Air Quality and Plume Rise Assessment Report

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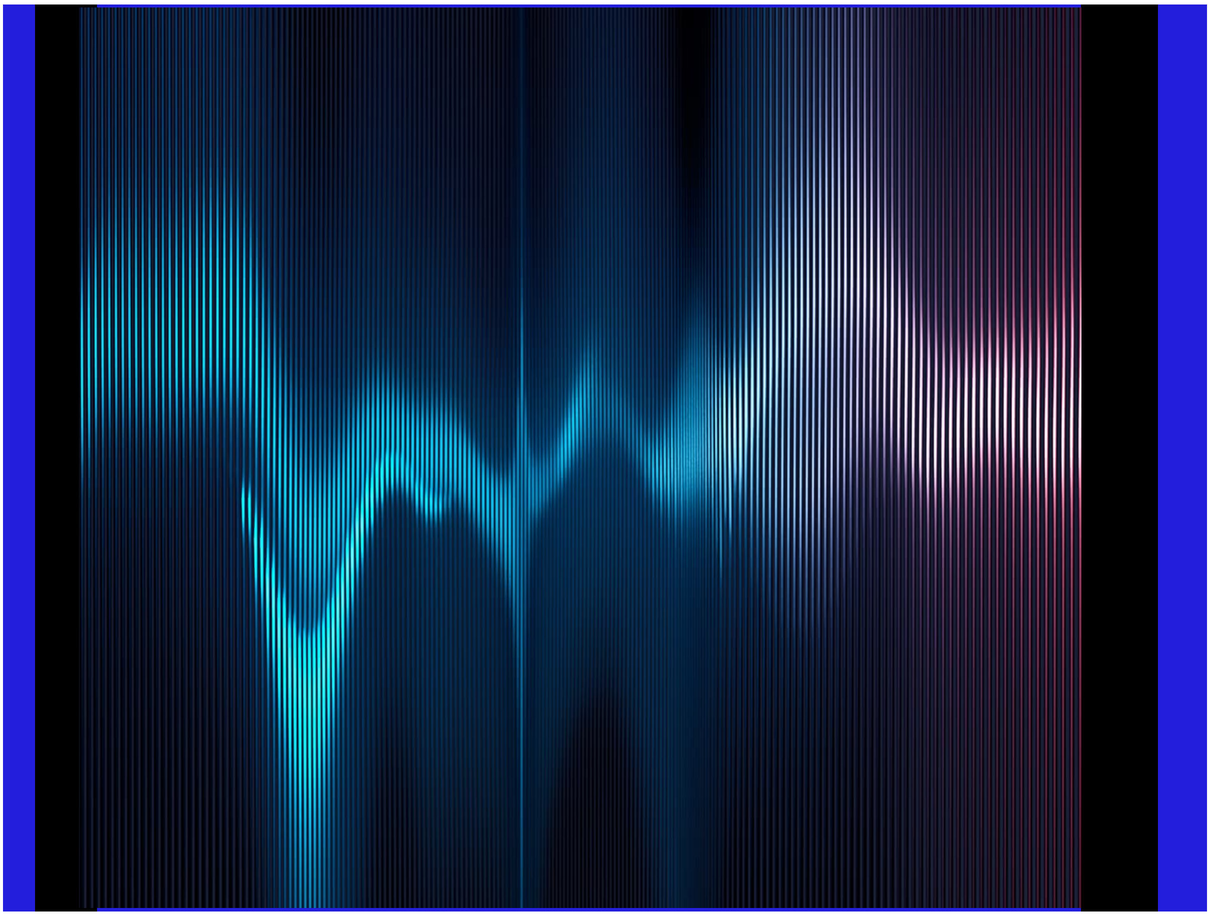
Stockland Corporation Development Pty Limited

Master Planning and Approval Services for Brooklyn Data Centre
20 May 2026



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Executive summary

Overview

This report has been prepared by Jacobs Group (Australia) Pty Ltd (Jacobs) on behalf of Stockland Development Pty Ltd (Stockland) in support of the planning permit application relating to the land at 413 Francis St Brooklyn (the Site). This application seeks approval for the use and development of the land for a data centre (the Project). This report provides an overview of the key features of the Project, including the key air quality and plume rise-related matters, establishes relevant criteria for the assessment, identifies and characterises key features of the existing environment, assesses the potential for air quality and plume rise impacts in-line with relevant VIC Environment Protection Authority (VIC EPA) and the Civil Aviation Safety Authority (CASA) assessment requirements, and provides relevant recommendations for minimising impacts consistent with the General Environmental Duty (GED).

The assessment determined that emissions to air during construction are not expected to present an issues, and would be able to be controlled or otherwise effectively managed. Regarding emissions to air during routine testing and maintenance of back-up emergency diesel generators, concentrations at surrounding sensitive receptors were generally predicted to remain below applicable air quality objective values. Exceedances were predicted during emergency partial and full main power outage scenarios. However, these events are expected to be very unlikely. Consistent with the General Environmental Duty (GED), control measures for reducing emissions from diesel generators were reviewed. However, it is noted that these technologies are less suitable when units are used in an intermittent, emergency back-up capacity. Noting these factors, no specific controls were recommended.

The assessment also determined that the Project could meet CASA plume rise requirements for surrounding prescribed airspace.

A more detailed summary of each element of the assessment including the key matters assessed, impact assessment approaches, relevant features of the existing environment and a more detailed account of the assessment outcomes are provided in the following subsections.

Key air quality and plume rise-related matters

A review of key details of the Project and its setting identified the following matters as the key elements for the assessment:

- **Air quality impacts during construction**: Nuisance dust was identified as the key air quality risk during construction, with other identified risks including exhaust emissions from construction plant, traffic and equipment and odours or airborne hazards arising from the handling of potentially contaminated materials and groundwater (if encountered).
- **Air quality impacts during operations**: Exhaust emissions (primarily nitrogen dioxide [NO_2], fine particulate matter [$PM_{2.5}$], carbon monoxide [CO] and volatile organic compounds [VOCs]) from the use of back-up emergency generators was identified as the key operational air quality risk. Impacts were considered from routine testing and maintenance of the generators, as well as for their use during partial or full mains power outages.
- **Plume rise impacts during operations:** Aviation authorities have determined that plumes of air above certain vertical velocities can in some circumstances, pose a risk to aviation operations. The Project site is located within 15 kilometres of two Certified Aerodrome (i.e., aerodrome authorised by CASA under subpart 139.B of the Civil Aviation Safety Regulations [CASR] to operate with specific safety standards, typically required for aerodromes with terminal instrument flight procedures), and hence the need to assess the potential for impacts to aviation operations from vertical plumes from the proposed developments was identified.

Impact assessment approaches

Different assessment methods were applied to assess the potential for impacts from each of the key risks identified above. Consistent with VIC EPA's 'Publication 1943: Guidance for assessing nuisance dust', a qualitative risk-based assessment approach was used to assess the potential for nuisance dust impacts during construction. A similar approach risk-based approach was applied to assess the potential for other air quality-related impacts during construction. Based on the outcomes of the assessment (detailed below), suitable mitigation and management measures were developed.

Regarding operations, VIC EPA's approved regulatory air dispersion model, AEROMOD, was used to predict resulting changes in air quality resulting from different routine and emergency diesel generator operations at the Project site. The model was set-up with reference to guidance presented in the relevant VIC EPA Publications, and impacts were assessed against criteria developed from the Environment Reference Standard (ERS) and Publication 1961.2 'Guideline for assessing and minimising air pollution in Victoria', (VIC EPA, 2025a). Based on the assessment outcomes, review of control options was also completed consistent with the requirements of the general environmental duty (GED) under the *Environment Protection Act 2017*.

Finally, a screening level plume rise assessment was undertaken to evaluate whether vertical plumes from the Project could affect aircraft operations in surrounding prescribed airspace. This was completed using 'The Air Pollution Model' (TAPM) developed by the CSIRO. The model was configured using the latest available guidance from CASA.

Key features of the existing environment

As part of the assessment, key features of the existing environment were identified including surrounding sensitive receptors, meteorology, other local sources of emissions to air, background air quality and prescribed airspace requirements.

The following findings were made in relation to the existing environment:

- The nearest sensitive receptors were around 0.3 kilometres from the site.
- Prevailing annual local meteorological conditions were winds blowing from the north and south most often, with winds from the west also common.
- Other existing nearby sources of emissions to air were identified, which generally comprised of industry. Key emissions to air from these industries included CO, NO_x, particulate matter (including PM_{10} and $PM_{2.5}$), heavy metals, sulfur dioxide (SO_2) and total and speciated VOCs.
- Background air quality concentrations around the site were recorded as generally meeting the ERS air quality objective values, with the exception of 24-hour averaged $PM_{2.5}$, which were occasionally measured above these limits in 2020, 2021 and 2024 of the five years (2020 to 2024) considered for the assessment.
- The site was confirmed as being within 15 kilometres of a Certified Aerodrome. Approximately 133 meters were determined as being available to the lowest prescribed airspace layer (being the OLS) at the approximate location of the Project.

Assessment of impacts, recommendations and conclusions

- **Construction air quality:**
  - Using the assessment methodology detailed in Publication 1943, 'medium' potential unmitigated nuisance dust impacts were determined for the Brooklyn site.
  - Suitable mitigation and management measures were developed in-line with Publication 1834.2, the GED and other relevant guidance. With these measures, it is expected that nuisance dust would be able to be effectively managed such that impacts during construction would be considered very unlikely.

   - Impacts from other emissions to air identified during construction are considered unlikely, with suitable control measures recommended for inclusion into the Project Construction Environmental Management Plan (CEMP).

- **Operational air quality:**
   - For NO_x and $PM_{2.5}$, compliance against ERS air quality objective values at surrounding sensitive receptors was generally achieved during generator routine testing and maintenance and emergency operations. The only exception was for $PM_{2.5}$ in 2021 and 2024 where the assessment predicted the potential for one additional day in the year where concentrations exceeded the 25 µg/m^3 air quality objective value at the most-affected representative sensitive receptor.
   - Exceedances were determined during emergency operations. Such events are considered to be very unlikely owing to the redundancy in power supplies to site. It is noted that emissions to air from these types of operations may be exempt under the *Environment Protection Regulations 2021* (VIC EPA, 2021a), but there is still the need to review potential controls to minimise impacts consistent with the requirements of the GED under the *Environment Protection Act 2017*. Available controls were reviewed, although it was determined that they would be unlikely to meet the threshold as being reasonable and feasible, noting the expected frequency of these events would be extremely low, and that the efficacy of such controls are limited for generators that are used in a back-up capacity. As such, no emission controls were recommended for the back-up generator units.
   - For CO and speciated VOCs under all operational scenarios (i.e., routine testing and maintenance and emergency operations), compliance was achieved against relevant ERS and Publication 1961.2 air quality objective values at surrounding sensitive receptors.

- **Operational plume rise:**
   - A plume rise screening assessment was completed using TAPM. Potential impacts were evaluated by reviewing the height at which vertical velocities from key sources fell below CASA's 4.3 m/s critical plume velocity (CPV), and comparing this against relevant prescribed airspace requirements for the affected Certified Aerodrome. Results were evaluated against the most stringent 4.3 m/s CPV at the lower (i.e., most conservative) protected airspace layer from the surrounding Certified Aerodrome.
   - Using this approach, it was determined that the vertical velocities from the back-up generators would fall below CASA's 4.3 m/s CPV well below the lowest protected airspace requirements relevant at the site. Still, in-line with from 'Advisory Circular AC 139.E-02 V1.0 Plume Rise Assessments' (CASA, 2023), a 1247 form (including associated meteorological data) has been prepared and submitted to CASA for their review.

Contents

Appendices

Tables

Figures

Acronyms and abbreviations

Acronym	Definition
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
APAC	Air pollutant assessment criteria
ARP	Aerodrome reference point
AWS	Automatic weather station
BoM	Bureau of Meteorology
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
CEMP	Construction Environmental Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CO	Carbon monoxide
CPV	Critical plume velocity
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEM	Digital elevation model
ERS	*Environmental Reference Standard*
GED	General Environmental Duty
GLC	Ground-level concentration
Jacobs	Jacobs Group (Australia) Pty Ltd
MW	Megawatt
NEPM AAQ	*National Environment Protection Measure for Ambient Air Quality*
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPI	National Pollutant Inventory
O_3	Ozone
OLM	Ozone limiting method
OLS	Obstacle limitation surface
PANS-OPS	Procedures for air navigation services – aircraft operations
ppb	Parts per billion
ppm	Parts per million
PM	Particulate matter
$PM_{2.5}$	Particulate matter with an equivalent aerodynamic diameter less than 2.5 microns
PM_{10}	Particulate matter with an equivalent aerodynamic diameter less than 10 microns
SRTM	Shuttle Radar Topography Mission

Stockland	Stockland Corporation Limited
TAPM	The Air Pollution Model
USGS	United States Geological Survey
VIC	Victoria
VIC EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound

1. Introduction

1.1 Background

Stockland Development Pty Limited (Stockland) is planning to develop a new data centre land at 413 Francis St Brooklyn (the Site). This application seeks approval for the Stage 1 portion of the land use and development (shown in **Figure 1-1** below) for a data centre (the Project). Further details of the Project are provided below in **Section 2**.

Jacobs Group (Australia) Pty Ltd (Jacobs) has been engaged to assist with the planning permit application for the Project. This report assesses potential operational air quality impacts and plume rise impacts for the planned development and describes how the development would meet relevant air quality-related planning and approvals requirements. This report forms part of the documents to inform the associated planning permit application.

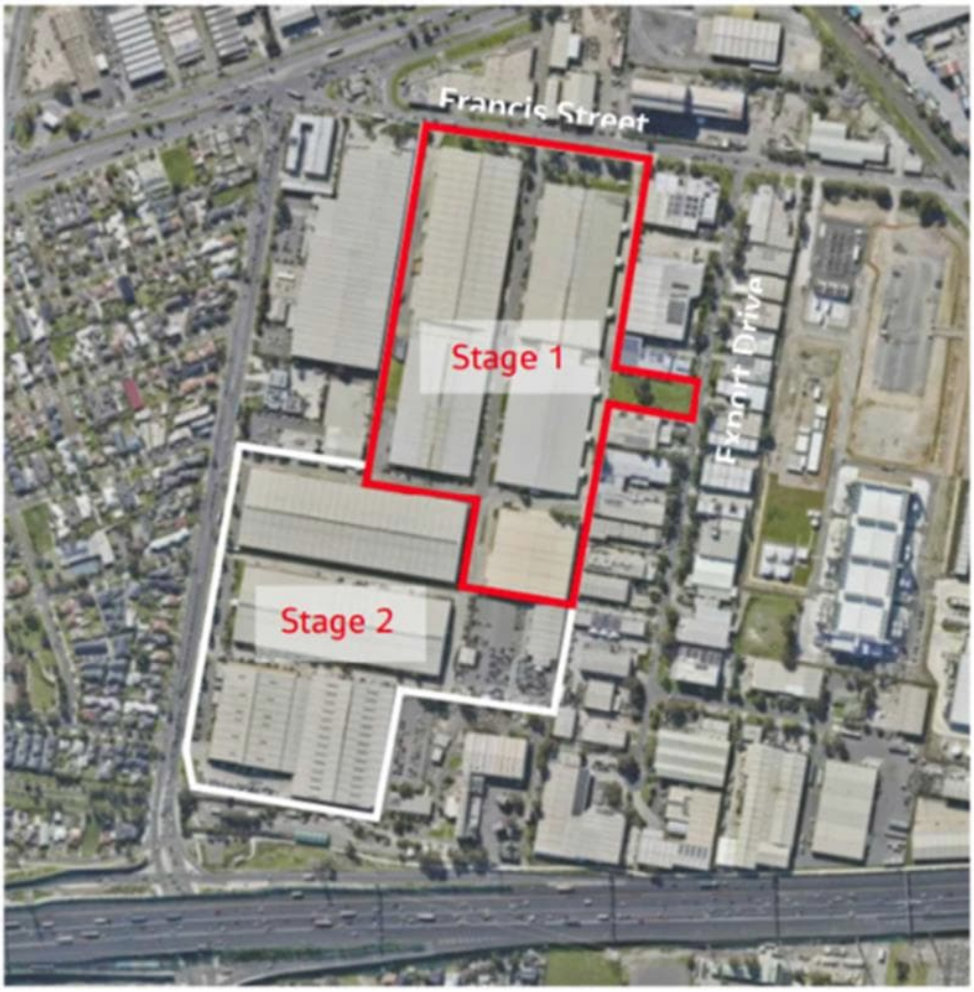


Figure 1-1. Project site and staging plan

1.2 Purpose

The purpose of this report is to assess the potential operational air quality and plume rise impacts associated with the Project, and describe how the development would meet relevant air quality-related planning and approvals requirements. The specific objectives of the assessment are to:

- Identify local air quality and aviation values and the nature and proximity of potentially sensitive receptors
- Provide an assessment of the likely impact of the Project on air quality and aviation values to inform approvals under relevant policy and legislation
- Provide recommendations to mitigate or otherwise effectively manage impacts where appropriate.

1.3 Structure

The report is structured as follows:

- **Introduction** (this section) which provides background details for the Project and outlines the purpose and structure of the assessment
- **Project description** (**Section 2**), where key details relevant to the assessment are explained
- **Legislation, policy, guidelines and adopted assessment criteria** (**Section 3**) which lists the legislative, policy, guideline and other documents relevant to the assessment, and establishes the assessment criteria
- **Methodology** (**Section 4**) where the approaches applied to assess potential impacts associated with the Project is explained
- **Existing conditions** (**Section 5**) which identifies key features of the existing environment as relevant to the assessment including details of surrounding sensitive receptors, existing local sources of emissions to air, prevailing local meteorology, and relevant prescribed airspace requirements.
- **Impact assessment** (**Section 6 and Section 7**), where impacts during the construction and operation of the Project, including potential plume rise impacts are evaluated
- **Summary and recommendations** (**Section 8**) where the objectives, methods, outcomes and recommendations of the assessment are presented.

2. Overview of Project

2.1 Overview

This section of the report provides a brief overview of the Project and summarises the key aspects relevant to this assessment.

2.2 Project description and summary

The Project seeks the staged use and development of a two-storey data centre (250MVA ultimate power capacity) pursuant to the Industrial 1 & 3 Zones. To facilitate these works, the existing warehouse buildings and associated hard stand/car parking area are to be removed. Early works approval will be sought to undertake bulk earthworks across the Site, including the preparation of leveling of the Site to allow AusNet to deliver the substation (utility installation). It is noted that substation area will be subject to separate planning approvals and the use and development associated with the substation will be subject to a separate approval prepared by AusNet.

This application meets the relevant eligibility criteria to be considered under the Development Facilitation Program where the Minister for Planning will be the Responsible Authority pursuant to Clause 53.22 of the Planning Scheme.

In particular, the Project seeks permission for the staged delivery of two, two-storey data centre buildings, generally comprising the following buildings and works:

- Bulk earthworks for site preparation and leveling (early works approval sought);
- Construction of two-storey data centre buildings with a building height of 18.3 metres, with an additional 7.2 metres of building services for plant and chiller equipment (combined maximum height of circa 25.5 metres);
- The buildings comprise a total gross floor area of circa 75,000 square metres across the two storey data halls and ancillary offices, with additional associated major plant open structures (housing generators and chillers);
- Vehicle ingress and egress is proposed centrally along the Site's frontage to Francis St, with circa 110 car parking spaces provided at the frontage of the two data centre buildings;
- Removal of some vegetation to accommodate the functional parameters of the proposed data centre and substation development;
- Additional landscaping provided in the front setback of the building, scattered throughout the Site and to the office entry of each building, providing an improved landscape response; and
- Provision of required utilities, including diesel generator back up power system, associated fuel storage systems, fire pump and associated water tanks.

The proposed data centre seeks to provide much needed AI integration, data, content and cloud services to address the emerging demand for cloud computing services.

The Project's design has been shaped by technical assessments and stakeholder feedback, ensuring a balanced approach to development. The Project seeks to provide a strategic response to the existing and emerging character through provision of an improved built form and landscape response.

An indicative layout for the site is displayed below in **Figure 2-1** with a depiction of the facility shown in **Figure 2-2**.

Figure 2-1. Brooklyn data centre proposed layout

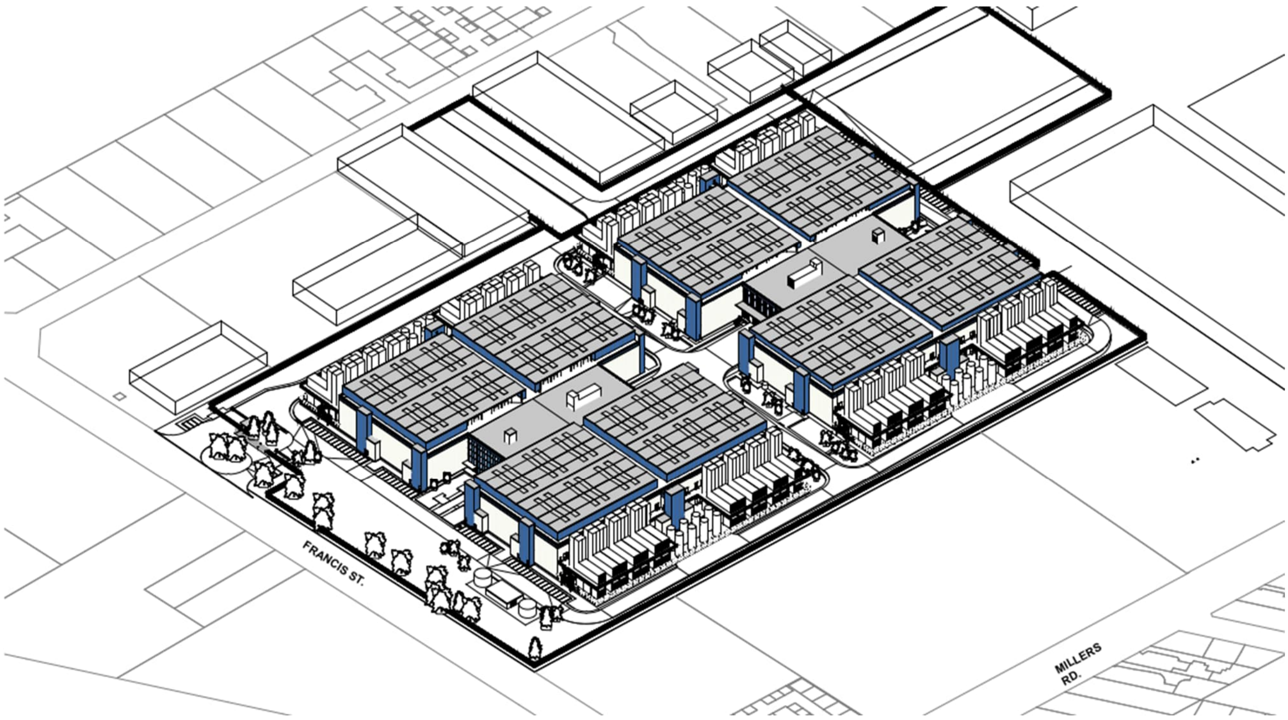


Figure 2-2. Aerial perspective of proposed Brooklyn data centre from west

2.3 Project location

The new Brooklyn data centre would be located at 413 Francis Street, Brooklyn. The regional context of the Project is displayed below in **Figure 2-3**.

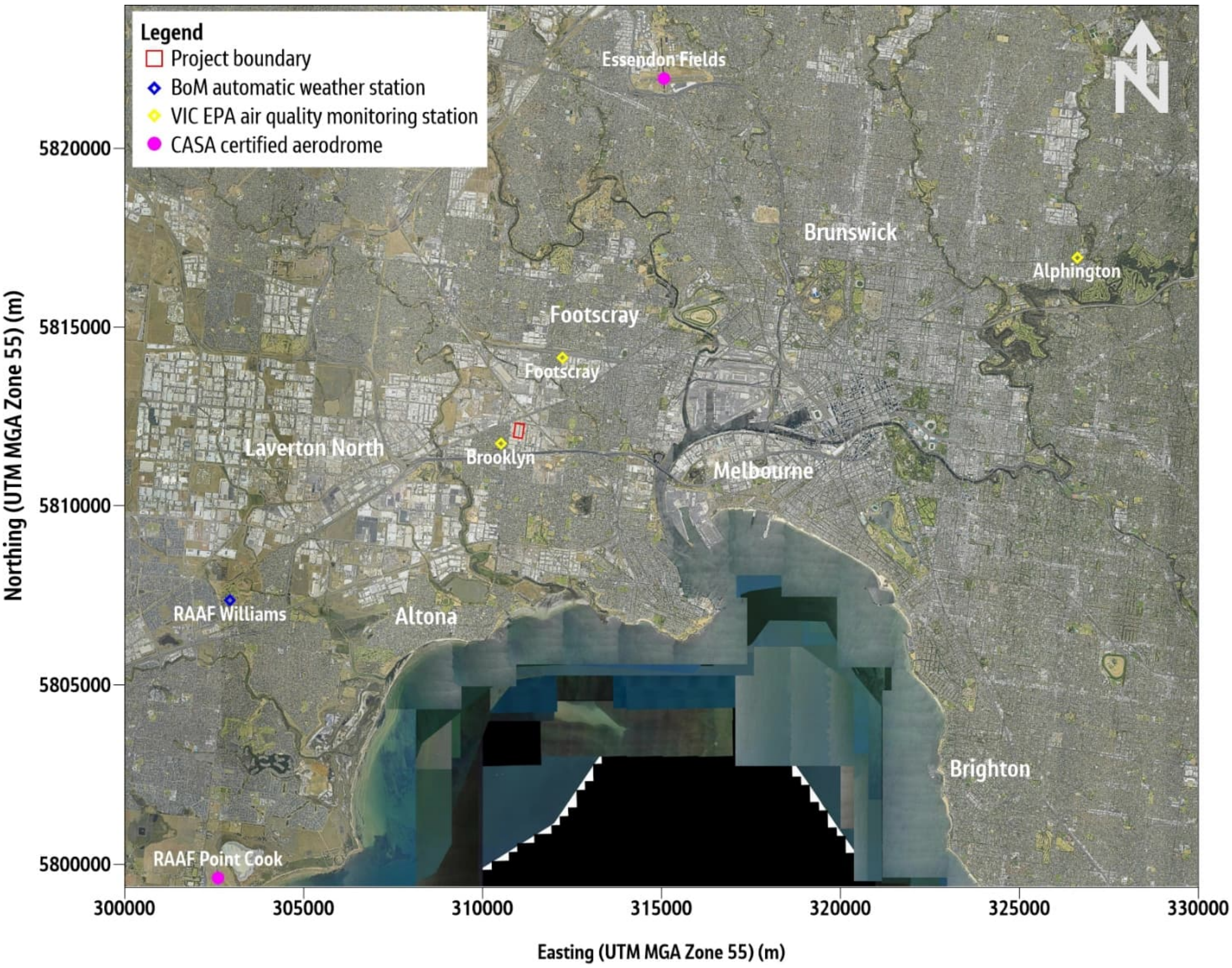


Figure 2-3. Project location

2.4 Summary of key aspects relevant to this assessment

There is the potential for air quality-related impacts from the Project during construction and operations. During construction, the primary air quality risk is expected to be dust. The term dust refers to particulate matter in the form of total suspended particulates (TSP), deposited dust, particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}), and finer particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). The Environment Reference Standard (ERS) (refer to **Section 3.2.4** below) establishes assessment indicators for PM_{10} and $PM_{2.5}$ with an objective of protecting human health. Any air quality impacts during construction would be temporary, and are expected to be able to be controlled with the effective implementation of suitable mitigation and management measures. An assessment of potential air quality impacts during construction and how these would be effectively managed has been undertaken, consistent with Victorian Environment Protection Authority (VIC EPA) assessment requirements.

As well as dust, other key air quality-related risks during construction include exhaust emissions from the combustion of fossil fuels in construction plant and equipment. The primary pollutants associated with plant exhaust emissions include carbon monoxide (CO), oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs) and sulphur dioxide (SO_2) (depending on fuel sulphur content). Finally, odours and airborne hazardous materials arising from uncovered contaminated materials represent another air quality related risk. These other air quality risks during construction beyond nuisance dust have been considered qualitatively, with measures developed to mitigate or otherwise effectively manage any potential impacts.

During operations from the key air quality-related risk was identified as being exhaust emissions from the testing and use of the emergency back-up generators. The site will have 112 Caterpillar 'CT175_20, Engine EM1366' 3 megawatt (MW) diesel emergency back-up generators to maintain power supply in the highly unlikely event of a grid outage. Two additional 1 MW back-up generators would also be in-place for the two administration buildings.

Key air pollutants associated with exhaust emissions from generators include particulate matter (predominantly $PM_{2.5}$), NO_x, CO and hydrocarbons, including VOCs. For diesel generators, the key speciated VOCs include:

- Acetaldehyde
- Benzene
- Formaldehyde
- Toluene
- Xylene.

Potential impacts from these pollutants were assessed quantitatively, in-line with VIC EPA's guidance.

Aviation authorities have established that wind gusts with vertical velocity exceeding 4.3 metres per second (m/s) may cause damage to an aircraft airframe or otherwise upset an aircraft flying at low levels. Where the vertical velocity of exhaust plumes from a facility exceeds the critical plume velocity (CPV) of 4.3 m/s at an aerodrome Obstacle Limitation Surface (OLS) or another protection airspace layer (e.g., procedures for air navigation services – aircraft operations [PANS-OPS]), or otherwise at 110 metres above ground level anywhere else or within 15 km of a Certified Aerodrome, the Civil Aviation Safety Authority (CASA) has identified the need for further assessment. The Project is located within 15 km of two Certified Aerodrome (RAAF Base Point Cook and Essendon Fields). Hence, the need to assess potential impacts of plume rise on aviation operations was identified.

3. Legislation, policy and guidelines

3.1 Overview

There are several statutes, policies and guidelines applicable to the matters considered in this assessment. These include:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- Commonwealth *National Environment Protection Measure for Ambient Air Quality* NEPM (AAQ)
- Environment Reference Standard (ERS)
- Environment Protection Authority Publications (primarily 1961.2, 1957 and 1943)
- 'Advisory Circular AC 139.E-02 V1.0 Plume Rise Assessments', (CASA, 2023)
- 'CAAP 89Z-1(0) Guidelines for plume rise assessments' (CASA, 2003).

Requirements relevant to the Project for each of these documents are outlined below in **Section 3.2** and **Section 3.3**.

3.2 Air quality

3.2.1 Environment Protection Act 2017

The *Environment Protection Act 2017* is a risk-based approach to preventing environmental harm and includes a general environmental duty (GED). The GED requires people to take reasonably practicable steps to eliminate, or otherwise reduce risks of harm to human health or the environment from pollution and waste. Doing what is reasonably practicable means putting in proportionate controls to mitigate or minimise the risk of harm. The GED requires identification of all risks and implementation of effective control measures so far as reasonably practicable. This guides the approach to managing impacts on air quality and associated environments during the Project, and was considered as part of this review.

3.2.2 Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* (VIC EPA, 2021a) are a subordinate instrument of the *Environment Protection Act* and cover a broad suite of topics including contaminated land, the new framework for permissions, waste management and environmental management (including air and noise) as well as administrative matters relating to offences, fees and transitional arrangements.

Part 5 (Environmental Management) of the Regulations addresses matters including air. Part 5.2 – Air (Regulations 103 to 112) specifies obligations on manufacturers and suppliers in relation to air pollution, including in relation to the National Pollutant Inventory and specifies obligations in relation to Class 3 substances (listed in Schedule 4). Part 5.6 prescribes standards, limits, testing requirements and offences relating to vehicle noise and air emissions.

Schedule 1 of the regulations lists 'prescribed activities' which require a VIC EPA operating licence. The two activities of note in relation to the Project are:

- L01 (General discharges or emissions to the atmosphere)
- K01 (Power generation).

Part 3.5, Clause 39 (b) (i) exempts projects from the requirements of L01 for 'standby' engines. Regarding requirement K01, the need for regulation is triggered when electrical power is generated from the consumption of a fuel at a "rated capacity of at least 5 MW of electrical power". This would need to be confirmed with the VIC EPA, noting that the individual generator units are less than 5 MW, but their collective output exceeds this value when they are required to be used.

3.2.3 National Environment Protection Measure for Ambient Air Quality

National ambient air quality standards are specified in the current *National Environment Protection Measure for Ambient Air Quality*, with the latest update gazetted in 2021 (the "NEPM(AAQ)"). The currently gazetted NEPM(AAQ) concentration standards are listed in **Table 3-1** for the indicators relevant to the Project.

Table 3-1. NEPM AAQ maximum concentration standards

Environmental indicator (air pollutant)	Averaging period	NEPM(AAQ) maximum concentration standard[3]	NEPM(AAQ) permissible exceedances[1]
Particles as PM_{10}	1 day	50 µg/m^3	None[4]
	1 year	25 µg/m^3	None
Particles as $PM_{2.5}$	1 day	25 µg/m^3	None[4]
	1 year	8 µg/m^3	None
NO_2	1 hour	80 ppb	None
	1 year	15 ppb	None
CO	8 hours[2]	9.0 ppm (9000 ppb)	None
SO_2	1 hour	100 ppb 75 ppb (from 2025)	None
	1 day	20 ppb	None
Odour	N/A	An air environment that is free from offensive odours from commercial, industrial, trade and domestic activities	N/A

[1] Maximum allowable exceedances of concentration standard in one calendar year.

[2] Rolling 8-hour average based on 1-hour averages.

[3] Mass concentrations for particles in NEPM(AAQ) are referenced to gas conditions of 0°C, 101.3 kPa

[4] Excludes exceptional events which are defined in the NEPM(AAQ) as a fire or dust occurrence directly related to bushfire, jurisdiction authorised hazard reduction burning or continental scale windblown dust.

It is noted that the NEPM(AAQ) concentration standards only become criteria once adopted into policy by each State and Territory.

3.2.4 Environment Reference Standard

The ERS (Victoria Government 2021) is a subordinate instrument made under the *Environment Protection Act*. The ERS was gazetted on 26 May 2021. The ERS identifies environmental values for Victoria in the areas of air quality, noise, water and contaminated land; and defines indicators and objectives to measure those values.

The ERS supports the protection of the environment from pollution and waste by providing a benchmark to assess and report on environmental conditions in the whole or any part of Victoria. The ERS does not set out enforceable compliance limits; rather, risks of harm to human health and the environment from pollution and waste must be minimised as far as reasonably practicable, in accordance with the GED. The ERS works alongside the GED.

Although it is not a compliance standard and does not set compliance limits (EPA, 2021b), the ERS must be considered by responsible authorities when making planning decisions. The ERS air quality objectives relevant to the Project have been reproduced below in **Table 3-2**.

Table 3-2. ERS air quality objectives

Environmental indicator (air pollutant)	Averaging period	ERS maximum concentration objective[3]	ERS permissible exceedances[1]
Particles as PM_{10}	1 day	50 µg/m^3	None
	1 year	20 µg/m^3	None
Particles as $PM_{2.5}$	1 day	25 µg/m^3	None
	1 year	8 µg/m^3	None
NO_2	1 hour	80 ppb	1 day/year
	1 year	15 ppb	None
CO	8 hours[2]	9.0 ppm (9000 ppb)	1 day/year
SO_2	1 hour	75 ppb	1 day/year
	1 day	20 ppb	1 day/year

1 Maximum allowable exceedances of concentration standard in one calendar year.

2 Rolling 8-hour average based on 1-hour averages.

3 Mass concentrations for particles in ERS are referenced to gas conditions of 0°C, 101.3 kPa

3.2.5 EPA Publication 1961.2

Publication 1961.2 'Guideline for assessing and minimising air pollution in Victoria', (VIC EPA, 2025a) provides a framework to assess and control risks associated with air pollution in the form of a technical guideline for air quality practitioners and specialists. The guideline provides a tiered approach to the assessment of risks from air pollution, with three levels of assessment in order of increasing complexity that define the role of atmospheric dispersion modelling and monitoring intended by EPA Victoria within the Environment Protection Act and GED framework.

As well as providing guidance for air quality modelling and assessment, Publication 1961.2 also provides air pollutant assessment criteria (APAC) for assessing developments that could result in emissions to air in Victoria. Publication 1961.2 adopts the same APAC values as the ERS objective values for the pollutants listed above in **Table 3-2**. It also provides the following APAC values for the following speciated VOCs relevant to the Project:

Table 3-3. Air pollutant assessment criteria for speciated VOCs (EPA, 2025)

Pollutant	Basis of design criteria	Averaging time	Design criteria
Acetaldehyde	Health	1-hour	470 µg/m^3
Benzene	Health	1-hour	580 µg/m^3
Formaldehyde	Health	30-minutes	100 µg/m^3
Toluene	Health	1-hour	7,600 µg/m^3
Xylene	Health	1-hour	22,000 µg/m^3

These APAC values from Publication 1961.2 were adopted to evaluate air quality outcomes, with the relevant guidance for undertaking and presenting the assessment process, outcomes and recommendations also incorporated.

3.2.6 Other relevant EPA Publications

In addition to Publication 1961.2 (VIC EPA, 2025a), the following VIC EPA publications also contain guidance relevant for the assessment:

- Publication 1943 'Guidance for assessing nuisance dust', (VIC EPA, 2025b)
- Publication 1957 'Guide to air pollution modelling', (VIC EPA, 2023).

Applicable guidance from these publications is summarised below in **Table 3-4**.

Table 3-4. Other VIC EPA Publications relevant to the assessment

Publication	Relevant guidance and how applied in the assessment
1957	Publication 1957 (VIC EPA, 2023) provides guidance for Air Pollution Impact Assessments required by VIC EPA for licence approvals and other regulatory purposes within the state. The publication provides guidance for practitioners who are involved in conducting air dispersion modelling of discharges to air in Victoria. The publication lists AERMOD as the VIC EPA's approved regulatory air dispersion model and details key settings and processes to be applied when the tool is used for air quality impact assessments in Victoria. Consistent with Publication 1957, AERMOD and the associated meteorological processor AERMET were used to assess operational emissions to air associated with the Project, with the recommended settings also applied as appropriate.
1943	Publication 1943 (VIC EPA, 2025b) provides a framework to assess risks from nuisance dust. This framework is consistent with the overarching provisions of the GED to 'eliminate or minimise the risks posed by hazards to prevent harm'. The framework assesses the risk posted by nuisance dust by considering three elements: ▪ Step 1: The hazard potential of dust sources. This is evaluated based on the size, nature of activities, type of emissions generated and level of control. ▪ Step 2: The exposure pathway between the source and receiving environment. The framework considers the separation distance, orientation, and intervening terrain and land uses features between the activity or project and the surrounding receivers. ▪ Step 3: The sensitivity of the receiving environment. This aspect considers the historical context of air quality-related issues experienced by people in the receiving environment, as well as the overall land use across this setting. The methodology presented in Publication 1943 was applied to assess the potential for nuisance dust risks during construction, including the development of suitable mitigation and management measures.

Guidance was also drawn from the following publications for managing dust and other emissions to air during construction:

- Publication 1834.2 'Civil construction, building and demolition guide', (EPA, 2025c)
- Publication 1730 'Solid storage and handling guidelines', (EPA, 2019a)
- Publication 1894 'Managing soil disturbance: guidance sheet', (EPA, September 2020a)
- Publication 1895 'Managing stockpiles: guidance sheet', (EPA, July 2019b)

- Publication 1897 'Managing truck and other vehicle movement: guidance sheet', (EPA, September 2020b).

3.3 CASA plume rise guidance

The publications listed above (CASA, 2003 and 2023) provide the process for assessing plume rise impacts. The current process is outlined in 'Advisory Circular AC 139.E-02 V1.0 Plume Rise Assessments', (CASA, 2023). The key steps now involve:

1. Proponent completing an initial assessment of plume exit velocities and potential effects.
2. If exit velocities exceed 4.3 m/s, submission of Form 1247 to CASA, as well as any aerodrome operators within 15 kilometres of the proposed facility.
3. CASA will use the information provided in the submitted Form 1247 to conduct a preliminary assessment using their screening tool. If the outputs of the screening assessment indicate that plume velocities would not infringe a flight protection surface (i.e., OLS, PANS-OPS) at a velocity exceeding 4.3 m/s, no further assessment is deemed as being required.
4. If CASA's screening assessment indicates that plume velocities may infringe a flight protection surface, subsequent more detailed assessment may be completed using the Exhaust Plume Analyser (EPA) software. Other factors (including outcomes from stakeholder consultation) would be considered in CASA's review of risks to aviation safety from plume effects of the proposed development.

This report presents the process and outcomes of steps 1 and 2 of the current CASA assessment process.

4. Assessment methods

4.1 Overview

This section of the report describes the approaches applied to assess potential operational air quality and plume rise impacts associated with the Project. The method applied in relation to air quality is presented in **Section 4.2**, and the approach for reviewing plume rise is summarised in **Section 4.3**.

4.2 Air quality

4.2.1 Existing environment

Key features of the existing environment as relevant to air quality include:

- Surrounding sensitive receptors
- Land use and topography
- Local meteorology
- Other local sources of emissions to air
- Background air quality
- Protected airspace requirements.

Table 4-1 below describes how each of these aspects of the existing environment around the Project were characterised:

Table 4-1. Inputs used to characterise features of existing environment

Feature	Source
Surrounding land uses and sensitive receptors	Surrounding land use and nearby sensitive receptors were identified using recent aerial imagery available from MetroMap, supplemented with land use information from VIC Plan (Victoria's Planning Policy Framework & Victoria Planning Provisions). Land uses and surrounding sensitive receptors around the Project are identified below in **Section 5.1**
Topography	Elevations around the Project were generated data from the United States Geological Survey (USGS) one-second (30 m resolution) Shuttle Radar Topography Mission (SRTM). Noting that this is an input to AERMOD, further details of this element of the existing environment are provided in **Section 4.2.2.4**.
Local meteorology	Data collected from the nearby automatic weather station (AWS) operated by the Commonwealth Bureau of Meteorology (BoM) at RAAF Williams (Laverton) were used with prognostic data generated using the CSIRO's TAPM to understand local meteorological conditions around the Project. Local meteorology is an input for AERMET. As such, local meteorology around the Project applied in the assessment is also described below in **Section 4.2.2.4**.
Other local sources of emissions to air	Surrounding existing sources of emissions to air around the Project were identified using information from the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW's) National Pollutant Inventory (2023/24 reporting year) database and VIC EPA's Operating Licence Register for prescribed activities defined in Schedule 1 of the *Environment Protection Regulations 2021*. Further details of these existing nearby sources of emissions to air are provided in **Section 5.2**.

Background air quality	Background air quality conditions around the Project were determined from monitoring data collected at nearby and otherwise representative stations operated by the VIC EPA. Details of the stations and data used are provided below in **Section 5.3**.
Protected airspace requirements	The Project site is located within the prescribed airspace of RAAF Base Point Cook and Essendon Fields Certified Aerodrome. Specific aviation restrictions (e.g., OLS and PANS-OPS) are published by the aerodrome operators. Further details of the restrictions that apply around the aerodrome are provided below in **Section 5.4**.

4.2.2 Impact assessment approach

4.2.2.1 Construction

The overall method for the construction air quality impact assessment included:

- Identifying key issues (as described in **Section 2.4**) to be addressed in the impact assessment
- Potential air quality impacts from the Project were determined in a manner generally consistent with Publication 1961. Consistent with this guidance, a Level 1 assessment methodology was applied.
- Construction nuisance dust impacts were assessed using the methodology detailed in Publication 1943 (refer to **Appendix C**) where a risk score is calculated that takes into account source, pathway and receptor attributes that contribute to the magnitude of dust impact risk. Initial unmitigated impact ratings were determined as summarised below in **Table 4-2**. It is noted that the scoring, ratings and descriptions in **Table 4-2** are reproduced from Publication 1943.

Table 4-2. Construction dust impact ratings (Source: EPA, 2025b)

Score	Impact rating	Description
32-36	Very high	Dust impact almost certain. Nuisance dust impacts will occur. Any interventions to reduce impacts in either the source, pathway or receiving environment are unlikely to be practical so effective mitigation is doubtful.
27-31	High	Dust impacts highly likely to occur. Significant nuisance dust to occur, and impacts are highly likely. There may be some interventions that can be applied to reduce the impacts, but it is likely that significant re-engineering or redesign will be required.
22-26	Medium	Dust impacts likely. Some nuisance dust impacts to occur and without careful and considered application of mitigation measures it is likely to cause impacts. The focus should be what can be done to break the source-pathway-receiving environment chain.
17-21	Moderate	Dust impacts only likely to occur on rare occasions. Although there may be some residual nuisance dust impacts, it is possible it can be practically and effectively managed.
12-16	Low	Dust impacts are not likely and any would be minimal.

- To address the initial, unmitigated impacts determined, mitigation and management measures were developed with reference to relevant guidance from Publication 1834.1, (VIC EPA, 2025c), Publication 1730, (VIC EPA, 2019a), Publication 1894, (VIC EPA, 2020a), Publication 1895, (VIC EPA, July 2019b) and Publication 1897, (VIC EPA, 2020b).

- Other air quality-related impacts were qualitatively assessed consistent with Publication 1961.2 Level 1 requirements. Potential impacts associated with these matters were identified with reference to the ratings developed for the assessment below in **Table 4-3**. Based on these outcomes, mitigation and management measures were recommended, consistent with the requirements of the GED, and residual construction air quality impacts were determined.

Table 4-3. Exhaust emissions and/or odours/airborne hazards impact assessment ratings

Impact rating	Comment
Very high	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts almost certain. Interventions to reduce impacts in either the source, pathway or receiving environment are unlikely to be practical so effective mitigation is doubtful.
High	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts highly likely to occur. Significant impacts to occur, and impacts are highly likely. There may be some interventions that can be applied to reduce the impacts, but it is likely that significant re-engineering or redesign will be required.
Medium	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts likely. Some impacts to occur and without careful and considered application of mitigation measures it is likely to cause impacts. The focus should be what can be done to break the source-pathway-receiving environment chain.
Moderate	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts only likely to occur on rare occasions. Although there may be some residual impacts, it is possible it can be practically and effectively managed.
Low	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts are not likely and are expected to be minimal.
Negligible	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts are extremely unlikely to occur.

4.2.2.2 Operations

Potential air quality impacts from emergency generator use (including routine testing and maintenance, as well as emergency operations) were quantitatively assessed using air dispersion modelling. Modelling was undertaken using the VIC EPA's approved regulatory model, AERMOD. The key steps in the assessment methodology, including the inputs and processes applied are outlined in the following subsections.

4.2.2.3 Emissions inventory

Emissions were developed and assessed for the following testing and maintenance, and emergency operational scenarios:

- **Scenario 1, testing and maintenance:** 2 units in operation, modelled as generator sources '1A' and '1B'.
- **Scenarios 2 and 3, emergency operations:**
  - One building (i.e., 56 units in operation, i.e. partial power supply outage)
  - Two buildings (i.e., all 112 3 MW units in operation, i.e. full power supply outage). It is noted that this is conservative, with up to 96 3 MW generator units expected to be required for a full mains outage.

Scenarios 2 and 3 are considered to be very unlikely owing to the redundancy in power supplies to site. Still both have been considered consistent with assessment requirements.

The approximate locations of each generator stack are displayed below in **Figure 4-1** with each location representing two generator unit stacks. The source parameters applied in the model (geometric, stack parameters and emission rates) are listed in **Appendix A**.

Figure 4-1. Source arrangement, proposed Brooklyn data centre

4.2.2.4 Modelling and assessment

Overview

Consistent with Publication 1957 the VIC EPA's approved regulatory dispersion model AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) was used to assess potential operational air quality impacts from the Project. Details regarding the inputs and set-up applied in the three key modules (AERMAP, AERMET and AERMOD) are provided in the following sub-sections.

AERMAP terrain set-up

AERMAP is the terrain preprocessor for the AERMOD modelling system. It incorporates terrain effects into air the model by calculating terrain elevations and hill heights for each receptor and source location. AERMAP uses digital elevation data to determine the elevation and the critical hill height scale, which influences plume rise and dispersion in complex terrain. By providing this terrain information, AERMAP ensures that AERMOD can accurately simulate how topography affects pollutant transport and concentration patterns.

Section 5 of Publication 1957 describes the VIC EPA's key considerations for configuring AERMAP. For the assessment, AERMAP was set-up in a manner consistent with these requirements, with the United States Geological Survey (USGS) one-second (30 m resolution) Shuttle Radar Topography Mission (SRTM) used to develop the digital elevation model (DEM) around the Project. Set-up details applied for the Project are summarised in **Table 4-4** below.

Table 4-4. AERMAP set-up details

Project site	1-second SRTM file used	Region DEM applied			
		Southwest corner (m)		Northeast corner (m)	
		X	Y	X	Y
Brooklyn	S38_E144_1arc_v3	306000	5807000	316000	5817000

The DEMs were applied to all sources, buildings and receptors (details provided below) in the respective models prepared for both sites.

AERMET meteorological set-up

AERMOD requires meteorological data that accurately represents atmospheric conditions at and around the Project site. AERMOD requires that these data are pre-processed using AERMET. AERMET converts raw surface and upper-air data into the specific parameters AERMOD needs, such as wind speed and direction, temperature, turbulence characteristics, and mixing heights. This processing ensures that the dispersion model accounts for boundary layer dynamics and stability, which are critical for predicting pollutant transport and dispersion under realistic conditions.

AERMET was set-up in general accordance with the guidance from Publication 1957, with the process applied as summarised below:

- Surface observation data was obtained from the Bureau of Meteorology (BoM) RAAF Williams (Laverton) automatic weather station (AWS) No. 087031 located approximately 9 km to the south east of the Project site for the calendar years 2020 to 2024 inclusive (i.e., five continuous years consistent with Section 4.1 of Publication 1957). Data from this AWS was selected noting its proximity to the site, as well as it being a similar distance from the coast as the Project site, and with the terrain between RAAF Williams (Laverton) and the Project site being generally flat with no significant intervening features.
- The CSIRO's prognostic model TAPM (The Air Pollution Model) was set up and run as summarised in **Table 4-5**. 'Nudging' was applied using observation data from the RAAF Laverton AWS.

Table 4-5. TAPM set-up details

Model input	Value
TAPM version	4.0.5
Number of grids (spacing)	4 (10 km, 3 km, 1 km and 0.3 km)
Number of grid points (x × y × z)	41 × 41 × 25
Simulation period	January 2020 to December 2024 inclusive with one spin-up day applied
Terrain information	AUSLIG 9 second DEM database
Land use and sea surface temperature	TAPM default databases
Centre of analysis	37°50.0'S, 144°48.5'E
Local data assimilation	Yes, model nudged using surface observation data from BoM RAAF Williams (Laverton) AWS. Observations configured as follows: Radius of influence = 3 km. Number of vertical levels for assimilation = 3. Quality factor = 1

- Meteorological data outputs from TAPM were extracted for the Project location and processed for use as on-site surface observation data in AERMET.
- Detailed set-up details for AERMOD are summarised below in **Table 4-6**.

Table 4-6. AERMET set-up details

Model input	Value
AERMET version	Latest USEPA AERMET version 24142 with data input via Lakes Environmental AERMET View software
Mode	Surface data from on-site stations only as extracted from TAPM
Modelling period	Five years (1 January 2020 to 31 December 2024 inclusive)
AERSURFACE surface parameters	12 sectors processed using AERSURFACE utility version 20060, with land use defined using NLCD92 Land Cover Classes interpreted from aerial photography using "Land Use Creator" module in AERMET View. Average moisture, with settings varying by season and month
Other parameters	Processing Stable Boundary Layer (SBL) using Bulk Richardson Numer enabled, threshold wind speed set at 0.5 m/s, low-wind surface friction velocity adjustment enabled

- AERMET was used to develop hourly meteorological conditions at the sites for 2020 to 2024 inclusive. Annual and seasonal wind roses from the AERMET outputs for each calendar year are displayed in **Appendix B**. Consolidated wind roses (i.e. merging the outputs from all five years at the site) providing a summary of the modelled conditions are also displayed in **Figure 4-2**. For comparison, measured values from BoM RAAF Williams (Laverton) AWS for 2020 to 2024 are also displayed in **Figure 4-3**.

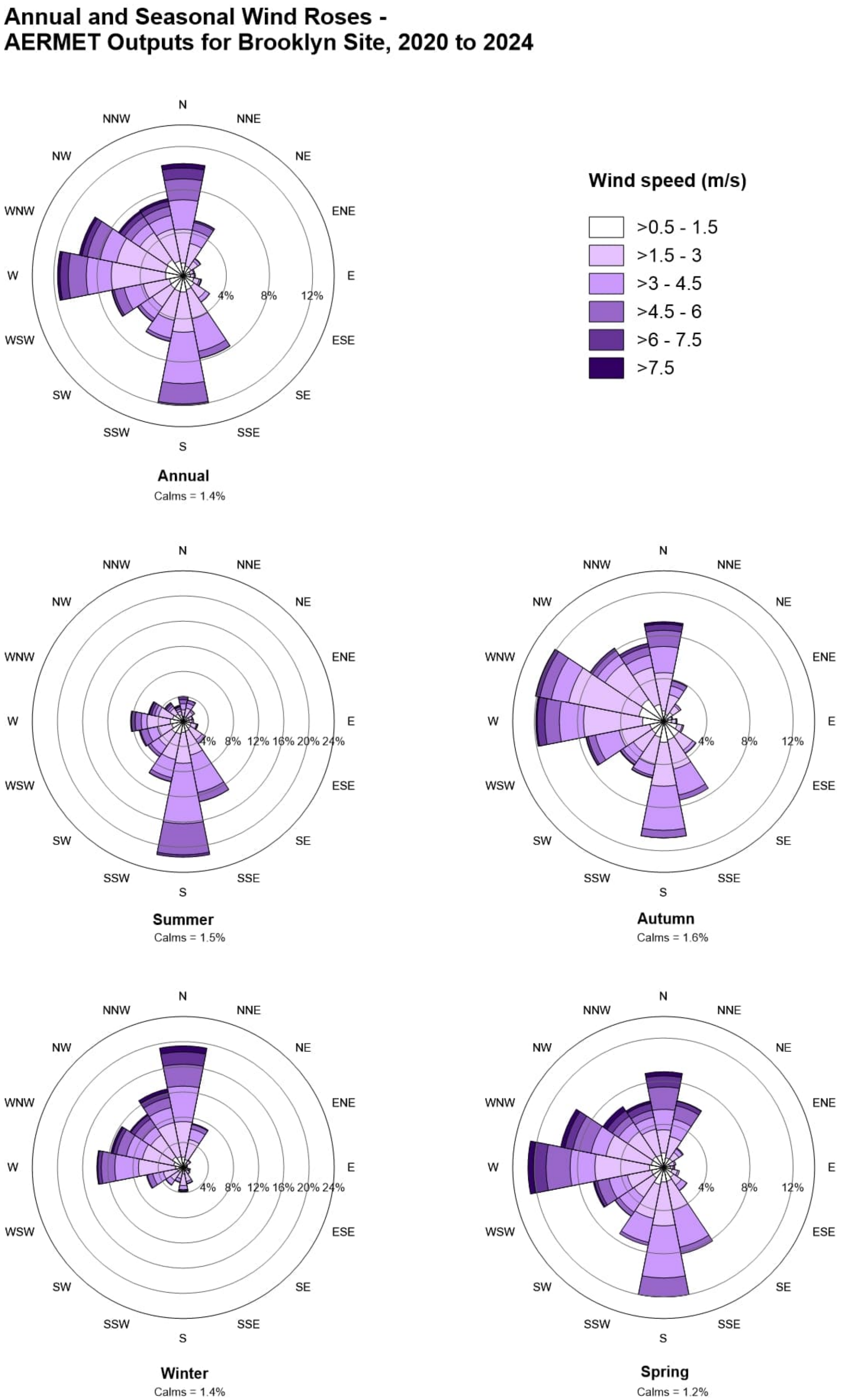


Figure 4-2. AERMET 2020 to 2024 annual and seasonal wind roses for Brooklyn site

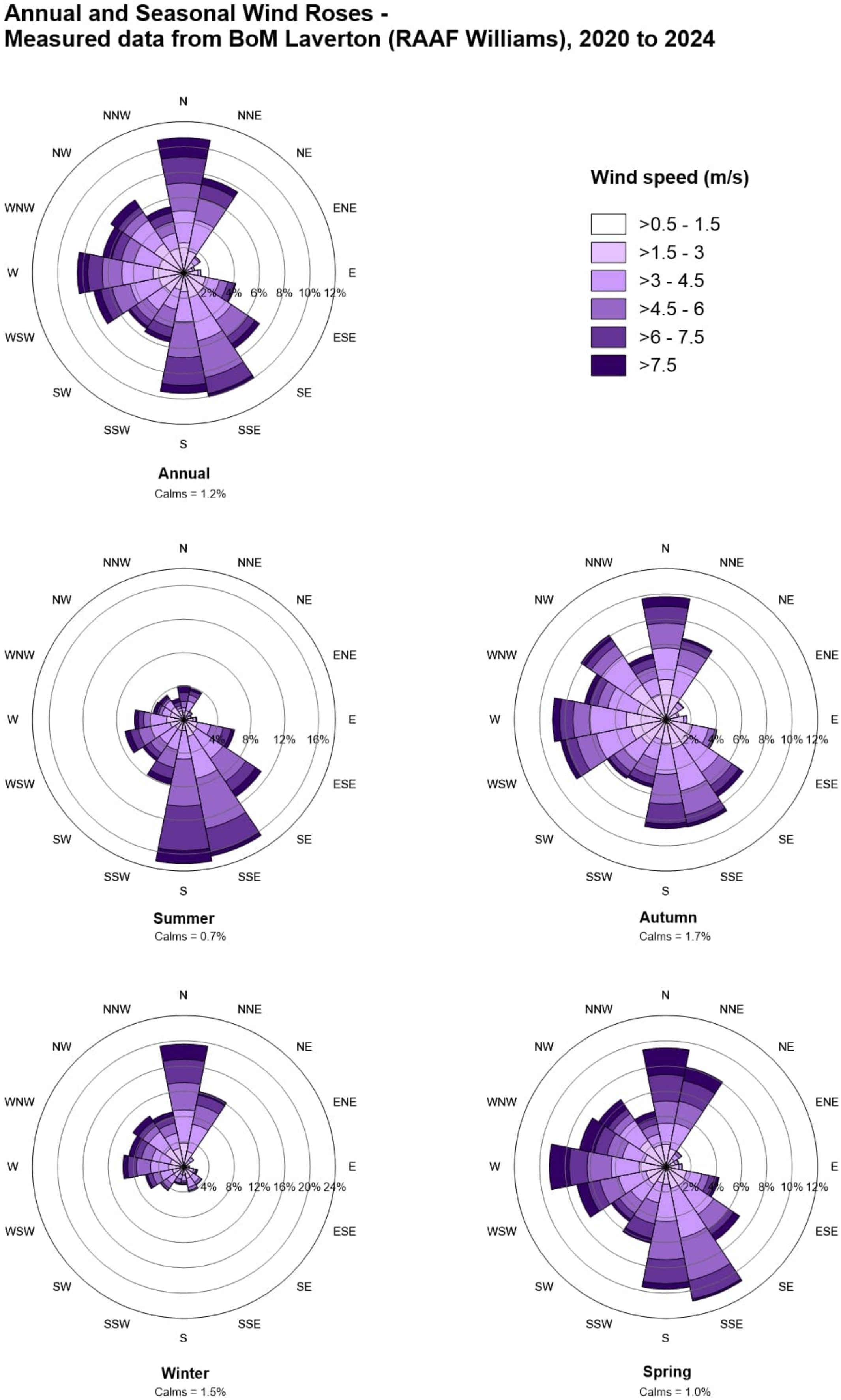
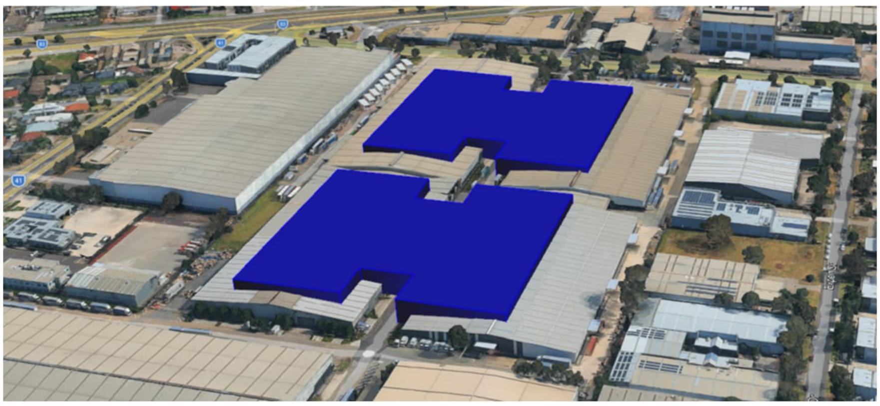


Figure 4-3. 2020 to 2024 annual and seasonal wind roses from BoM Laverton (RAAF Williams)

AERMOD dispersion modelling set-up

AERMOD is VIC EPA's approved regulatory model for air quality impact assessment. AERMOD is a steady-state atmospheric dispersion modelling system that utilises Gaussian plume dispersion concepts for horizontal spreading and Non-Gaussian approaches for vertical dispersion, accounting for boundary-layer turbulence. **Table 4-7** describes how the model were configured for the assessment. This set-up is generally consistent with the guidance presented in Publication 1957.

Table 4-7. AERMOD set-up details

Model input	Value
AERMOD version	AERMOD.EXE (v 24142 64-bit)
Control pathway	
Dispersion options	Default regulatory options, 'Urban' dispersion co-efficient
Pollutants	NO_2, particulate matter, CO and hydrocarbons
Averaging periods and percentiles	NO_2: 1-hour (99.9th), Annual PM: 24-hour (100th), Annual CO: Rolling 8-hour (100th) Hydrocarbons: 1-hour and 30-minutes (99.9th)
NO_x to NO_2 conversion	Ozone Limiting Method using hourly averaged Ozone (O_3) from VIC EPA Footscray supplemented with data from VIC EPA Alphington (for data gaps)
Terrain options	'Elevated' with elevations assigned to all receptors. Extents applied (Brooklyn): Southwest corner: 316000, 5807000 Northeast corner: 306000, 5817000 Mesh size: 100
Assessment period	2020 to 2024 inclusive
Source pathway	
Sources	Refer to **Section 4.2.2.3** above and **Appendix A**
Building downwash calculation	On-site building footprints (in blue) and heights added and downwash effects considered using BPIP/BPIP Prime algorithm as detailed below. Both buildings were set at a height of approximately 24.5 m above finished ground level. Other existing buildings at the site would be removed and were not included. 
Background concentrations	Hourly background concentrations applied for each pollutant listed above (including O_3) as described below in **Section 5.3**.

Indicative population of the urban area	100,000
Receptor pathway	
Gridded receptors	Applied via uniform cartesian grid over the same extents as the 'Terrain options' above at a spacing of 50 m.
Discrete receptors	Discrete receptors applied at the nearest sensitive receptors in each direction as described below in **Section 5.1**.
Meteorology pathway	
Surface and profile meteorological inputs	2020 to 2024 surface (.SFC) and profile (.PFL) files generated using AERMET described above with the base height of the surface station anemometer set at the site ground level above mean sea level.
Output pathway	
Output settings	9th highest hourly, 1st height results for rolling 8-hour and daily 24-hour predicted concentrations at each gridded and discrete sensitive receptor.

Post-processing and evaluation

Potential impacts were evaluated by comparing the cumulative (i.e., background plus Project contribution) modelling results at sensitive receptors with the ERS and other relevant air quality objectives outlined in **Section 3.2**. Results have been presented in the relevant tabulated and graphical contour plot formats (refer to **Appendix D**), as described in Publication 1957.

4.3 Plume rise assessment

The site is located within 15 km of Certified Aerodrome. Certified Aerodrome have prescribed airspace that needs to be kept free from obstacles and effects that could affect aircraft operations. To assess against these requirements, a screening assessment was initially completed in accordance with CASA's most recent, explicit TAPM (The Air Pollution Model) plume rise assessment set-up guidance. This methodology is presented in 'CAAP 89Z-1(0) Guidelines for plume rise assessments' (CASA, 2003) and included:

- Modelling using TAPM version 2.0 or higher using multiple years of continuous meteorological data modelled. Consistent with this requirement and more recent advice from CASA, 2022 to 2024 were considered for this assessment.
- Horizontal displacement of the plume centreline evaluated as a function of height
- Plume spread about the centreline evaluated as a function of height
- Consideration of "average" and "peak" vertical plume velocities for each height
- Wind speed evaluated as a function of height
- Predicting the probability of vertical velocity exceeding the CASA critical plume velocities (CPVs) being exceeded.

Further model set-up details for the plume rise screening review are provided below in **Table 4-8**.

Table 4-8. TAPM set-up details for plume rise screening review

Model input	Value
TAPM version	4.0.5
Number of grids (spacing)	3 (30 km, 10 km, 3 km)
Number of grid points (x × y × z)	25 × 25 × 25
Simulation period	Jan 2022 to Dec 2024 inclusive
Terrain information	AUSLIG 9 second DEM data
Centre of analysis	37°50.0'S, 144°47.5'E
Local data assimilation	None
Mode	Meteorology and pollution mode

For emissions from multiple stacks there is the possibility that merged, overlapping hot plumes may interact with one another, resulting in a single, higher buoyancy plume. This process is referred to as buoyancy enhancement.

The buoyancy enhancement factor (N_E) is defined (Hibberd *et al*, 2005) as follows:

Equation 1

$$N_E = \left[\frac{n+S}{1+S}\right]$$

Where *n* is the number of stacks and *S* is a dimensionless separation factor, defined as:

Equation 2

$$S = 6 \times \left[\frac{(n-1).\Delta s}{n^{\frac{1}{3}}.\Delta z}\right]^{\frac{3}{2}}$$

Where Δs is the stack separation and Δz is the rise of an individual plume. This approach is relevant to stack emissions of similar physical and emission characteristics, as is the case for the Project. TAPM was initially run without buoyancy enhancement. From these runs, the buoyancy enhancement results in **Table 4-9** were determined. This confirmed that buoyancy enhancement required consideration. Using equations 1 and 2 above, TAPM was re-run with the calculated N_E values applied to account for the buoyance enhancement effects resulting from the generator stacks being similar and located in close proximity to each other.

Table 4-9. Back-up diesel generator initial maximum and average final rise heights of the individual plumes (m AGL) and calculated buoyancy enhancement factor (N_E)

Parameter	Results, Brooklyn (2022, 2023 and 2024)
Average plume rise height (m AGL)	76, 72 and 75
Maximum plume rise height (m AGL)	350, 394 and 393
Buoyancy enhancement factor (N_E)	5.5, 6.2 and 6.2 (Average 6.0)

Results from the plume rise screening assessment were evaluated by reviewing the results against CASA's primary CPV (4.3 m/s) at the level of the most stringent applicable protected airspace layer (described in further detail below in **Section 5.4**).

5. Existing conditions

5.1 Surrounding sensitive land uses

VIC EPA Publication 1961.2 defines sensitive land uses as including "land use where it is plausible for humans to be exposed over durations greater than 24 hours, such as residential premises, education and childcare facilities, nursing homes, retirement villages, hospitals". It is noted that the ERS air quality objectives apply to all locations across Victoria, including less sensitive land uses (e.g., commercial and industrial) that are not covered under the definition from Publication 1961.2 above.

The nearest sensitive land uses in relation to the proposed Brooklyn data centre are displayed in **Figure 5-1** below.

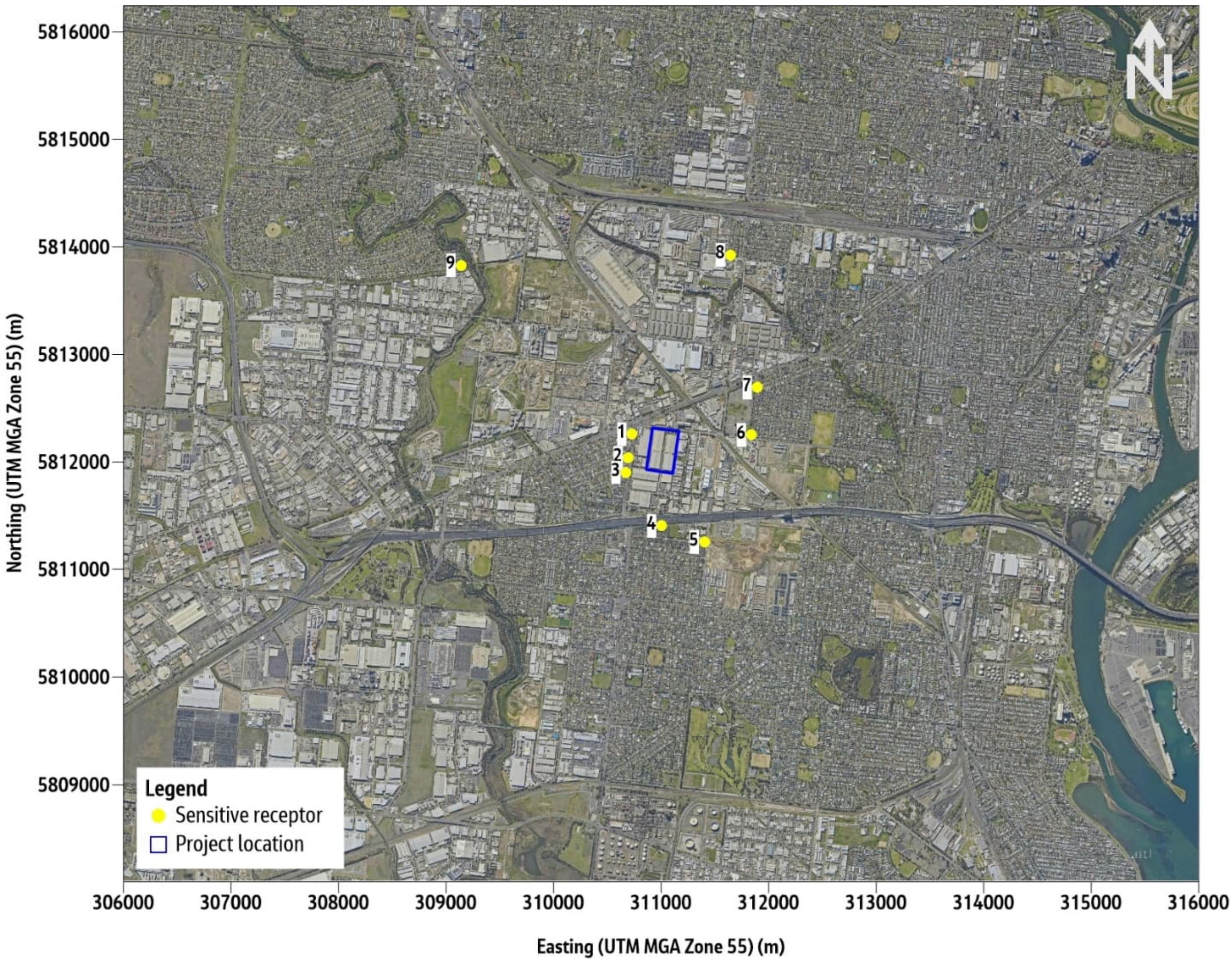


Figure 5-1. Surrounding land uses and receptors, Brooklyn

The details of the nine nearby representative sensitive receptors around the site displayed on **Figure 5-1** are also summarised below in **Table 5-1**.

With reference to the ERS, **Figure 5-1** shows that other industrial land uses outside the Publication 1961.2 sensitive land uses definition are located immediately adjacent to the Project site.

Table 5-1. Nearby representative sensitive receptors around Brooklyn site

Receptor ID	Type	Easting (UTM MGA Zone 55) (m)	Northing (UTM MGA Zone 55) (m)	Elevation (m)
1	Residential	310725	5812259	24
2	Residential	310691	5812038	22
3	Residential	310671	5811901	26
4	Residential	311004	5811402	24
5	Residential	311400	5811251	23
6	Residential	311838	5812251	16
7	Residential	311892	5812692	22
8	Residential	311643	5813926	29
9	Residential	309137	5813829	29

5.2 Other local sources of emissions to air

As outlined in **Section 4.2.1**, other existing sources of emissions to air around the Project location were identified from a review of 1) nearby facilities that triggered applicable thresholds and reported to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW's) NPI database in 2023/24, and 2) surrounding sites with an active operating licence issued by the VIC EPA. These locations around the Project are summarised below in **Table 5-2** (NPI-triggered facilities) and **Table 5-3** (locations with active VIC EPA operating licence). For sites that triggered NPI reporting thresholds and also hold an active VIC EPA operating licence, these locations have not been reproduced in **Table 5-3**.

As these table demonstrate, there are several industrial facilities around the Project that would contribute to existing local air quality conditions.

Table 5-2: Nearby facilities around the Brooklyn site where NPI emissions to air were reported in 2023/24

Facility name	Registered Business name	Address	Main activities	Emissions to air reported in 2023/24
Opal Fibre Packaging Brooklyn	OPAL PACKAGING AUSTRALIA PTY LTD	512-520 GEELONG RD Brooklyn	Manufacturing of cardboard boxes and packaging material from recycled paper	CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, PAHs, VOCs (total)
Brooklyn	JBS AUSTRALIA PTY LIMITED	30 INDUSTRY PARK DR Brooklyn	Red Meat Processing (abattoir)	Metals, VOCs (total and speciated), CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2,TEQ, PAHs
Veolia Brooklyn	VEOLIA ENVIRONMENTAL SERVICES (AUSTRALIA) PTY LTD	15 MCDONALD RD Brooklyn	Liquid & solid prescribed waste treatment.	Mercury, sulfuric acid, zinc and compounds

Allegion Door and Access Systems - Brooklyn	ALLEGION (AUSTRALIA) PTY LTD	42 EXPORT DR Brooklyn	Manufacturer of Locks (Doors and Access Systems)	Zinc and compounds
CARGILL PROCESSING LIMITED	CARGILL PROCESSING LIMITED	425 SOMERVILLE RD Footscray West	Oilseed Processing Plant - crushing canola to produce vegetable oil and high protein meal for stockfeed.	Metals, VOCs (total and speciated), CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2,TEQ, PAHs, mercury

Table 5-3. Locations with active VIC EPA operating licence around the Brooklyn site

Operating licence No.	Activity site	Permission holder	Air quality discharge requirements
OL000000788	680 Geelong Road Brooklyn	AUSTRALIAN TALLOW PRODUCERS PTY. LTD.	No licenced air discharge points or limits
OL000212257	457 Somerville Rd Brooklyn	BLACK RUBBER PTY LTD	No licenced air discharge points or limits
OL000011972	84 - 92 Jones Rd Brooklyn	WESTERN LAND RECLAMATION PTY LTD	No licenced air discharge points or limits
OL000011628	27 - 35 McDonald Rd Brooklyn	TANK SERVICES AUSTRALIA PTY LTD	No licenced air discharge points or limits
OL000300095	44 McDonald Road Brooklyn	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	No licenced air discharge points or limits
OL000300052	125 Bunting Road Brooklyn	RESOURCECO PTY LTD	No licenced air discharge points or limits
OL000069025	174 Old Geelong Rd Brooklyn	EDL LFG (VIC) PTY LTD	CO, 205 tonnes per year (t/y)
OL000300079	473 Somerville Road, Brooklyn	DELTA RECYCLING PTY LTD	No licenced air discharge points or limits
OL000300058	174 Old Geelong Road Brooklyn	CLEANAWAY SOLID WASTE PTY LTD	No licenced air discharge points or limits
OL000000694	21 Paw Paw Rd Brooklyn	CHEMPROD NOMINEES PROPRIETARY LIMITED	Points 1 and 2: SO_2, 7.5 grams per minute (g/min) Sulfur trioxide (SO_3), 0.9 g/min Point 1 only: Alumina hydrate, 8 g/min
OL000068908	74 Old Geelong Rd Brooklyn	APA VTS AUSTRALIA (OPERATIONS) PTY LTD	CO, 250 g/min NO_x as NO_2, 475 g/min

5.3 Background air quality

5.3.1 Overview

The VIC EPA operates an ambient air quality monitoring network throughout the state. The stations that measure the required pollutants over the period of assessment (2020 to 2024) that are nearest and most representative of conditions around the Project site include:

- **Brooklyn station:** Located 400 m to the southwest of the site in a residential area adjacent to industry. The station has been in operation since late 2009. Only Particulate matter as $PM_{2.5}$ is measured at the station.
- **Footscray station:** Located around 2.3 km to the northeast of the site in a residential area adjacent to industry and key transport corridors. Pollutants including NO_2, CO, $PM_{2.5}$ and O_3 are measured at the station.
- **Alphington station:** Located further away, approximately 16 km to the northeast of the Brooklyn site. The station was operational over the entire period of review (2020 to 2024 inclusive), with pollutants including NO_2, CO, $PM_{2.5}$ and O_3 measured. The station provides a representative alternative for background conditions when data from the two closer stations are not available.

Background air quality data for sensitive receptors around the site were initially adopted from Footscray. Any data gaps in the Footscray monitoring data were supplemented using data from Alphington. Any residual gaps were filled using the 70^{th} percentile value of the measured data applied from Footscray and Alphington stations. Data were not used from the Brooklyn station owing to the limited pollutants measured and there being some issues with data completeness.

The background data developed for the assessment using this approach are summarised by pollutant below in **Section 5.3.2** (NO_2 and O_3), **Section 5.3.3** (CO) and **Section 5.3.4** ($PM_{2.5}$).

5.3.2 Nitrogen dioxide (NO_2) and Ozone (O_3)

As described in **Section 4.2.2.4**, the OLM method was used to convert results for NO_x to NO_2. **Figure 5-2** displays a time series of the hourly background NO_2 and O_3 concentrations that were applied in the assessment

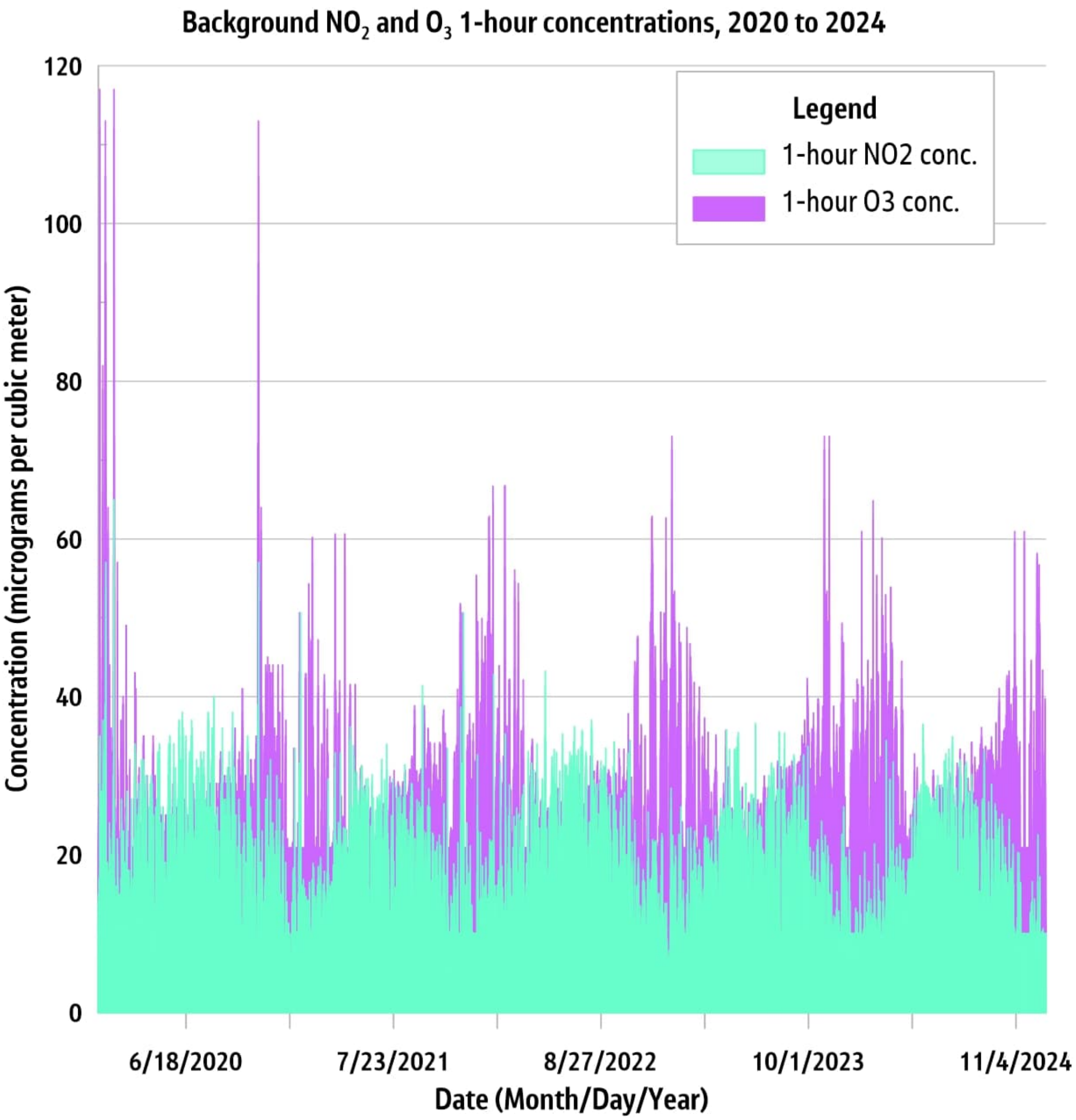


Figure 5-2. Time-series of adopted 1-hour NO_2 and O_3 background concentrations (EPA, 2020 to 2024)

5.3.3 Carbon monoxide (CO)

Figure 5-3 shows a time series plot of the rolling 8-hour averaged CO concentrations applied in the assessment using data collected from the VIC EPA's Footscray and Alphington stations from 2020 to 2024.

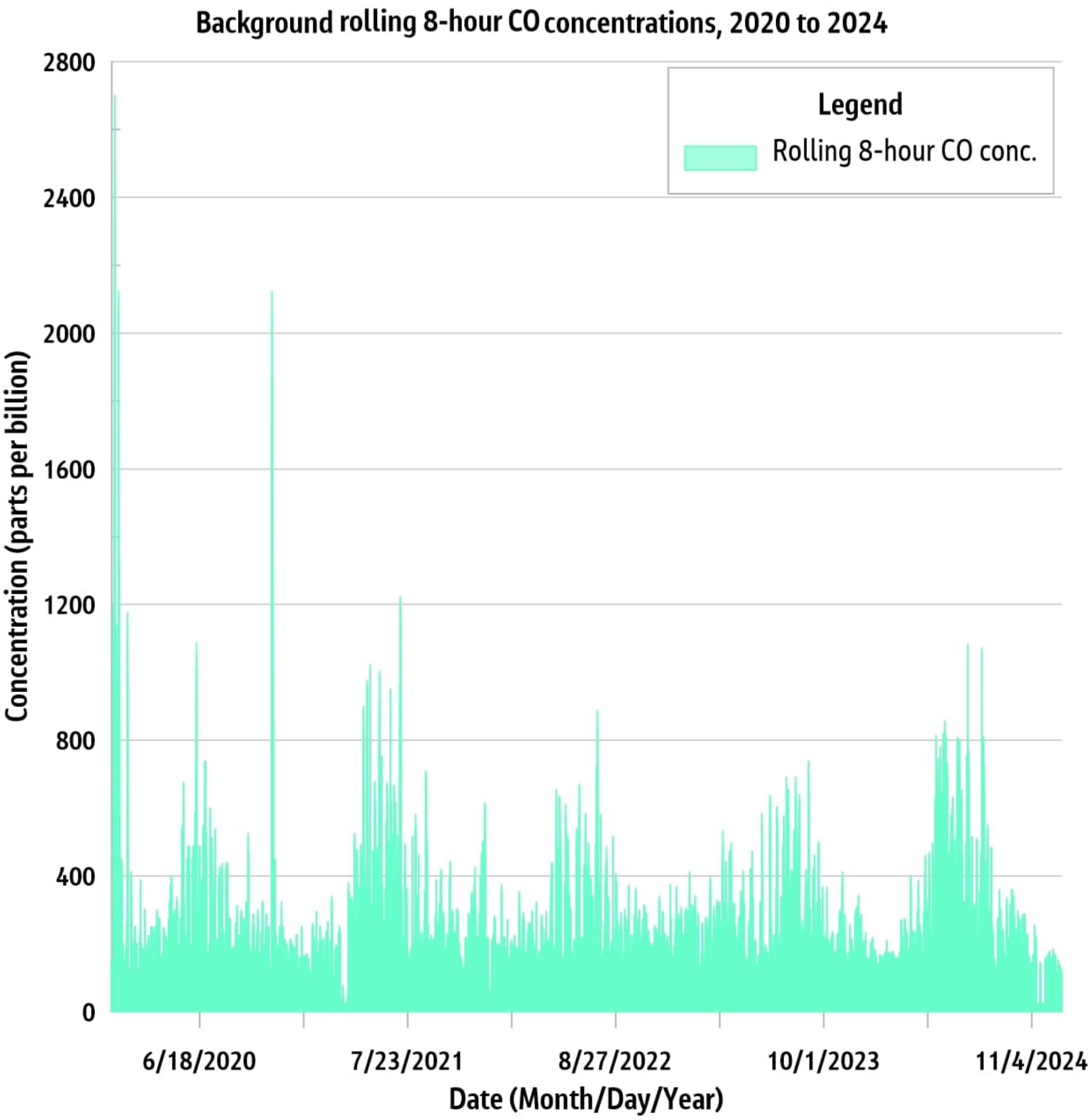


Figure 5-3. Time-series of adopted rolling 8-hour averaged CO background concentrations (EPA, 2020 to 2024)

The highest rolling 8-hour averaged CO concentration recorded over the five year period was 2,700 ppb which is well below the 9,000 ppb (10,300 µg/m^3) objective from the ERS and Publication 1961.2.

5.3.4 Particulate matter ($PM_{2.5}$)

A time series of the 24-hour averaged $PM_{2.5}$ concentrations applied in the assessment using data from Footscray and Alphington stations is shown below in **Figure 5-4**.

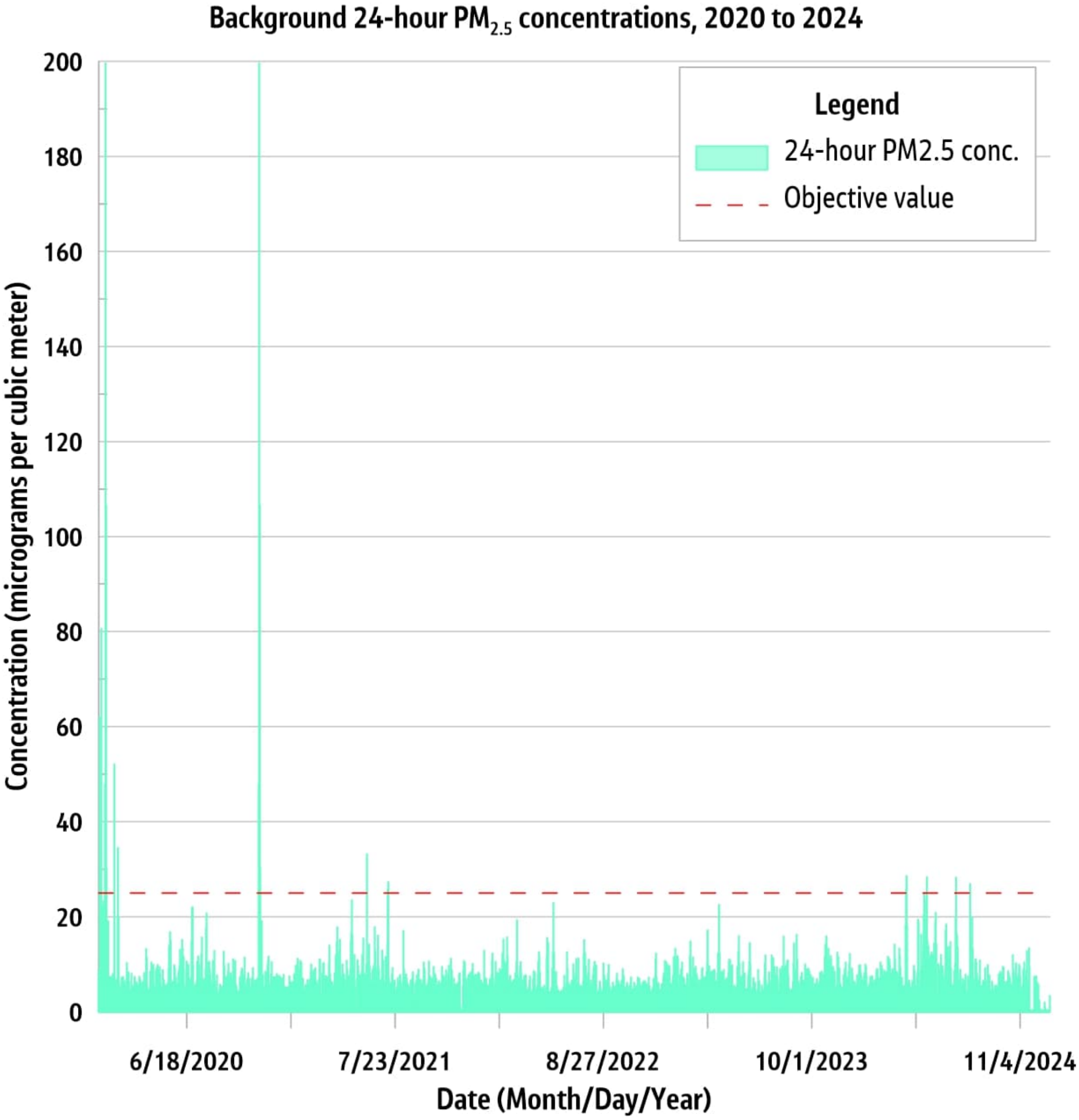


Figure 5-4. Time-series of adopted 24-hour averaged $PM_{2.5}$ background concentrations (EPA, 2020 to 2024)

As **Figure 5-4** shows, there were several instance from 2020 to 2024 where daily averaged $PM_{2.5}$ concentrations exceeded 25 µg/m^3:

- 13 days in 2020
- 3 days in 2021
- 6 days in 2024.

Key statistics for $PM_{2.5}$ over the monitoring period are summarised below in **Table 5-4**.

Table 5-4. Local background $PM_{2.5}$ statistics over the 2020 to 2024 monitoring period

Year	Annual average (µg/m^3)	Maximum 24-hour average (µg/m^3)	70th percentile 24-hour average (µg/m^3)	Highest 24-hour concentration below criterion (µg/m^3)
2020	10	200	8	23.3
2021	7	33	8	23.5
2022	6	23	7	23
2023	7	23	8	23
2024	7	29	8	23.5

The statistics in **Table 5-4** are presented, noting that the 24-hour averaged criteria from the ERS and Publication 1961.2 applies to the maximum cumulative daily $PM_{2.5}$ concentration. 70th percentile and the next highest 24-hour averaged concentration in the 2020 to 2024 period below the 25 µg/m^3 criteria are listed so that the test can be applied whether the Project could result in any additional exceedances of this criterion at surrounding sensitive receptors.

5.4 Protected airspace requirements

5.4.1 RAAF Base Point Cook

The Brooklyn data centre site is located approximately 15 km northeast of RAAF Base Point Cook Certified Aerodrome. RAAF Base Point Cook has an OLS and PANS-OPS. At the approximate location of the proposal, it is understood that the OLS is the lower of the PANS-OPS and OLS (i.e., more stringent), being a minimum of 150 m above ground level referenced to the aerodrome reference point (ARP). The height of the ARP at RAAF Base Point Cook is 4 m and the approximate base elevation for the new data centre at Brooklyn is around 31 m. As such, the height available to the OLS around the new Brooklyn data centre would be approximately 123 m.

5.4.2 Essendon Fields

The Brooklyn data centre site is also located within 15 km of Essendon Fields Certified Aerodrome. Current OLS and PANS-OPS for the airport are published in 'Essendon Airport Master Plan 2013', (Essendon Airport Pty Ltd, 2014). It is understood that this plan is to be updated, although this is scheduled to commence in quarter three of 2026. Current advice from the aerodrome operator is that the 2013 Master Plan remains in effect. The Project is also located in the 'outer horizontal surface' for the OLS. At the approximate location of the new data centre the OLS is lower than the PANS-OPS, being 228.5 m high, referenced to the Essendon Fields Aerodrome ARP (86 m). As noted above the approximate ground elevation at the Project is around 31 m. As such the available height above ground level at the new Brooklyn data centre would be around 197.5 m.

5.4.3 Summary

Based on the information presented in **Section 5.4.1** and **Section 5.4.2** it was determined that the OLS around RAAF Base Point Cook would be the most stringent nearby prescribed airspace layer. As such, impacts were evaluated against this requirement.

6. Air quality impact assessment

6.1 Construction

6.1.1 Nuisance dust review

6.1.1.1 Overview

Publication 1943 provides a framework for assessing nuisance dust impacts. This framework is consistent with the overarching provisions of the GED to 'eliminate or minimise the risks posed by hazards to prevent harm'. The framework assesses the risk posted by nuisance dust by considering three elements:

- **Step 1:** The hazard potential of dust sources. This is evaluated based on the size, nature of activities, type of emissions generated and level of control.
- **Step 2:** The exposure pathway between the source and receiving environment. The framework considers the separation distance, orientation, and intervening terrain and land uses features between the activity or project and the surrounding receivers.
- **Step 3:** The sensitivity of the receiving environment. This aspect considers the historical context of air quality-related issues experienced by people in the receiving environment, as well as the overall land use across this setting.

As displayed below in **Figure 6-1** these outcomes from **Steps 1**, **2** and **3** are combined to determine the overall risk of dust impacts from an activity or project (**Step 4**), with the final outcome being any residual impacts once planned mitigation and management measures are applied.

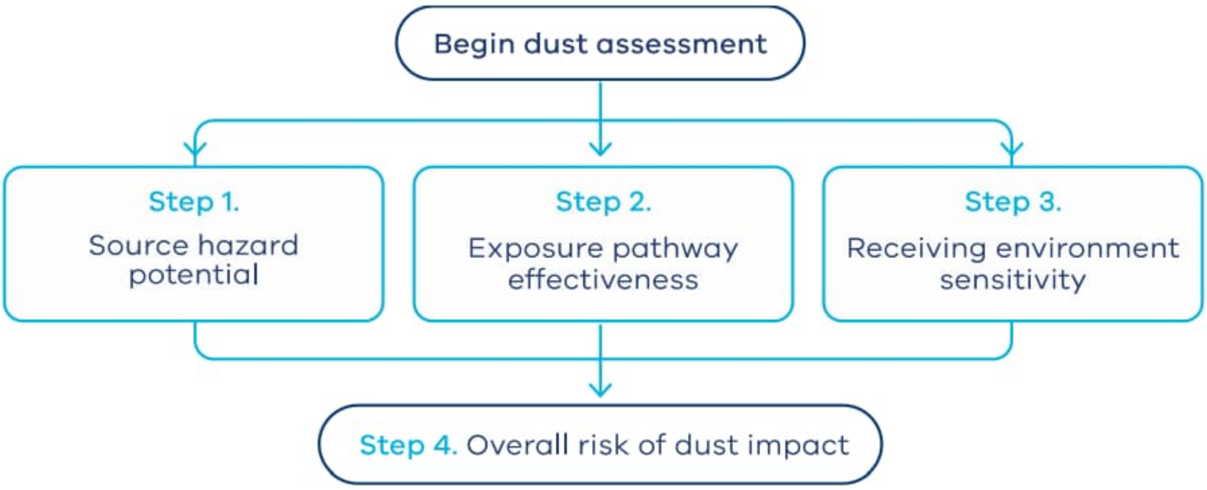


Figure 6-1. Nuisance dust risk assessment framework (Source: EPA, 2025b)

The process and outcomes applied for steps 1 to 4 are presented in the following subsections.

6.1.1.2 Step 1: Hazard potential of dust sources

Step 1 of the Publication 1943 nuisance dust assessment method involves evaluating the potential for an activity or source to generate nuisance dust emissions, as well as the characteristics of the dust emissions. The method considers the size of the potential dust emission sources, nature of activities to be undertaken, the type of dust emissions (relating to the material type), and the ease of control of emissions. Based on Project size, the expected extent of earthworks and demolition of existing structures required, and the expected activities during construction and using the guidance from Publication 1943 (reproduced in **Appendix C**) the following construction dust hazard potential ratings were determined:

Table 6-1. Construction dust hazard potential ratings

Project	Score				
	Size of dust emitting source	Activities being undertaken	Type of dust emission	Level of control	Total
Brooklyn site	2	2	2	2	**8**

6.1.1.3 Step 2: Exposure pathway effectiveness

Step 2 of the Publication 1943 nuisance dust assessment method considers the effectiveness of the dust transmission pathway from the source to the receiving environment. The factors evaluated in determining the dust transmission pathway effectiveness are detailed in **Appendix C**. Using this guidance and current limited information available for the Project, the dust exposure pathway effectiveness ratings listed in **Table 6-2** below were estimated.

Table 6-2. Construction dust exposure pathway effectiveness ratings

Project	Score				
	Distance	Orientation of receivers relative to prevailing wind direction	Terrain	Intervening land use	Total
Brooklyn site	2	1#	2	2	**7**

Based on wind roses developed for the assessment and the location of the nearest representative sensitive receptors in-relation to the site

6.1.1.4 Step 3: Receiving environment sensitivity

Step 3 the EPA's nuisance dust assessment framework considers the context (historical and land use) within which an activity or project is to be completed. Guidance for characterising these aspects for an assessment has been reproduced in **Appendix C**. Using this guidance and current limited information available for the Project, the following nuisance dust receiving environment sensitivity ratings were estimated:

Table 6-3. Receiving environment nuisance dust sensitivity ratings

Project	Score		
	Historical Context	Land use	Total
Brooklyn site	4	4	**8**

6.1.1.5 Step 4: Unmitigated impact assessment

Consistent with **Figure 6-1**, Step 4 involves the combination of the values for hazard potential (Step 1), pathway effectiveness (Step 2) and receiving environment sensitivity (Step 3) to determine the overall potential for impacts (in the absence of mitigation). Guidance from Publication 1943 for Step 4 was reproduced above in **Table 4-2**.

Based on the hazard potential (Step 1), pathway effectiveness (Step 2) and receiving environment sensitivity (Step 3) ratings determined above, **Table 6-4** lists the overall potential unmitigated nuisance dust ratings determined for the Project.

Table 6-4. Unmitigated nuisance dust impact ratings, construction

Project	Score				Unmitigated impact rating
	Receiving environment sensitivity	Pathway effectiveness	Hazard potential	Total and rating	
Brooklyn site	8	7	8	**23**	Medium, dust impacts likely if not properly managed

6.1.1.6 Dust management measures during construction

Based on the outcomes in **Table 6-4** above, the need for management of nuisance dust during construction was determined. Consistent with the Publication 1834.2, the GED and other relevant guidance, the following measures are recommended for inclusion in the Construction Environmental Management Plan (CEMP):

- Watering of exposed and disturbed areas. This will minimise the level of dust generated from Project exposed and disturbed areas, such that associated residual impacts would be minimised.
- Modifying the intensity of activities based on observed dust levels and local meteorological conditions. This would identify adverse ambient air quality and meteorological conditions so that activities can be scaled back or suspended accordingly (i.e., avoid or minimise). This would reduce the potential for any residual impacts when ambient conditions are already degraded.
- Covering of loads and removing loose materials/debris before vehicles exit the site. This would minimise dust associated with the transport of construction materials.
- Minimising the extent of disturbed and exposed areas and stockpiles. This would limit dust arising from wind erosion.
- Covering or stabilising long-term stockpiles. Again, this would limit the extent of dust resulting from wind erosion effects at these areas.
- Positioning any dusty activities such as concrete batching and materials stockpiles as far as practicable from surrounding receptors to minimise the potential for impacts.
- Identifying appropriate site speed limits. Dust generated from traffic traveling along unsealed roads is less at lower speeds, minimising the potential for impacts.
- Revegetating or sealing finished areas as soon as possible. Revegetated and sealed areas are less susceptible to wind erosion, minimising the potential for impacts.
- Maintain minimum setback distances of at least 100m to sensitive receptors from temporary concrete batch plants consistent with guidance presented in EPA's 'Publication 1949: Separation distance guidelines' (EPA, 2024) (if required). This will minimise the potential for impacts from emissions to air arising from concrete batching activities
- Regular review of controls so that they remain suitable.

6.1.2 Other air quality impacts during construction

As noted in **Section 2.4**, other potential emissions to air during construction identified included exhaust emissions from the combustion of fossil fuels in construction plant and equipment, odours and airborne hazardous materials arising from uncovered contaminated materials. Based on the assessment ratings developed in **Table 4-3** it was determined that unmitigated impacts at surrounding sensitive receptors from both these sources would be 'low'. This determination was made based on the low likelihood of these types of emissions to air being generated to an extent that any impacts would be expected. With the application of the appropriate control measures detailed above and below via the CEMP, it is expected that residual impacts associated with these types of emissions during construction would be 'negligible':

- Conducting routine servicing and maintenance of equipment. This will make sure that they continue operating in a proper and efficient manner. This is expected to reduce (i.e., minimise) emissions from abnormal operations.
- Switching off all vehicles, plant and equipment when not in-use for extended periods. This avoids unnecessary exhaust-related emissions by removing the emissions source.
- Applying odour supressing agents to materials as necessary should any contaminated or hazardous materials be uncovered during the works, to mitigated and associated effects.
- Adhering to relevant requirements for removal and disposal of contaminated and hazardous materials listed in the applicable health and safety legislature and regulations so that any emissions are avoided or otherwise minimised, and effects are effectively mitigated.

6.2 Operations

This section presents and discusses the outcomes of the operational air quality assessments completed for the Project. The results presented were determined quantitatively using the EPA-approved AERMOD dispersion model as described above in **Section 4.2.2**. Results are presented by pollutant in the subsections below as follows:

- Nitrogen dioxide (NO_2), **Section 6.2.1**
- Carbon monoxide (CO), **Section 6.2.2**
- Particulate matter as $PM_{2.5}$, **Section 6.2.3**
- VOCs, **Section 6.2.4.**

Results are presented in tabulated form at the surrounding representative receptor locations identified in **Section 5.1**. Ground-level concentration contour plots are also provided for selected results in **Appendix D**.

6.2.1 Nitrogen dioxide (NO_2)

1-hour averaged 99.9th percentile cumulative ground level concentrations of NO_2 predicted at the nearest sensitive receptors (i.e., those identified in **Section 5.1**) around the Project site are summarised below in **Table 6-5**. These results represent the total contribution from the Project, as well as existing background concentrations, with the OLM method applied to convert NO_x to NO_2 as outlined in **Section 4.2.2**. The results in **Table 6-5** are highly conservative, noting that:

- Scenarios would only occur for a small number of hours each year, however impacts were assessed for all hours. This has been done to determine the potential maximum (in this case 99.9th percentile) impacts but it assumes a reasonably worst-case combination of meteorological and background conditions occurring concurrent with these short-term and in the case of scenarios 2 and 3, very infrequent and unlikely operations.

Table 6-5. 1-hour averaged 99.9th percentile NO_2 results, Brooklyn

Sensitive receptor	Predicted NO_2 cumulative concentrations (µg/m^3)															Air quality objective (µg/m^3)
	Scenario 1: Routine testing and maintenance					Scenario 2:56 units operating (emergency, partial power outage)					Scenario 3: 112 units operating (emergency, full power outage)					
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	
1	92	73	70	65	62	**690**	**682**	**695**	**605**	**644**	**833**	**828**	**843**	**790**	**801**	150
2	92	73	69	65	62	**575**	**597**	**598**	**561**	**558**	**784**	**781**	**816**	**757**	**767**	
3	93	73	68	66	62	**561**	**577**	**590**	**576**	**576**	**863**	**917**	**909**	**890**	**919**	
4	96	75	69	71	63	**483**	**476**	**470**	**487**	**468**	**938**	**932**	**912**	**946**	**921**	
5	98	75	70	68	68	**473**	**453**	**458**	**465**	**462**	**884**	**859**	**879**	**866**	**858**	
6	92	76	75	73	72	**541**	**537**	**572**	**559**	**572**	**761**	**734**	**762**	**740**	**740**	
7	92	75	70	66	64	**421**	**416**	**426**	**400**	**408**	**699**	**710**	**659**	**694**	**697**	
8	94	73	67	66	62	**192**	**179**	**197**	**197**	**197**	**355**	**349**	**359**	**373**	**369**	
9	92	73	67	66	62	**157**	130	**165**	145	**153**	**285**	**235**	**283**	**256**	**267**	

As **Table 6-5** shows, during routine generator testing (scenario 1), 99.9th cumulative 1-hour averaged NO_2 concentrations were predicted to remain below the 150 µg/m^3 air quality objective value.

Exceedances were predicted for scenarios 2 and 3, noting the conservative assumptions outlined above. Still, consistent with the intent of the GED, namely to "minimise risks as far as reasonably practicable" even when the frequency of such risks is very low, the efficacy of different options were reviewed to reduce resulting concentrations at surrounding sensitive receptors during emergency operations:

- **Exhaust stack adjustments:** Exhaust heights are set as part of the overall design, but there could be some flexibility insofar as the exhaust diameter to increase exit velocities. The worst-case combination (i.e., scenario 3, 2023 meteorology and background conditions) was re-run with a smaller diameter (reduced from 0.8 to 0.7), increasing the stack velocity from around 23 to 31 m/s. It is noted that AERMOD does not consider enhanced buoyancy of multiple plumes which may under-estimate the effectiveness of this option. This option achieved a reduction in GLC at the most affected sensitive receptor of around 4% (approximately 38 µg/m^3). it was determined that this approach would only be effective in conjunction with other controls, and was not explicitly recommended.
- **Generator control approaches:** Various potential control options for the proposed generator units exist including derating (i.e., reducing output), temperature adjustments, use of fuel additives, engine modifications such as exhaust gas recirculation (EGS), and other reduction technologies like selective catalytic reduction (SCR). Table 7 of 'National Pollutant Inventory Emission Estimation Technique Manual for Combustion Engines (Version 3.0)', (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2008) provides guidance regarding the efficacy of NO_x reduction control approaches for large diesel engines.

  Cumulative 99.9th percentile, 1-hour averaged NO_2 ground level concentrations at the most-affected sensitive receptor for scenario 3 with 2023 meteorology based on the application of different control approaches are summarised below in **Table 6-6**. The 50% and 90% control options are based on guidance from DEWHA, 2008 with the application of EGR and SCR respectively.

Table 6-6. Brooklyn site NO_x GED controls review

Control option	Cumulative 99.9th percentile 1-hour averaged NO_2 concentration at most-affected representative receptor (µg/m³)	Air quality objective (µg/m³)
50% reduction in NO_x emissions (e.g., EGR)	456	150
90% reduction in NO_x emissions (e.g., SCR)	91	

Technologies like SCR are more effective in generator units that are operated continuously which would not be the case for the Project. Noting the very low expected frequency and short-term nature of scenario 2 and 3 emergency use events, these controls have been reviewed consistent with the GED, but are not explicitly recommended.

6.2.2 Carbon monoxide (CO)

Rolling 8-hour averaged 100th percentile cumulative ground level CO concentrations determined at the nearest sensitive receptors around the Project are listed in **Table 6-7** .

Table 6-7. Rolling 8-hour averaged 100th percentile CO results, Brooklyn

Sensitive receptor	Predicted CO cumulative concentrations (mg/m³)															Air quality objective (mg/m³)
	Scenario 1: Routine testing and maintenance					Scenario 2:56 units operating (emergency, partial power outage)					Scenario 3: 112 units operating (emergency, full power outage)					
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	
1	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.8	1.3	3.1	1.4	1.1	0.9	1.6	10.3
2	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.1	0.9	1.2	3.1	1.4	1.2	1.1	1.3	
3	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.2	0.9	1.2	3.1	1.4	1.3	1.2	1.2	
4	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.1	0.9	1.2	3.1	1.4	1.1	1.0	1.2	
5	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.9	1.2	3.1	1.4	1.0	0.9	1.2	
6	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.8	1.2	3.1	1.5	1.0	0.8	1.2	
7	3.1	1.4	1.0	0.8	1.2	3.1	1.5	1.0	0.8	1.2	3.1	1.5	1.0	0.8	1.3	
8	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.8	1.3	
9	3.1	1.4	1.0	0.8	1.2	3.1	1.4	1.0	0.9	1.3	3.1	1.4	1.0	0.9	1.3	

As **Table 6-7** shows, cumulative CO concentrations were determined to remain below the rolling 8-hour 99.9th percentile ERS air quality objective at the nearest most-affected sensitive receptors around the Project sites during routine testing and maintenance, as well as during emergency operations.

6.2.3 Particulate matter

Cumulative 100th percentile 24-hour averaged ground level $PM_{2.5}$ concentrations determined at the nearest sensitive receptors around Brooklyn are listed below in **Table 6-8**. In addition to the factors of conservatism described for the NO_x modelling, the result also assumes operation for a full 24 hours. In reality routine testing and maintenance events would be in the order of several hours.

Table 6-8. 24-hour averaged 100th percentile $PM_{2.5}$ results, Brooklyn

Sensitive receptor	Predicted $PM_{2.5}$ cumulative concentrations (µg/m³)															Air quality objective (µg/m³)
	Scenario 1: Routine testing and maintenance					Scenario 2:56 units operating (emergency, partial power outage)					Scenario 3: 112 units operating (emergency, full power outage)					
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	
1	**200**	**33**	23	23	**29**	**213**	**44**	**50**	**39**	**47**	**230**	**74**	**79**	**61**	**89**	25
2	**200**	**33**	23	23	**29**	**202**	**42**	**44**	**43**	**41**	**214**	**64**	**74**	**67**	**70**	
3	**200**	**33**	23	23	**29**	**201**	**47**	**48**	**54**	**47**	**204**	**68**	**73**	**81**	**63**	
4	**200**	**33**	23	23	**29**	**207**	**49**	**36**	**41**	**42**	**217**	**94**	**74**	**82**	**81**	
5	**200**	**33**	23	23	**29**	**204**	**38**	**32**	**31**	**49**	**207**	**50**	**54**	**52**	**74**	
6	**200**	**33**	23	23	**29**	**206**	**34**	**35**	**32**	**37**	**212**	**46**	**56**	**57**	**45**	
7	**200**	**33**	23	23	**29**	**202**	**34**	24	23	**31**	**205**	**36**	**36**	**31**	**39**	
8	**200**	**33**	23	23	**29**	**202**	**34**	24	23	**31**	**203**	**34**	24	23	**33**	
9	**200**	**33**	23	23	**29**	**201**	**34**	24	23	**33**	**202**	**34**	**25**	24	**37**	

As displayed in **Table 6-8**, during routine generator testing (scenario 1), maximum cumulative 24-hour averaged $PM_{2.5}$ concentrations were predicted to be exceed the 25 µg/m³ air quality objective value for background and meteorological conditions in 2020, 2021 and 2024. As outlined in **Section 5.3.4**, there were several days in these years where existing background levels were measured above 25 µg/m³. The assessment approach is conservative whereby worst-case background air quality and meteorological conditions have been applied at the time of testing. Again, in reality, testing would occur monthly with each event being completed over the course of several hours. For the three years where exceedances were predicted, additional analysis was completed to understand the relative contribution from the Project, and whether routine generator testing could result in additional instances of the air quality objective value. This analysis is presented in **Table 6-9** below.

Table 6-9. Additional review of 24-hour averaged 100th percentile $PM_{2.5}$ results for scenario 1, Brooklyn

Year	Days with $PM_{2.5}$ concentration above 25 µg/m³	Maximum Project 24-hour $PM_{2.5}$ contribution at most-affected sensitive receptor	Highest 24-hour concentration below criterion (µg/m³)	Will routine testing result in additional days of exceedance at a surrounding representative sensitive receptor?
2020	13	1.5	23.3	No
2021	3	1.6	23.5	Yes, the maximum Project contribution would result in an additional exceedance. The 2nd highest contribution from the Project was 1.4 µg/m3. This

				would not result in an additional exceedance.
2024	6	1.7	23.5	Yes, the maximum Project contribution would result in an additional exceedance. The 2nd highest contribution from the Project was 1.3 µg/m3. This would not result in an additional exceedance.

As **Table 6-9** shows, even with the conservative assumptions detailed above, it was determined that routine testing would not result in any additional days of exceedance at any of the identified representative sensitive receptors. The exceptions were for 2021 and 2024 where a single potential additional exceedance per year was predicted.

Regarding scenarios 2 and 3 (partial and full power outages) the results in **Table 6-8** are also affected by elevated local background $PM_{2.5}$ concentrations over the period of assessment. Again, the outcomes presented are highly conversative, with worst-case background air quality and meteorological conditions applied at the time that emergency operations would be required, and emissions from these activities considered for all hours (i.e., in reality, 24-hour concentrations would be lower for events less than 24 hours duration where the emission rates before and after the event are zero).

As discussed above for NO_2, noting the very low likelihood of emergency operation events, the limited effectiveness of many control approaches when generators are used in a back-up capacity, and that these types of such operations may be exempt from requiring a permission, no specific controls are recommended.

6.2.4 VOCs

As identified in **Section 2.4** the key speciated VOCs relevant for diesel generators include acetaldehyde, benzene, formaldehyde, toluene and xylene. A review of the emission rates determined for each species (see **Appendix A**) and their applicable APACs from Publication 1961.2 (listed in **Table 3-3**) identified that benzene and formaldehyde had the highest emission rate compared with their respective objective values. As such, these substances identified as the key speciated VOCs, understanding that if compliance for these two was met, this would also be the case for acetaldehyde, toluene and xylene.

Resulting 99.9th percentile, 1-hour averaged ground level concentrations of benzene and formaldehyde at the nearest surrounding sensitive receptors were predicted around the Project. The results from this assessment are summarised as follows in the tables below:

- Benzene, **Table 6-10**
- Formaldehyde, **Table 6-11**.

As these tables show, resulting concentrations at sensitive receptors around the site were predicted to remain below the relevant design criteria from Publication 1961.2 for all three operational assessment scenarios.

Table 6-10. 1-hour averaged 99.9th percentile benzene results, Brooklyn

Sensitive receptor	Predicted benzene concentrations (µg/m³)															Air quality objective (µg/m³)
	Scenario 1: Routine testing and maintenance					Scenario 2:56 units operating (emergency, partial power outage)					Scenario 3: 112 units operating (emergency, full power outage)					
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	
1	3E-3	2E-3	3E-3	2E-3	3E-3	1E-1	1E-1	1E-1	9E-2	1E-1	1E-1	1E-1	1E-1	1E-1	1E-1	580
2	2E-3	3E-3	3E-3	2E-3	2E-3	9E-2	9E-2	9E-2	9E-2	9E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
3	2E-3	3E-3	3E-3	3E-3	3E-3	9E-2	9E-2	9E-2	9E-2	9E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
4	4E-3	4E-3	4E-3	4E-3	4E-3	7E-2	7E-2	7E-2	7E-2	7E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
5	4E-3	4E-3	4E-3	4E-3	4E-3	7E-2	7E-2	7E-2	7E-2	7E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
6	5E-3	5E-3	5E-3	5E-3	5E-3	8E-2	8E-2	9E-2	9E-2	9E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
7	4E-3	4E-3	4E-3	4E-3	4E-3	6E-2	6E-2	6E-2	6E-2	6E-2	1E-1	1E-1	1E-1	1E-1	1E-1	
8	1E-3	1E-4	1E-3	1E-4	1E-3	3E-2	3E-2	2E-2	3E-2	3E-2	5E-2	5E-2	6E-2	6E-2	6E-2	
9	8E-4	6E-4	8E-4	7E-4	7E-4	2E-2	2E-2	2E-2	2E-2	2E-2	4E-2	3E-2	4E-2	4E-2	4E-2	

Table 6-11. 30-minute averaged 99.9th percentile formaldehyde results, Brooklyn

Sensitive receptor	Predicted formaldehyde concentrations (µg/m³)															Air quality objective (µg/m³)
	Scenario 1: Routine testing and maintenance					Scenario 2:56 units operating (emergency, partial power outage)					Scenario 3: 112 units operating (emergency, full power outage)					
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	
1	3E-4	3E-4	3E-4	3E-4	3E-4	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	2E-2	1E-2	1E-2	100
2	2E-4	3E-4	3E-4	2E-4	2E-4	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	
3	3E-4	4E-4	4E-4	3E-4	3E-4	1E-2	1E-2	1E-2	1E-2	1E-2	2E-2	2E-2	2E-2	2E-2	2E-2	
4	4E-4	4E-4	4E-4	4E-4	4E-4	8E-3	8E-3	8E-3	8E-3	8E-3	2E-2	2E-2	2E-2	2E-2	2E-2	
5	5E-4	4E-4	5E-4	5E-4	5E-4	8E-3	8E-3	8E-3	8E-3	8E-3	2E-2	2E-2	2E-2	2E-2	2E-2	
6	6E-4	5E-4	6E-4	6E-4	5E-4	1E-2	1E-3	1E-3	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	1E-2	
7	4E-4	5E-4	5E-4	5E-4	5E-4	7E-3	7E-3	7E-3	7E-3	7E-3	1E-2	1E-2	1E-2	1E-2	1E-2	
8	2E-4	1E-4	2E-4	1E-4	2E-4	3E-3	3E-3	3E-3	3E-3	3E-3	6E-3	6E-3	6E-3	6E-3	7E-3	
9	9E-5	7E-5	9E-5	8E-5	8E-5	2E-3	2E-3	2E-3	2E-3	2E-3	5E-3	4E-3	5E-3	4E-3	4E-3	

7. Plume rise screening assessment

Results for the back-up diesel generators for 2022 to 2024 meteorology with buoyancy enhancement effects applied (described above in **Section 4.3**) for the Project are summarised below in **Table 7-1**.

Table 7-1: Estimated height above ground level at which plume vertical velocity falls below CASA's 4.3 m/s CPV, Brooklyn back-up generators

Percentage exceedance	Height at which plume vertical velocity falls below 4.3 m/s (m AGL)			Available height (m AGL) for vertical velocity to fall below CPV from OLS
	2022	2023	2024	
0%	38	37	37	123
0.05%	36	36	37	
0.10%	36	36	36	
0.20%	36	36	36	
0.30%	35	35	36	
0.50%	35	35	35	
1%	34	34	34	
2%	34	34	34	
3%	33	33	33	
4%	33	33	33	
5%	33	33	33	
6%	33	33	33	
7%	33	33	33	
8%	33	33	33	
9%	33	33	33	
10%	33	33	33	
20%	32	32	32	
30%	32	32	32	
40%	32	32	32	
50%	32	32	32	
60%	32	32	32	
70%	32	32	32	
80%	32	32	32	
90%	31	31	31	
100%	31	31	31	

As **Table 7-1** shows, vertical velocities from the 3 MW back-up generators were predicted to fall below CASA's primary and secondary CPVs well below the lowest protected airspace requirements. Still, in-line with step 3 of the plume rise assessment methodology from 'Advisory Circular AC 139.E-02 V1.0 Plume Rise Assessments' (CASA, 2023), a 1247 form (including associated meteorological data) has been submitted to

CASA for their review. Other sources not considered in this screening review (e.g., chiller exhaust) were included in the information supplied to CASA.

8. Conclusion

An air quality and plume rise assessment has been completed for a new data centre proposed at Brooklyn, VIC. The assessment determined the following outcomes and requirements with regard to the three key risks identified:

- **Construction air quality:**
  - Using the assessment methodology detailed in Publication 1943, 'medium' potential unmitigated nuisance dust impacts were determined for the Brooklyn site.
  - Suitable mitigation and management measures were developed in-line with Publication 1834.2, the GED and other relevant guidance. With these measures, it is expected that nuisance dust would be able to be effectively managed such that impacts during construction would be considered very unlikely.
- **Operational air quality:**
  - For NO_x and $PM_{2.5}$, compliance against ERS air quality objective values at surrounding sensitive receptors (other otherwise no additional potential instances of exceedances when background conditions were already elevated, except for $PM_{2.5}$ in 2021 and 2024 where one potential additional day of exceedance was predicted) was generally determined during generator routine testing and maintenance and emergency operations. Justifiable exceedances were determined during emergency operations. It is noted that emissions to air from these types of operations may be exempt, but there is still the need to review potential controls to minimise impacts consistent with the requirements of the GED. Such controls were reviewed, although it was determined that they would be unlikely to meet the threshold as being reasonable and feasible, noting the expected frequency of these events would be extremely low, and that the efficacy of such controls are limited for generators that are used in a back-up capacity.
  - For all operational scenarios (i.e., routine testing and maintenance and emergency operations) compliance was determined against relevant ERS and Publication 1961.2 air quality objective values at surrounding sensitive receptors for CO and speciated VOCs.
- **Operational plume rise:**
  - A plume rise screening assessment was completed using TAPM. Results were evaluated against the most stringent 4.3 m/s CPV at the lower (i.e., most conservative) prescribed airspace layer at the nearest Certified Aerodrome.
  - Using this approach, it was determined that the vertical velocities from the back-up generators would fall below CASA's 4.3 m/s CPV well below the lowest protected airspace requirements relevant at the site. Consistent with 'Advisory Circular AC 139.E-02 V1.0 Plume Rise Assessments' (CASA, 2023), a 1247 form (including associated meteorological data) has been submitted to CASA for their review.

9. References

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Appendix A. Generator stack inputs

Brooklyn generators geometric, exit velocity and exit temperature inputs

Stack ID	Stack co-ordinates (MGA UTM Zone 55 m)		Stack height (m AGL)	Stack diameter (m)	Base elevation (m AHD)	Exit velocity (m/s)	Exit temp (C)
	X co-ordinate	Y co-ordinate					
G1A	310905.40	5811978.03	25.5	0.8	21.9	23.4	460.7
G1B	310905.88	5811980.63	25.5	0.8	21.9	23.4	460.7
G2A	310905.93	5811982.45	25.5	0.8	21.9	23.4	460.7
G2B	310906.41	5811985.19	25.5	0.8	21.9	23.4	460.7
G3A	310907.47	5811994.89	25.5	0.8	21.9	23.4	460.7
G3B	310908.00	5811997.77	25.5	0.8	21.9	23.4	460.7
G4A	310908.24	5811999.02	25.5	0.8	21.9	23.4	460.7
G4B	310908.57	5812002.24	25.5	0.8	21.9	23.4	460.7
G5A	310909.74	5812011.63	25.5	0.8	21.9	23.4	460.7
G5B	310910.42	5812014.61	25.5	0.8	21.9	23.4	460.7
G6A	310910.18	5812016.04	25.5	0.8	21.9	23.4	460.7
G6B	310910.87	5812019.03	25.5	0.8	21.9	23.4	460.7
G7A	310903.80	5811969.52	25.5	0.8	21.9	23.4	460.7
G7B	310904.28	5811972.49	25.5	0.8	21.9	23.4	460.7
G8A	310914.00	5812036.95	25.5	0.8	21.9	23.4	460.7
G8B	310914.57	5812039.76	25.5	0.8	21.9	23.4	460.7
G9A	310914.68	5812041.36	25.5	0.8	21.9	23.4	460.7
G9B	310915.18	5812044.53	25.5	0.8	21.9	23.4	460.7
G10A	310916.24	5812053.69	25.5	0.8	21.9	23.4	460.7
G10B	310916.70	5812057.03	25.5	0.8	21.9	23.4	460.7
G11A	310916.93	5812058.21	25.5	0.8	21.9	23.4	460.7
G11B	310917.54	5812061.38	25.5	0.8	21.9	23.4	460.7
G12A	310918.91	5812070.43	25.5	0.8	21.9	23.4	460.7
G12B	310919.57	5812073.53	25.5	0.8	21.9	23.4	460.7
G13A	310919.72	5812075.03	25.5	0.8	21.9	23.4	460.7
G13B	310920.37	5812077.87	25.5	0.8	21.9	23.4	460.7
G14A	310921.01	5812083.47	25.5	0.8	21.9	23.4	460.7
G14B	310921.51	5812086.60	25.5	0.8	21.9	23.4	460.7
G15A	310928.59	5812135.76	25.5	0.8	20.1	23.4	460.7
G15B	310929.23	5812138.88	25.5	0.8	20.1	23.4	460.7

G16A	310929.88	5812144.12	25.5	0.8	20.1	23.4	460.7
G16B	310930.55	5812147.24	25.5	0.8	20.1	23.4	460.7
G17A	310930.66	5812148.73	25.5	0.8	20.1	23.4	460.7
G17B	310931.19	5812151.70	25.5	0.8	20.1	23.4	460.7
G18A	310932.41	5812161.10	25.5	0.8	20.1	23.4	460.7
G18B	310932.97	5812164.18	25.5	0.8	20.1	23.4	460.7
G19A	310933.16	5812165.35	25.5	0.8	20.1	23.4	460.7
G19B	310933.59	5812168.59	25.5	0.8	20.1	23.4	460.7
G20A	310934.91	5812177.84	25.5	0.8	20.1	23.4	460.7
G20B	310935.41	5812180.83	25.5	0.8	20.1	23.4	460.7
G21A	310935.83	5812182.44	25.5	0.8	20.1	23.4	460.7
G21B	310936.24	5812185.26	25.5	0.8	20.1	23.4	460.7
G22A	310938.82	5812203.22	25.5	0.8	20.1	23.4	460.7
G22B	310939.37	5812206.29	25.5	0.8	20.1	23.4	460.7
G23A	310939.31	5812207.62	25.5	0.8	20.1	23.4	460.7
G23B	310939.82	5812210.84	25.5	0.8	20.1	23.4	460.7
G24A	310941.22	5812220.01	25.5	0.8	20.1	23.4	460.7
G24B	310941.88	5812223.11	25.5	0.8	20.1	23.4	460.7
G25A	310941.97	5812224.75	25.5	0.8	20.1	23.4	460.7
G25B	310942.25	5812227.75	25.5	0.8	20.1	23.4	460.7
G26A	310943.64	5812236.91	25.5	0.8	20.1	23.4	460.7
G26B	310944.30	5812239.77	25.5	0.8	20.1	23.4	460.7
G27A	310944.51	5812241.38	25.5	0.8	20.1	23.4	460.7
G27B	310945.07	5812244.35	25.5	0.8	20.1	23.4	460.7
G28A	310945.67	5812249.87	25.5	0.8	20.1	23.4	460.7
G28B	310946.15	5812252.75	25.5	0.8	20.1	23.4	460.7
G29A	311067.24	5811945.70	25.5	0.8	21.9	23.4	460.7
G29B	311067.59	5811947.85	25.5	0.8	21.9	23.4	460.7
G30A	311068.56	5811954.14	25.5	0.8	21.9	23.4	460.7
G30B	311068.76	5811956.12	25.5	0.8	21.9	23.4	460.7
G31A	311069.04	5811958.68	25.5	0.8	21.9	23.4	460.7
G31B	311069.46	5811960.68	25.5	0.8	21.9	23.4	460.7
G32A	311071.09	5811970.94	25.5	0.8	21.9	23.4	460.7
G32B	311071.40	5811973.23	25.5	0.8	21.9	23.4	460.7
G33A	311071.66	5811975.36	25.5	0.8	21.9	23.4	460.7
G33B	311072.12	5811977.73	25.5	0.8	21.9	23.4	460.7
G34A	311073.34	5811987.40	25.5	0.8	21.9	23.4	460.7

G34B	311073.80	5811990.26	25.5	0.8	21.9	23.4	460.7
G35A	311074.12	5811991.91	25.5	0.8	21.9	23.4	460.7
G35B	311074.47	5811994.67	25.5	0.8	21.9	23.4	460.7
G36A	311077.33	5812012.84	25.5	0.8	21.9	23.4	460.7
G36B	311077.63	5812015.38	25.5	0.8	21.9	23.4	460.7
G37A	311077.94	5812017.63	25.5	0.8	21.9	23.4	460.7
G37B	311078.19	5812019.97	25.5	0.8	21.9	23.4	460.7
G38A	311080.06	5812029.55	25.5	0.8	21.9	23.4	460.7
G38B	311080.29	5812032.47	25.5	0.8	21.9	23.4	460.7
G39A	311080.52	5812033.96	25.5	0.8	21.9	23.4	460.7
G39B	311080.82	5812036.85	25.5	0.8	21.9	23.4	460.7
G40A	311082.46	5812046.42	25.5	0.8	21.9	23.4	460.7
G40B	311082.72	5812049.08	25.5	0.8	21.9	23.4	460.7
G41A	311082.98	5812051.08	25.5	0.8	21.9	23.4	460.7
G41B	311083.30	5812053.68	25.5	0.8	21.9	23.4	460.7
G42A	311084.26	5812059.15	25.5	0.8	21.9	23.4	460.7
G42B	311084.58	5812062.00	25.5	0.8	21.9	23.4	460.7
G43A	311092.07	5812111.69	25.5	0.8	20.4	23.4	460.7
G43B	311092.42	5812114.55	25.5	0.8	20.1	23.4	460.7
G44A	311093.29	5812120.07	25.5	0.8	20.1	23.4	460.7
G44B	311093.66	5812122.90	25.5	0.8	20.1	23.4	460.7
G45A	311094.03	5812124.50	25.5	0.8	20.1	23.4	460.7
G45B	311094.22	5812127.29	25.5	0.8	20.1	23.4	460.7
G46A	311095.89	5812136.48	25.5	0.8	20.1	23.4	460.7
G46B	311096.15	5812139.82	25.5	0.8	20.1	23.4	460.7
G47A	311096.43	5812141.21	25.5	0.8	20.1	23.4	460.7
G47B	311096.84	5812144.15	25.5	0.8	20.1	23.4	460.7
G48A	311098.37	5812153.47	25.5	0.8	20.1	23.4	460.7
G48B	311098.66	5812156.50	25.5	0.8	20.1	23.4	460.7
G49A	311098.99	5812158.25	25.5	0.8	20.1	23.4	460.7
G49B	311099.25	5812161.02	25.5	0.8	20.1	23.4	460.7
G50A	311102.12	5812179.08	25.5	0.8	20.1	23.4	460.7
G50B	311102.31	5812181.84	25.5	0.8	20.1	23.4	460.7
G51A	311102.75	5812183.62	25.5	0.8	20.1	23.4	460.7
G51B	311102.88	5812186.31	25.5	0.8	20.1	23.4	460.7
G52A	311104.54	5812195.92	25.5	0.8	20.1	23.4	460.7
G52B	311104.72	5812198.58	25.5	0.8	20.1	23.4	460.7

G53A	311105.33	5812200.43	25.5	0.8	20.1	23.4	460.7
G53B	311105.42	5812203.09	25.5	0.8	20.1	23.4	460.7
G54A	311107.23	5812212.69	25.5	0.8	20.1	23.4	460.7
G54B	311107.28	5812215.43	25.5	0.8	20.1	23.4	460.7
G55A	311107.57	5812217.36	25.5	0.8	20.1	23.4	460.7
G55B	311107.63	5812219.75	25.5	0.8	20.1	23.4	460.7
G56A	311108.91	5812225.48	25.5	0.8	20.1	23.4	460.7
G56B	311109.19	5812228.31	25.5	0.8	20.1	23.4	460.7

Stack emission rates (Source: Caterpillar, 2025)

Pollutant	Emission rate (g/s)	Emission rate	Emission rate (g/s)
PM	0.13	NO_x as NO_2	6.3
PM_{10}	0.13	CO	0.68
$PM_{2.5}$*	0.127	Hydrocarbons	0.015

* $PM_{2.5}$ emission rate derived from the ratio of PM_{10} to $PM_{2.5}$ emission rates (around 1 : 0.976) for large (>450 kW) diesel engines from Table 43 of ‘National Pollutant Inventory Emission Estimation Technique Manual for Combustion Engines (Version 3.0)’, (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2008)

Speciated VOC estimated emission rates

Pollutant	Ratio to VOCs	Emission rate (g/s)
Hydrocarbons	1 : 1.053*	0.015
Total VOCs	1 : 1	0.016
Acetaldehyde	0.00032 : 1#	4.98E-06
Benzene	0.01 : 1#	1.58E-04
Formaldehyde	0.001 : 1#	1.58E-05
Toluene	0.00354 : 1#	5.59E-05
Xylene	0.00246 : 1#	3.89E-05

* Total hydrocarbons to total VOCs ratio adopted from ‘Conversion Factors for Hydrocarbon Emission Components, EPAA420-R-05-015 NR-002c’, (United States Environment Protection Authority, 2005)
# Speciated VOC emission rates derived from the ratio of speciated VOC to Total VOC emission rates for large (>450 kW) diesel engines from Table 43 of ‘National Pollutant Inventory Emission Estimation Technique Manual for Combustion Engines (Version 3.0)’, (Department of the Environment, Water, Heritage and the Arts, 2008)

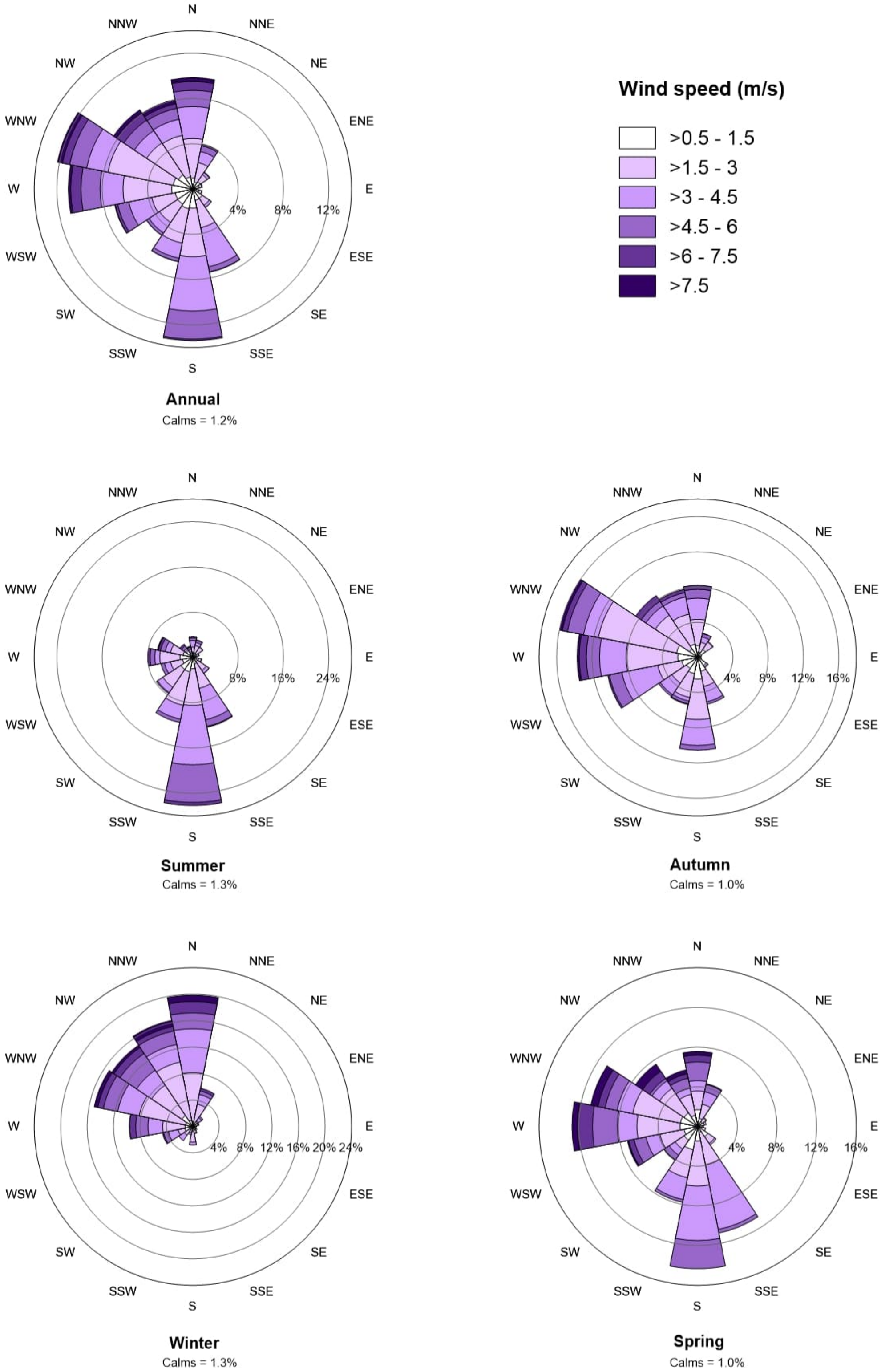
Appendix B. AERMET annual and seasonal wind roses

2024

Annual and Seasonal Wind Roses -
AERMET Outputs for Brooklyn Site, 2024

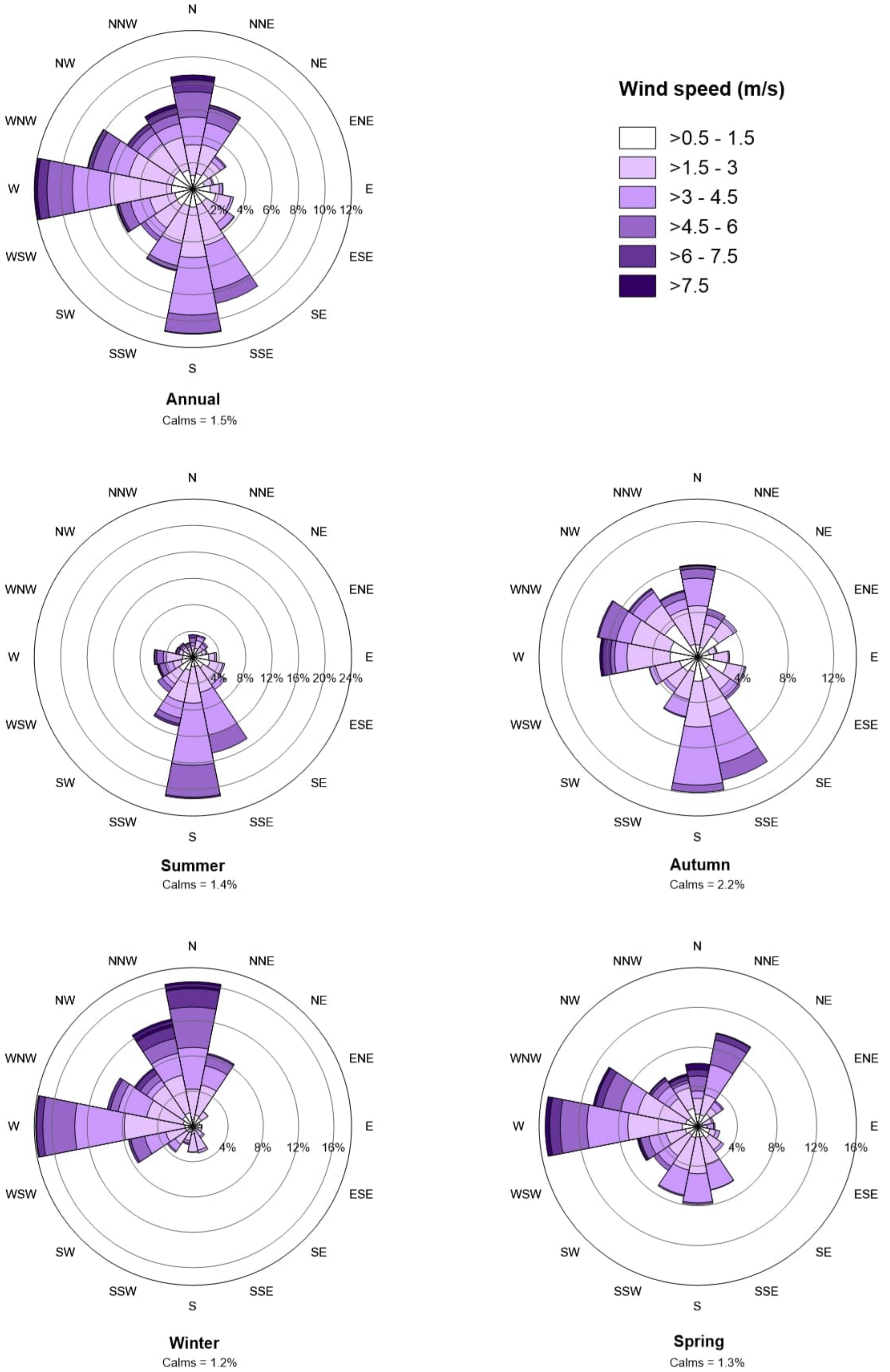
2023

Annual and Seasonal Wind Roses -
AERMET Outputs for Brooklyn Site, 2023



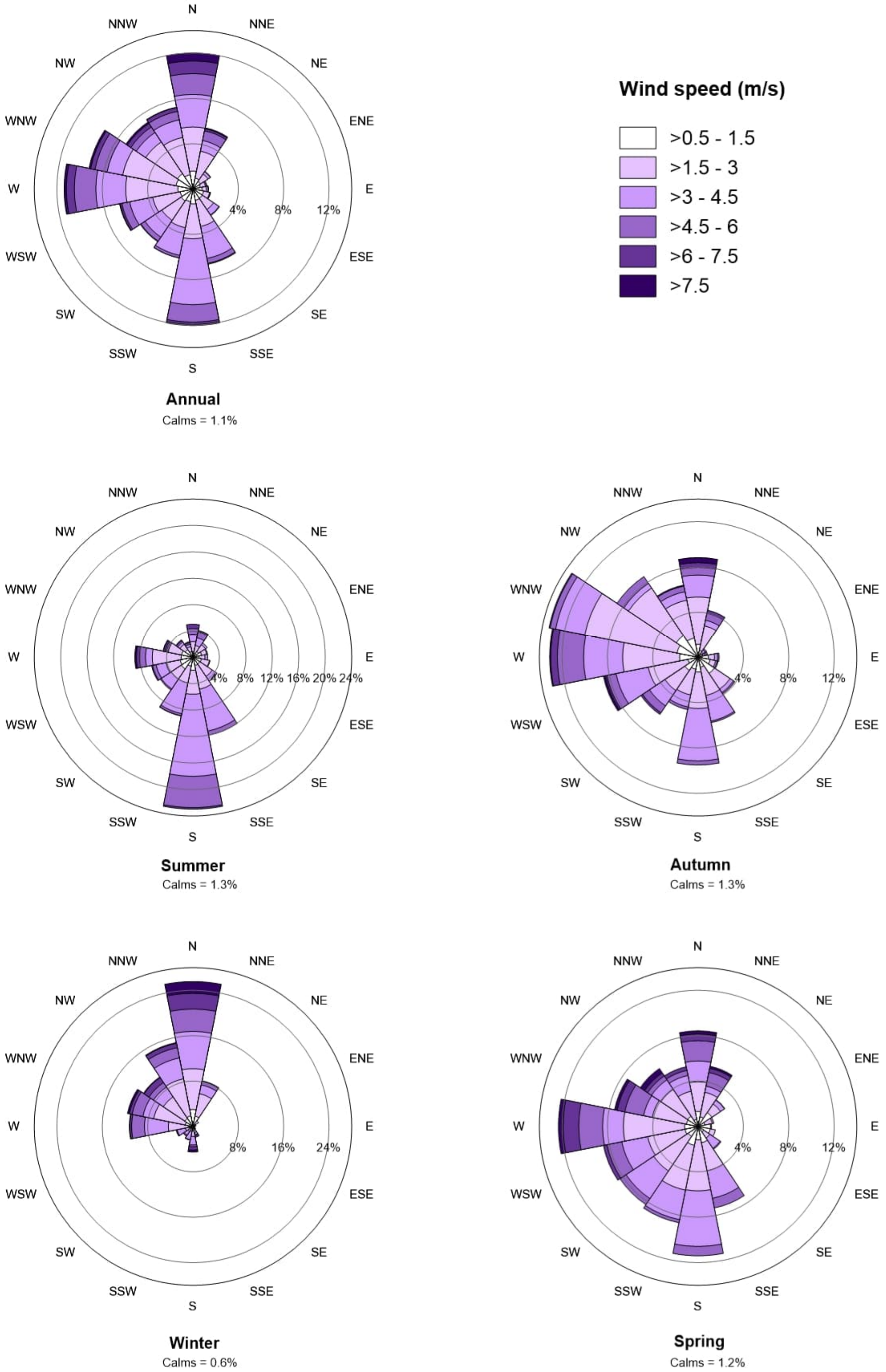
2022

Annual and Seasonal Wind Roses -
AERMET Outputs for Brooklyn Site, 2022



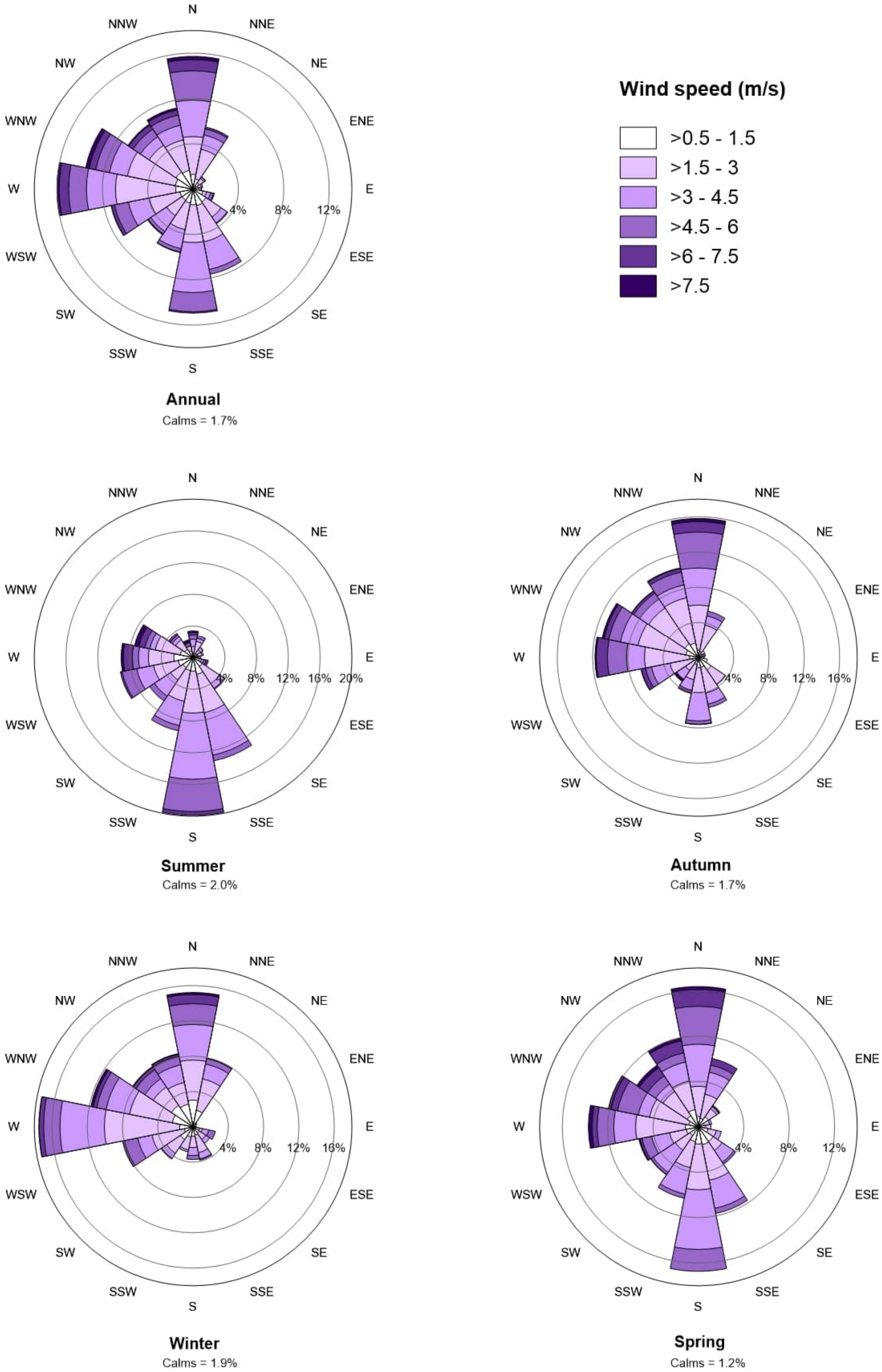
2021

Annual and Seasonal Wind Roses -
AERMET Outputs for Brooklyn Site, 2021



2020

Annual and Seasonal Wind Roses - AERMET Outputs for Brooklyn Site, 2020



Appendix C. Nuisance dust assessment Publication 1943 guidance

Step 1 Source hazard potential

Score	Size of dust emitting source	Activities being undertaken	Type of dust emission	Level of Control
1	**Small:** materials usage in the order of hundreds of tonnes/m³ per year; area sources of tens m²	**Low potential for dust emissions:** Dust not generated by activity per-se (car yards, auto recyclers, washing and cleaning leads to sediments. Sites with exposed areas without activity (typically vacant yards, lots etc).	**Coarse:** only larger stony materials on site, very coarse sand, blue metal	**Full control or containment:** Fully sealed areas and/or highly effective, tangible measures in place leading to little or no residual dust. Releases only due to plant failure. Good housekeeping, enclosed operation with extraction and treatment equipment
2	**Medium:** materials usage in the order of thousands of tonnes/m³ per year; area sources of hundreds of m².	**Moderate potential for dust emissions:** activities on unsealed sites, i.e., container parks, or other access roads, leading to track-out onto external roads. Cement and building products manufacturing.	**Intermediate:** crushed rock, beach and builders' sands, or fine stone, aggregates.	**Partial Control or containment:** Some areas of the site may be controlled or sealed but there are areas not addressed (e.g., haul roads or car parks). Reliance on management and housekeeping (i.e., water carts, keeping tip-faces small, wheel washes etc.).
3	**Large:** Materials usage in the order of hundreds of thousands of tonnes/m3 per year; area sources of thousands of m2.	**High potential for dust emissions:** grinding, blasting, material handling in open air, crushing, screening, haul roads for heavy vehicles, agricultural activities (ploughing fields)	**Fine:** Very fine dusts that can readily become airborne (i.e., silt clay, coal dust, dried tracked out mud, gypsum, cement etc.)	**No effective control or containment:** Large exposed stockpiles or unsealed areas, specifically dry conditions, open air operation with no containment, management controls not maintained.

Step 2 Exposure pathway effectiveness

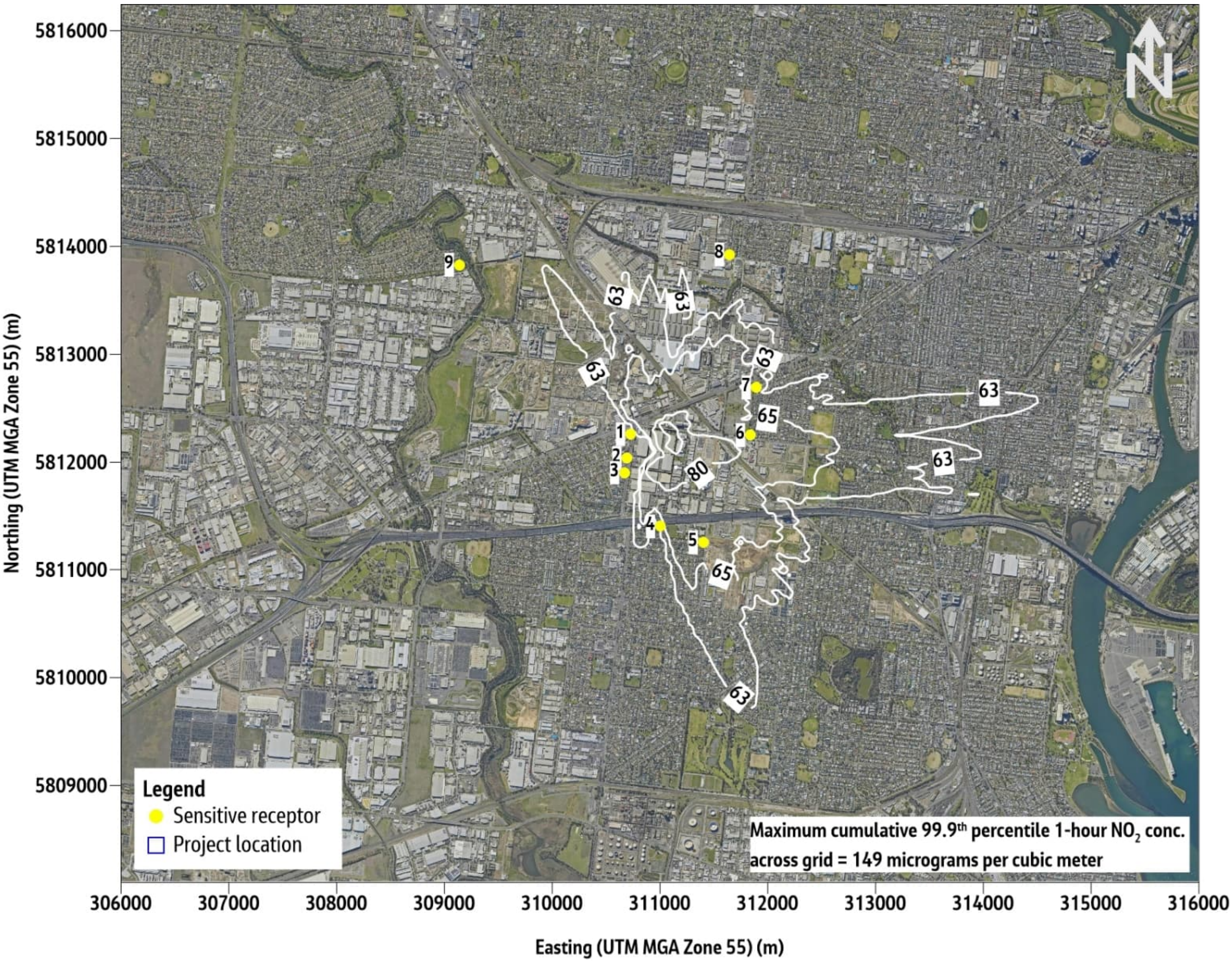
Score	Distance	Orientation of receptors relative to the prevailing wind direction	Terrain	Intervening land use
1	• Receptors are hundreds of metres or kilometres from source or • Separation distance has been met easily.	• Winds rarely (<10%) blow from source to receptor or • Source is upwind, winds are of low speed	• Source located in a valley or quarry hole, downslope from receptor or highly undulating terrain between source and receptor	• High vegetation, i.e., densely forested or, • Highly built-up or intervening zone with multiple non-sensitive uses that have no dust emissions of their own
2	• Receptors are tens or hundreds of metres from source or • Separation distance has not been met or met but only just at the threshold distances	• Even distribution of winds (10-20%) from source to receptor or • source is upwind, winds are of moderate speed • High frequency (>10%) of stable weather conditions with low dispersion.	• Source is on same altitude as receiving environment, generally flat land.	• Moderate vegetation and/or • Intervening land use zone contains other non-sensitive industry or smaller businesses.
3	• Receptors are adjacent to the source/site or • Distance well below (less than half) separation distances.	• High frequency (>20%) of winds from source to receptor or • source is upwind, winds are of high speed	• Source is upslope of receiving environment and/or located in the same valley	• Open land and cleared of obstacles and/or • Isolated dwellings or structures in pathway

Step 3 Receiving environment sensitivity

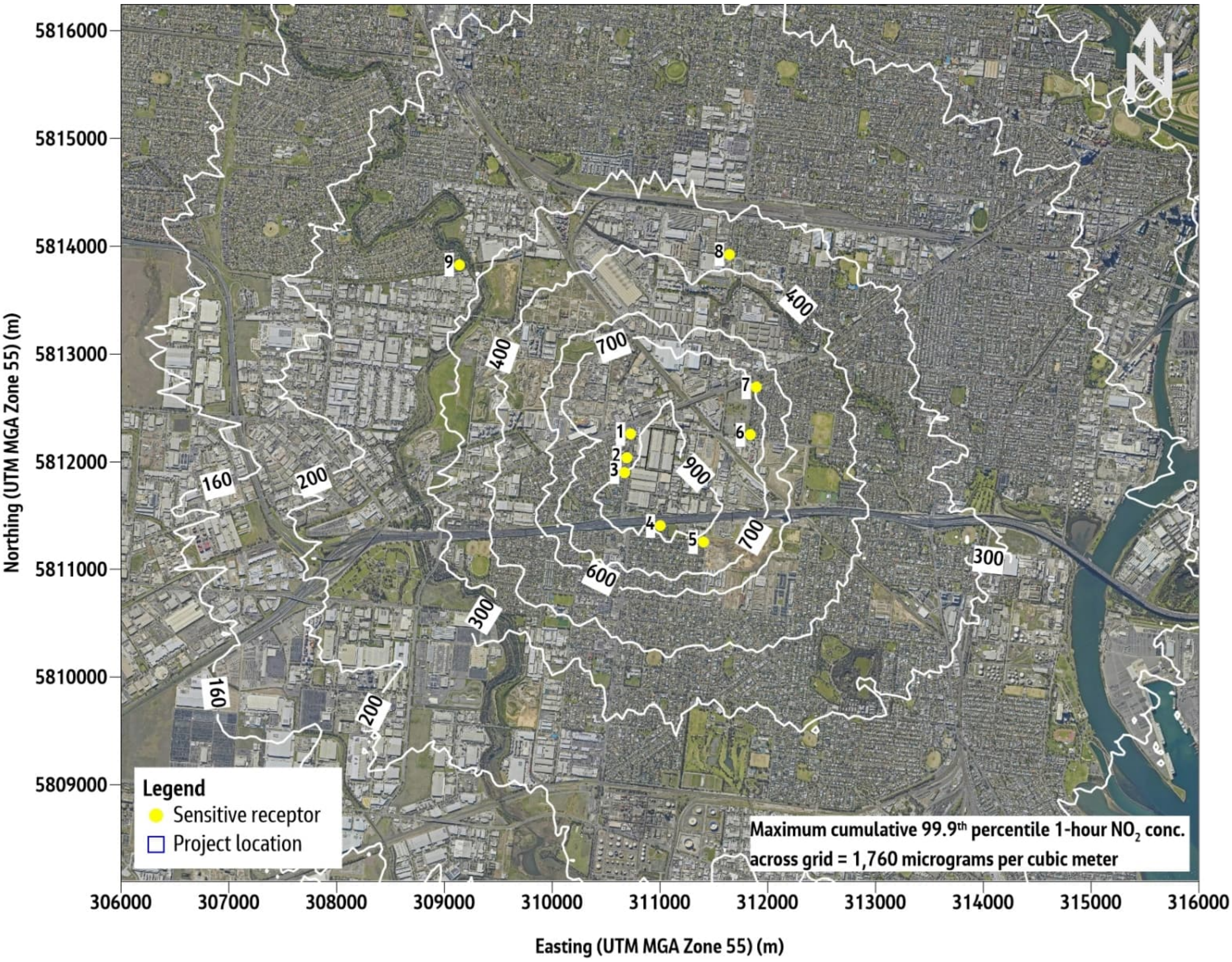
Score	Historical context	Land use
2	**No previous history** no incidents or non-compliance. Only single isolated reports. Generally, the public is unconcerned.	**Low general expectation of amenity** • exposure can be easily avoided. • Dust doesn't have an impact in any lasting way on. appearance, aesthetics or value of property by soiling or, locations where human exposure is transient or, areas of low ecological value • E.g., footpaths, walking or bike trails, farmland (unless sensitive horticultural land,) short term car parks, roads, no nearby waterways, dry arid areas, or waste land (abandoned paddocks etc.).
4	**Some history** Occasional complaints, history of the industry causing problems elsewhere. Some concern in immediate area but not widespread.	**Moderate general expectation of amenity** • people can move on, can potentially avoid exposure. • Dust could impact on appearance, aesthetics or value of property, locations where people are occupationally exposed over a full working day but not in a home setting or, areas of moderate ecological value • E.g., enjoyment of the outdoors, recreational activities, playing sport, offices, warehouses and industrial units, playgrounds, shopping areas, longer term vehicle storage, peri-urban or outer suburban nature areas, somewhat modified water ways.
6	**Significant history** Community has had regular impacts of dust and is highly sensitised. Regular or repeated non-compliance, past enforcement activity	**High general expectation of amenity** • exposure cannot be avoided. • Dust is likely to impact on damage to property, clothes, vehicles, affects food preparation, etc. or, individuals may be exposed for over eight hours or more in a day, areas of high ecological value • E.g., residential properties with backyards and open living areas, rural living zones, hospitals, schools, prisons, accommodation, residential care homes, car parks associated with workplace or residential parking

Appendix D. Selected operational ground-level concentration plots

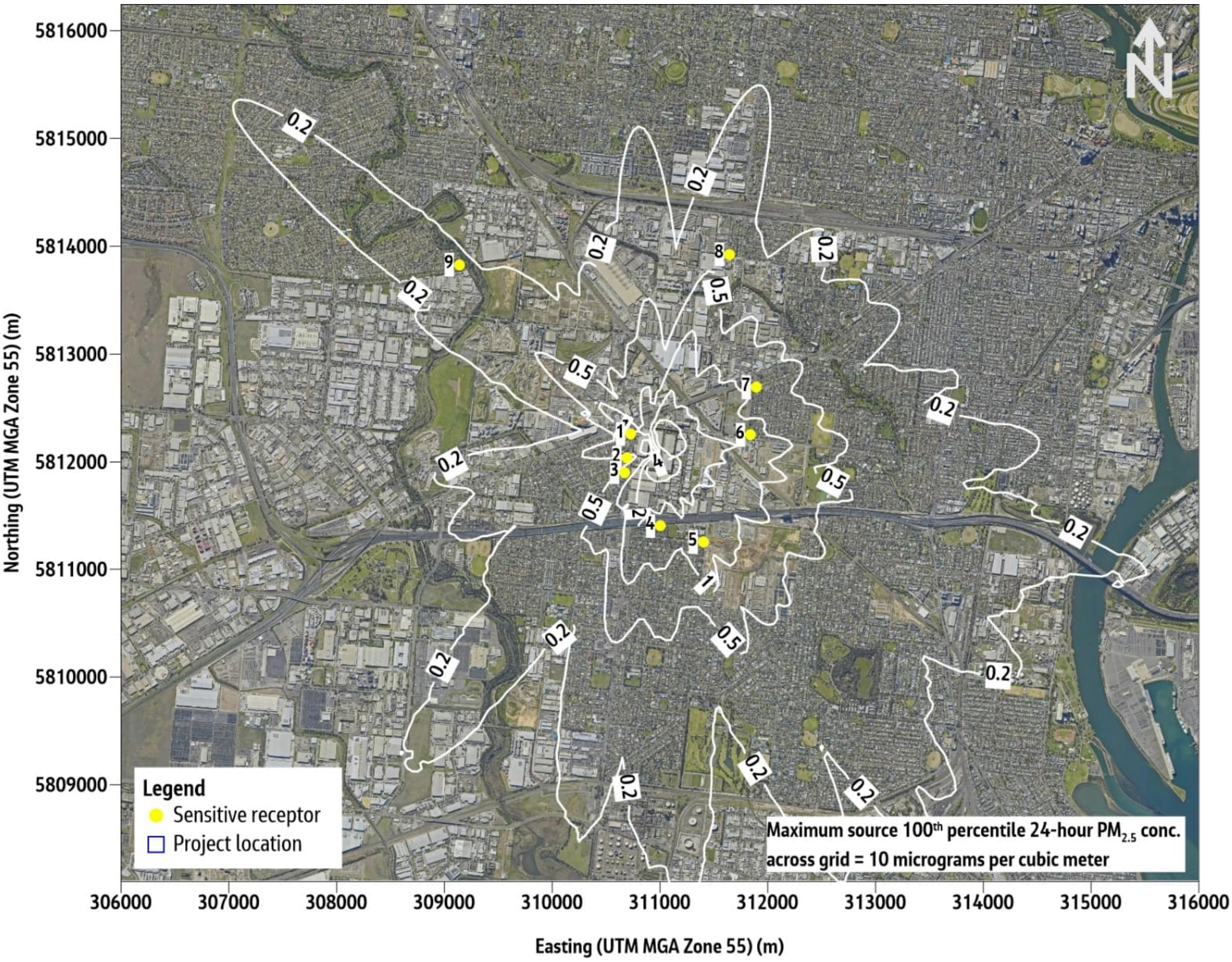
99.9th percentile, 1-hour averaged cumulative NO_2 (µg/m^3) for scenario 1 (routine testing and maintenance) for 2024 year of assessment



99.9th percentile, 1-hour averaged cumulative NO_2 (µg/m^3) for scenario 3 (full outage) for 2024 year of assessment



100th percentile, 24-hour averaged $PM_{2.5}$ ($\mu g/m^3$) contribution for scenario 1 (routine testing and maintenance) for 2024 year of assessment



100th percentile, 24-hour averaged $PM_{2.5}$ (μg/m^3) contribution for scenario 3 (full outage) for 2024 year of assessment