Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

Goodman Property Services (Aust) Pty Ltd

The Hayesbery
1-11 Hayes Road
Rosebery NSW 2018

Prepared by:

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Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
3.0	27 May 2025	K Barker	G Starke	G Starke
2.0	26 September 2024	K Barker	J A Cox	J A Cox
1.0	20 September 2024	K Barker	V Marwaha	V Marwaha

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Goodman Property Services (Aust) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Goodman Property Services (Aust) Pty Ltd (Goodman) to prepare an air quality impact assessment (AQIA) for the proposed development of the Data Centre at 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot (the Project).

This AQIA report serves to support the State Significant Development Application (SSDA) relating to the Project.

1.1 Secretary's Environmental Assessment Requirements

This AQIA report is prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs). The SEARs for the Project outline key Issues to be addressed as part of the EIS and includes emissions to air associated with operation.

Table 1 lists the SEARS requirements and the sections where they are addressed within this report.

Table 1 SEARS Requirements

#	Requirements	Response
11. Air Quality	Provide an assessment of air quality impacts, prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must address construction works and include modelling of emissions and air pollutants from predicted operations (including testing of the back-up power system) and a peak emission and air pollutant scenario, and outline the proposed mitigation, management and monitoring measures that would be implemented.	Assessment of construction impacts: **Section 8.1** Dispersion assessment of maintenance and emergency scenarios: **Section 8.2 and 8.3** Mitigation, management, and monitoring: **Section 9.0**
Additional assessment requirements – Air Quality	The EIS must include an air quality impact assessment, which: • includes consideration of potential impacts to nearby commercial and industrial receptors • is prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2022).	List of receptors including commercial and industrial: **Section 6.2** Policies and guidelines considered in preparation of this assessment report: **Section 1.2**

1.2 Stakeholder Engagement

This updated report addresses issues raised by stakeholders at the submissions stage of the State Significant Development application on the earlier revision of this report provided with the EIS. At this stage, the Department of Planning, Housing and Infrastructure (the Department) is the only stakeholder with issues raised. **Table 2** lists the submissions related to air quality, a summary response, and where they are addressed within this report.

Table 2 Stakeholder Engagement

Items Discussed	Response to submission	Where addressed in report
30. Please update the air quality assessment to include consideration of non-criteria pollutants, including, but not limited to, volatile organic compounds (VOCs).	The primary pollutants emitted by diesel generators include carbon dioxide, nitrogen oxides, particulate matter, carbon monoxide, and sulfur dioxide. Hydrocarbons and volatile organic compounds are also emitted, however specific types and quantities of these compounds emitted can vary. To assess potential impacts of VOCs, a quantitative risk assessment was undertaken to determine the highest risk VOC to use as a marker for assessment – if the assessment for the marker is satisfactory, then the assessment is satisfactory for all the other VOCs. It has been identified benzene is the highest risk air toxic and has been included in this report as a marker of pollutants for assessment as VOC impacts. Compliance with the benzene criteria demonstrates that unacceptable impacts from other VOCs are unlikely, and therefore further assessment of trace pollutants or low toxicity compounds not identified by the Approved Methods criteria is not considered warranted.	Described in **Section 4.4** Assessed in **Section 8.2** and **8.3**
31. The Department notes it is unclear which back-up generator/s were modelled as part of the generator testing scenario. Accordingly, please provide a figure which identifies those back-up generator/s which were modelled as part of this scenario, along with detailed justification for why the chosen location/s can be considered to reflect a realistic 'worst-case' assessment of day-to-day operations at all nearby sensitive receptors	The generator(s) modelled are shown as red stacks in Figure 16 of Section 7.4.2. Two generators were modelled to assess operational (testing) impacts as described in Section 7.3, as only two generators are proposed to be tested at a time. The emission stacks are spread across a distance of 80m on the Site. It is noted that assessment of each stack would have unique worst impacts, due to the varying proximity of receptors. These generators have been selected as they are centred amongst the other stacks and due to their proximity to receptor R11. This receptor is the closest receptor to a stack, and due to the north/south spread of stacks, it is also the closest to the largest number of stacks. It is considered that the selection of these stacks would be representative of the impacts from a higher number of operational testing scenarios, and would assist in ensuring that assessed	Stack locations shown in **Figure 17** of **Section 7.4.2**. Worst-case emission scenario described in Section **7.3.1** and assessed in **Section 8.2.**

Items Discussed	Response to submission	Where addressed in report
	impacts are not under representative of the operational testing emissions at the site. Further, for consideration of a 'worst case' assessment, it was assumed that one generator runs continuously between 7:00 am and 6:00 pm, every day of the year. This approach is likely to significantly overestimate the 24-hour average and annual average downwind air pollutant concentrations due to the following: • Only 2 generators are proposed to be tested at a time. • Testing lasts between 65 to 90 minutes (excluding cooldown). • Only 4 tests are to be conducted per generator, per year. • Up to 9 tests may occur in a day at a maximum, not necessarily every day.	

2.0 Relevant Policies, Guidelines and Plans

This assessment has been prepared with consideration of the following policies and guidelines:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA 2022) (the Approved Methods)
- Approved Methods for the Sampling and Analysis of Air Pollutants in (NSW EPA 2022a)
- *Protection of the Environment Operations Act 1997* (NSW Parliament, 1997)
- Protection of the Environment Operations (Clean Air) Regulation 2022 (NSW Parliament 2022)
- National Environment Protection (Ambient Air Quality) Measure (NEPC 2021)

The Approved Methods outlines the requirements for conducting an air quality impact assessment as follows (also indicated are the relevant sections of this report where the requirements are met):

- Description of local topographic features and sensitive receptor locations (**Section 6.1** and **Section 6.2** respectively)
- Establishment of air quality assessment criteria (**Section 5.4**)
- Analysis of climate and dispersion meteorology for the region (**Section 6.3** and **Appendix A**)
- Description of existing air quality environment (**Section 6.4**)
- Compilation of a comprehensive emissions inventory for the proposed activities (**Section 7.3**)
- Completion of atmospheric dispersion modelling and analysis of results (**Section 8.0**)
- Preparation of an air quality impact assessment report comprising the above.

3.0 Project Description

3.1 Project Overview

The proposed development (SSD-71368959) will seek approval for the construction of a 120 MVA Data Centre. The proposal seeks to demolish existing structures on the site, construct, fit out and the 24/7 operation of a Data Centre, with associated works.

[Drafting note: Please provide updated project text]

The works subject to SSD-71368959 include the following:

- Site preparation works including demolition, bulk excavation, and removal of existing structures on the site, tree and vegetation clearing, and bulk earthworks,
- Construction, fit out and 24/7 operation of a 120 MVA data centre with a maximum building height of 40m (from natural ground level) and total gross floor area of approximately 26,052m2 comprising:
  - At-grade parking for thirty-four (34) car parking spaces and one (1) accessible car parking spaces,
  - Two (2) 12.5m loading dock spaces,
  - Four (4) levels of technical data hall floor space with one data hall on ground level, three (3) data halls on levels one and two (2) data halls on level three.
  - Secure entrance lobby on ground level and ancillary office space on each level and mezzanine level,
- Provision of required plant and utilities, including:
  - Six (6) 33kV switch rooms on ground level
  - 1,172,000L above ground diesel storage tanks,
  - 5,125kL above ground water storage tanks,
  - 72 diesel generators
- Acoustic screen parapet,
- Vehicle access provided via Gardeners Road and Ricketty Street,

3.2 Project Location

The project is located on land known as 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot, legally referred to as Lot 1 and Lot 2 DP529177 and Lot 1 DP1009083. The site is located on Country of the Gadigal people within the local government area of Bayside Council.

It has a land area of approximately 23,470 m^2 with frontages to Ricketty Street, Kent Road and Gardeners Road, all of which are classified roads.

The Project location is shown in **Figure 1.**

The site forms part of the Mascot West Employment lands which comprises a mix of land zoned for industrial, commercial and business park uses. To the east of the site is Mascot Station Town Centre which comprises a mix of retail, commercial, residential and recreational open space land uses.

Figure 1 The Project Location

Surrounding land uses in the immediate vicinity of the include:

- **North**: Gardeners Road, which is the LGA boundary with the City of Sydney. Further to the north is existing industrial development with Alexandra Canal beyond.
- **South**: Ricketty Street is immediately south, with predominantly one (1) to four (4) storey commercial and industrial development beyond.
- **East**: Kent Road is immediately to the east, with four (4) to 14 storey high density residential development beyond.
- **West**: To the west is light industrial development typically one (1) to two (2) storey in height.

The site is zoned E3 Productivity Support under the Bayside Local Environmental Plan 2012 (BLEP 2021). The proposal is permissible with development consent in the E3 zone and meets the zone objectives.

In its existing state, the site itself contains two large warehouse buildings which are currently leased out to multiple tenants. Large extents of the site consist of hardstand for vehicle circulation and parking with a number of mature trees are located along the site's boundaries.

A summary of the site is provided in **Table 3**.

Table 3 Site Detail Summary

Item	Description
Site Area	23,470 m2
Ownership	Goodman
Legal Description	Lot 1 in DP529177, Lot 1 in DP1009083 and Lot 2 DP529177

4.0 Potential Sources of Emissions to Air

4.1 Construction Phase

The main emissions to air during the construction phase are likely to be fugitive emissions of suspended particulate matter and nuisance dust from the movement of vehicles and construction equipment, excavation and rehabilitation, demolition, clearing and grading, truck loading and unloading and wind erosion.

Fugitive dust emissions during the construction works could give rise to nuisance and/or health impacts for the surrounding sensitive areas.

4.2 Operational Phase

During the operational phase of the Project, standby generators are required to provide power in the event of an unexpected interruption of mains grid electricity for more than a few minutes. The generators would be a source of products of combustion while undergoing scheduled testing or in the event of a power failure. In general, power interruptions may last from a few seconds to a few hours and therefore even when required, the generators would only operate for a relatively short time.

Each generator will undergo annual and quarterly maintenance testing. **Table 4** summarises the proposed maintenance regime which has been adopted for the maintenance scenario in this AQIA. It is understood that no more than 2 generators will be tested at any given time. The total test time for all generators (existing and proposed) is estimated to be 183 hours per year. Each generator will have 4 tests per year (3 quarterly for and 1 annual) for a total of 285 minutes per year (excluding cooldown) per generators. Testing will occur on up to 144 days per year if each test (of 2 generators) were to occur on separate days, however, up to 9 tests per day may occur.

The standby generators will be located on an external generator gantry, occupying four floors with 18 generators per floor, totalling 72 generators (Model: 20V4000G24F).

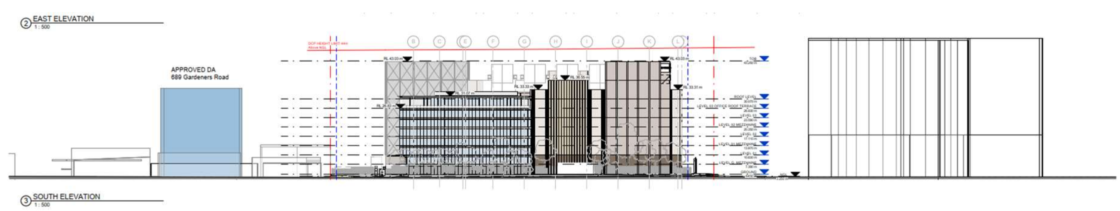
The flue discharge height have been assumed at 39.1 m for this assessment. All flue discharge orientations are vertical as shown in **Figure 2**.

Table 4 Proposed Generator Maintenance Testing Regime

Parameter	Value	
Test frequency per generator	Quarterly maintenance*	Annually operational run
No of generators	72	72

Parameter	Value	
No of test each year per generator	3	1
Run time per test (minutes)	65	90
Cooldown per test (minutes)	5	5
Total testing for all generators (minutes)	15,120	6,840
Total testing for all generators (hours)	252	114
No of generators per test	2	2
Cumulative Testing Time (Hours)**	183	
Maximum Number of tests per day	9	
Testing schedule	7:00 am to 6:00 pm Monday to Saturday, and 8:00 am to 6:00 pm Sundays & public holidays.	
Note: Generator tested under low load is to be undertaken such that the emissions do not exceed the POEO (Clean Air) Standard of Concentration for non-scheduled premises. * Quarterly maintenance occurs in three quarters of the year, annual testing occurs in the 4th quarter. ** Cumulative testing considers the number of generators running simultaneously per test. Source: (ARUP 2024)		

Figure 2 Generator Flues Arrangement



Source: Extract from Goodman Duke DC Sections SSDA Submissions (Doc. Ref: SSDA06-01-01, 8 May 2025) (GRIMSHAW 2025)

4.3 Emergency operations

Generators will operate as a standby power supply in the event of mains failure. The connection enquiry with Ausgrid is for N-1 33kV feeders, fully rated supplies of the entire site load. Failure rates for a N-1 supply in this arrangement are extremely low, each feeder is fed from diverse bus section of the Zone Substation and the site can be fully maintained under loss of one feeder.

Although it is not possible to determine exactly the duration of each power outage/damage over a year which would require the standby generators to be in operation, based on the electricity supplier Ausgrid Distribution and Transmission Annual Planning Report Summary (References by ARUP in the Services Infrastructure Report (ARUP 2024)), it has been determined that the average unplanned actual system average interruption duration index (SAIDI) of power outage incident over the past 10 years is 74.5 minutes (total cumulative events) of unplanned outages per year per customer – based on year 2013/14 to 2022/23 of SAIDI data. This equates to less than 0.01% of likelihood of occurrence in a year. Ausgrid network and operations covers Sydney, the Central Coast and Hunter regions of New South Wales.

In order to assess the worst-case emergency conditions, the modelling undertaken for the emergency operation scenario conservatively assumes that all 72 generators run concurrently within the same hour.

4.4 Pollutants of Concern

Potential air pollutants of interest for the operation of the Project are considered to be emissions associated with the combustion of fuel in standby generators which include:

- carbon monoxide (CO)
- oxides of nitrogen (NO_x)
- particulate matter (PM_{10} and $PM_{2.5}$)
- sulfur dioxide (SO_2)
- volatile organic compounds (VOCs)
- hydrocarbons (HCs)

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 health effects of particulate matter are strongly influenced by the size of the airborne particles. Smaller particles can penetrate further into the respiratory tract, with the smallest particles having a greater impact on human health as they penetrate to the gas exchange areas of the lungs. Larger particles primarily cause nuisance associated with coarse particles settling on surfaces and possessions (dust deposition), affecting visibility and contaminating tank water supplies. High rates of dust deposition can also adversely affect vegetation by blanketing leaf surfaces.

The term “particulate matter” generically classifies airborne pollutants comprising of heterogeneous suspended particles in the air which can be further categorised by particle size. The particle size of less than 100 microns (µm) is typically termed total suspended particulate (TSP). Epidemiological studies suggest a relationship between health impacts and exposure to concentrations of finer particulate matter, for example particulate matter with an aerodynamic diameter of 10 microns or less, which is referred to as PM_{10}. The PM_{10} size fraction is sufficiently small to penetrate the large airways of the lungs, while $PM_{2.5}$ (2.5 microns or less) particulates are generally small enough to be drawn in and deposited into the deepest portions of the lungs. Potential adverse health impacts associated with exposure to PM_{10} 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. In an urban setting, the emission of $PM_{2.5}$ is primarily associated with vehicles exhausts resulting from the incomplete combustion of diesel. It is anticipated that the primary particle fraction associated with construction will be PM_{10}.

CO is an odourless, colourless gas formed from the incomplete burning of fuels. It can be a common pollutant at the roadside and highest concentrations are typically found in the kerbside environments with concentrations decreasing rapidly with increasing distance from the road.

In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). 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 NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 after leaving the combustion source at a rate dependent on ambient and atmospheric conditions.

Sulfur in fuel converts to sulfur oxides during combustion, hence emissions of SO_2 are directly related to the concentration of sulfur in the fuel. Diesel contains more sulfur than gas, as there is negligible sulfur content in Australian natural gas and LPG.

Diesel generators also release HCs and VOCs. HCs are emitted due to incomplete combustion of diesel fuel. The sources are unburned fuel and engine oil and not all the HCs are volatile; i.e., not all evaporate readily. The specific types and quantities of VOCs emitted from diesel generators can vary. VOCs have high vapour pressure at normal room-temperature conditions. Their high vapour pressure leads to evaporation from liquid or solid form and emission release into the atmosphere. VOCs are emitted by a variety of sources, including motor vehicles and industrial sources. Industrial VOCs that are typical of these sources include benzene, toluene, ethylbenzene and xylenes ('BTEX').

The National Environment Protection Council (NEPC) established the *National Environment Protection (Air Toxics) Measure* (NEPC 2011), targeting five key VOCs known as 'air toxics': BTEX, and benzo(a)pyrene (B(a)P). For assessment in NSW B(a)P is often used as an indicator for total polycyclic aromatic hydrocarbons (PAHs). As many VOCs are emitted in diesel engine emissions, including benzene and PAHs, a quantitative risk assessment was undertaken to determine the highest risk VOC to use as a marker for assessment – if the assessment for the marker is satisfactory, then the assessment is satisfactory for all the other VOCs. This was undertaken by comparing emission factors for large diesel engines with their NSW impact assessment criteria. The emission factors were sourced from a U.S. Environmental Protection Agency (US EPA 2025) update for large diesel engines, (power rating greater than 447kW). Cross-checks were made with the National (Australian) Pollutant Inventory's Emission Estimation Technique Manual for Combustion Engines (DEWHA 2008). See **Table 14** of **Section 7.3** for a summary of this risk assessment. Regardless of the source the result of the quantitative risk assessment was benzene as the highest risk VOC due to emissions from large diesel engines. As such benzene was used as the marker for VOCs/air toxics, for this assessment.

Benzene is a well-known carcinogen, particularly linked to leukemia and other blood cancers. While long term exposure can lead to severe health effects such as immune system impairment, short term exposure can cause dizziness and respiratory issues.

The rate and composition of air pollutant emissions from generators is a function of several factors, including the type and size of the generators, level of operation and fuel type.

Other trace pollutants and low toxicity pollutants can be emitted from diesel generators; however, they are not considered further in this assessment as the primary and high toxicity (and therefore highest risk) pollutants have been identified and assessed.

5.0 Regulatory Framework

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 (see **Section 5.4**).

5.1 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 NSW Department of Planning and Environment which enables the Government to establish instruments for setting environmental standards, goals, protocols and guidelines.

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

- Section 124 of the POEO Act states that any plant located at a premise (e.g. generators) should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 125 of the POEO Act states that maintenance to any plant located at a premise (e.g. generators) should be carried out in a proper and efficient manner such that it does not cause 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.

Schedule 1 of the POEO, Scheduled Activities, defines those activities that require a licence for the premises for which the activity is carried out. Clause 17 Electricity Generation applies to electricity works (wind farms), general electricity works, metropolitan electricity works (gas turbines) and metropolitan electricity works (internal combustion engines). The criteria for general electricity works is the capacity to generate more than 30 megawatts of electrical power. Clause 17 does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year. Given the total testing time of the stand by generators is well below 200 hours per year and the duration of emergency operations is expected to be insignificant, the proposal is not classified as a scheduled activity.

5.2 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
- imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

Part 5 of the POEO (Clean Air) Regulation 2022 (the 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) under Schedule 2 and Schedule 3 as noted below in **Table 5** and **Table 6**.

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 5 Relevant Schedule 2 Standards of Concentration for (Group 6 1) Scheduled Premises

Air impurity	Activity [2]	Concentration [3]
Solid Particles	Any activity/ plant	50 mg/m^3
NO_2 or NO or both, as NO_2 equivalent	Stationary reciprocating internal combustion engines	450 mg/m^3
VOCs as n-propane	Any stationary reciprocating internal combustion engine using a liquid fuel	1,140 mg/m^3 VOCs or 5,880 mg/m^3 CO
	Any stationary reciprocating internal combustion engine using a solid or gaseous fuel	40 mg/m^3 VOCs or 125 mg/m^3 CO
Smoke	An activity or plant in connection with which solid, liquid or gaseous fuel is burnt	20% opacity
Note 1 Group 6: Activity granted DA consent and commenced to operate after 1 September 2005. Note 2 only concentration standards relevant to the operations at the Site have been listed. Note 3 Reference conditions are: Dry, 273 K, 101.3 kPa for any activity.		

Table 6 Relevant Schedule 3 Standards of Concentration for (Group C 1) Non-Scheduled Premises

Air impurity	Activity	Concentration [2]
Solid Particles	Any activity/ plant	100 mg/m^3
Smoke	Solid fuel is burnt	20% opacity
	Liquid fuel is burnt	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.		

Under Clause 37 the Regulation exempts emergency standby plant (comprising a stationary reciprocating internal combustion engine) for generating electricity from the air impurities standard for NO_2 and NO specified in Schedule 2 relevant to that plant if the plant comprises a stationary reciprocating internal combustion engine and is used for a total of not more than 200 hours per year.

As outlined in **Section 4.2**, each generator (plant) is proposed to be operated for 285 minutes per year (excluding cooldown) minutes per year for the purposes of testing, however each testing period will include 2 generators operating simultaneously. While generators will be required to operate for the purpose of electricity generation during major power interruptions, such events would only occur very infrequently and for a limited period. Therefore, it is anticipated that the plant would be required to operate for a total of less than 200 hours per year.

As such the Project is exempt from the concentration limits outlined in **Table 6**.

5.3 Local Air Quality Toolkit

The Local Government Air Quality Toolkit (AQ Toolkit) has been developed by the EPA to assist local government in their management of air quality issues and provides guidelines for air quality management and for the use of air pollution control techniques. Relevant AQ Toolkit air quality guidance notes include:

- Dust from urban construction sites (NSW EPA 2007)
- Construction sites (NSW EPA 2007-2).

5.4 Approved Methods for the Modelling and Assessment of Air Pollutants in NSW

The Approved Methods 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.

5.4.1 Air Quality Criteria

NSW EPA has established ground level air quality impact assessment criteria for air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. The criteria are the defining ambient air quality criteria for NSW, derived from a range of sources (including National Health and Medical Research Council (NHMRC), National Environment Protection Council (NEPC), World Health Organisation (WHO) and Australian and New Zealand Environment Conservation Council (ANZEEC) and are considered appropriate for this AQIA.

Table 7 Outlines the air quality goals for the pollutants of concern outlined in **Section 4.4.**

Table 7 Project Air Quality Goals

Pollutant	Averaging time	Criteria
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
	Annual	8 µg/m^3
Deposited dust	Annual	2 g/m^2/month (maximum increase) 4 g/m^2/month (maximum cumulative)
NO_2	1 hour	164 µg/m^3
	Annual	31 µg/m^3

Pollutant	Averaging time	Criteria
CO	15 minutes	100 mg/m^3
	1 hour	30 mg/m^3
	8 hours	10 mg/m^3
SO_2	1 hour	215 mg/m^3
	24 hours	57 mg/m^3
Toxic Pollutant	**Averaging Time**	**Criteria (99.9th percentile)**
Benzene	1 hour	0.029 mg/m^3
Toluene	1 hour	0.36 mg/m^3
Ethylbenzene	1 hour	8 mg/m^3
Xylene	1 hour	0.19 mg/m^3
PAHs (as benzo(a)pyrene)	1 hour	0.0004 mg/m^3
Formaldehyde	1 hour	0.02 mg/m^3

In accordance with the Approved Methods, the impact assessment criteria are to be applied as follows:

- At the nearest existing or likely future off-site sensitive receptor.
- The incremental impact (predicted impacts due to the pollutant source alone) for each pollutant must be reported in units and averaging periods consistent with the impact assessment criteria.
- For individual toxic air pollutants (ie PAH, benzene), the incremental impact at and beyond the site boundary for each pollutant must be reported in concentration units consistent with the criteria, for an averaging period of 1 hour and as the 99.9th percentile of dispersion model predictions for Level 2 impact assessments.
- Background concentrations must be included using the procedures specified in Section 5 of the Approved Methods.
- Total cumulative impact (incremental impact plus background) must be reported as the 100th percentile (P=100) (or 99th percentile (P=99) for odour) in concentration or deposition units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

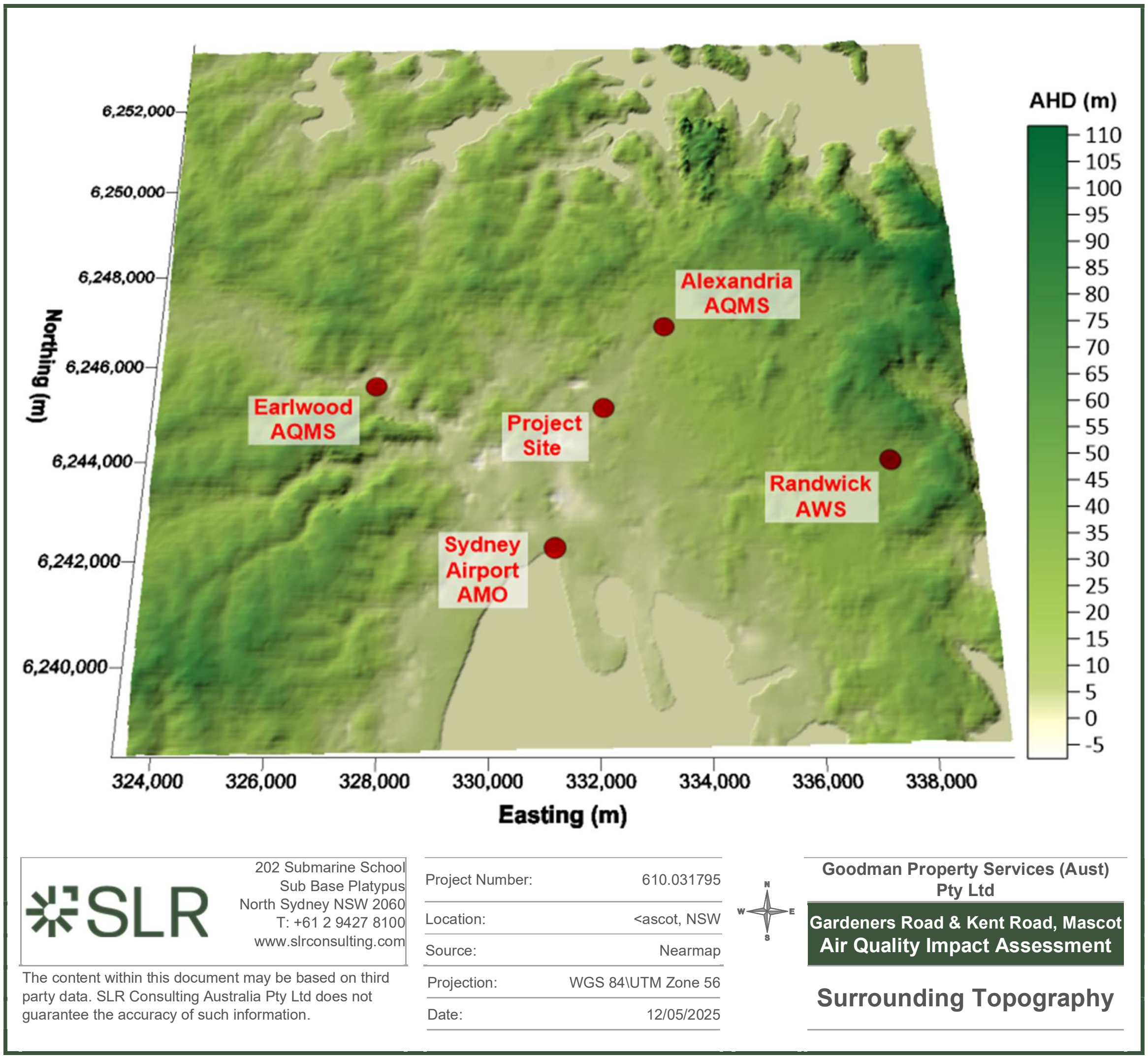
6.0 Existing Environment

6.1 Topography

Atmospheric dispersion can be influenced by terrain effects such as night-time katabatic (downhill) drainage flows from elevated terrain, channelling effects in valleys or gullies or plume interception at higher ground.

A three-dimensional representation of the area surrounding the Project is presented in **Figure 3**. The elevation ranges generally from between approximately -5 and 110 m Australian Height Datum (AHD). The topography of the Project site itself is relatively flat.

Figure 3 Topography Surrounding Site Location.



6.2 Land Use and Sensitive Receptors

As shown in **Figure 4**, the Site and the adjacent lands to west and south are zoned Productivity Support (E3). The area to the east is zoned Mixed Use (MU1) and the area to the north is zoned General Industrial (E4).

Based on available aerial images, the nearest sensitive receptors that have the potential to be impacted by air emissions during operation of the Project have been identified for investigation in this assessment.

The closest residential receptors are located immediately east in the upper levels of the developments within the Mixed Use zone, located approximately 160 m east of the Project emission sources. It is noted that a number of existing industrial facilities are in close proximity of the Site in all directions as identified in **Figure 5** to **Figure 6** and **Table 8**.

Figure 4 Land Zoning Surrounding the Project

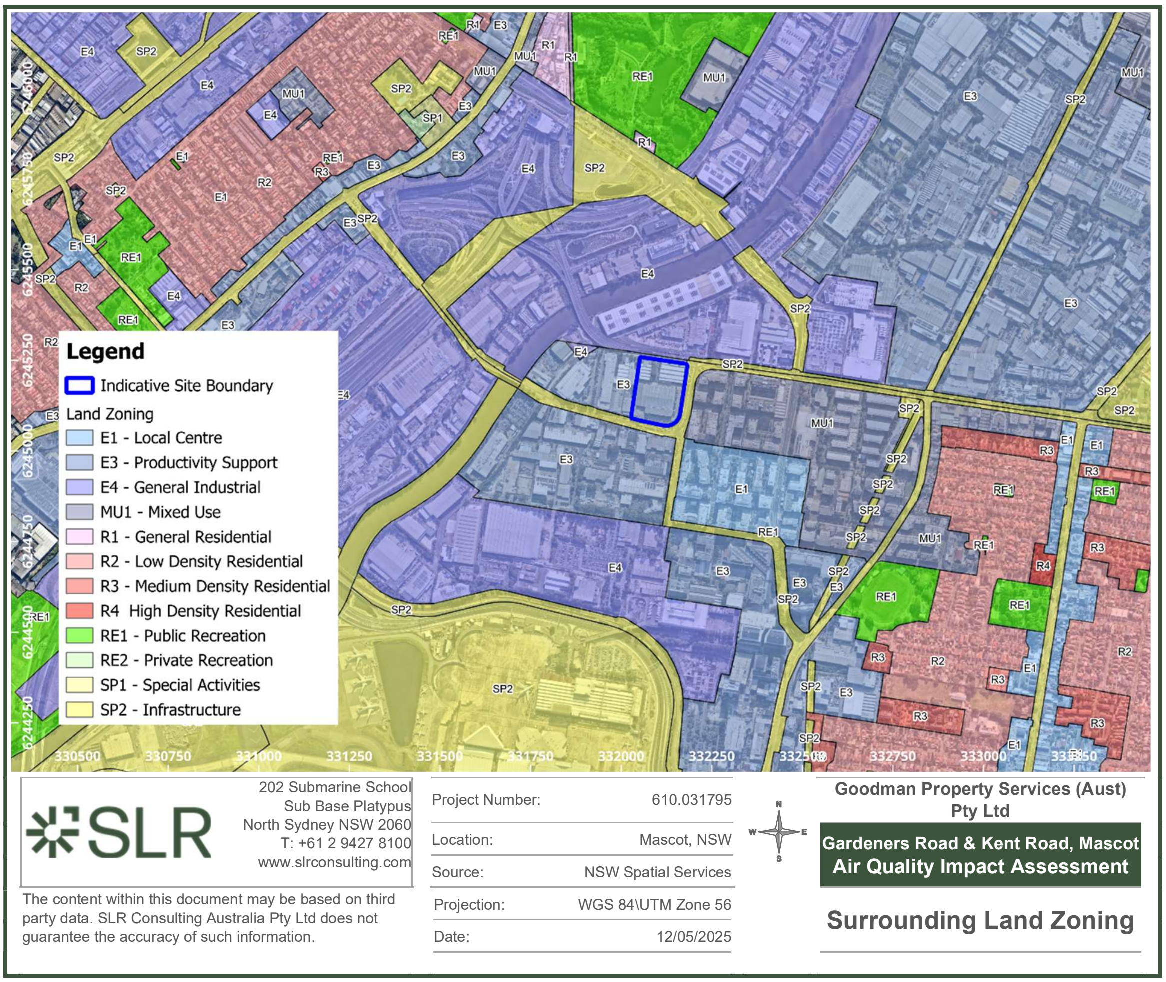


Table 8 Location of Nearest Identified Sensitive Receptors

ID	Easting (m)	Northing (m)	Elevation (AHD; m)	Receptor height (m)	Description	Approx. Distance from Emission Sources (km)*
R_1	332866.7	6245056	10.2	0	Residential	0.81
R_2	330932.4	6245481	11.4	0	Residential	1.18

ID	Easting (m)	Northing (m)	Elevation (AHD; m)	Receptor height (m)	Description	Approx. Distance from Emission Sources (km)*
R_3	330301.8	6244655	12	0	Residential	1.83
R_4	332161.3	6245846	6.7	0	Park	0.70
R_5	332059.7	6245055	5.2	0	Industrial	0.10
R_6	332142	6245302	6	0	Industrial	0.17
R_7	332147.3	6245323	5.7	8	Industrial	0.19
R_8	332059	6245039	5.2	22	Industrial	0.11
R_9	332020.1	6245161	5.5	10	Industrial	0.05
R_10	331997.3	6245169	5.2	0	Industrial	0.07
R_11	332219.1	6245144	7.2	49	Residential	0.15
R_12	332203.6	6245148	7.1	0	Commercial	0.14
R_13	331882	6244420	6.3	0	Qantas Jet Base Office	0.75
R_14	333422.7	6245199	14.4	0	Gardeners Road Public School	1.36
R_15	331546.4	6246021	16.8	0	St Peters Community Preschool /St Peters Public School / Helping Hands - St Peters	1.01
R_16	332288.1	6244836	8.3	0	Little Lion Early Learning Mascot \ Little Angels at Mascot Central	0.39
R_17	332616.9	6244975	10	0	Active Kids Mascot	0.58
R_18	333052.3	6244632	9.3	0	Botany Family Day Care	1.12
R_19	333013.5	6244868	7.9	0	Kindisaurus Child Care Centre	0.99
R_20	333146.3	6245296	12.8	0	Learn & Laugh Early Learning Alexandria	1.09
R_21	332415.2	6244539	13.1	0	The Joey Club Sydney - Child Care Centre	0.71
R_22	332532.6	6244644	13.5	0	Toybox Early Learning - Mascot	0.69
R_23	332241.8	6244761	8.4	0	Story House Early Learning Mascot	0.43
R_24	332204.6	6244980	6.4	0	MindChamps Earling Learning & Preschool @ Mascot	0.22
R_25	332800.8	6244743	9.4	0	Montessori Preschool of Sydney	0.84
R_26	332183.7	6245050	7.3	0	Commercial	0.16
R_27	332193.1	6245049	7.4	50	Residential	0.16
R_28	331951.8	6245070	4.6	0	Industrial	0.14
R_29	332265.8	6245303	6.4	0	Industrial	0.25
R_30	331806.8	6244834	3.1	0	Industrial	0.41
R_31	332539.9	6245295	8.7	0	Industrial	0.50
R_32	331986.5	6244690	5	0	Industrial	0.47
R_33	332802.3	6245757	10.5	0	Industrial	0.95
R_34	331491.6	6245089	6.6	0	Industrial	0.58
R_35	331623.3	6245263	5.1	0	Industrial	0.46
R_36	331890.5	6245147	3.4	0	Industrial	0.17
R_37	331760.5	6245007	4.8	0	Industrial	0.34
R_38	331441.7	6244696	2.8	0	Industrial	0.77
R_39	331797.3	6245493	3.4	0	Industrial	0.43
R_40	332448.9	6245140	7.9	0	Budget Car & Truck Tenal Alexandria	0.38

* Note that the measurement is take from the generators stack location to the sensitive receiver, not from the property boundary to receiver.

Figure 5 Inner Sensitive Receptors

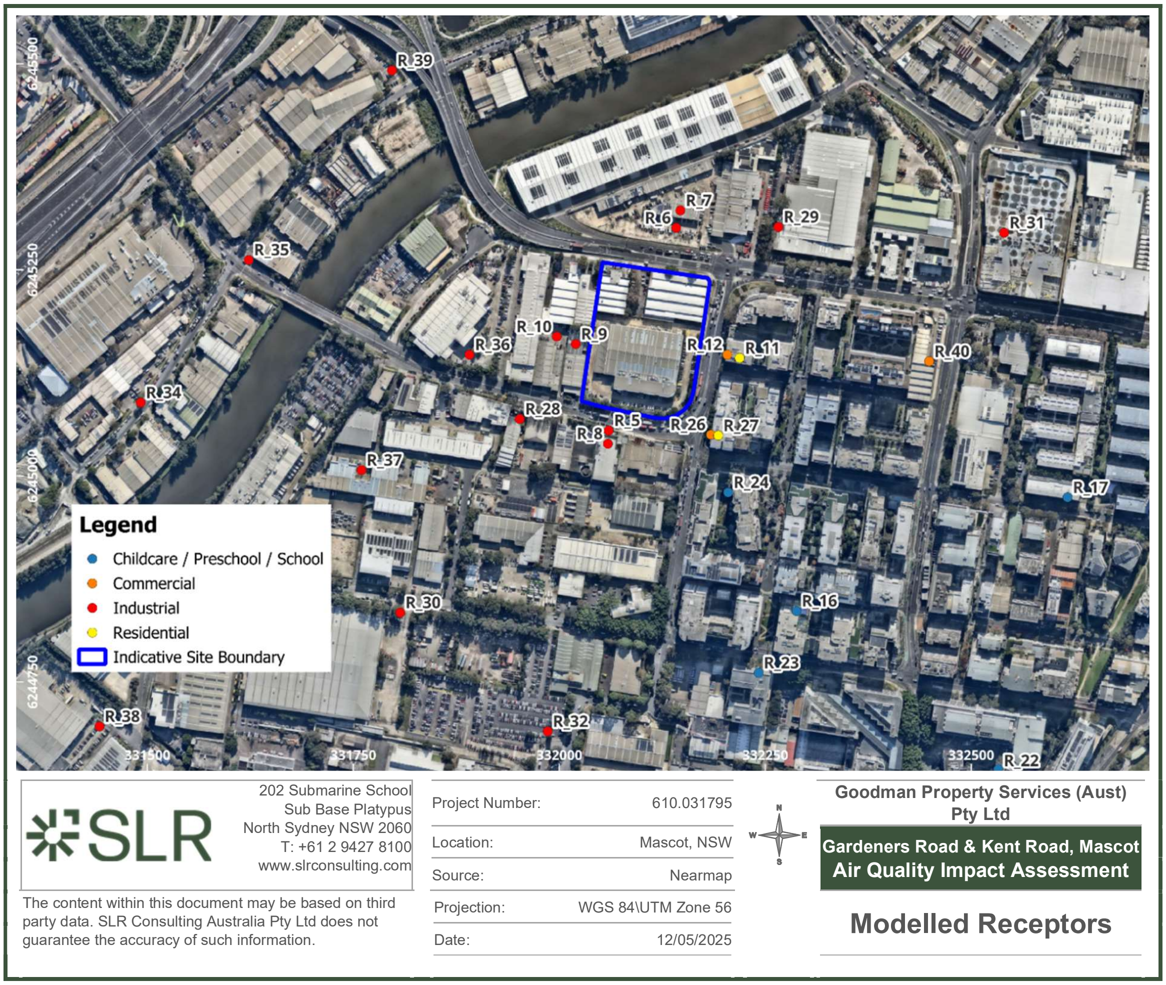


Figure 6 Outer Sensitive Receptors

6.3 Local Meteorology

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station recording long term wind speed and wind direction data is the Sydney Airport Aeronautical Meteorological Observer (Sydney Airport AMO) (Station ID 66037), located approximately 3 kilometres (km) south-southwest of the Project. Considering the terrain between the Site and Sydney Airport AMO, wind conditions at the Project are expected to be similar to those recorded at the AMO.

6.3.1 Wind

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 past five years, 2019 to 2023, compiled from data recorded by the Sydney Airport AMO are presented in **Figure 7**. 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. 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. **Table 9** outlines the wind scale used to describe the wind speed.

Table 9 Wind Scale Descriptions

Description	km/h	m/s	Description on land
Calm	0-1.8	0-0.5	Smoke rises vertically
Light air	1.8-5.5	0.5-1.5	Smoke drift indicates wind direction
Light breeze	5.4-10.8	1.5-3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
Gentle breeze	10.8-19.8	3-5.5	Leaves and small twigs in constant motion; light flags extended.
Moderate winds	19.8-28.8	5.5-8.0	Raises dust and loose paper, small branches are moved
Fresh winds	28.8-37.8	8.0-10.5	Small trees in leaf begin to sway, crested wavelets form on inland waters
Strong winds	>37.8	>10.5	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

The annual wind rose indicates the winds in the area blow from all directions with a higher frequency of winds from the northwest, south, and north-northeast. Calm wind conditions were recorded to occur 1.1% of the time throughout the investigated period. The average seasonal wind roses for the year 2018-2023 indicate that:

- In summer, winds range generally evenly from light breeze to strong winds are mostly between and blow predominantly from the south to southeast and northeast/north-northeast, with very few winds from other directions. Calms were recorded approximately 2.% of the time during the summer months.
- In autumn, winds range from light breeze to strong winds with a higher frequency of gentle breeze winds than summer. Winds blow predominantly from the northwest and other western directions, with low frequency of winds from northern and southern directions and very little winds from the east. Calms were recorded approximately 0.8% of the time during autumn.
- In winter, winds range from light breeze to strong winds with a higher frequency of gentle breeze winds than autumn. Winds blow predominantly from the northwest with a high frequency of winds ranging from north-northwest to west-southwest with very few winds blowing from any other direction. Calms were recorded approximately 0.5% of the time during the winter months.
- In spring, winds range generally evenly from light breeze to strong winds are mostly between and blow predominantly from the north-northeast and northeast, south/south-

southeast and northwest to west-southwest, with very few winds from other directions. Calms were recorded approximately 0.9% of the time during spring.

As identified in **Section 6.2**, there are existing residential receptors located to the east of the Project from approximately 160 m onwards. Annual winds from the west (including west northwest and west southwest blowing air emissions from the Project towards the sensitive receptors occur approximately <25% of the time.

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 2019 - 2023 at Sydney Airport AMO is presented in **Figure 8**. The plot shows that the frequency of wind speeds exceeding 5.5 m/s for the period was approximately 17%.

Figure 7 Average Annual and Seasonal Wind Roses (Sydney Airport AMO - 2019-2023)

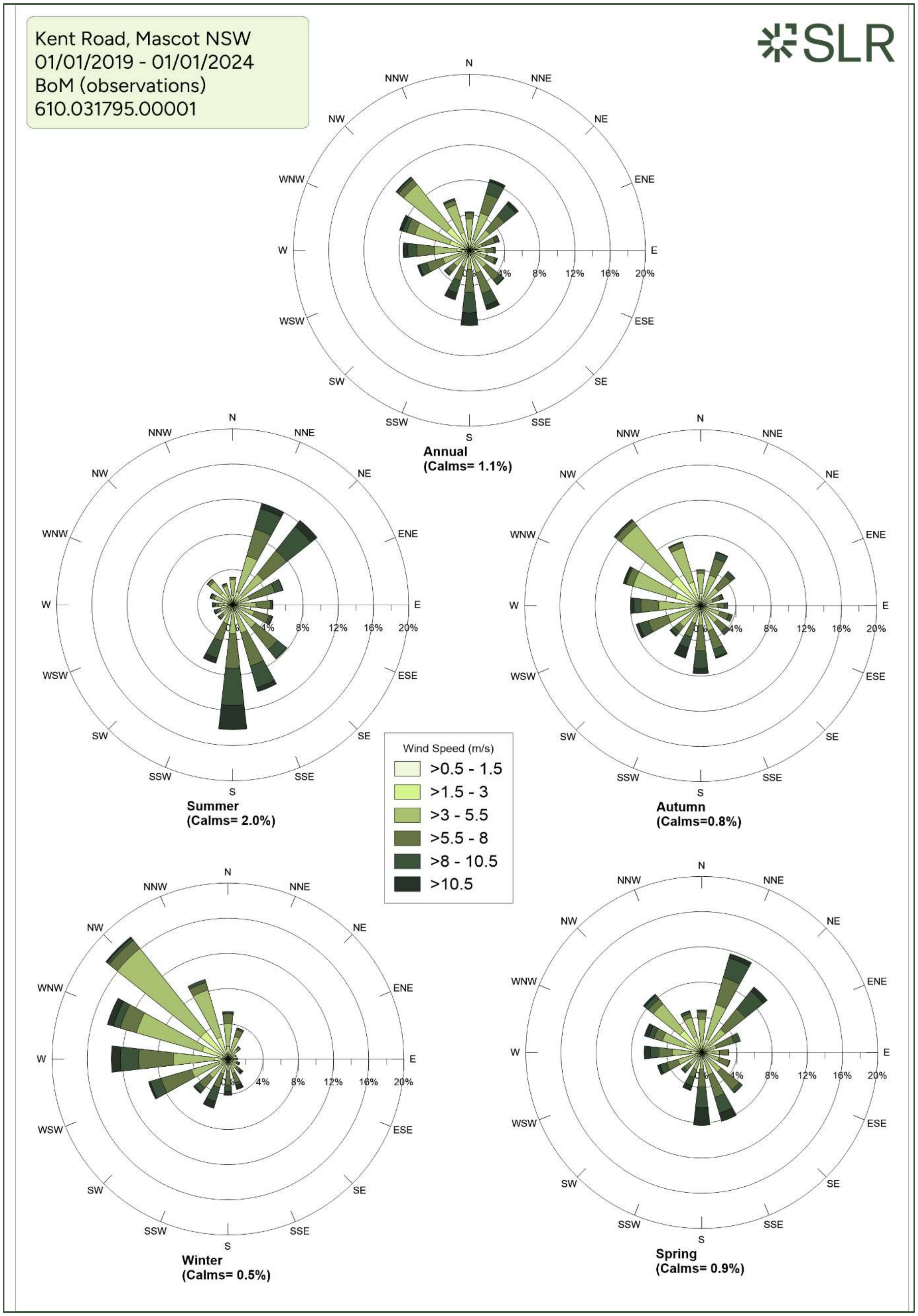
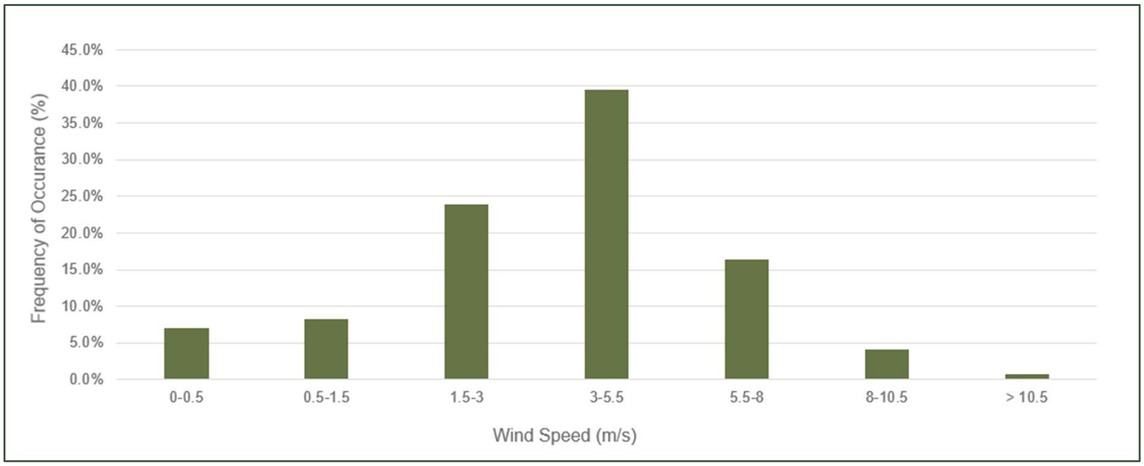


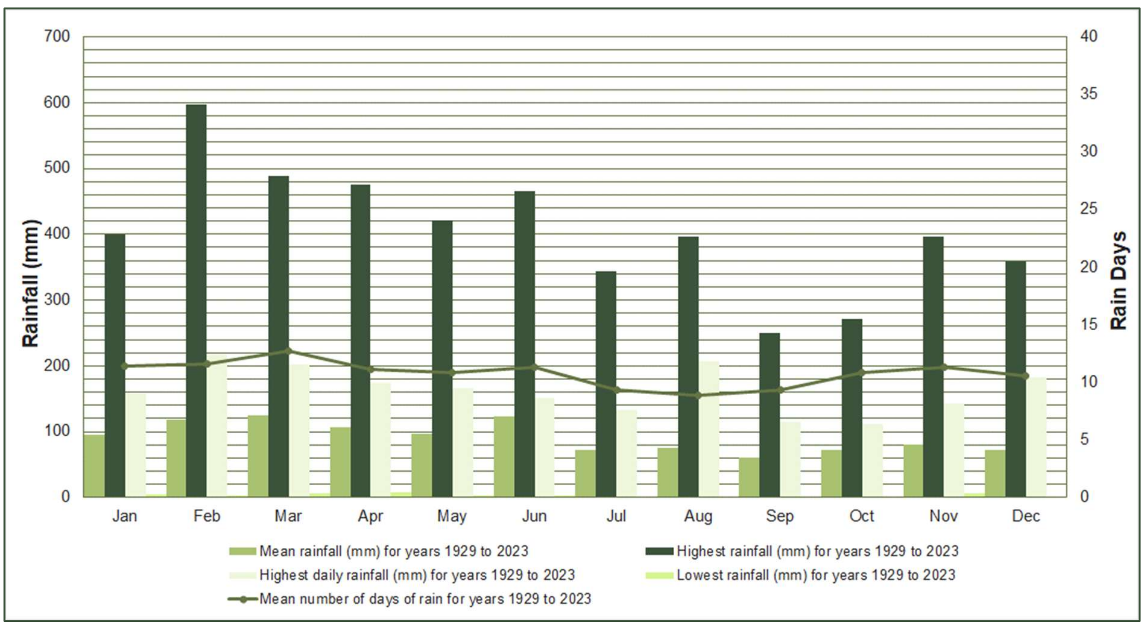
Figure 8 Wind Speed Frequency Chart for Sydney Airport AMO – 2019-2023



6.3.2 Rainfall

Rainfall statistics for Sydney Airport AMO for the years 1929 to 2023 are summarised in **Figure 9**. The mean annual rainfall is 1,093 millimetres (mm). The average monthly rainfall is highest in summer with the highest average monthly rainfall of 124.7 mm/month in February and an average of 13 rain days. The lowest average rainfall is 59.8 mm/month in September, with an average of 9 days of rain. The highest monthly rainfall recorded over the time period examined was 596.9 mm recorded in February 1956. The maximum daily rainfall of 216.2 mm was recorded on 3rd February 1990.

Figure 9 Monthly Rainfall Data for Sydney Airport AWS (1929 – 2023)



6.4 Background Air Quality

Air quality monitoring is performed by the Climate and Atmospheric Science Branch of the Department of Climate Change, Energy, the Environment and Water (DCCEW) at a number of air quality monitoring stations (AQMS) across NSW. The nearest such stations are located at Alexandria, Earlwood and Randwick, located approximately 2 km northwest, 4.6 km west, and 5.4 km east of the Site respectively. Alexandria does not have complete data for the meteorological year selected for this assessment (see **Section 7.2.2**), and Earlwood does not monitor for CO or SO_2. As such Randwick has been selected to describe background ambient air quality.

The Randwick AQMS is located at the Randwick Army Barracks grounds, near Avoca and Bundock Streets. It measures air quality in a residential area in the eastern suburbs of Sydney:

- NO, NO_2 and NO_X
- SO_2
- $PM_{2.5}$ and PM_{10}

As Randwick does not monitor for CO, data has been sourced from the Alexandria AQMS for use in contemporaneous assessments, it is noted that this data starts in October 2021.

A summary of the monitored pollutant concentrations for the last five years (2019-2023) is presented in **Table 10** and the data are presented graphically in **Figure 10** to **Figure 16**.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion were recorded by the Randwick AQMS in three years, 2019-2021, and exceedances of the 24-hour average and $PM_{2.5}$ criteria were recorded in all years except 2022.

SLR has reviewed of the available compliance monitoring reports for these year, which indicates that PM_{10} and $PM_{2.5}$ exceedances across east coast NSW were primarily due to exceptional events such as bushfire emergencies, dust storms and hazard reduction burns (NSW DPIE 2019) (NSW DPIE 2020) (NSW DPE 2021). The high number of exceedances recorded in 2019 were due to bushfire smoke that affected Sydney and the surrounding areas for a significant number of days in late 2019 and early 2020 (the 'Black Summer' bushfire event).

Exceedances of the annual average $PM_{2.5}$ criterion were recorded in 2019. The annual average PM_{10} criterion was not exceeded during the five years reviewed.

Ambient concentrations of the gaseous pollutants NO_2, CO and SO_2 were all below the relevant criteria for all years investigated.

Three exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded in 2023. The NEPM compliance report for 2023 has not been published at the time of this assessment, but a review of the available data shows that during mid-September when air quality impacts saw exceedances at multiple AQMQ stations due to large hazard reduction burns reported across Sydney. [1]

1 Exceedances of the 24-hour average $PM_{2.5}$ criteria occur on 11th, 12th, 14th September 2023. '*Sydney smoke: air quality among worst in world due to hazard-reduction burns'* | Bushfires | The Guardian.' https://www.theguardian.com/australia-news/2023/sep/14/sydney-air-quality-smoke-haze-today-back-burning-schedule-hazard-reduction-burns, Accessed 4 April 2024.

Table 10 Summary of AQMS Data (2019-2023)

AQMS	Randwick								Alexandria	
Pollutant	PM_{10}		$PM_{2.5}$		NO_2		SO_2		CO	
Averaging Period	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual	Maximum 1-hour	Maximum 24-hour	Maximum 1-hour	Maximum 8-hour
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	mg/m³
2019	127.7	23.5	95.2	9.8	104.6	13.3	82.9	14.3	-	-
2020	137.3	19.3	114.8	7.0	75.9	10.2	40.0	11.4	-	-
2021	37.6	15.9	31.2	6.1	59.5	10.5	62.9	14.3	0.4	0.3
2022	37.4	14.5	14.6	4.7	65.6	12.9	80.1	11.4	1.6	1.3
2023	89.0	16.1	67.7	6.0	82.0	14.9	68.6	11.4	2.5	1.0
Average	85.8	17.9	64.7	6.7	77.5	12.4	66.9	12.6	0.9	0.5
Criterion	**50**	**25**	**25**	**8**	**164**	**31**	**215**	**57**	**30**	**10**

Figure 10 Measured 24-Hour Average PM_{10} Concentrations at Randwick AQMS Data (2019-2023)

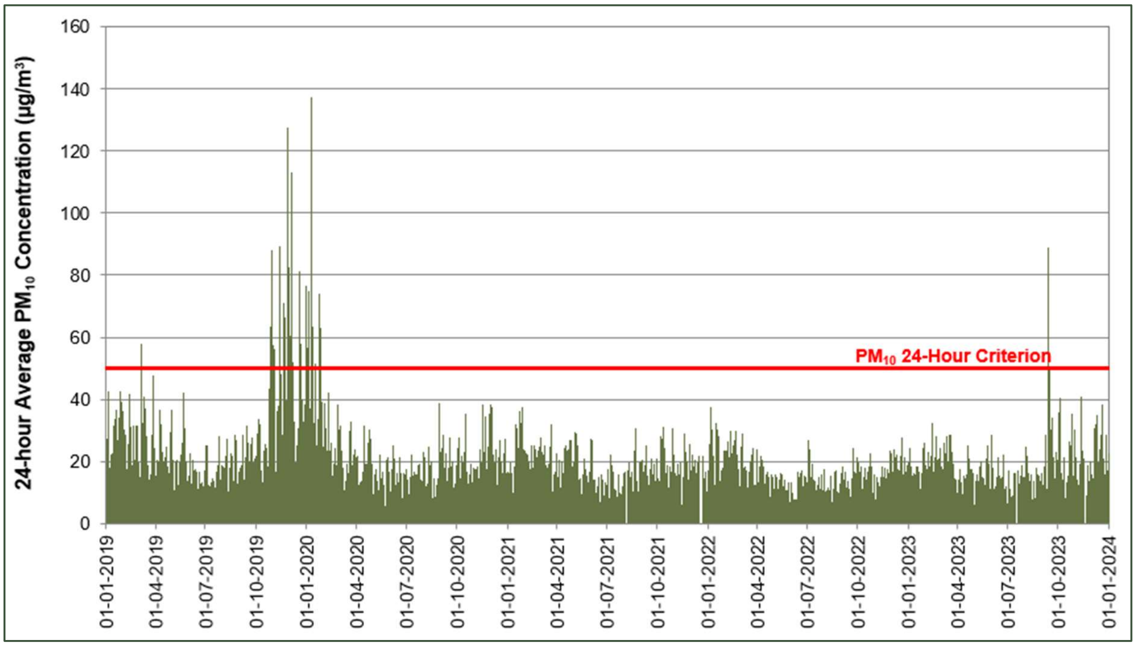


Figure 11 Measured 24-Hour Average $PM_{2.5}$ Concentrations at Randwick AQMS Data (2019-2023)

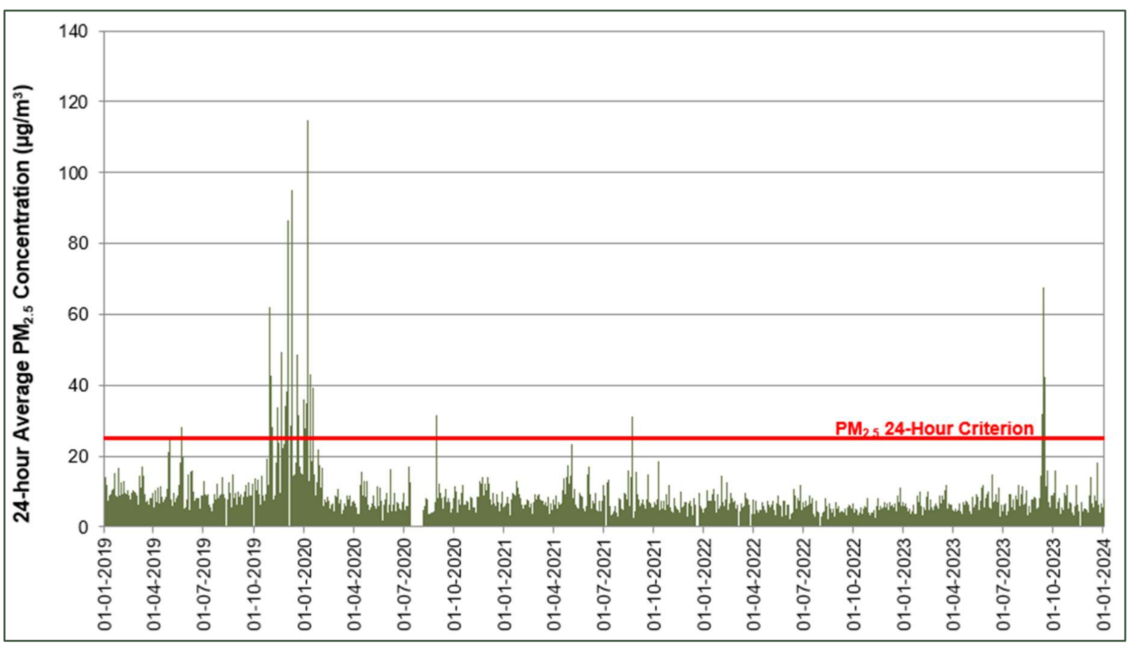


Figure 12 Measured 1-Hour Average NO_2 Concentrations at Randwick AQMS Data (2019-2023)

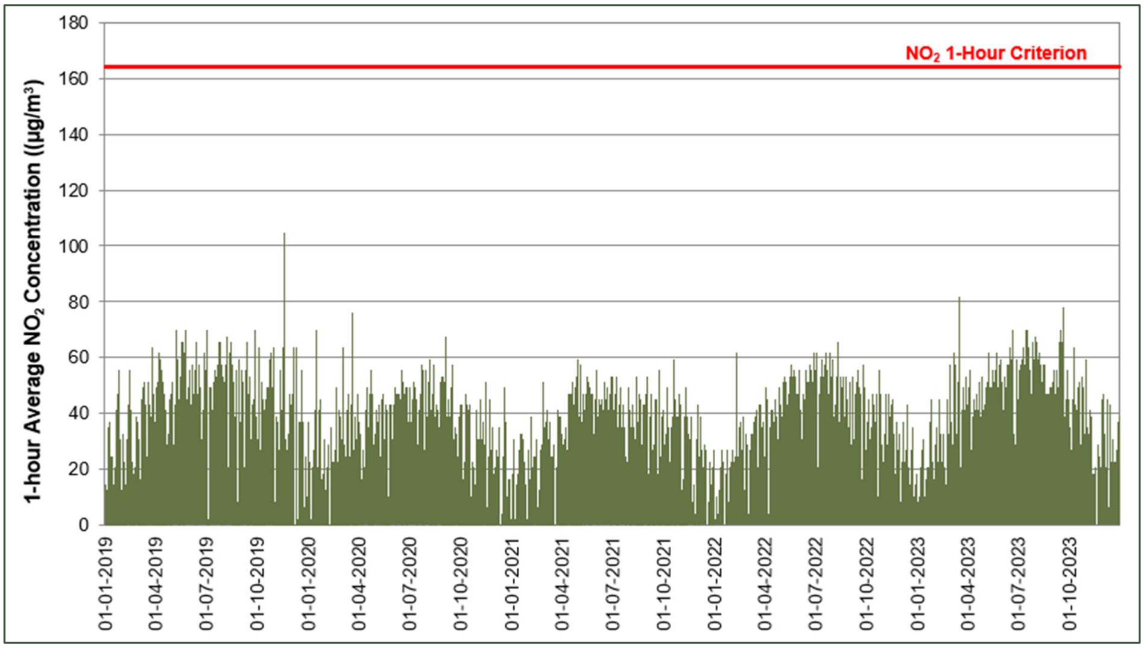


Figure 13 Measured 24-Hour Average SO_2 Concentrations at Randwick AQMS Data (2019-2023)

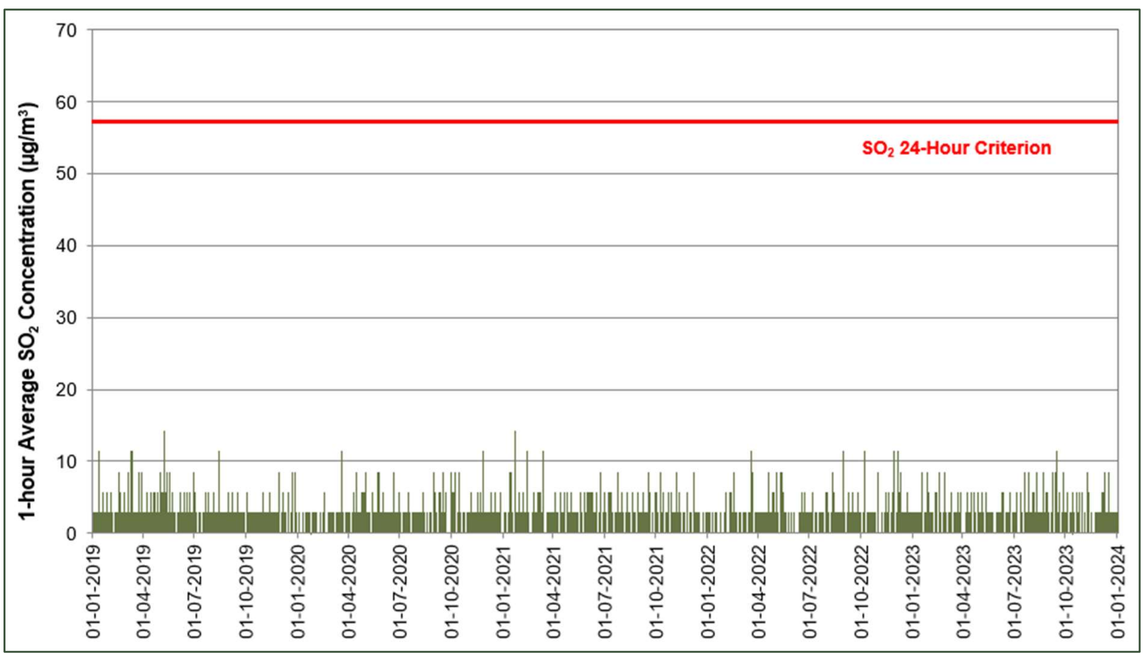


Figure 14 Measured 1-Hour Average SO_2 Concentrations at Randwick AQMS Data (2019-2023)

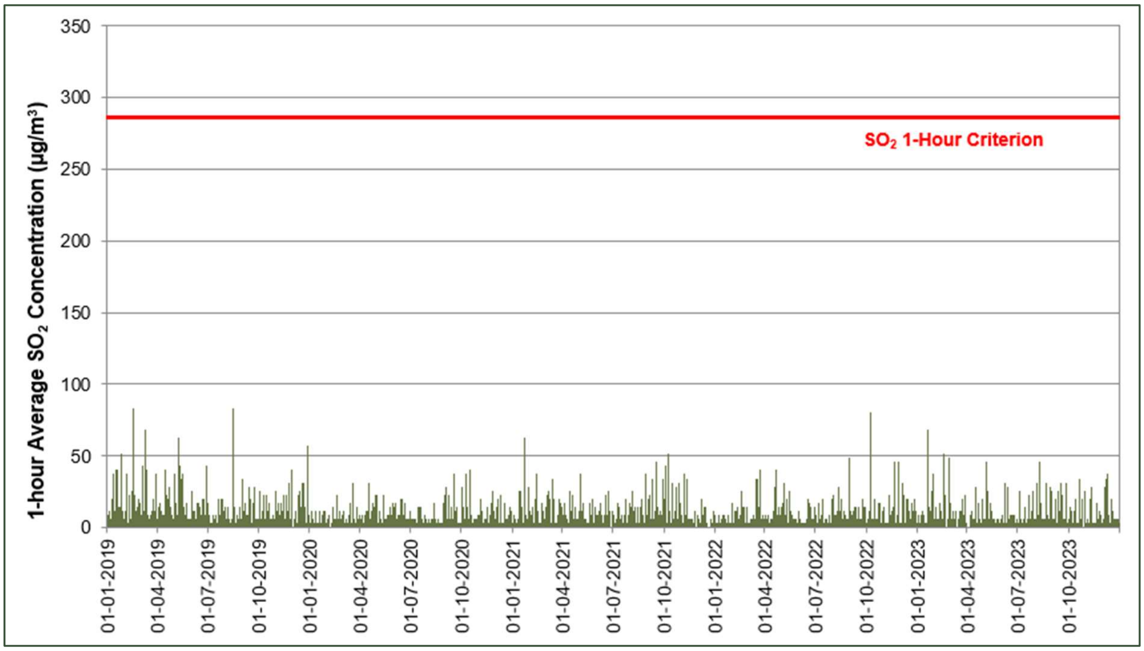


Figure 15 Measured 1-Hour Average CO Concentrations at Alexandria AQMS Data (2019-2023)

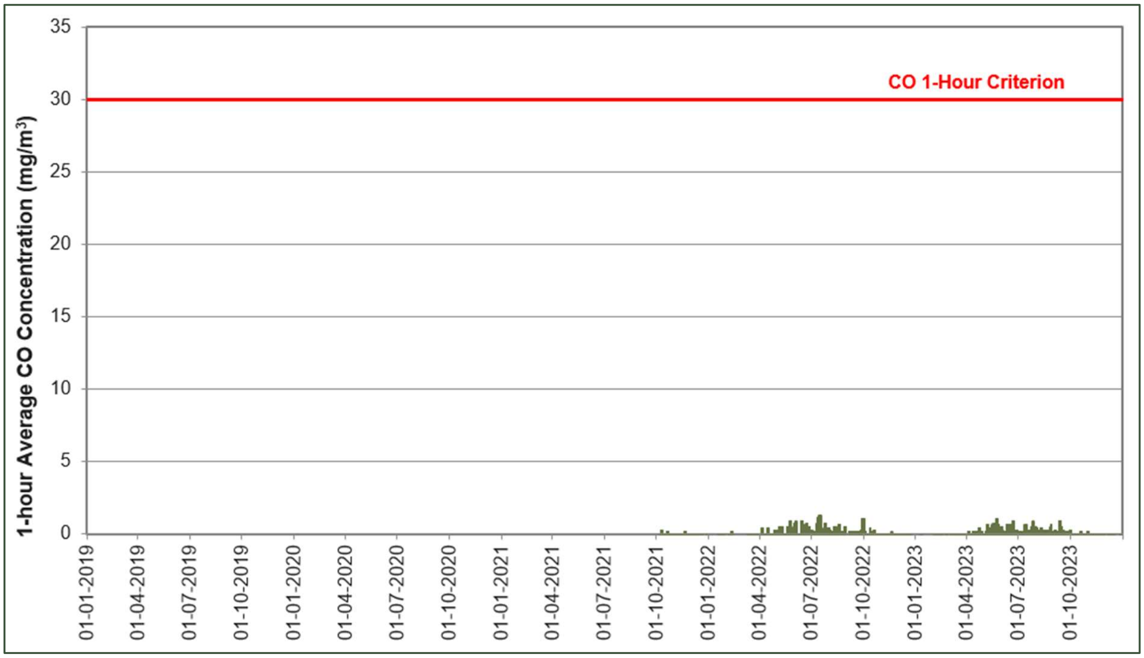
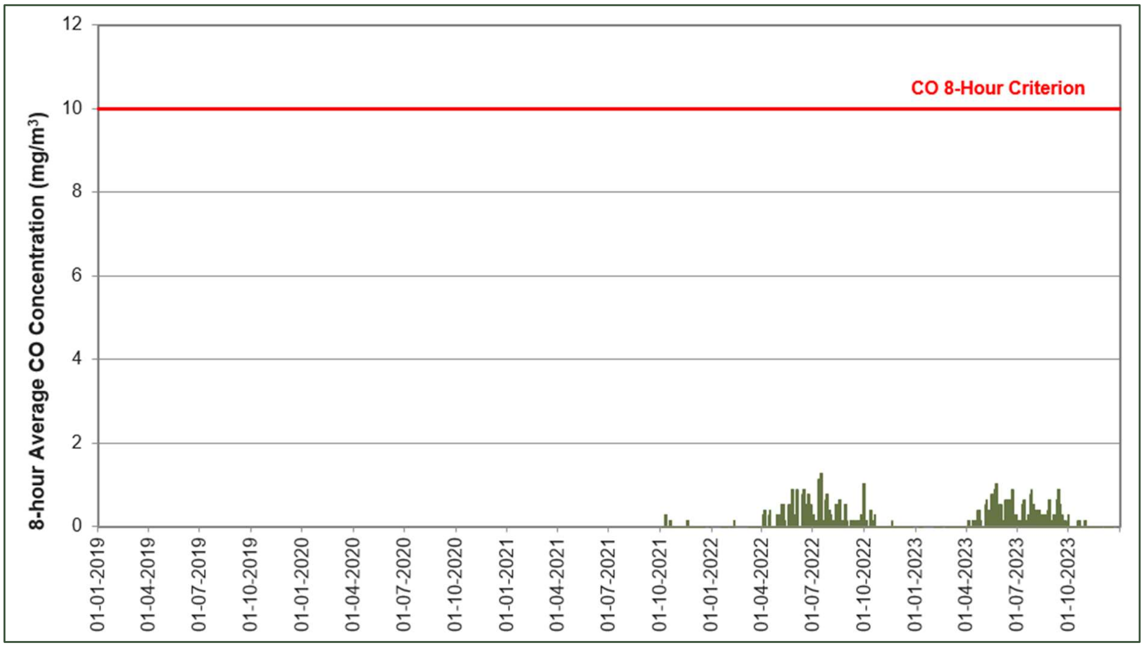


Figure 16 Measured Rolling 8-Hour Average CO Concentrations at Alexandria AQMS Data (2019-2023)



7.0 Assessment Methodology

This section discusses the methodologies adopted for the assessment of air quality impacts during construction and operational scenarios. In summary, the assessment of air emissions due to construction was performed qualitatively using risk based methodology whereas the operational phase of the Project was performed quantitatively through the use of dispersion modelling techniques.

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, earthworks construction and trackout 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 B** 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 and Emergency Dispersion Modelling Study

7.2.1 Plume Dispersion Model

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.

7.2.2 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 TAPM and CALMET, as discussed in the following sections.

Selection of Meteorological Year

Meteorological data recorded over the five-year period 2019-2023 by the Sydney Airport AMO was 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 the year 2021 was chosen for the AQIA (See **Appendix A** for selection of meteorological year).

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 that can be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM 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 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 observational data assimilated into the model run are presented in **Table 11**. The three-dimensional upper air data from the TAPM output was used as input for the diagnostic meteorological model (CALMET).

Table 11 Meteorological Modelling Parameters - TAPM v 4.0.4

Parameter	Data
Modelling Period	1 January 2021 to 31 December 2021
Centre of analysis	332,076 mE 6,244,673 mS (UTM Coordinates)
Number of grid points	25 × 25 × 35
Number of grids (spacing)	4 (10 km, 3 km, 1 km, 300 m)
Data assimilation	Canterbury Racecourse AWS Sydney Airport AMO Earlwood AQMS Randwick AQMS

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 12 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 surface weather observations were obtained from Sydney Airport AMO and Canterbury Racecourse AWS.

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.

A summary of the key meteorological conditions predicted by CALMET at the Site is presented in **Appendix C**.

Table 12 Meteorological Modelling Parameters - CALMET

Parameter	Data
Coarse Grid	
Modelling period	1st January 2021 to 31st December 2021
Domain size	12 km x 12 km
Meteorological grid resolution	100 m
Grid southwest corner coordinates	326,103 mE 6,239,133 mS (UTM Coordinates)
Initial guess filed	TAPM output
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data assimilation	Sydney Airport AMO Canterbury Racecourse AWS
Refined Grid	
Modelling period	1st January 2021 to 31st December 2021
Domain size	2 km x 2 km
Meteorological grid resolution	25 m
Grid southwest corner coordinates	331,103 mE 6,244,135 mS (UTM Coordinates)
Initial guess filed	TAPM output
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data assimilation	Sydney Airport AMO Canterbury Racecourse AWS

7.3 Source Characteristics and Emission Rates

CALPUFF requires a range of inputs to describe the emissions to air resulting from the proposed activities. Potential emissions to air from the generator stacks were estimated based on the diesel engine technical specifications.

Specifications for the proposed data centre generators are provided in **Table 13**. This assessment assumes and considers 72 x 20V4000G24F generators. Full specifications are provided in **Appendix D**.

Table 13 Diesel Generator Specifications – Data Centre

Parameter	Units	Specifications
Model	-	20V4000G24F
Number	-	72
Electrical generation capacity: individual	kW	2,420
Electrical generation capacity: generators combined	MW	174.24

Parameter	Units	Specifications
Fuel consumption	L/hr	554
NO_X [a]	g/kWh	16.28
CO [a]	g/kWh	0.84
PM [a]	g/kWh	0.04
HCs [a]	g/kWh	0.22
NO_X in-stack concentration [b]	mg/Nm^3	4703.2
CO in-stack concentration [b]	mg/Nm^3	242.7
PM in-stack concentration [b]	mg/Nm^3	11.6
HCs in-stack concentration [b]	mg/Nm^3	63.6
NO_X in-stack concentration	mg/Nm^3 @7% O_2	5272.1 [c]
CO in-stack concentration	mg/Nm^3 @7% O_2	272.0
PM in-stack concentration	mg/Nm^3 @7% O_2	13.0
HC in-stack concentration	mg/Nm^3 @ 7% O_2	71.2

a At 100% of power rating (most conservative)

b Based on residual oxygen value (as measured)

c It is noted that the anticipated maximum in-stack NO_X concentration exceeds the 450 mg/m^3 Protection of the Environment Operations (Clean Air) Regulation 2022 Group 6 limit (Refer Section 5.2). However, as the emergency standby plant is anticipated to operate less than 200 hours per year, it is exempt from these limits under the Regulation.

The generator set specifications sheet includes emission rates of the pollutants of concern with the exception of SO_2, PAHs and VOCs. HC emissions are available and included in **Table 13**, however it would be highly conservative to assume all HCs emissions represent a single VOC or PAH for the purpose of assessment. It has been identified in **Section 4.4** that PAHs (as benzo(a)pyrene) and benzene are the are the highest priority air toxics for assessment.

In the absence of SO_2 emission rates provided in the generator datasheets (see **Table 13** and **Appendix D**), emission rates are adopted from the specification sheet for the Cummins QSK95-G4, (also provided in **Appendix D**). The Cummins QSK95-G4 SO_2 emission factor of 0.004 grams per break horsepower-hour (g/bhp-hr) is equal to 0.0054 grams per kilowatt-hour (g/kW-hr).

Emission rates of benzene were estimated from emission factors adopted from USEPA "*AP-42: Compilation of Air Emissions Factors from Stationary Sources, Chapter 3 Stationary Internal Combustion Sources, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines"* (US EPA 2025). From this document, Table 3.4-2 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines" provides emission factors for benzene.

A quantitative risk assessment was undertaken to determine the highest risk VOC to use as a marker for assessment. This was undertaken by comparing emission factors for large diesel engines with their NSW impact assessment criteria. The emission factors were sourced from a U.S. Environmental Protection Agency (US EPA 2025) update for large diesel engines, (power rating greater than 447kW). The result of the quantitative risk assessment was benzene as the highest risk VOC due to emissions from large diesel engines, see **Table 14** for the emission rate to criteria ratio from the risk assessment. As such benzene was used as the marker for VOCs/air toxics for this assessment. If no exceedances of the benzene criteria are predicted, it is considered appropriate to assume that other VOC emissions from the operation of the Project would also result in no exceedances of the relevant criteria.

Table 14 Comparison of Emission Rate to Criteria for VOCs

Compound	Emission Factor (lb/MMBtu)	Emission rate (g/s)	Criteria (mg/m3)	Emission to criteria ratio
Benzene	7.76E-04	0.0018	0.029	0.063
Toluene	2.81E-04	0.00067	0.36	0.0018
Xylenes	1.93E-04	0.00046	0.19	0.0024
Propylene	2.79E-03	0.0066	N/A	N/A
Formaldehyde	7.89E-05	0.00019	0.04	0.0047
Acetaldehyde	2.52E-05	0.000060	0.02	0.0030
Acrolein	7.88E-06	0.000019	0.042	0.00044

Emission rates of PAH's were also estimated from emission factors adopted from USEPA "*AP-42: Compilation of Air Emissions Factors from Stationary Sources, Chapter 3 Stationary Internal Combustion Sources, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines"* (USEPA 2006 and Updates). From this document, Table 3.4-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines" provides emission factors as a function of diesel fuel input for 16 PAHs.

The Approved Methods requires that all PAHs be assessed as benzo(a)pyrene toxic equivalency quotient (B(a)PTEQ) using the potency equivalency factors (PEFs) provided in **Table 15.** The emission of PAHs as B(a)PTEQ is equal to the sum of the individual PAH emission factors multiplied by their PEFs:

$$EF_{B(a)PTEQ} = \sum_{i=1}^{n} EF_i \times PEF_i$$

The USEPA PAH emission factors are presented in **Table 16** along with their PEFs, where provided, and the resultant PAH as B(a)PTEQ emission factor.

Table 15 Approved Methods Potency Equivalency Factors for PAHs

Pah or derivative	Cas number	PEF
Benzo[a]pyrene	50-32-8	1
Benzo[a]anthracene	56-55-3	0.1
Benzo[b]fluoranthene	205-99-2	0.1
Benzo[j]fluoranthene	205-82-3	0.1
Benzo[k]fluoranthene	207-08-9	0.1

Pah or derivative	Cas number	PEF
Bibenz[a,j]acridine	224-42-0	0.1
Bibenz[a,h]acridine	226-36-8	0.1
7h-dibenzo[c,g]carbazole	194-59-2	1
Dibenzo[a,e]pyrene	192-65-4	1
Dibenzo[a,h]pyrene	189-64-0	10
Dibenzo[a,i]pyrene	189-55-9	10
Dibenzo[a,l]pyrene	191-30-0	10
5-nitroacenaphthene	602-87-9	0.01
Indeno[1,2,3-cd]pyrene	193-39-5	0.1
5-methylchrysene	3697-24-3	1
1-nitropyrene	5522-43-0	0.1
4-nitropyrene	57835-92-4	0.1
1,6-dinitropyrene	42397-64-8	10
1,8-dinitropyrene	42397-65-9	1
6-nitrocrysene	08-02-7496	10
2-nitrofluorene	607-57-8	0.01
Chrysene	218-01-9	0.01
Dibenz[a,h]anthracene	53-70-3	0.4
7,12-dimethylbenzanthracene	57-97-6	21.8
3-methylcholanthrene	56-49-5	1.9

Table 16 PAH (as Benzo(a)pyrene) Emission Factor

PAH	AP42 Emission Factor (lb/MMBtu)	PEF ^
Benzo(a)anthracene	6.22E-07	0.1
Chrysene	1.53E-06	0.01
Benzo(b)fluoranthene	1.11E-06	0.1
Benzo(k)fluoranthene	2.18E-07	0.1
Benzo(a)pyrene	2.57E-07	1
Indeno(1,2,3-cd)pyrene	4.14E-07	0.1
Dibenz(a,h)anthracene	6.22E-07	0.4
PAH as B(a)PTEQ	7.3E-07	
^ Approved Methods Table 14		

Table 17 provides a summary of stack parameters and emission rates for the proposed generators. SLR understands that the generators will be tested at varying loads, however this assessment has conservatively assumed generators running will be tested at 100% load for the duration of testing.

Table 17 Stack Parameters and Emission Rates

Parameter	16V4000G84F	Unit	Reference/Base
Temperature	833	K	Engine specifications (Refer **Appendix D**)
Release height	39.1	m	Client drawings
Exhaust gas velocity	25.1	m/s	Calculated from engine specifications (Refer **Appendix D**)
Stack diameter	0.6	m	Client drawings
Stack orientation	Vertical		Client drawings
NO_x emission rate	10.9	g/s	Engine specifications (Refer **Appendix D**)
CO emission rate	0.56	g/s	
PM emission rate	0.027	g/s	
SO_2 emission rate	0.0036	g/s	In absence of data, based on Cummins QSK95-G4 engine specifications (Refer **Appendix D**), scaled for power output.
PAH (as B(a)P) emission rate	0.0000027	g/s	Calculated using engine specifications (Full Continuous fuel consumption rate; Refer **Appendix D)** and AP42: 3.4 emission factors for large uncontrolled diesel engines.
Benzene emission rate	0.0018	g/s	

7.3.1 Worst-Case Scenario

To represent the worst case testing regime (**Section 4.0**), for modelling purposes it is assumed that two generators run continuously between 7:00 am and 6:00 pm, every day of the year. This approach is likely to significantly overestimate the 24-hour average and annual average downwind air pollutant concentrations due to the following:

- Only 2 generator are proposed to be tested at a time.
- Testing lasts between 65 to 90 minutes (excluding cooldown).
- Only 4 tests are to be conducted per generator, per year.
- Up to 9 tests may occur in a day at a maximum, not necessarily every day.

The generator closest to a receptor was modelled for the operational maintenance scenario. All stacks were modelled for the emergency scenario. All exhaust stacks were represented in the model as point sources.

7.4 Additional Model Parameters and Options

7.4.1 Background Pollutant Concentrations

Hourly varying air quality data recorded by the Randwick AQMS during the modelling period were used for the contemporaneous analysis of cumulative ground level concentrations.

It is noted that 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 because of the proposed activity.

7.4.2 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.

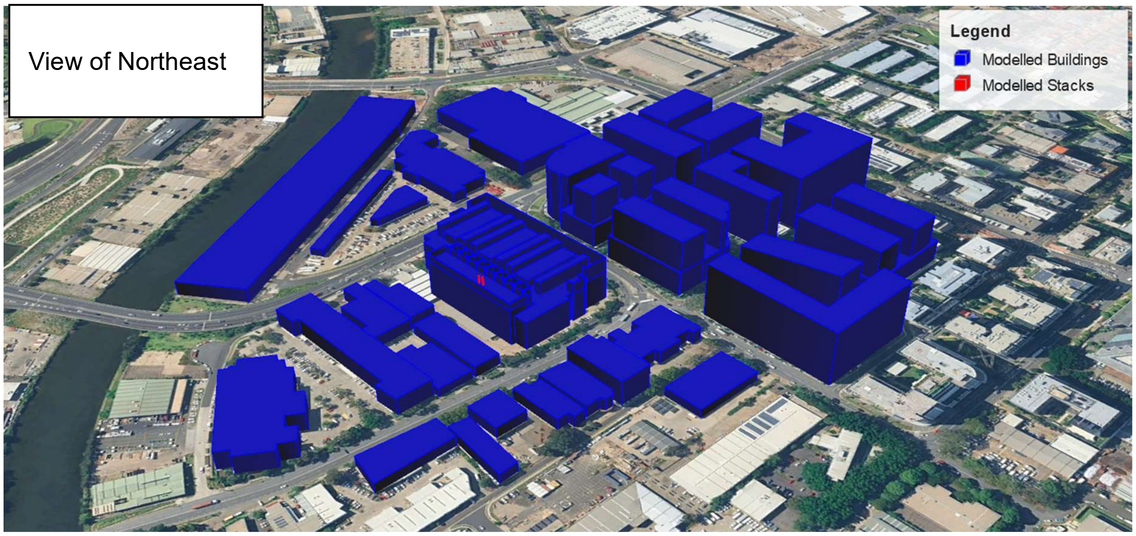
The USEPA has established a Good Engineering Practice (GEP) stack height which is defined as the '*height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutants in the immediate vicinity of the source as a result of atmospheric downwash, eddies 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 Project buildings as well as existing buildings in the surrounding area were included in the modelling. **Figure 17 Figure 18** illustrate the buildings input into the model, and the relative locations of point sources representing the generator exhausts.

Figure 17 Modelled Buildings and Point Sources (Operational Maintenance Scenario).



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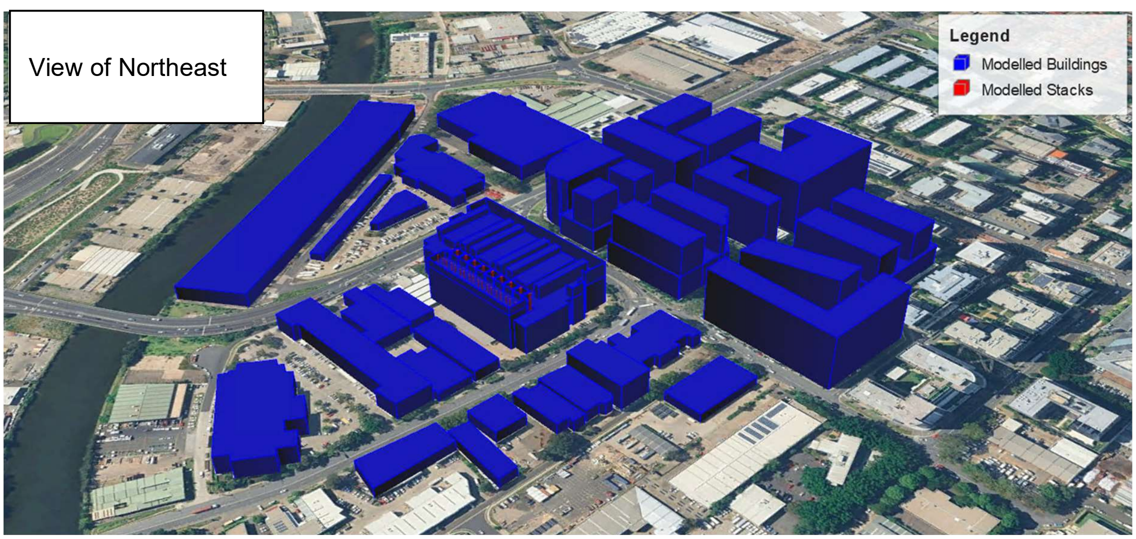
Project Number:	610.031795
Location:	Mascot, NSW
Source:	Calpuff view/Google Earth
Projection:	WGS 84 \ UTM Zone 56
Date:	12/05/2025

Goodman Property Services (Aust) Pty Ltd
-22Gardeners Road & Kent Road, Mascot Air Quality Impact Assessment
Operational Maintenance

Figure 18 Modelled Buildings and Point Sources (Emergency Conditions Scenario).



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-22Gardeners Road & Kent Road, Mascot Air Quality Impact Assessment
Emergency Conditions

7.4.3 NO_x to NO_2 conversion

NO_x emitted from combustion processes mainly consist of NO with a small portion (approximately 10%) of NO_2. In the atmosphere however, NO emitted from the source oxidises to NO_2 in the presence of ozone (O_3) and sunlight as it travels further from the source. The rate of oxidation depends on a number of parameters including the ambient O_3 concentration. The Approved Methods lists the following methods that can be applied to take account the oxidation of NO to NO_2 in estimating downwind NO_2 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 NO_2 before the plume arrives at the receptor location. Use of this method can significantly over-predict NO_2 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 O_3 or all the NO is used up. NO_2 concentrations can be estimated by this method using the following equation:

$[NO_2]_{total} = \{0.1 \times [NO_x]_{pred}\} + \mathrm{MIN}\{(0.9) \times [NO_x]_{pred}$ or $(46/48) \times [O_3]_{bkgd}\} + [NO_2]_{bkgd}$

Again, given the close proximity of sensitive receptors with short transport and duration periods from the Project, 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 2022)

Method 3 – NO to NO_2 conversion using empirical relationship

An empirical equation for estimating the oxidation rate of NO in power plant plumes dependent on distance downwind from the source and the parameters A and α and has the following form:

$$NO_2 = NO_x \times A(1 - e^{-\alpha x})$$

where *x* is the distance from the source and A and α are classified according to the O_3 concentration, wind speed and season (Janssen, et al. 1988) as provided in **Table 18.**

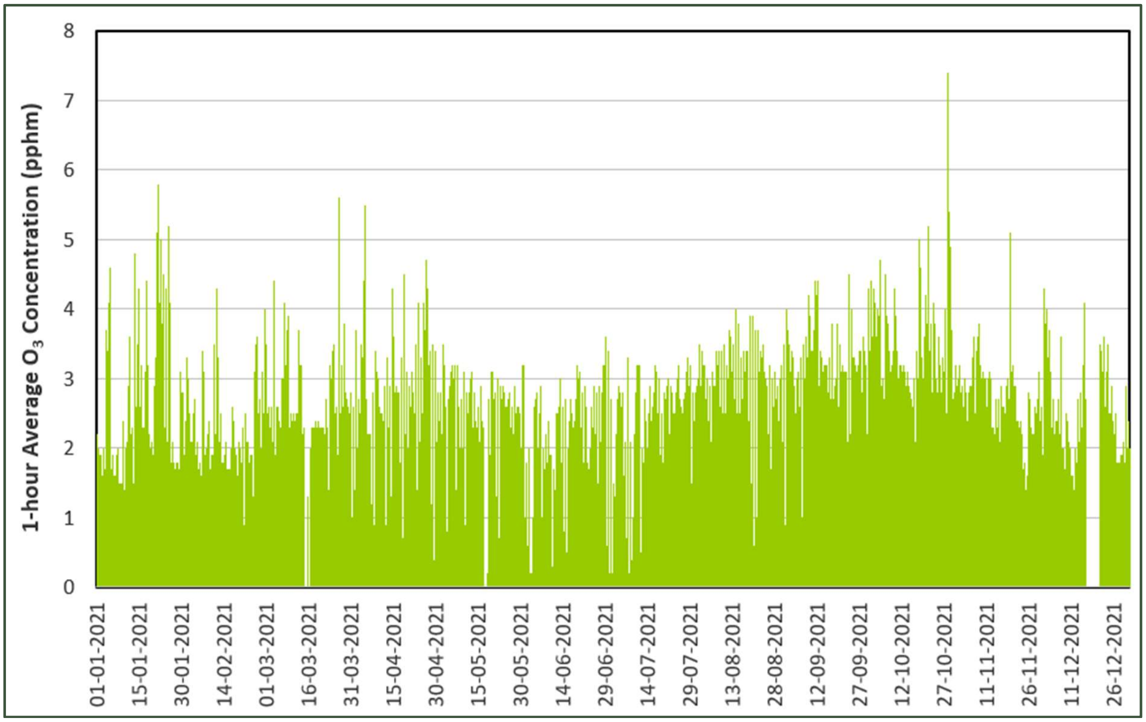
Table 18 Classification of Values for A and α by Season

Season	Ozone (ppb)	Wind speed (m/s)		
		5	15	>15
Winter	40	A = 0.87 α = 0.07	A = 0.87 α = 0.07	A = 0.87 α = 0.15
	30	A = 0.82	A = 0.83	A = 0.83

Season	Ozone (ppb)	Wind speed (m/s)		
		5	15	>15
		α = 0.07	α = 0.07	α = 0.07
	20	A = 0.74 α = 0.07	A = 0.74 α = 0.07	A = 0.74 α = 0.07
	10	A = 0.49 α = 0.05	A = 0.49 α = 0.05	A = 0.49 α = 0.05
Spring/Autumn	60	A = 0.85 α = 0.10	A = 0.85 α = 0.15	A = 0.85 α = 0.30
	40	A = 0.80 α = 0.10	A = 0.80 α = 0.10	A = 0.80 α = 0.25
	30	A = 0.74 α = 0.10	A = 0.74 α = 0.10	A = 0.74 α = 0.15
	20	A = 0.635 α = 0.10	A = 0.635 α = 0.10	A = 0.635 α = 0.10
Summer	200	A = 0.93 α = 0.40	A = 0.93 α = 0.65	A = 0.93 α = 0.80
	120	A = 0.88 α = 0.20	A = 0.88 α = 0.35	A = 0.88 α = 0.45
	60	A = 0.81 α = 0.15	A = 0.81 α = 0.25	A = 0.81 α = 0.35
	40	A = 0.74 α = 0.10	A = 0.74 α = 0.15	A = 0.74 α = 0.25
	30	A = 0.67 α = 0.10	A = 0.67 α = 0.10	A = 0.67 α = 0.10

This assessment employs Method 3, adopting O_3 data from the Randwick AQMS, presented in **Figure 19**, to estimate the incremental and cumulative NO_2 impacts at nearby sensitive receptors as a result of the Project emissions.

Figure 19 Randwick AQMS O_3 1-Hour Average Concentrations (2021)



7.4.4 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

C_0 = concentration for the shorter time-averaging period

t_0 = longer averaging time

t = shorter averaging time

7.4.5 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 Impacts

8.1 Construction Phase

8.1.1 Step 1 – Screening Based on Separation Distance

As noted in **Section 6.2**, the nearest sensitive receptor is located approximately 20 m from the nearest Site boundary.

The screening criteria for detailed assessment are:

- a 'human receptor[2]' 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).
- an 'ecological receptor[3]' within:
  - 50 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).

As a 'human receptor' is located within 250 m of the boundary of the site, further assessment is required.

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

Based on the IAQM definitions presented in Appendix D**,** dust emission magnitudes for the anticipated works have been categorised as presented in **Table 19**.

Table 19 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Category Assumption
Demolition	Large	Total building volume >75,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >12 m above ground level.
Earthworks	Medium	Total site area between 18,000 m^2 - 110,000 m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds between 3 m - 6 m in height.
Construction	Large	Total building volume > 75,000 m^3, on site concrete batching; sandblasting.
Trackout	Small	Between 20 - 50 heavy vehicle movements in any one day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length

[2] A 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production).

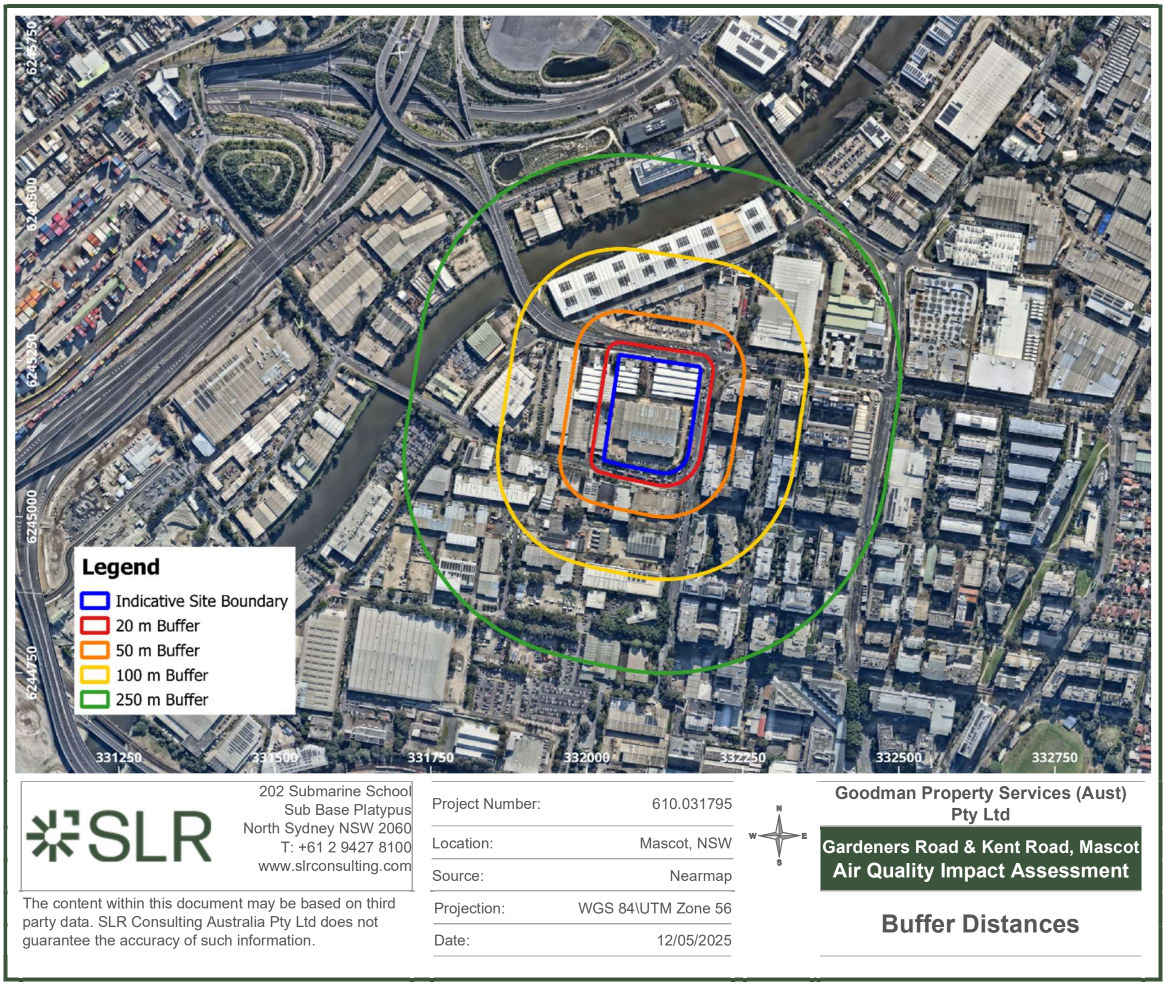
[3] An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats).

8.1.3 Step 2b – Risk Assessment

Receptor Sensitivity to Dust Soiling Effects and Health Effects

The number of residential receptors and childcare centres is estimated to be >100 within 50 m of the Site boundary. Based on the criteria listed in **Table B1** in **Appendix B**, the sensitivity of the receptors in this study is concluded to be *high*. This is the highest level of sensitivity and therefore will be applied to all receptors for the assessment (see **Figure 20**).

Figure 20 Buffered Distances from the Project Boundary



Sensitivity of an Area

Based on the classifications shown in **Table B2** and **Table B3** in **Appendix B**, the sensitivity of the area to dust soiling may be classified as *high* and the sensitivity of the area to health effects may be classified as *low*. This categorisation has been made taking into account the individual receptor sensitivities derived above, the 5-year mean background PM_{10} concentration of 15.9 µg/m^3 recorded at Randwick AQMS (see **Section 6.4**) and the existing number of sensitive receptors present in the vicinity of the Site.

Risk Assessment

The resulting preliminary risk of air quality impacts from construction activities is presented in **Table 20**.

Table 20 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude				Preliminary Risk (No Mitigation)			
		Demolition	Earthworks	Construction	Trackout	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	Large	Medium	Large	Medium	High Risk	Medium Risk	High Risk	Medium Risk
Human Health	Low					Medium Risk	Low Risk	Low Risk	Low Risk

Based on the IAQM methodology, the overall air quality risk from the project construction activities is rated as high for residential receptors and the childcare centres.

8.1.4 Step 3 - Mitigation Measures

The IAQM document provides guidance on appropriate mitigation measures for construction activities determined to have low, medium and high preliminary risk of adverse air quality impacts. **Table 21** lists the relevant mitigation measures by the IAQM methodology for a project shown to have a high risk of adverse impacts.

These measures are designated as *highly recommended* (H) or *desirable* (D) by the dust IAQM method.

Not all these measures would be practical or relevant for the Project, hence a detailed review of the recommendations should be performed as part of a development of the Construction Environmental Management Plan (CEMP) and the most appropriate measures adopted.

Table 21 Proactive Dust Mitigation Measures

Mitigation measure	Highly recommended or Desirable
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
Display the name and contact details of person(s) account-able 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 Council. The level of detail will depend on the risk and should include as a minimum the highly	H

Mitigation measure	Highly recommended or Desirable
recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.	
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 off-site, and the action taken to resolve the situation in the logbook.	H
Monitoring	
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Council when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.	H
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
Agree dust deposition, dust flux, or real-time PM continuous monitoring locations 10 with the Local Council. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	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
Erect solid screens or barriers around dusty activities or the site boundary that are 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 actives for an extensive period	H
Avoid site runoff of water or mud.	H
Keep site fencing, barriers and scaffolding clean using wet methods.	H
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.	H
Cover, seed or fence stockpiles to prevent wind whipping.	H
Operating vehicle/machinery and sustainable travel	
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
Impose and signpost a maximum-speed-limit of 25 kph on surfaced and 15 kph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	H
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	H

Mitigation measure	Highly recommended or Desirable
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	H
Operations	
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
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H
Use enclosed chutes and conveyors and covered skips.	H
Minimise drop heights from conveyors, loading shovels, hoppers 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.	H
Waste management	
Avoid bonfires and burning of waste materials.	H

Additional mitigation measures targeting potential impacts from earthworks, construction and trackout are recommended by the IAQM which should reduce the risk impacts.

For almost all construction activity, the dust IAQM method 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.

Appropriate site-specific construction mitigation measures are recommended to be included in a Construction Air Quality Management Plan (CAQMP).

Mitigation measures targeting potential impacts from specific activities are provided in **Table 22** to **Table 25**. These are based on their specific preliminary risk outcome. Implementing these measures may reduce the risk of these impacts for sensitive receptors.

Table 22 Mitigation Measures Specific to Demolition

Activity	Highly recommended or Desirable
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	H
Ensure effective water suppression is used during demolition operations. Handheld 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
Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H
Bag and remove any biological debris or damp down such material before demolition.	H

H = Highly recommended; D = Desirable

Table 23 Mitigation Measures Specific to Earthworks

Activity	Highly recommended or Desirable
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	D
Only remove the cover in small areas during work and not all at once.	D

H = Highly recommended; D = Desirable

Table 24 Mitigation Measures Specific to Construction

Activity	Highly recommended or Desirable
Avoid scabbling (roughening of concrete surfaces) if possible.	H
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.	H
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	H
For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	D

H = Highly recommended; D = Desirable

Table 25 Mitigation Measures Specific to Trackout

Activity	Highly recommended or Desirable
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	H
Avoid dry sweeping of large areas.	H
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
Record all inspections of haul routes and any subsequent action in a site log book.	H
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
Access gates to be located at least 10 m from receptors where possible.	H

H = Highly recommended; D = Desirable

Appendix D lists the relevant general mitigation measures designated by the dust IAQM method for a development shown to have a high risk of adverse impacts.

8.1.5 Step 4 - Residual Impacts

For almost all construction activity, the dust IAQM method 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. Hence the residual effect will normally be negligible.

8.2 Operational Maintenance Scenario

This section presents the results of the operational maintenance dispersion modelling. Isopleth plots of predicted incremental concentrations are presented in **Appendix E**.

8.2.1 Particulates

Table 26 and **Table 27** present the maximum 24-hour and annual average incremental particulate matter concentrations at surrounding sensitive receptor locations respectively. The insignificant incremental increase of particulate matter predicted at the identified receptors is not likely to result in additional exceedances of the criteria. It is noted that one (1) exceedance of the 24-hour average $PM_{2.5}$ Criterion was recorded by the Randwick AQMS for the modelled year (Refer **Section 6.4**).

Table 26 Maximum Predicted 24-hour average PM Concentrations at Modelled Receptors

Receptor ID	Maximum 24-hour average incremental concentration (µg/m³)	Maximum cumulative 24-hour average concentration (µg/m³)		Additional exceedances as result of project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R1	0.1	37.6	31.2	No	No
R2	0.0	37.6	31.2	No	No
R3	0.0	37.6	31.2	No	No
R4	0.1	37.6	31.2	No	No
R5	0.7	37.7	31.4	No	No
R6	0.4	37.6	31.2	No	No
R7	0.4	37.6	31.2	No	No
R8	0.6	37.7	31.4	No	No
R9	0.2	37.7	31.3	No	No
R10	0.1	37.6	31.2	No	No
R11	0.5	37.6	31.2	No	No
R12	0.4	37.6	31.2	No	No
R13	0.1	37.6	31.2	No	No
R14	0.0	37.6	31.2	No	No
R15	0.1	37.6	31.2	No	No

Receptor ID	Maximum 24-hour average incremental concentration (µg/m³)	Maximum cumulative 24-hour average concentration (µg/m³)		Additional exceedances as result of project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R16	0.2	37.7	31.3	No	No
R17	0.1	37.6	31.2	No	No
R18	0.0	37.6	31.2	No	No
R19	0.1	37.6	31.2	No	No
R20	0.0	37.6	31.2	No	No
R21	0.0	37.6	31.2	No	No
R22	0.1	37.6	31.2	No	No
R23	0.1	37.6	31.2	No	No
R24	0.2	37.7	31.3	No	No
R25	0.1	37.6	31.2	No	No
R26	0.2	37.6	31.3	No	No
R27	0.5	37.8	31.4	No	No
R28	0.3	37.7	31.3	No	No
R29	0.3	37.6	31.2	No	No
R30	0.2	37.6	31.2	No	No
R31	0.1	37.6	31.2	No	No
R32	0.1	37.6	31.2	No	No
R33	0.0	37.6	31.2	No	No
R34	0.1	37.6	31.2	No	No
R35	0.1	37.6	31.2	No	No
R36	0.1	37.6	31.2	No	No
R37	0.2	37.6	31.2	No	No
R38	0.0	37.6	31.2	No	No
R39	0.1	37.6	31.2	No	No
R40	0.2	37.6	31.2	No	No
Criteria		**50**	**25**		
a Over and above background.					

Table 27 Maximum Predicted Annual Average PM Concentrations at Modelled Receptors

Receptor ID	Annual average incremental concentration (µg/m³)	Cumulative annual average concentration (µg/m³)		Exceedance as result of project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R1	<0.1	16.2	6.3	No	No

Receptor ID	Annual average incremental concentration (µg/m³)	Cumulative annual average concentration (µg/m³)		Exceedance as result of project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R2	<0.1	16.2	6.3	No	No
R3	<0.1	16.2	6.3	No	No
R4	<0.1	16.2	6.3	No	No
R5	0.1	16.3	6.3	No	No
R6	<0.1	16.3	6.3	No	No
R7	<0.1	16.3	6.3	No	No
R8	<0.1	16.3	6.3	No	No
R9	<0.1	16.2	6.3	No	No
R10	<0.1	16.2	6.3	No	No
R11	0.1	16.3	6.4	No	No
R12	0.1	16.3	6.4	No	No
R13	<0.1	16.2	6.3	No	No
R14	<0.1	16.2	6.3	No	No
R15	<0.1	16.2	6.3	No	No
R16	<0.1	16.2	6.3	No	No
R17	<0.1	16.2	6.3	No	No
R18	<0.1	16.2	6.3	No	No
R19	<0.1	16.2	6.3	No	No
R20	<0.1	16.2	6.3	No	No
R21	<0.1	16.2	6.3	No	No
R22	<0.1	16.2	6.3	No	No
R23	<0.1	16.2	6.3	No	No
R24	<0.1	16.3	6.3	No	No
R25	<0.1	16.2	6.3	No	No
R26	<0.1	16.3	6.3	No	No
R27	0.1	16.3	6.4	No	No
R28	<0.1	16.3	6.3	No	No
R29	<0.1	16.2	6.3	No	No
R30	<0.1	16.2	6.3	No	No
R31	<0.1	16.2	6.3	No	No
R32	<0.1	16.2	6.3	No	No
R33	<0.1	16.2	6.3	No	No
R34	<0.1	16.2	6.3	No	No
R35	<0.1	16.2	6.3	No	No

Receptor ID	Annual average incremental concentration (µg/m³)	Cumulative annual average concentration (µg/m³)		Exceedance as result of project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R36	<0.1	16.2	6.3	No	No
R37	<0.1	16.2	6.3	No	No
R38	<0.1	16.2	6.3	No	No
R39	<0.1	16.2	6.3	No	No
R40	<0.1	16.3	6.3	No	No
Criteria		**25**	**8**		
a Over and above background.					

8.2.2 NO_2

Table 28 presents the maximum incremental and cumulative 1-hour and annual average NO_2 concentrations predicted at identified sensitive receptor locations.

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

Table 28 Maximum Predicted NO_2 Concentrations at Modelled Receptors

Receptor ID	Incremental (µg/m³)							Cumulative (µg/m³)	
	Maximum 1-Hour	*Corresponding 1-Hour* [a]					Annual	1-Hr	Annual
		NO_X (µg/m³)	O_3 (ppb)	Wind Speed (m/s)	Transport Time (s) [b]	NO_2 (µg/m³)			
R1	7.0	134.9	5.0	1.9	432.0	24.4	0.1	54.8	9.7
R2	10.7	162.6	31.0	3.1	377.9	0.0	0.1	54.5	9.7
R3	10.3	116.1	20.0	2.5	727.8	30.1	0.0	54.5	9.6
R4	7.6	213.5	24.0	2.3	300.4	13.2	0.1	54.5	9.7
R5	5.8	914.9	38.0	5.2	18.3	9.4	0.1	54.5	9.7
R6	5.5	482.9	12.0	5.4	32.1	0.0	0.1	54.5	9.7
R7	5.6	561.5	26.0	2.8	68.3	9.4	0.1	54.5	9.7
R8	8.7	714.3	52.0	6.8	16.4	1.9	0.1	54.5	9.7
R9	2.0	445.7	45.0	5.8	7.1	5.6	0.0	54.5	9.6
R10	1.6	225.8	45.0	5.8	11.4	5.6	0.0	54.5	9.6
R11	7.0	849.2	20.0	2.3	69.5	15.0	0.2	55.1	9.8
R12	5.9	716.5	34.0	6.4	22.3	5.6	0.2	55.1	9.8
R13	5.7	149.5	24.0	3.4	223.7	5.6	0.1	54.5	9.7
R14	6.4	75.1	5.0	1.9	725.3	24.4	0.1	54.5	9.7
R15	6.9	135.8	20.0	1.8	577.3	9.4	0.1	54.5	9.7

Receptor ID	Incremental (µg/m³)							Cumulative (µg/m³)	
	Maximum 1-Hour	*Corresponding 1-Hour* [a]					Annual	1-Hr	Annual
		NO_X (µg/m³)	O_3 (ppb)	Wind Speed (m/s)	Transport Time (s) [b]	NO_2 (µg/m³)			
R16	9.7	379.5	28.0	2.9	132.0	1.9	0.1	54.9	9.7
R17	7.3	248.0	20.0	2.3	255.0	15.0	0.2	55.8	9.8
R18	7.2	128.2	29.0	6.7	167.6	18.8	0.1	55.9	9.7
R19	10.1	202.6	20.0	2.3	434.2	15.0	0.1	55.4	9.7
R20	3.9	63.6	30.0	3.0	367.8	20.7	0.1	54.5	9.7
R21	4.2	92.7	11.0	2.5	278.4	20.7	0.1	54.6	9.7
R22	5.1	113.7	9.0	2.1	336.2	5.6	0.1	55.5	9.7
R23	8.8	311.1	11.0	2.8	151.8	13.2	0.1	54.6	9.7
R24	5.7	235.7	40.0	5.0	44.3	3.8	0.1	54.9	9.7
R25	6.5	136.3	31.0	1.6	518.8	9.6	0.1	56.2	9.7
R26	3.8	361.7	17.0	1.9	83.7	15.0	0.1	55.3	9.7
R27	8.7	1014.3	24.0	2.6	63.8	3.8	0.2	57.8	9.8
R28	5.8	393.0	43.0	5.9	22.9	1.9	0.1	54.5	9.8
R29	5.4	321.1	6.0	5.2	49.5	18.8	0.1	54.5	9.7
R30	5.7	247.2	36.0	2.7	151.7	9.4	0.2	54.5	9.8
R31	5.0	152.0	11.0	3.5	143.6	13.2	0.1	54.5	9.7
R32	6.7	280.9	24.0	3.4	138.6	5.6	0.1	54.5	9.7
R33	5.2	108.6	28.0	3.6	269.3	7.5	0.0	54.5	9.6
R34	7.9	230.9	41.0	1.6	366.5	0.0	0.1	54.5	9.7
R35	10.8	366.5	23.0	3.8	117.4	0.0	0.1	54.5	9.7
R36	4.1	221.3	41.0	5.2	32.4	3.8	0.0	54.5	9.6
R37	6.0	314.6	39.0	3.0	110.3	1.9	0.1	54.5	9.7
R38	8.2	188.8	31.0	2.7	284.2	11.3	0.1	54.5	9.7
R39	6.4	259.0	34.0	3.3	132.7	-1.9	0.1	54.5	9.7
R40	7.9	308.3	5.0	1.8	222.3	30.1	0.2	54.8	9.8
Criteria								**164**	**31**

a Used to calculate 1-hour incremental NO_2 concentration using the Method 3 (Section 7.4.3).
b Approximate plume transport time from source to receptor based on windspeed and separation distance.

8.2.3 CO

Table 29 presents the maximum incremental 15-minute, 1-hour and 8-hour average CO concentrations predicted at surrounding sensitive receptor locations along with the corresponding 15-minute, 1-hour and 8-hour average maximum background concentrations. Given the insignificant incremental increase of CO predicted at the identified receptors and the existing low background concentrations of CO (both relative to the criteria), exceedances of the relevant criteria due to the operation of the Project are not predicted.

Table 29 Maximum Predicted CO Concentrations at Modelled Receptors

Receptor ID	Increment (mg/m³)		
	15-Minute*	1-Hour	8-Hour
R1	<0.01	0.01	0.01
R2	<0.01	<0.01	0.01
R3	<0.01	<0.01	<0.01
R4	<0.01	0.01	0.01
R5	0.03	0.06	0.08
R6	0.02	0.03	0.04
R7	0.02	0.03	0.04
R8	0.03	0.06	0.07
R9	0.01	0.02	0.03
R10	<0.01	0.01	0.02
R11	0.03	0.05	0.07
R12	0.02	0.04	0.05
R13	<0.01	<0.01	0.01
R14	<0.01	<0.01	<0.01
R15	<0.01	<0.01	<0.01
R16	<0.01	0.02	0.03
R17	<0.01	0.02	0.02
R18	<0.01	<0.01	<0.01
R19	<0.01	0.01	0.02
R20	<0.01	<0.01	<0.01
R21	<0.01	<0.01	0.01
R22	<0.01	<0.01	0.01
R23	<0.01	0.02	0.03
R24	<0.01	0.02	0.02
R25	<0.01	<0.01	<0.01
R26	<0.01	0.02	0.02
R27	0.03	0.07	0.09
R28	0.02	0.02	0.03
R29	0.01	0.02	0.03
R30	<0.01	0.01	0.02
R31	<0.01	<0.01	0.01
R32	<0.01	0.01	0.02

Receptor ID	Increment (mg/m³)		
	15-Minute*	1-Hour	8-Hour
R33	<0.01	<0.01	0.01
R34	<0.01	0.01	0.02
R35	<0.01	0.02	0.02
R36	<0.01	0.01	0.02
R37	<0.01	0.02	0.02
R38	<0.01	0.01	0.02
R39	<0.01	0.01	0.02
R40	0.01	0.02	0.02
Maximum background**	3.30	2.50	1.50
Maximum cumulative impact***	3.33	2.57	1.59
Criteria	**100**	**30**	**10**

* The 1-hour average CO concentrations predicted by the modelling were converted to 15-minute averages using the power law formula.

** As ambient background data at Alexandria AQMS is incomplete for 2021, the maximum background hour and 8-hour concentrations between 2021 and 2024 has been used here for contemporaneous assessment.

*** Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.

8.2.4 SO_2

Table 30 presents the maximum incremental 1-hour and 24-hour average SO_2 concentrations predicted at surrounding sensitive receptor locations along with the maximum 1-hour and 24-hour average background concentrations for 2021. Given the insignificant incremental increase of SO_2 predicted at the identified receptors and the existing low background concentrations of SO_2 (both relative to the criteria), exceedances of the relevant criteria due to the operation of the Project are not predicted.

Table 30 Maximum Predicted SO_2 Concentrations at Modelled Receptors

Receptor ID	Increment (µg /m³)	
	1-Hour	24-Hour
R1	0.1	<0.1
R2	0.1	<0.1
R3	0.0	<0.1
R4	0.1	<0.1
R5	0.4	0.1
R6	0.2	0.1
R7	0.2	<0.1
R8	0.4	0.1
R9	0.2	<0.1

Receptor ID	Increment (µg /m³)	
	1-Hour	24-Hour
R10	0.1	<0.1
R11	0.3	0.1
R12	0.2	<0.1
R13	0.1	<0.1
R14	0.0	<0.1
R15	0.0	<0.1
R16	0.1	<0.1
R17	0.1	<0.1
R18	0.0	<0.1
R19	0.1	<0.1
R20	0.0	<0.1
R21	0.0	<0.1
R22	0.1	<0.1
R23	0.1	<0.1
R24	0.1	<0.1
R25	0.0	<0.1
R26	0.1	<0.1
R27	0.5	0.1
R28	0.2	<0.1
R29	0.1	<0.1
R30	0.1	<0.1
R31	0.1	<0.1
R32	0.1	<0.1
R33	0.1	<0.1
R34	0.1	<0.1
R35	0.1	<0.1
R36	0.1	<0.1
R37	0.1	<0.1
R38	0.1	<0.1
R39	0.1	<0.1
R40	0.1	<0.1
Maximum background	62.9	14.3
Maximum cumulative impact	63.4	14.4
Criteria	**215**	**57**
* Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.		

8.2.5 PAHs

The maximum (99.9th percentile) incremental 1-hour average PAH concentrations predicted beyond the Project boundary was 0.0000004 mg/m^3 [4] significantly less (<1%) than the criterion of 0.0004 mg/m^3. For the purposes of modelling, background PAH concentrations were assumed to be negligible. Regardless, the addition of the incremental impacts to a background concentration are not predicted to cause an exceedance.

Table 31 presents the incremental maximum 1-hour average PAH concentrations predicted at surrounding sensitive receptor locations.

Table 31 Maximum Predicted PAH Concentrations at Modelled Receptors

Receptor ID	Increment 1-hour (mg/m³) ^
R1	<0.00001
R2	<0.00001
R3	<0.00001
R4	<0.00001
R5	<0.00001
R6	<0.00001
R7	<0.00001
R8	<0.00001
R9	<0.00001
R10	<0.00001
R11	<0.00001
R12	<0.00001
R13	<0.00001
R14	<0.00001
R15	<0.00001
R16	<0.00001
R17	<0.00001
R18	<0.00001
R19	<0.00001
R20	<0.00001
R21	<0.00001
R22	<0.00001
R23	<0.00001
R24	<0.00001
R25	<0.00001

[4] UTM Coordinates: 332,069 mE 6,245,081 mS.

Receptor ID	Increment 1-hour (mg/m³) ^
R26	<0.00001
R27	<0.00001
R28	<0.00001
R29	<0.00001
R30	<0.00001
R31	<0.00001
R32	<0.00001
R33	<0.00001
R34	<0.00001
R35	<0.00001
R36	<0.00001
R37	<0.00001
R38	<0.00001
R39	<0.00001
R40	<0.00001
Criteria	**0.0004**
^ 99.9th percentile.	

8.2.6 Benzene

The maximum (99.9th percentile) incremental 1-hour average benzene concentrations predicted beyond the Project boundary was 0.00027 mg/m^3[5] significantly less (<1 %) than the criterion of 0.029 mg/m^3. For the purposes of modelling, background benzene concentrations were assumed to be negligible. Regardless, the addition of the incremental impacts to a background concentration are not predicted to cause an exceedance.

Table 31 presents the incremental maximum 1-hour average benzene concentrations predicted at surrounding sensitive receptor locations.

Table 32 Maximum Predicted PAH Concentrations at Modelled Receptors

Receptor ID	Increment 1-hour (mg/m³) ^
R1	<0.001
R2	<0.001
R3	<0.001
R4	<0.001
R5	<0.001
R6	<0.001
R7	<0.001
R8	<0.001

[5] UTM Coordinates: 332,069 mE 6,245,081 mS.

Receptor ID	Increment 1-hour (mg/m^3) ^
R9	<0.001
R10	<0.001
R11	<0.001
R12	<0.001
R13	<0.001
R14	<0.001
R15	<0.001
R16	<0.001
R17	<0.001
R18	<0.001
R19	<0.001
R20	<0.001
R21	<0.001
R22	<0.001
R23	<0.001
R24	<0.001
R25	<0.001
R26	<0.001
R27	<0.001
R28	<0.001
R29	<0.001
R30	<0.001
R31	<0.001
R32	<0.001
R33	<0.001
R34	<0.001
R35	<0.001
R36	<0.001
R37	<0.001
R38	<0.001
R39	<0.001
R40	<0.001
Criteria	**0.029**
^ 99.9^{th} percentile.	

8.2.7 Summary

The dispersion modelling study, which accounted for operational maintenance conditions (**Section 4.0**) predicted no exceedances of the relevant ambient air quality criteria as a result of the operation of the Project.

8.3 Emergency Conditions Scenario

This section presents the results of the emergency conditions dispersion modelling. Isopleth plots of predicted incremental concentrations are presented in **Appendix E**.

8.3.1 Particulates

In order to realistically assess PM_{10} and $PM_{2.5}$ emergency operation impacts against 24-hour average criterion, it is conservatively assumed that the emergency operation occurs for 24 hours of each day of the year. The daily predicted 24-hour average incremental concentrations, is added to the 24-hour average background concentration to give the equivalent cumulative 24-hour average concentration as provided in the **Table 33.**

It is noted that 1 exceedance the 24-hour average $PM_{2.5}$ Criterion were recorded by the Randwick AQMS for the modelled year (Refer **Section 6.4**).

The modelling results show that the predicted cumulative maximum 24-hour PM_{10} concentrations could potentially exceed the relevant criteria at 3 of the 40 receptors modelled. The highest impacted receptor at 59.8 µg/m³ is R5 (industrial) which has predicted 6 days of criterion exceedances.

The modelling results show that the predicted cumulative maximum 24-hour $PM_{2.5}$ concentrations could potentially exceed the relevant criteria at 23 of the 40 receptors modelled. The highest impacted receptor at 49.1 µg/m³ is R5 (industrial) which has 26 days of criterion exceedances, however R11 (residential) has the highest number of exceedances.

Table 33 Maximum Predicted 24-Hour PM Concentrations at Modelled Receptors

Receptor ID	Daily 1-hour emergency operation				
	Maximum 24-Hour Incremental Concentration (µg/m³)	Maximum Cumulative 24-Hour Average Concentration (µg/m³) [b]		Additional Exceedances as Result of Project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R1	5.7	37.6	31.3	0	0
R2	4.4	37.6	31.2	0	0
R3	2.1	37.6	31.2	0	0
R4	6.5	38.0	31.2	0	0
R5	36.7	59.8	49.1	6	26
R6	27.3	43.3	31.5	0	3
R7	25.0	41.0	31.2	0	2
R8	35.6	57.2	45.6	5	21
R9	14.6	46.0	33.3	0	1
R10	5.6	38.0	31.2	0	0
R11	33.9	47.6	39.2	0	37

Receptor ID	Daily 1-hour emergency operation				
	Maximum 24-Hour Incremental Concentration (µg/m³)	Maximum Cumulative 24-Hour Average Concentration (µg/m³) [b]		Additional Exceedances as Result of Project [a]	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
R12	18.2	41.1	33.5	0	4
R13	5.6	41.3	33.2	0	2
R14	1.9	37.6	31.2	0	0
R15	4.1	38.5	31.2	0	0
R16	11.7	40.2	37.4	0	3
R17	9.4	38.2	33.0	0	2
R18	4.2	37.9	32.3	0	2
R19	5.0	37.7	31.9	0	1
R20	2.3	37.6	31.2	0	0
R21	4.7	38.3	32.7	0	2
R22	6.6	38.7	34.7	0	2
R23	9.5	39.0	33.9	0	2
R24	9.2	40.5	36.1	0	2
R25	5.3	38.1	33.1	0	2
R26	10.2	39.8	35.2	0	2
R27	27.4	52.2	45.7	1	28
R28	19.0	44.2	36.0	0	2
R29	10.6	37.7	31.2	0	0
R30	11.1	41.0	33.8	0	1
R31	7.8	37.6	31.2	0	0
R32	10.2	42.0	34.6	0	2
R33	2.9	37.6	31.2	0	0
R34	5.3	37.6	31.2	0	0
R35	11.2	37.6	31.2	0	0
R36	5.5	38.3	31.2	0	0
R37	10.1	41.7	31.4	0	0
R38	3.3	37.8	31.3	0	0
R39	7.5	38.2	31.2	0	0
R40	11.5	37.8	31.5	0	2
Criteria		**50**	**25**		

a Over and above background, for which four exceedances are recorded.

b Equal to the maximum 1-hour incremental concentration divided by 24, plus corresponding background 24-hour average on that day.

8.3.2 NO_2

Table 35 presents the maximum incremental and cumulative 1-hour average NO_2 concentrations predicted at modelled receptor locations.

The modelling results show that the predicted cumulative maximum 1-hour NO_2 concentrations could potentially exceed the relevant criteria at 34 of the 40 receptors modelled. The highest impacted receptor at 773.2 µg/m³ is R11 (residential) which has 55 hours of criterion exceedances, however R4 (park) has the most exceedances at 152 hours.

Table 34 Maximum Predicted NO_2 Concentrations at Sensitive Receptors

Receptor ID	Incremental (µg/m³)							Cumulative (µg/m³)	
	Maximum 1-Hour	*Corresponding 1-Hour* [a]					Annual	1-Hour	Annual
		NO_X (µg/m³)	O_3 (ppb)	Wind Speed (m/s)	Transport Time (s) [b]	NO_2 (µg/m³)			
R1	452.2	8651.5	1.0	2.9	281.0	30.1	9.8	482.3	19.4
R2	497.2	6692.3	32.0	2.5	462.7	0.0	5.0	497.2	14.6
R3	460.4	4115.2	18.0	2.2	838.0	0.0	3.2	460.4	12.8
R4	421.5	9266.3	32.0	5.5	127.8	1.9	11.2	423.4	20.8
R5	199.8	31509.8	0.0	2.5	38.6	9.6	9.5	209.8	19.1
R6	165.7	14508.8	10.0	4.6	37.5	13.2	8.5	178.9	18.1
R7	176.8	13788.2	22.0	4.1	46.9	7.5	9.0	186.0	18.6
R8	261.3	21343.8	52.0	6.8	16.4	1.9	10.3	263.2	19.9
R9	70.4	15451.4	45.0	5.8	7.1	5.6	2.2	76.1	11.8
R10	58.5	8089.8	45.0	5.8	11.4	5.6	0.7	64.2	10.3
R11	763.6	72157.3	0.0	1.2	128.4	9.6	16.4	773.2	26.0
R12	143.1	17233.0	34.0	6.4	22.3	5.6	8.5	159.7	18.1
R13	458.4	9446.1	18.0	1.4	552.8	0.0	11.8	458.4	21.4
R14	412.8	4833.3	0.0	1.2	1099.6	9.6	6.4	422.4	16.0
R15	345.9	5372.8	0.0	2.7	375.6	9.6	10.0	359.9	19.6
R16	299.3	11735.5	0.0	1.3	300.8	9.6	12.2	318.0	21.8
R17	420.4	11062.2	2.0	2.0	294.9	18.8	14.3	439.2	23.9
R18	399.3	5625.9	0.0	2.3	493.3	9.6	11.5	422.7	21.1
R19	518.0	8168.4	2.0	2.0	502.2	18.8	11.0	536.8	20.6
R20	378.2	5437.6	2.0	1.6	676.6	22.6	6.7	400.8	16.3
R21	280.8	6139.1	3.0	1.8	397.2	18.8	7.5	299.6	17.2
R22	254.9	5684.9	2.0	2.5	275.9	37.6	10.2	292.5	19.8
R23	427.3	15162.7	0.0	1.9	223.8	9.6	9.6	437.5	19.2
R24	141.9	5822.3	40.0	5.0	44.3	3.8	7.0	145.6	16.6
R25	369.7	6805.5	0.0	1.8	480.4	9.6	12.6	379.3	22.2
R26	88.0	9580.8	32.0	5.4	29.4	0.0	5.9	97.9	15.5

Receptor ID	Incremental (µg/m³)							Cumulative (µg/m³)	
	Maximum 1-Hour	*Corresponding 1-Hour* [a]					Annual	1-Hour	Annual
		NO_x (µg/m³)	O_3 (ppb)	Wind Speed (m/s)	Transport Time (s) [b]	NO_2 (µg/m³)			
R27	213.6	19224.0	0.0	1.2	141.7	9.6	15.3	223.2	24.9
R28	182.4	12300.7	43.0	5.9	22.9	1.9	8.4	187.2	18.0
R29	150.9	8909.2	10.0	4.9	51.9	11.3	6.0	166.9	15.6
R30	348.8	13118.3	0.0	1.2	331.9	9.6	12.0	358.4	21.6
R31	239.7	7315.7	1.0	1.9	269.5	18.8	9.3	258.5	18.9
R32	335.4	12021.3	46.0	1.7	267.6	22.6	11.7	358.0	21.3
R33	362.9	5924.0	7.0	2.0	481.8	20.7	5.2	383.6	14.8
R34	219.1	5884.2	19.0	2.4	239.2	-1.9	4.0	217.2	13.6
R35	416.5	12766.4	45.0	2.9	155.0	-1.9	4.6	414.7	14.2
R36	144.5	7777.6	41.0	5.2	32.4	3.8	2.0	148.3	11.6
R37	159.7	7300.1	21.0	2.8	119.9	-1.9	5.8	165.3	15.4
R38	308.7	6238.1	18.0	2.2	350.3	0.0	5.6	308.7	15.2
R39	229.1	8097.4	0.0	3.8	113.8	9.6	7.4	238.7	17.0
R40	278.0	10876.2	1.0	0.6	707.3	33.8	14.7	311.9	24.3
Criteria								**164**	**31**

a Used to calculate 1-hour incremental NO_2 concentration using the Method 3 (Section 7.4.3).
b Approximate plume transport time from source to receptor based on windspeed and separation distance.

8.3.3 CO

Table 35 presents the maximum incremental 15-minute, 1-hour and 8-hour average CO concentrations predicted at surrounding sensitive receptor locations along with the maximum 15-minute, 1-hour and 8-hour average maximum background concentrations. Given the insignificant incremental increase of CO predicted at the identified receptors and the existing low concentrations of background CO (both relative to the criteria), exceedances of the relevant criteria due to the operation of the Project are not predicted.

Table 35 Predicted CO Concentrations at Sensitive Receptors

Receptor ID	Increment (mg/m³)		
	15-Minute*	1-Hour	8-Hour
R1	0.21	0.51	0.68
R2	0.23	0.41	0.54
R3	0.09	0.22	0.29
R4	0.28	0.48	0.63
R5	1.06	1.63	2.15
R6	0.60	0.80	1.06
R7	0.55	0.75	0.99

Receptor ID	Increment (mg/m³)		
	15-Minute*	1-Hour	8-Hour
R8	1.10	1.51	2.00
R9	0.63	0.98	1.30
R10	0.25	0.53	0.70
R11	1.32	4.02	5.31
R12	0.68	0.91	1.20
R13	0.25	0.49	0.64
R14	0.13	0.31	0.41
R15	0.20	0.29	0.39
R16	0.40	0.62	0.82
R17	0.38	0.59	0.78
R18	0.20	0.38	0.50
R19	0.22	0.45	0.59
R20	0.12	0.32	0.42
R21	0.18	0.33	0.44
R22	0.23	0.43	0.56
R23	0.48	0.90	1.19
R24	0.27	0.44	0.57
R25	0.25	0.42	0.55
R26	0.28	0.51	0.67
R27	0.74	1.17	1.54
R28	0.64	0.82	1.08
R29	0.32	0.54	0.71
R30	0.34	0.68	0.89
R31	0.23	0.38	0.50
R32	0.37	0.62	0.82
R33	0.14	0.36	0.48
R34	0.18	0.43	0.56
R35	0.36	0.66	0.87
R36	0.22	0.44	0.57
R37	0.32	0.38	0.50
R38	0.17	0.39	0.52
R39	0.25	0.42	0.55
R40	0.40	0.74	0.98
Maximum background **	3.30	2.50	1.50

Receptor ID	Increment (mg/m^3)		
	15-Minute*	1-Hour	8-Hour
Maximum cumulative impact***	4.62	6.52	6.81
Criteria	**100**	**30**	**10**
* The 1-hour average CO concentrations predicted by the modelling were converted to 15-minute averages using the power law formula. ** As ambient background data at Alexandria AQMS is incomplete for 2021, the maximum background hour and 8-hour concentrations between 2021 and 2024 has been used here for contemporaneous assessment. *** Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.			

8.3.4 SO_2

Table 36 presents the maximum incremental 1-hour average SO_2 concentrations predicted at surrounding sensitive receptor locations along with the maximum 1-hour average background concentrations for 2021. Given the insignificant incremental increase of SO_2 predicted at the identified receptors and the existing low concentrations of background SO_2 (both relative to the criteria), exceedances of the relevant criteria due to the operation of the Project are not predicted.

Table 36 Predicted SO_2 Concentrations at Residential Receptors

Receptor ID	Increment 1-Hour (µg/m³)	Increment 24-Hour (µg/m³)
R1	3.3	0.8
R2	2.6	0.6
R3	1.4	0.3
R4	3.1	0.9
R5	10.4	4.9
R6	5.1	3.7
R7	4.8	3.4
R8	9.7	4.8
R9	6.3	2.0
R10	3.4	0.8
R11	25.7	4.5
R12	5.8	2.4
R13	3.1	0.7
R14	2.0	0.3
R15	1.9	0.5
R16	4.0	1.6
R17	3.8	1.3
R18	2.4	0.6
R19	2.9	0.7

Receptor ID	Increment 1-Hour (µg/m³)	Increment 24-Hour (µg/m³)
R20	2.0	0.3
R21	2.1	0.6
R22	2.7	0.9
R23	5.8	1.3
R24	2.8	1.2
R25	2.7	0.7
R26	3.3	1.4
R27	7.4	3.7
R28	5.2	2.5
R29	3.4	1.4
R30	4.3	1.5
R31	2.4	1.1
R32	4.0	1.4
R33	2.3	0.4
R34	2.7	0.7
R35	4.2	1.5
R36	2.8	0.7
R37	2.4	1.4
R38	2.5	0.4
R39	2.7	1.0
R40	4.7	1.5
Maximum background	62.9	14.3
Maximum cumulative impact	88.6	19.2
Criteria	**215**	**57**
* Conservatively calculated from the maximum incremental and maximum background, noting that these do not necessarily occur at the same time.		

8.3.5 PAHs

The maximum (99.9th percentile) incremental 1-hour average PAH ground level concentrations predicted beyond the Site boundary was 0.000015 mg/m^3[6], less (<3.8%) than the criterion of 0.0004 mg/m^3. For the purposes of modelling, background PAH concentrations were assumed to be negligible. Regardless, the addition of the incremental impacts to a background concentration are not predicted to cause an exceedance.

Table 37 presents the incremental maximum 1-hour average PAH concentrations predicted at surrounding sensitive receptor locations.

[6] UTM Coordinates: 332,219 mE 6,245,144 mS.

Table 37 Predicted PAH Concentrations at Residential Receptors

Receptor id	Increment 1-Hour (mg/m^3) ^
R1	<0.00001
R2	<0.00001
R3	<0.00001
R4	<0.00001
R5	<0.00001
R6	<0.00001
R7	<0.00001
R8	<0.00001
R9	<0.00001
R10	<0.00001
R11	<0.00001
R12	<0.00001
R13	<0.00001
R14	<0.00001
R15	<0.00001
R16	<0.00001
R17	<0.00001
R18	<0.00001
R19	<0.00001
R20	<0.00001
R21	<0.00001
R22	<0.00001
R23	<0.00001
R24	<0.00001
R25	<0.00001
R26	<0.00001
R27	<0.00001
R28	<0.00001
R29	<0.00001
R30	<0.00001
R31	<0.00001
R32	<0.00001
R33	<0.00001
R34	<0.00001
R35	<0.00001

Receptor id	Increment 1-Hour (mg/m³) ^
R36	<0.00001
R37	<0.00001
R38	<0.00001
R39	<0.00001
R40	<0.00001
R41	<0.00001
R42	<0.00001
Criteria	**0.0004**
^ 99.9th percentile.	

8.3.6 Benzene

The maximum (99.9th percentile) incremental 1-hour average benzene concentrations predicted beyond the Project boundary was 0.010 mg/m^3 [7], less (<36%) than the criterion of 0.029 mg/m^3. For the purposes of modelling, background benzene concentrations were assumed to be negligible. Regardless, the addition of the incremental impacts to a background concentration are not predicted to cause an exceedance.

Table 31 presents the incremental maximum 1-hour average benzene concentrations predicted at surrounding sensitive receptor locations.

Table 38 Maximum Predicted PAH Concentrations at Modelled Receptors

Receptor ID	Increment 1-hour (mg/m³) ^
R1	0.002
R2	0.001
R3	<0.001
R4	0.001
R5	0.005
R6	0.002
R7	0.002
R8	0.005
R9	0.003
R10	0.002
R11	0.010
R12	0.003
R13	0.001
R14	<0.001
R15	<0.001

[7] UTM Coordinates: 332,219 mE 6,245,144 mS.

Receptor ID	Increment 1-hour (mg/m³) ^
R16	0.002
R17	0.002
R18	<0.001
R19	0.001
R20	<0.001
R21	<0.001
R22	0.001
R23	0.003
R24	0.001
R25	0.001
R26	0.001
R27	0.003
R28	0.003
R29	0.002
R30	0.002
R31	0.001
R32	0.002
R33	<0.001
R34	0.001
R35	0.001
R36	0.001
R37	0.001
R38	<0.001
R39	0.001
R40	0.002
Criteria	**0.029**
^ 99.9th percentile.	

8.3.7 Summary

The dispersion modelling study, which accounted for the emergency conditions (all generators running) every hour of the year predicted no exceedances of the CO, SO_2, PAH or benzene ambient air quality criteria. Exceedances of the 24 hour PM_{10}, $PM_{2.5}$ and hourly NO_2 criteria were predicted.

At the time of writing, information on the historical power interruptions at the Site is unavailable. A study conducted by SLR for a similar facility in Eastern Creek observed the following for that site:

- The site had two power interruptions in the past ten years.
- Each interruption consisted of the loss of one of four feeder supplies.

- The two interruptions lasted for 13 minutes and 21 minutes, respectively.
- Loss of one feeder to that site did not require all generators to be used to provide emergency power.

Assuming that the performance of the future network supplying the power is similar to the existing network performance, it can be concluded that the actual likelihood of an exceedance of the air quality criteria at nearby sensitive receptors due to the emergency operation of the Project is negligible.

The model predictions of the emergency conditions presented above include a number of conservative assumptions. Each assumption has an associated likelihood of occurring, which when factored together with the likelihood of the necessary meteorological and air quality conditions, indicates a much-reduced likelihood of an exceedance of the criterion at one or more of the nearest sensitive receptors.

The conservative assumptions for the emergency conditions include:

1 Loss of primary power supply to the Site.
2 Loss of primary and secondary power supply to the Site concurrently.
3 Loss of feeder supply to the Site for at least one hour (NO_2) or 24 hours (PM_{10}/$PM_{2.5}$)

Below discusses the likelihood of exceedances for NO_2 and PM_{10}/$PM_{2.5}$.

Likelihood of exceedance - PM_{10} and $PM_{2.5}$

To provide comprehensive worst-case assessment as requested, the emergency conditions with operation of all backup generators were modelled for every hour of the year to account for all meteorological and background air quality conditions. Exceedances are only predicted for a number of meteorological and background air quality conditions that occur throughout the year.

When assessed conservatively assuming that emergency operation occurs every hour of the day, up to 6 exceedances of the 24-hour average PM_{10} were predicted at 3 of the 40 receptors modelled and up to 37 exceedances of the 24-hour average $PM_{2.5}$ were predicted at 23 of the 40 receptors modelled.

This scenario is a conservative over estimate as it is extremely unlikely that all diesel generators would be operational for 24-hours. However, if an emergency condition event lasting up to 24 hours is conservatively assumed to occur once every 10 years, the likelihood of that emergency condition resulting in a predicted exceedance of the criteria (for the most impacted receptor) for $PM_{2.5}$ would be (37days / 3650 days) x (1day / 3650 days) = 0.0002% (1 in 3600 chances of exceedance, or once in 10 years).

Likelihood of exceedance - NO_2

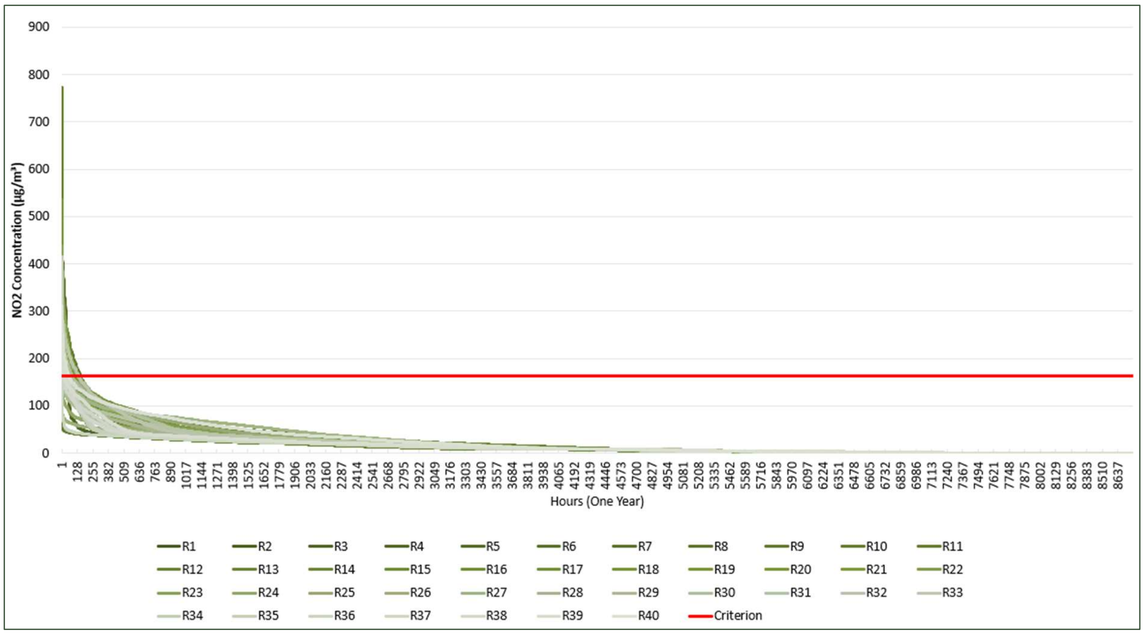
When assessed conservatively assuming that emergency operation occurs every hour of the day, up to 152 exceedances of the 1-hour average NO_2 criterion were predicted at 34 of the 40 receptors modelled.

However, assuming the more realistic situation of one emergency operation event lasting 1 hour, occurring once per year (rather than every day), the likelihood of NO_2 exceedances at this receptor is equivalent to 1 exceedance every 8,760 hours (1 year).

If an emergency condition event lasting less than 1 hour is conservatively assumed to occur once per year, every year, the likelihood of that emergency condition resulting in a predicted exceedance of the criteria (for the most impacted receptor) would be (152h / 8,760h) x (1h / 8,760h) = 0.0002% (1 in 500,000 chances of exceedance, or once in 58 years).

Figure 21 presents a plot of the predicted cumulative impacts (for sensitive receptors with exceedances of the criterion) during one year in descending order of hours of exceedance. The receptor with the most predicted hours exceedance of the criterion is R4 with 1.735% of the hours in the year.

Figure 21 Predicted 1-Hour NO_2 Cumulative Concentrations at Sensitive Receptors With Exceedances of the Criterion: 1-Hour Runtime, Every Hour of the Year



9.0 Air Quality Monitoring and Mitigation Measures

Given the nature and scale of the proposed standard operation test activities, with predicted ground level concentrations within the assessment criteria limits it is not anticipated that any impacts upon human health or amenity values would be experienced during the operational phase. Therefore, monitoring of air quality is not considered to be required during the operational phase.

The emergency conditions scenario, based on a number of cumulative assumptions, does show exceedances, however, considering the nature of these results and the conclusion regarding the normal operations above, the results from the worst-case operations scenario does not justify the need for any monitoring.

Given the worst-case operating scenario modelled predicted concentrations below all relevant air quality impact assessment criteria, and the low probability of exceedances due to emergency conditions, additional mitigation measures are not deemed necessary to comply with assessment criteria.

10.0 Conclusions

The main potential sources of air emissions were identified as suspended particulate matter and deposited dust during the construction stage and combustion gases and particulate matter during the operational stage of the Project.

The potential for off-site air quality impacts during the construction stage of the Project were assessed using a qualitative risk-based approach, concluding that given the nature of the operations proposed, the location of the Site and the local meteorological conditions, exceedances of the relevant air quality criteria are unlikely, assuming appropriate mitigation measures are implemented.

The potential for off-site air quality impacts during the operational stage of the Project were conservatively assessed quantitatively using dispersion modelling techniques in general accordance with the Approved Methods. The dispersion modelling study, which accounted for worst-case testing conditions predicted no exceedance of the relevant ambient air quality as a result of the operation of the Project.

The dispersion of emissions due to emergency conditions, where loss of all grid power to the Site requiring all generators to operate simultaneously, was conservatively modelled and predicted compliance with relevant PM_{10}, CO, SO_2 , PAHs, and Benzene criteria. Exceedances of the 1-hour average NO_2criterion were predicted for 34 of the 40 receptors modelled. However, the predicted low likelihood of an exceedance coupled with the low likelihood of an emergency condition event happening was demonstrated to result in a very low risk of an exceedance occurring.

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Appendix A Sydney Airport AMO Meterological Analysis (Selection Of Representative Meteorological Data)

Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.031795.00001

27 May 2025

A.1 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 Sydney Airport AMO (2019 to 2023 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 2019 to 2023 is summarised in **Figure A1** to **Figure A3**. Examination of the data indicates the following:

- **Figure A1** indicates a higher frequency of winds from the north-northwest quadrant in 2021, similar to the most recent year 2023, which would blow emissions from the Project towards the nearest residential sensitive receptors.
- **Figure A2** indicates that average monthly wind speeds during 2021 typically below the 5-year average wind speeds which would lead to less effective dispersion of pollutants (ie more conservative).
- **Figure A3** shows that temperatures for all years generally reflect the 5-year average.

Given the above, the year 2021 was selected as the representative year of meteorology.

Figure C1 Frequency of Winds at Horsley Park Equestrian Centre AWS for 2019 – 2023

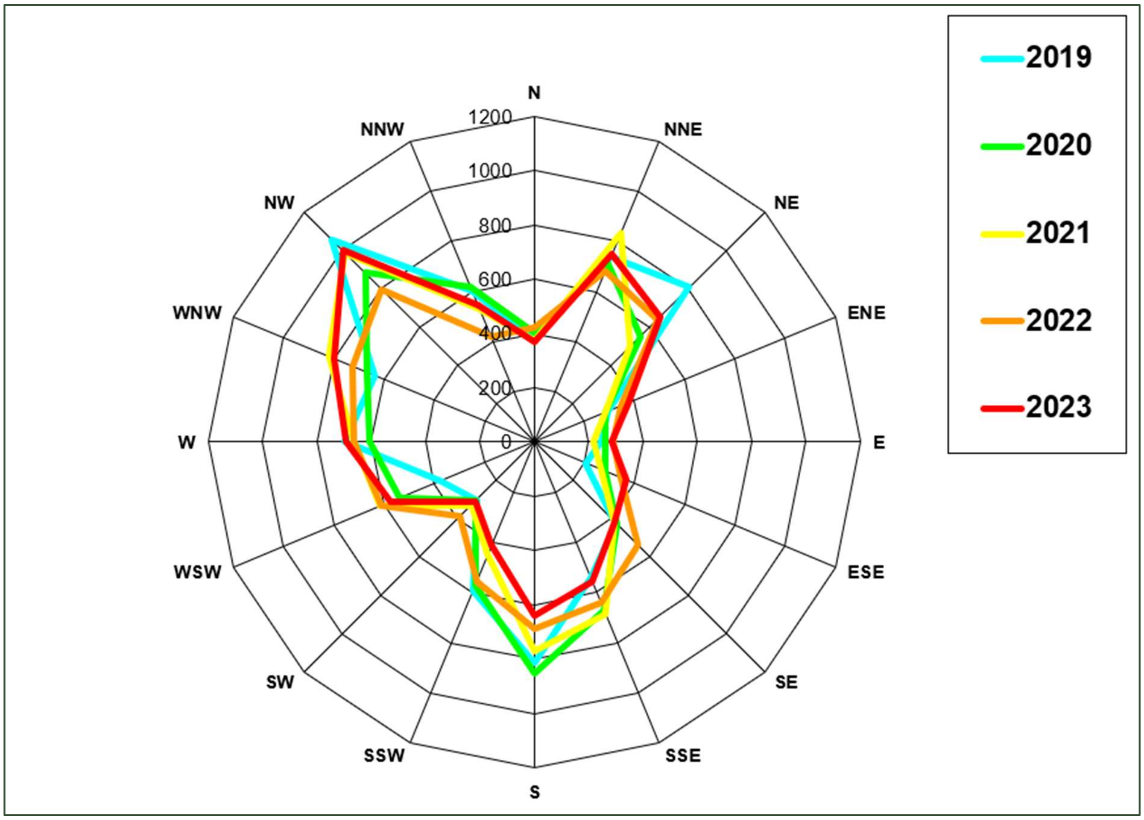


Figure A2 Monthly Average Wind Speed at Horsley Park Equestrian Centre AWS for 2019 – 2023

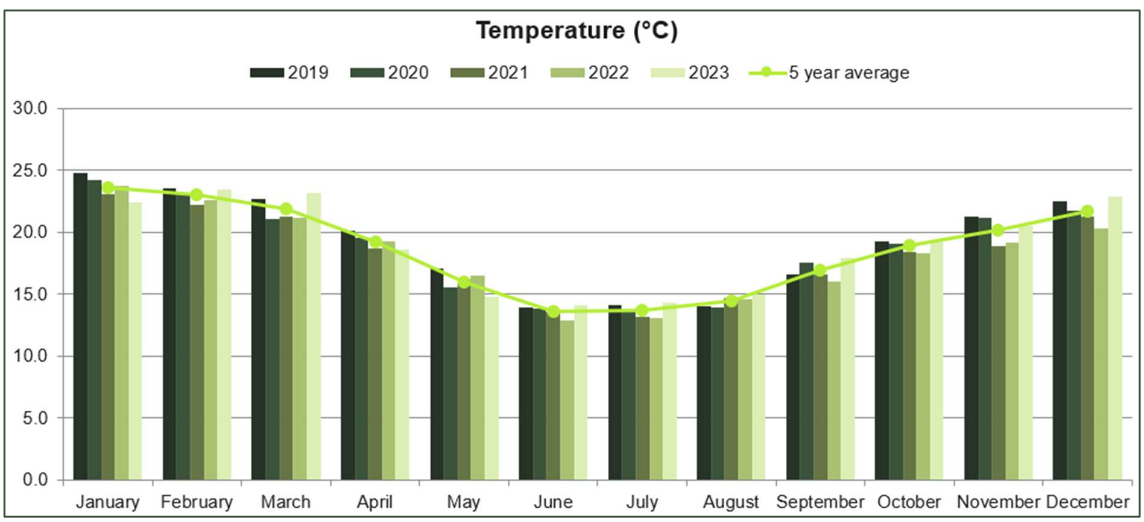
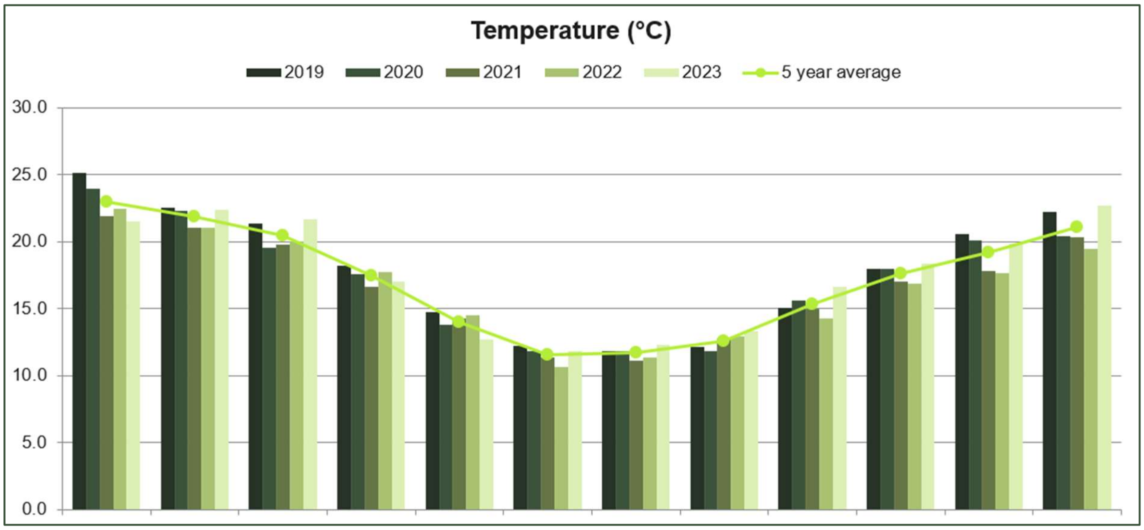


Figure A3 Monthly Average Temperature at Horsley Park Equestrian Centre AWS for 2019 – 2023



Appendix B IAQM Construction Assessment Methodology

Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.031795.00001

27 May 2025

Construction Phase Risk Assessment Methodology

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 m^3, 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 m^3 – 75,000 m^3, potentially dusty construction material, demolition activities 6-12 m above ground level.
  - **Small**: Total building volume less than12,000 m^3, 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 m^2, 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 m^2 to 110,000 m^2, 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 m^2, 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 m^3, on site concrete batching; sandblasting.
    - **Medium**: Total building volume 12,000 m^3 to 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
    - **Small**: Total building volume less than 12,000 m^3, 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 PM_{10}, 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 B-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.
	Examples: Dwellings, museums other culturally important collections, medium and long term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	• Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (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 PM_{10} (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.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}.*	*Examples: Public footpaths, playing fields, parks and shopping streets.*
Ecological	• Locations that support International or National (EPBC) level species or ecological communities of conservation significance that may be affected by dust soiling; or	• Locations that support National or State level 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	• Locations that support State or Local Government level species of conservational significance where the features may be affected by dust deposition.

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
	• 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).	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.	• 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.
	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.	*Examples: Threatened or Priority Ecological Communities that are sensitive to dust by inhibiting photosynthesis and respiration of species.*	*Examples: a local Nature Reserve with dust sensitive vegetation communities.*

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 PM_{10} 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 B-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 PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} 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/m^3 for PM_{10}) 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 B-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/m³	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	21-25 µg/m³	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	17-21 µg/m³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<17 µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>25 µg/m³	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	21-25 µg/m³	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	17-21 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<17 µg/m³	>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 B-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 B-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 B-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 B-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 B-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 C CALMET Meteoroloigical Data Overview

Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.031795.00001

27 May 2025

C.1 Wind Speed and Direction

Table C1 outlines the wind scale used to describe wind speed.

Table C1 Wind Scale Descriptions

Description	km/h	m/s	Description on land
Calm	0-1.8	0-0.5	Smoke rises vertically
Light air	1.8-5.5	0.5-1.5	Smoke drift indicates wind direction
Light breeze	5.4-10.8	1.5-3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
Gentle breeze	10.8-19.8	3-5.5	Leaves and small twigs in constant motion; light flags extended.
Moderate winds	19.8-28.8	5.5-8.0	Raises dust and loose paper, small branches are moved
Fresh winds	28.8-37.8	8.0-10.5	Small trees in leaf begin to sway, crested wavelets form on inland waters
Strong winds	>37.8	>10.5	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

A summary of the predicted TAPM/CALMET annual wind speed frequency is provided in **Figure C1** and a summary of annual wind behaviour predicted for the Project site is presented in **Figure C2**. Based on the model predictions, the Project site experienced calm winds 0.8% of the time, and majority of winds will be gentle to moderate winds (between 3 m/s and 8 m/s), from all directions but with fewer winds from the northwest and east quadrants. Annually the prevailing wind direction is north-westerly.

The seasonal wind roses indicate that in summer, winds from the northeastern and southeastern quadrants are predominant. In autumn, winds blow from all directions with the highest frequency from the northeastern quadrant. Winter sees a stronger predominance from the northwestern quadrant while in spring winds predominantly blow from the northeastern and southeastern quadrants.

Figure C1: Wind Speed Frequency Chart

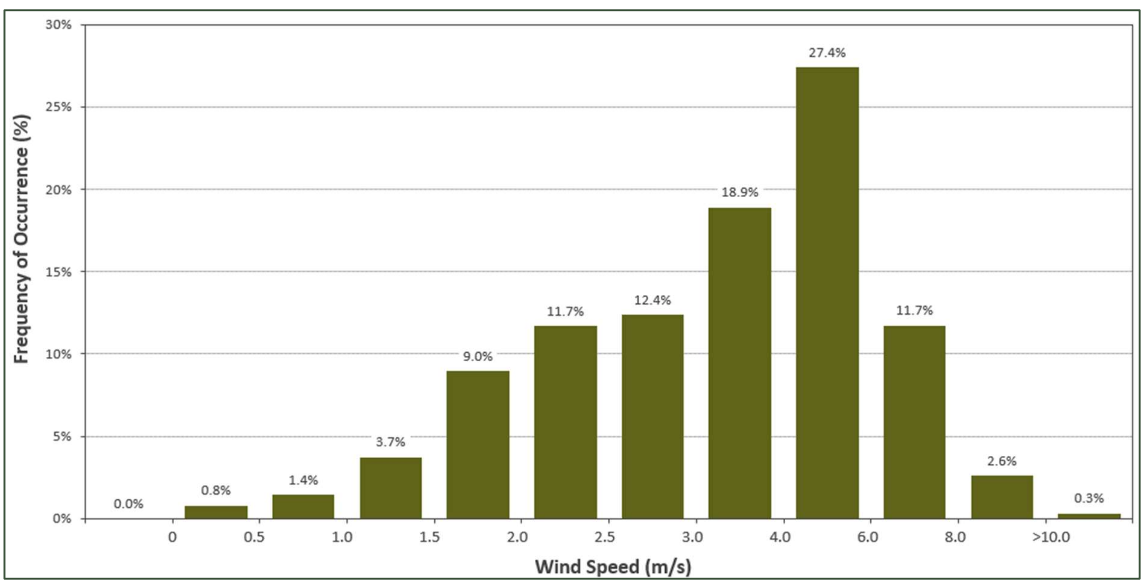
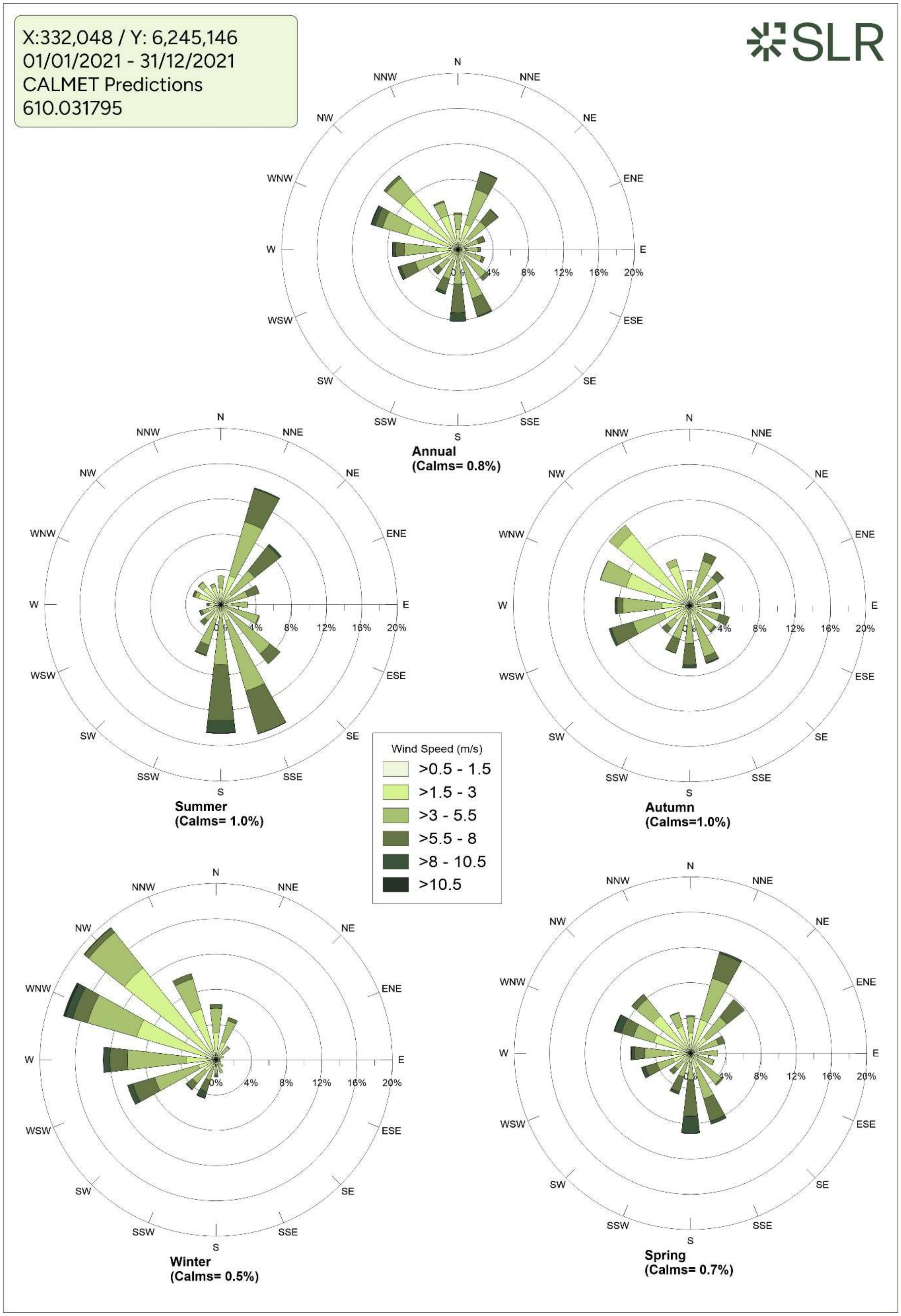


Figure C2 Wind Roses for the Project Site, as Predicted by CALMET



C.2 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 in **Table C2**

Table C2 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.

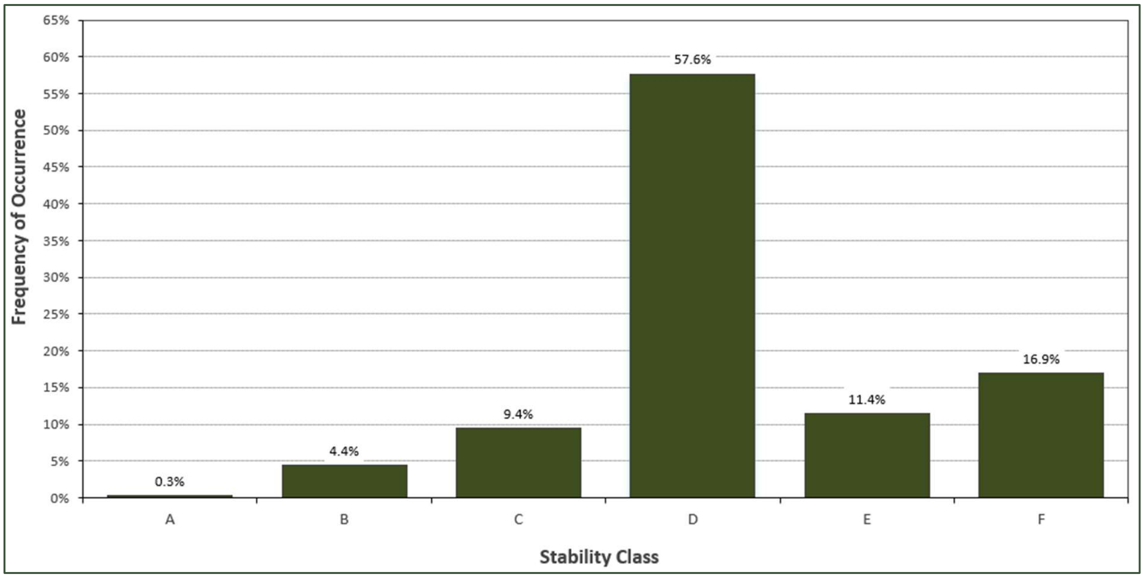
Night refers to the period from 1 hour before sunset to 1 hour after sunrise.

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 Project site during 2021 is presented in **Figure C3**. The results indicate a high frequency of conditions typical to Stability Class D (Neutral), with a low frequency of very unstable conditions (Stability Class A) and Slightly stable conditions (Stability Class E). Moderately stable conditions (Stability Class F) also occur relatively frequently. Stable conditions occur during the night-time, under low wind speed conditions, which inhibit pollutant dispersion.

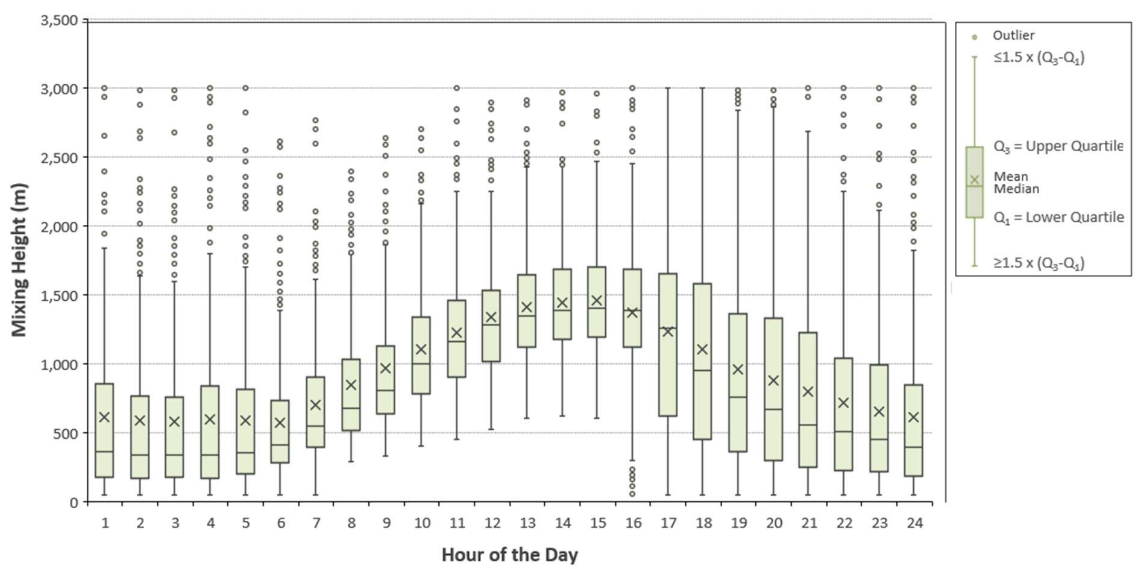
Figure C3 Stability Class Distribution for the Project Site, as Predicted by CALMET



C.3 Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Project site are illustrated in **Figure B3**. 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 B-3 Mixing Heights for the Project Site, as Predicted by CALMET



Appendix D Deisel Generator Specification Sheets

Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.031795.00001

27 May 2025

ROLLS ROYCE

mtu A Rolls-Royce solution

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G24F				
Fuel type	EN590				
Application Group	3B, 3E, 3F, 3G				
Legislative body	Fuel-consumption optimized				
Test cycle	D2 + 110%				
Fuel sulphur content [ppm]	5				
mg/mN^3 values base on residual oxygen value of [%]	5				

Not to exceed emission values*

Cycle point	[-]	n1	n2	n3	n4	n5	n6
Power	kW	2670	2420	1815	1210	605	242
Power relative	[-]	1.1	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1	1
NO_X concentration corr. (5% O_2)	ppm		2701	2426	1614	1384	2157
Carbon monoxide (CO) (5% O_2)	ppm		250	167	249	663	1545
Hydrocarbon (HC) (5% O_2)	ppm		123	131	180	358	1249
Formaldehyde (HCHO) (5% O_2)	ppm		10	9	11	23	92
NO_X mass flow	kg/h		39.39	26.74	12.3	5.86	4.78
CO mass flow	kg/h		2.04	1.03	1.08	1.62	2.02
HC_1 mass flow	kg/h		0.54	0.44	0.41	0.46	0.84
NO_X+HC_1 mass flow	kg/h		39.94	27.18	12.72	6.32	5.62

PDF	Name	Project no.	Size
Configurator	Theiss, Sandro (TVMG)	Order no.	A4
Approver1	Kneifel, Alexander (TSLE)	EDS-ID	
Approver2	Koliwer, Michael (TV)	2598-03.05.2023	
Approver3			
Approver4			
User	FN2\hummerj	Title	
Engine model	20V4000G24F	Emission data sheet	

Description of Revision | Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: 420_G_020_bearbeitet.nc.nc2 for 1208 in EDS platfrom.

Configuration-ID 1208	Documentation	Emissionstage Fuel-consumption optimized	Sheet
		Emissionstage basis Fuel-consumption optimized	of

PM mass flow	kg/h		0.093	0.147	0.109	0.196	0.465
NO_X-Emissions specific	g/kWh		16.28	14.73	10.17	9.68	19.77
CO-Emissions specific	g/kWh		0.84	0.57	0.89	2.68	8.34
HC_1-Emissions specific	g/kWh		0.22	0.24	0.34	0.76	3.46
NO_X+HC_1-Emissions specific	g/kWh		16.5	14.97	10.51	10.44	23.23
PM-Emissions specific (Meas.)	g/kWh		0.04	0.084	0.094	0.338	2.001
NO_X-Emissions (based on $_5$% O_2)	mg/m^3N		6025	5486	3641	3096	4684
	ppmV		3242	2922	1935	1634	2490
CO-Emissions (based on $_5$% O_2)	mg/m^3N		313	208	312	828	1931
HC_1-Emissions (based on $_5$% O_2)	mg/m^3N		83	88	120	234	800
NO_X+HC_1-Emissions (based on $_5$% O_2)	mg/m^3N		6108	5574	3761	3330	5484
PM-Emissions (based on $_5$% O_2)	mg/m^3N		14.9	30.8	32.7	104.5	463.6
Dust (meas. O_2)	mg/m^3N		4.2	9.1	15.1	39.6	100.6

PDF	Name	Project no.	Size
Configurator	Theiss, Sandro (TVMG)	Order no.	A4
Approver1	Knellel, Alexander (TSLE)	EDS-ID	
Approver2	Koliwer, Michael (TV)	2598-03.05.2023	
Approver3			
Approver4			
User	FN2\hummerj		

Description of Revision | Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: 420_G_020_bearbeitet.nc.nc2 for 1208 in EDS platfrom.

Engine model
20V4000G24F

Title
Emission data sheet

Emissionstage
Fuel-consumption optimized

Sheet

of

Configuration-ID
1208

Documentation

Emissionstage basis
Fuel-consumption optimized

Appendix E Incremental Isopleth Plots

Air Quality Impact Assessment

Data Centre: 2 & 10-22 Kent Road, and 685 Gardeners Road, Mascot

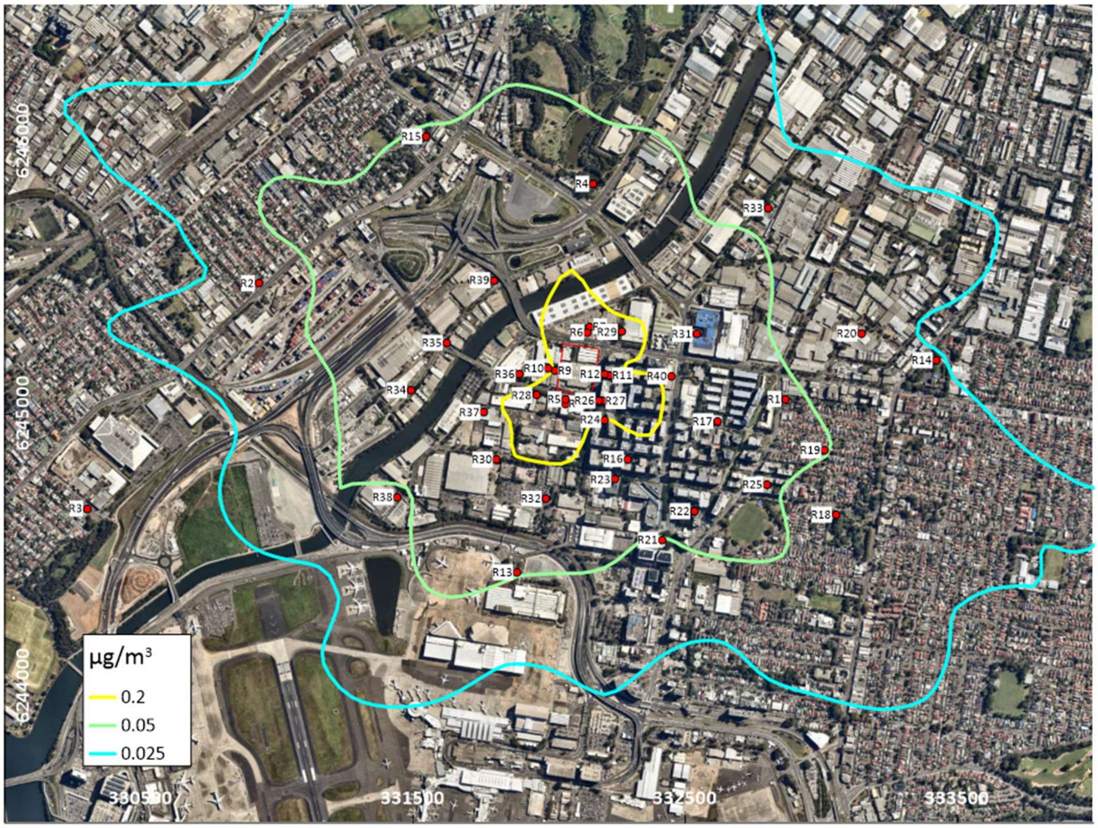
Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.031795.00001

27 May 2025

E.1 Operational Isopleth plots

Figure E 1 Predicted 24-hour Average Incremental Particulates Isopleth Plot – Operations



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Date:	27/05/2025

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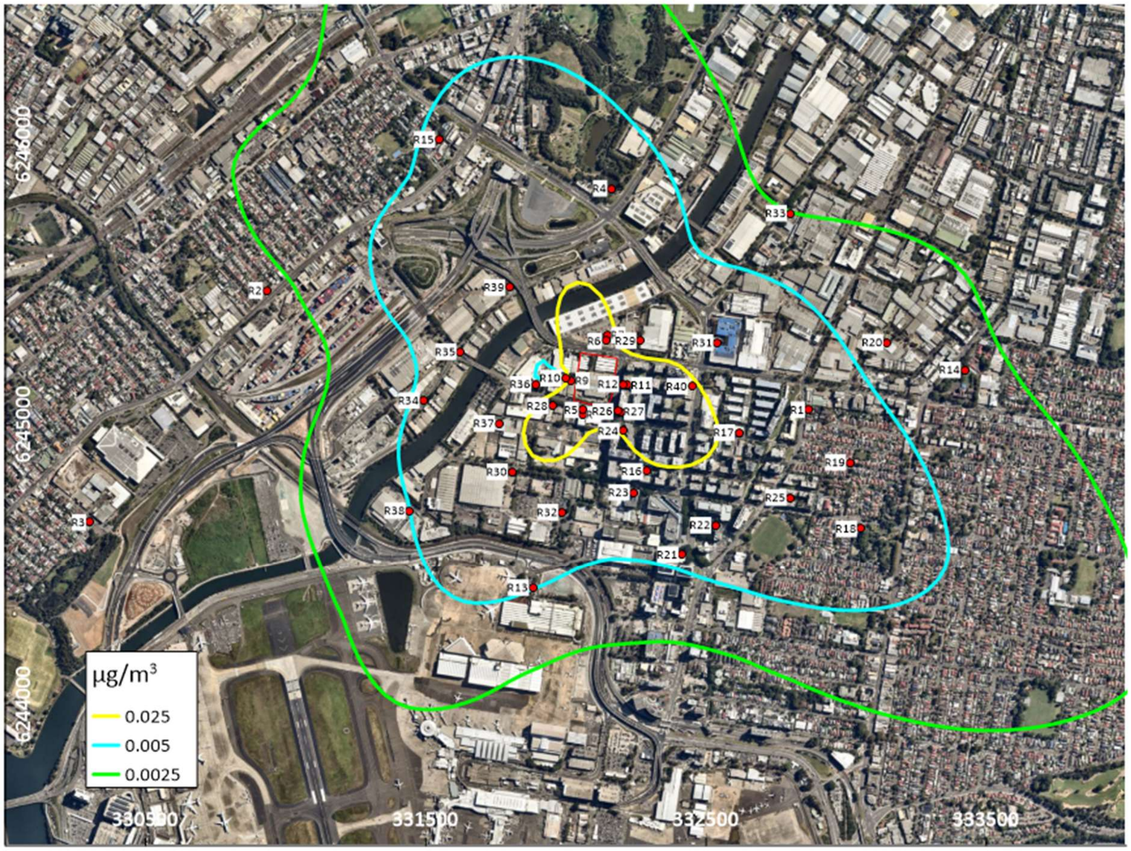
Gardeners Road & Kent Road, Mascot
Air Quality Impact Assessment

Proposed Operations

Pollutant:	Particulate	Averaging Period:	24-hour	Unit:	µg/m³

Figure E 2 Predicted Annual Average Incremental Particulates Isopleth Plot – Operations



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Gardeners Road & Kent Road, Mascot
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Proposed Operations

Pollutant:	Particulate	Averaging Period:	Annual	Unit:	µg/m³

Figure E 3 Predicted 1-hour Average Incremental NO_X Isopleth Plot – Operations

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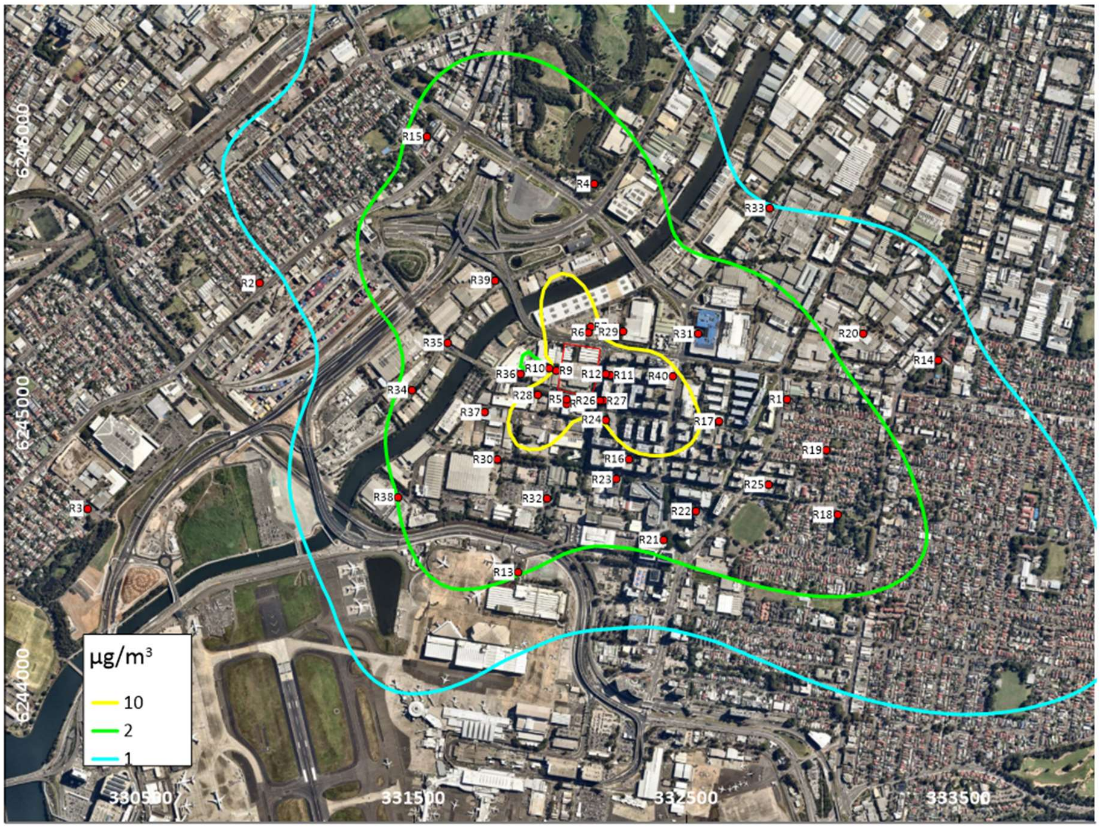
Air Quality Impact Assessment

Proposed Operations

Pollutant:	NO_x	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 4 Predicted Annual Average Incremental NO_X Isopleth Plot – Operations



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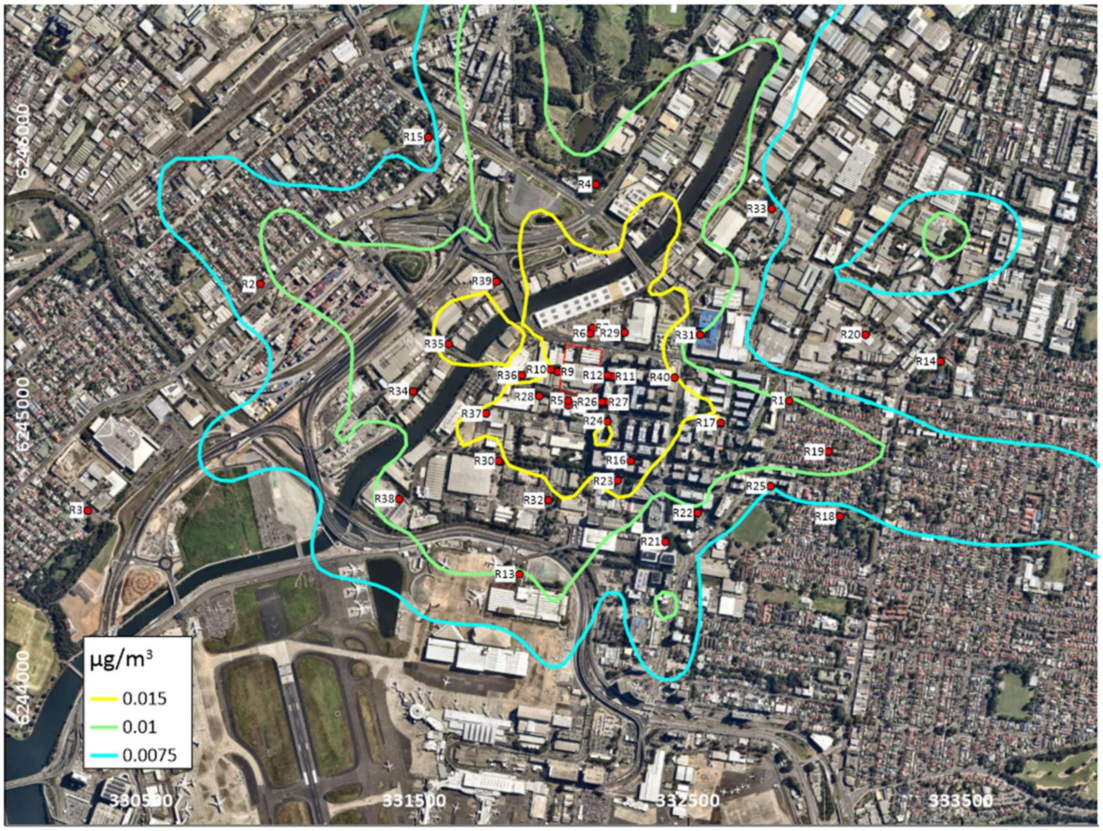
Air Quality Impact Assessment

Proposed Operations

Pollutant:	NO_x	Averaging Period:	Annual	Unit:	µg/m³

Figure E 5 Predicted 1-hour Average Incremental CO Isopleth Plot – Operations



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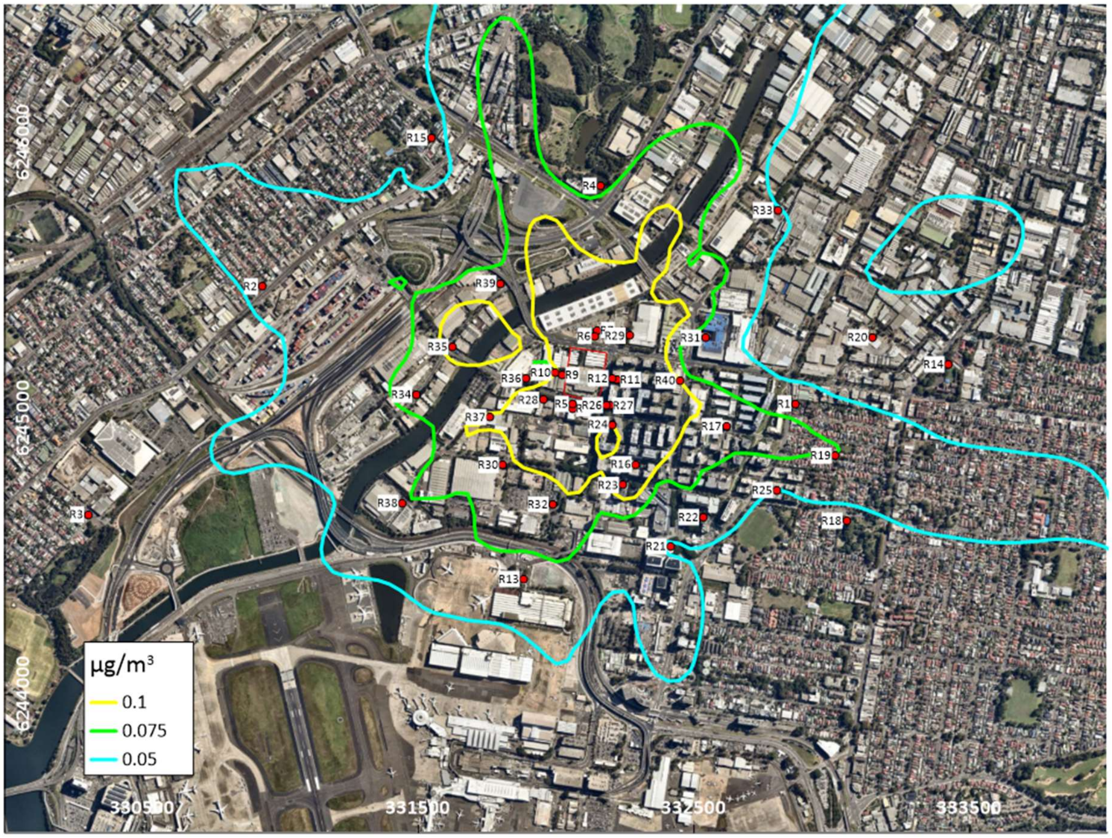
Proposed Operations

Pollutant:	CO	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 6 Predicted 1-hour Average Incremental SO_2 Isopleth Plot – Operations



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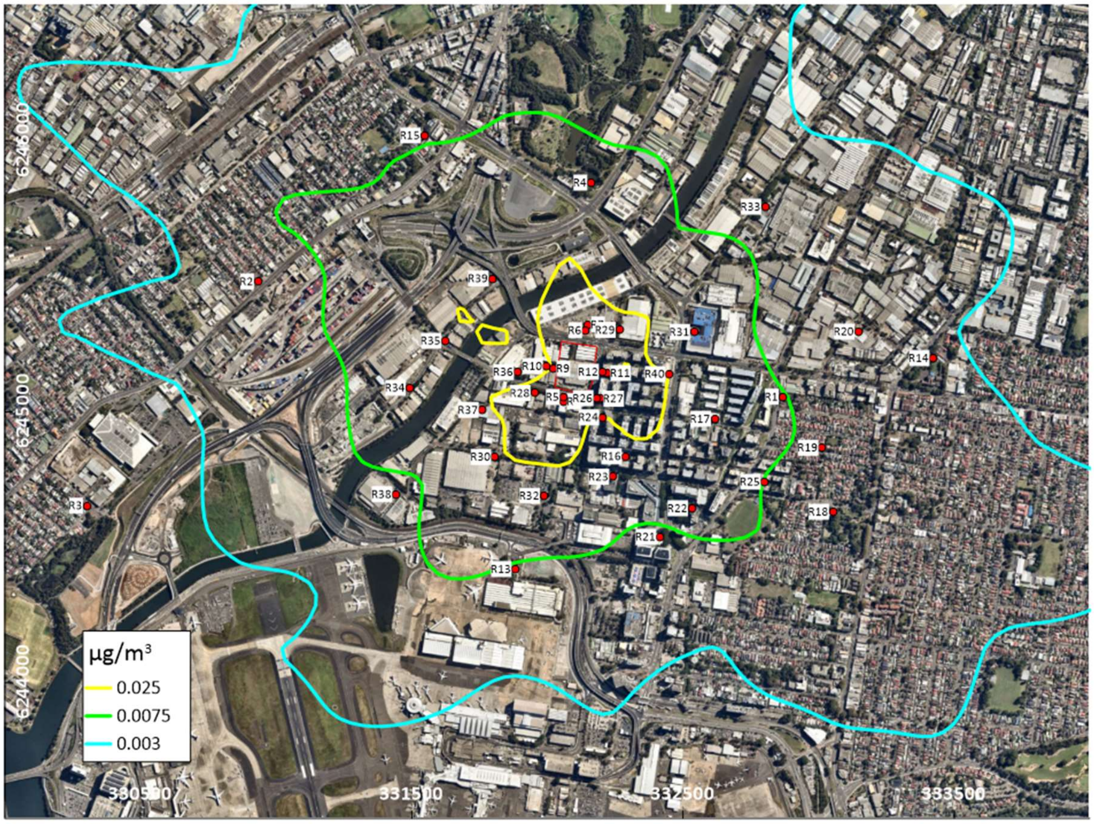
Gardeners Road & Kent Road, Mascot
Air Quality Impact Assessment

Proposed Operations

Pollutant:	SO_2	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 7 Predicted 24-hour Average Incremental SO_2 Isopleth Plot – Operations



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Proposed Operations

Pollutant:	SO_2	Averaging Period:	24-hour	Unit:	µg/m³

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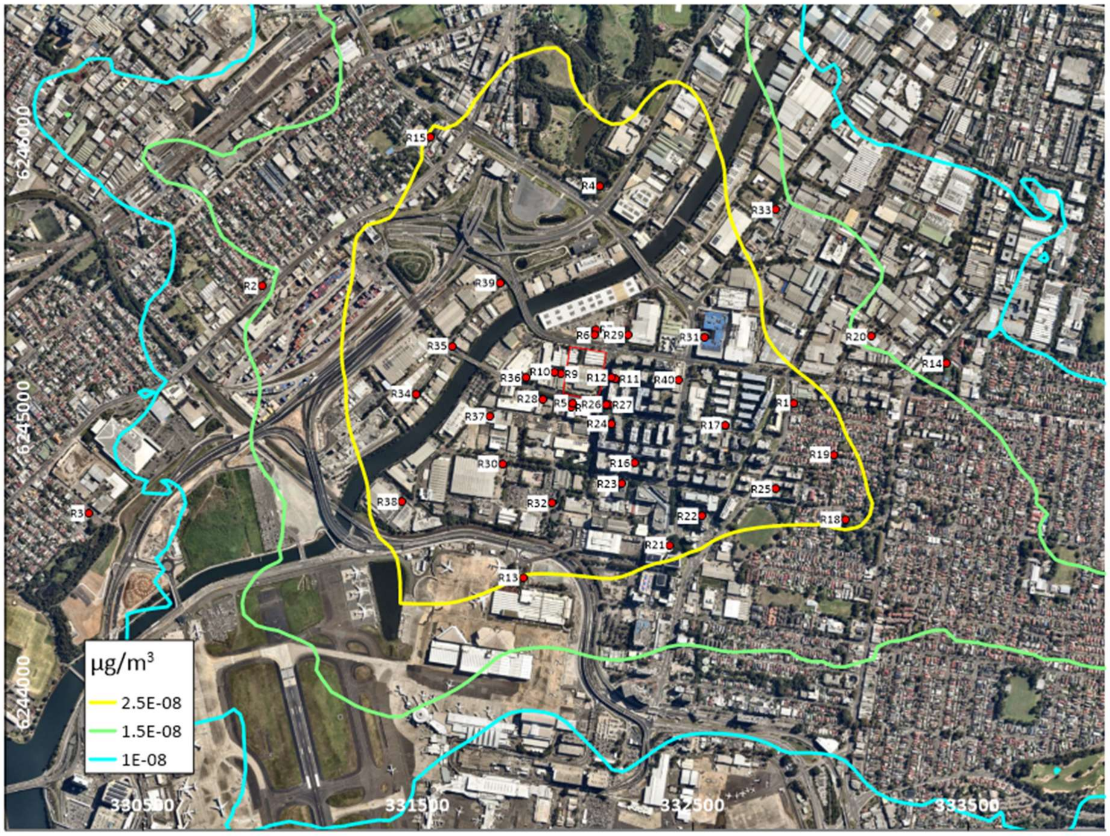
Figure E 8 Predicted 1-hour Average 99.9th percentile Incremental PAHs Isopleth Plot – Operations



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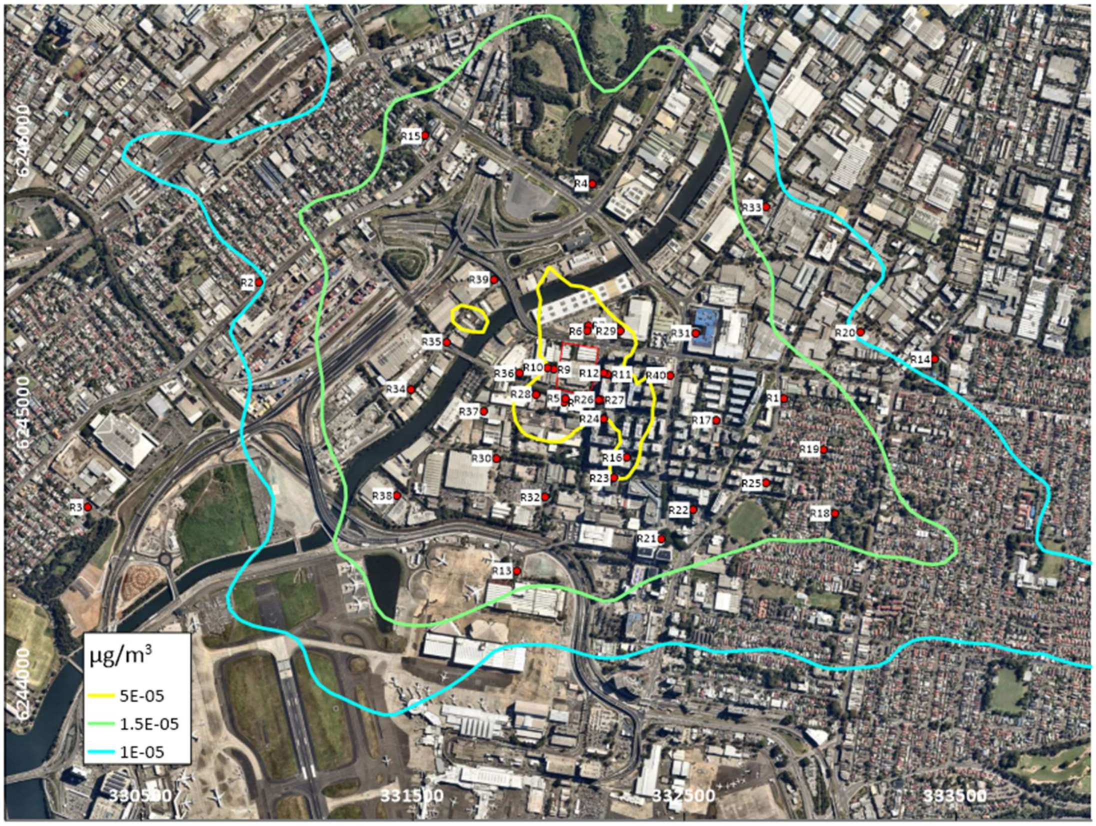
Air Quality Impact Assessment

Proposed Operations

Pollutant:	PAHs	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 9 Predicted 1-hour Average 99.9th percentile Incremental Benzene Isopleth Plot – Operations



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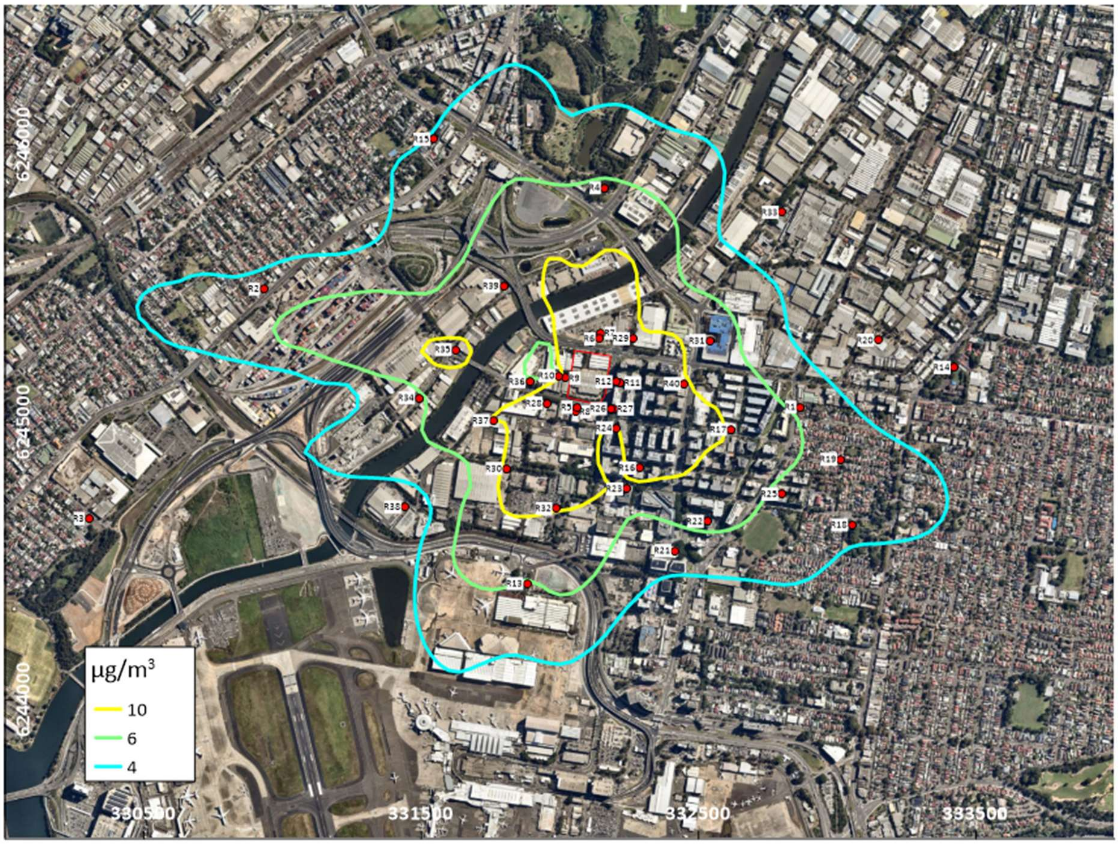
Air Quality Impact Assessment

Proposed Operations

Pollutant:	Benzene	**Averaging Period:**	1-hour	**Unit:**	µg/m³

E.2 Emergency Isopleth plots

Figure E 10 Predicted 24-hour Average Incremental Particulates Isopleth Plot – Emergency Conditions



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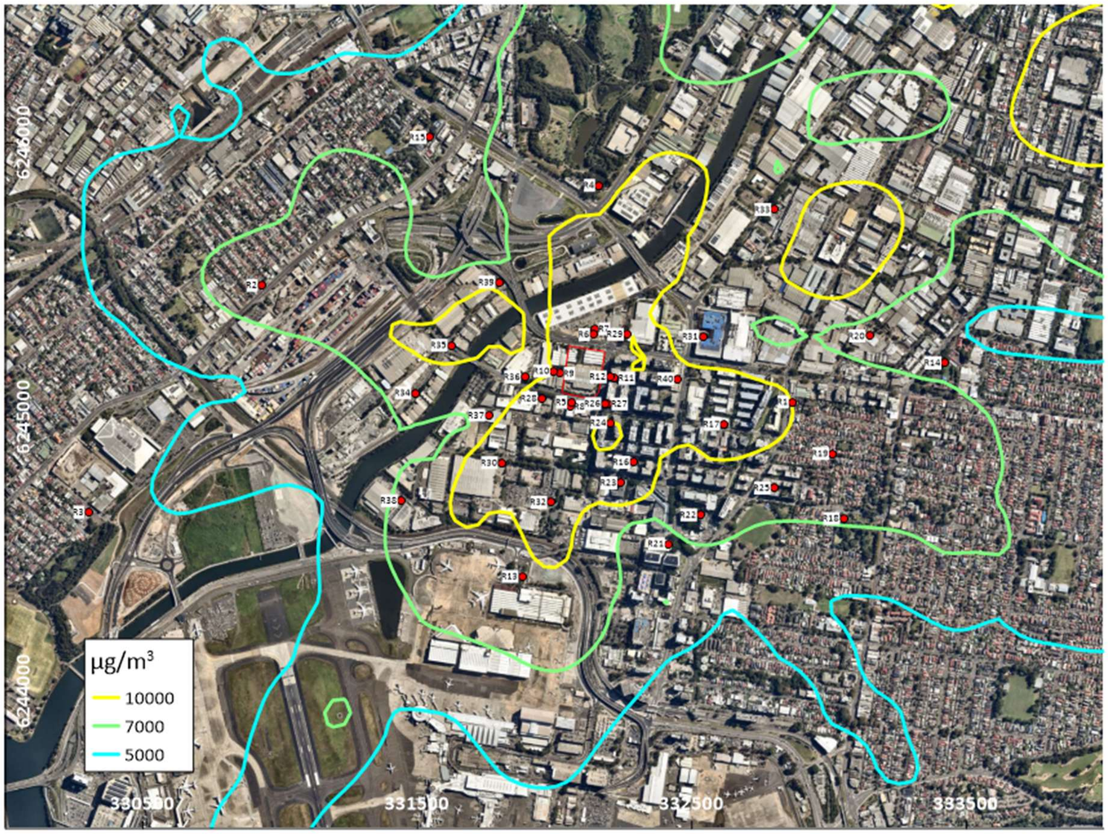
Emergency Conditions

Pollutant:	Particulate	Averaging Period:	24-hour	Unit:	µg/m³

Figure E 11 Predicted 1-hour Average Incremental NO_X Isopleth Plot – Emergency Conditions



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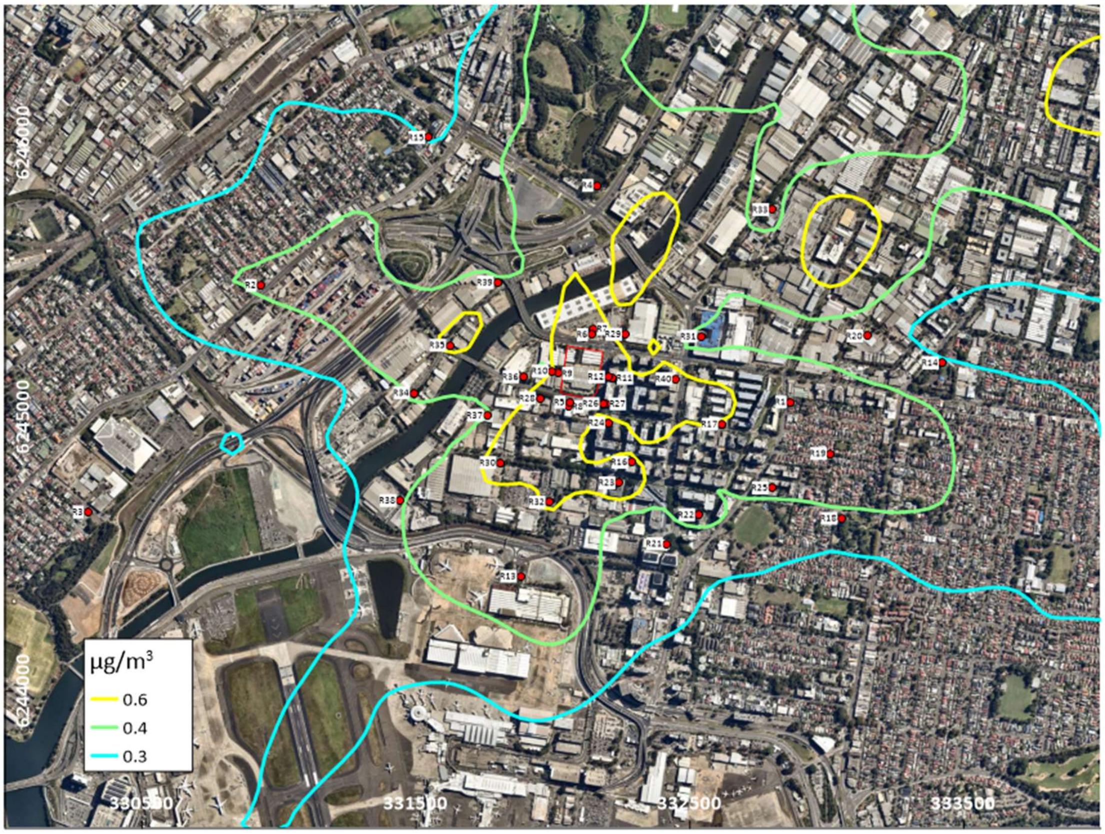
Air Quality Impact Assessment

Emergency Conditions

Pollutant:	NO_x	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 12 Predicted 1-hour Average Incremental CO Isopleth Plot – Emergency Conditions



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Pollutant:	CO	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 13 Predicted 1-hour Average Incremental SO_2 Isopleth Plot – Emergency Conditions

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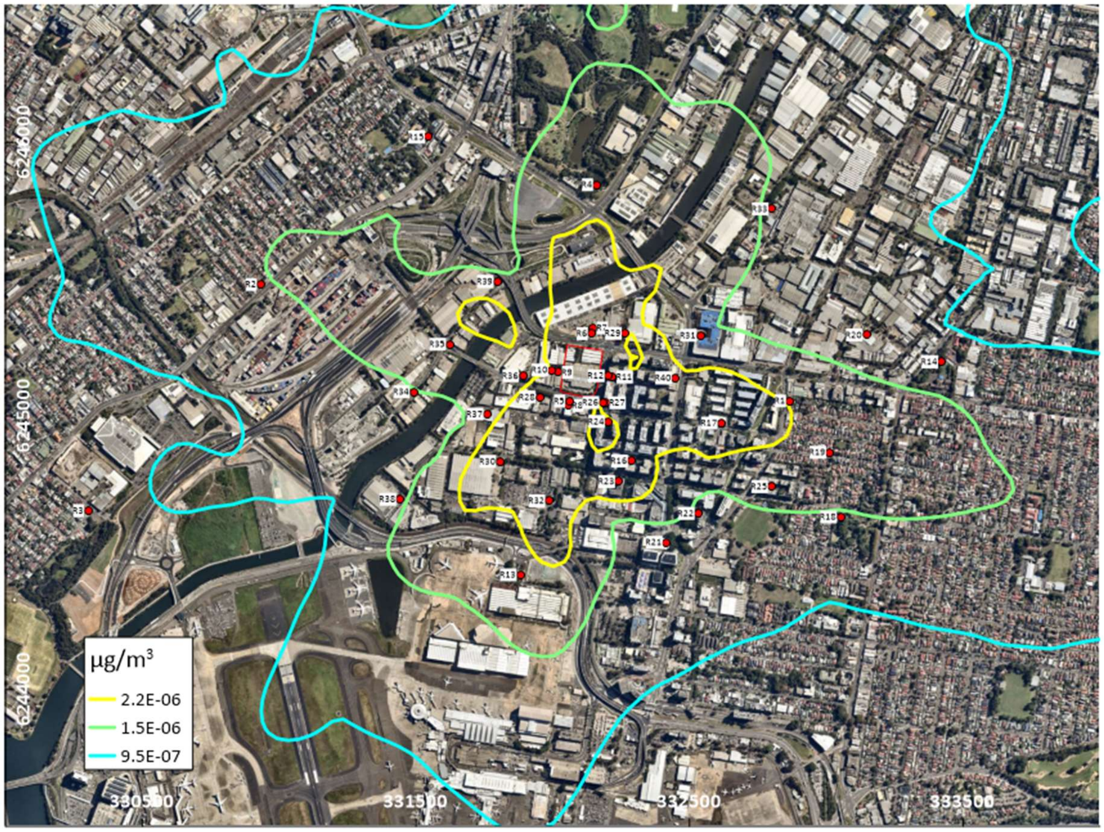
Emergency Conditions

Pollutant:	SO_2	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 14 Predicted 1-hour Average 99.9th Percentile Incremental PAHs Isopleth Plot – Emergency Conditions



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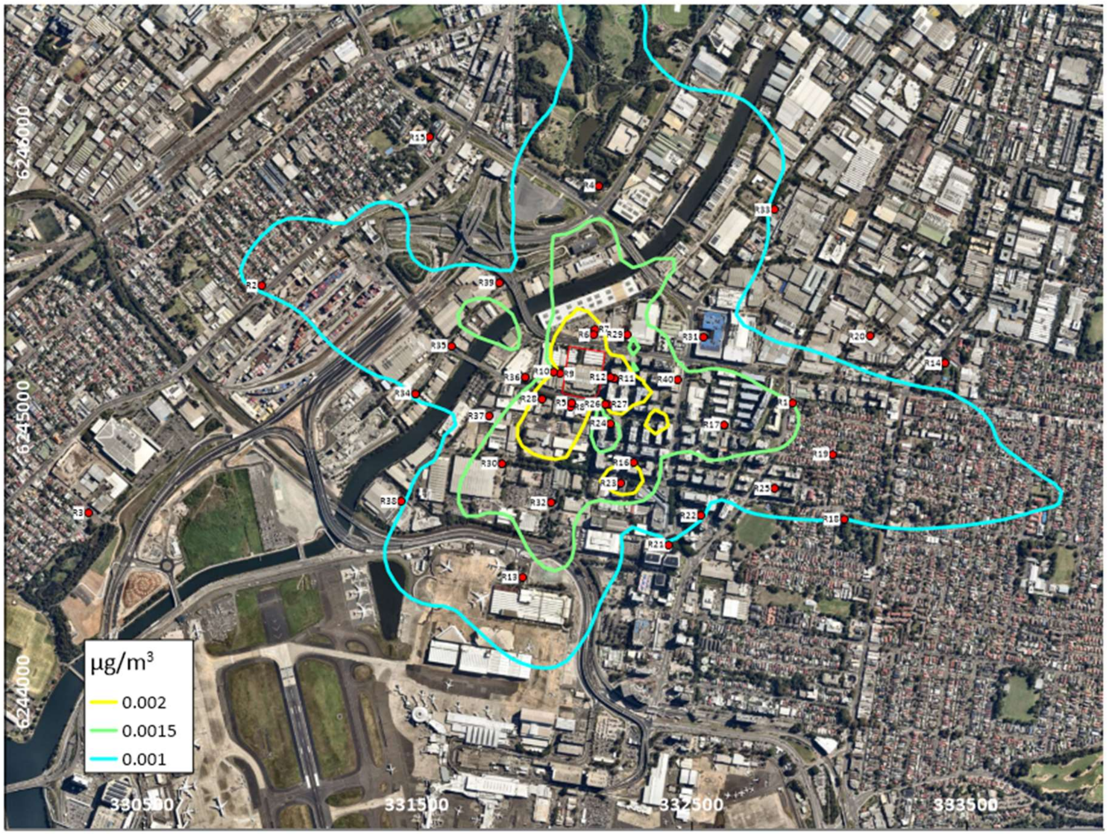
Emergency Conditions

Pollutant:	PAHs	Averaging Period:	1-hour	Unit:	µg/m³

Figure E 15 Predicted 1-hour Average 99.9th Percentile Incremental Benzene Isopleth Plot – Emergency Conditions



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Pollutant:	Benzene	Averaging Period:	1-hour	Unit:	μg/m³

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