figure 1](#)), Lot 1 DP866251, within the Huntingwood Industrial Estate, 32 km west of the Sydney CBD and 12 km west of Parramatta CBD. The Site is situated along the southern boundary of Huntingwood, bordering the Western Motorway (M4) to the south and Huntingwood Drive to the north.

The total area of the Site is 163,933 m² (16.4 hectares). The site currently contains three large freestanding industrial buildings, the main 'L-shaped' processing building to the north and two warehouses to the south. The balance of the Site includes small ancillary buildings, car parking, loading areas and privately used open space. The north-west corner of the Site currently acts as an on-site detention (OSD) basin.

Figure 1 Site Location



2.2 Project Overview

Development Consent SSD-17352813 was granted approval on 1 July 2022. The approved development comprises the construction and operation of a new food processing facility



(bakery) with a production capacity of 13,000 tonnes per annum, and supporting ancillary structures and infrastructure, including:

- Two ingredient silo buildings, processing building and storage building.
- Multi-level car parking facility for 468 vehicles.
- Landscaping works.
- Replacement of the existing on-site detention basin with a new on-site detention tank.
- Demolition of a number of ancillary structures including the main existing car park and driveway, recreational amenities and two small engineering sheds.

The proposal seeks to modify the expansion works to the Arnotts' facility by introducing a Stage 1 development that includes the construction and operation of the following buildings/facilities:

- Oven annex
- Engineering shed, including minor hardstand extensions to accommodate the facility
- Chocolate manufacturing building, including ancillary high voltage building
- Enrobing annex
- Packaging material warehouse

Stage 2 will involve the construction of the previously approved processing facility, albeit the building has been reduced in area by 1,080sqm. In addition, SLR understands that the proposed modification application seeks to:

- Increase the production capacity of the 'expanded facility' to 50,000t/yr (increase from 13,000t/yr). Amend stack heights:
 - Increase existing Line 1 at Stage 1 from 16.75 m to 28.5 m.
 - Reduce heights of approved stacks from 18 m to 16.75 m
- Reduce number of approved lines from 10 to 9 (remove Line 10)
- Amend number of approved emission stacks per line:
 - Line 6 – reduce total number of stacks from 8 to 7
 - Line 8 – reduce total number of stacks from 8 to 6
 - Line 9 – increase total number of stacks from 4 to 5

The maximum capacity of the proposed modification as assessed in this report is shown in [Table 4](#) (refer to **Section 7.3.1.2** for further details).



Table 4 Maximum Production Capacity

Lines	Existing (t/year)	Stage 1 (t/year)	Stage 2 (t/year)
Lines 1-5	60,000	60,000	60,000
Line 6	N/A	33,000	33,000
Lines 7-9	N/A	N/A	17,000
Total	60,000	93,000	110,000

The proposed ground floor layout for Stage 1 and Stage 2 are shown in [Figure 2](#) and [Figure 3](#) respectively.



[illegible]

[illegible]

Source: HLA Architects Drawing No: 200810-AR-A003.



The existing and approved operations on the Site involve food processing (bakery) which operates 24 hours a day, seven days a week. The expanded facility will continue to operate 24 hours per day, seven days per week.

The on-site activities associated with the modified development will be similar to those currently undertaken at the Site, namely:

- Raw materials delivery and storage;
- Production and baking of biscuits, crackers and wafers;
- Product packaging;
- Dispatch and distribution; and
- Ancillary office administration.

The existing wastewater treatment plant is understood to have capacity to process the additional throughput that would result from the proposed modification, with no upgrade or modification of this plant proposed.

2.3 Site Inspection

A site visit was performed in 2021 as part of the Approved AQIA to observe the existing operations, identify air emission points and discuss existing and proposed air emissions mitigation measures for the Project. During the site visit, the weather was characterised as overcast skies and calm conditions. The facility was fully operational, with normal production and wastewater treatment processes in progress.

Potential sources of air emissions associated with the operation of the facility were identified as follows:

- Odour emissions from the baking and processing of products
- Odour emissions from ingredient storage
- Combustion gas emissions from the operation of the gas fired ovens
- Odour emissions from the treatment of wastewater and storage of sludge
- Products of fuel combustion (including particulates) from onsite vehicle movements; and
- Wheel-generated particulate emissions from onsite vehicle movements.

During the site visit, 'distinct' odours could be detected within the boundary of the Site and 'weak' odours were detectable within an approximate 100 m radius of the Site boundary. The hedonic tone of these odours ranged from +1 to -1 ('mildly pleasant' to 'mildly unpleasant'). The odours were predominantly characteristic of baking processes. No 'distinct' raw material odours or wastewater/sludge odours could be detected except at locations very close to these activities.

During the site visit, no visible dust emissions were observed. The housekeeping at the facility was observed to be of the highest order.

It is understood that no significant changes in operations have occurred since the previous assessment.

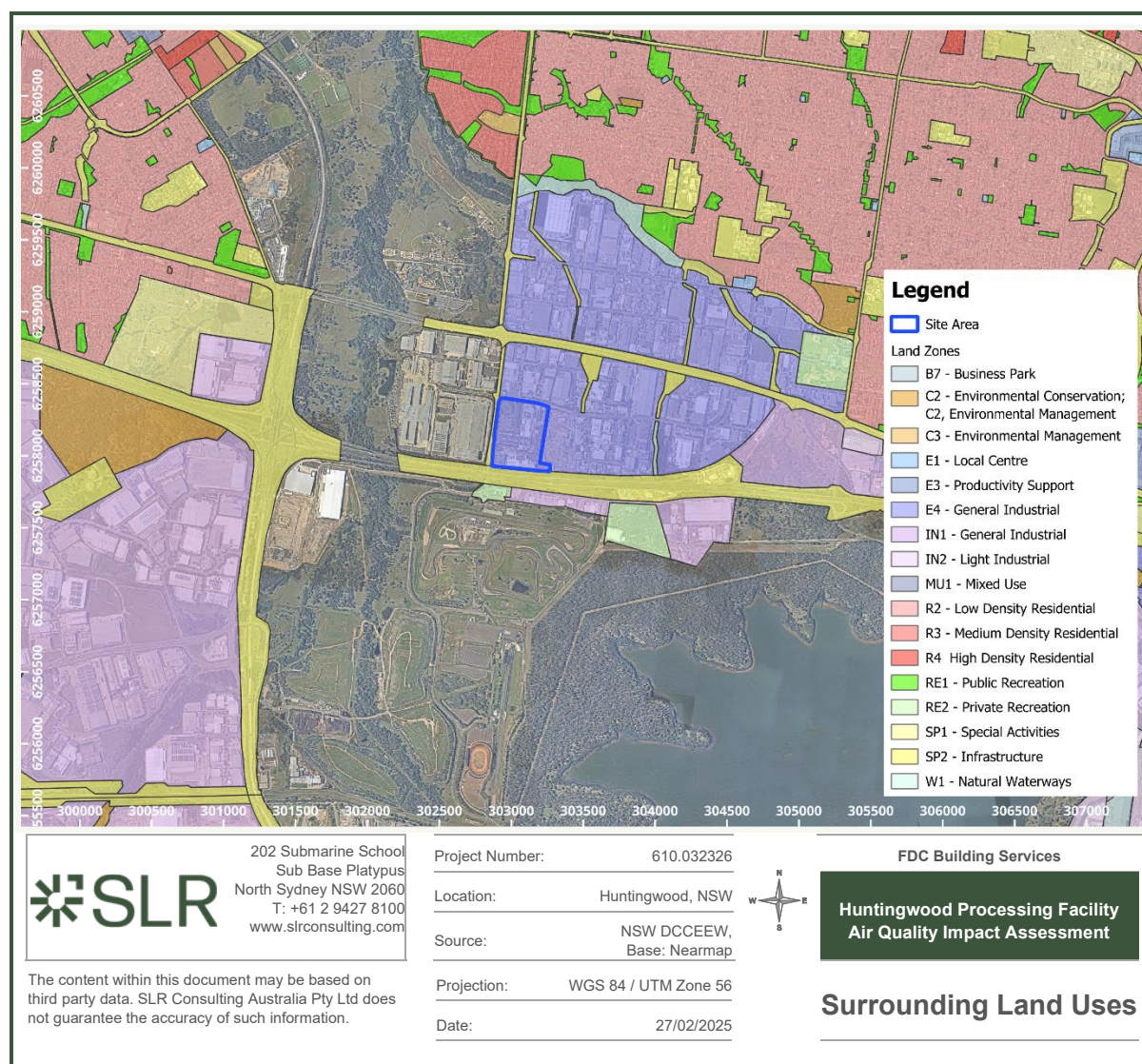


3.0 Project Setting

3.1 Land Use

The Site is currently subject to the land use and development control provisions of the Blacktown Local Environmental Plan 2015. [Figure 4](#) illustrates the surrounding land zoning as specified in the Blacktown Local Environmental Plan 2015 as well as the location of the closest nearby residential receptors. The areas immediately to the east and north of the Site are zoned light industrial (IN-2). A small area of General industrial (IN-1) and Private recreational (RE-2) zones is located immediately south of the Site.

Figure 4 Zoning of Surrounding Land



3.2 Sensitive Receptors

The nearest residential areas are located approximately 1.5 km north of the Site in Bungarribee. There are industrial receptors on neighbouring lots and Sydney Zoo is located approximately 800 m to the northwest, with the Bungarribee Playground beyond that. A small number of scattered residences are located along Pikes Lane, 1.1 – 1.3 km to the west of the Site. The nearest receivers are shown in [Figure 5](#) and detailed in [Table 5](#)



SLR understands that the facility does not have any records of complaints relating to air quality issues.

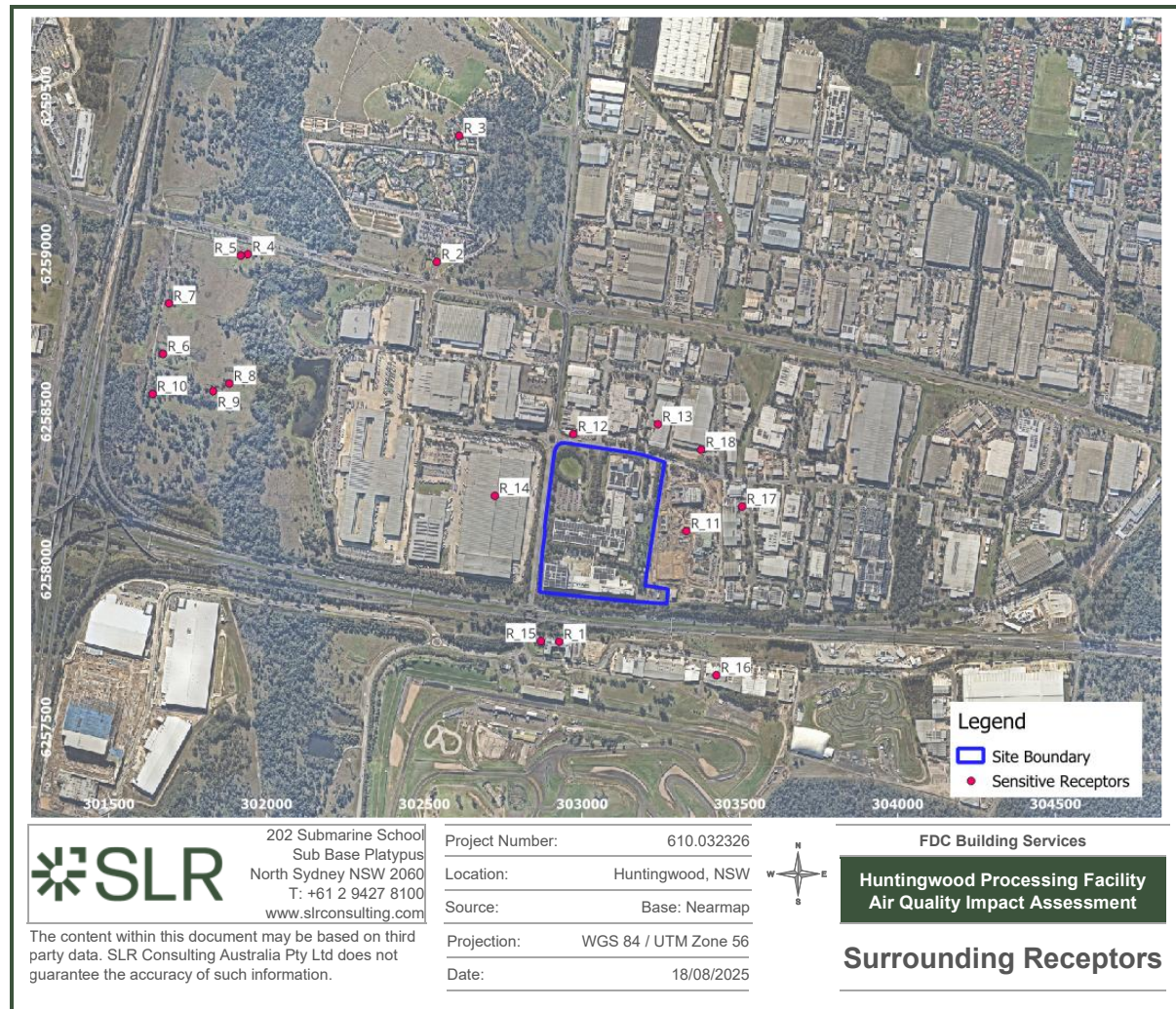
The nearest sensitive receivers are commercial and industrial properties surrounding the Site, ranging from 30 metres to the north to 170 metres to the south. The nearest receivers are shown in [Figure 5](#) and detailed in [Table 5](#).

Table 5 Surrounding Sensitive Receivers

ID	Description	Easting (m)	Northing (m)	Type	Distance (m)	Direction
R01	Alpha Hotel Eastern Creek	302,927	6,257,769	Hotel	400	South
R02	Sydney Zoo	302,539	6,258,974	Attraction	690	Northwest
R03	Bungarabee Playground	302,610	6,259,374	Leisure	1,030	North West
R04	Residential Receptor	301,940	6,258,998	Residential	1,150	West
R05	Residential Receptor	301,918	6,258,994	Residential	1,170	West
R06	Residential Receptor	301,671	6,258,682	Residential	1,290	West
R07	Residential Receptor	301,690	6,258,843	Residential	1,300	West
R08	Residential Receptor	301,881	6,258,589	Residential	1,050	West
R09	Residential Receptor	301,830	6,258,565	Residential	1,100	West
R10	Residential Receptor	301,638	6,258,555	Residential	1,280	West
R11	Endeavour Energy	303,330	6,258,120	Industrial	100	East
R12	Eastern Creek Tavern	302,972	6,258,428	Commercial	30	North West
R13	Office	303,240	6,258,459	Commercial	100	Northeast
R14	Hunter & Northern Logistics	302,723	6,258,233	Commercial	170	West
R15	Oak Bar and Grill	302,869	6,257,772	Commercial	160	South
R16	Labourpower Recruitment Services	303,425	6,257,663	Commercial	280	South east
R17	Office	303,507	6,258,198	Commercial	270	East
R18	DHL Supply Chain	303,377	6,258,379	Industrial	120	East



Figure 5 Surrounding Receptors



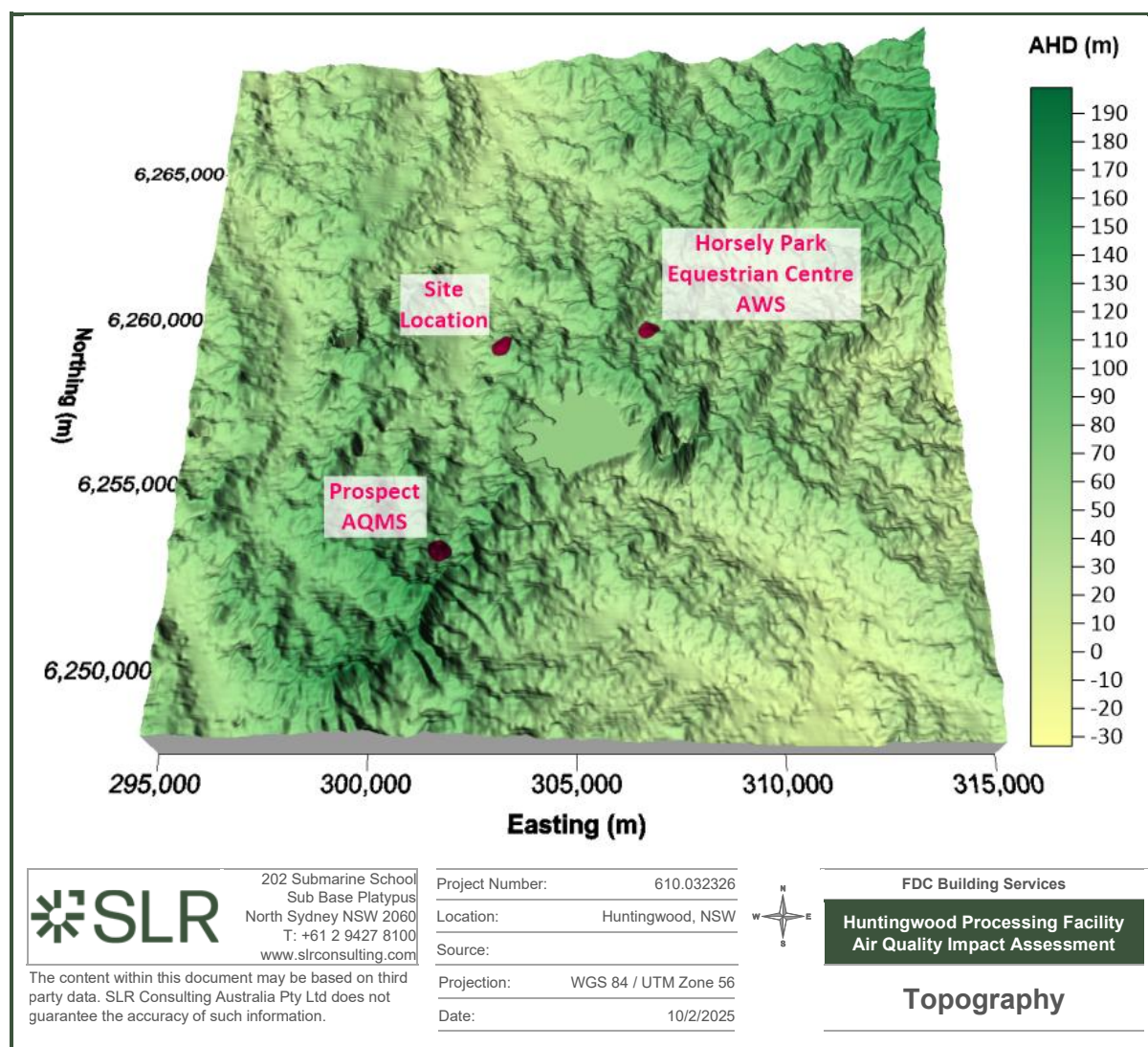
3.3 Local Topography

Topography is important in air quality studies as local atmospheric dispersion can be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies.

A three-dimensional representation of the region surrounding the Site is shown in [Figure 6](#). The topography of the local area ranges from an approximate elevation of -30 m to 195 m Australian Height Datum (AHD).

The topography of the Site and its immediate surrounds is relatively flat, with open areas of land cleared for motorsports to south. The northwestern edge of the Site sits up to approximately 4 m above the surrounding road reserves. The balance of the Site is reasonably flat with a slight fall towards the northwest. A large water body (Prospect Reservoir) is located approximately 1.5 km to the southeast.

Figure 6 Local Topographical Features



3.4 Local Meteorological Conditions

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) affects the degree of mechanical turbulence, which also influences the rate of dispersion of air pollutants.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station to the Site is Horsley Park Equestrian Centre Automatic Weather Station (AWS) (Station no. 67119), which is located approximately 6 km to the south-southwest of the Site.

The Horsley Park Equestrian Centre AWS was commissioned in 1997, sits at an elevation of 100 m and has data available for the following parameters:

- wind speed (m/s) and wind direction (degrees)
- temperature (°C)
- rainfall (mm)
- relative humidity (%).

A review of the long-term climate data collected at this station is provided in the following sections.

3.4.1 Rainfall

Rainfall statistics for Horsley Park Equestrian Centre AWS are summarised in [Figure 7](#). The average monthly rainfall is distributed evenly throughout the year. The lowest mean monthly rainfall of 37.6 mm/month was recorded during September. The highest average monthly rainfall of 122.3 mm/month occurred in February. The maximum mean number of rain days occurs in December, with an average of 12.2 rain days recorded in this month. Maximum rainfall of 461.8 mm and minimum rainfall of 0 mm have been recorded.

3.4.2 Relative Humidity

Available humidity statistics (9 am and 3 pm monthly averages) for Horsley Park Equestrian Centre AWS are summarised in [Figure 8](#). Morning humidity levels range from an average of around 61% in mid spring to around 81% in early autumn. Afternoon humidity levels are lower at around 42% in early spring, and around 55% in mid-winter.

3.4.3 Temperature

Available temperature statistics for Horsley Park Equestrian Centre AWS are summarised in [Figure 9](#). Mean maximum temperatures range from 17.6°C in winter to 29.9°C in summer, while mean minimum temperatures range from 5.9°C in winter to around 18.0°C in summer. Maximum temperatures of 47°C and minimum temperatures of -2.3°C have been recorded.



Figure 7 Monthly Rainfall Data for Horsley Park Equestrian Centre AWS

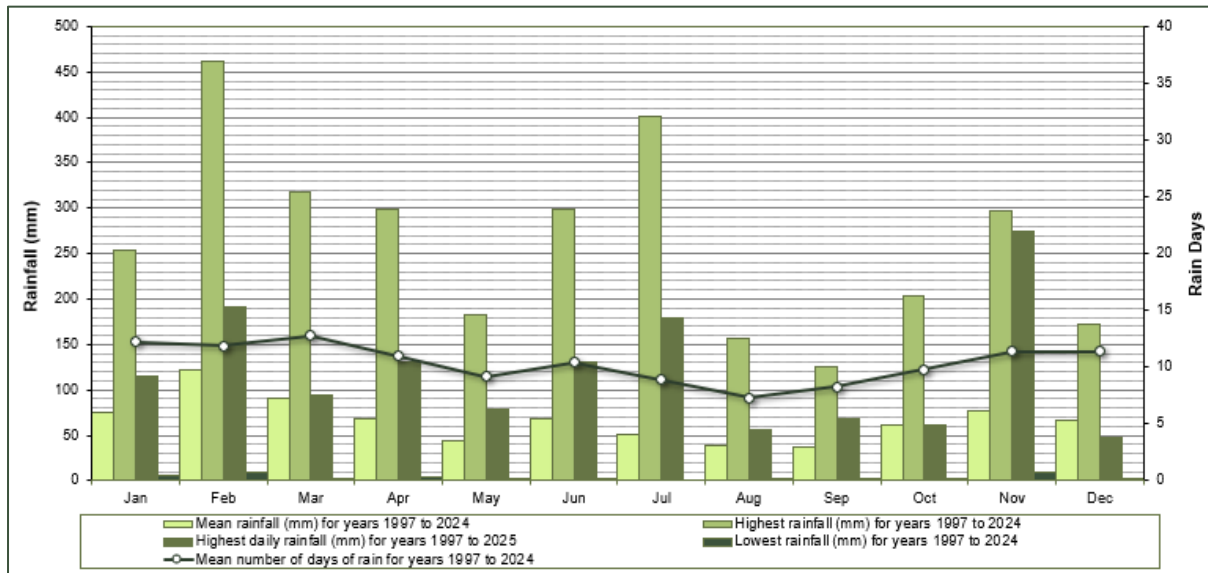


Figure 8 Humidity Data for Horsley Park Equestrian Centre AWS

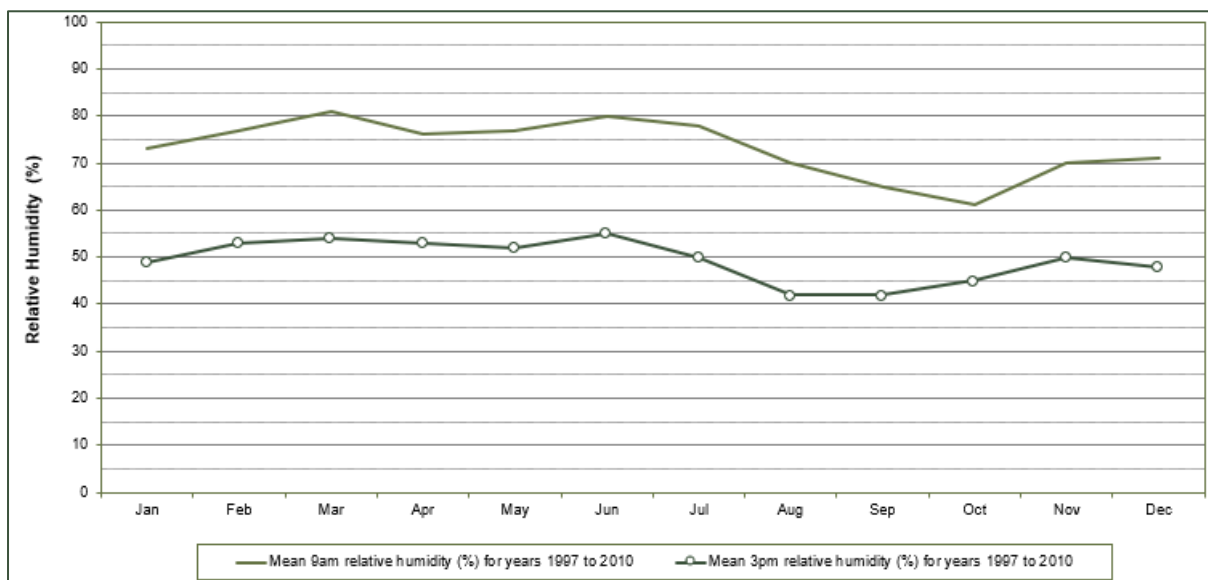
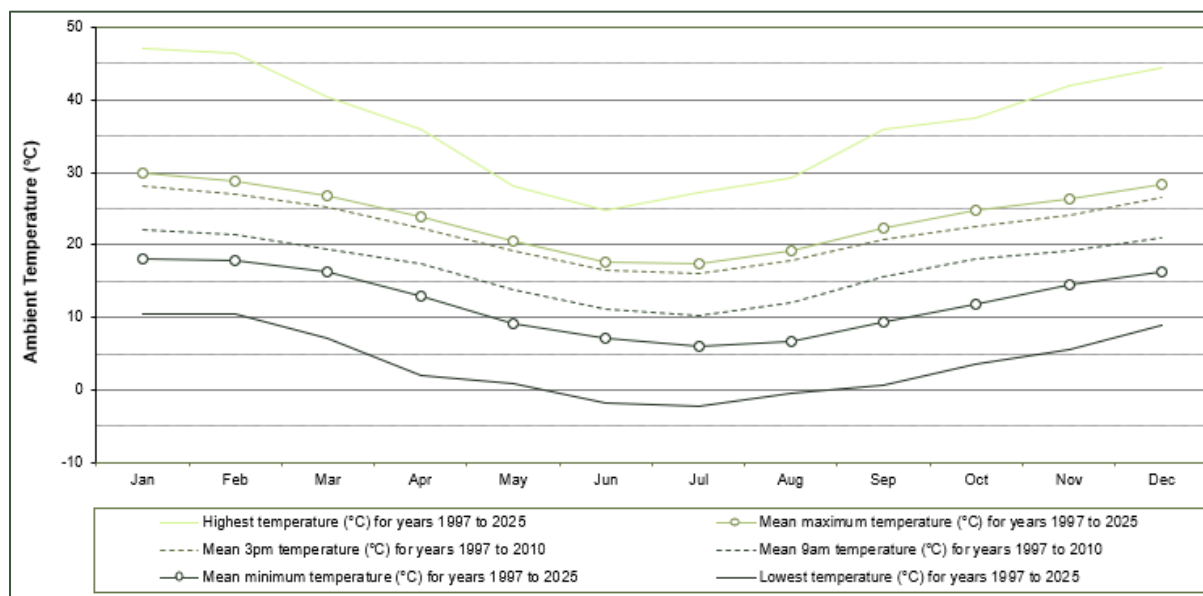


Figure 9 Temperature Data for Horsley Park Equestrian Centre AWS



3.4.4 Wind Speed and Direction

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) will also influence dispersion.

Annual and seasonal wind roses for the five-year period from 2020 to 2024, compiled from data recorded by the Horsley Park Equestrian Centre AWS are presented in [Figure 10](#). Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day. It is noted that considering the terrain between the Site and Horsley Park Equestrian Centre AWS, wind conditions at the Site may be different to those recorded by the AWS (see [Section 7.3.3](#) for Site specific meteorological modelling).

There are times when the wind is calm (defined as being from zero to 0.5 metres/second), and the percentage of the time that winds are calm are shown as a note on the wind rose. The annual wind rose indicates that winds blow from all directions, with the least frequent winds coming from the northeastern quadrant and the most frequent winds coming from the southwestern quadrant. Calm wind conditions (wind speed less than 0.5 m/s) were recorded to occur 18.5% of the time throughout the investigated period. The average seasonal wind roses for the year 2020-2024 indicate that:

- In summer, winds blow from all directions except the northwestern quadrant, where winds occur infrequently. Calms were recorded approximately 16% of the time during the summer months.



- In autumn, winds predominantly blow from the southwestern quadrant, with the least frequent winds originating from the northeastern quadrant. Calms were recorded approximately 20% of the time during the autumn months.
- In winter, winds predominantly blow from the southwestern and northwestern quadrant, with the least frequent winds originating from the northeastern and southeastern quadrants. Calms were recorded approximately 21% of the time.
- In spring, winds blow almost evenly from all directions. Calms were recorded approximately 16% of the time during spring.

Wind erosion of dust from exposed surfaces is usually initiated when wind speeds exceed the threshold friction velocity for a given surface or material, however a general rule of thumb is that wind erosion can be expected to occur above approximately 5.5 m/s. The frequency of wind speeds for the period of 2020-2024 is presented in [Figure 11](#). The plot shows that the frequency of wind speeds exceeding 5.5 m/s for the period 2020-2024 at Horsley Park Equestrian Centre AWS was approximately 2% of the time.



Figure 10 Horsley Park Equestrian Centre AWS Seasonal and Annual Wind Roses (2020 – 2024)

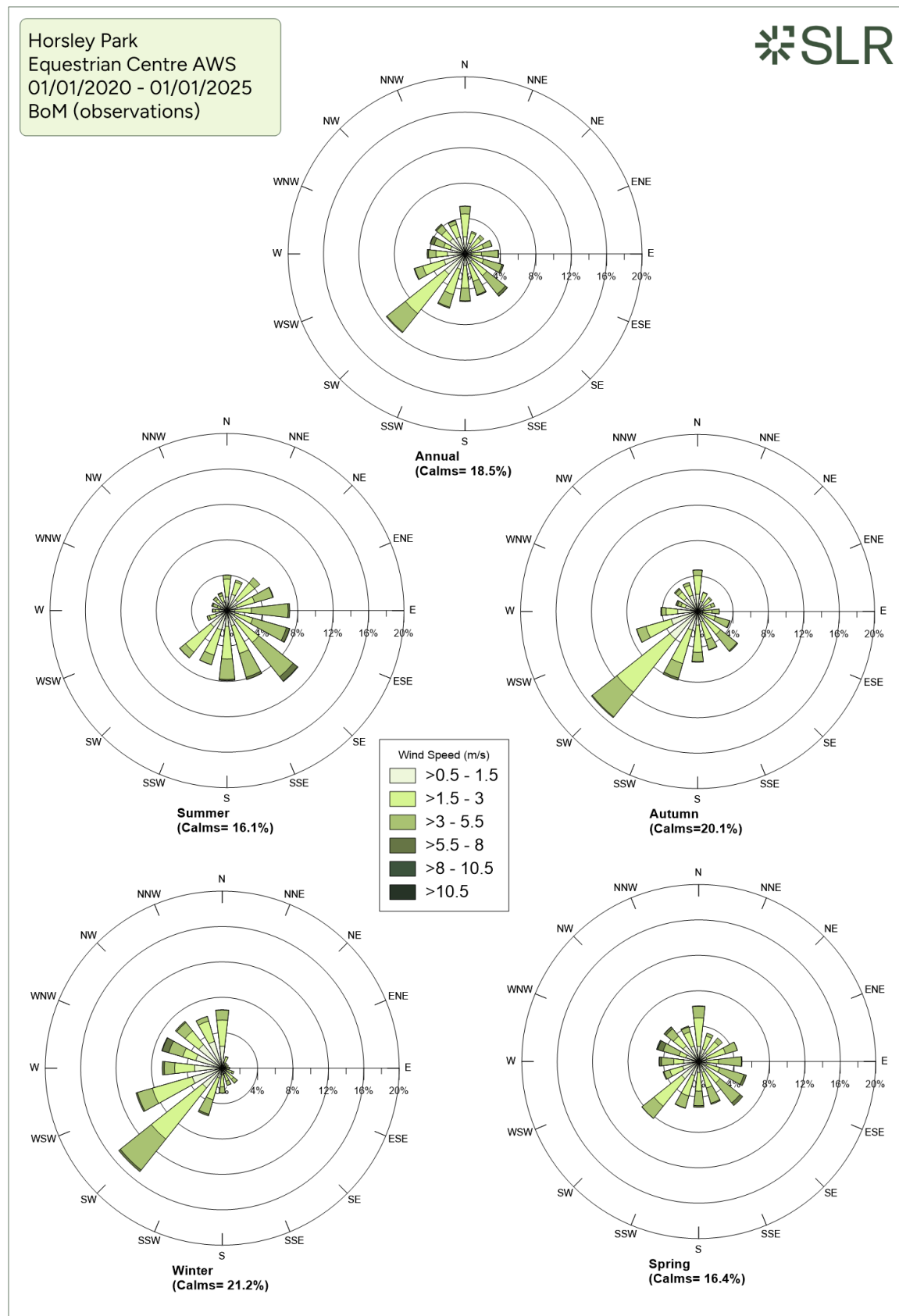
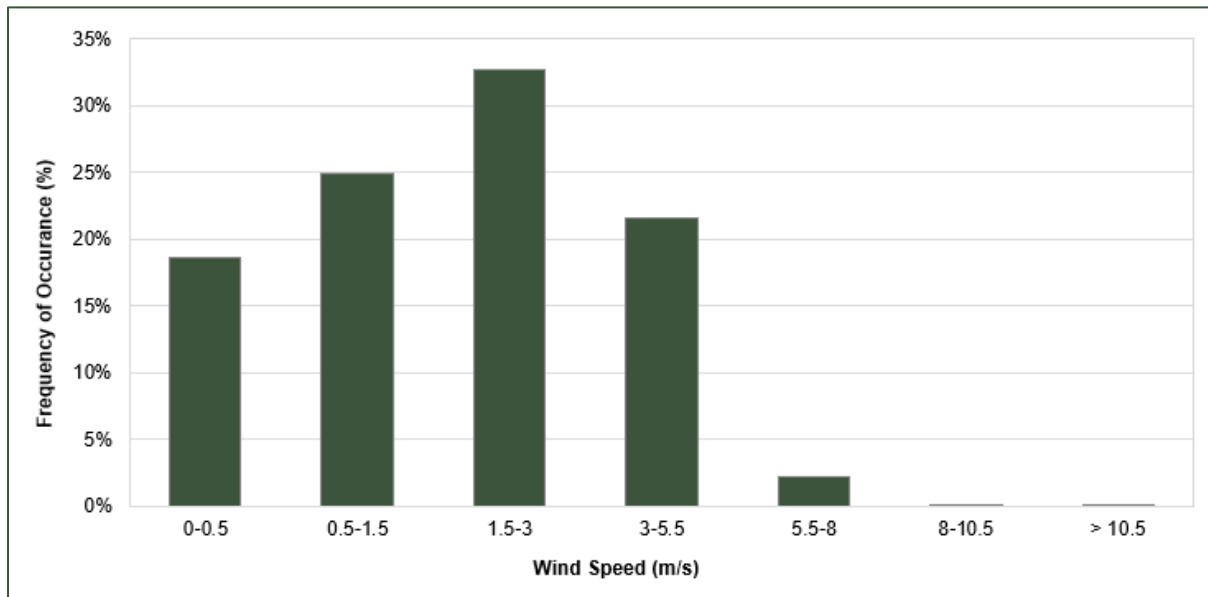


Figure 11 Wind Speed Frequency Chart for Horsley Park Equestrian Centre AWS – 2020-2024



3.5 Other Local Air Emission Sources

Other sources of air emissions and odour in the surrounding area with the potential to result in cumulative impacts with emissions from the construction and operation of the expansion, as identified from the site visit and a desktop review of aerial imagery, are as follows:

- Traffic emissions from the surrounding road network, including the M4 Western Motorway (M4) and Westlink (M7), and the Eastern Creek racetrack. There are several logistics/distribution centres in the area which will also generate potentially significant local traffic movements.
- A search of the **National Pollutant Inventory (NPI)** identified three industrial facilities in the 2148 post code that are located within 1 km of the Site. These are as follow:
 - Diageo Australia (described as the manufacture and importation of alcoholic (spirits) and non-alcoholic beverages, located 760 m to the east). This site reported emissions of volatile organic compounds (VOCs) and therefore has potential for some odour emissions, however they would be of a very different character to those emitted from the existing and proposed operations at the Site. There is not considered to be any potential for cumulative impacts from this facility with air emissions from the Arnott's operations.
 - Asahi Beverages (described as the manufacture and importation of alcoholic (wine and other) and non-alcoholic beverages, located 1 km to the east. This site reported emissions of carbon monoxide, ethanol, oxides of nitrogen, particulate matter, polycyclic aromatic hydrocarbons (PAHs), sulphur dioxide and volatile organic compounds (VOCs) and therefore has potential for some odour emissions. The organic nature of these emissions have the potential to be of a similar character to those emitted from the existing and proposed operations at the Site. Therefore, there is considered to be potential for cumulative impacts from this facility with air emissions from the Arnott's operations.
 - Elgas Sydney (described as a petroleum product wholesaler, located 850 m to the northeast). This site reported emissions of volatile organic compounds (VOCs) and therefore has potential for some odour emissions, however they would be of a very different character to those emitted from the existing and proposed operations at the Site. There is not considered to be any potential for cumulative impacts from this facility with air emissions from the Arnott's operations.
- A search of existing **Environmental Protection Licences on the EPA** website for Huntingwood identified one site, being Cookers Bulk Oil System, located at 2 Healey Circuit, Huntingwood. This site is licenced to receive and store "Used cooking oil only". Any odour emissions from this site would be of a very different character to those emitted from the existing and proposed operations at the Site. There is not considered to be any potential for cumulative impacts from this facility with air emissions from the Arnott's operations.



4.0 Pollutants of Concern

4.1 Construction Phase

Potential air emissions associated with the construction phase include:

- Fugitive dust emissions from the demolition/construction of buildings and other structures; and
- Products of combustion from construction plant and machinery.

No significant sources or emissions of odour are expected during the construction phase.

4.1.1 Fugitive Dust Emissions

During the construction phase, the potential for dust to be emitted from the Site will be directly influenced by the nature of the activities being performed. Activities that may lead to short-term emissions of dust, include:

- Loading and unloading of materials;
- Wheel-generated dust from trucks travelling along unpaved roads; and
- Wind erosion of exposed surfaces and stockpiles.

These activities will need to be managed appropriately to ensure off-site impacts are minimised (refer **Section 8.1.1**).

Temporary elevation in the emissions of particulate matter and local dust is considered to be inevitable as part of the construction works, particularly where those activities are undertaken during periods of low rainfall and/or windy conditions. The impact of elevated dust emissions is dependent upon the potential for particulates to become and remain airborne prior to being deposited as dust or experienced as an ambient particulate concentration.

It is noted that dust-generating activities will not be occurring continuously throughout the construction period.

4.1.2 Products of Combustion

Exhaust emissions from cranes, trucks, plant and other equipment associated with the construction of the Project will be a source of emissions to air during the construction phase.

Considering the size of the nature of the proposed development, air emissions from diesel-powered construction plant and machinery are anticipated to be relatively small compared to the existing background emission levels from vehicles on the surrounding road network.

4.2 Operational Phase

4.2.1 Current Emissions

Table 6 presents the annual air emission loads reported by the Arnott's Huntingwood facility to the NPI for the 2023/2024² reporting year.

²Most recent year publicly available at time report is prepared. Sourced: <https://www.npi.gov.au/npidata/action/load/individual-facility-detail/criteria/state/NSW/year/2024/jurisdiction-facility/907> (Accessed 28 February 2025)



As shown in [Table 6](#), the main emission is ammonia, which is associated with the use of ammonium bicarbonate in some products as a leavening agent; when these products are baked, ammonia gas is released causing the goods to rise.

Table 6 Reported Annual Air Emissions –2023/2024 NPI Reporting Year

Substance	Point Source (Stack) Emissions (kg)	Fugitive Emissions (kg)	Total Emissions (kg)
Ammonia (total)	26,543	-	26,543
Oxides of nitrogen (NOx)	8,672	64	8,737
Carbon monoxide (CO)	7,706	453	8,160
Particulate Matter less than 10 µm (PM ₁₀)	643	5	648
Particulate Matter less than 2.5 µm (PM _{2.5})	642	4.6	647
Total Volatile Organic Compounds (VOCs)	1,012	537.8	1,550
Sulfur dioxide (SO ₂)	95	0.3	96
Zinc and compounds	2.5	-	2.5
Nickel & compounds	0.2	-	0.2
Chromium (III) compounds	0.1	-	0.1
Cadmium & compounds	0.1	-	0.1
Copper & compounds	0.1	-	0.1
Polycyclic aromatic hydrocarbons (B[a]P _{eq})	0.1	-	0.1
Lead & compounds	-	-	-
Manganese & compounds	-	-	-
Mercury & compounds	-	-	-
Arsenic & compounds	-	-	-
Formaldehyde (methyl aldehyde)	1.5	1.5	2.9
Cobalt & compounds	-	-	-
Selenium & compounds	-	-	-
Beryllium & compounds	-	-	-
Polychlorinated dioxins and furans (TEQ)	-	-	-

The annual emissions of ammonia from the facility are estimated for the purposes of NPI reporting based on the assumption that all ammonium bicarbonate (NH₄HCO₃, with a molecular weight of 79.06 kg/kmol) consumed at the facility is converted to ammonia (NH₃, molecular weight of 17.03 kg/mol). That is:

$$\text{NH}_3 \text{ (kg)} = \text{NH}_4\text{HCO}_3 \text{ (kg)} \times 17.03/79.06$$

This approach assumes 100% reaction of all ammonium bicarbonate used by the facility (i.e. based on purchasing records for the year) and would provide a conservative overestimate of



actual emissions. The results of stack testing (7.3.1) shows that not all potential ammonia is released through the stacks. Approximately 12% of the ammonium bicarbonate mass is released as ammonia stack emissions.

The next most significant group of emissions are the key combustion-related pollutants (NO_x, CO, PM₁₀, PM_{2.5}, total VOCs and SO₂). A very small portion of these emissions are identified as being fugitive in nature (not discharged via a stack or vent) and are therefore expected to be associated with diesel and LPG combustion in forklifts and other mobile plant, however the vast majority are associated with gas combustion in the baking ovens, boilers and hot water heaters. Very small quantities of metals and individual VOCs are also reported as being emitted, which will be associated with trace emissions from fuel combustion.

The emissions from fuel combustion at the facility are estimated for the purposes of NPI reporting based on the quantities of natural gas, LPG and diesel consumed by the facility over the year (based on purchasing records, gas meter readings etc) and emission factors provided in the relevant NPI Emission Estimation Technique Manual (EETM) for the type of combustion source (e.g. the NPI EETM for Boilers or the EETM for Combustion Engines etc). These emission factors are developed to provide conservatively high estimates of emissions to address the uncertainties associated with the emission estimates not being based on the engine specifications or emission test results etc.

4.2.2 Proposed Emissions

Based upon a review of the activities proposed as part of the Project (presented in **Section 2.2**), no new potential air emission sources or pollutant types are proposed, only an increase in processing capacity. Potential air emission sources associated with the operational phase remain consistent with the Approved AQIA, which were identified as follows:

- Odours from the existing and new manufacturing lines;
- Odours from on-site handling and storage of raw materials as well as solid and liquid waste;
- Products of combustion from the gas-fired ovens on the existing and new manufacturing lines;
- Increased ammonia emissions associated with an increase in use of ammonium bicarbonate; and
- Products of combustion from mobile plant (forklifts etc.) and incoming/outgoing delivery trucks.

In addition to odour, particulates are also emitted from bakery operations in the form of fumes. Cooking methods such as solid fuel-fired cooking produce the most significant quantities of particulate matter. There is a very low potential for significant particulate matter emissions from the existing and proposed gas-fired ovens at the Site, except under upset operating conditions.

4.2.2.1 Odour

Odour is the principal air emission of concern from the new processing facility and will be primarily generated from the baking processes. There is also the potential for odour emissions from the waste management operations on the Site.



Baking Odours

Odorous emissions from bakeries are the result of complex mixtures of odorous VOCs, which are formed in the baking process as a result of chemical reactions between sugars and amino acids in the dough and breakdown of natural fats and oils.

The addition of chocolate manufacturing as part of the Approved SSDA will result in a change in the character of the odour emitted from this part of the operations compared to the current situation, however the hedonic tone of the odours can be expected to be pleasant to the vast majority of the population which would have significantly lower annoyance potential than unpleasant/neutral odours.

Odour emissions from bakeries may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in

Section 9.0.

Handling and Storage of Raw Materials and Waste

If not appropriately managed, some raw ingredients delivered to the Site could be a source of odour emissions. Solid and liquid organic waste produced on site also has the potential to be a source of odour emissions. The most effective way to minimise odours from the ingredient and waste storage and handling areas is by ensuring all material is stored at appropriate temperatures and that all areas are well ventilated.

Odour emissions from the ingredient storage and waste storage/treatment areas can be directly released into the atmosphere through openings in the buildings. While not all such emissions can be captured by air extraction systems (e.g. slightly positive pressures are required for chilled warehouse, odour emissions from waste being transferred off site will be emitted directly to atmosphere, etc.), suitable air extraction systems are being designed for all processing and storage areas to ensure odorous air is extracted in compliance with relevant AS and BCA guidelines. Moreover, it is understood that:

- Containment measures for spillages will be provided at appropriate locations to reduce odorous emissions from waste spillages;
- Solid organic waste and general waste will be removed from site for off-site disposal on a daily basis on Monday to Friday; and
- The refrigerated warehouse areas will ensure that all perishable food is kept at an appropriate temperature to avoid spoiling.

Odour emissions from food and waste handling and storage may be effectively managed through the implementation of a combination of physical and management measures. Refer to **Section 9.0.**

4.2.2.2 Products of Combustion

Gas-Fired Ovens

Emissions associated with the combustion of natural gas in the existing and new ovens will include carbon monoxide (CO) and oxides of nitrogen (NO_x). There will also be very low levels of emission of particulate matter (PM₁₀ and PM_{2.5}) and volatile organic compounds (VOCs). Emissions of sulfur dioxide (SO₂) from fossil fuel combustion are directly linked to the amount of sulfur in the fuel. As Australian natural gas contains only trace amounts of sulfur, SO₂ emissions from the ovens will be minimal.

The emissions from the burners on the existing ovens are vented directly to atmosphere via stacks that extend above the roof of the building, 16.75m from ground level (see [Figure 12](#)).



Line 1 stacks are proposed to be extended from 16.75m to 28m above the as part of Stage 1. All The stacks serving all new production lines are proposed to be 16.75m above ground level. No changes are proposed to stacks serving the remainder of the existing production lines.

As detailed in **Section 7.3.1.2**, the Site's daily day consumption rate is anticipated to be 854.7 GJ/day upon completion of Stage 1 and 1071.3 GJ/day after completion of Stage 2.

Figure 12 Photograph of Existing Bakery Building Showing Oven Stacks



Vehicle Movements

Emissions associated with the combustion of fuel (diesel, petrol, etc.) in mobile plant and delivery/staff/service vehicles will include CO, NO_x, PM₁₀ and PM_{2.5}, sulfur dioxide (SO₂) and VOCs. The rate and composition of air pollutant emissions from road vehicles is a function of a number of factors, including the type, size and age of the vehicles, the type of fuel combusted, number and speed of vehicles and the road gradient.

Vehicular access to the Site for light vehicles is via an existing entry and exit driveway (Liberty Road) at the Huntingwood Drive frontage. Separate heavy vehicle access to the site is available from Huntingwood Drive adjacent to the eastern boundary. Heavy vehicle access to the high-bay warehouse is also available from Brabham Drive.

SLR understand the modified Project would result in an increase in heavy vehicle trip generation across the day. [Table 7](#) presents a comparison between Approved SSDA and Project traffic generation rates.



Table 7 Proposed Changes in Daily Vehicle Movements – Operational Phase

Location	Vehicle Type	Approximate Timing	Approved SSDA Total	The Project (Proposed Stage 1 + Stage 2)
Raw Materials	Semi-trailer tankers	24 hrs/day	15	21
	Semi-trailer	7am – 7pm	12	7
	Rigid	7am – 7pm	7	5
Waste	Rigid/skip change out	5am – 11pm	8	7
	Semi-trailer	7am – 3pm	3	2
Packaging Materials	B-Double	7am – 6pm	1	0
	Semi-trailer	7am – 6pm	9	14
	Rigid	7am – 6pm	7	7
Service and Support Vehicles	Courier vans	7am – 5pm	4	14
	Engineering and service vans	7am – 5pm	1	0
	Deliveries	7am – 5pm	3	14
High Bay Warehouse	B-double	24hr	11	28
	Semi-trailer	24hr	17	86
	Rigid truck	24hr	1	21
Facility Staff	Light vehicle	Morning	284	347
		Afternoon	171	176
		Evening	178	213
Total Heavy Vehicle Movements			99	226
Total Light Vehicle Movements			633	736
Total Movements			732	962
Total Percentage increase				31%
Source: Technical Memorandum – Addendum Transport Impact Assessment, Project Number: P0087666, 11 November 2025				

[Table 7](#) indicates that the Project will result in a 31% increase in vehicle movements at the Site, giving a total of 962 vehicle movements per day (226 of these being heavy vehicles). To put this into context, the existing morning peak traffic volumes for the surrounding road network are presented in [Table 8](#).



Table 8 Morning Peak Traffic Volumes – Surrounding Road Network

Location	Light Vehicle Movements	Heavy Vehicle Movements
Horsley Dr & Cowpasture Rd Roundabout	3,611	313
Cowpasture Rd & The Horsley Dr Signals	3,272	631
Cowpasture Rd & Victoria St Roundabout	1,532	315
Cowpasture Rd & Trivet St Intersection	1,217	109

Source: Approved AQIA

Given the scale of on-site vehicle parking and proposed increases in operations it is considered that the emissions generated due to the combustion of fuel in light and heavy vehicles generated by the Project will be negligible compared to the emissions generated by traffic on the surrounding road network (and the gas-fired ovens and boilers) and do not represent a major increase relative to the current on-Site operations. Therefore, emissions from mobile plant and delivery vehicles have not been considered further in this assessment.

4.2.2.3 Ammonia

Products that will be produced in the new baking lines will use ammonium bicarbonate as a leavening agent.

The maximum anticipated ammonium bicarbonate consumption per any line 46.4 kg/hr with a total of 75.2 kg/hr for all lines in Stage 1 and a total of 79.9 kg/hr for all lines in Stage 2. The production schedule and ammonium bicarbonate usage is presented in more detail in **Section 7.3.1.2**.



5.0 Regulatory Framework

5.1 Relevant Legislation, Policy and Guidance

The following air quality policy and guidance documents have been referenced within this assessment and have been used to identify the relevant air quality criteria.

5.1.1 Protection of the Environment Operations (POEO) Act 1997 & Amendment Act 2011

The POEO Act (and Amendment Act 2011) is a key piece of environment protection legislation administered by the EPA group which enables and establishes instruments for setting environmental standards, goals, protocols and guidelines.

The following sections of the POEO Act are of general relevance to the Site:

- Section 124 and 125 of the POEO Act states that any plant located at a premise (e.g. the oven exhaust fans at the Site) should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials (e.g. raw ingredients and waste storage/disposal at the Site) are managed in a proper and efficient manner to prevent air pollution.
- Section 128 of the POEO Act states:
 - 1 The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.
 - 2 Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

5.1.2 Protection of the Environment Operations (Clean Air) Regulation 2022

The POEO (Clean Air) Regulation 2022 (the Regulation) is the core regulatory instrument for air quality issues in NSW. In relation to industry, the Regulation:

- sets maximum limits on emissions from activities and plant for a number of substances;
- deals with the transport and storage of volatile organic liquids;
- restricts the use of high sulphur liquid fuel; and
- imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

Part 5 of Regulation also deals with emissions of air impurities from activities and plant, and sets maximum limits on emissions for a number of substances (including solid particles and visible smoke) as noted below in [Table 9](#), with the limits relevant to the Site highlighted. The standards of concentrations prescribed by Part 5, Division 3 do not apply to plant during start up and shutdown periods, however such emissions are still subject to the requirements of Section 128 (2) of the POEO Act in relation to the prevention and minimisation of air pollution.



Table 9 Schedule 6 Standards of Concentration for (Group C1) Non-Scheduled Premises

Air Impurity	Activity	Concentration 2
Particles	Any activity/ plant	100 mg/m ³
Smoke	Solid fuel is burnt	Ringlemann 1 or 20% opacity
	Liquid fuel is burnt	Ringlemann 1 or 20% opacity
Note 1 Group C: Activity granted DA consent and commenced to operate after 1 September 2005.		
Note 2 Reference conditions are: Dry, 273 K, 101.3 kPa for any activity.		

5.1.3 NSW Environment Protection Authority Air Quality Policy and Guidance

The EPA is the NSW regulatory authority responsible for air quality regulation and associated activities.

NSW Approved Methods (NSW EPA 2022), lists the statutory methods for modelling and assessing air pollutants from stationary sources and specifies criteria which reflect the environmental outcomes adopted by the EPA. The Approved Methods are referred to in the POEO (Clean Air) Regulation 2022 for assessment of impacts of air pollutants. The air quality criteria set out in the Approved Methods have been reproduced and discussed in **Section 5.3**.

5.1.4 Odour Technical Framework and Notes

With respect to odour, the NSW EPA publications, *Technical Framework: Assessment and management of odour from stationary sources in NSW* (NSW DEC 2006a) and the associated *Technical Notes* (NSW DEC 2006b) (the Technical Framework) provide a policy framework for assessing and managing activities that emit odour and offers guidance on dealing with odour issues.

Odour performance goals guide decisions on odour management. The Technical Framework makes note in several parts of the document that 'no odour' is not a realistic objective for some activities, namely:

- **Executive Summary:** *"Emissions of odour may not be preventable from some activities. 'No odour' is not a realistic objective."*
- **Section 1.2 Context of the framework:** *"It must be recognised that the emission of odour cannot be prevented from some activities and that 'no odour' is not a realistic objective in these cases."*
- **Section 3.3 Odour assessment criteria:** *"Odour assessment criteria guide decisions about effective odour management but recognise it may be neither possible nor desirable to achieve 'no odour'."*

5.2 Local Government Air Quality Toolkit

NSW EPA issues the *"Local Government Air Quality Toolkit"*³ ("the Toolkit") in response to requests from council officers for information and guidance on the common air quality issues

³ <https://www.epa.nsw.gov.au/your-environment/air/air-nsw-overview/local-government-air-quality-toolkit>



they manage. In 2024 the Toolkit was updated through the involvement of a number of NSW Government agencies including the EPA in consultation with air quality consultants. It provides contemporary easy-to-access information about air quality management for a number of industries.

The most relevant sections of the Toolkit to the Project are :

- *'Construction sites guidance note'*⁴.
- *'Food outlets guidance note'*⁵.
- *'Odour from food outlet inspection checklist'*⁶

5.2.1 National Construction Code and Australian Standards

The National Construction Code (NCC) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of efficiently achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives. The NCC contains mandatory technical provisions for the design and construction of NCC class buildings.

Australian Standard (AS) 1668.2-2024 *The use of ventilation and air conditioning in building, Part 2: Mechanical ventilation in buildings* sets design requirements for mechanical ventilation systems. Mechanical ventilation is required in enclosures where specific health and ventilation amenity requirements cannot be met by natural means.

- Section 3.3.1 of the AS lists the types of effluents requiring ventilation,
- Section 3.10.1 of the AS lists the flow rates at which discharges would be deemed to be objectionable.
- Section 3.10.3 and 3.10.4 of the AS outlines the discharge requirements of for effluents and discharges deemed objectionable.

Where relevant, discharges from the Site should compliance with the NCC and AS1668.2-2024.

4 <https://www.epa.nsw.gov.au/sites/default/files/240180-local-government-air-quality-toolkit-construction-sites-guidance-note.pdf>

5 <https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/air/240171-local-government-air-quality-toolkit-food-outlets-guidance-note.pdf>

6 <https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/air/local-government-air-quality-toolkit-resource-pack-odour-from-food-outlet-inspection-checklist.pdf>



5.3 Ambient Air Quality Criteria

Ambient air quality criteria for the identified pollutants of concern are prescribed by Section 7.1 of the Approved Methods. The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW and are considered to be appropriate for the setting. Those relevant to the identified emission sources at the Project are discussed below.

It is noted that in the Approved AQIA construction and operational odour impact were assessed qualitatively and ammonia and combustion gases were assessed quantitatively, in agreement with DPHI (previously DPIE), which demonstrated predicted compliance with the criteria.

5.3.1 Odour

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit (ou). An odour goal of less than 1 OU would theoretically result in no odour impact being experienced. Odour performance goals guide decisions on odour management but are generally not intended to achieve 'no odour'. The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit (ou). An odour goal of less than 1 ou would theoretically result in no odour impact being experienced. Impacts from odorous air contaminants are often a source of nuisance rather than resulting in adverse health-effects. There are various elements that are regarded as combining to cause odour nuisance, which are listed below and are collectively known as the FIDOL factors:

- **Frequency:** how often the odour occurs
- **Intensity:** how strong the odour is perceived to be
- **Duration:** how long the odour is present for
- **Offensiveness:** how offensive the odour is perceived to be
- **Location or Context:** where the person is experiencing the odour.

In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on a combination of the following factors:

- **Odour quality:** whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Source characteristics:** whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are usually located in rural locations.
- **Health Effects:** whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

Other factors may come into play when assessing odour impacts, such as:



- *Population sensitivity*: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level*: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation*: whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.

The NSW EPA recommends within the Technical Framework that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 ou. This is based on experience gained through odour assessments from proposed and existing facilities in NSW indicating that an odour performance goal of 7 ou is likely to represent the level below which “offensive” odours should not occur (for an individual with a ‘standard sensitivity’ to odours). This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour performance goals need to be designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas. It is often not possible, or practical, to determine and assess the cumulative odour impacts of all odour sources that may impact on a receptor in an urban environment. Therefore, the proposed odour performance goals allow for population density, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity.

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the Odour Framework, is expressed as follows:

$$\text{Impact assessment criterion (ou)} = \frac{(\log_{10} \text{population} - 4.5)}{-0.6}$$

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in [Table 10](#). For areas such as that surrounding the Site, the relevant odour impact assessment criterion set by the Approved Methods for complex mixtures of odorous air pollutants is 2 ou (nose-response-time average, 99th percentile). As noted above, a quantitative odour modelling assessment has not been performed as part of this study, hence compliance with the criterion cannot be demonstrated. As discussed in Section 3.1, the facility is not aware of any complaints or concerns from the local community regarding odours from the existing operations.



Table 10 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community (number of receptors)	Impact Assessment Criteria for Complex Mixtures of Odours (ou) (nose-response-time average, 99th percentile)
Urban area (> 2000)	2
~500	3
~125	4
~30	5
~10	6
Single residence (< 2)	7

5.3.2 Products of Combustion and Fugitive Dust

Ambient air quality criteria for the products of combustion and fugitive dust emissions associated with the Project are prescribed by Section 7.1 of the Approved Methods. The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW and are considered to be appropriate for the setting. Those relevant to the identified emission sources at the Project are discussed below.

Carbon Monoxide

CO is an odourless, colourless gas formed from the incomplete burning of fuels. CO bonds to the haemoglobin in the blood and reduces the oxygen carrying capacity of red blood cells, thus decreasing the oxygen supply to the tissues and organs, in particular the heart and the brain.

CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow. The highest concentrations are found at the kerbside, with concentrations decreasing rapidly with increasing distance from the road.

The impact assessment criteria specified within the Approved Methods for CO are provided in [Table 11](#).

Table 11 Impact Assessment Criteria for Carbon Monoxide (CO)

Pollutant	Averaging Period	Criterion
CO	15-minutes	87 ppm (100 mg/m ³)
	1-hour	25 ppm (30 mg/m ³)
	8-hour	9 ppm (10 mg/m ³)

Note: ppm = parts per million

Oxides of Nitrogen

NOX is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry NOX generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO₂).

NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to form NO₂ which can have significant health effects including damage to the respiratory tract and increased



susceptibility to respiratory infections and asthma. Long term exposure to NO₂ can lead to lung disease. NO will be converted to NO₂ in the atmosphere after being emitted. The impact assessment criteria specified within the Approved Methods for NO₂ are provided in [Table 12](#). It is noted that the criteria for NO₂ has reduced since the Approved AQIA was conducted.

Table 12 Impact Assessment Criteria for Nitrogen Dioxide (NO₂)

Pollutant	Averaging Period	Criterion
NO ₂	1-hour	8 pphm (164 µg/m ³)
	Annual	1.5 pphm (31 µg/m ³)

Note: pphm = parts per hundred million

Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP).

The TSP impact assessment criteria was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter. PM₁₀ and PM_{2.5} are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the PM_{2.5} category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM₁₀ and PM_{2.5} include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The impact assessment criteria specified within the Approved Methods for suspended particulate matter are provided in [Table 13](#).

Table 13 Impact Assessment Criteria for Suspended Particulate Matter

Pollutant	Averaging Period	Criterion
TSP	Annual	90 µg/m ³
PM ₁₀	24-hour	50 µg/m ³
	Annual	25 µg/m ³
PM _{2.5}	24-hour	25 µg/m ³
	Annual	8 µg/m ³

Deposited Particulate

The criteria presented above are concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts from fugitive dust emissions during the construction phase also need to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m²/month).



Table 14 presents the impact assessment criteria set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 14 EPA Impact Assessment Criteria for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m ² /month	4 g/m ² /month

Sulphur Dioxide

SO₂ is a colourless, pungent gas with an irritating smell. When present in sufficiently high concentrations, exposure to SO₂ can lead to impacts on the upper airways in humans (i.e. the nose and throat irritation). SO₂ can also mix with water vapour to form sulphuric acid (acid rain) which can damage vegetation, soil quality and corrode materials. Main sources of SO₂ in the air are industries that process materials containing sulphur (e.g. wood pulping, paper manufacturing, metal refining and smelting, textile bleaching, wineries etc.). SO₂ is also present in motor vehicle emissions, however since Australian fuels are relatively low in sulphur, high ambient concentrations are not common.

The impact assessment criteria specified within the Approved Methods for SO₂ are provided in **Table 15**. It is noted that the criteria for SO₂ has reduced since the Approved AQIA was conducted.

Table 15 Impact Assessment Criteria for Sulphur Dioxide (SO₂)

Pollutant	Averaging Period	Criteria
SO ₂	1-hour	7.5 pphm (215 µg/m ³)
	24-hour	2 pphm (57 µg/m ³)

Note: pphm = parts per hundred million

Ammonia

Ammonia is a colourless gas with a characteristically pungent smell. When present in sufficiently high concentrations, exposure to high concentrations of ammonia in air causes immediate burning of the eyes, nose, throat, and respiratory tract and can result in blindness, lung damage or death. Inhalation of lower concentrations can cause coughing, and nose and throat irritation. Agricultural activities are the main source of ammonia emissions. Other sources of ammonia include industrial processes, vehicular emissions and volatilisation from soils and oceans. The human-health based impact assessment criterion specified within the Approved Methods for ammonia is presented in **Table 16**. The odour threshold for ammonia is higher than the Approved Methods criterion, therefore compliance with this criterion would indicate no potential risk of nuisance odour impacts.

Table 16 Impact Assessment Criterion for Ammonia

Pollutant	Averaging Period	Criterion
Ammonia	1-hour (99.9 th Percentile)	0.46 ppm (0.33 mg/m ³)

Note: ppm = parts per million



6.0 Review of Ambient Air Quality Monitoring Data

Air quality monitoring is performed by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) at a number of monitoring stations across NSW. The closest station to the Site is the Prospect Air Quality Monitoring Station (AQMS), located approximately 3.8 km to the east of the Site (see **Section 3.3**). The following air pollutants are monitored at this station:

- Oxides of nitrogen (NO, NO₂ and NO_x)
- Sulfur dioxide (SO₂)
- Carbon monoxide (CO)
- Fine particles as PM_{2.5}
- Fine particles as PM₁₀

A summary of the monitored pollutant concentrations for the last five years (2020-2024) is presented in [Table 17](#) and the data are presented graphically in [Figure 13](#) to [Figure 19](#).

Table 17 Summary of Air Quality Monitoring Data at Prospect AQMS (2020-2024)

Pollutant	PM ₁₀		PM _{2.5}		NO ₂		CO		SO ₂	
	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual	Maximum 1-hour	Maximum 8-hour	Maximum 1-hour	Maximum 24-hour
Units	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	mg/m ³	µg/m ³	µg/m ³
2020	245.8(10)	20.1	70.8 (13)	8.4	88.2	15.1	2.6	2.3	51.5	11.4
2021	44.6	17.1	37.3 (2)	6.8	88.2	14.9	1.6	1.3	42.9	8.6
2022	29.2	12.0	18.2	4.7	86.1	13.1	1.6	1.1	48.6	8.6
2023	44.4	16.7	29.6 (2)	7.2	100.5	16.2	1.8	1.3	68.6	11.4
2024	43.5	16.7	20.3	7.0	86.1	18.1	1.5	1.3	60.1	11.4
Criteria	50	25	25	8	164	31	30	10	215	57
# numbers in brackets represent number of exceedances of relevant criteria recorded each year.										

Exceedances of the 24-hour average criteria for PM_{2.5} were recorded in the years 2020, 2021 and 2023. Exceedances of the 24-hour average PM₁₀ criteria were recorded in 2020. Exceedances of the annual average PM_{2.5} criterion were also recorded for the year 2020.

A review of the available compliance monitoring reports indicates that the PM₁₀ and PM_{2.5} exceedances during these years were primarily due to exceptional events such as bushfire emergencies, dust storms and hazard reduction burns (NSW DPIE 2020) (NSW DPE 2021) (DCCEEW 2025). The high number of exceedances recorded in 2020 were due to bushfire smoke that affected Sydney and the surrounding areas for a significant number of days in late early 2020 (the 'Black Summer' bushfire event).



Figure 13 Measured Daily Maximum 1-Hour Average NO₂ Concentrations at Prospect AQMS (2020-2024)

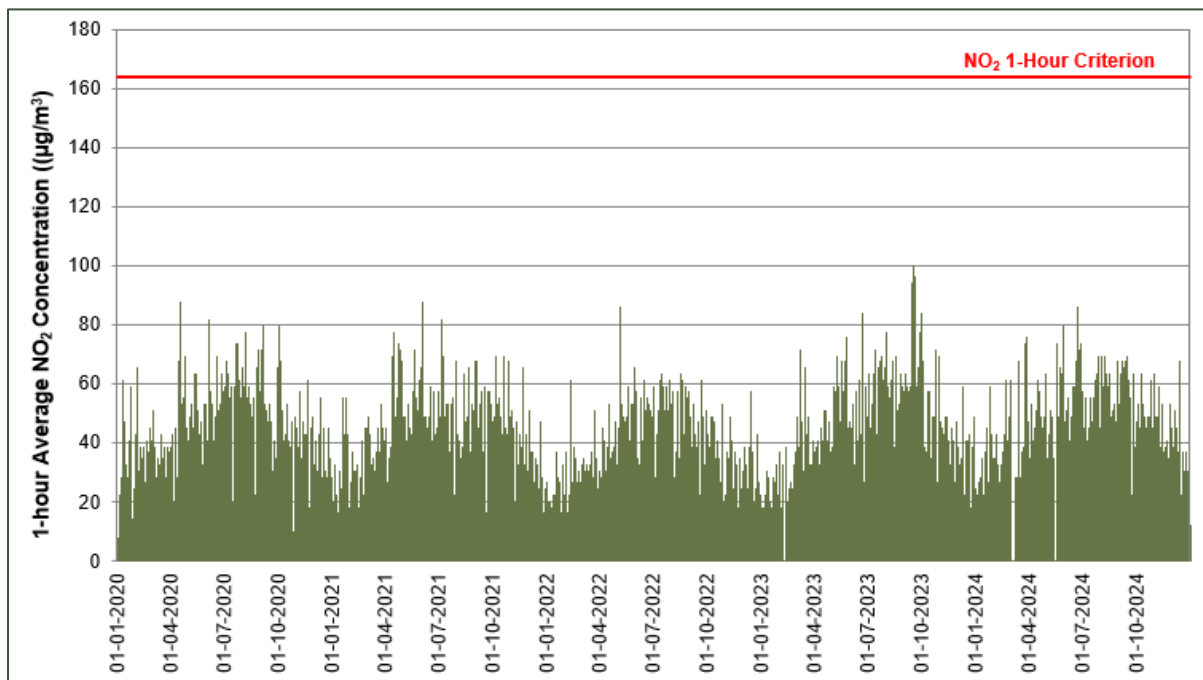


Figure 14 Measured Daily Maximum 1-Hour Average SO₂ Concentrations at Prospect AQMS (2020-2024)

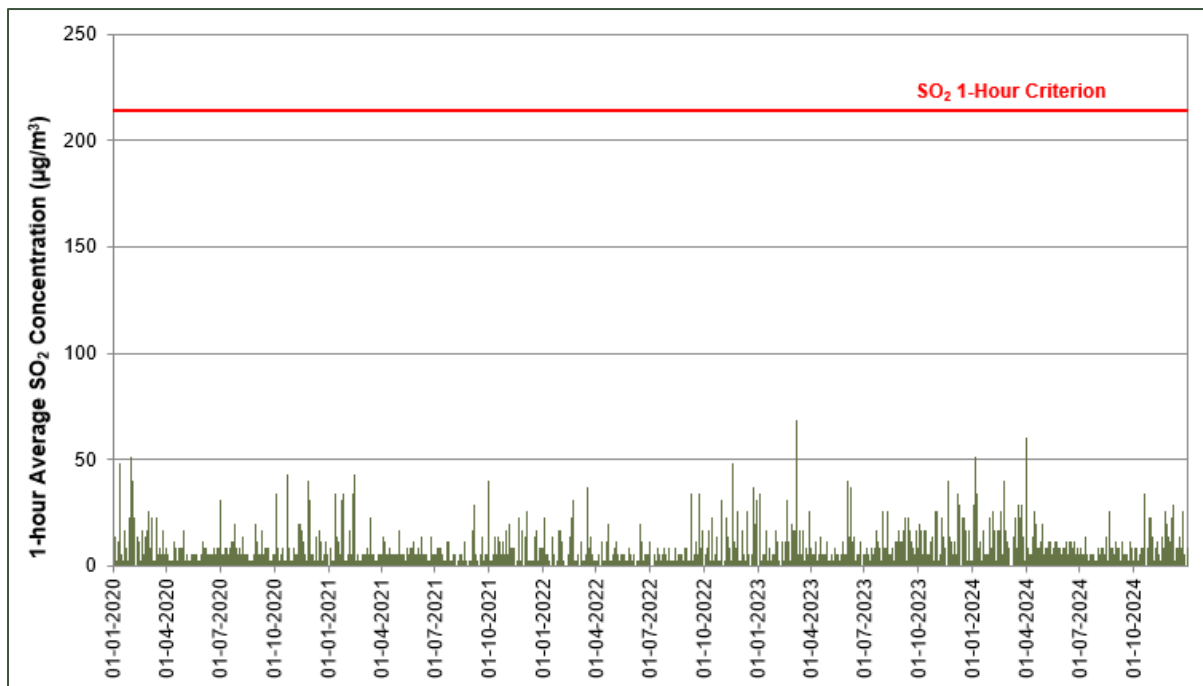


Figure 15 Measured 24-Hour Maximum SO₂ Concentrations at Prospect AQMS (2020-2024)

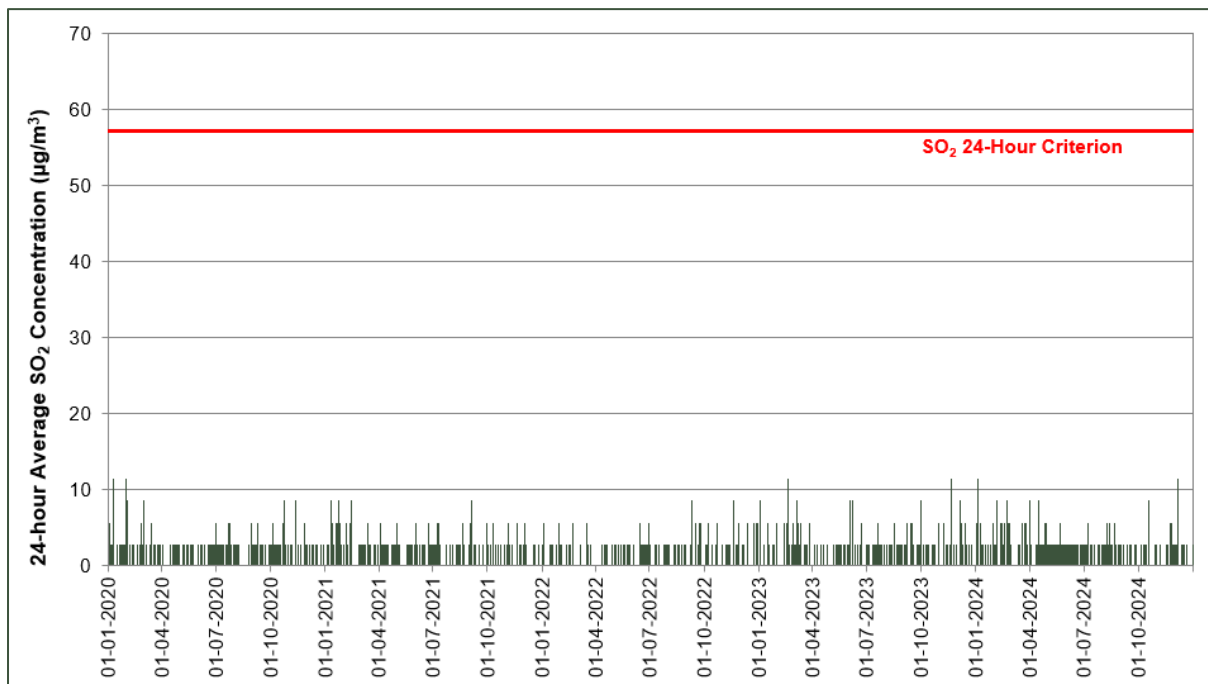


Figure 16 Measured 1-Hour Average CO Concentrations at Prospect AQMS (2020-2024)

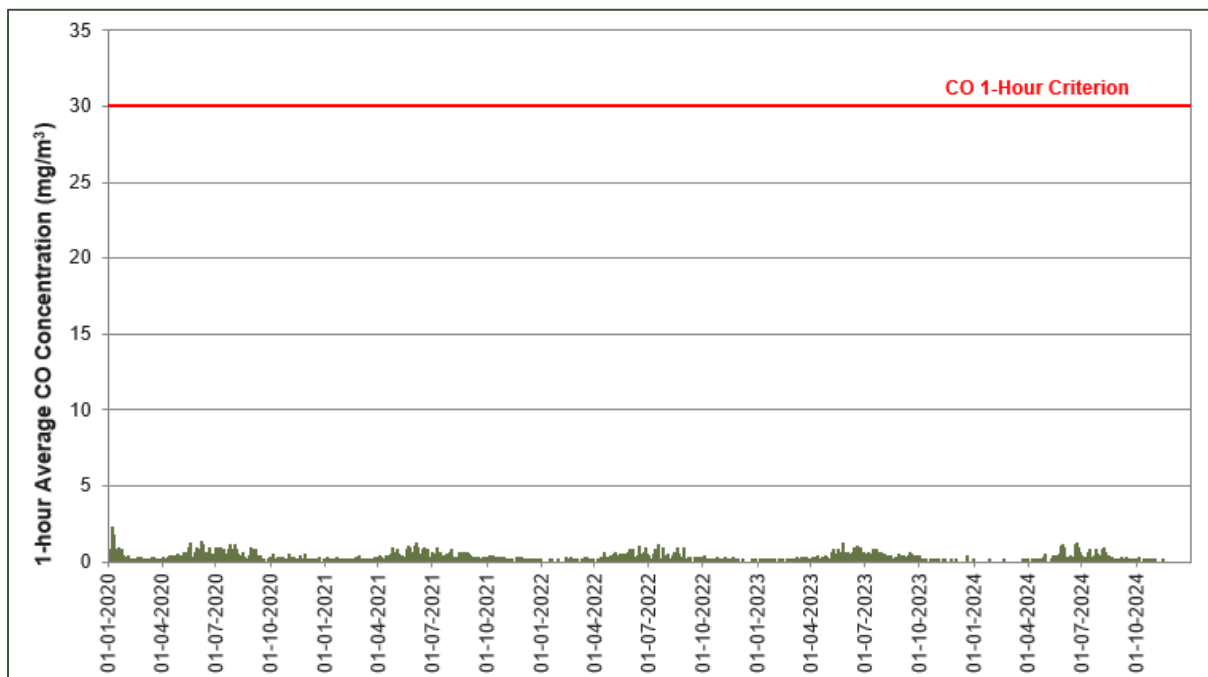


Figure 17 Measured 8-Hour Average CO Concentrations at Prospect AQMS (2020-2024)

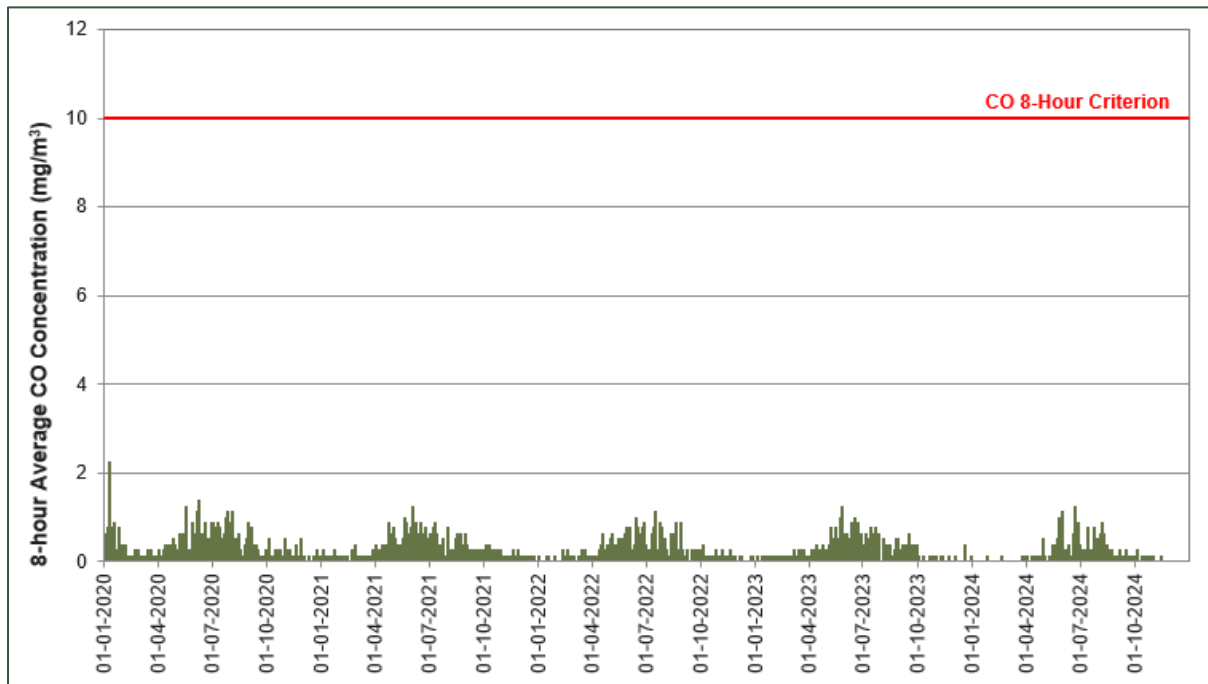


Figure 18 Measured 24-Hour Average PM₁₀ Concentrations at Prospect AQMS (2020-2024)

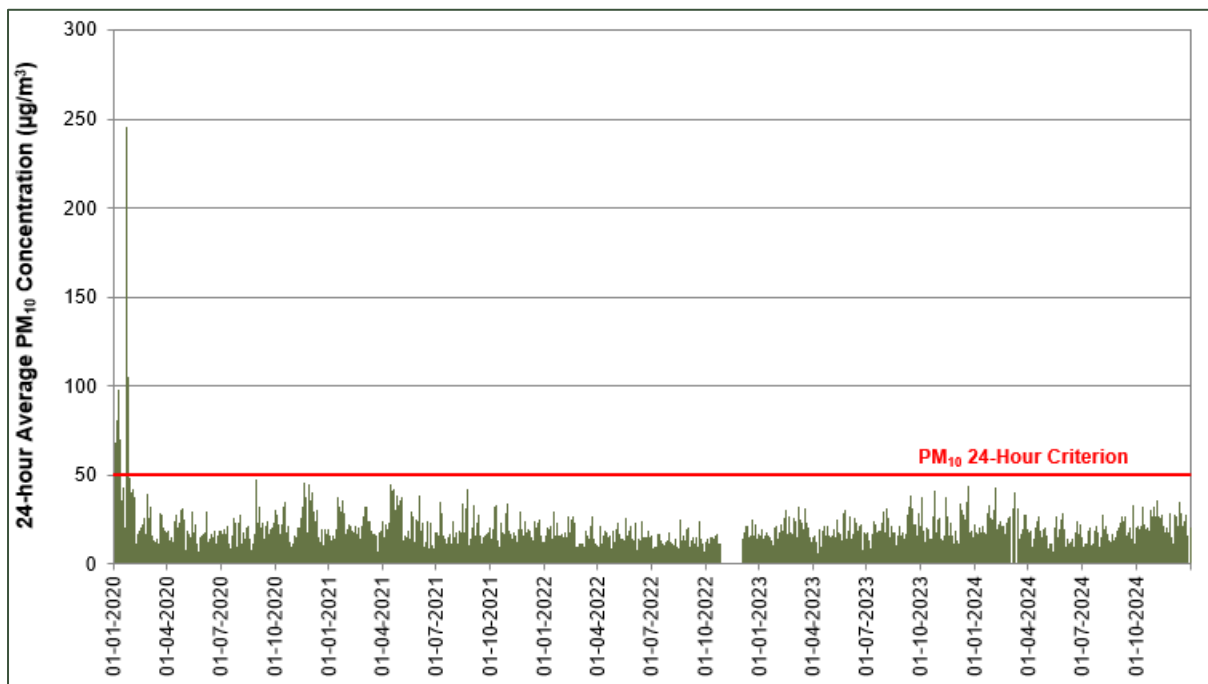
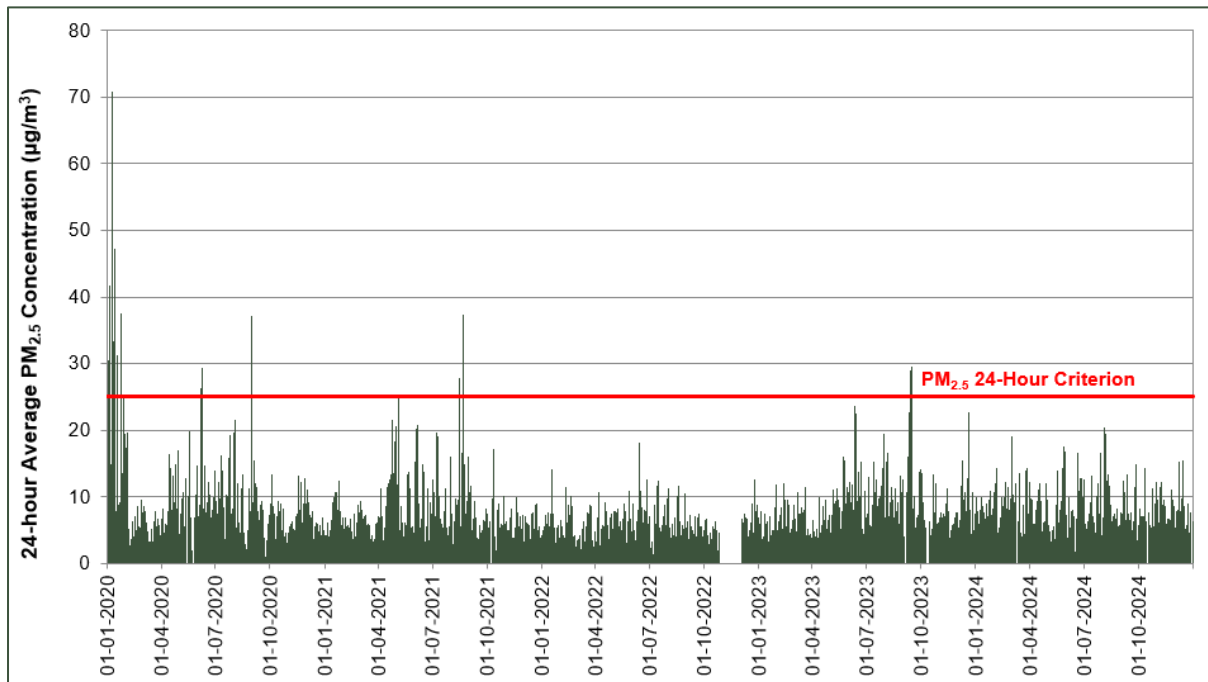


Figure 19 Measured 24-Hour Average PM_{2.5} Concentrations at Prospect AQMS (2020-2024)



7.0 Assessment Methodology

7.1 Construction Phase Qualitative Impact Assessment

Quantitatively assessing impacts of fugitive dust emissions from construction projects using predictive modelling is seldom considered appropriate, primarily due to the uncertainty in the details of the construction activities, including equipment type, number, location and scheduling, which are unlikely to be available at the time of the assessment. Furthermore, they are also likely to change as construction progresses.

Instead, it is considered appropriate to conduct a qualitative assessment of potential construction related air quality impacts. Potential impacts of dust emissions associated with proposed demolition and construction activities at the Site has been performed based on the methodology outlined in the Institute of Air Quality Management (UK) (IAQM) document, "Assessment of dust from demolition and construction" (IAQM 2024). This guidance document provides a structured approach for classifying construction sites according to the risk of air quality impacts, to identify relevant mitigation measures appropriate to the risk (see **Appendix A** for full methodology).

The IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures and has been accepted by regulators across all states and territories for a variety of construction projects.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- Step 1: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- Step 2: Assess risk of dust effects from activities based on:
 - the scale and nature of the works, which determines the potential dust emission magnitude; and
 - the sensitivity of the area surrounding dust-generating activities.
- Step 3: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- Step 4: Assess significance of remaining activities after management measures have been considered.

It is noted that that accurate information regarding construction activities and equipment are not available at this stage, hence SLR has made conservative assumptions where necessary to assess impacts from construction activities. If these parameters were to be significantly modified, re-assessment of construction impacts is recommended.

7.2 Operational Phase Qualitative Assessment

A risk-based qualitative assessment approach has also been adopted for odour emissions due to the modified operational activities at the Site as well as air quality impacts due to mobile plant and delivery vehicles (see **Appendix B** for full methodology). Similar to the construction phase air quality assessment, the inputs into the model for these sources would be subject to a high degree of uncertainty as there is a very high degree of uncertainty associated with quantification of odour emissions from the bakery and waste/food handling. Further, during consultation with DPIE during the preparation of the Approved AQIA it was



established that the qualitative assessment of odour impacts to be adequate for the Project and a quantitative assessment of odours was not required.

The risk-based operational assessment methodology takes account of a range of impact descriptors, including the following:

- **Nature of Impact:** does the impact result in an adverse or beneficial environment?
- **Sensitivity:** how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude:** what is the anticipated scale of the impact?

The integration of sensitivity with impact magnitude is used to derive the predicted significance of that change. Given the nature of the operations proposed to be performed, and the limited design data available at the time of preparing this report, it is considered that this approach is appropriate to identify those key activities that have the potential to give rise to off-site air quality impacts, in order that recommended mitigation measures may be identified. If appropriate, these recommendations may include further detailed modelling assessment of key activities to confirm that the proposed mitigation measures will ensure compliance with relevant air quality criteria, once detailed design data is available.

7.3 Operational Phase Quantitative Assessment

The assessment of ammonia and combustion gas emissions from the operational phase of the Project has been performed quantitatively through the use of dispersion modelling techniques. Modelling was performed for the following pollutants:

- Nitrogen dioxide (emitted as total oxides of nitrogen)
- Carbon monoxide
- Sulphur dioxide
- Particulate matter (PM₁₀ and PM_{2.5})
- Ammonia

7.3.1 Emission Source Quantification

Modelling was performed for two operating scenarios, representative of:

- Proposed modified expansion - Stage 1 operations (peak operations)
- Proposed modified expansion - Stage 2 operations (peak operations)

Use of the annual emission rates presented reported by Arnott's to the NPI for these pollutants in the dispersion modelling study is not deemed appropriate, as the annual average data would not allow for meaningful assessment of peak emissions from the Site. Therefore, stack emission testing was performed by NATA accredited laboratory, Ektimo (Accreditation No. 14601) in accordance with the Approved Methods for Sampling in order to obtain NO_x, CO, SO₂ and ammonia emissions data appropriate for use in the dispersion modelling study. Ektimo's emission test report is presented in **Appendix C** and a summary of the testing program and results obtained is provided below.

For particulate matter (PM) emissions, which were not monitored, a NO_x to PM ratio of 1:0.074, based on emission factors provided in the NPI Emission Estimation Technique Manual for Combustion in Boilers (Department of Environment and Energy 2011) was used.



7.3.1.1 Stack Testing Program

To quantify peak NO_x, CO, SO₂ and ammonia emissions from the existing production lines, samples were collected from 12 of the existing stacks. This included:

- Four of the eight Line 1 gas fired oven stacks, with a product containing the highest ammonium bicarbonate content (of any product produced at the Site) being baked on the day of testing (Country Cheese). Ammonia emissions during the baking of this product are deemed to be representative of peak ammonia emissions from the Site. Stacks serving different zones of the travelling oven were tested to allow for a more accurate estimation of total emissions from the oven through the baking process,
- Four of the eight Line 4 gas fired oven stacks, with the oven set to the maximum heat setting and gas throughput. Stacks serving different zones of the travelling oven were tested to allow for a more accurate estimation of total emissions from the oven,
- Four gas fired boilers/ hot water heater stacks operating under normal conditions.

A summary of the parameters measured at each location is presented in [Table 18](#) and a summary of the emission testing results is presented in [Table 19](#). [Figure 20](#) illustrates the location of stacks tested as part of the emission testing program.

Table 18 Emission Testing Program

Location	Identification	Test Date	Test Parameters	Test Method
Line 1	Stack A	13 January 2022	Temperature, flow, velocity	TM-2
	Stack B		Ammonia (NH ₃)	USEPA method CTM 27
	Stack C		Nitrogen oxides (as NO ₂)	TM-11
	Stack D		Carbon monoxide (CO)	TM-32
Line 4	Stack A	12 January 2022	Sulphur Dioxide (SO ₂)	TM-2
	Stack B		Temperature, flow, velocity	TM-11
	Stack C		Nitrogen oxides (as NO ₂)	TM-32
	Stack D		Carbon monoxide (CO)	
Boilers and Hot Water Heater	HW1	14 January 2022	Sulphur Dioxide (SO ₂)	TM-2
	V150		Temperature, flow, velocity	TM-11
	V151		Nitrogen oxides (as NO ₂)	TM-32
	V152		Carbon monoxide (CO)	



Figure 20 Emission Testing Program – Location of Tested Stacks



Table 19 Emission Testing Results

Location	Date	Stack Diameter	Exhaust Temperature	Exhaust Flowrate		Exit Velocity	Ammonia Emissions		Nitrogen Oxides Emissions		Carbon Monoxide Emissions		Sulphur Dioxide Emissions	
		(m)	(°K)	m³/s	Nm³/s	m/s	mg/Nm³	g/s	mg/Nm³	g/s	mg/Nm³	g/s	mg/Nm³	g/s
Line 1 - Stack A	13-01-2022	0.3	510	0.34	0.15	4.8	1,100	0.17	59	0.01	600	0.09	< 6	< 0.001
Line 1 - Stack B	13-01-2022	0.3	548	0.41	0.14	5.8	2,800	0.39	130	0.02	470	0.07	< 6	< 0.001
Line 1 - Stack C	13-01-2022	0.3	412	0.29	0.18	4.2	100	0.02	< 4	< 0.001	10	0.002	< 6	< 0.001
Line 1 - Stack D	13-01-2022	0.5	347	1.5	1.1	7.5	2.3	0.00	< 4	< 0.004	< 2	< 0.002	< 6	< 0.007
Line 4 - Stack A	12-01-2022	0.3	487	0.31	0.15	4.4	-	-	17	0.003	97	0.01	< 6	< 0.001
Line 4 - Stack B	12-01-2022	0.3	548	0.36	0.12	5.1	-	-	60	0.01	590	0.07	< 6	< 0.001
Line 4 - Stack C	12-01-2022	0.3	460	0.43	0.19	6.1	-	-	12	0.002	87	0.02	< 6	< 0.001
Line 4 - Stack D	12-01-2022	0.3	331	0.13	0.095	1.8	-	-	< 4	< 0.0004	< 2	< 0.0002	< 6	< 0.001
Hot Water Heater – HW1	14-01-2022	0.37	403	0.56	0.35	5.2	-	-	85	0.03	6.9	0.002	< 6	< 0.002
Boiler - V150	14-01-2022	0.29	435	0.33	0.17	5.0	-	-	52	0.01	6.3	0.001	< 6	< 0.001
Boiler - V151	14-01-2022	0.3	452	0.21	0.1	3.0	-	-	67	0.01	10	0.001	< 6	< 0.001
Boiler - V152	14-01-2022	0.4	410	0.45	0.25	3.6	-	-	81	0.02	< 2	< 0.001	< 6	< 0.002



7.3.1.2 Source Characteristics and Emission Rates

CALPUFF requires a range of inputs to describe the emissions to air for each modelled source.

Potential air emissions and relevant stack parameters for the emission stacks were estimated based on the stack testing data reported by Ektimo (refer [Table 19](#)).

The peak production schedule provided to SLR (shown in [Table 20](#)) has been used to develop the emissions inventory for this assessment. It is noted that the air emissions are dependent on the ammonium bicarbonate usage and gas consumption, not the plant throughput capacity.

The following changes to the stack characteristics have been assumed for this assessment which vary from the Approved SSDA:

- Amend stack heights:
 - Increase existing Line 1 at Stage 1 from 16.75 m to 28 m.
 - Reduce heights of approved stacks from 18 m to 16.75 m
- Reduce number of approved lines from 10 to 9 (remove Line 10)
- Amend number of approved emission stacks per line:
 - Line 6 – reduce total number of stacks from 8 to 7
 - Line 8 – reduce total number of stacks from 8 to 6
 - Line 9 – increase total number of stacks from 4 to 5
- Products containing ammonium bicarbonate are baked on all existing production lines with the exception of Line 4. The Approved AQIA assumed that ammonium bicarbonate is only used on Line 1.

Table 20 Peak Production Schedule

Line	Stage 1			Stage 2		
	Capacity (t/year)	Ammonium bicarbonate usage (kg/hr)	Gas Consumption (GJ/day)	Capacity (t/year)	Ammonium bicarbonate (kg/hr)	Gas Consumption (GJ/day)
1	60,000	46.4	130.0	60,000	46.4	130.0
2		1.7	130.0		1.7	130.0
3		0.6	130.0		0.6	130.0
4		0	130.0		0	130.0
5		9.3	130.0		9.3	130.0
6	33,000	17.2	204.7	33,000	17.2	204.7
7				17,000	0.2	72.2
8					4.1	72.2
9					0.4	72.2
Total	90,000	75.2	854.7	110,000	79.9	1071.3

Emission testing results from Line 1 have been used to develop emission factors for combustion gas and ammonia emissions for the remaining stacks. This is consistent with the Approved AQIA This is shown in [Table 21](#).



The stack testing emission rates from each the four of the eight Line 1 oven stacks were applied to other stacks serving representative zones of the travelling oven to allow for estimation of total emissions from the oven through the baking process. An emission factor for each combustion gas emission and ammonia emissions was calculated based on the total emissions of Line 1 and the fuel consumption or ammonia bicarbonate usage of Line 1.

Table 21 Line 1 Emission rates

ID	Line name	Stack number	Emissions Ref	NOx (g/s)	Ammonia (g/s)	CO (g/s)	SO ₂ (g/s)
1	Line 1	1	Line 1 - Stack A	0.009	0.165	0.090	0.001
2	Line 1	2	Line 1 - Stack A	0.009	0.165	0.090	0.001
3	Line 1	3	Line 1 - Stack B	0.018	0.392	0.066	0.001
4	Line 1	4	Line 1 - Stack B	0.018	0.392	0.066	0.001
5	Line 1	5	Line 1 - Stack B	0.018	0.392	0.066	0.001
6	Line 1	6	Line 1 - Stack C	0.001	0.018	0.002	0.001
7	Line 1	7	Line 1 - Stack C	0.001	0.018	0.002	0.001
8	Line 1	8	Line 1 - Stack D	0.004	0.003	0.002	0.007
Line 1 Total Emissions				0.08	1.54	0.38	0.013

Table 22 Derived Emission Factors

Parameter	NOx	Ammonia	CO	SO ₂
Emission Factor (kg of pollutant / GJ of gas combusted) ¹	0.05	-	0.25	0.01
Emission Factor (kg ammonia / kg of ammonium bicarbonate used) ²	-	0.12	-	-
¹ – calculated using emission rates detailed in Table 22 and gas consumption rate at the time of stack testing (5.42 GJ/hour) ² – calculated using emission rates detailed in Table 22 , ammonium bicarbonate molar mass of 79.056 g/mol and ammonia molar mass of 17.031 g/mol.				

The emission factors from [Table 22](#) were applied to each line as per the fuel consumption or ammonium bicarbonate usage shown in [Table 20](#).

In addition, the following assumptions have been made:

- All stacks operate 24/7, which is a conservative assumption as there will be fluctuations in the production schedule.
- Emissions from each the four of the eight Line 1 oven stacks were applied to other stacks serving representative zones of the travelling oven to allow for estimation of total emissions from the oven through the baking process. Stack emissions from production lines were assumed to follow the same distribution across the oven as



Line 1. Were a line has fewer stacks than Line 1, the remaining emissions were distributed proportionally across the oven stacks.

- For particulate matter (PM) emissions, which were not monitored, a NO_x to PM ratio of 1:0.074, based on emission factors provided in the NPI Emission Estimation Technique Manual for Combustion in Boilers (Department of Environment and Energy 2011) was used. It is noted that this document provides two sets of emission factors for natural gas fired boilers, namely wall fired and tangential fired. The NO_x to PM ratio used relates to wall fires boilers, which is 70% higher (and therefore more conservative) than the NO_x to PM ratio calculated from tangential fired boilers.
- For stacks with monitored pollutant levels below the detection limit (as was the case for all SO₂ emissions measurements on all stacks), the concentration was conservatively assumed to be equal to the detection limit. Actual emissions could be far below this concentration.
- The new oven stack exhausts will be oriented vertically as per the current stacks.

[Table 23](#) provides a summary of the stack parameters and [Table 24](#) summarised the modelled emission rates for each of the Stage 1 and Stage 2 production lines included in the modelling, as well as gas-fired boiler and hot water heater stacks.

The modelled stack locations are shown in [Figure 21](#).

Table 23 Modelled Stack Parameters

ID	X	Y	Status	Description	Height (m)	Diameter (m)	Velocity (m/s)	Temperature (K)
1	303111	6258255	Existing	Line 1-1	28.5	0.3	4.8	510
2	303111	6258246	Existing	Line 1-2	28.5	0.3	4.8	510
3	303109	6258231	Existing	Line 1-3	28.5	0.3	5.8	548
4	303107	6258217	Existing	Line 1-4	28.5	0.3	5.8	548
5	303105	6258200	Existing	Line 1-5	28.5	0.3	5.8	548
6	303102	6258183	Existing	Line 1-6	28.5	0.3	4.2	412
7	303101	6258174	Existing	Line 1-7	28.5	0.3	4.2	412
8	303100	6258163	Existing	Line 1-8	28.5	0.5	7.5	347
9	303117	6258254	Existing	Line 2-1	16.75	0.3	4.8	510
10	303117	6258245	Existing	Line 2-2	16.75	0.3	4.8	510
11	303115	6258231	Existing	Line 2-3	16.75	0.3	5.8	548
12	303113	6258216	Existing	Line 2-4	16.75	0.3	5.8	548
13	303111	6258199	Existing	Line 2-5	16.75	0.3	5.8	548
14	303108	6258182	Existing	Line 2-6	16.75	0.3	4.2	412
15	303107	6258174	Existing	Line 2-7	16.75	0.3	4.2	412
16	303106	6258163	Existing	Line 2-8	16.75	0.5	7.5	347
17	303122	6258253	Existing	Line 3-1	16.75	0.3	4.8	510
18	303122	6258244	Existing	Line 3-2	16.75	0.3	4.8	510
19	303120	6258230	Existing	Line 3-3	16.75	0.3	5.8	548
20	303118	6258216	Existing	Line 3-4	16.75	0.3	5.8	548
21	303116	6258199	Existing	Line 3-5	16.75	0.3	5.8	548
22	303114	6258182	Existing	Line 3-6	16.75	0.3	4.2	412
23	303112	6258173	Existing	Line 3-7	16.75	0.3	4.2	412



ID	X	Y	Status	Description	Height (m)	Diameter (m)	Velocity (m/s)	Temperature (K)
24	303111	6258162	Existing	Line 3-8	16.75	0.5	7.5	347
25	303127	6258253	Existing	Line 4-1	16.75	0.3	4.8	510
26	303127	6258243	Existing	Line 4-2	16.75	0.3	4.8	510
27	303126	6258226	Existing	Line 4-3	16.75	0.3	5.8	548
28	303123	6258212	Existing	Line 4-4	16.75	0.3	5.8	548
29	303121	6258196	Existing	Line 4-5	16.75	0.3	5.8	548
30	303119	6258177	Existing	Line 4-6	16.75	0.3	4.2	412
31	303117	6258161	Existing	Line 4-7	16.75	0.3	4.2	412
32	303115	6258150	Existing	Line 4-8	16.75	0.5	7.5	347
33	303133	6258252	Existing	Line 5-1	16.75	0.3	4.8	510
34	303133	6258243	Existing	Line 5-2	16.75	0.3	4.8	510
35	303131	6258228	Existing	Line 5-3	16.75	0.3	5.8	548
36	303130	6258214	Existing	Line 5-4	16.75	0.3	5.8	548
37	303127	6258197	Existing	Line 5-5	16.75	0.3	5.8	548
38	303125	6258180	Existing	Line 5-6	16.75	0.3	4.2	412
39	303124	6258172	Existing	Line 5-7	16.75	0.3	4.2	412
40	303122	6258161	Existing	Line 5-8	16.75	0.5	7.5	347
41	303081	6258239	Existing	HW2-2	16.75	0.37	5.2	403
42	303079	6258240	Existing	HW1-1	16.75	0.37	5.2	403
43	303091	6258243	Existing	V150-1	16.75	0.29	5	435
44	303091	6258241	Existing	V151-2	16.75	0.3	3	452
45	303087	6258241	Existing	V152-3	16.75	0.4	3.6	410
46	303155	6258262	Proposed	Line 6-1	16.75	0.5	5.8	500
47	303153	6258246	Proposed	Line 6-2	16.75	0.5	5.8	500
48	303152	6258234	Proposed	Line 6-3	16.75	0.5	5.8	550
49	303151	6258220	Proposed	Line 6-4	16.75	0.5	5.8	550
50	303149	6258205	Proposed	Line 6-5	16.75	0.5	5.8	550
51	303148	6258190	Proposed	Line 6-6	16.75	0.5	4.8	550
52	303147	6258184	Proposed	Line 6-7	16.75	0.5	4.8	550
53	303058	6258281	Proposed	Line 7-1	16.75	0.3	4.8	500
54	303057	6258272	Proposed	Line 7-2	16.75	0.3	4.8	500
55	303057	6258269	Proposed	Line 7-3	16.75	0.3	4.8	550
56	303055	6258257	Proposed	Line 7-4	16.75	0.3	4.8	550
57	303054	6258244	Proposed	Line 7-5	16.75	0.3	4.8	550
58	303054	6258240	Proposed	Line 7-6	16.75	0.3	3.6	550
59	303053	6258287	Proposed	Line 7-7	16.75	0.3	3.6	550
60	303052	6258279	Proposed	Line 8-1	16.75	0.3	4.8	500
61	303051	6258267	Proposed	Line 8-2	16.75	0.3	4.8	500
62	303050	6258255	Proposed	Line 8-3	16.75	0.3	4.8	550
63	303048	6258242	Proposed	Line 8-4	16.75	0.3	4.8	550
64	303048	6258238	Proposed	Line 8-5	16.75	0.3	4.8	550
65	303048	6258290	Proposed	Line 8-6	16.75	0.3	4.8	550



ID	X	Y	Status	Description	Height (m)	Diameter (m)	Velocity (m/s)	Temperature (K)
66	303045	6258258	Proposed	Line 9-1	16.75	0.3	4.8	500
67	303044	6258249	Proposed	Line 9-2	16.75	0.3	4.8	500
68	303046	6258270	Proposed	Line 9-3	16.75	0.3	3.6	550
69	303045	6258258	Proposed	Line 9-4	16.75	0.3	3.6	550
70	303044	6258249	Proposed	Line 9-5	16.75	0.3	3.6	550

Table 24 Modelled Stack Emission Rates

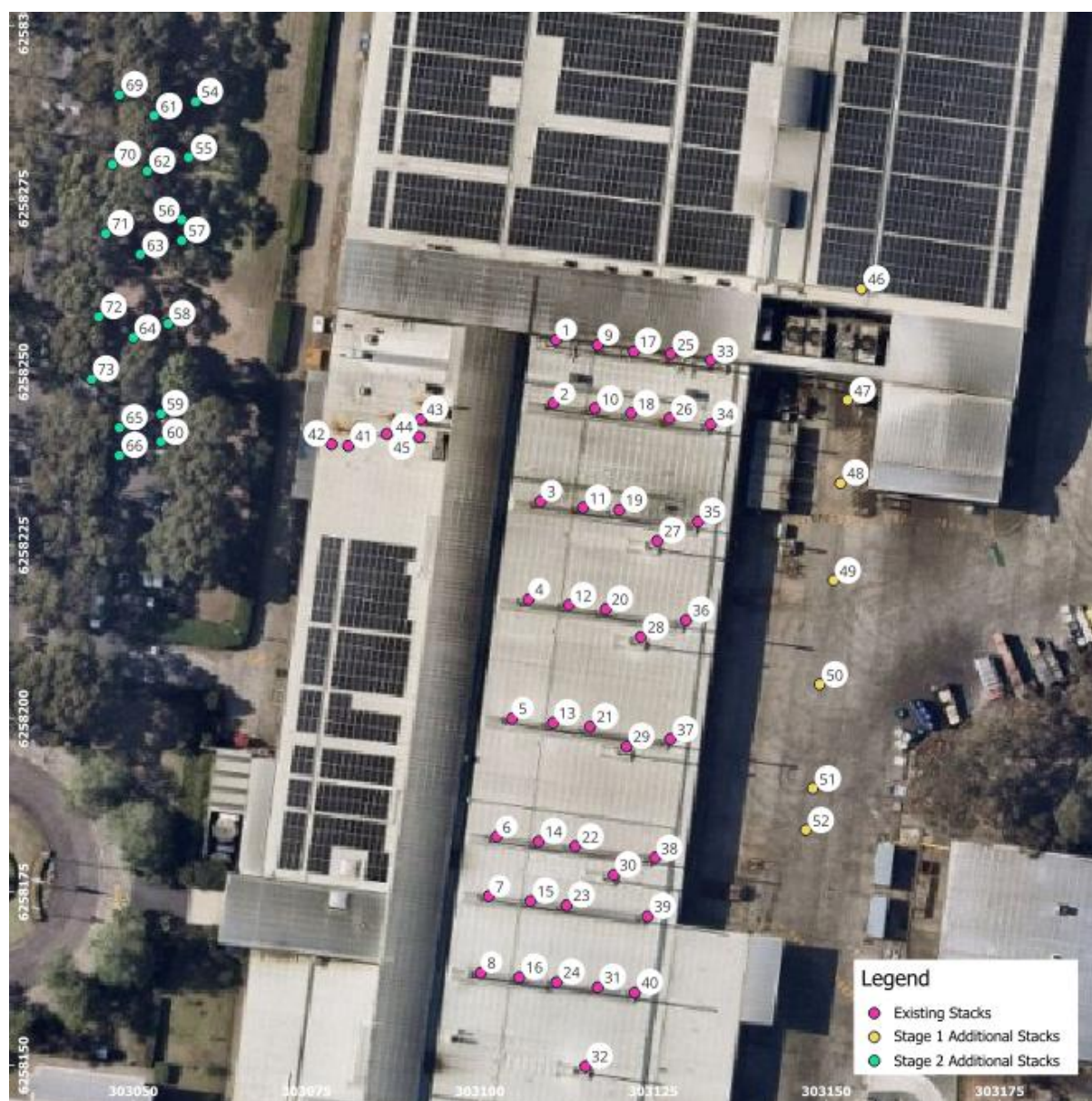
ID	Stage 1					Stage 2				
	NOx (g/s)	Ammonia (g/s)	CO (g/s)	SO ₂ (g/s)	PM (g/s)	NOx (g/s)	Ammonia (g/s)	CO (g/s)	SO ₂ (g/s)	PM (g/s)
1	0.009	0.165	0.090	0.001	0.001	0.009	0.165	0.090	0.001	0.001
2	0.009	0.165	0.090	0.001	0.001	0.009	0.165	0.090	0.001	0.001
3	0.018	0.392	0.066	0.001	0.001	0.018	0.392	0.066	0.001	0.001
4	0.018	0.392	0.066	0.001	0.001	0.018	0.392	0.066	0.001	0.001
5	0.018	0.392	0.066	0.001	0.001	0.018	0.392	0.066	0.001	0.001
6	0.001	0.018	0.002	0.001	0.000	0.001	0.018	0.002	0.001	0.000
7	0.001	0.018	0.002	0.001	0.000	0.001	0.018	0.002	0.001	0.000
8	0.004	0.003	0.002	0.007	0.000	0.004	0.003	0.002	0.007	0.000
9	0.009	0.006	0.090	0.001	0.001	0.009	0.006	0.090	0.001	0.001
10	0.009	0.006	0.090	0.001	0.001	0.009	0.006	0.090	0.001	0.001
11	0.018	0.014	0.066	0.001	0.001	0.018	0.014	0.066	0.001	0.001
12	0.018	0.014	0.066	0.001	0.001	0.018	0.014	0.066	0.001	0.001
13	0.018	0.014	0.066	0.001	0.001	0.018	0.014	0.066	0.001	0.001
14	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.002	0.001	0.000
15	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.002	0.001	0.000
16	0.004	0.000	0.002	0.007	0.000	0.004	0.000	0.002	0.007	0.000
17	0.009	0.002	0.090	0.001	0.001	0.009	0.002	0.090	0.001	0.001
18	0.009	0.002	0.090	0.001	0.001	0.009	0.002	0.090	0.001	0.001
19	0.018	0.005	0.066	0.001	0.001	0.018	0.005	0.066	0.001	0.001
20	0.018	0.005	0.066	0.001	0.001	0.018	0.005	0.066	0.001	0.001
21	0.018	0.005	0.066	0.001	0.001	0.018	0.005	0.066	0.001	0.001
22	0.001	0.000	0.002	0.001	0.000	0.001	0.000	0.002	0.001	0.000
23	0.001	0.000	0.002	0.001	0.000	0.001	0.000	0.002	0.001	0.000
24	0.004	0.000	0.002	0.007	0.000	0.004	0.000	0.002	0.007	0.000
25	0.009	0.000	0.090	0.001	0.001	0.009	0.000	0.090	0.001	0.001
26	0.009	0.000	0.090	0.001	0.001	0.009	0.000	0.090	0.001	0.001
27	0.018	0.000	0.066	0.001	0.001	0.018	0.000	0.066	0.001	0.001
28	0.018	0.000	0.066	0.001	0.001	0.018	0.000	0.066	0.001	0.001
29	0.018	0.000	0.066	0.001	0.001	0.018	0.000	0.066	0.001	0.001
30	0.001	0.000	0.002	0.001	0.000	0.001	0.000	0.002	0.001	0.000
31	0.001	0.000	0.002	0.001	0.000	0.001	0.000	0.002	0.001	0.000



ID	Stage 1					Stage 2				
	NOx (g/s)	Ammonia (g/s)	CO (g/s)	SO ₂ (g/s)	PM (g/s)	NOx (g/s)	Ammonia (g/s)	CO (g/s)	SO ₂ (g/s)	PM (g/s)
32	0.004	0.000	0.002	0.007	0.000	0.004	0.000	0.002	0.007	0.000
33	0.009	0.033	0.090	0.001	0.001	0.009	0.033	0.090	0.001	0.001
34	0.009	0.033	0.090	0.001	0.001	0.009	0.033	0.090	0.001	0.001
35	0.018	0.079	0.066	0.001	0.001	0.018	0.079	0.066	0.001	0.001
36	0.018	0.079	0.066	0.001	0.001	0.018	0.079	0.066	0.001	0.001
37	0.018	0.079	0.066	0.001	0.001	0.018	0.079	0.066	0.001	0.001
38	0.001	0.004	0.002	0.001	0.000	0.001	0.004	0.002	0.001	0.000
39	0.001	0.004	0.002	0.001	0.000	0.001	0.004	0.002	0.001	0.000
40	0.004	0.001	0.002	0.007	0.000	0.004	0.001	0.002	0.007	0.000
41	0.030	0.000	0.002	0.002	0.002	0.030	0.000	0.002	0.002	0.002
42	0.030	0.000	0.002	0.002	0.002	0.030	0.000	0.002	0.002	0.002
43	0.009	0.000	0.001	0.001	0.001	0.009	0.000	0.001	0.001	0.001
44	0.007	0.000	0.001	0.001	0.000	0.007	0.000	0.001	0.001	0.000
45	0.020	0.000	0.001	0.002	0.002	0.020	0.000	0.001	0.002	0.002
46	0.015	0.061	0.142	0.003	0.001	0.015	0.061	0.142	0.003	0.001
47	0.015	0.061	0.142	0.003	0.001	0.015	0.061	0.142	0.003	0.001
48	0.030	0.146	0.104	0.004	0.002	0.030	0.146	0.104	0.004	0.002
49	0.030	0.146	0.104	0.004	0.002	0.030	0.146	0.104	0.004	0.002
50	0.030	0.146	0.104	0.004	0.002	0.030	0.146	0.104	0.004	0.002
51	0.001	0.007	0.003	0.002	0.000	0.001	0.007	0.003	0.002	0.000
52	0.001	0.007	0.003	0.002	0.000	0.001	0.007	0.003	0.002	0.000
53	N/A	N/A	N/A	N/A	N/A	0.005	0.001	0.050	0.001	0.000
54	N/A	N/A	N/A	N/A	N/A	0.005	0.001	0.050	0.001	0.000
55	N/A	N/A	N/A	N/A	N/A	0.011	0.001	0.037	0.001	0.001
56	N/A	N/A	N/A	N/A	N/A	0.011	0.001	0.037	0.001	0.001
57	N/A	N/A	N/A	N/A	N/A	0.011	0.001	0.037	0.001	0.001
58	N/A	N/A	N/A	N/A	N/A	0.000	0.000	0.001	0.001	0.000
59	N/A	N/A	N/A	N/A	N/A	0.000	0.000	0.001	0.001	0.000
60	N/A	N/A	N/A	N/A	N/A	0.005	0.015	0.050	0.001	0.000
61	N/A	N/A	N/A	N/A	N/A	0.005	0.015	0.050	0.001	0.000
62	N/A	N/A	N/A	N/A	N/A	0.011	0.035	0.037	0.002	0.001
63	N/A	N/A	N/A	N/A	N/A	0.011	0.035	0.037	0.002	0.001
64	N/A	N/A	N/A	N/A	N/A	0.011	0.035	0.037	0.002	0.001
65	N/A	N/A	N/A	N/A	N/A	0.000	0.002	0.001	0.001	0.000
66	N/A	N/A	N/A	N/A	N/A	0.005	0.001	0.050	0.001	0.000
67	N/A	N/A	N/A	N/A	N/A	0.005	0.001	0.050	0.001	0.000
68	N/A	N/A	N/A	N/A	N/A	0.011	0.003	0.037	0.002	0.001
69	N/A	N/A	N/A	N/A	N/A	0.011	0.003	0.037	0.002	0.001
70	N/A	N/A	N/A	N/A	N/A	0.011	0.003	0.037	0.002	0.001



Figure 21 Modelled Stack Locations



7.3.2 Selection of Models

Emissions from the Site were modelled using a combination of the TAPM, CALMET and CALPUFF models.

CALPUFF is a transport and dispersion model that ejects “puffs” of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so, it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain hourly concentration evaluated at selected receptor locations. The CALPOST post-processor is then used to



process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

7.3.3 Meteorological Modelling

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke 2002).

For this study, a site-representative three-dimensional meteorological dataset was compiled using a combination of the TAPM and CALMET models, as discussed in the following sections.

7.3.3.1 Selection of Modelling Year

Meteorological data recorded over the five-year period 2020-2024 by the Horsley Park Equestrian Centre AWS were analysed to select a worst-case meteorological year in order to provide a conservative air quality impact assessment. An analysis of the wind speed, wind direction, temperature and relative humidity recorded in each of the calendar years aligned well with the five-year average data with no particular years of note, however the year 2023 reported the worst-case combination of low average wind speed and greater number of calms, which generally results in reduced plume dispersion and consequently greater ground level impacts. For this reason, 2023 was chosen for the AQIA (refer **Appendix C** for details).

7.3.3.2 TAPM

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which can be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM model predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM model can assimilate actual local wind observations so that they can optionally be included in a model solution. TAPM parameters used for this study, including the data assimilation data used in the TAPM model are presented in [Table 25](#). The three-dimensional upper air data from the TAPM output was used as input for the diagnostic meteorological model (CALMET).



Table 25 Meteorological Parameters Used for this Study (TAPM v 4.0.4)

Modelling Period	1 January 2023 to 31 December 2023
Centre of analysis	303,284 mE 6,257,989 mS (UTM Coordinates)
Number of grid points	40 × 40 × 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Prospect AQMS St Marys AQMS
Terrain	AUSLIG 9 second DEM

7.3.3.3 CALMET

CALMET is a diagnostic meteorological model that develops wind and temperature fields on a 3-dimensional gridded modelling domain. Associated 2-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and land uses.

[Table 26](#) details the parameters used in the meteorological modelling to drive the CALMET model. TAPM-generated three-dimensional meteorological data was used as the initial guess wind field. The local topographical data and available surface weather observations in the area were then used to refine the initial guess wind field predetermined by the TAPM data.

The topographical data was sourced from the United States Geological Service's Shuttle Radar Topography Mission database that has recorded topography across Australia with a 1 arc second (approximately 30 m) spacing. The land use data file was created using the latest publicly available aerial imagery.

Table 26 Meteorological Modelling Parameters – CALMET

Parameter	Data
Coarse Grid	
Modelling period	1st January 2023 to 31st December 2023
Meteorological grid resolution	100 m
Grid southwest corner coordinates	295,150 mE 6250,000 mS (UTM Coordinates)
Initial guess field	TAPM output
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1,200 m, 2,000 m, 3,000 m, 4,000 m)
Data assimilation	None
Refined Grid	
Modelling period	1st January 2023 to 31st December 2023



Parameter	Data
Meteorological grid resolution	25 m
Grid southwest corner coordinates	303,150 mE 6258.000 mS (UTM Coordinates)
Initial guess field	TAPM output
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1,200 m, 2,000 m, 3,000 m, 4,000 m)
Data assimilation	None

7.3.3.4 Site Representative Meteorological Data

This section presents a summary of the key meteorological conditions predicted by CALMET at the Site.

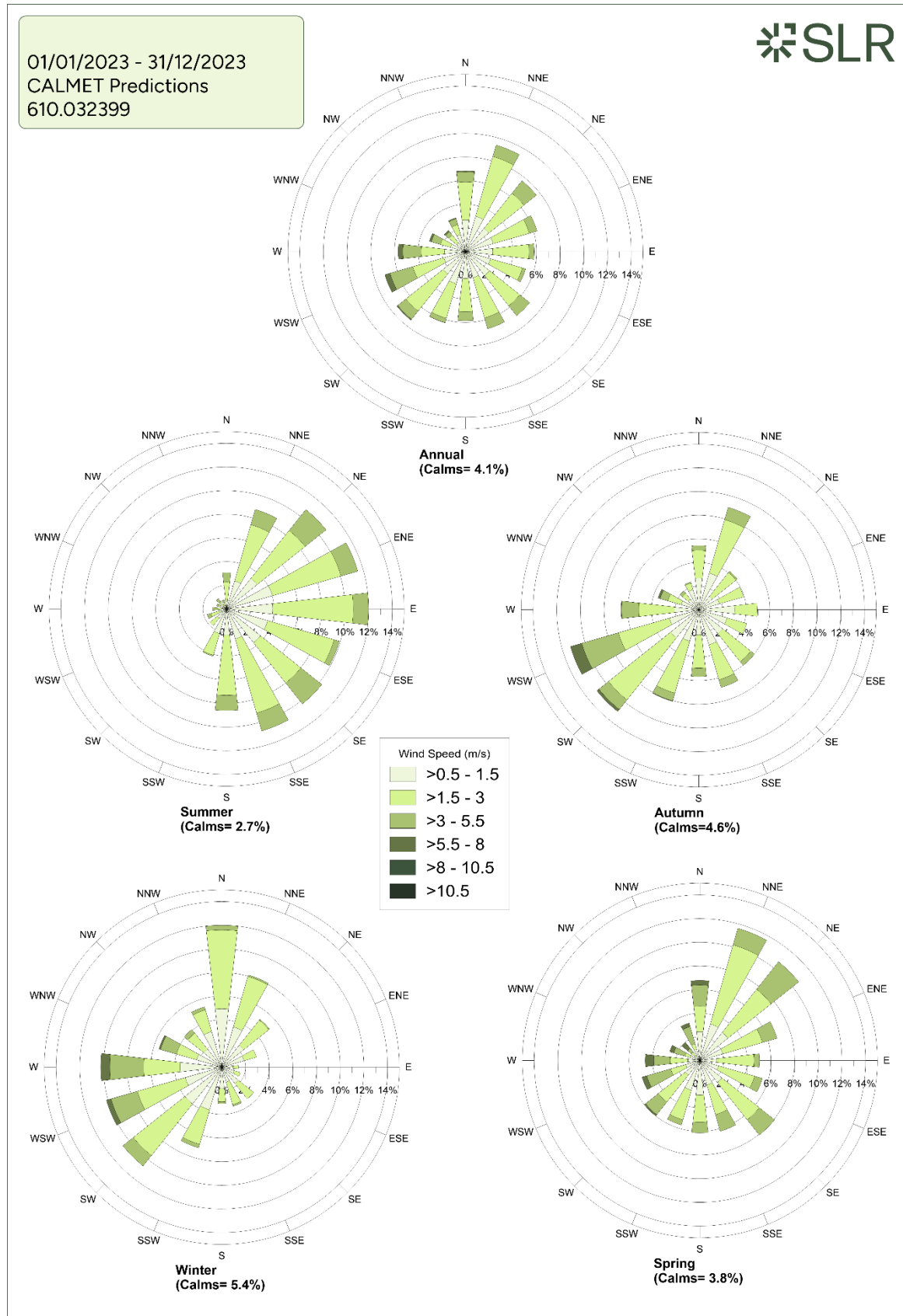
Wind Speed and Direction

A summary of the annual wind behaviour predicted by TAPM/CALMET (refined grid) for the Site is presented in [Figure 22](#). Based on the model predictions, the Site experienced winds between 0.5 m/s and 8 m/s, from all directions, but with fewer winds from the northwestern quadrant. Calm wind conditions (wind speeds less than 0.5 m/s) were predicted to occur 4.1% of the time.

The seasonal wind roses indicate that in summer, winds from the eastern directions are predominant. In autumn and winter, winds from the south-western quadrant predominately. In spring, winds blow from northeast quadrant predominantly.



Figure 22 Wind Roses for the Site, as Predicated by CALMET



Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford-Turner (PGT) assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each PGT stability class are shown [Table 27](#).

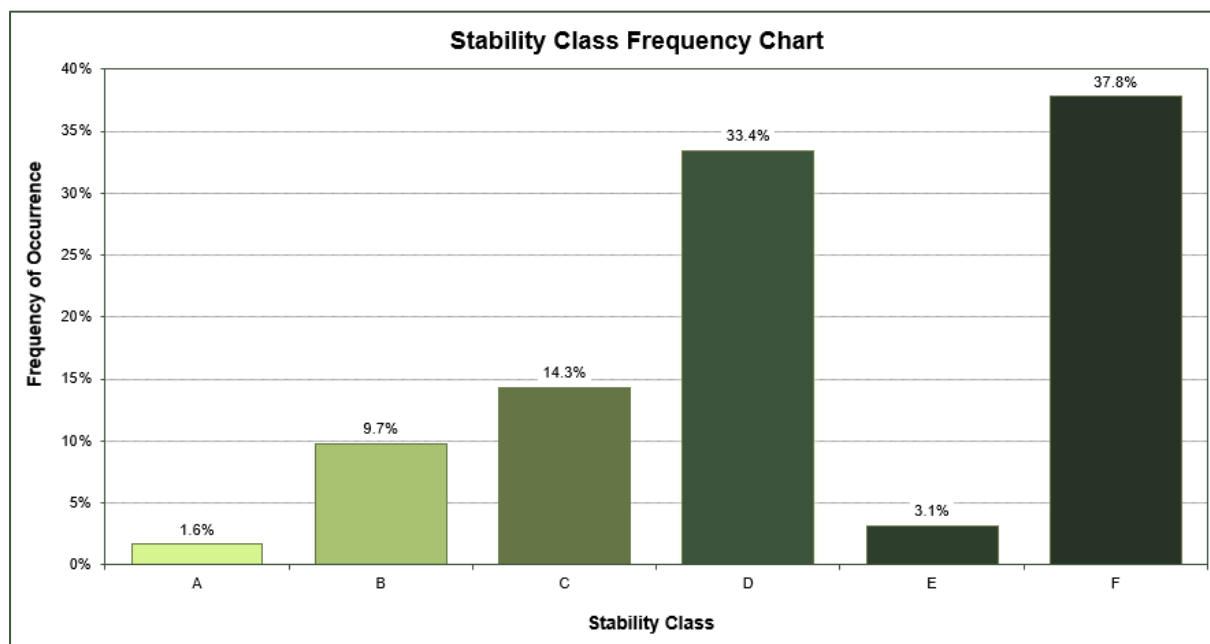
Table 27 Meteorological Conditions Defining PGT Stability Classes

Surface wind speed (m/s)	Daytime insolation			Night-time conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D
Notes: Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter. Night refers to the period from 1 hour before sunset to 1 hour after sunrise. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above. Source: NOAA, 2018.					

The predicted frequency of each stability class at the Site during 2023 is presented in [Figure 23](#). The results indicate a high frequency of conditions typical to Stability Class F (Very Stable) and D (Neutral), with a low frequency of very unstable conditions (Stability Class A). Stable conditions occur during the night-time, under low wind speed conditions, which inhibit pollutant dispersion.



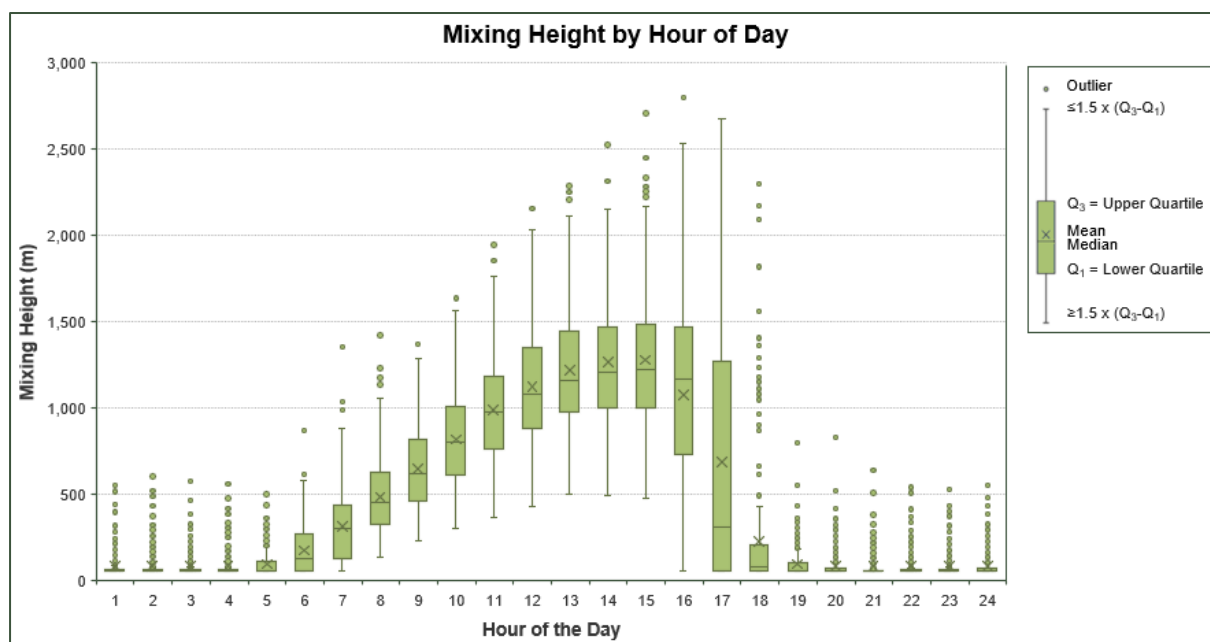
Figure 23 Stability Class Distribution Predicted by CALMET for the Site



Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Site are illustrated in [Figure 24](#). As would be expected, an increase in the mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure 24 Mixing Heights Predicted by CALMET for the Site



7.3.4 Plume Dispersion Modelling

Emissions from the Project were modelled using the CALPUFF model. CALPUFF is a transport and dispersion model that ejects “puffs” of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so, it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain hourly concentration evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

7.3.4.1 CALPUFF Model Parameters and Options

A summary of additional CALPUFF modelling options and parameters used for the assessment is provided in [Table 28](#).

Table 28 Model Parameters

Parameter	Option
Calculation Type	Concentration
Plume Rise Method	Briggs
Building Downwash	BPIP-PRIME
Gridded Receptors	Nested 4.0 km x 4.0 km; 0 m AGL centred on Site
Gridded Receptor Spacing	100 m to 1,000 m; 150 m from 1,000 m to 2,000 m 300 m from 2,000 m to 4,000 m
Discrete Receptors	Refer Section 3.12

AGL Above ground level

7.3.4.2 Background Pollutant Concentrations

Hourly varying NO₂, PM₁₀ and PM_{2.5} concentrations recorded by the Prospect AQMS during the modelling period (2023) were used for the contemporaneous analysis of cumulative ground level concentrations. Cumulative CO and SO₂ impacts were assessed semi-quantitatively given the very low background concentrations in Sydney.

Background concentrations of ammonia were assumed to be negligible, and the incremental impacts predicted for the Project were compared directly against the ambient air quality criterion, in accordance with the Approved Methods.

7.3.4.3 Building Downwash

Building downwash is a phenomenon caused by structures near to pollutant emission sources influencing atmospheric turbulence. Airflow is rapidly mixed to the ground as frictional forces and pressure gradients cause stagnations and eddies to develop in the wake of buildings downwind of elevated sources.

The USEPA has established a Good Engineering Practice (GEP) stack height which is defined as the ‘height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutants in the immediate vicinity of the source as a result of atmospheric downwash, eddies or wakes which may be created by the source itself,



nearby structures or nearby terrain obstacles' (USEPA 1985). The definition of GEP stack height is the building height plus 1.5 times the lesser of the building height or projected building width.

A stack is considered to be wake-affected when the stack and building are located less than five times the lesser of the building height or project building width apart.

CALPUFF contains the Prime algorithm which was used to predict building downwash effects. Influencing building dimensions were calculated using the USEPA's Building Profile Input Program (BPIP).

For modelling purposes, proposed and existing Site buildings, as well as enclosures for the existing stacks, were included in the modelling to account for potential building wakes. The relative locations of the sources and buildings are illustrated in [Figure 25](#) and [Figure 26](#).

Figure 25 Modelled Sources and Buildings – Stage 1



Figure 26 Modelled Sources and Buildings – Stage 2



7.3.4.4 NO_x to NO₂ conversion

NO_x emitted from combustion processes mainly consist of NO with a small portion (approximately 10%) of NO₂. In the atmosphere however, NO emitted from the source oxidises to NO₂ in the presence of ozone (O₃) and sunlight as it travels further from the source. The rate of oxidation depends on a number of parameters including the ambient O₃ concentration. The Approved Methods lists the following methods that can be applied to take account the oxidation of NO to NO₂ in estimating downwind NO₂ concentrations at receptor locations.

Method 1 – 100% Conversion

This method is usually used as a screening level assessment and assumes 100% conversion of NO to NO₂ before the plume arrives at the receptor location. Use of this method can significantly over-predict NO₂ concentrations at nearfield receptors. Given the close proximity of sensitive receptors to the Site, the use of Method 1 (100% conversion) is not appropriate.

Method 2 – Ambient Ozone Limiting Method (OLM)

This method assumes that all the available ozone in the atmosphere will react with NO in the plume until either all the O₃ or all the NO is used up. NO₂ concentrations can be estimated by this method using the following equation:

$$[\text{NO}_2]_{\text{total}} = \{0.1 \times [\text{NO}_x]_{\text{pred}}\} + \text{MIN}\{(0.9) \times [\text{NO}_x]_{\text{pred}} \text{ or } (46/48) \times [\text{O}_3]_{\text{bkgd}}\} + [\text{NO}_2]_{\text{bkgd}}$$

Again, given the close proximity of sensitive receptors with short transport and duration periods from the Site, Method 2 could be deemed overly conservative as it assumes that the



atmospheric reaction is instantaneous when in reality, the reaction takes place over a number of hours (NSW EPA 2017).

This assessment employs Method 2, adopting O₃ data from the Prospect AQMS, presented in [Figure 27](#) and summarised [Table 29](#), to estimate the incremental and cumulative NO₂ impacts at nearby receptors as a result of the Project emissions. This approach is deemed conservative as it assumes that the atmospheric reaction is instantaneous. In reality, the reaction takes place over a number of hours. This approach will therefore provide a conservative assessment for near field locations at short transport and duration periods from the source.

Figure 27 Prospect AQMS O₃ 1-Hour Average Concentrations (2023)

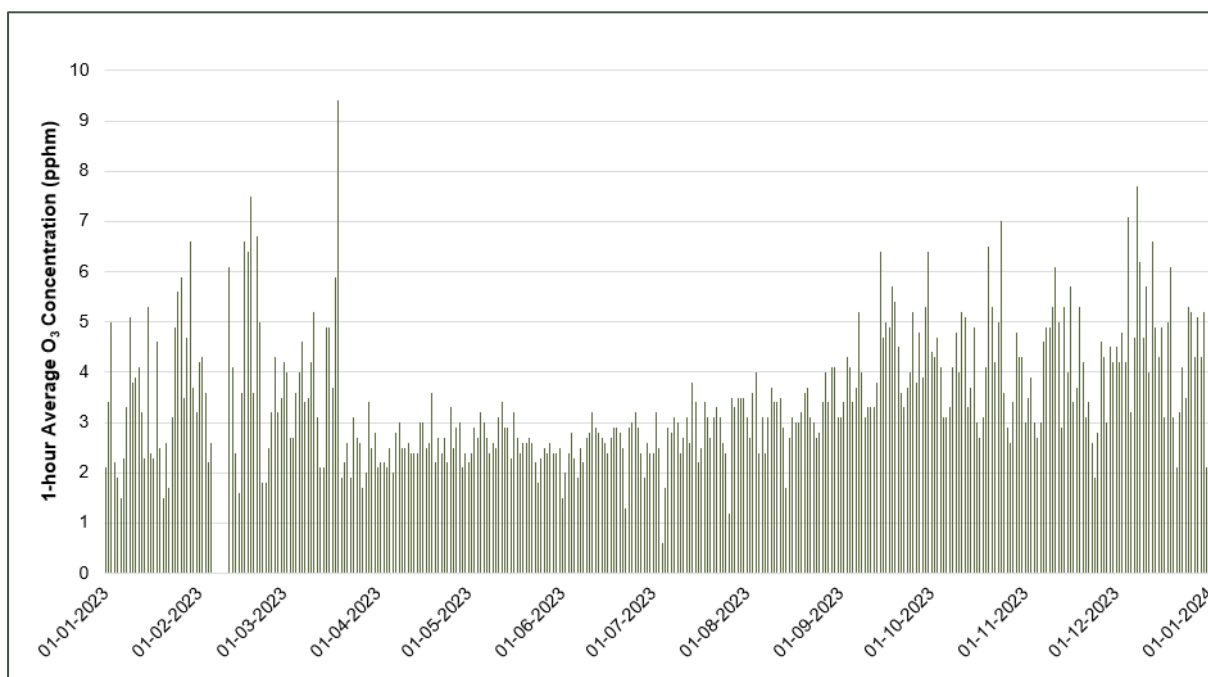


Table 29 O₃ Concentration Summary: Prospect AQMS (2023)

Pollutant	Averaging Period	Units	Maximum Concentration
O ₃	1-hour	pphm	9.4
		µg/m ³	201.2



7.3.4.5 Conversion of Averaging Times

For pollutants with short-term (sub-hourly) air quality impact assessment criteria, in the absence of specific guidance in the Approved methods, the short term impacts have been estimated using the formula cited in the Guidance notes for using the regulatory air pollution model AERMOD in Victoria (EPAV 2013) as follows:

$$C_t = C(t_0) \times (t_0/t)^{0.2}$$

Where

C_t = concentration for the longer time-averaging period

C₀ = concentration for the shorter time-averaging period

t₀ = longer averaging time

t = shorter averaging time

7.3.5 Accuracy of Modelling

All atmospheric dispersion models, including CALPUFF, represent a simplification of the many complex processes involved in the dispersion of pollutants in the atmosphere. To obtain good quality results it is important that the most appropriate model is used and the quality of the input data (meteorological, terrain, source characteristics) is adequate.

The main sources of uncertainty in dispersion models, and their effects, are discussed below:

- **Oversimplification of physics:** This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Uncertainties are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally-varying meteorology).
- **Uncertainties in emission rates:** Ground level concentrations are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst-case emission levels or are based on the results of a small number of stack tests, however operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- **Uncertainties in wind direction and wind speed:** Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Uncertainties in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.
- **Uncertainties in mixing height:** If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- **Uncertainties in temperature:** Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- **Uncertainties in stability estimates:** Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind



(which are used directly or indirectly to estimate stability class for Gaussian models). In either case, uncertainties in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

The USEPA makes the following statement in its Modelling Guideline (US EPA 2005) on the relative accuracy of models:

“Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ± 10 to 40% are found to be typical, i.e., certainly well within the often quoted factor-of-two accuracy that has long been recognised for these models. However, estimates of concentrations that occur at a specific time and site are poorly correlated with actually observed concentrations and are much less reliable.”



8.0 Assessment of Air Quality Impacts

8.1 Construction Phase

8.1.1 Fugitive Dust Emissions

The construction activities associated with the Project have been assessed and represent the change in construction previously assessed in the Approved AQIA. It is noted that the staged approach is not anticipated to significantly increase the total quantity of construction in the Approved SSDA.

The full assessment methodology is provided in **Appendix A**.

Step 1 – Screening Based on Separation Distance

The IAQM screening criteria for further assessment is the presence of a 'human receptor' within:

- 250 m of the boundary of the Site ; or
- 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance(s).

There is at least one sensitive receptor 30 m north of the Site boundary on the north side of Huntingwood Drive.

Step 2a – Assessment of Scale and Nature of the Works

Based upon the above assumptions and the IAQM definitions presented **Appendix A**, the dust emission magnitudes for each phase of the construction works have been categorised as presented in [Table 30](#).

Table 30 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude Stage 1	Dust Emission Magnitude Stage 2	Basis
Demolition	Small	Small	<i>Small: Total building volume less than 12,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities less than 6 m above ground, demolition during wetter months.</i> <i>Stage 1 basis:</i> There are no main structures being demolished. <i>Stage 2 basis:</i> There are no main structures being demolished. There are some smaller structures that will be demolished but do not exceed 12,000 m³.



Activity	Dust Emission Magnitude Stage 1	Dust Emission Magnitude Stage 2	Basis
Earthworks	Small	Medium	<i>Small: Total site area less than 18,000 m², soil type with large grain size (e.g. sand), less than 5 heavy earth moving vehicles active at any one time, formation of bunds less than 3 m in height.</i> <i>Medium: Total site area between 18,000-110,000 m², moderately dusty soil type (e.g. silt), less than 5-10 heavy earth moving vehicles active at any one time, formation of bunds between 3-6 m in height.</i> <i>Stage 1 basis:</i> The area of construction is ~5,200 m² and any associated preparation works are anticipated to be minor. <i>Stage 2 basis:</i> The area of construction is ~23,000 m² and any associated preparation works are anticipated to be minor.
Construction	Medium	Large	<i>Medium: Total building volume 12,000 m³ to 75,000 m³, potentially dusty construction material (e.g. concrete), on site concrete batching.</i> <i>Large: Total building volume > 75,000 m³, on site concrete batching; sandblasting.</i> <i>Stage 1 basis:</i> The construction volume is approximately ~41,000 m³. <i>Stage 2 basis:</i> The construction volume is > 260,000 m³.
Trackout	Small	Small	<i>Small: Less than 20 heavy vehicle (>3.5 t) outward movements in any one day, surface materials with a low potential for dust release, less than 50 m of unpaved road length.</i> <i>Stage 1 Project basis:</i> Sealed road access already on site and minimal predicted daily heavy vehicle movements. <i>Stage 2 basis:</i> Sealed road access already on site and minimal predicted daily heavy vehicle movements.

Step 2b – Risk Assessment

Receptor sensitivity is based on the criteria listed in **Appendix A**. The sensitivity of the identified residential receptors in this study is concluded to be *high* for health impacts and *high* for dust soiling.

Sensitivity of an Area

Based on the classifications shown in **Table A-1** and **Table A-2**, the sensitivity of the area to dust soiling may be classified as *low* as there are:

- 1- 10 receptors within 50 m of the Site



- 10-100 high sensitivity receptors within 100 m of the Site.

The sensitivity of the area to dust health impacts may be classified as *low* due to a maximum representative annual average PM₁₀ concentration of 16.7 (refer [Table 17](#) of the main report) and there are:

- 1- 10 receptors within 50 m of the Site
- 10-100 high sensitivity receptors within 100 m of the Site.

Risk Assessment

Given the sensitivity of the general area is classified as *low* for dust soiling and *low* for health effects, and the dust emission magnitudes for the various construction phase activities as shown in [Table 30](#), the resulting risk of air quality impacts (with no mitigation) is as presented in [Table 31](#).

The results indicate that if no mitigation measures were to be applied to control emissions during the construction works:

- there is a **negligible** risk of adverse dust soiling and a **negligible** risk of human health impacts during the demolition phase at the off-site sensitive receptor locations.
- there is a **low** risk of adverse dust soiling and a **low** risk of human health impacts during earthworks, construction, and trackout phases occurring at the off-site sensitive receptor locations.

Table 31 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Stage	Impact	Sensitivity of Area	Dust Emission Magnitude				Preliminary Risk			
			Demolition	Earthworks	Construction	Trackout	Demolition	Earthworks	Construction	Trackout
Stage 1	Dust Soiling	Low	Small	Small	Medium	Small	Negligible	Low	Low	Negligible
	Human Health	Low					Negligible	Low	Low	Negligible
Stage 2	Dust Soiling	Low	Small	Medium	Large	Small	Negligible	Low	Low	Negligible
	Human Health	Low					Negligible	Low	Low	Negligible



Step 3 - Mitigation Measures

For almost all construction activities, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Step 2 of this risk assessment shows that mitigation measures designated as *highly recommended (H)* or *desirable (D)* by the IAQM methodology for a development shown to have a low risk of adverse impacts should be adopted by the proposed development during construction. These measures are summarised in **Section 9.1**.

Not all these measures would be practical or relevant to construction works at the Site, so these measures should be reviewed in consultation with the construction contractor or as part of the development of the Construction Environmental Management Plan (CEMP) before their implementation.

Step 4 - Residual Impacts

For almost all construction activity, the IAQM Guidance notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation, and that experience shows that this is normally possible. Hence the residual effects will normally be *negligible*, providing the appropriate level of dust control is effectively implemented. Based on SLR's experience, for almost all construction activities, provided effective mitigation is adopted, the residual air quality impact can be managed to acceptable levels.

To confirm that the controls are adequately controlling dust emissions from the site, it is recommended that visual inspections of dust levels be performed on a daily basis. These daily inspections should include, but not be limited to:

- visual inspection of any airborne dust being generated on-site or being observed blowing off-site
- ensuring roads leaving the Site are free of soil and dust, and that there is no observable soil or dust tracking onto the road network
- inspection of any the erosion and sediment control systems for silt build-up
- inspection of any stockpiles and waste storage areas to ensure no significant wind erosion is observable.

Any inspection reports should include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions must be reported to the Site Manager as soon as is practicable.

A reappraisal of the predicted unmitigated air quality impacts on receptors has been performed to demonstrate the minimisation of risks associated with the use of mitigation strategies and is presented below in [Table 32](#). These are termed 'residual impacts'.

Table 32 Residual Risk of Air Quality Impacts from Construction

Impact	Sensitivity of Area	Residual Risk			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk
Human Health	Low	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk

The mitigated dust deposition and human health impacts risks for demolition, earthworks, construction, and trackout phases are anticipated to be *negligible* provided appropriate mitigation measures are implemented.



Monitoring using dust gauges or real-time PM₁₀ monitoring equipment is not considered to be required given the industrial nature of the surrounding area unless complaints regarding dust nuisance are received. However, in the event of a dust complaint being received then a targeted dust monitoring campaign should be implemented to verify the issues raised and to assist in managing the effectiveness of dust controls being applied.

8.1.2 Products of Fuel Combustion

Ambient air quality monitoring performed in the Sydney area over the last few decades has shown that the city's air quality has typically improved and is continuing to improve. A major driver of this improvement in urban air quality is the fact that newer vehicles produce significantly less emissions than older vehicles. This is in part a result of improvements in the quality and composition of fuels, as well as improved engine designs and fuel efficiency. According to Trends in Motor Vehicles and their Emissions (NSW EPA 2014) cars built from 2013 onwards emit only 3% of the NO_x emissions compared to vehicles built in 1976, and diesel trucks built from 2011 onwards emit just 8% of the particles emitted by vehicles built in 1996. Therefore, even as Sydney's population, and total vehicle kilometres travelled each year have increased (ABS 2018) key measures of air pollution have dropped significantly and this trend is expected to continue.

The results from the background air quality concentrations show that the monitored concentrations have been well below the respective criteria for CO, NO₂ and SO₂ for 5 years running (2020-2024) (see **Section 3.5**).

Given the nature of the construction works, it is considered that the emissions generated due to the combustion of fuel in construction plant and machinery will be of limited duration and small compared to the emissions generated by road traffic on the surrounding road network. Given the short term and low level of emissions of these pollutants from the Site during the construction works, they are considered unlikely to have significant impacts on local air quality and have not been considered any further in this assessment.

8.2 Operational Phase -Qualitative Assessment

As discussed in **Section 4.2.2.1**, odour emissions will occur from activities at the Site.

As discussed in **Section 2.3**, during the site visit, SLR staff observed 'distinct' odours within the boundary of the Site, reducing to 'weak' odours within an approximate 100 m radius of the Site boundary.

By addressing the FIDOL factors, the potential magnitude for odour impacts from these sources at the sensitive receptors may be determined, as follows:

Frequency & Duration – The closest residential areas have the potential to experience impacts when winds blow towards the receptors. As outlined in **Section 3.4** winds blowing towards the nearest existing residences and recreational facilities (>800 m away) occur approximately 23% of the time, while winds that would blow air emissions towards the nearby hotel (400 m away) occur only 7% of the time.

Intensity – The new processing building (including baking, raw materials, and waste storage areas) is proposed to be equipped with AS and BCA compliant air extraction systems which are designed to ensure effective dispersal of emissions. While the relationship between throughput and observed odour levels cannot be assumed to be linear, and the site visit will not be representative of all operating conditions or meteorological conditions, it is considered reasonable to expect that the proposed increase in throughput may result in some odours from the facility being detected further downwind and some higher intensity odours in closest proximity to the Site than for current operations.



Offensiveness – Considering that there will not be a change in the type of odour emitted from the Site, and given organic waste will be removed from site on a daily basis, Monday to Friday, the offensiveness is not considered to be impacted.

Location – the impact of location on the acceptability of odours from the Site has been accounted for by the receptor sensitivity classification of high (residential) and medium (industrial/commercial).

Given the above considerations, the magnitude of odour is predicted to be of **slight** magnitude (ie predicted impact may be tolerated, **Table B2**) at both the surrounding industrial/commercial areas as well as the nearest residential areas.

Given the **high sensitivity** of the potentially affected receptors and the **slight magnitude** of the potential odour impact of the facility's staged expanded operations, the potential impact significance for the expanded site at the nearest sensitive receptors is concluded to be of **intermediate/minor significance** (see [Table 33](#)).

Considering the **intermediate/minor significance** impact significance for receptors due to the facility's expanded operations, additional significant mitigation measures are not deemed necessary. However, should it be required, further mitigation measures can be put in place to further reduce or remove any impacts (refer to **Section 9.0**).

Table 33 Impact Significance Matrix

Magnitude Sensitivity		[Defined by Table B-2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table C-1]	Very High Sensitivity	Major Significance	Major/Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

8.3 Operational Phase -Quantitative Assessment

8.3.1 NO₂

[Table 34](#) presents the incremental maximum 1-hour and annual average NO₂ concentrations predicted at the 18 surrounding receptor locations for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources. [Table 35](#) presents the cumulative maximum 1-hour and annual average NO₂ concentrations predicted at the 18 surrounding receptor locations for existing, Stage 1, and Stage 2 sources.

Isopleth plots of the predicted incremental NO_x concentrations are shown in **Appendix E**.



Table 34 Maximum Incremental Predicted NO₂ Concentrations at Surrounding Receptors

Receptor ID	Stage 1		Stage 2	
	1-Hour (µg/m ³)	Annual (µg/m ³)	1-Hour (µg/m ³)	Annual (µg/m ³)
R1	43.9	1.1	47.0	1.3
R2	27.5	0.4	36.8	0.6
R3	21.8	0.4	27.2	0.4
R4	18.8	0.2	27.1	0.3
R5	18.6	0.2	26.1	0.3
R6	18.2	0.2	26.1	0.3
R7	16.1	0.2	23.0	0.3
R8	20.0	0.2	28.7	0.3
R9	18.5	0.2	27.1	0.3
R10	17.8	0.2	25.0	0.2
R11	82.3	1.3	92.3	1.4
R12	53.0	2.7	59.3	3.5
R13	53.4	2.0	54.3	2.4
R14	35.0	1.1	39.6	1.4
R15	35.4	0.9	39.8	1.2
R16	39.6	0.3	43.3	0.3
R17	55.4	1.0	73.4	1.2
R18	62.1	1.8	64.7	2.1
Criteria	164	31	164	31

Table 35 Maximum Cumulative Predicted NO₂ Concentrations at Surrounding Receptors

Receptor ID	Stage 1		Stage 2	
	1-Hour (µg/m ³)	Annual (µg/m ³)	1-Hour (µg/m ³)	Annual (µg/m ³)
R1	97.4	15.9	97.8	16.1
R2	92.1	15.3	92.1	15.4
R3	92.1	15.2	92.1	15.3
R4	92.1	15.1	92.1	15.1
R5	92.1	15.1	92.1	15.1
R6	92.1	15.0	92.1	15.1
R7	92.1	15.1	92.1	15.1
R8	92.1	15.1	92.1	15.2
R9	92.1	15.1	92.1	15.1



Receptor ID	Stage 1		Stage 2	
	1-Hour ($\mu\text{g}/\text{m}^3$)	Annual ($\mu\text{g}/\text{m}^3$)	1-Hour ($\mu\text{g}/\text{m}^3$)	Annual ($\mu\text{g}/\text{m}^3$)
R10	92.1	15.0	92.1	15.1
R11	92.1	16.2	99.8	16.3
R12	92.1	17.5	92.1	18.3
R13	92.1	16.9	92.1	17.2
R14	92.1	15.9	92.1	16.3
R15	92.1	15.8	95.6	16.0
R16	92.1	15.1	92.1	15.2
R17	92.1	15.9	92.1	16.0
R18	92.1	16.7	92.1	17.0
Criteria	164	31	164	31

The modelling results show that the predicted cumulative maximum 1-hour and annual average NO_2 concentrations are well below the relevant ambient air quality criteria at all receptor locations modelled.

8.3.2 CO

[Table 36](#) presents the maximum incremental 15-minute, 1-hour and 8-hour average CO concentrations predicted at the 18 surrounding receptor locations for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources.

Isopleth plots of the predicted incremental CO concentrations are shown in **Appendix E**.

Table 36 Maximum Predicted CO Concentrations at Surrounding Receptors

Receptor ID	Stage 1			Stage 2		
	15-Minutes* (mg/m^3)	1-Hour (mg/m^3)	8-Hour (mg/m^3)	15-Minutes* (mg/m^3)	1-Hour (mg/m^3)	8-Hour (mg/m^3)
R1	0.31	0.24	0.18	0.32	0.25	0.19
R2	0.17	0.13	0.11	0.22	0.17	0.14
R3	0.15	0.11	0.08	0.19	0.14	0.10
R4	0.11	0.09	0.04	0.15	0.12	0.06
R5	0.12	0.09	0.04	0.15	0.12	0.06
R6	0.11	0.08	0.06	0.15	0.11	0.08
R7	0.10	0.07	0.04	0.13	0.10	0.06
R8	0.12	0.09	0.07	0.16	0.12	0.10
R9	0.11	0.08	0.07	0.15	0.11	0.09
R10	0.10	0.08	0.06	0.14	0.11	0.07
R11	0.45	0.34	0.23	0.60	0.46	0.31
R12	0.37	0.28	0.25	0.42	0.32	0.30
R13	0.45	0.34	0.31	0.48	0.36	0.31



Receptor ID	Stage 1			Stage 2		
	15-Minutes* (mg/m ³)	1-Hour (mg/m ³)	8-Hour (mg/m ³)	15-Minutes* (mg/m ³)	1-Hour (mg/m ³)	8-Hour (mg/m ³)
R14	0.24	0.18	0.13	0.28	0.21	0.17
R15	0.26	0.20	0.14	0.31	0.23	0.15
R16	0.26	0.20	0.08	0.30	0.23	0.10
R17	0.32	0.25	0.19	0.45	0.34	0.25
R18	0.38	0.29	0.23	0.44	0.33	0.26
Maximum background	2.31	1.75	1.25	2.31	1.75	1.25
Maximum cumulative impact **	2.76	2.09	1.56	2.91	2.21	1.56
Criteria	100	30	10	100	30	10
* The 1-hour average CO concentrations predicted by the modelling were converted to 15-minute averages using the power law formula. ** Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.						

Given the insignificant incremental increase of CO predicted at the identified receptors, and low background concentrations exceedances of the relevant CO criteria due to the operation of the Project are not predicted at any identified surrounding receptor location.

8.3.3 SO₂

Table 37 presents the maximum incremental 1-hour and 24-hour average SO₂ concentrations predicted at the 18 surrounding receptor locations (based on 1-hour average model predictions and assuming that all stacks are emitting at the limit of detection of the sampling) for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources.

Given the conservative assumptions used in the modelling, the very low incremental increase of SO₂ predicted at the identified receptors, and low background concentrations of the relevant SO₂ criteria due to the operation of the Project would not be expected at any identified surrounding receptor location.

Isopleth plots of the predicted incremental SO₂ concentrations are shown in **Appendix E**.

Table 37 maximum Predicted SO₂ Concentrations at Surrounding Receptors

Receptor ID	Incremental Stage 1		Incremental Stage 2	
	1-Hour (µg/m ³)	24-Hour (µg/m ³)	1-Hour (µg/m ³)	24-Hour (µg/m ³)
R1	7.3	1.9	7.7	2.2
R2	4.1	1.0	5.5	1.4
R3	3.6	0.8	4.6	1.0
R4	2.9	0.7	4.0	1.0
R5	2.8	0.7	3.9	1.0



Receptor ID	Incremental Stage 1		Incremental Stage 2	
	1-Hour ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)	1-Hour ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)
R6	2.6	0.7	3.7	0.9
R7	2.5	0.5	3.4	0.7
R8	2.9	0.8	4.1	1.1
R9	2.8	0.7	3.9	0.9
R10	2.8	0.5	3.6	0.6
R11	18.6	6.0	19.1	7.1
R12	8.2	3.8	10.9	5.0
R13	9.9	3.8	10.6	4.0
R14	7.0	1.9	7.7	2.2
R15	7.1	1.7	8.2	2.0
R16	5.5	1.3	6.9	1.5
R17	6.6	2.8	8.9	3.3
R18	8.9	3.7	9.7	4.2
Maximum background	68.6	11.4	68.6	11.4
Maximum cumulative impact **	87.2	17.4	87.7	18.5
Criteria	215	57	215	57
** Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.				

8.3.4 Particulate Matter

[Table 38](#) presents the incremental maximum and cumulative 24-hour average PM_{10} concentrations predicted at the 18 surrounding receptor locations for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources. [Table 39](#) presents the incremental maximum and cumulative annual average PM_{10} concentrations predicted for these scenarios.

[Table 40](#) presents the incremental maximum and cumulative 24-hour average $\text{PM}_{2.5}$ concentrations predicted at the 18 surrounding receptor locations for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources. [Table 41](#) presents the incremental maximum and cumulative 24-hour average $\text{PM}_{2.5}$ concentrations predicted for these scenarios. Isopleth plots of the predicted incremental PM concentrations are presented shown in **Appendix E**.

Note that the predictions are the same for PM_{10} and $\text{PM}_{2.5}$ as it is assumed that all particulate matter from gas combustion is in the $\text{PM}_{2.5}$ size fraction.

No exceedances of the 24-hour average or annual average PM_{10} criterion are predicted. No exceedances of the annual average $\text{PM}_{2.5}$ criterion are predicted. The exceedances of the 24-hour $\text{PM}_{2.5}$ criteria are due to elevated $\text{PM}_{2.5}$ background concentrations (refer Section 6.0). As discussed in Section 6.0, exceedances of the 24-hour average $\text{PM}_{2.5}$ criteria in the



year 2023 were recorded by the Prospect AQMS due to exceptional events (DCCEEW 2025).

In circumstances where the existing ambient air pollutant concentrations exceed the impact assessment criteria, the Approved Methods requires the AQIA to demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity.

No additional exceedances of the 24-hour PM_{2.5} criteria are predicted at any residential receptor due to the Project.

Table 38 Maximum Predicted 24-hour PM₁₀ Concentrations at Receptors

Receptor ID	Incremental Maximum 24-Hour (µg/m³)		Cumulative (Plus Background) Maximum 24-Hour (µg/m³)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R1	1.0	1.3	44.6	44.6	0	0
R2	0.5	0.7	44.5	44.5	0	0
R3	0.4	0.5	44.5	44.5	0	0
R4	0.4	0.5	44.4	44.4	0	0
R5	0.4	0.5	44.4	44.4	0	0
R6	0.3	0.5	44.4	44.4	0	0
R7	0.2	0.3	44.4	44.4	0	0
R8	0.4	0.5	44.4	44.4	0	0
R9	0.3	0.4	44.4	44.4	0	0
R10	0.2	0.3	44.4	44.4	0	0
R11	1.8	2.3	44.5	44.5	0	0
R12	2.0	2.6	44.9	45.0	0	0
R13	2.2	2.3	44.4	44.4	0	0
R14	0.9	1.1	44.5	44.5	0	0
R15	0.9	1.0	44.7	44.7	0	0
R16	0.6	0.6	44.4	44.4	0	0
R17	1.4	1.8	44.4	44.4	0	0
R18	2.4	2.6	44.4	44.4	0	0
Criteria	-	-	50	50	-	-



Table 39 Maximum Predicted Annual PM₁₀ Concentrations at Receptors

Receptor ID	Incremental Annual (µg/m³)		Cumulative (Plus Background) Annual (µg/m³)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R1	0.1	0.1	16.9	16.9	0	0
R2	0.0	0.0	16.8	16.8	0	0
R3	0.0	0.0	16.8	16.8	0	0
R4	0.0	0.0	16.8	16.8	0	0
R5	0.0	0.0	16.8	16.8	0	0
R6	0.0	0.0	16.8	16.8	0	0
R7	0.0	0.0	16.8	16.8	0	0
R8	0.0	0.0	16.8	16.8	0	0
R9	0.0	0.0	16.8	16.8	0	0
R10	0.0	0.0	16.8	16.8	0	0
R11	0.1	0.2	16.9	17.0	0	0
R12	0.2	0.3	17.0	17.1	0	0
R13	0.2	0.3	17.0	17.1	0	0
R14	0.1	0.1	16.9	16.9	0	0
R15	0.1	0.1	16.9	16.9	0	0
R16	0.0	0.0	16.8	16.8	0	0
R17	0.1	0.1	16.9	16.9	0	0
R18	0.2	0.2	17.0	17.0	0	0
Criteria	-	-	25	25	-	-

Table 40 Maximum Predicted 24-hour PM_{2.5} Concentrations at Receptors

Receptor ID	Incremental Maximum 24-Hour (µg/m³)		Cumulative (Plus Background) Maximum 24-Hour (µg/m³)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R1	1.0	1.3	29.8	29.9	0	0
R2	0.5	0.7	29.6	29.6	0	0
R3	0.4	0.5	29.6	29.6	0	0
R4	0.4	0.5	29.6	29.6	0	0
R5	0.4	0.5	29.6	29.6	0	0
R6	0.3	0.5	29.6	29.6	0	0
R7	0.2	0.3	29.6	29.6	0	0
R8	0.4	0.5	29.6	29.6	0	0



Receptor ID	Incremental Maximum 24-Hour (µg/m³)		Cumulative (Plus Background) Maximum 24-Hour (µg/m³)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R9	0.3	0.4	29.6	29.6	0	0
R10	0.2	0.3	29.6	29.6	0	0
R11	1.8	2.3	29.7	29.8	0	0
R12	2.0	2.6	29.6	29.6	0	0
R13	2.2	2.3	29.8	29.9	0	0
R14	0.9	1.1	29.6	29.6	0	0
R15	0.9	1.0	29.7	29.8	0	0
R16	0.6	0.6	29.6	29.6	0	0
R17	1.4	1.8	29.7	29.7	0	0
R18	2.4	2.6	29.6	29.6	0	0
Criteria	-	-	25	25	-	-

Table 41 Maximum Predicted Annual PM_{2.5} Concentrations at Receptors

Receptor ID	Incremental Annual (µg/m³)		Cumulative (Plus Background) Annual (µg/m³)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R1	0.1	0.1	7.5	7.5	0	0
R2	0.0	0.0	7.4	7.4	0	0
R3	0.0	0.0	7.4	7.4	0	0
R4	0.0	0.0	7.4	7.4	0	0
R5	0.0	0.0	7.4	7.4	0	0
R6	0.0	0.0	7.4	7.4	0	0
R7	0.0	0.0	7.4	7.4	0	0
R8	0.0	0.0	7.4	7.4	0	0
R9	0.0	0.0	7.4	7.4	0	0
R10	0.0	0.0	7.4	7.4	0	0
R11	0.1	0.2	7.5	7.5	0	0
R12	0.2	0.3	7.6	7.7	0	0
R13	0.2	0.3	7.6	7.6	0	0
R14	0.1	0.1	7.5	7.5	0	0
R15	0.1	0.1	7.5	7.5	0	0
R16	0.0	0.0	7.4	7.4	0	0



Receptor ID	Incremental Annual ($\mu\text{g}/\text{m}^3$)		Cumulative (Plus Background) Annual ($\mu\text{g}/\text{m}^3$)		Additional Exceedances as a Result of the Project	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
R17	0.1	0.1	7.5	7.5	0	0
R18	0.2	0.2	7.6	7.6	0	0
Criteria	-	-	8	8	-	-

8.3.5 Ammonia

Table 42 presents the incremental maximum 1-hour average ammonia concentrations predicted at the surrounding discrete receptor locations for Stage 1 (including existing) and Stage 2 (including existing and Stage 1) sources. The modelling results conservatively assume that ammonia is being emitted by these lines continuously 24/7 to ensure that the maximum 1-hour average concentrations output by the model cover all potential worst-case meteorological conditions.

Isopleth plots of the predicted incremental ammonia concentrations at these locations are presented in **Appendix E**.

The maximum incremental 99.9th percentile 1-hour average ammonia concentrations predicted at the modelled receptor locations was 0.19 mg/m^3 for Stage 1 and 0.30 mg/m^3 for Stage 2, with both below the criterion of 0.33 mg/m^3 . The maximum concentration predicted beyond the Site boundary was 0.27 mg/m^3 for Stage 1 and 0.30 mg/m^3 for Stage 2, occurring at the northern east boundary of the Site for Stage 1 and to the eastern boundary (Receptor 11) for Stage 2.

Table 42 Maximum Predicted Incremental 1-Hour Average Ammonia Concentrations at Surrounding Receptors

Receptor ID	Stage 1	Stage 2
	(mg/m^3) ^	(mg/m^3) ^
R1	0.13	0.13
R2	0.09	0.11
R3	0.08	0.09
R4	0.04	0.05
R5	0.04	0.05
R6	0.03	0.04
R7	0.03	0.04
R8	0.04	0.05
R9	0.04	0.04
R10	0.03	0.04
R11	0.18	0.30
R12	0.17	0.21



Receptor ID	Stage 1	Stage 2
	(mg/m ³) ^	(mg/m ³) ^
R13	0.19	0.19
R14	0.10	0.11
R15	0.08	0.09
R16	0.13	0.14
R17	0.12	0.16
R18	0.19	0.20
Maximum concentration at/beyond the Site boundary	0.27	0.30
Criterion	0.33	0.33

^ 99.9th percentile.

8.3.6 Summary

The dispersion modelling study, which accounted for peak proposed operational activities and adopted several conservative assumptions predicted compliance with the NO₂, CO, SO₂, PM₁₀, PM_{2.5} and ammonia ambient air quality criteria all sensitive receptors modelled. No additional exceedance of the relevant criteria is predicted by the model for due to the Project.



9.0 Mitigation Measures and Monitoring

Construction mitigation measures are reflective of Condition B2 of the SSD-17352813 consent.

9.1 Construction

Table 43 lists the mitigation measures designated as *highly recommended (H)* or *desirable (D)* by the IAQM methodology for a development shown to have a low risk of adverse impacts. Not all these measures would be practical or relevant to construction works at the Site, so these measures should be reviewed in consultation with the construction contractor or as part of the development of the Construction Environmental Management Plan (CEMP) before their implementation. For almost all construction activities, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Table 43 Site-Specific Management Measures Recommended by the IAQM

Activity	
Communications	
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H
Display the head or regional office contact information.	H
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	D
Site Management	
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
Make the complaints log available to the local authority when asked.	H
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	H
Monitoring	
Perform daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary.	D
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority, when asked.	H
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
Preparing and Maintaining the Site	
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H



Activity	
Erect solid screens or barriers around dusty activities or the site boundary that is at least as high as any stockpiles on site.	H
Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	D
Avoid site runoff of water or mud.	H
Keep site fencing, barriers and scaffolding clean using wet methods.	D
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	D
Cover, seed or fence stockpiles to prevent wind erosion	D
Land stabilisation works are carried out progressively on site to minimise exposed surfaces	H
Operating Vehicle/Machinery and Sustainable Travel	
Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H
Ensure all vehicles switch off engines when stationary - no idling vehicles	H
Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable	H
Operations	
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H
Use enclosed chutes and conveyors and covered skips	H
Minimise drop heights from loading shovels and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	D
Waste Management	
Avoid bonfires and burning of waste materials.	H
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D
Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H



Activity	
Demolition	
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D
Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H
Construction	
Avoid scabbling (roughening of concrete surfaces) if possible	D
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	D
Trackout	
Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	D
Avoid dry sweeping of large areas.	D
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
Record all inspections of haul routes and any subsequent action in a site log book.	D
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D

9.2 Operational

9.2.1 Existing and Proposed

As outlined in **Section 4.2** a number of mitigation measures are to be adopted under the Approved SSDA. These measures, which are proposed to be maintained include the following:

- Discharges of pollutants to the air from the majority of potentially odorous activities (ovens and production areas) will be captured by BCA and AS standard compliant extraction systems and directed to rooftop vents.
- Containment measures for spillages will be provided at appropriate locations in the expansion area to reduce odorous emissions from waste spillages.
- The good housekeeping observed during the site visit will continue to be maintained on all areas of the Site, including regular cleaning of all internal and external areas.
- Organic waste and general waste will be removed from site for off-site disposal on a daily basis, Monday to Friday. In addition:
 - All generated waste will be identified and separated into common material streams or categories at the point of generation for separate collection. This



ensures that any waste that has the potential to cause odour emissions is dealt with appropriately.

- All organic waste will be stored in closed containers and away from direct sun.
 - All putrescible waste materials will be covered during transport.
 - Signage will be provided in waste management and processing areas to provide information relating to general housekeeping requirements and to act as a daily reminder to staff working at the premises.
- The physical controls (including ventilation fans, exhaust stacks, extraction hoods, grease traps, air pollution control devices etc.) are/will be designed to allow for easy and safe cleaning and maintenance. Regular cleaning of physical controls is and will be undertaken as per manufacturer's requirements.

In addition, the capacity of the wastewater treatment plant has been reviewed and has been confirmed as being adequate to treat waste from the expanded operations without any modifications to the plant.

9.2.2 Additional Recommended Measures

In order to further reduce the potential for off-site air quality impacts during operation, additional mitigation measures were recommended in the Approved AQIA. The following outlines a number of possible mitigation measures relevant to the proposed activities at the Site. It is noted that some of these measures are being considered by the detailed design team.

As outlined above, BCA/AS standard compliant extraction systems are being designed for the Project in order to extract emissions and discharge them to atmosphere via dedicated discharge vents. Air pollution control devices may be implemented to further reduce emissions where complaints are received in relation to nuisance odour or where prolonged smoke is visible during normal or peak operations (i.e. not during start up or shut down).

- Signage should be displayed to remind drivers to turn off vehicle engines when idling at the Site for longer than 1 minute to minimise exhaust emissions.
- General environmental awareness training should be provided to relevant staff and contractors, including:
 - Potential air quality and odour impacts that may be caused by activity during normal and abnormal circumstances;
 - Prevention of accidental air emissions and actions to be taken when accidental emissions occur;
 - Efficient and appropriate use and maintenance of equipment used on the Site (where relevant to their role); and
 - Procedures for complaint handling.
- All staff and contractors should be instructed to report any undue pollutant release (including odour) and visible emissions from the exhaust vents to the Site manager.
- In order to reduce the company's overall carbon footprint and combustion gas emissions generated by vehicles, it is recommended that commuting to work using sustainable modes of travel (such as public transport, cycling, and car share) be encouraged through the implementation of an incentive scheme and that facilities for cyclists such as bike storage areas, showers and lockers be provided.



9.3 Monitoring

Given the nature and scale of the Project, it is not anticipated that any impacts upon human health or amenity values would be experienced during the construction or operational phases.

Regular site walk overs and boundary inspections are recommended to be performed during the construction phase and ongoing monitoring of air quality is not considered to be required.



10.0 Conclusions

The main potential sources of air emissions were identified as dust impacts during the construction phase, and ammonia, odour and products of combustion during the operational phase.

The potential for off-site dust impacts was assessed using a qualitative risk-based approach prescribed by the Institute of Air Quality Management (IAQM). The results of this assessment indicate that dust impacts due to the staged construction works do not have significant potential to adversely impact on surrounding sensitive land uses.

The risk of off-site odour impacts during the operational stage of the Project was concluded to be low based on the nature and scale of the proposed staging, lack of any odour complaints regarding existing operations and observations of odours and house-keeping practices during site visits by SLR staff.

The dispersion modelling study, which accounted for peak proposed operational activities and adopted several conservative assumptions predicted compliance with the NO₂, CO, SO₂, PM₁₀, PM_{2.5} and ammonia ambient air quality criteria all sensitive receptors modelled. No additional exceedance of the relevant criteria is predicted by the model for due to the Project.

The additional mitigation measures recommended in this report will assist in further reducing the risk of any adverse off-site air quality impacts during the construction and operational phases of the Project, and are consistent with the Approved AQIA.

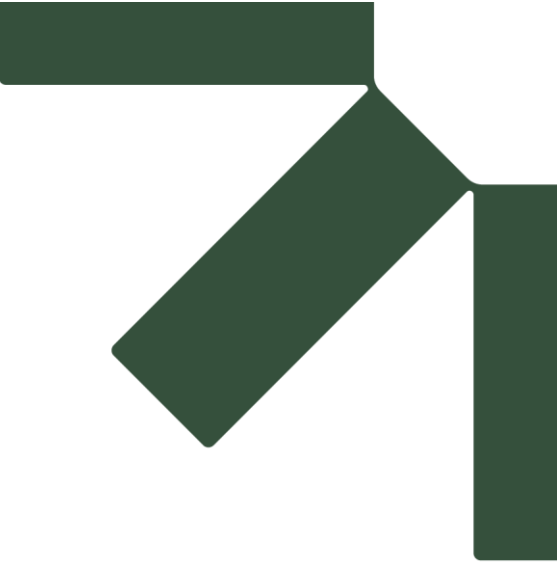
This assessment finds that the proposed modification to the approved SSDA including increased production capacity does not materially change the outcomes of the Approved AQIA and therefore, SLR concludes that any exceedances of the relevant air quality criteria due to the Project are highly unlikely.



11.0 References

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Appendix A Construction Risk Assessment Methodology

Arnott's Huntingwood Processing Facility Expansion Modification

Air Quality Impact Assessment

FDC Building Services

SLR Project No.: 610.032399.00001

20 February 2026

A qualitative risk assessment of potential construction dust associated with the Project is conducted using the IAQM “*Guidance on the Assessment of Dust from Demolition and Construction*” developed in the United Kingdom by the Institute of Air Quality Management (IAQM 2024).

The approach identifies the appropriate mitigation measures based on the level of risk during each phase of the construction works and is considered to be a more appropriate methodology than quantitative modelling given the temporary and highly variable nature of construction activities.

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM Guidance (IAQM 2024) suggests an assessment may be required where:

- a ‘human receptor’ is located within:
 - 250 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on public roads, up to 250 m from the site entrance.
- an ‘ecological receptor’ is located within:
 - 50 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on public roads, up to 250 m from the site entrance.

This step is noted as having deliberately been chosen to be conservative and will require assessments for most projects. A planning authority may require dust assessment despite the proposed site falling outside the distances above for specific (high risk) projects.

Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides “dust emissions magnitudes” for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). The magnitudes are: Large; Medium; or Small, with suggested definitions for each category. The definitions given in the IAQM guidance for demolition, earthworks, construction activities and track-out, are as follows:

- *Demolition (Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time):*
 - **Large:** Total building volume greater than 75,000 m³, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities higher than 12 m above ground level.
 - **Medium:** Total building volume 12,000 m³ – 75,000 m³, potentially dusty construction material, demolition activities 6-12 m above ground level.
 - **Small:** Total building volume less than 12,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities less than 6 m above ground, demolition during wetter months.
- *Earthworks (Covers the processes of soil-stripping, ground-levelling, excavation and landscaping):*
 - **Large:** Total site area greater than 110,000 m², potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size),



- more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 6 m in height.
- **Medium:** Total site area 18,000 m² to 110,000 m², moderately dusty soil type (e.g. silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 3 m to 6 m in height.
- **Small:** Total site area less than 18,000 m², soil type with large grain size (e.g. sand), less than 5 heavy earth moving vehicles active at any one time, formation of bunds less than 3 m in height.
- Construction (*Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc.*):
 - **Large:** Total building volume greater than 75,000 m³, on site concrete batching; sandblasting.
 - **Medium:** Total building volume 12,000 m³ to 75,000 m³, potentially dusty construction material (e.g. concrete), on site concrete batching.
 - **Small:** Total building volume less than 12,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber).
- Track-out (*The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network*):
 - **Large:** More than 50 heavy vehicle (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), greater than 100 m of unpaved road length.
 - **Medium:** Between 20 and 50 heavy vehicle (>3.5 t) outward movements in any one day, moderately dusty surface materials (e.g. high clay content), between 50 m and 100 m of unpaved road length.
 - **Small:** Less than 20 heavy vehicle (>3.5 t) outward movements in any one day, surface materials with a low potential for dust release, less than 50 m of unpaved road length.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Assessment of the Sensitivity of the Area

Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:

- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts
- The proximity and number of those receptors
- In the case of PM₁₀, the local background concentration
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Individual human receptors are classified as having high, medium or low sensitivity to either dust deposition or human health impacts. The IAQM method provides guidance on the sensitivity of different human receptor types to dust soiling and health effects as summarised



in **Table A-1**. The definitions and examples given in the IAQM Guidance for ecological receptors have been modified in **Table A-1** to be relevant to the Australian context based on advice from SLR's ecological specialist team.

It is noted in the IAQM Guidance that people's expectations of amenity levels (dust soiling) is also dependent on existing deposition levels.

Table A-1 IAQM - Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	- Users can reasonably expect a high level of amenity; or - The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	- Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or - The appearance, aesthetics or value of their property could be diminished by soiling; or - The people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	- The enjoyment of amenity would not reasonably be expected; or - Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	<i>Examples: Dwellings, museums other culturally important collections, medium and long term car parks and car showrooms.</i>	<i>Examples: Parks and places of work.</i>	<i>Examples: Playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.</i>
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	<i>Examples: Residential properties, hospitals, schools and residential care homes.</i>	<i>Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM₁₀.</i>	<i>Examples: Public footpaths, playing fields, parks and shopping streets.</i>
Ecological	Locations that support International or National	Locations that support National or State level	Locations that support State or Local



Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
	(EPBC) level species or ecological communities of conservation significance that may be affected by dust soiling; or Locations that are protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), that will require approval from the Commonwealth Government Minister for the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on Matters of National Environmental Significance (MNES).	species or ecological communities of conservation significance, where its dust sensitivity is uncertain or unknown; or Locations that are protected under the EPBC Act or State legislation (e.g. Biodiversity Conservation Act), that will require approval from the Commonwealth or State Government Minister for the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on MNES or State listed conservation significant species or communities.	Government level species of conservational significance where the features may be affected by dust deposition. Locations that are protected under State legislation (e.g. Biodiversity Conservation Act) or Local Government Environmental Management Plans, that will require approval from the State Government Minister for the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on State listed conservation significant species or communities.
	<i>Examples: Threatened avifauna that are impacted from air pollution through the ingestion of fine dust particles into the liver and lungs due to their high metabolic rate and special respiratory systems.</i>	<i>Examples: Threatened or Priority Ecological Communities that are sensitive to dust by inhibiting photosynthesis and respiration of species.</i>	<i>Examples: a local Nature Reserve with dust sensitive vegetation communities.</i>

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM₁₀ concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activity on nearby sites
- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant
- The season during which the works will take place



- Any conclusions drawn from local topography
- The duration of the potential impact (as a receptor may become more sensitive over time)
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table A-2**. The sensitivity of the area should be derived for each of activity relevant to the Project (i.e. construction and earthworks).

Table A-2 IAQM - Categorising the Sensitivity of an Area to Dust Soiling Impacts

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<250
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table A-3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM₁₀ (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM₁₀ in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (i.e. an annual average of 25 µg/m³ for PM₁₀) the IAQM method has been modified slightly.

This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:

- any history of dust generating activities in the area
- the likelihood of concurrent dust generating activity on nearby sites
- any pre-existing screening between the source and the receptors
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place
- any conclusions drawn from local topography
- duration of the potential impact
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.



Table A-3 IAQM - Categorising the Sensitivity of an Area to Dust Health Impacts

Receptor sensitivity	Annual Mean PM ₁₀	Number of receptors ^{a,b}	Distance from the source (m)			
			<20	<50	<100	<250
High	>25 µg/m ³	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	21-25 µg/m ³	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	17-21 µg/m ³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<17 µg/m ³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>25 µg/m ³	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	21-25 µg/m ³	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	17-21 µg/m ³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<17 µg/m ³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g. the total within 250 m and not the number between 100 and 250 m); noting that only the highest level of area sensitivity from the table needs to be considered.
 (b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

The IAQM Guidance matrix used to categorise the sensitivity of the area to ecological impacts from dust is presented in **Table A-4**.



Table A-4 IAQM - Categorising the Sensitivity of an Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Notes: (a) The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site.
 (b) Only the highest level of area sensitivity from the table needs to be considered.
 (c) For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site.

Step 2c - Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A-5** (demolition), **Table A-6** (earthworks and construction) and **Table A-7** (track-out) to determine the risk category with no mitigation applied.

Table A-5 Risk Category from Demolition Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table A-6 Risk Category from Earthworks Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A-6 Risk Category from Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible



Table A-7 Risk Category from Track-out Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Large
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Step 3 - Site-Specific Mitigation

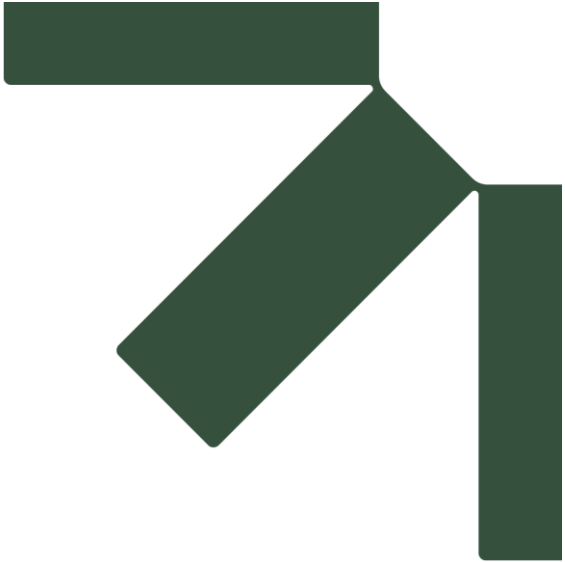
Once the risk categories are determined for each of the relevant activities, general management measures and management measures for the four dust generating activities (demolition, earthworks, construction, trackout) can be identified based on whether the Site is a low, medium or high risk site.

Step 4 – Residual Impacts

After Step 3, it should then be determined whether there are residual significant impacts. For almost all construction activity, the IAQM Guidance notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation, and that experience shows that this is normally possible. Providing that the appropriate level of dust control is effectively implemented, the residual effects will normally be negligible or not significant.

It is noted though that there all situations are assessed on a case-by-case basis as certain site restrictions may limit the ability to effectively implement mitigation measures, such as inadequate access to water for dust suppression. It is important that the specific characteristics of the site and the surrounding area are considered to ensure that the conclusion of negligible residual impacts is robust.





Appendix B Operational Odour Risk Assessment Method

Arnott's Huntingwood Processing Facility Expansion Modification

Air Quality Impact Assessment

FDC Building Services

SLR Project No.: 610.032399.00001

20 February 2026

Nature of Impact

Predicted impacts may be described in terms of the overall effect upon the environment:

- **Beneficial:** the predicted impact will cause a beneficial effect on the receiving environment.
- **Neutral:** the predicted impact will cause neither a beneficial nor adverse effect.
- **Adverse:** the predicted impact will cause an adverse effect on the receiving environment.

Receptor Sensitivity

Sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes, for example, a high sensitivity to changes in air quality, but low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the following broad categories - Very high, High, Medium, and Low.

Table B-1 outlines the methodology used in this study to define the sensitivity of receptors to air quality impacts.

Table B-1 Methodology for Assessing Sensitivity of a Receptor

Sensitivity	Criteria
Very High	Receptors of very high sensitivity to air pollution (e.g., dust or odour) such as: hospitals and clinics, and retirement homes.
High	Receptors of high sensitivity to air pollution, such as: schools, residential areas, food retailers, glasshouses, and nurseries.
Medium	Receptors of medium sensitivity to air pollution, such as: farms / horticultural land, offices/recreational areas, painting and furnishing, hi-tech industries and food processing, and outdoor storage (i.e., new cars).
Low	All other air quality sensitive receptors not identified above, such as light and heavy industry.

Magnitude

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions (refer to **Table B-2**).

Magnitude may be described quantitatively or qualitatively. Where an impact is defined by qualitative assessment, suitable justification is provided in the text.



Table B-2 Magnitude of Impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

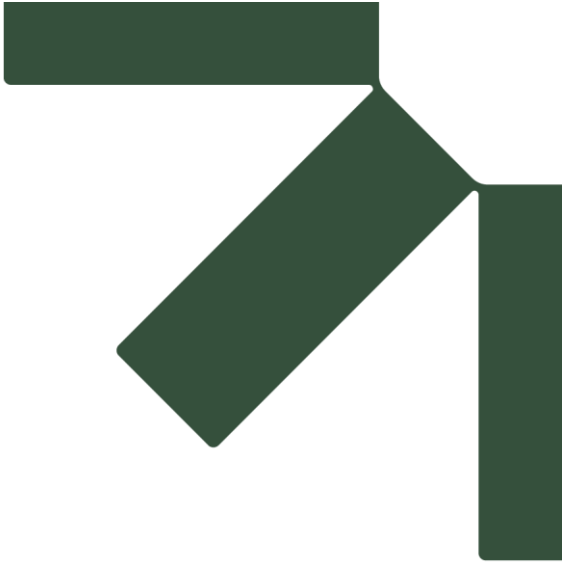
Significance

The risk-based matrix provided in **Table B-3** illustrates how the definitions of sensitivity and magnitude interact to produce impact significance.

Table B-3 Impact Significance Matrix

Magnitude Sensitivity		[Defined by Table C-2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table C-1]	Very High Sensitivity	Major Significance	Major/Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance





Appendix C Emission Test Report

Arnott's Huntingwood Processing Facility Expansion Modification

Air Quality Impact Assessment

FDC Building Services

SLR Project No.: 610.032399.00001

20 February 2026

SLR Consulting Australia Pty Ltd, North Sydney
The Arnott's Group
Emission Testing Report
Report Number R012166-1

Document Information

Template Version 211117

Client Name: SLR Consulting Australia Pty Ltd
Report Number: R012166-1
Date of Issue: 18 March 2022
Attention: Ali Naghizadeh
Address: Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Testing Laboratory: Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



Graham Edwards
Senior Air Monitoring
Consultant

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

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Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 Executive Summary

1.1 Background

Ektimo was engaged by SLR Consulting Australia Pty Ltd to perform emission testing a facility owned and operated by The Arnott's Group, located in Huntingwood, NSW.

1.2 Project Objective

The objective of the project was to quantify emissions from twelve (12) discharge points as part of SLR Consulting Australia Pty Ltd's emissions review and dispersion modelling assessment of The Arnott's Group (Huntingwood facility).

Monitoring was performed as follows:

Location	Identification	Test Date	Test Parameters*
Line 4	Stack A	12 January 2022	Nitrogen Oxides (as NO ₂), Carbon Monoxide (CO), Sulfur Dioxide (SO ₂), Carbon Dioxide (CO ₂), Oxygen (O ₂)
	Stack B		
	Stack C		
	Stack D		
Line 1	Stack A	13 January 2022	Ammonia (NH ₃) Nitrogen Oxides (as NO ₂), Carbon Monoxide (CO), Sulfur Dioxide (SO ₂), Carbon Dioxide (CO ₂), Oxygen (O ₂)
	Stack B		
	Stack C		
	Stack D		
Boiler Unit	HW1	14 January 2022	Nitrogen Oxides (as NO ₂), Carbon Monoxide (CO), Sulfur Dioxide (SO ₂), Carbon Dioxide (CO ₂), Oxygen (O ₂)
	V150		
	V151		
	V152		

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

1.3 Results Summary

The results summary below outlines the reported parameters at each location tested within the Arnott's facility from January 12th to January 14th, 2022.

Pollutant	Test date	Units	Line 1			
			Stack A	Stack B	Stack C	Stack D
Ammonia (NH ₃)	13-Jan-22	mg/m ³	1100	2800	100	2.3
Nitrogen Oxides (as NO ₂)		mg/m ³	59	130	<4	<4
Carbon Monoxide (CO)		mg/m ³	600	470	10	<2
Sulfur Dioxide (SO ₂)		mg/m ³	<6	<6	<6	<6
Carbon Dioxide (CO ₂)		% v/v	2.4	4.9	0.4	<0.4
Oxygen (O ₂)		% v/v	17.3	12	20.3	20.9

Pollutant	Test date	Units	Line 4			
			Stack A	Stack B	Stack C	Stack D
Nitrogen Oxides (as NO ₂)	12-Jan-22	mg/m ³	17	60	12	<4
Carbon Monoxide (CO)		mg/m ³	97	590	87	<2
Sulfur Dioxide (SO ₂)		mg/m ³	<6	<6	<6	<6
Carbon Dioxide (CO ₂)		% v/v	3.2	6	2.1	<0.4
Oxygen (O ₂)		% v/v	15.2	10.9	17.5	20.9

Pollutant	Test date	Units	Boiler Unit			
			HW1	V150	V151	V152
Nitrogen Oxides (as NO ₂)	14-Jan-22	mg/m ³	85	52	67	81
Carbon Monoxide (CO)		mg/m ³	6.9	6.3	10	<2
Sulfur Dioxide (SO ₂)		mg/m ³	<6	<6	<6	<6
Carbon Dioxide (CO ₂)		% v/v	5.9	6.4	9.7	9.2
Oxygen (O ₂)		% v/v	11.1	9.9	4.1	4.9

2 Results

2.1 Line 1

2.1.1 Stack A

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack A
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	16	
Gas molecular weight, g/g mole	27.4 (wet)	29.2 (dry)
Gas density at STP, kg/m ³	1.22 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m ³	0.65	

Gas Flow Parameters

Flow measurement time(s) (hhmm)	0800 & 1015
Temperature, °C	237
Temperature, K	510
Velocity at sampling plane, m/s	4.8
Volumetric flow rate, actual, m ³ /s	0.34
Volumetric flow rate (wet STP), m ³ /s	0.18
Volumetric flow rate (dry STP), m ³ /s	0.15
Mass flow rate (wet basis), kg/hour	800

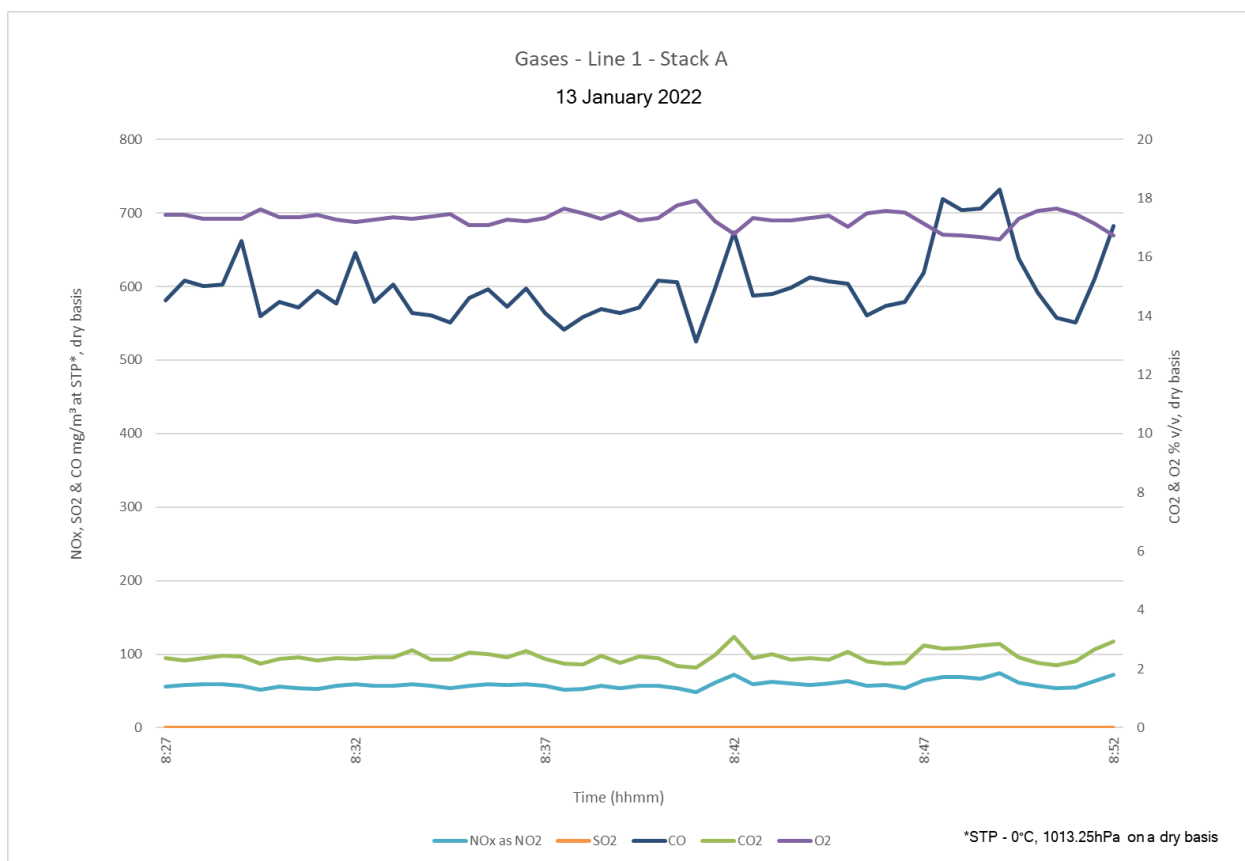
Isokinetic Results

Sampling time	Results	
	Concentration mg/m ³	Mass Rate g/min
Ammonia	1100	10
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	107	
Velocity difference, %	-9	

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack A
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average		Minimum		Maximum	
	Sampling time	0827 - 0852		0827 - 0852		0827 - 0852	
Combustion Gases		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
	Nitrogen oxides (as NO ₂)	59	0.53	48	0.44	74	0.67
	Sulfur dioxide	<6	<0.05	<6	<0.05	<6	<0.05
	Carbon monoxide	600	5.4	520	4.8	730	6.7
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		2.4		2		3.1	
Oxygen		17.3		16.6		17.9	



2.1.2 Stack B

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack B
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	33	
Gas molecular weight, g/g mole	25.6 (wet)	29.4 (dry)
Gas density at STP, kg/m ³	1.14 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m ³	0.57	

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1015 & 1140
Temperature, °C	275
Temperature, K	548
Velocity at sampling plane, m/s	5.8
Volumetric flow rate, actual, m ³ /s	0.41
Volumetric flow rate (wet STP), m ³ /s	0.2
Volumetric flow rate (dry STP), m ³ /s	0.14
Mass flow rate (wet basis), kg/hour	840

Isokinetic Results

Sampling time
Ammonia

Results

1021-1126

Concentration mg/m ³	Mass Rate g/min
2800	22

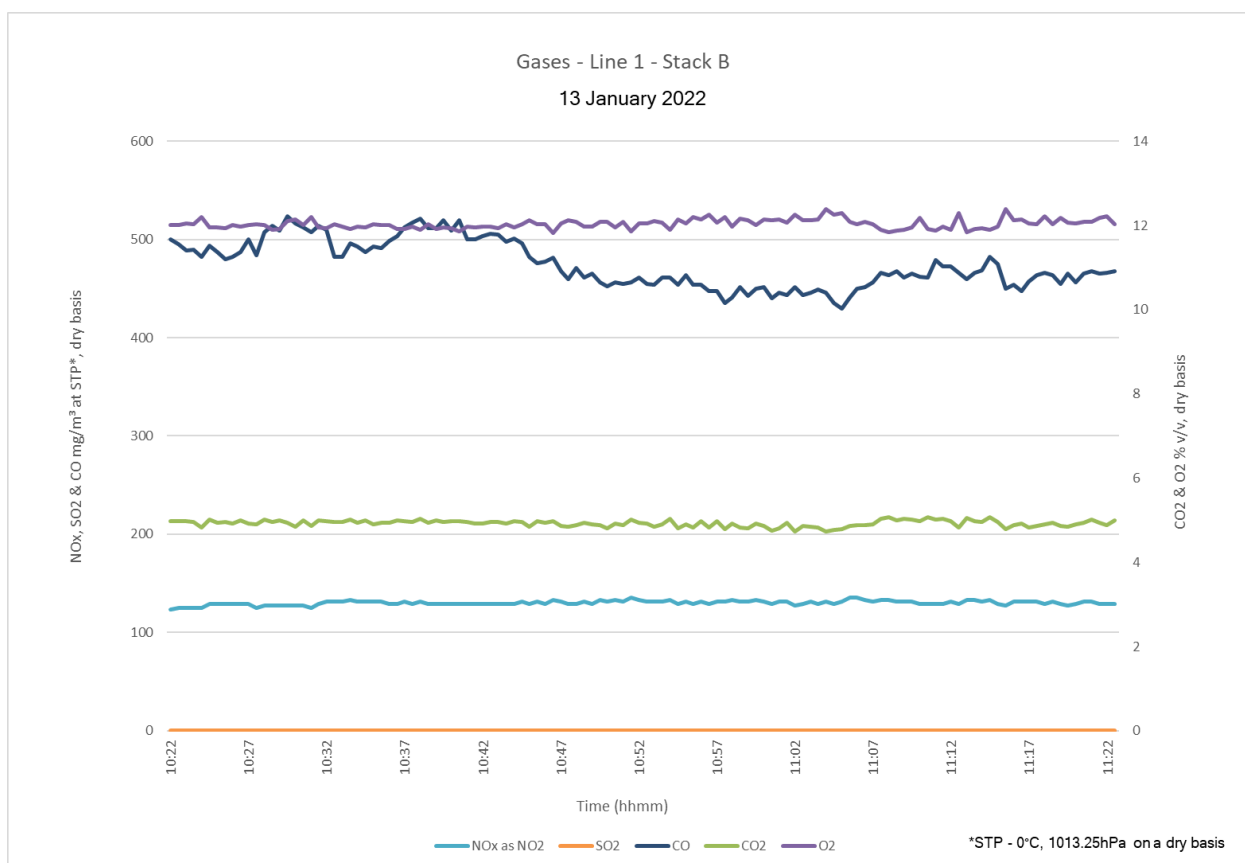
Isokinetic Sampling Parameters

Sampling time, min	64
Isokinetic rate, %	103
Velocity difference, %	3

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack B
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1022 - 1122		Minimum 1022 - 1122		Maximum 1022 - 1122	
Combustion Gases	Sampling time	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
	Nitrogen oxides (as NO ₂)	130	1.1	120	1	140	1.1
	Sulfur dioxide	<6	<0.05	<6	<0.05	<6	<0.05
	Carbon monoxide	470	3.9	430	3.5	520	4.3
		Concentration %v/v		Concentration %v/v		Concentration %v/v	
	Carbon dioxide	4.9		4.7		5.1	
	Oxygen	12		11.8		12.4	



2.1.3 Stack C

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack C
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	7.3	
Gas molecular weight, g/g mole	28.2 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m ³	0.83	

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1150 & 1340
Temperature, °C	139
Temperature, K	412
Velocity at sampling plane, m/s	4.2
Volumetric flow rate, actual, m ³ /s	0.29
Volumetric flow rate (wet STP), m ³ /s	0.19
Volumetric flow rate (dry STP), m ³ /s	0.18
Mass flow rate (wet basis), kg/hour	880

Isokinetic Results

Sampling time

Results

1227-1335

	Concentration mg/m ³	Mass Rate g/min
Ammonia	100	1.1

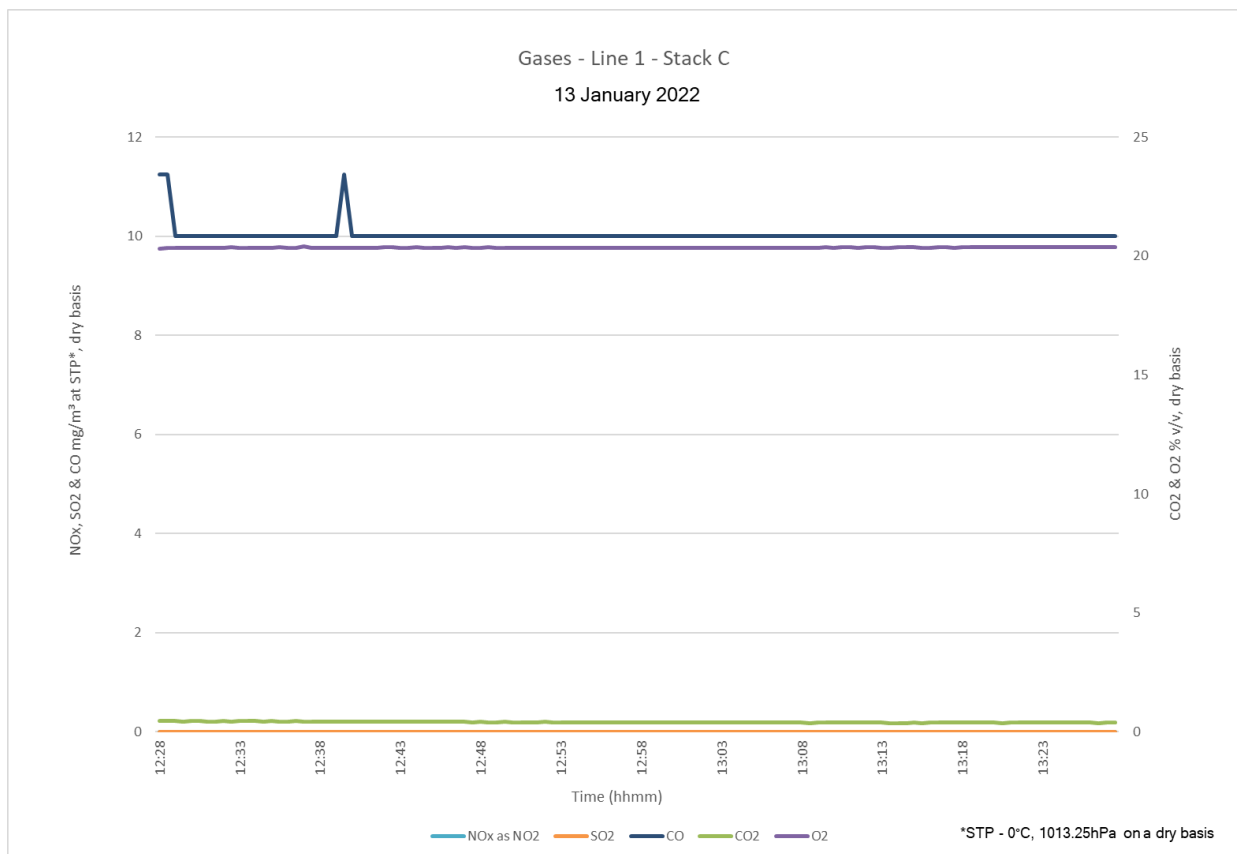
Isokinetic Sampling Parameters

Sampling time, min	64
Isokinetic rate, %	91
Velocity difference, %	5

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack C
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1228 - 1328		Minimum 1228 - 1328		Maximum 1228 - 1328	
	Sampling time						
		Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Combustion Gases							
Nitrogen oxides (as NO ₂)		<4	<0.05	<4	<0.05	<4	<0.05
Sulfur dioxide		<6	<0.06	<6	<0.06	<6	<0.06
Carbon monoxide		10	0.11	10	0.11	11	0.12
		Concentration %v/v		Concentration %v/v		Concentration %v/v	
Carbon dioxide		0.4		<0.4		0.5	
Oxygen		20.3		20.3		20.4	



2.1.4 Stack D

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack D
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	500 mm
Sampling plane area	0.196 m ²
Sampling port size, number & depth	2" BSP (x2), 55 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	1	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m ³	1.01	

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1330 & 1510
Temperature, °C	74
Temperature, K	347
Velocity at sampling plane, m/s	7.5
Volumetric flow rate, actual, m ³ /s	1.5
Volumetric flow rate (wet STP), m ³ /s	1.2
Volumetric flow rate (dry STP), m ³ /s	1.1
Mass flow rate (wet basis), kg/hour	5300

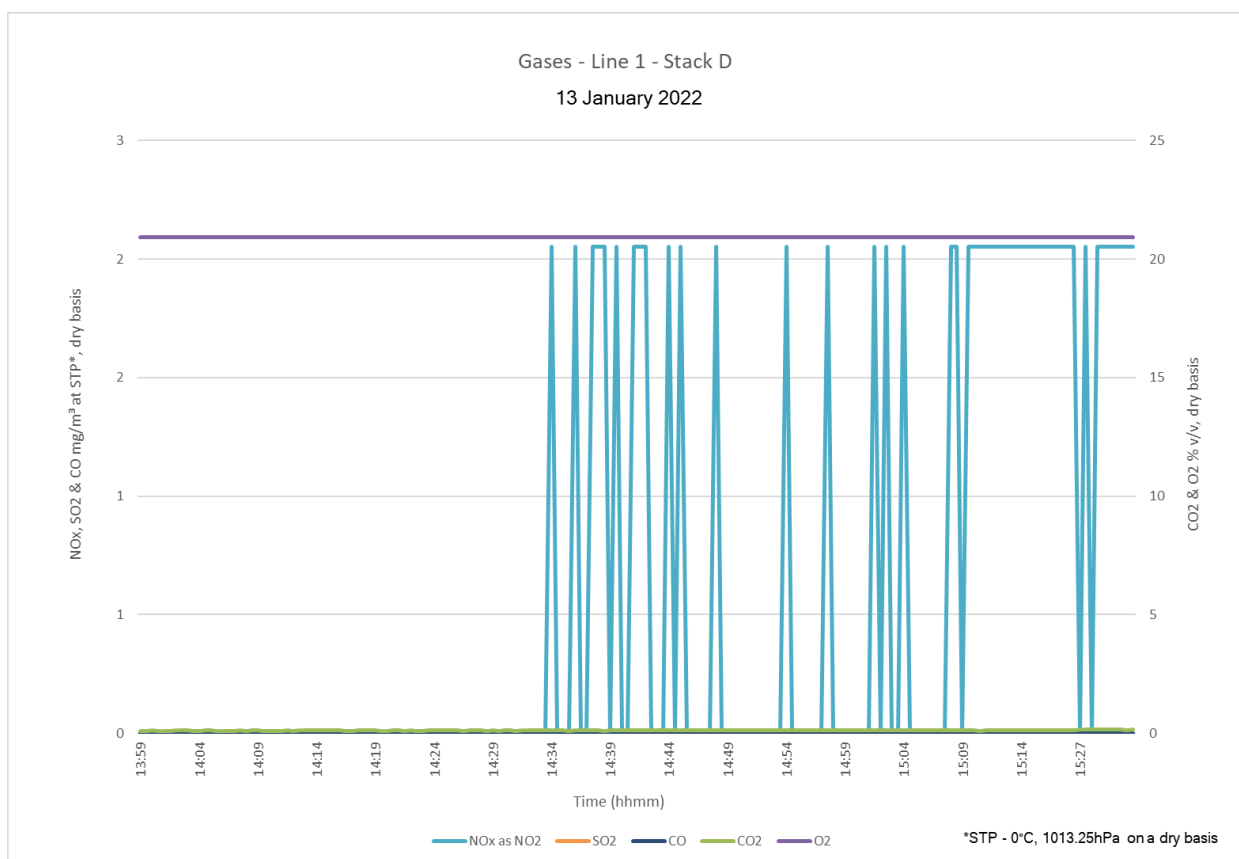
Isokinetic Results

Sampling time	Results	
	1400-1502	
	Concentration mg/m ³	Mass Rate g/min
Ammonia	2.3	0.16
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Velocity difference, %	-9	

Date	13/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 1 - Stack D
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1359 - 1531		Minimum 1359 - 1531		Maximum 1359 - 1531	
	Sampling time						
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
Combustion Gases		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
Nitrogen oxides (as NO₂)		<4	<0.3	<4	<0.3	<4	<0.3
Sulfur dioxide		<6	<0.4	<6	<0.4	<6	<0.4
Carbon monoxide		<2	<0.2	<2	<0.2	<2	<0.2
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		<0.4		<0.4		<0.4	
Oxygen		20.9		20.9		20.9	



2.2 Line 4

2.2.1 Stack A

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack A
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

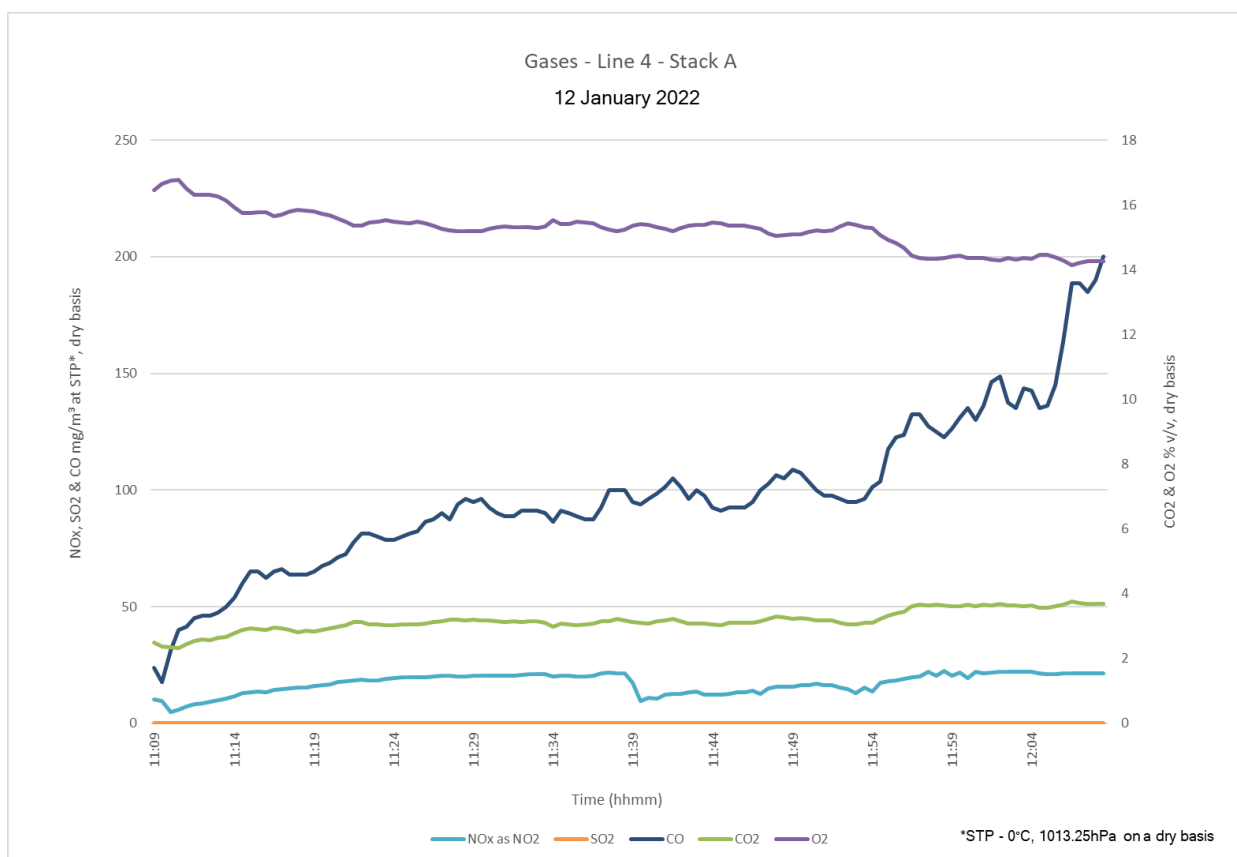
Sampling Plane Details	
Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	14	
Gas molecular weight, g/g mole	27.6 (wet)	29.2 (dry)
Gas density at STP, kg/m³	1.23 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.69	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1050 & 1215	
Temperature, °C	214	
Temperature, K	487	
Velocity at sampling plane, m/s	4.4	
Volumetric flow rate, actual, m³/s	0.31	
Volumetric flow rate (wet STP), m³/s	0.18	
Volumetric flow rate (dry STP), m³/s	0.15	
Mass flow rate (wet basis), kg/hour	780	
Velocity difference, %	-8	

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack A
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1109 - 1209		Minimum 1109 - 1209		Maximum 1109 - 1209	
Sampling time							
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
	Combustion Gases	mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
	Nitrogen oxides (as NO₂)	17	0.15	4.7	0.042	22	0.2
	Sulfur dioxide	<6	<0.05	<6	<0.05	<6	<0.05
	Carbon monoxide	97	0.87	17	0.16	200	1.8
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
	Carbon dioxide	3.2		2.3		3.8	
Oxygen	15.2		14.1		16.8		



2.2.2 Stack B

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack B
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	32	
Gas molecular weight, g/g mole	25.8 (wet)	29.5 (dry)
Gas density at STP, kg/m ³	1.15 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.57	

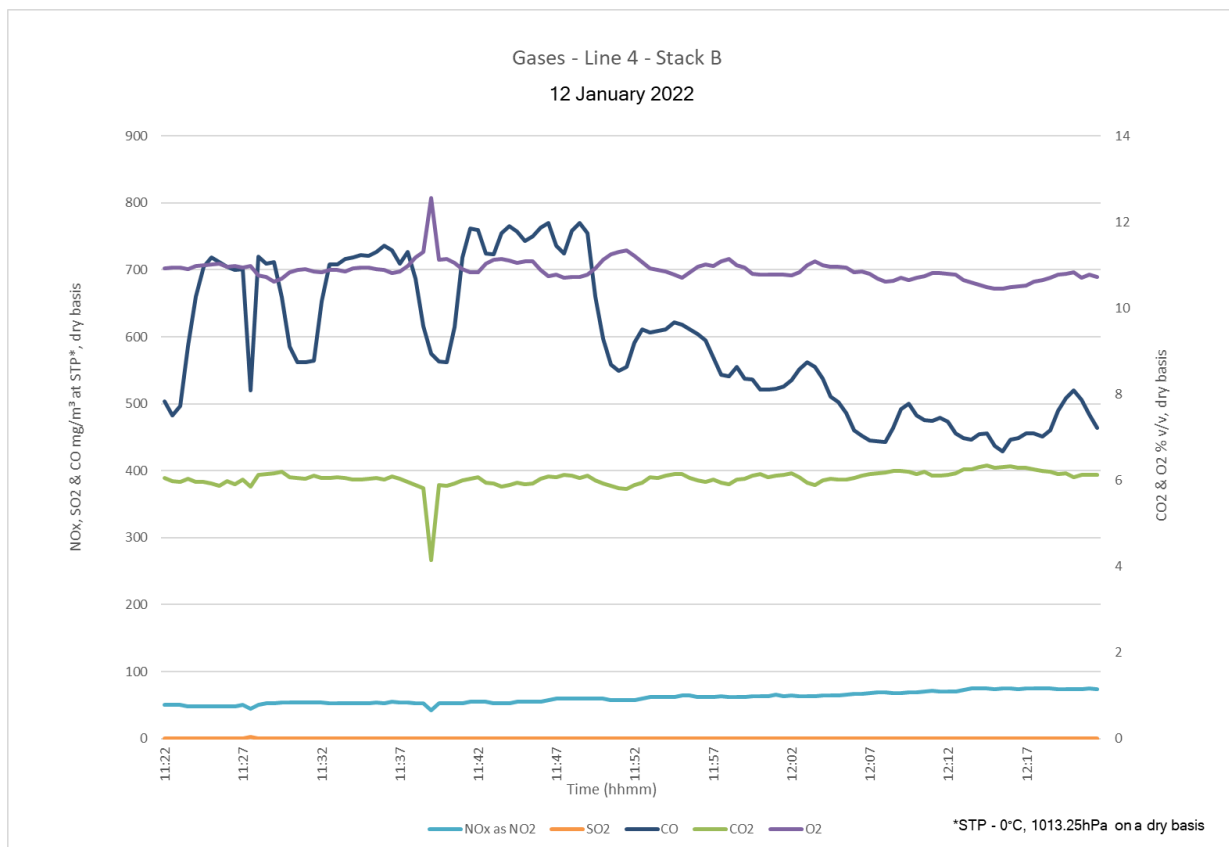
Gas Flow Parameters

Flow measurement time(s) (hhmm)	1110 & 1235
Temperature, °C	275
Temperature, K	548
Velocity at sampling plane, m/s	5
Volumetric flow rate, actual, m ³ /s	0.36
Volumetric flow rate (wet STP), m ³ /s	0.18
Volumetric flow rate (dry STP), m ³ /s	0.12
Mass flow rate (wet basis), kg/hour	740
Velocity difference, %	-7

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack B
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average		Minimum		Maximum	
	Sampling time	1122 - 1222		1122 - 1222		1122 - 1222	
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
Combustion Gases		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
Nitrogen oxides (as NO ₂)		60	0.44	42	0.3	75	0.54
Sulfur dioxide		<6	<0.04	<6	<0.04	<6	<0.04
Carbon monoxide		590	4.3	430	3.1	770	5.6
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		6		4.2		6.3	
Oxygen		10.9		10.5		12.6	



2.2.3 Stack C

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack C
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters

Moisture content, %v/v	26	
Gas molecular weight, g/g mole	26.3 (wet)	29.2 (dry)
Gas density at STP, kg/m ³	1.17 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m ³	0.70	

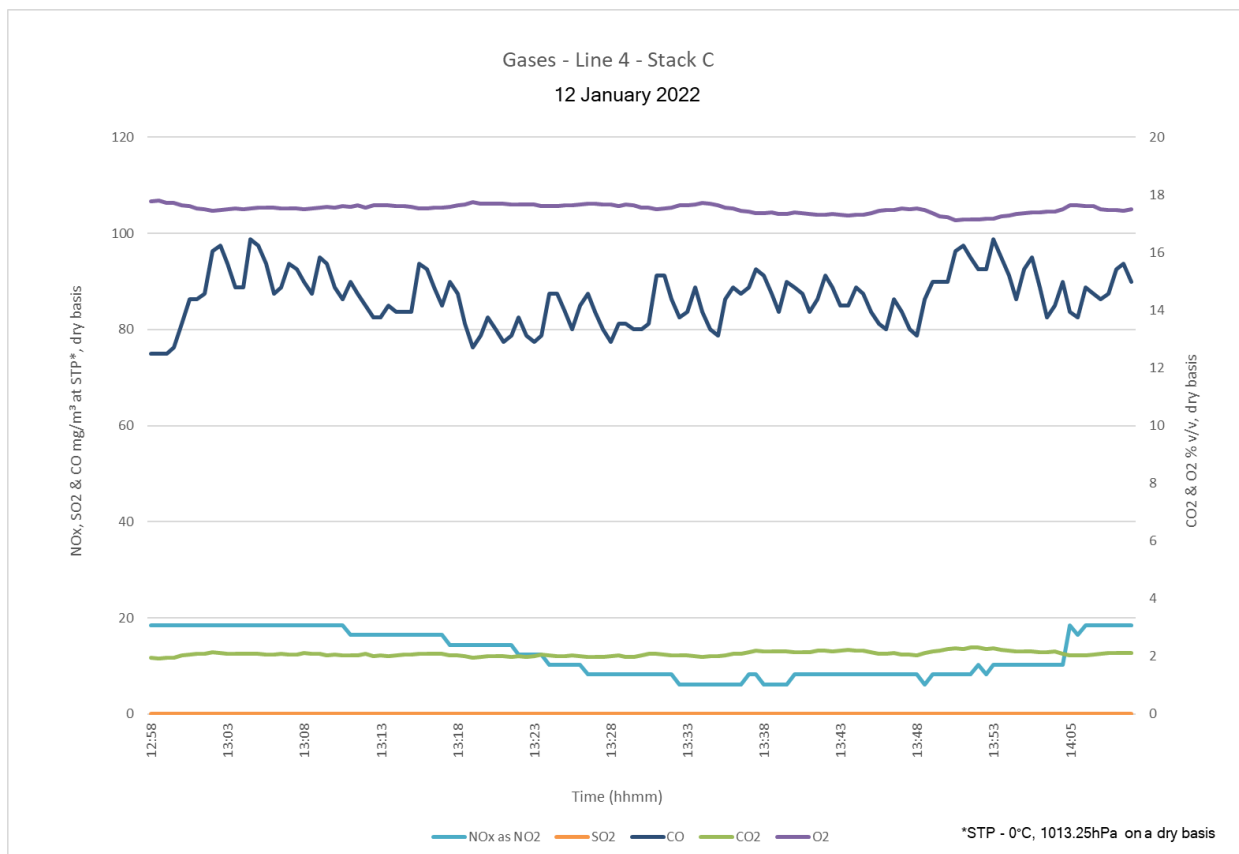
Gas Flow Parameters

Flow measurement time(s) (hhmm)	1300 & 1415
Temperature, °C	187
Temperature, K	460
Velocity at sampling plane, m/s	6.1
Volumetric flow rate, actual, m ³ /s	0.43
Volumetric flow rate (wet STP), m ³ /s	0.26
Volumetric flow rate (dry STP), m ³ /s	0.19
Mass flow rate (wet basis), kg/hour	1100
Velocity difference, %	7

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack C
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average		Minimum		Maximum	
	Sampling time	1258 - 1409		1258 - 1409		1258 - 1409	
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
Combustion Gases		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
Nitrogen oxides (as NO ₂)		12	0.14	6.2	0.071	18	0.21
Sulfur dioxide		<6	<0.07	<6	<0.07	<6	<0.07
Carbon monoxide		87	1	75	0.86	99	1.1
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		2.1		1.9		2.3	
Oxygen		17.5		17.1		17.8	



2.2.4 Stack D

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack D
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number & depth	2" BSP (x2), 57 mm
Access & height of ports	Fixed ladder 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS4323.1 (2021)	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters

Moisture content, %v/v	12	
Gas molecular weight, g/g mole	27.7 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m ³	1.02	

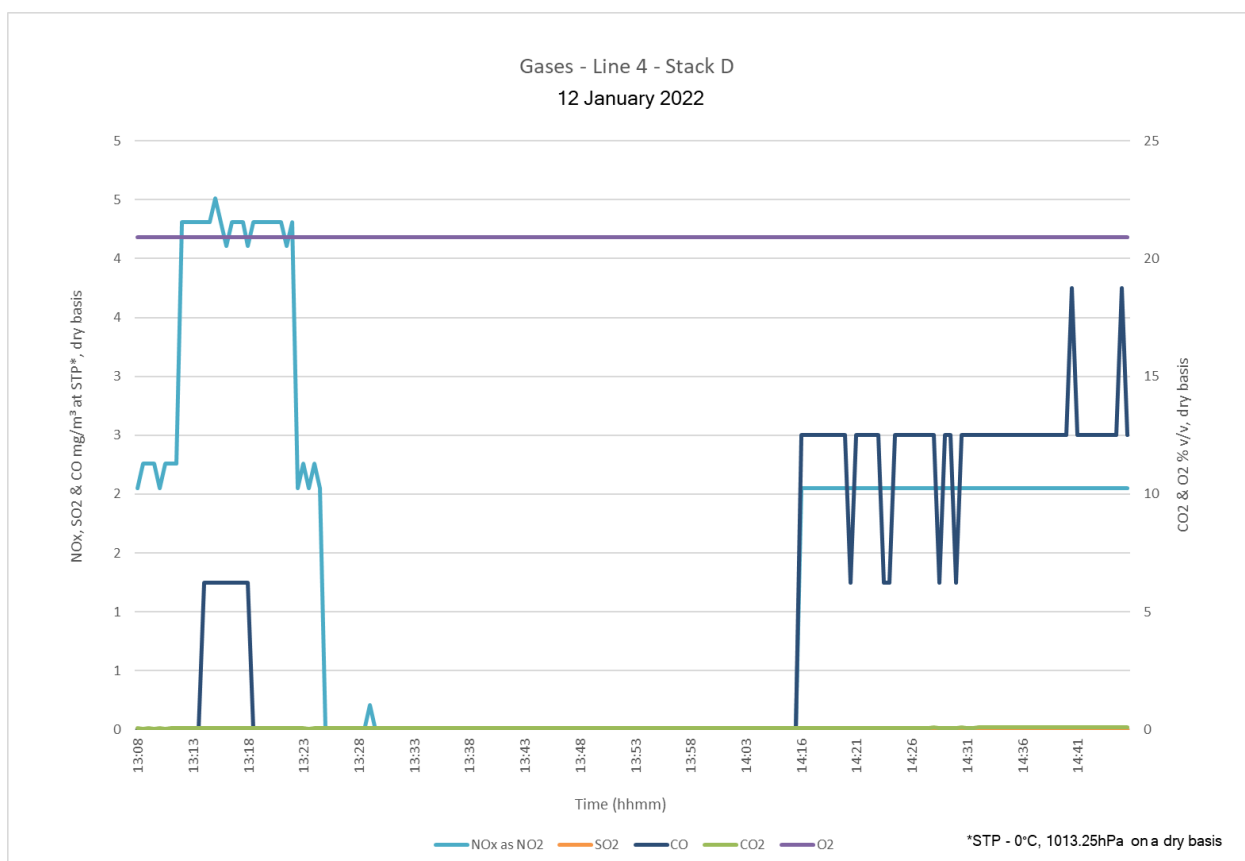
Gas Flow Parameters

Flow measurement time(s) (hhmm)	1310 & 1430
Temperature, °C	58
Temperature, K	331
Velocity at sampling plane, m/s	1.9
Volumetric flow rate, actual, m ³ /s	0.13
Volumetric flow rate (wet STP), m ³ /s	0.11
Volumetric flow rate (dry STP), m ³ /s	0.095
Mass flow rate (wet basis), kg/hour	480
Velocity difference, %	<1

Date	12/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Line 4 - Stack D
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Rick Peralta	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1308 - 1445		Minimum 1308 - 1445		Maximum 1308 - 1445	
	Sampling time						
		Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Combustion Gases							
Nitrogen oxides (as NO ₂)		<4	<0.02	<4	<0.02	4.5	0.026
Sulfur dioxide		<6	<0.03	<6	<0.03	<6	<0.03
Carbon monoxide		<2	<0.01	<2	<0.01	3.7	0.021
		Concentration %v/v		Concentration %v/v		Concentration %v/v	
Carbon dioxide		<0.4		<0.4		<0.4	
Oxygen		20.9		20.9		20.9	



2.3 Boiler Units

2.3.1 HW1

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - HW1
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	370 mm
Sampling plane area	0.108 m ²
Sampling port size, number	10mm hole
Access & height of ports	Stairs & fixed ladder 12 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Comments

Boiler unit was cycling between operating and not-operating during the test time.
Stack exit dimensions are required for the velocity data.

Stack Parameters

Moisture content, %v/v	6.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.5 (dry)
Gas density at STP, kg/m ³	1.28 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.86	

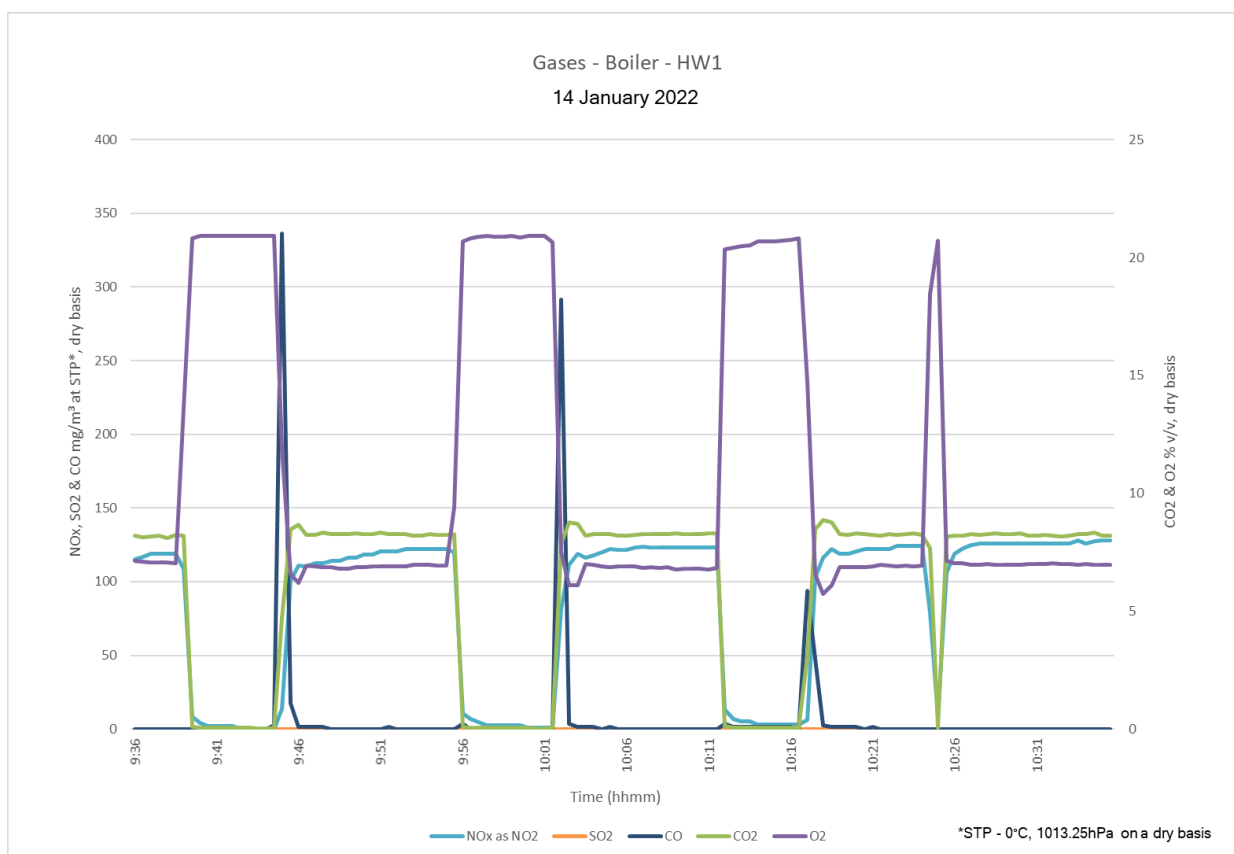
Gas Flow Parameters

Flow measurement time(s) (hhmm)	0925 & 1105
Temperature, °C	130
Temperature, K	403
Velocity at sampling plane, m/s	5.2
Volumetric flow rate, actual, m ³ /s	0.56
Volumetric flow rate (wet STP), m ³ /s	0.37
Volumetric flow rate (dry STP), m ³ /s	0.35
Mass flow rate (wet basis), kg/hour	1700
Velocity difference, %	-4

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - HW1
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 0936 - 1035		Minimum 0936 - 1035		Maximum 0936 - 1035	
Sampling time							
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
	Combustion Gases	mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
	Nitrogen oxides (as NO ₂)	85	1.8	<4	<0.09	130	2.7
	Sulfur dioxide	<6	<0.1	<6	<0.1	<6	<0.1
	Carbon monoxide	6.9	0.15	<2	<0.05	340	7.1
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
	Carbon dioxide	5.9		<0.4		8.9	
Oxygen	11.1		5.7		20.9		



2.3.2 V150

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V150
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	290 mm
Sampling plane area	0.0661 m ²
Sampling port size, number	10mm hole
Access & height of ports	Stairs & fixed ladder 12 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters

Moisture content, %v/v	17	
Gas molecular weight, g/g mole	27.6 (wet)	29.5 (dry)
Gas density at STP, kg/m ³	1.23 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.77	

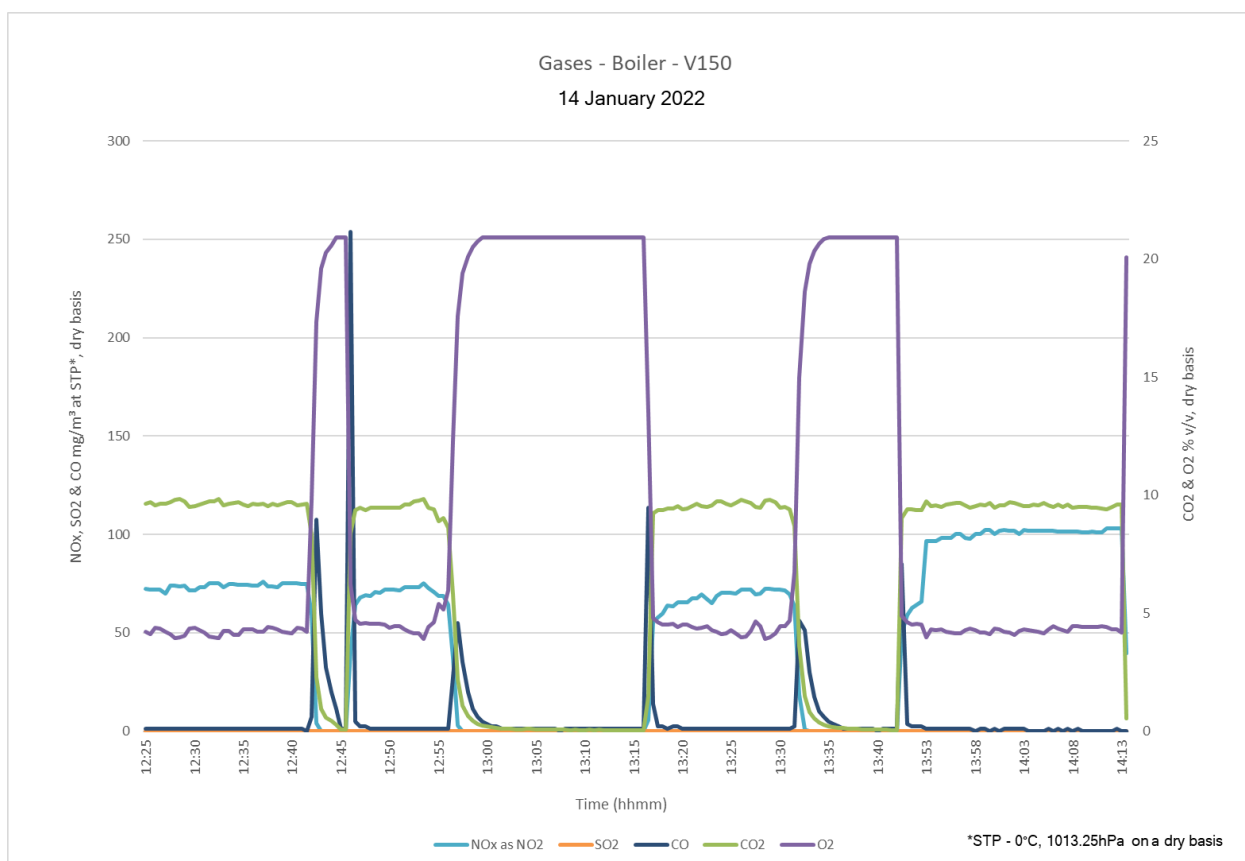
Gas Flow Parameters

Flow measurement time(s) (hhmm)	1230 & 1335
Temperature, °C	162
Temperature, K	435
Velocity at sampling plane, m/s	5
Volumetric flow rate, actual, m ³ /s	0.33
Volumetric flow rate (wet STP), m ³ /s	0.21
Volumetric flow rate (dry STP), m ³ /s	0.17
Mass flow rate (wet basis), kg/hour	910
Velocity difference, %	9

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V150
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average 1225 - 1413		Minimum 1225 - 1413		Maximum 1225 - 1413	
Sampling time							
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
	Combustion Gases						
	Nitrogen oxides (as NO ₂)	52	0.54	<4	<0.04	100	1.1
	Sulfur dioxide	<6	<0.06	<6	<0.06	<6	<0.06
	Carbon monoxide	6.3	0.065	<2	<0.03	250	2.6
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide	6.4		<0.4		9.9		
Oxygen	9.9		3.9		20.9		



2.3.3 V151

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V151
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m ²
Sampling port size, number	10mm hole
Access & height of ports	Stairs & fixed ladder 12 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters

Moisture content, %v/v	18	
Gas molecular weight, g/g mole	27.7 (wet)	29.8 (dry)
Gas density at STP, kg/m ³	1.23 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m ³	0.74	

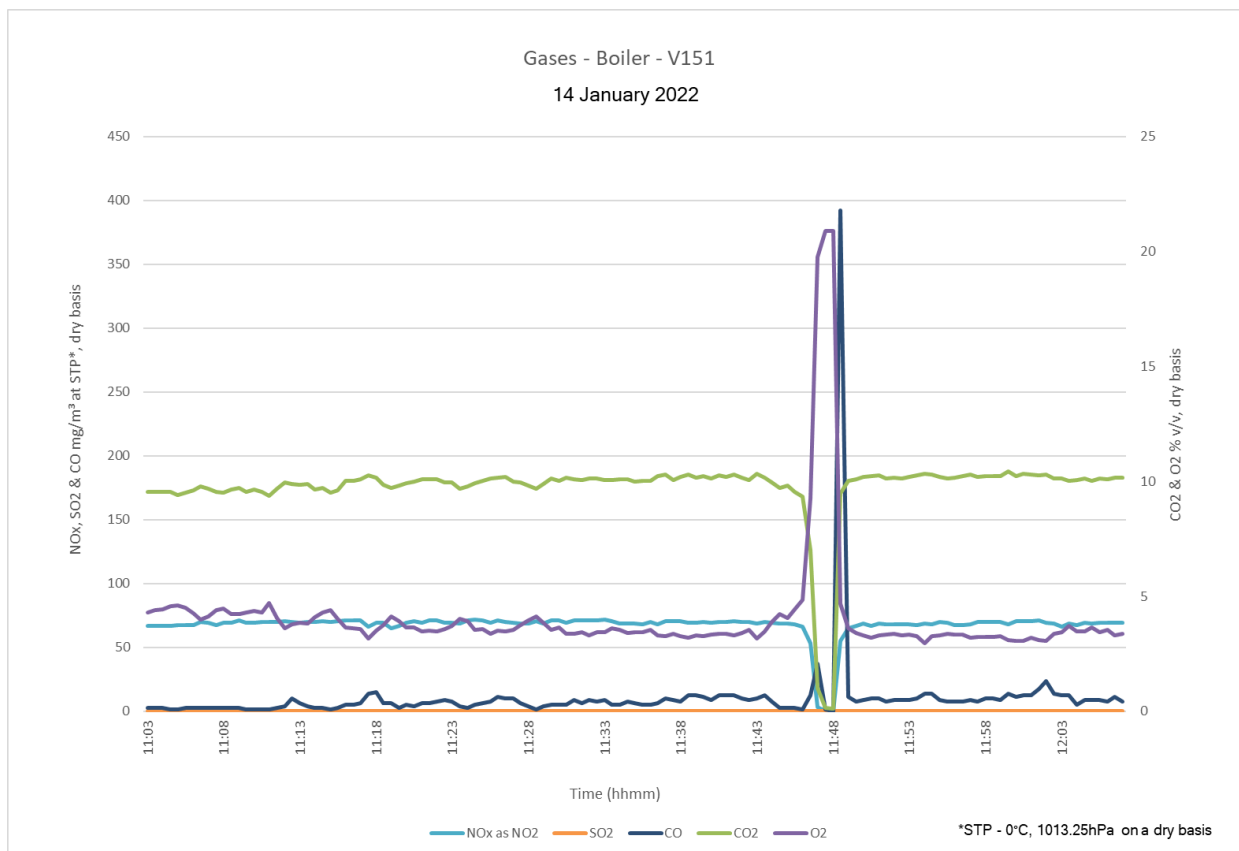
Gas Flow Parameters

Flow measurement time(s) (hhmm)	1050 & 1430
Temperature, °C	178
Temperature, K	452
Velocity at sampling plane, m/s	3
Volumetric flow rate, actual, m ³ /s	0.21
Volumetric flow rate (wet STP), m ³ /s	0.13
Volumetric flow rate (dry STP), m ³ /s	0.1
Mass flow rate (wet basis), kg/hour	560
Velocity difference, %	-8

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V151
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average		Minimum		Maximum	
Sampling time		1103 - 1207		1103 - 1207		1103 - 1207	
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
Combustion Gases		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
Nitrogen oxides (as NO ₂)		67	0.42	<4	<0.03	72	0.45
Sulfur dioxide		<6	<0.04	<6	<0.04	<6	<0.04
Carbon monoxide		10	0.064	<2	<0.02	390	2.4
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		9.7		<0.4		10.4	
Oxygen		4.1		3		20.9	



2.3.4 V152

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V152
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Sampling Plane Details

Sampling plane dimensions	400 mm
Sampling plane area	0.126 m ²
Sampling port size, number	10mm hole
Access & height of ports	Stairs & fixed ladder 12 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter >6 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters

Moisture content, %v/v	17	
Gas molecular weight, g/g mole	27.8 (wet)	29.8 (dry)
Gas density at STP, kg/m ³	1.24 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m ³	0.82	

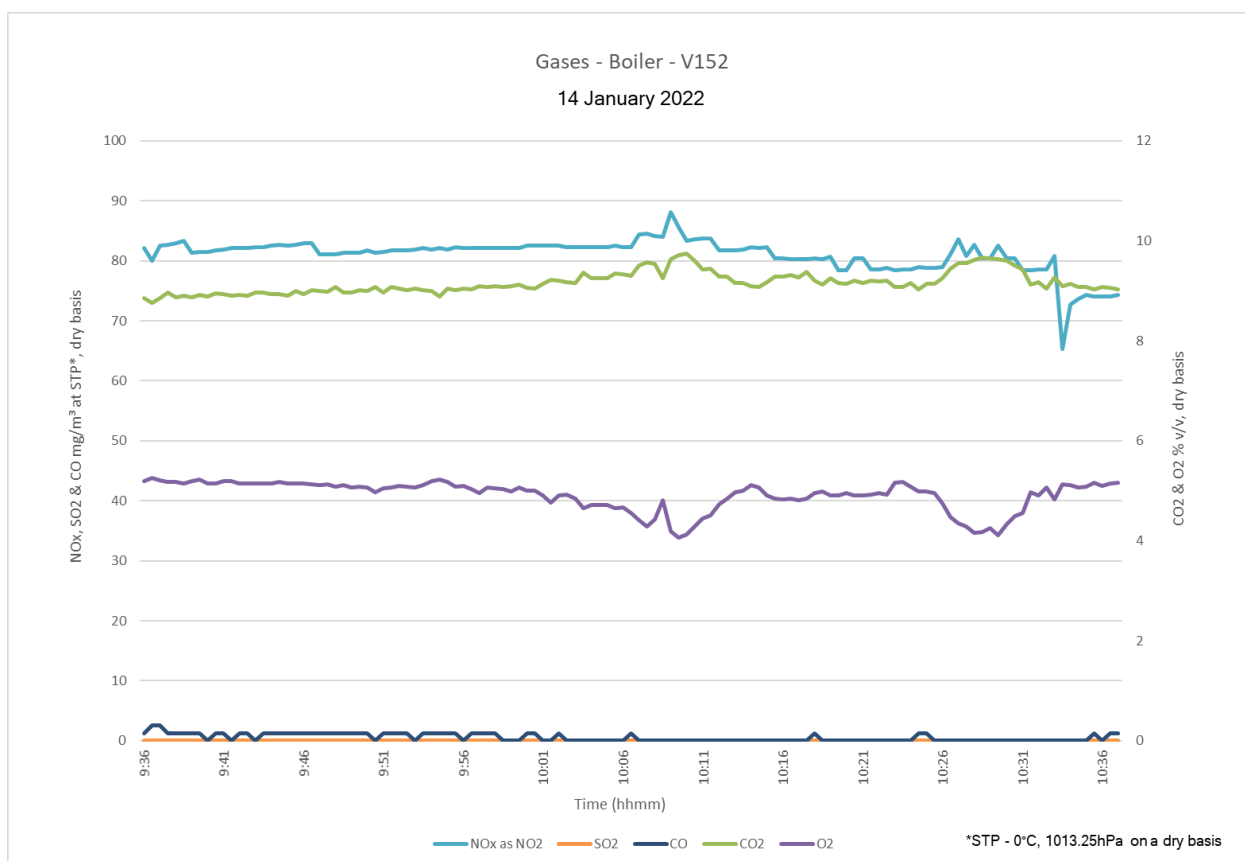
Gas Flow Parameters

Flow measurement time(s) (hhmm)	0917 & 1430
Temperature, °C	136
Temperature, K	410
Velocity at sampling plane, m/s	3.6
Volumetric flow rate, actual, m ³ /s	0.45
Volumetric flow rate (wet STP), m ³ /s	0.3
Volumetric flow rate (dry STP), m ³ /s	0.25
Mass flow rate (wet basis), kg/hour	1300
Velocity difference, %	-8

Date	14/01/2022	Client	The Arnott's Group
Report	R012166	Stack ID	Boiler - V152
Licence No.	-	Location	Huntingwood
Ektimo Staff	Graham Edwards/Ish Alam	State	NSW
Process Conditions	Please refer to client records.		

220107

Gas Analyser Results		Average		Minimum		Maximum	
	Sampling time	0936 - 1037		0936 - 1037		0936 - 1037	
		Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
Combustion Gases		mg/m³	g/min	mg/m³	g/min	mg/m³	g/min
Nitrogen oxides (as NO ₂)		81	1.2	65	0.97	88	1.3
Sulfur dioxide		<6	<0.09	<6	<0.09	<6	<0.09
Carbon monoxide		<2	<0.04	<2	<0.04	2.5	0.037
		Concentration		Concentration		Concentration	
		%v/v		%v/v		%v/v	
Carbon dioxide		9.2		8.8		9.8	
Oxygen		4.9		4.1		5.3	



3 Plant Operating Conditions

Please refer to Arnott's records for complete process and operating conditions.

4 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	NSW EPA TM-1	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2	NSW EPA TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22	NSW EPA TM-22	19%	✓	✓
Molecular weight	NA	NSW EPA TM-23	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24	NSW EPA TM-24	13%	✓	✓
Carbon monoxide	NSW EPA TM-32	NSW EPA TM-32	12%	✓	✓
Nitrogen oxides	NSW EPA TM-11	NSW EPA TM-11	12%	✓	✓
Oxygen	NSW EPA TM-25	NSW EPA TM-25	13%	✓	✓
Sulfur dioxide	NSW EPA TM-4	NSW EPA TM-4	12%	✓	✓
Ammonia	USEPA CTM 027	Envirolab in-house methods Inorg-093 & Inorg-057	18%	✓	✓ [‡]

220317

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 24 January 2022 in report 286751.

5 Deviations From Test Methods

NSW EPA TM-11 is generally performed over a 60-minute period. The sampling period for Line 1 - Stack A has been reduced to 25-minutes due to inconsistencies with the gases data.

6 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

7 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D ₅₀	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D ₅₀ method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D ₅₀ of that cyclone and less than the D ₅₀ of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM ₁₀	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
PM _{2.5}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

8 Appendix 1: Site Photos



Access Ladder 2nd landing



Access Ladder Ground Level

Ektimo

ektimo.com.au

1300 364 005

MELBOURNE (Head Office)

26 Redland Drive

Mitcham

VIC 3132

AUSTRALIA

SYDNEY

6/78 Reserve Road,

Artarmon

NSW 2064

AUSTRALIA

WOLLONGONG

1/251 Princes Highway

Unanderra

NSW 2526

AUSTRALIA

PERTH

52 Cooper Road

Cockburn Central

WA 6164

AUSTRALIA

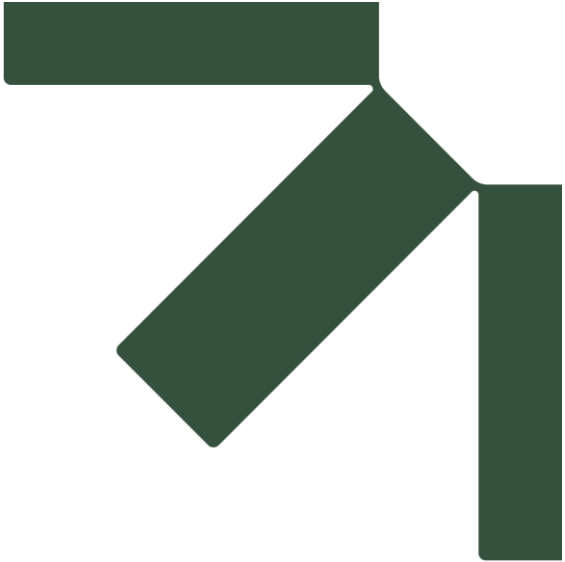
BRISBANE

3/109 Riverside Place

Morningside

QLD 4170

AUSTRALIA



Appendix D Meteorological Year

Arnott's Huntingwood Processing Facility Expansion Modification

Air Quality Impact Assessment

FDC Building Services

SLR Project No.: 610.032399.00001

20 February 2026

Selection of Meteorological Year

Once emitted to atmosphere, the emissions will:

- Rise according to the momentum and buoyancy of the emission at the discharge point relative to the prevailing atmospheric conditions;
- Be advected from the source according to the strength and direction of the wind at the height which the plume has risen in the atmosphere;
- Be diluted due to mixing with the ambient air, according to the intensity of turbulence; and
- (Potentially) be chemically transformed and/or depleted by deposition processes.

Dispersion is the combined effect of these processes. Dispersion modelling is used as a tool to simulate the air quality effects of specific emission sources, given the meteorology typical for a local area together with the expected emissions. Selection of a year when the meteorological data is atypical means that the resultant predictions may not appropriately represent the most likely air quality impacts. Therefore, in dispersion modelling, one of the key considerations is the representative nature of the meteorological data used.

The year of meteorological data used for the dispersion modelling was selected by reviewing the most recent five years of historical surface observations at Horsley Park Equestrian Centre AWS (2020 to 2024 inclusive) to determine the year that is most representative of average conditions. Wind direction, wind speed and ambient temperature were compared to 5-year averages for the region to determine the most representative year.

Data collected from 2020 to 2024 is summarised in Figure C1 to Figure C3. Examination of the data indicates the following:

- Figure C1 indicates all years are generally similar with a higher frequency of winds from the southwest..
- Figure C2 indicates that average monthly wind speeds during 2021, 2024 and 2023 were typically lower than the 5-year average wind speeds. Lower wind speeds lead to less effective dispersion of pollutants and as such the use of a data set with lower wind speeds is considered to be conservative.
- Figure C3 shows that temperatures for all years generally reflect the 5-year average.
- Figure C4 indicates that calms conditions during 2023 were typically higher than the 5-year average wind speeds. Lower wind speeds are considered to be conservative.
- Given the above, the year 2023 was selected as the representative year of meteorology.



Figure C1 Frequency of Winds at Horsley Park Equestrian Centre AWS for 2020-2024

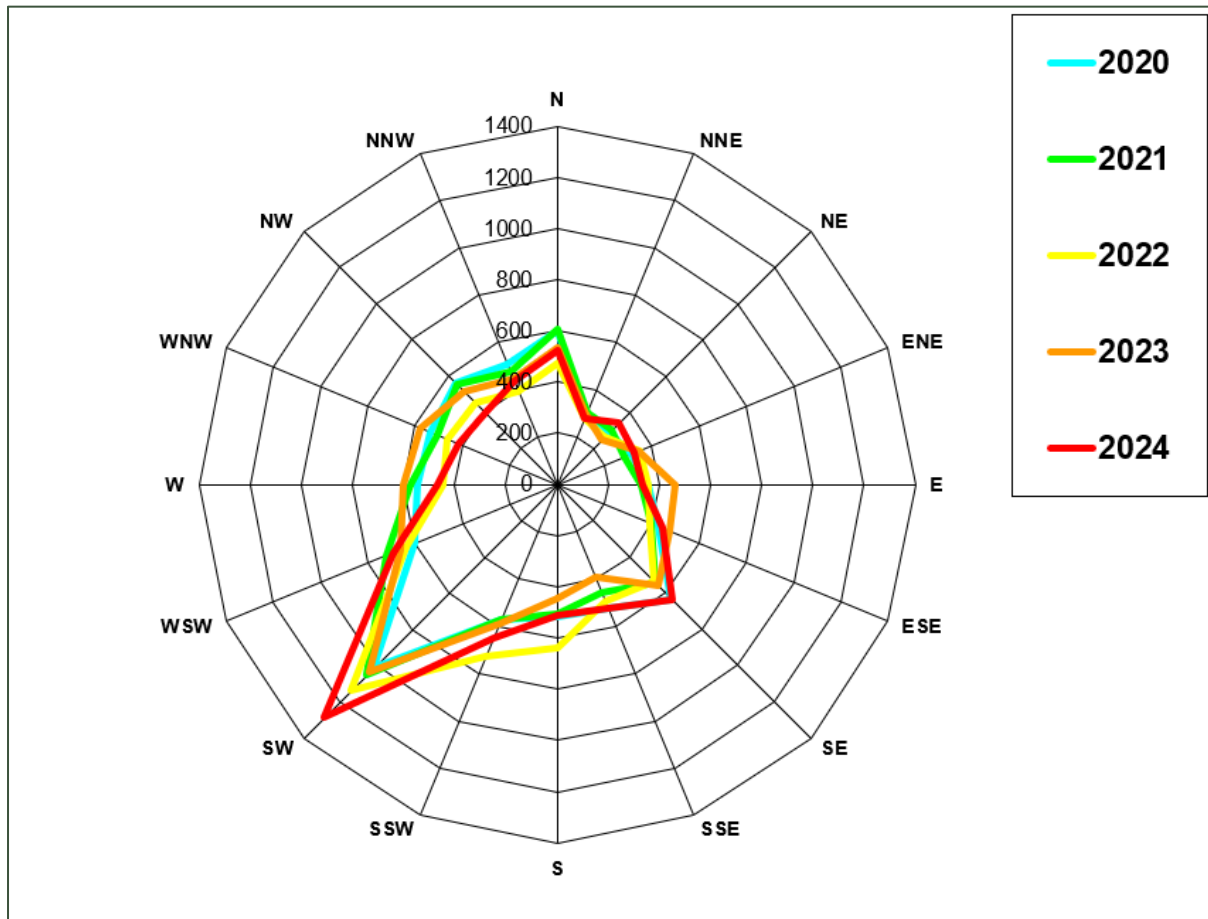


Figure A2 Monthly Average Wind Speed at Horsley Park Equestrian Centre AWS for 2020-2024

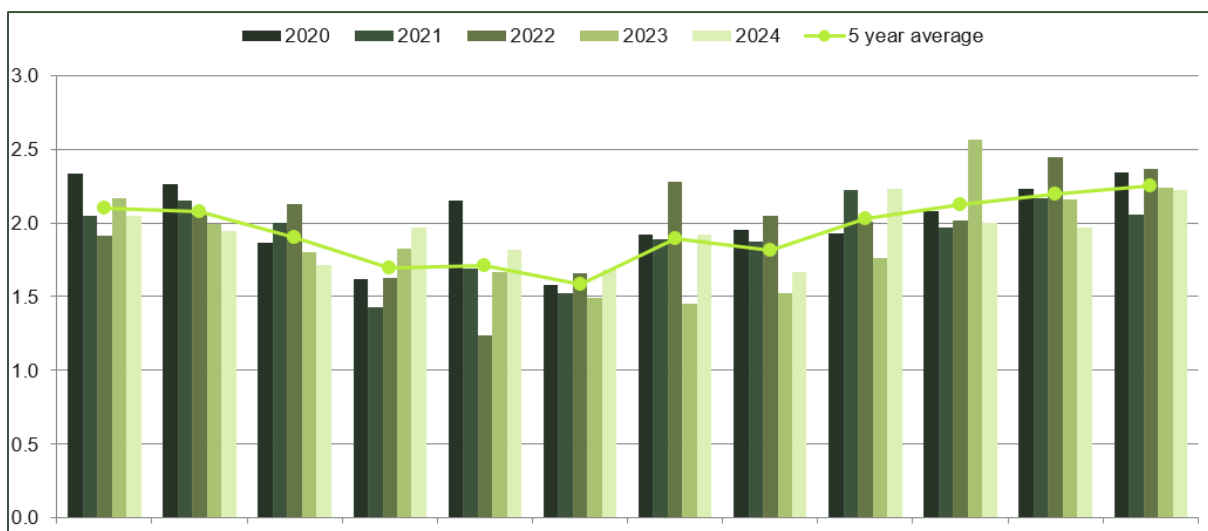


Figure A3 Monthly Average Temperature at Horsley Park Equestrian Centre AWS for 2020-2024

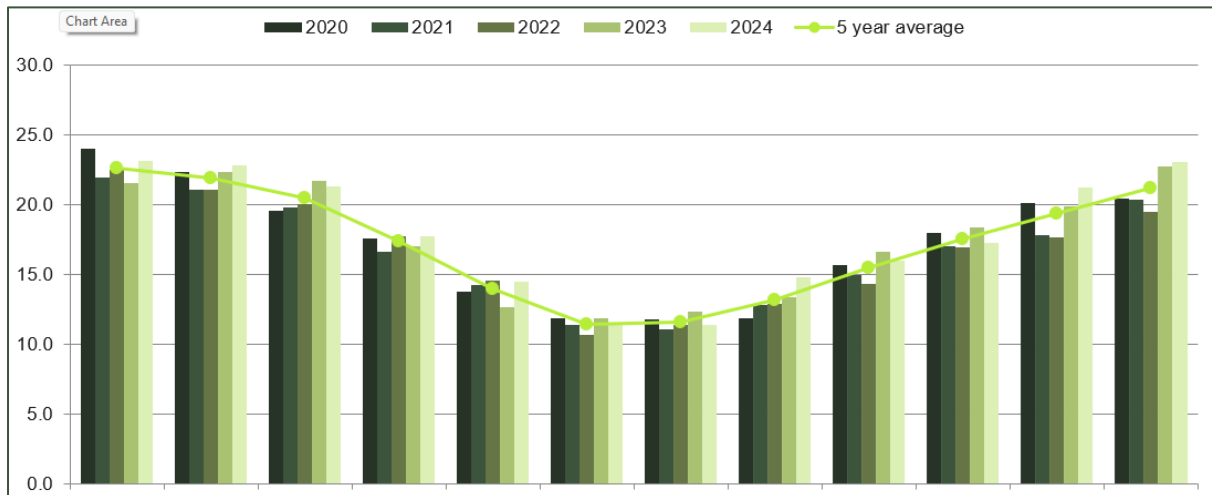
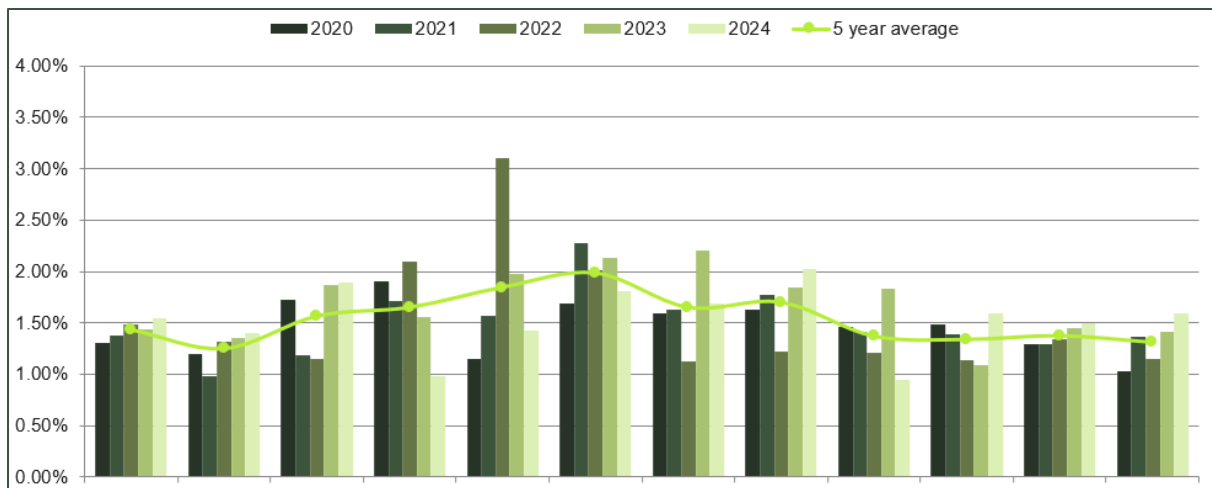
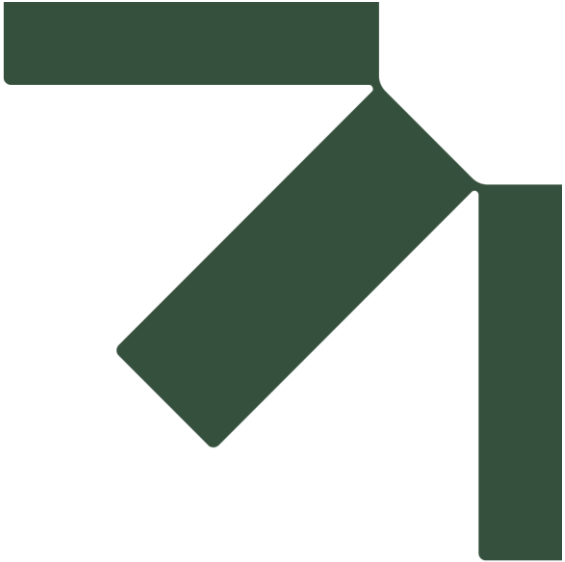


Figure D3 Calms at Horsley Park Equestrian Centre AWS for 2020-2024





Appendix E Isopleth Plots

Arnott's Huntingwood Processing Facility Expansion Modification

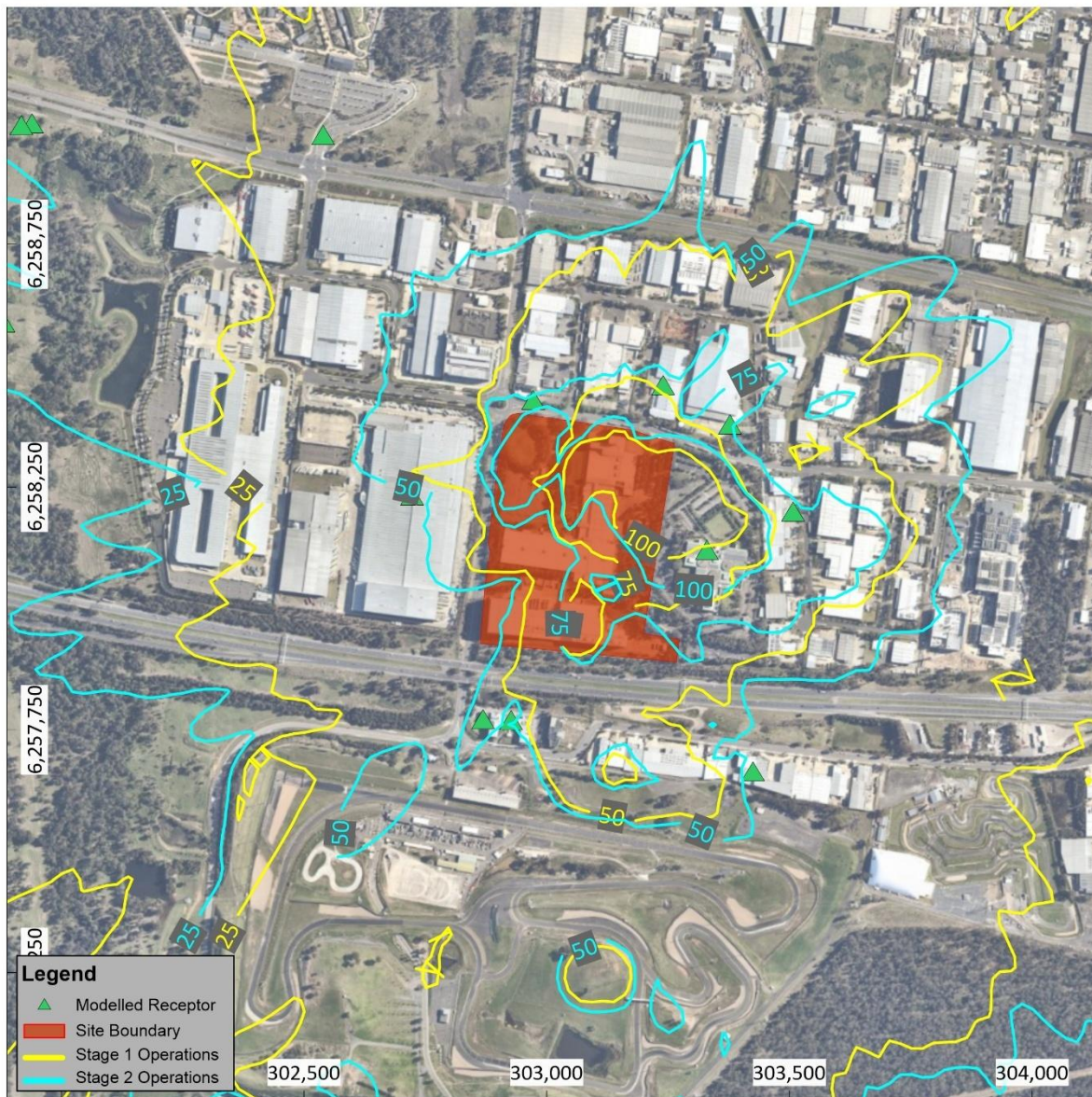
Air Quality Impact Assessment

FDC Building Services

SLR Project No.: 610.032399.00001

20 February 2026

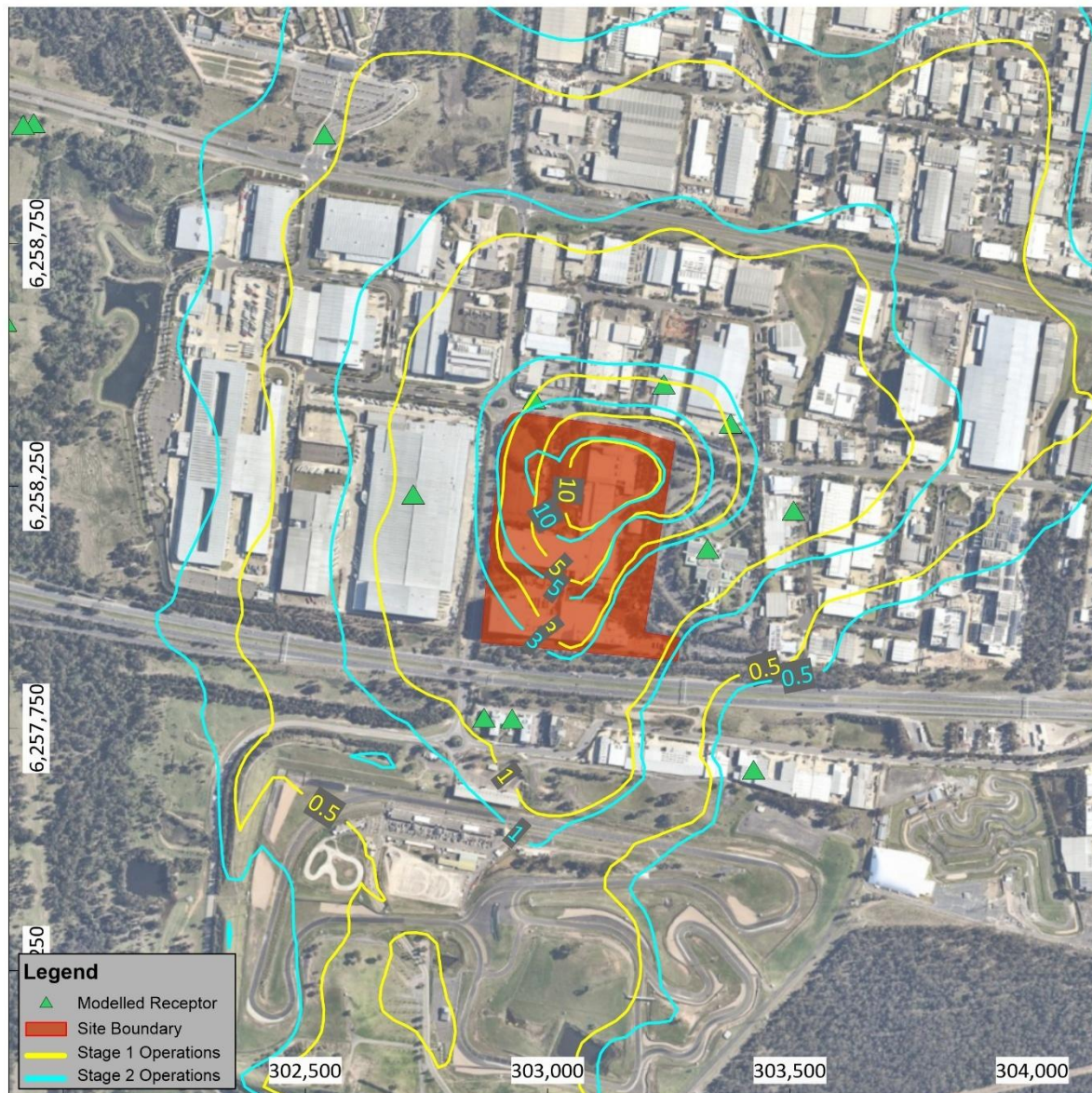
Figure E1 Predicted 1-Hour Average Incremental NO_x Isopleth Plot



 Tenancy 202 Submarine School Sub Base Platypus 120 High Street North Sydney NSW 2060 Australia T: +61 2 9427 8100 F: +61 2 9427 8200 <i>The content within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.</i>	Project Number: 610.032399		 FDC Construction & Fitout (NSW) Pty Ltd Arnotts Huntingwood Expansion Air Quality Assessment Incremental Impact - Operations				
	Dispersion Model: CALPUFF						
	Modelling Period: 2023						
	Projection: GDA 1994 MGA Zone 56						
	Date: 20/08/2025		Pollutant	NO _x	Avg Period	1-Hour	Unit



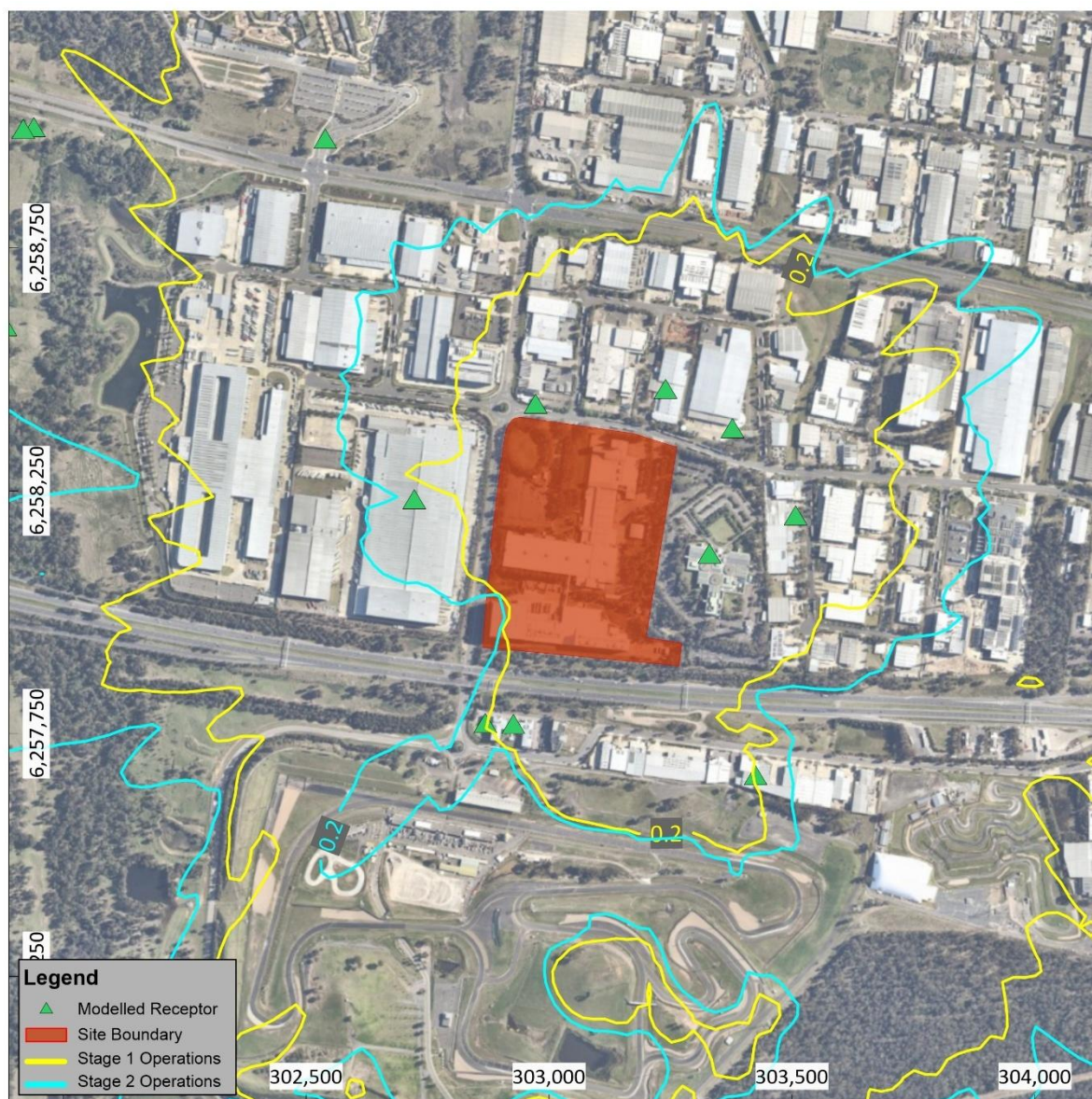
Figure E2 Predicted Annual Average Incremental NO_x Isopleth Plot



 Tenancy 202 Submarine School Sub Base Platypus 120 High Street North Sydney NSW 2060 Australia T: +61 2 9427 8100 F: +61 2 9427 8200 The content within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.	Project Number: 610.032399				FDC Construction & Fitout (NSW) Pty Ltd			
	Dispersion Model: CALPUFF				Arnotts Huntingwood Expansion			
	Modelling Period: 2023				Air Quality Assessment			
	Projection: GDA 1994 MGA Zone 56				Incremental Impact - Operations			
	Date: 20/08/2025							
		Pollutant	NOx	Avg Period	Annual	Unit	µg/m³	



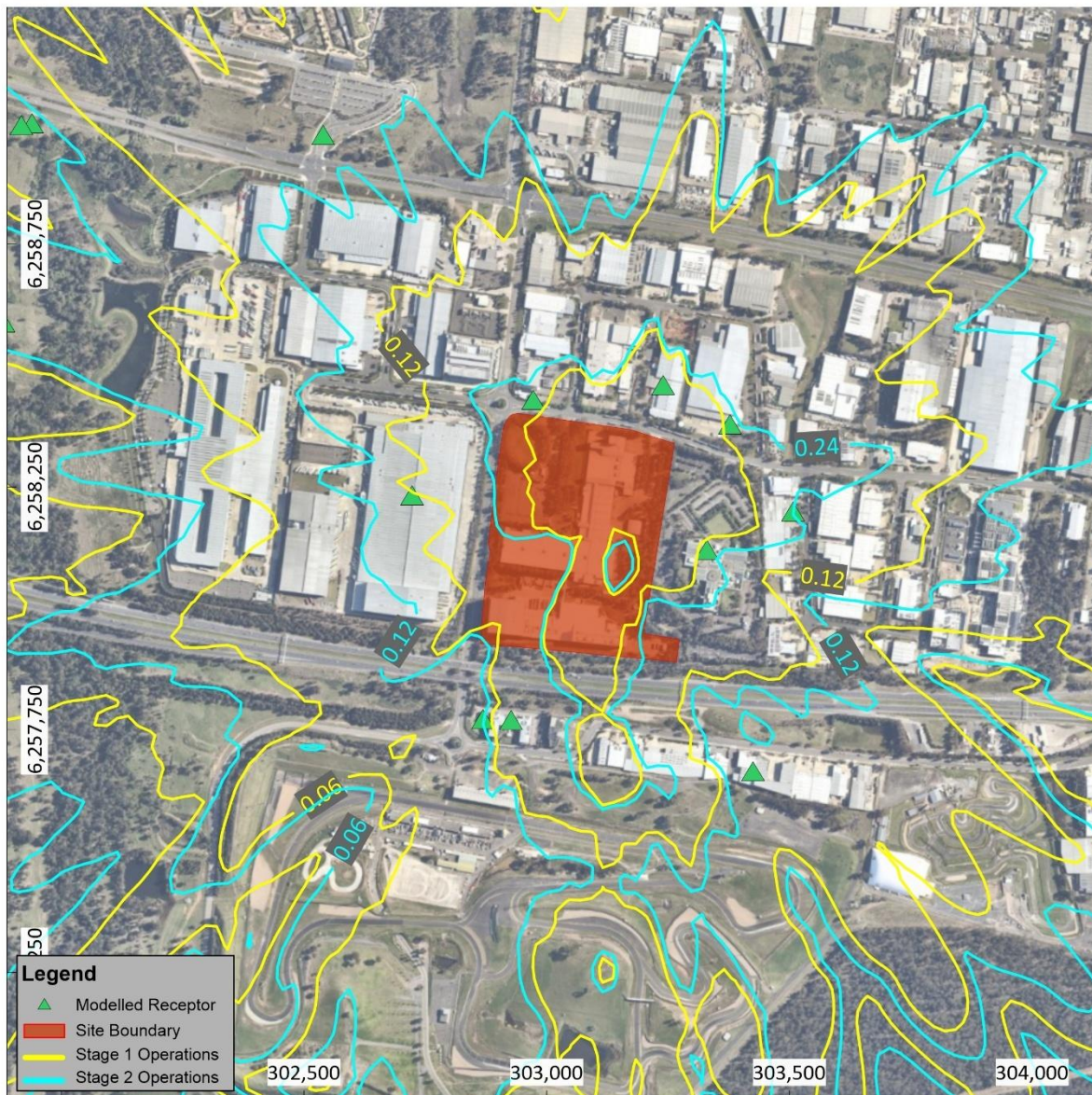
Figure E3 Predicted 1-Hour Average Incremental CO Isopleth Plot



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	Dispersion Model: CALPUFF		Arnott's Huntingwood Expansion			
	Modelling Period: 2023		Air Quality Assessment			
	Projection: GDA 1994 MGA Zone 56		Incremental Impact - Operations			
Date: 20/08/2025		Pollutant	CO	Avg Period	1-Hour	Unit mg/m ³



Figure E4 Predicted 8-Hour Average Incremental CO Isopleth Plot



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Project Number: 610.032399
 Dispersion Model: CALPUFF
 Modelling Period: 2023
 Projection: GDA 1994 MGA Zone 56
 Date: 20/08/2025



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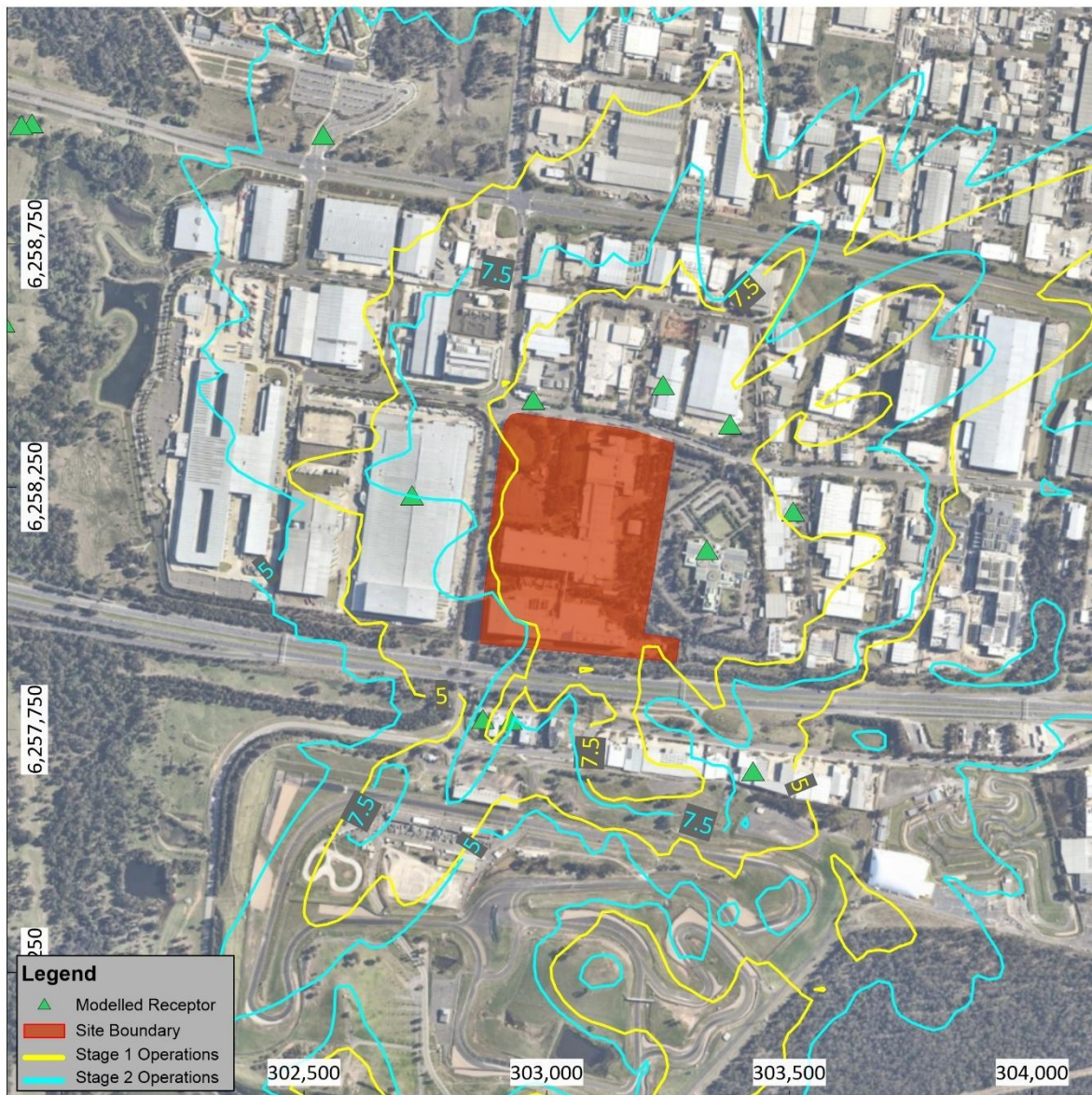
**Arnott's Huntingwood Expansion
 Air Quality Assessment**

Incremental Impact - Operations

Pollutant	CO	Avg Period	8-Hour	Unit	mg/m ³
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Figure E5 Predicted 1-Hour Average Incremental SO₂ Isopleth Plot



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	Dispersion Model: CALPUFF				Arnotts Huntingwood Expansion				
	Modelling Period: 2023				Air Quality Assessment				
	Projection: GDA 1994 MGA Zone 56				Incremental Impact - Operations				
	Date: 20/08/2025				Pollutant	SO ₂	Avg Period	1-Hour	Unit



Figure E6 Predicted 24-Hour Average Incremental SO₂ Isopleth Plot

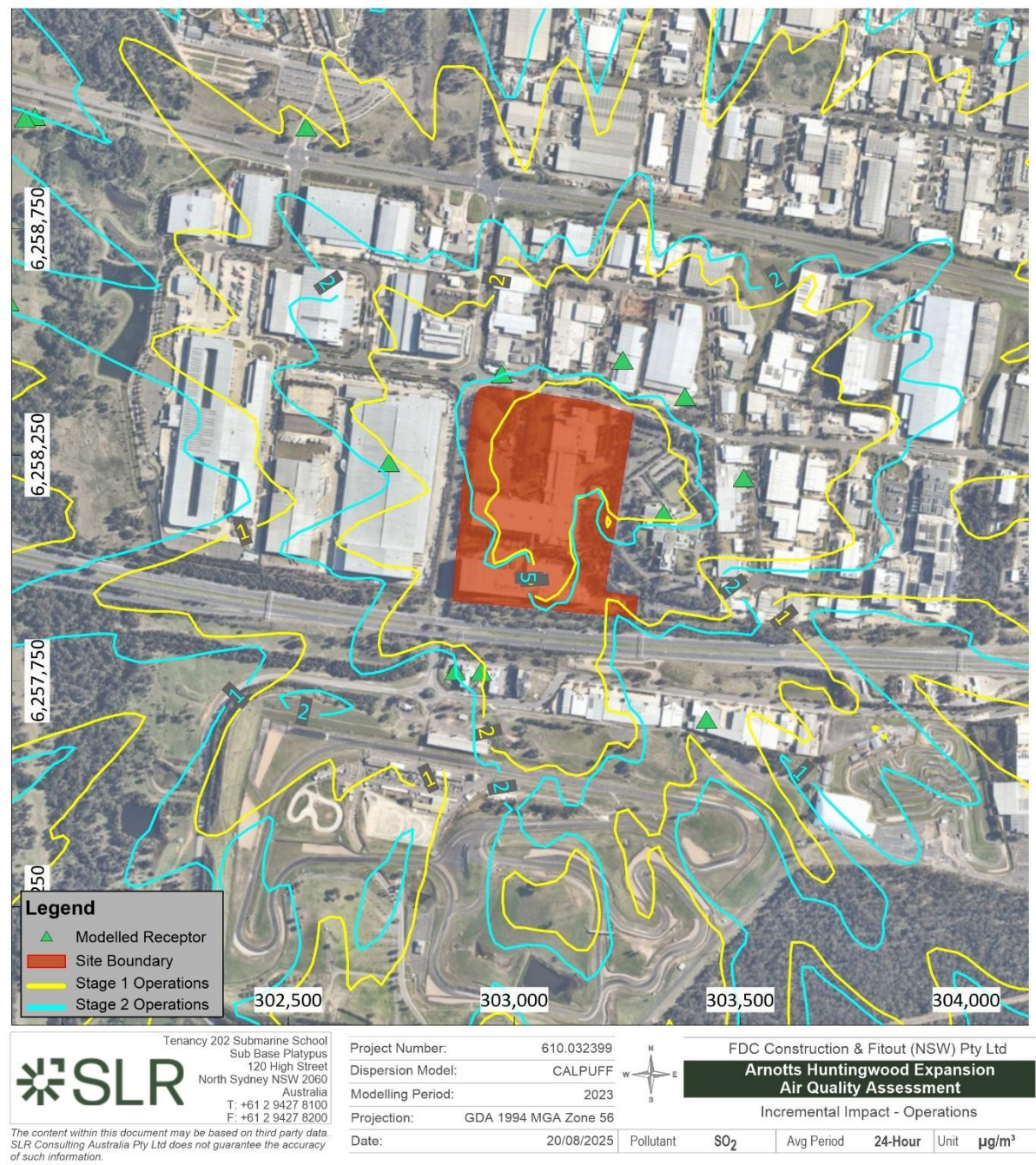
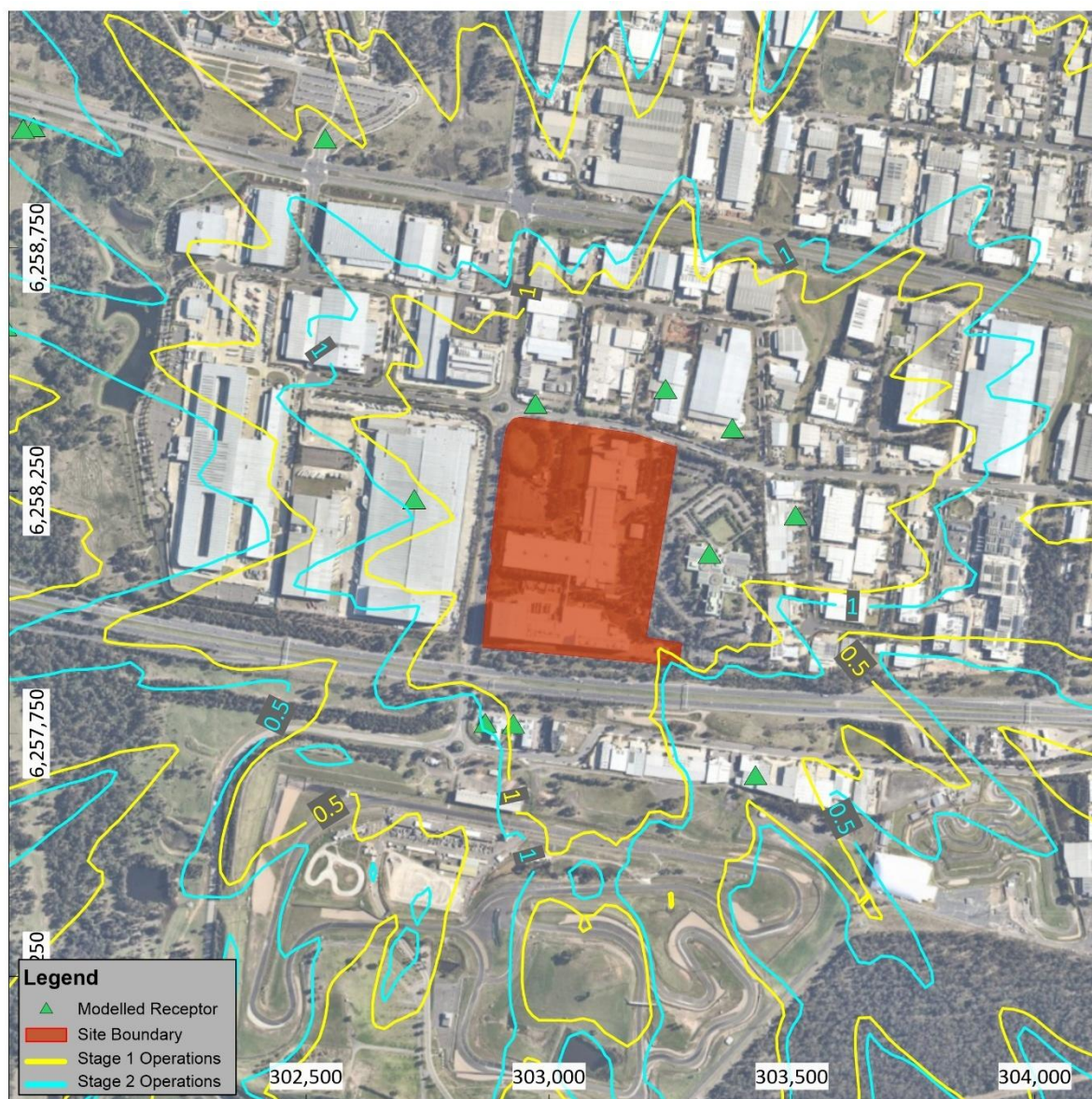


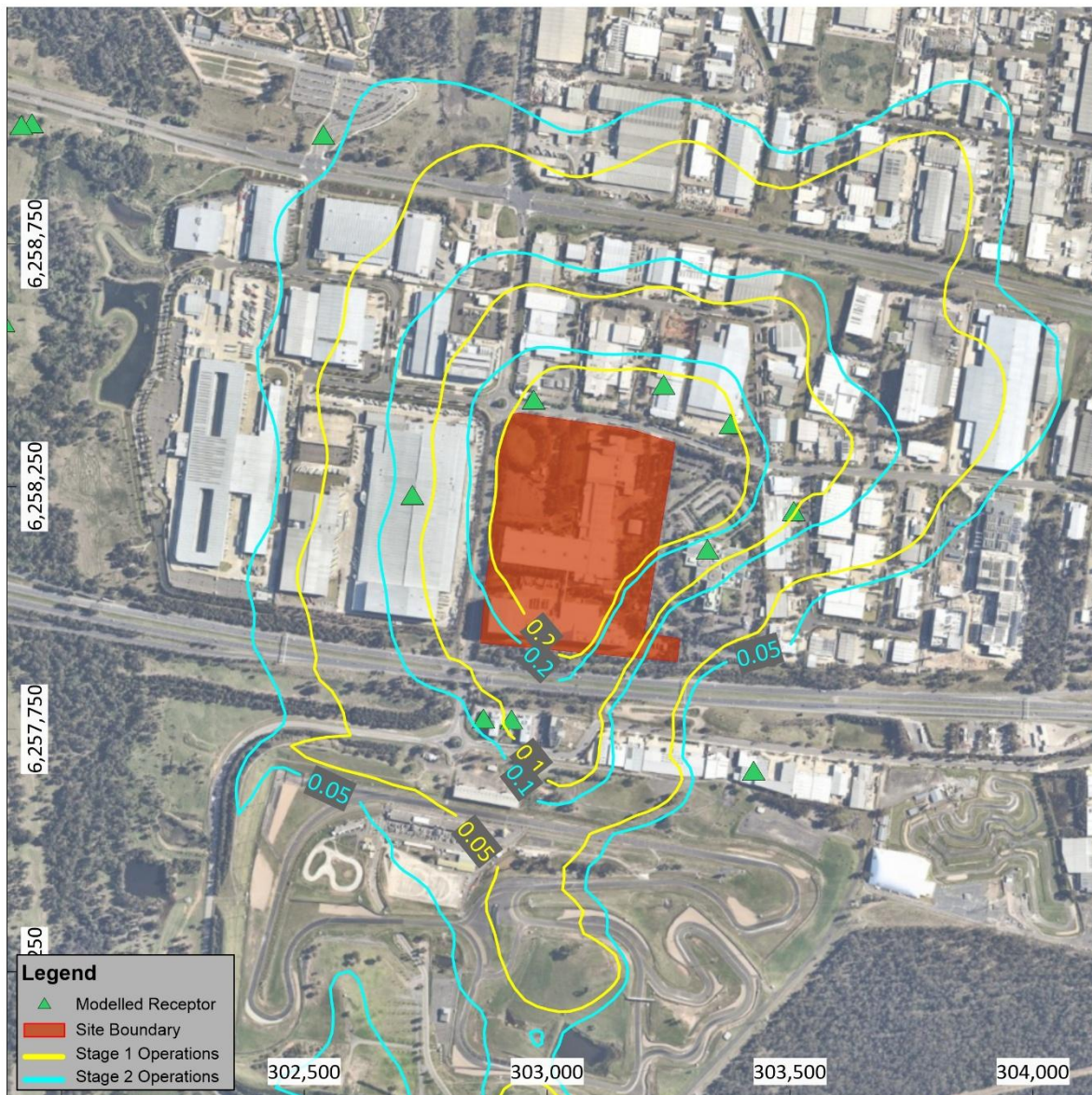
Figure E7 Predicted 24-Hour Average Incremental PM Isopleth Plot



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	Dispersion Model: CALPUFF		Arnotts Huntingwood Expansion			
	Modelling Period: 2023		Air Quality Assessment			
	Projection: GDA 1994 MGA Zone 56		Incremental Impact - Operations			
Date: 20/08/2025		Pollutant	PM	Avg Period	24-Hour	Unit $\mu\text{g}/\text{m}^3$



Figure E8 Predicted Annual Average Incremental PM Isopleth Plot



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 Dispersion Model: CALPUFF
 Modelling Period: 2023
 Projection: GDA 1994 MGA Zone 56
 Date: 20/08/2025



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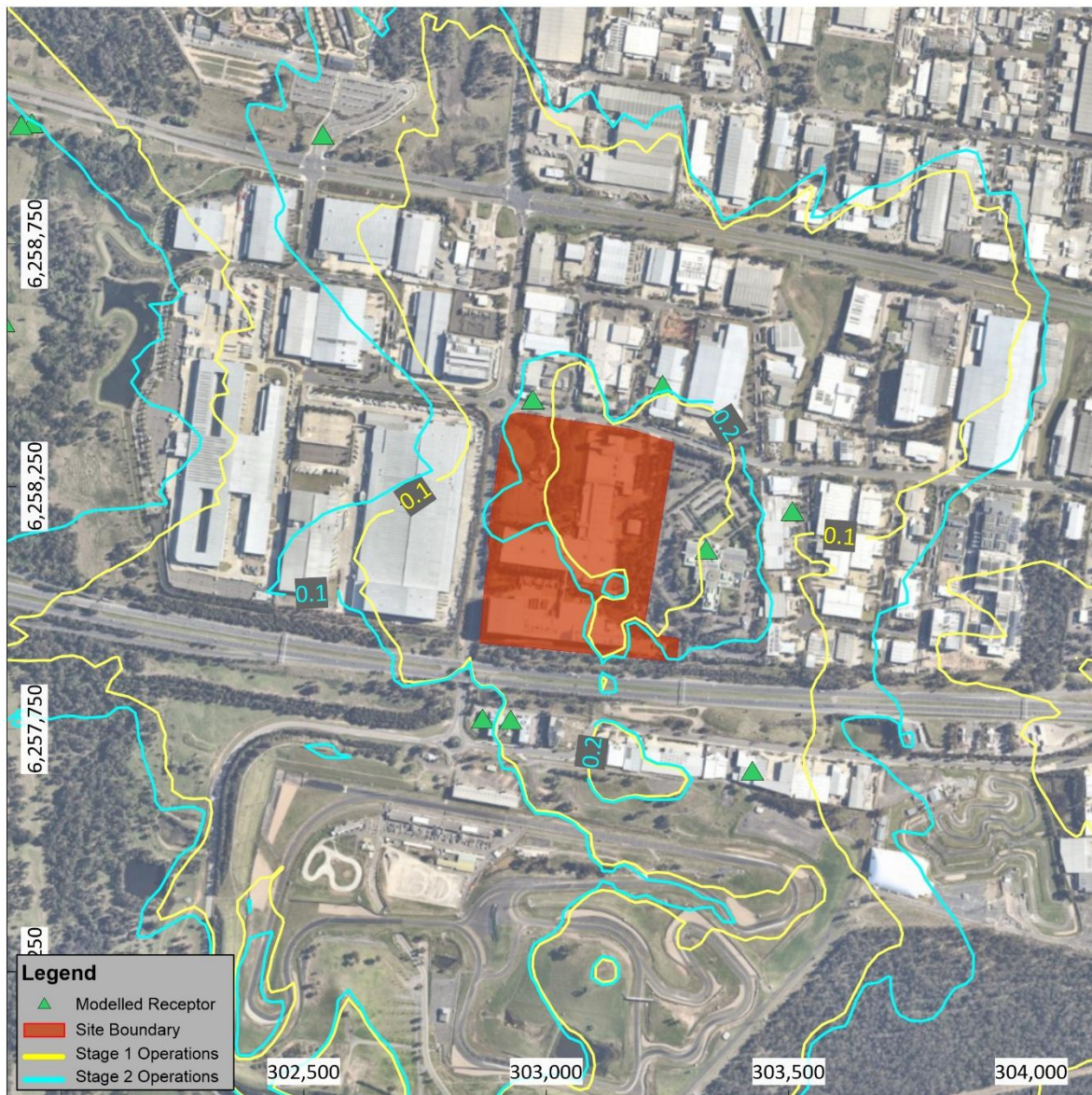
**Arnotts Huntingwood Expansion
 Air Quality Assessment**

Incremental Impact - Operations

Date:	Pollutant	Avg Period	Annual	Unit
20/08/2025	PM			$\mu\text{g}/\text{m}^3$



Figure E9 Predicted 1-Hour Average Incremental Ammonia Isopleth Plot



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Project Number: 610.032399
 Dispersion Model: CALPUFF
 Modelling Period: 2023
 Projection: GDA 1994 MGA Zone 56
 Date: 20/02/2026



FDC Construction & Fitout (NSW) Pty Ltd

**Arnott's Huntingwood Expansion
 Air Quality Assessment**

Incremental Impact - Operations

Pollutant	Avg Period	Unit
Ammonia	1-Hour	mg/m ³



