

KELLYVILLE PARK CENTRE OF EXCELLENCE AND COMMUNITY FACILITY

**Parramatta Eels
Air Quality and Odour Assessment**

Prepared for:

Parramatta National Rugby League Club Pty Limited
Cnr Kennedy Ave & Stone Mason Drive,
Kellyville NSW 2155

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Tenancy 202 Submarine School, Sub Base Platypus, 120 High Street
North Sydney NSW 2060 Australia

T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

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

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Parramatta National Rugby League Club Pty Ltd to undertake an air quality and odour assessment (AQOA) for the proposed construction and operation of a Centre of Excellence and Community Facility at Kellyville Park, Kellyville (the Project).

The Planning Secretary's Environmental Assessment Requirements (SEARs) relating to air quality issues for the project are as follows:

The EIS must include an air quality assessment of onsite and offsite air quality impacts, including odours, in accordance with the relevant EPA guidelines. The assessment must detail construction and operational air quality impacts both onsite and on nearby sensitive receivers and outline the proposed management and mitigation measures that would be implemented to reduce any air quality impacts.

The NSW Environmental Protection Agency (NSW EPA) has also provided the following comments for the project:

Based on the information provided, the proposal does not appear to require an environment protection licence under the Protection of the Environment Operations Act 1997. Furthermore, the EPA understands that the proposal is not being undertaken by or on behalf of a NSW Public Authority nor are the proposed activities or other activities for which the EPA is the appropriate regulatory authority. In view of these factors, the EPA has no comments to provide on this project and no follow-up consultation is required, Hills Shire Council should be consulted as the appropriate regulatory authority for the Protection of the Environment Operations Act 1997 in relation to the proposal.

This report summarises the potential construction and operational air quality impacts associated with the Project and has been prepared to accompany the State Significant Development (SSD) application for the proposal.

1.1 Approach to Assessment

At the time of preparing this report, detailed information on the proposed operational activities within the building (ventilation rates, potential emission rates, location of ventilation stacks, etc.) is not yet available. A large number of assumptions would therefore be required to be used as input to any quantitative (i.e., air dispersion modelling) assessment. Similarly, a quantitative modelling assessment of potential air emissions associated with the construction activities would also require a number of assumptions to be made to enable the estimation of particulate emission rates for input into the models. The uncertainty associated with the output of such studies means it would be of limited value and would not (in itself) assist with the identification of air quality control measures to actively manage the risks.

SLR has therefore performed a qualitative (risk-based) assessment of both construction and operational impacts based on the information available, to identify activities that have the potential for off-site air quality impacts if not adequately controlled, so that appropriate mitigation measures can be identified and incorporated into the project design and relevant environmental management plans.

Based on SLR's experience, for almost all construction activities, provided effective mitigation is adopted, the residual air quality impact will be insignificant. The adopted quantitative assessment approach identifies the appropriate mitigation measures based on the level of risk during each phase of the construction works and is therefore deemed to be a more appropriate methodology than quantitative modelling.

1.1.1 Construction Impact Assessment Methodology

For the assessment of construction phase impacts, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction*, developed in the United Kingdom by the Institute of Air Quality Management (IAQM, 2014) has been used to provide a qualitative assessment method (see **Appendix A** for full methodology). The IAQM method uses a four-step process for assessing potential dust impacts from construction activities:

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

1.1.2 Operational Impact Assessment Methodology

A risk-based qualitative assessment approach has also been adopted for the proposed operational activities at the Site (see **Appendix B** for full methodology). Similar to the construction phase air quality assessment, a quantitative assessment in general accordance with the Approved Methods could be prepared for the operational phase of the Project, however, the inputs into the model would be subject to a high degree of uncertainty as:

- Detailed information on the proposed operational activities is not yet available for all the identified sources (ventilation rates, potential emission rates, location of ventilation stacks, etc.); and
- There is a very high degree of uncertainty associated with quantification of emissions from the identified sources of emissions, particularly the café kitchen, as no published emission factors are available for such sources and the emission inventory would need to rely on publicly available pollutant concentrations measured at other sites which may handle different types of food and have different management practices. The availability of such data is also very limited, and a number of assumptions would need to be made to be able to apply it to the Project to compile the emission data required for a modelling assessment.

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

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

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

As part of the qualitative risk-based approach adopted for the operational phase air quality assessment, published separation distances have been referenced to evaluate the potential risk of conflicting land uses. As there are no separation guidelines issued by NSW EPA, guidelines set by other regulatory agencies in Australia have been reviewed and the most conservative applicable separation distances were adopted for the risk based assessment.

In states where separation distance guidelines are published, the separation distances are typically used as a screening tool to identify if a detailed quantitative assessment is required. As such, these separation distances, which are typically based on quantitative modelling studies, history of complaints and air quality monitoring data are considered to be conservative in nature and overestimate the level of risk associated with emission sources.

2 Project Description

2.1 Site Location

The Project site is identified as Lot 60 DP10702 and Lot 1 DP167535, and is located at 8 Memorial Avenue, Kellyville NSW, , approximately 35 km northwest of the Sydney Central Business District (CBD) and 13 km south-southeast of Parramatta CBD (**Figure 1**),The Project site, which has a total area of 3.1 hectares (ha) is located in within the Hills Shire Council Local Government Area (LGA) in an area strategically identified as an zone currently used for recreational sport playing fields, car parks and sport facilities. The Project site is situated along the eastern boundary of Strangers Creek, bordering Memorial Avenue to the north and Stone Mason Drive to the west.

Figure 1 Site Location



2.2 The Proposed Development

The site currently accommodates recreational playing fields, car parking and changing rooms/facilities and is used for community sport and public use, and provides cricket nets, basketball and netball courts, baseball field and several rectangular football fields.

In 2019, the Hills Shire Council (the Council) exhibited Kellyville Park Landscape Master Plan. Council identified Kellyville Park as the premier sports facility in the Hills Shire for rugby league, including being the preferred rugby league venue in the Hills Shire for a National Rugby League presence.

The Project will provide state of the art facilities which enable physical recreation opportunities in conjunction with improved facilities for staff, players and existing users of the site. The proposed development will be integrated with the existing recreational landscape of the site and complement the upgrades to the existing playing fields being undertaken by Council. The proposed development is defined as a Recreation facility (major), and includes the following components:

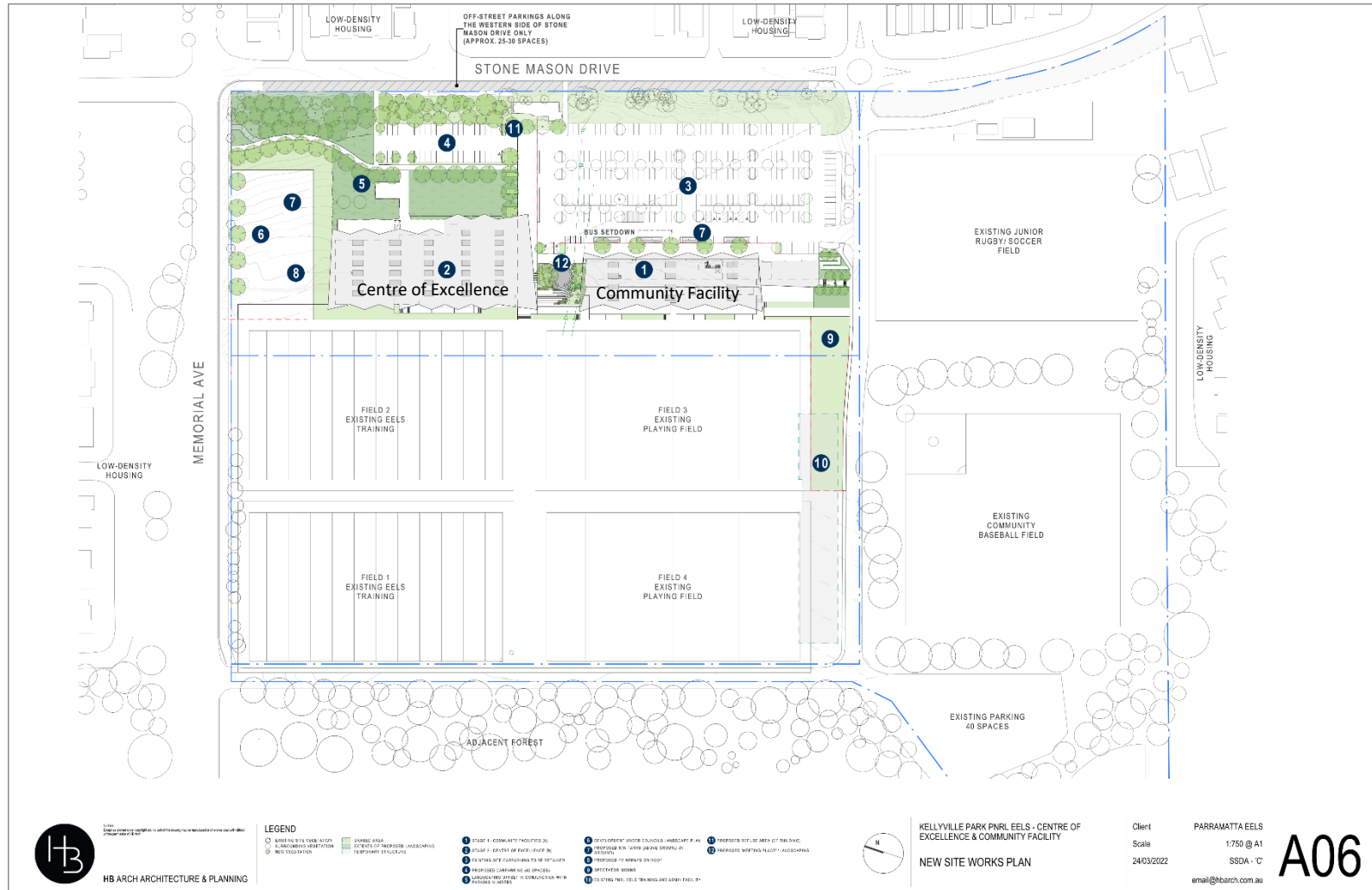
- Construction of high-performance Centre of Excellence in the north east of the Project site adjacent to Training Field 2. The Centre of Excellence is proposed to include:
 - Elite level gymnasium
 - Medical and rehabilitation facilities
 - Aquatic recovery and rehabilitation pools
 - Lecture theatre and meeting rooms
 - Player education and study areas
 - Administration offices for the Parramatta Eels
 - New female facilities including a dedicated female change room, cubicle toilets and showers
 - Balcony and terrace area
 - End of Trip Facilities and bicycle parking
 - Refuse Area
- Construction of a Community Facility, including a grandstand with approximately 1,500 seats in the centre of the Project site adjacent to the Main Playing Field 3. The Community Facility is proposed to include:
 - Unisex changerooms and amenities
 - Referee changeroom and amenities
 - First Aid/Medical room
 - Community gymnasium
 - Café/kiosk
 - Concourse terrace
 - Multipurpose community function room with kitchen and amenities
 - Refuse Area
 - Bicycle parking

- Solar arrays will be included on the roof of both the Centre of Excellence and Community Facility.
- Additional 40 car parking spaces for the s to operate in conjunction with existing at grade car parking already constructed by Council.
- Additional landscaping throughout the development footprint.
- Removal of a small number of trees internal to the site, however noting perimeter trees will be retained where not affected by the proposed building footprints.
- Hours of operation for the Centre of Excellence and Community Facility are 5:00am to 12:00am, however the following key times are likely:
 - Centre of Excellence: 7.00am - 7.00pm
 - Community Facility: 7.00am - 10.00pm

The proposed site layout is presented in **Figure 2**.

It is noted that the construction of the Centre of Excellence and Community Facility will be staged. It is anticipated that construction of the Community Facility will be completed over approximately 10 months. Construction works for the Centre of Excellence will begin after the completion of the Community Facility construction and is anticipated to take approximately 13 months.

Figure 2 Proposed Project Site Layout



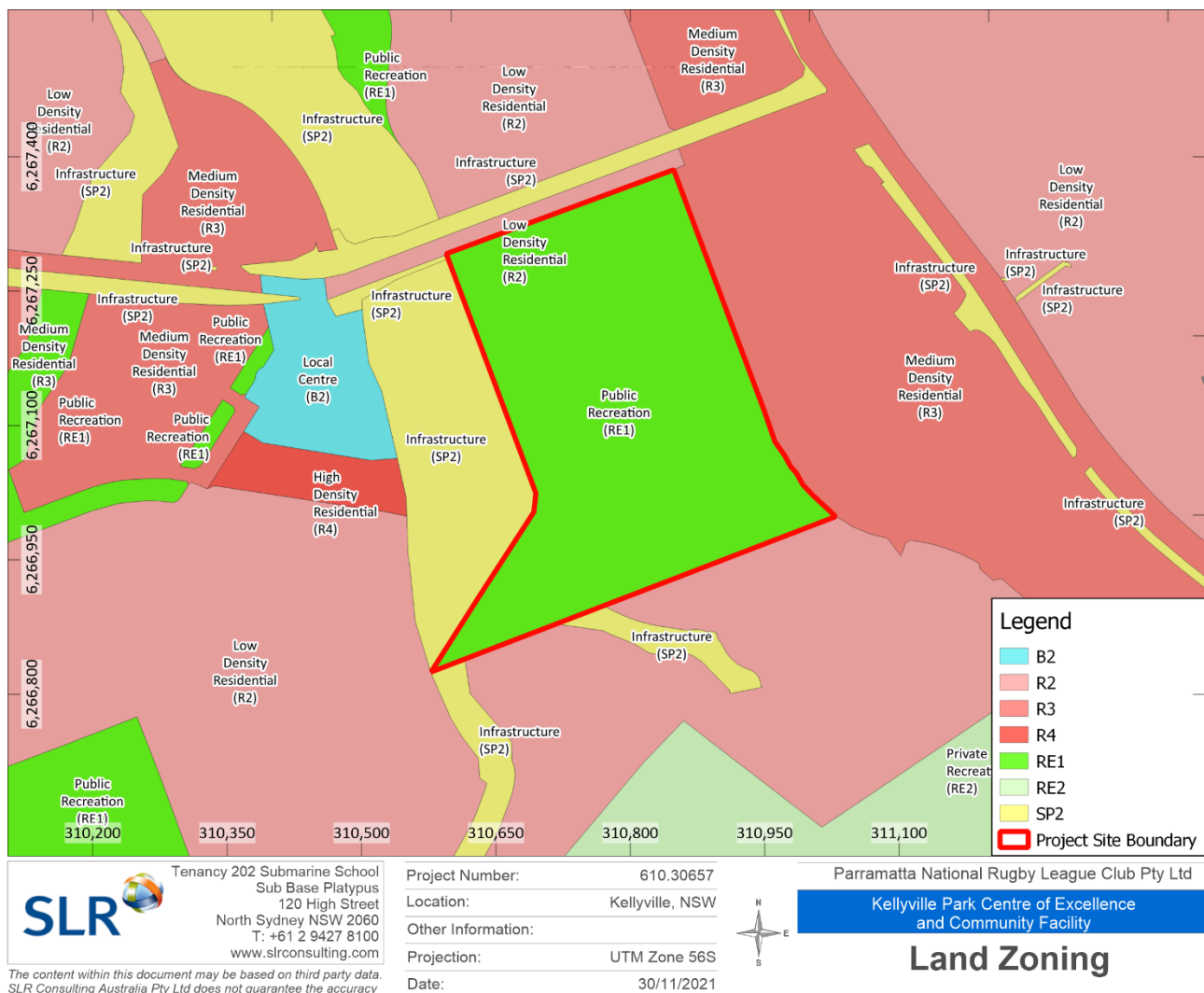
3 Project Setting

3.1 Surrounding Land Zoning and Sensitive Receptors

As per the Hills Shire Local Environment Plan (LEP), the Project site is zoned RE1 Public Recreation as shown in **Figure 3**. The Project Site is bounded by R2 Low Density Residential land approximately to the north, R3 Medium Density Residential land to the east, R2 Low Density Residential and SP2 infrastructure land to the south, and SP2 Infrastructure land to the west.

The nearest sensitive receptors are located approximately 10 m from northern eastern and western Project site boundaries. The nearest receptors to the carpark and proposed restaurant located at the Project site are approximately 40 m and 90 m to the east respectively.

Figure 3 Zoning of Surrounding Land

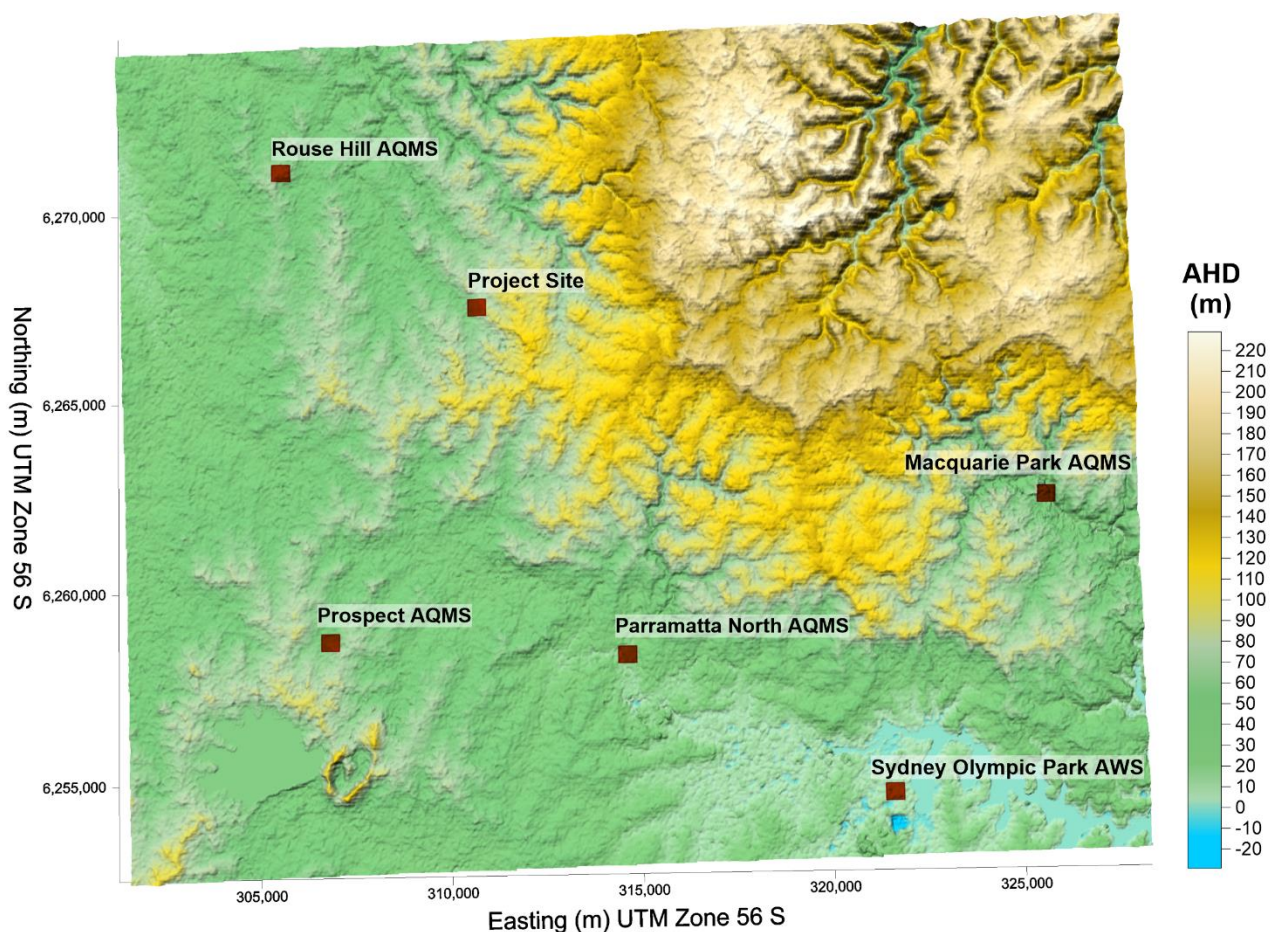


3.2 Local Topography

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

A three-dimensional representation of the region surrounding the Project site is shown in **Figure 4**. The topography of the area illustrated ranges from an approximate elevation of -20 m to 220 m Australian Height Datum (AHD). The topography in Project Site is relatively flat with a gentle slope towards the eastern boundary of the site. There is limited potential for channelling effects and night-time slope flows to affect the dispersion of air emissions from the Project site.

Figure 4 Topography of Area Surrounding the Site



3.3 Local Meteorological Conditions

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

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station is the Sydney Olympic Park Automatic Weather Station (AWS) (Station ID: 66212), which is located approximately 17 km to the southeast of the Project site.

Meteorological monitoring is also performed by the NSW Department of Planning, Industry and Environment’s Environment, Energy and Science (EES) group at a number of monitoring stations across NSW. The closest such stations to the Project site are the Rouse Hill AQMS (operational since 2019), located approximately 6.5 km to the northwest and Parramatta North AQMS (operational since 2017), located approximately 9.5 km south-southeast of the Project site.

Considering the distance and terrain features between the Project Site location and the Sydney Olympic Park AWS and Parramatta North AQMS, the recordings from these stations are not considered to be a reasonable representation of the wind conditions in the area surrounding the Project site. Given this, and considering long term meteorological data are not available for the Rouse Hill AQMS, The Air Pollution Model (TAPM) meteorological model (Version 4.0.4) was used to compile a more site-representative dataset for the Project site

TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia, is a prognostic model which can be used to compile a site-representative meteorological dataset in areas where there is limited observational data available, and has been widely used for meteorological and pollutant dispersion modeling studies throughout Australia. The model allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses).

The CSIRO has a global data set of synoptic meteorological data that is required as input to the TAPM model. It is derived from analysis data used by meteorological services for weather forecasting. The synoptic meteorological data used in the modelling has been obtained from the CSIRO for the Asia Pacific region for the years of 2015-2020 (inclusive). **Table 1** details the parameters used in the TAPM meteorological model for this assessment.

Table 1 TAPM Input Parameters Used in this Study

Parameter	Project Site
Number of grids (spacing)	5 (30 km, 10 km, 3 km, 1 km, 0.3 km)
Number of grid points	25 x 25 x 25
Year of analysis	2016-2020
Centre of analysis	310817 mE 6267387 mS (UTM zone 56s)

A summary of the average annual and seasonal wind behaviour predicted by TAPM for the modelled years (2016-2020) at Project Site is presented as wind roses in **Figure 5**.

Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e., northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for periods during the day.

The annual wind rose for the years 2016-2020 indicates that throughout the year, winds are mostly light to gentle (between 1.5 m/s and 5.5 m/s) and blow from the northeast quadrant. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur approximately 2.4% of the time.

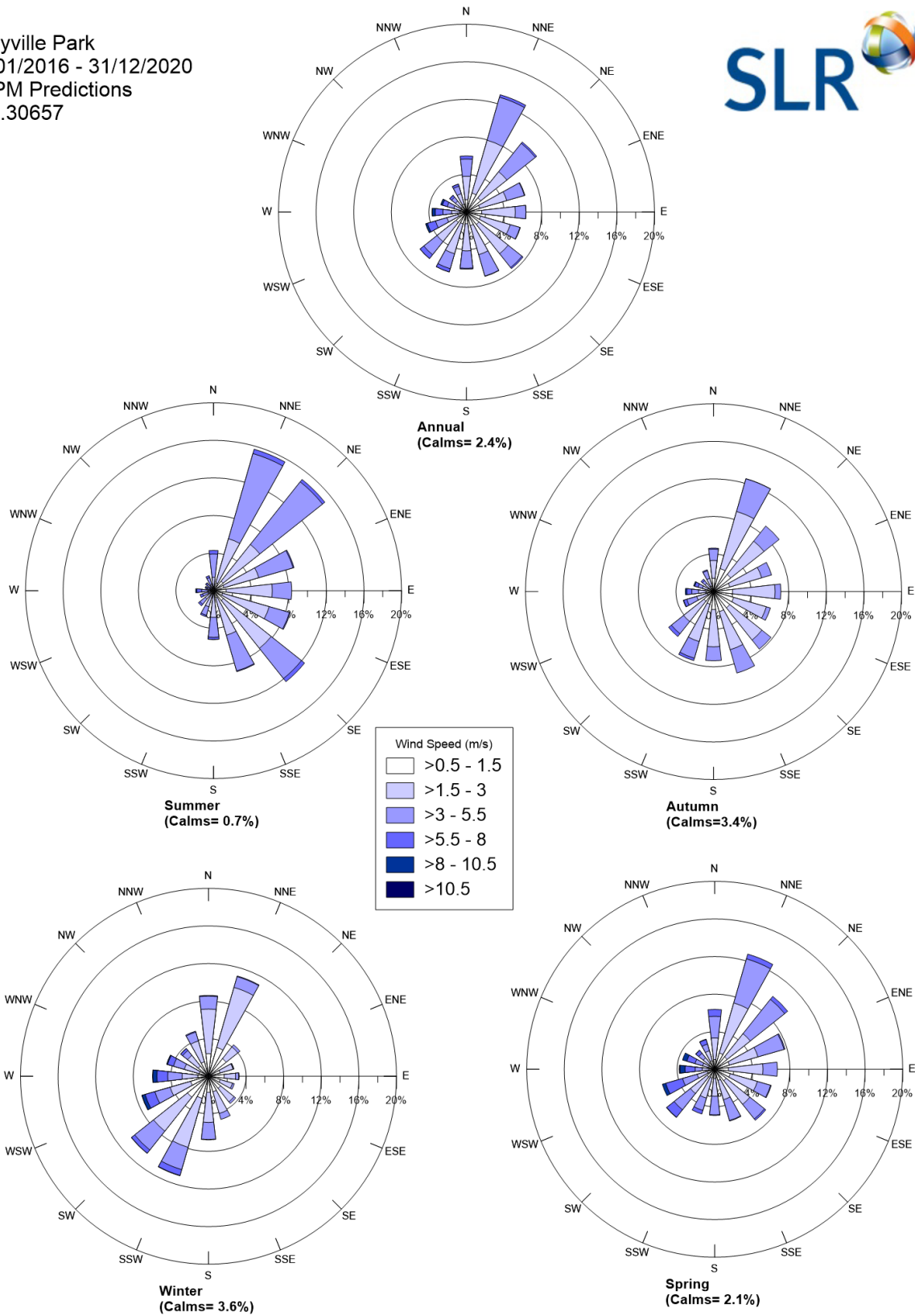
The seasonal wind roses for the years 2016-2020 indicate that:

- In summer, winds are predominantly from northeast quadrant, with few winds from the south-southwest to north-northwest directions. Calms were predicted to occur approximately 0.7% of the time.
- In autumn, winds are predominantly from the northeast and southeast quadrants and there is a higher frequency of winds from the south-southwest quadrant compared to summer. Calms were predicted to occur approximately 3.4% of the time.
- In winter, winds are predominantly from southwest quadrant with very few winds from the northeast to south-southeast directions. Calms were predicted to occur approximately 3.6% of the time.
- In spring winds blow from all directions with the highest frequency of winds from the northeast quadrant and the lowest frequency from the northwest quadrant. Calms were predicted to occur approximately 2.1% of the time.

As identified in **Section 3.1**, the closest sensitive receptors are located to the north, east and south of the Project site. Winds blowing emissions from the site towards these sensitive receptors occur throughout the year. Winds blowing from the southwest to northwest directions which could carry emissions from car park and proposed kitchen towards the nearest receptors to the east occur approximately 20% of the time.

Figure 5 Project Site Annual and Seasonal Wind Roses, 2016-2020

Kellyville Park
 01/01/2016 - 31/12/2020
 TAPM Predictions
 610.30657



3.4 Existing Air Emission Sources

Other sources of air emissions and odour in the area with the potential to result in cumulative impacts with emissions from the construction and operation of the Project were investigated:

- A desktop mapping of industrial sites regulated by the EPA; and
- A review of facilities required to report to the National Pollutant Inventory (NPI)

Environment Protection Licences (EPLs) are issued under the POEO Act and are regulated by the NSW EPA. EPLs stipulate emission limits to water, land and/or air and provide operational protocols to ensure industrial emissions/operations comply with relevant standards. General requirements of EPLs relating to air quality include:

- Plant and equipment to be maintained and operated in a proper and efficient manner.
- Emissions of dust and odour from the premises are to be minimised/prevented.

The NPI database provides details on industrial emissions of over 4,000 facilities across Australia. The requirement to return annual reports to the NPI quantifying a facility's emissions is determined by the activities/processes being undertaken at the facility, and whether those processes exceed process-specific thresholds in terms of activity rates (i.e., throughput and/or consumption). It is not intended to make a statement that the emissions associated with those activities will be significant in terms of their potential for impact and/or generation of complaint, however it provides a tool to identify significant emission sources in a specific area that then may be investigated further to assess their potential to impact on local air quality.

A search of the EPA public register and NPI database for the area surrounding the Project site (2 km radius) returned no records of industries which could potentially result in cumulative impacts with emissions from the construction and operation of the Project.

It is noted that industrial and commercial activities that operate below the activity threshold specified for the relevant industry type may be present in the local area. Sources that potentially fall under this category would not have significant potential for impacting air quality.

4 Pollutants of Concern

4.1 Construction Phase

Potential air emissions associated with the construction phase include:

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

No significant sources of emissions of odour are expected during the construction phase. A preliminary site investigation (contamination) undertaken by Douglas Partners Pty Ltd (DP) for the Project found that there is a low potential for contamination associated with fill at the site (Douglas Partners Pty Ltd, 2021).

A subsequent detailed site investigation (contamination) undertaken by DP, that involved the collection and testing of 29 soil samples from test locations across the Project site found:

- Concentration of contaminants were below the relevant health investigation levels and health screening levels at all locations tested
- Concentrations of contaminants were below the relevant the ecological investigation levels and ecological screening levels at all but two locations. The two exceedances were deemed by DP as minor and not considered statistically significant.

Given the above, the risk of volatilisation of ground contaminants is considered to be negligible and is not considered further.

4.1.1 Fugitive Dust Emissions

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

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

These activities will need to be managed appropriately to ensure off-site impacts are minimised (refer **Section 7.1.1**).

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

The construction works may require up to 23 months to complete (inclusive of up to 13 months for the Centre of Excellence and up to 10 months for the Community Facility). It is noted that dust-generating activities will not be occurring continuously throughout this period and construction of the Centre of Excellence and Community Facility will not overlap.

4.1.2 Products of Combustion

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

Considering the size of the nature of the proposed development, air emissions from diesel-powered construction plant and machinery are anticipated to be relatively small.

4.2 Operational Phase

Based upon a review of the new activities that are proposed as part of the proposed development (presented in **Section 2.2**), potential air emission sources associated with the operational phase have been identified as follows:

- Odour and particulate emissions from café kitchen
- Products of combustion from operational phase traffic

In addition to the above, there is also a low potential for odour emissions to be generated from the use of chemicals in the proposed rehabilitation pools. However, given the scale of the aquatic recovery room (approximately 100m² area) significant odour emissions from this source is considered highly unlikely and as such potential impacts from this source have not been assessed further.

4.2.1 Odour and Particulate Emissions from Kitchens

Odour is the principal air emission of concern from kitchens and is primarily generated from the cooking process. Odorous emissions from kitchens are the result of complex mixtures of odorous VOCs which are formed in the cooking process as breakdown products of natural fats and oils.

Impacts from odorous air contaminants are often nuisance-related rather than health-related. There are various elements that are commonly regarded as combining to cause odour nuisance, which are listed below and are collectively known as the FIDOL factors:

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

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

- *Population sensitivity*: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level*: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.

- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.

In addition to odour, particulates are also emitted from kitchen operations in the form of smoke and fumes. Cooking methods such as deep frying, barbecuing, and solid fuel-fired cooking produce the most significant amount of particulates.

While emissions from kitchens (particularly odour emissions) can be directly released into the atmosphere through openings in the building, a well-designed air extraction system is capable of capturing and if required treating emissions prior to release to atmosphere. The air extraction systems for the proposed café kitchen will be designed to meet Australian Standards (AS) and Building Council of Australia (BCA) requirements. It is understood that it is currently proposed that all kitchen exhaust systems will discharge vertically above roof level.

Odour emissions from kitchens may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in **Section 8**.

4.2.2 Products of Combustion from Operational Phase Traffic

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

Combustion gas emissions from vehicles may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in **Section 8**.

At present a total of 215 spaces are provided in the car park to the east of the playing fields, with a further 40 spaces accommodated in the secondary car park, providing a total of 255 formalised parking spaces. As part of the proposed development, the main car park will be extended, accommodating an additional 40 parking spaces.

According to the Traffic Impact Assessment Report prepared by WSP for the Project (WSP, 2021), the peak traffic generation period would be in the afternoon (4.30 pm to 5.30 pm) when a total of 181 inbound vehicle movements and 165 outbound vehicle movements would be generated (346 total vehicle movements).

To put this into context, according to the WSP report, the forecasted traffic volumes for the intersection of Memorial Avenue and Windsor Road (200 m to the east of the Project site and currently undergoing an upgrade as part of the Memorial Avenue duplication), for the year 2026 is 5,600 peak hourly movements through the intersection for the morning peak and 5,400 peak hourly movements through the for the afternoon peak.

5 Regulatory Framework

5.1 Relevant Legislation, Policy and Guidance

The following Air Quality Policy and Guidance documents have been referenced within this assessment and have been used to identify the relevant air quality criteria (see **Section 5.2**).

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

The POEO Act (and Amendment Act 2011) is a key piece of environment protection legislation administered by the NSW Department of Planning, Industry and Environment's Environment, Energy and Science (EES) group which enables the Government to establish instruments for setting environmental standards, goals, protocols, and guidelines.

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

- Section 117 of the POEO Act states that the wilful or negligent release of ozone depleting substances such as chlorofluorocarbons (CFCs) to the atmosphere carries the highest of all penalties under NSW environmental law.
- Section 124 and 125 of the POEO Act states that any plant located at a premise (e.g., the kitchen exhaust fans at the Project site) should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials (e.g., raw food and waste storage/disposal at the Site) are managed in a proper and efficient manner to prevent air pollution (e.g., odour).
- Section 128 of the POEO Act states:
 1. The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.
 2. Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

5.1.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The POEO (Clean Air) Regulation 2010 (the Regulation) is the core regulatory instrument for air quality issues in NSW. In relation to industry, the Regulation:

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

5.1.3 NSW Environment Protection Authority Air Quality Policy and Guidance

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

The NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (hereafter 'the Approved Methods') (NSW EPA, 2017) lists the statutory methods for modelling and assessing air pollutants from stationary sources and specifies criteria which reflect the environmental outcomes adopted by the EPA. The Approved Methods are referred to in the POEO (Clean Air) Regulation 2002 for assessment of impacts of air pollutants. The air quality criteria set out in the Approved Methods have been reproduced and discussed in **Section 5.2**.

5.1.4 Odour Technical Framework and Notes

The EPA publications, *Technical Framework: Assessment and management of odour from stationary sources in NSW* (NSW DEC, 2006) and the associated *Technical Notes* (the Odour Policy) (NSW DEC, 2006b) provide a policy framework for assessing and managing activities that emit odour and offers guidance on dealing with odour issues. **Section 5.2.1** outlines relevant recommendations from these documents.

5.1.5 Local Air Quality Toolkit

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

- Dust from urban construction sites (NSW EPA, 2007a);
- Construction sites (NSW EPA, 2007b); and
- Food outlets (NSW EPA, 2007c).

5.1.6 Building Code of Australia and Australian Standards

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

Australian Standard (AS) 1668.2-2012 *The use of ventilation and air conditioning in building, Part 2: Ventilation design for indoor air contaminant control* sets design requirements for mechanical ventilation systems. Mechanical ventilation is required in enclosures where specific health and ventilation amenity requirements cannot be met by natural means.

Section 3.10.1 states of the AS states "All exhaust air shall be discharged to atmosphere in such a manner not to cause danger or nuisance to occupants in the building, occupants of neighbouring buildings or members of the public."

Section 5 of the AS states the following:

- **5.2.2 Exhaust locations:** As far as practicable, exhaust-air intakes used for general exhaust-air collection shall be located on the opposite sides of the enclosure from the sources of make-up air, to ensure that the effluents are effectively removed from all parts of the enclosure.

- **5.3.2.1 General requirements:** The effluent shall be collected as it is being produced, as close as practicable to the source of generation.
- **5.10.1 Air discharges:** Where discharges are deemed to be objectionable (i.e., nuisance related), discharges shall:
 - Be emitted vertically with discharge velocities not less than 5 m/s.
 - Be situated at least 3 m above the roof at point of discharge.
 - Treated to reduce the concentration of contaminants where required.
 - Be emitted to the outside at velocities and in a direction that will ensure, to the extent practicable, a danger to health or a nuisance will not occur.
 - Be situated a minimum separation distance of 6 m (where the airflow rate is $\geq 1,000$ L/s) from any outdoor) air intake opening, natural ventilation device or opening, and boundary to an adjacent allotment, except that where the dimensions of the allotment make this impossible, then the greatest possible distance shall apply.

5.2 Relevant Air Quality Criteria

As discussed in **Section 1.1**, a qualitative (risk-based) assessment has been performed for both construction and operational impacts, to identify activities that have the potential for off-site air quality impacts if not adequately controlled, so that appropriate mitigation measures can be identified and incorporated into the project design and relevant environmental management plans. A quantitative emissions estimation and dispersion modelling study has not been performed, hence the Project's compliance with the ambient air quality criteria listed in the following sections is not able to be presented as part of this assessment report. The criteria have been used, however, to assess the existing background air quality in **Section 6**.

5.2.1 Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve "no odour".

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines one odour unit (ou). An odour goal of less than 1 OU would theoretically result in no odour impact being experienced.

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

- **Odour quality:** whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity:** any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level:** whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.

- **Public expectation:** whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics:** whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- **Health effects:** whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

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

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

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

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

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in **Table 2**. For areas such as that surrounding the Site, the relevant odour impact assessment criterion set by the Approved Methods for complex mixtures of odorous air pollutants is 2 ou (nose-response-time average, 99th percentile). As noted above, the risk of exceedances is qualitatively assessed as part of this study to identify weather quantitative modelling of potential odour impacts from the Site is appropriate or warranted.

Table 2 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

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

5.2.2 Products of Combustion and Fugitive Dust

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

The criteria outlined in the sections below present the current ambient air quality criteria adopted by the NSW Government. It is noted that these criteria are based on the standards set out in the National Environment Protection (Ambient Air Quality) Measure (the AAQ NEPM). On 15 April 2021, The National Environmental Protection Council agreed to vary the AAQ NEPM, and as part of this upcoming variation, the ambient air standards for NO₂ and SO₂ currently included in the AAQ NEPM are to be amended. These changes to the ambient air quality standards for NO₂ and SO₂ include:

- SO₂:
 - The 1-hour standard for SO₂ in the AAQ NEPM will be retained, however the numerical value of the standard will be reduced to 100 ppb (previously 200 ppb).
 - A future 1-hour SO₂ standard of 75 ppb will be implemented from 2025.
 - The 24-hour standard for SO₂ in the AAQ NEPM will be retained, however the numerical value of the standard will reduce to 20 ppb (previously 80 ppb).
 - No future target for 24-hour average SO₂ concentrations is proposed at this stage.
 - The current annual mean standard for SO₂ will be removed from the AAQ NEPM.
 - The form of both the revised 1-hour and 24-hour SO₂ standards will be as maximum values with no allowable exceedances.
- NO₂:
 - The 1-hour standard for NO₂ in the AAQ NEPM will be retained, however the numerical value of the standard will be reduced to 80 ppb (previously 120 ppb).
 - The annual standard for NO₂ in the AAQ NEPM will be retained, however the numerical value of the standard will be reduced to 15 ppb (previously 30 ppb).
 - The form of both the 1-hour and annual NO₂ standards will be as maximum values with no allowable exceedances.

It is not yet known if or when the Approved Methods will be amended to reflect the upcoming changes to the AAQ NEPM.

Carbon Monoxide

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

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

The impact assessment criteria specified within the Approved Methods for CO are provided in **Table 3**.

Table 3 Impact Assessment Criteria for Carbon Monoxide (CO)

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

Note: ppm = parts per million

Oxides of Nitrogen

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

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

NO will be converted to NO₂ in the atmosphere after being emitted. The impact assessment criteria specified within the Approved Methods for NO₂ are provided in **Table 4**.

Table 4 Impact Assessment Criteria for Nitrogen Dioxide (NO₂)

Pollutant	Averaging Period	Criterion
NO ₂	1-hour	12 pphm (246 µg/m ³)
	Annual	3 pphm (62 µg/m ³)

Note: pphm = parts per hundred million

Suspended Particulate Matter

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

The annual impact assessment criteria for TSP recommended by the NSW EPA is $90 \mu\text{g}/\text{m}^3$. The TSP impact assessment criteria was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

PM_{10} and $\text{PM}_{2.5}$ are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $\text{PM}_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $\text{PM}_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children. The impact assessment criteria specified within the Approved Methods for suspended particulate matter are provided in **Table 5**.

Table 5 Impact Assessment Criteria for Suspended Particulate Matter

Pollutant	Averaging Period	Criterion
TSP	Annual	$90 \mu\text{g}/\text{m}^3$
PM_{10}	24-hour	$50 \mu\text{g}/\text{m}^3$
	Annual	$25 \mu\text{g}/\text{m}^3$
$\text{PM}_{2.5}$	24-hour	$25 \mu\text{g}/\text{m}^3$
	Annual	$8 \mu\text{g}/\text{m}^3$

Deposited Particulate

The criteria presented above are concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts from fugitive dust emissions during the construction phase also need to be considered, mainly in relation to deposited dust.

In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month ($\text{g}/\text{m}^2/\text{month}$).

Table 6 presents the impact assessment criteria set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 6 EPA Impact Assessment Criteria for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	$2 \text{ g}/\text{m}^2/\text{month}$	$4 \text{ g}/\text{m}^2/\text{month}$

Source: Approved Methods, EPA 2017

Sulphur Dioxide

SO₂ is a colourless, pungent gas with an irritating smell. When present in sufficiently high concentrations, exposure to SO₂ can lead to impacts on the upper airways in humans (i.e. the nose and throat irritation). SO₂ can also mix with water vapour to form sulphuric acid (acid rain) which can damage vegetation, soil quality and corrode materials.

Main sources of SO₂ in the air are industries that process materials containing sulphur (e.g., wood pulping, paper manufacturing, metal refining and smelting, textile bleaching, wineries etc.). SO₂ is also present in motor vehicle emissions, however since Australian fuels are relatively low in sulphur, high ambient concentrations are not common.

The impact assessment criteria specified within the Approved Methods for SO₂ are provided in **Table 7**.

Table 7 Impact Assessment Criteria for Sulphur Dioxide (SO₂)

Pollutant	Averaging Period	Criterion
SO ₂	10-min	25 pphm (712 µg/m ³)
	1-hour	20 pphm (570 µg/m ³)
	24-hour	8 pphm (228 µg/m ³)
	Annual	2 pphm (60 µg/m ³)

Note: pphm = parts per hundred million

Volatile Organic Compounds

VOCs are organic compounds (i.e. contain carbon) that have high vapour pressure at normal room-temperature conditions. Their high vapour pressure leads to evaporation from liquid or solid form and emission release to the atmosphere.

VOCs are emitted by a variety of sources, including motor vehicles, chemical plants, automobile repair services, painting/printing industries, and rubber/plastics industries. VOCs that are often typical of these sources include benzene, toluene, ethylbenzene and xylenes (BTEX). Biogenic (natural) sources of VOC emissions are also significant (eg vegetation).

Impacts due to emissions of VOCs can be health or nuisance (odour) related. Benzene is a known carcinogen and a key VOC linked with the combustion of motor vehicle fuels. The impact assessment criteria specified within the Approved Methods for BTEX compounds are provided in **Table 8**.

Table 8 Impact Assessment Criteria for VOCs

Pollutant	Averaging Period	Criteria*
Benzene	1-hour	0.029 mg/m ³
Ethylbenzene	1-hour	8.0 mg/m ³
Toluene	1-hour	0.36 mg/m ³
Xylenes	1-hour	0.19 mg/m ³

* Gas volumes are expressed at 25°C and at an absolute pressure of 1 atmosphere (101.325 kPa)

6 Review of Ambient Air Quality Monitoring Data

Based on information from the 43 station EES Air Quality Monitoring Network, air quality is generally good in Sydney. Between 2000 and 2019, the air quality was 'very good', 'good' or 'fair' for 94% of days in the Sydney North-West region. During this time, exceedances of the national air quality standards for particle pollution have usually been associated with regional dust storms and vegetation fires (NSW Government, 2017) (NSW OEH, 2017b) (NSW OEH, 2019).

The nearest EES AQMS stations to the Project site are located at Parramatta North and Prospect (refer to **Figure 4**). The Parramatta North AQMS was commissioned in December 2017 and is located at Cumberland Hospital at an elevation of 16 m. It is part of the Sydney North-West air quality monitoring network. The Prospect AQMS, which is also part of the Sydney North-West air quality monitoring network, was commissioned in February 2007 and is located at William Lawson Park, Myrtle Street, Prospect. The AQMS is situated in a residential area at an elevation of 66 m.

Given the similar distance to the Project site and considering the long-term data availability for Prospect AQMS, air quality data recorded by Prospect AQMS has been reviewed for the purpose of this AQA.

Prospect AQMS monitors the following air pollutants:

- PM₁₀
- PM_{2.5}
- NO, NO₂ & NO_x
- CO
- SO₂

Air pollutant data recorded by the Prospect AQMS were obtained for the calendar years 2015 – 2020. The data are summarised in **Table 9** (red font/shading indicates an exceedance of the relevant criterion), and are presented graphically in **Figure 6** to **Figure 10**. To be consistent with the annual NSW compliance monitoring reports, the data for gaseous pollutants are presented in parts per hundred million (pphm) or parts per million (ppm), rather than µg/m³ and mg/m³.

A review of the Prospect AQMS data shows that exceedances of the 24-hour average PM₁₀ and PM_{2.5} criteria were recorded by the Prospect AQMS in all six years. A review of the available compliance monitoring reports indicates that the exceedances recorded by the Prospect AQMS were primarily due to exceptional events, such as bushfire emergencies, dust storms and hazard reduction burns. The high number of exceedances recorded by the Prospect AQMS in late 2019 and early 2020 was due to the bushfire smoke that affected Sydney and the surrounding areas for a number of weeks over this period.

Exceedances of the annual average PM_{2.5} criterion were also recorded by the Prospect AQMS in all six years investigated except for 2017. Ambient PM_{2.5} concentrations often exceed the annual average criteria set out in the Approved Methods across the Sydney Greater Metropolitan Area. The annual average PM₁₀ criterion was only exceeded in 2019, which was primarily due to the abovementioned bushfires in the areas surrounding Sydney in late 2019.

Ambient concentrations of the gaseous pollutants SO₂, NO₂, and CO were all well below the relevant criteria for all years investigated.

Table 9 Summary of Prospect AQMS Data (2015 – 2020)

Pollutant	CO	NO ₂		SO ₂		PM ₁₀		PM _{2.5}	
Averaging Period	Maximum 1-hour	Maximum 1-hour	Annual	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual
Units	ppm	pphm	pphm	pphm	pphm	µg/m ³	µg/m ³	µg/m ³	µg/m ³
2015	1.9	5.3	1.1	2.7	0.1	68.7	17.6	29.6	8.2
2016	1.6	5.3	1.0	2.1	0.1	110.1	18.9	84.9	8.7
2017	1.6	6.0	1.0	2.3	0.1	61.1	18.9	30.1	7.7
2018	1.3	5.1	0.9	2.5	0.1	113.3	21.9	47.5	8.5
2019	5.5	4.9	0.9	2.1	0.1	182.8	26.0	134.1	11.9
2020	2.1	4.3	0.7	1.8	0.1	245.8	20.2	70.8	8.6
Criterion	25	12	3	20	2	50	25	25	8

Notes:

- ¹ For 2015, one (1) exceedance of the 24-hour average PM₁₀ and one (1) exceedance of the 24-hour average PM_{2.5} was recorded.
- ² For 2016, four (4) exceedances of the 24-hour average PM₁₀ and five (5) exceedances of the 24-hour average PM_{2.5} were recorded.
- ³ For 2017, one (1) exceedance of the 24-hour average PM₁₀ and three (3) exceedances of the 24-hour average PM_{2.5} were recorded.
- ⁴ For 2018, eight (8) exceedances of the 24-hour average PM₁₀ and four (4) exceedances of the 24-hour average PM_{2.5} were recorded.
- ⁵ For 2019, 25 exceedances of the 24-hour average PM₁₀ and 25 exceedances of the 24-hour average PM_{2.5} were recorded.
- ⁶ For 2020, ten (10) exceedances of the 24-hour average PM₁₀ and 13 exceedances of the 24-hour average PM_{2.5} were recorded.

Figure 6 1-Hour Average Ambient CO Concentrations - Prospect AQMS (2015 – 2020)

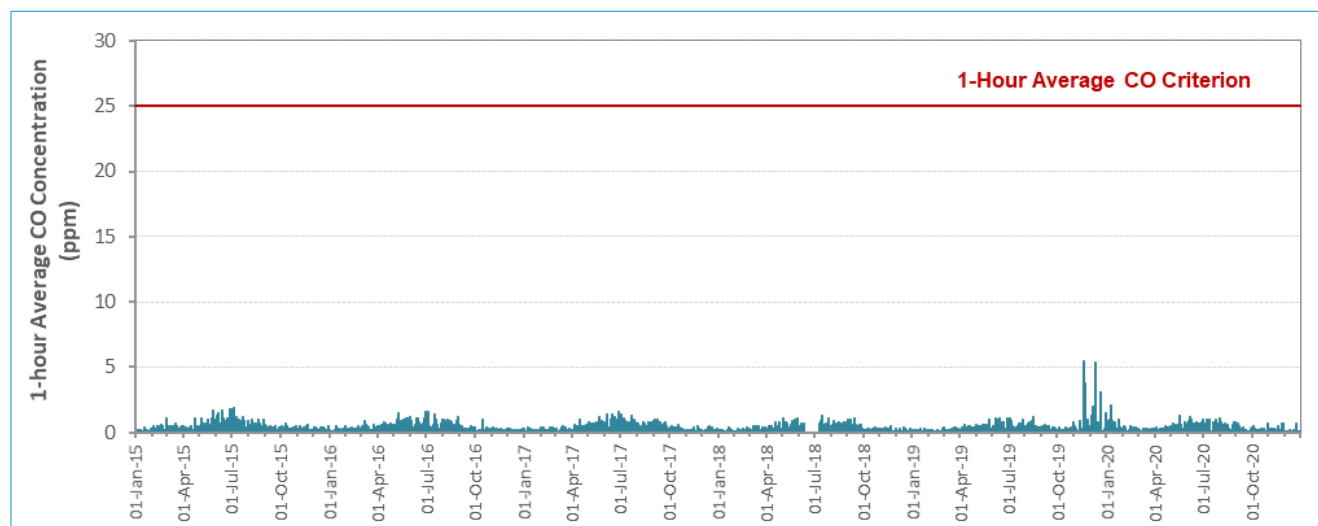


Figure 7 1-Hour Average Ambient NO₂ Concentrations - Prospect AQMS (2015 – 2020)

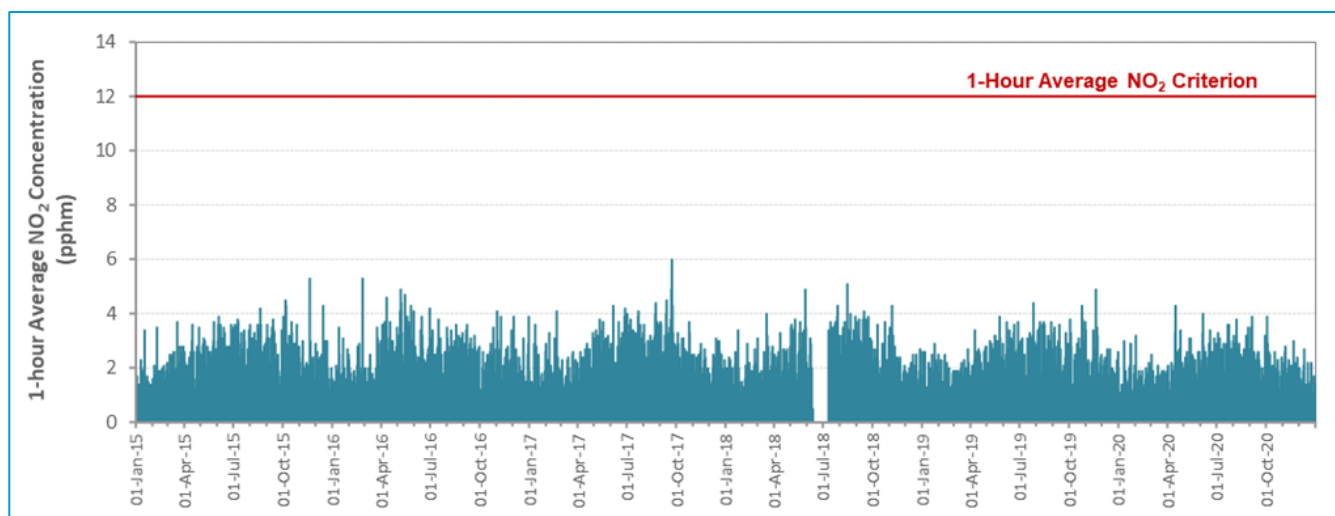


Figure 8 Ambient 1-Hour Average SO₂ Concentrations - Prospect AQMS (2015 – 2020)

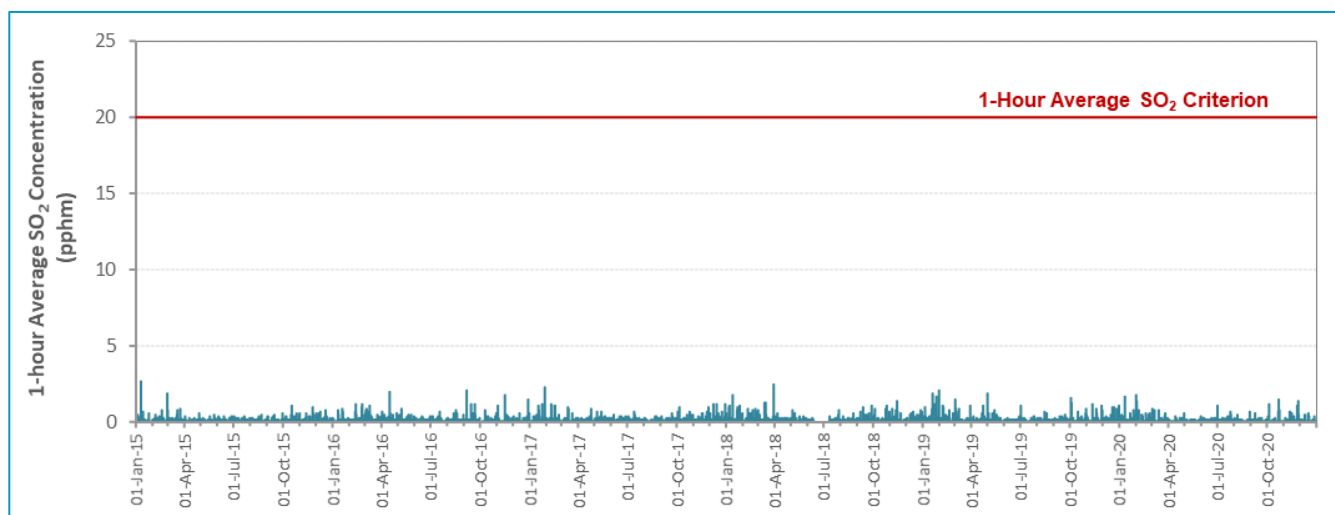


Figure 9 24-Hour Average Ambient PM₁₀ Concentrations - Prospect AQMS (2015 – 2020)

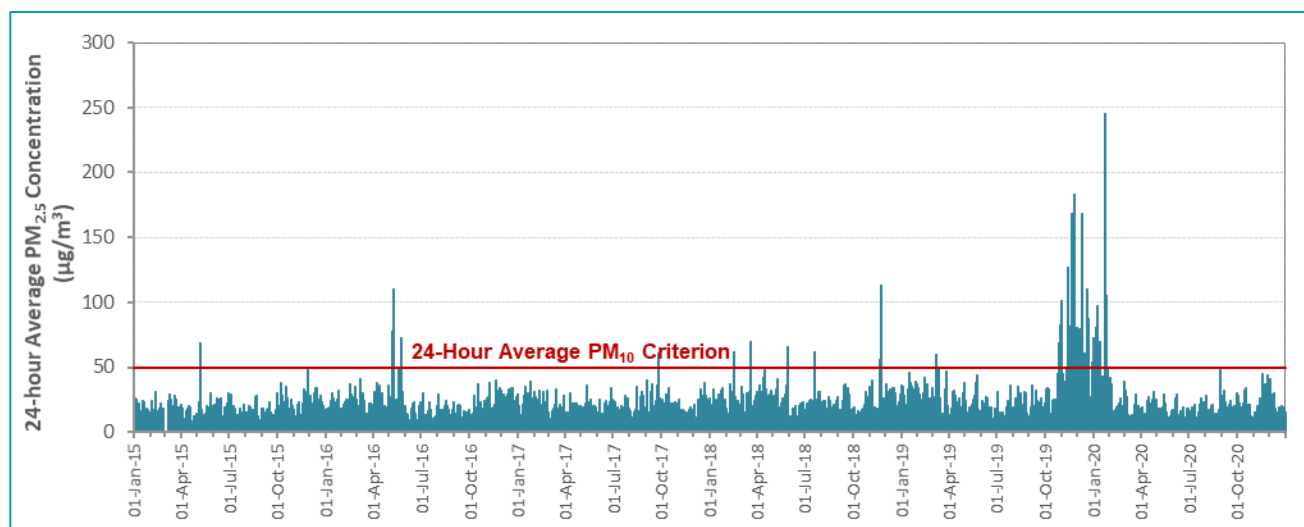
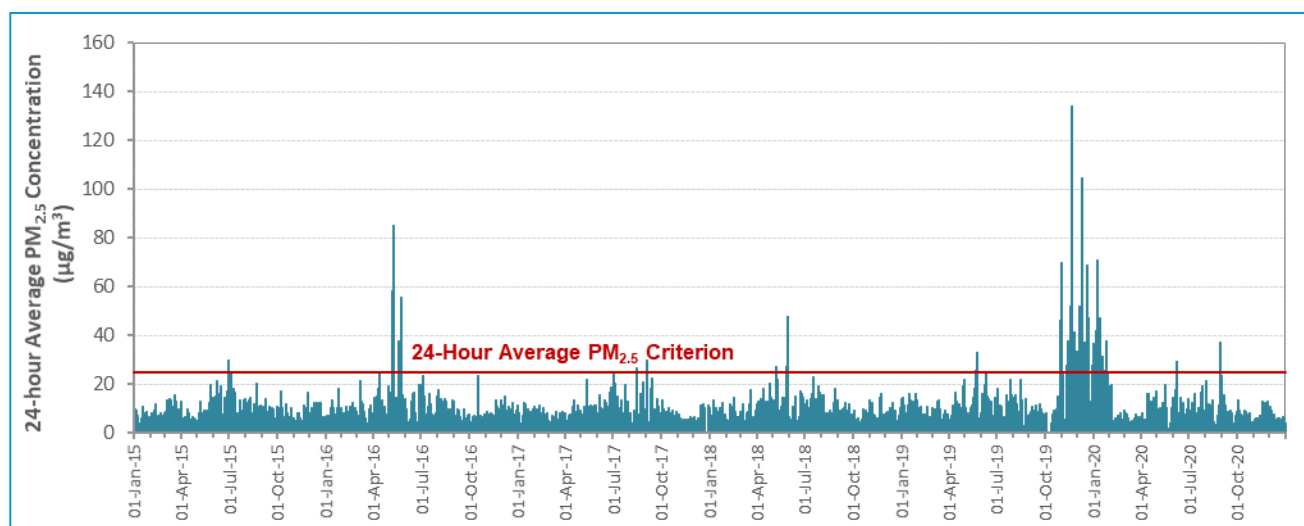


Figure 10 Ambient 24-Hour Average PM_{2.5} Concentrations - Prospect AQMS (2015 – 2020)



7 Assessment of Potential Impacts

7.1 Construction Phase

7.1.1 Dust Emissions During Construction

The key potential air pollution and amenity issues associated with fugitive dust emissions from the proposed activities during the construction works at the Project Site are:

- Annoyance due to dust deposition (soiling of surfaces) and visible dust plumes; and
- Elevated suspended particulate concentrations (PM₁₀).

Modelling of dust from construction activities is generally not considered appropriate, as emission rates can vary significantly depending on a combination of the activity and prevailing meteorological conditions (i.e., rainfall and wind speed), which cannot be reliably predicted. The following sections therefore present a qualitative assessment of the potential risks to air quality associated with dust from construction activities at the Project. Details of the IAQM methodology used to perform the risk assessment are provided in **Appendix A**.

Step 1 – Screening Based on Separation Distance

As noted in **Section 3.1**, the nearest sensitive receptor (residential) is located approximately 10 m from the nearest Project Site boundary.

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

- 350 m of the boundary of the site; or
- 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

As ‘human receptors’ are present within 350 m of the boundary of the site, and within 50 m of the route(s) used by construction vehicles, further assessment is required and was completed (refer Step 2, Step 3 and Step 4 below). For the purpose of this assessment, the number of sensitive receptors is estimated to be approximately 200 within 100 m of the Project Site Boundary.

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

Based upon the above assumptions and the IAQM definitions presented in **Appendix A**, the dust emission magnitudes for each phase of the construction works have been categorised as presented in **Table 10**. No significant demolition activities are proposed as part of the works, hence the risk of dust impacts from demolition activities have not been assessed. As outlined in **Section 2.2**, the construction of the Centre of Excellence and Community Facility will be staged with the construction works (including demolition and earthworks) for the Centre of Excellence not starting until the Community Facility is completed.

Table 10 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Demolition	Small	IAQM Definition: Total building volume <20,000 m³, construction material with low potential for dust release (e.g., metal cladding or timber), demolition activities <10m above ground, demolition during wetter months. Relevance to this Project: <i>No significant demolition activities are proposed as part of the Project. The total building volume to be demolished is estimated to be <u>less than 5,000m³</u>. Demolition volume will largely relate to paving, drainage, site services works, tree removal and the site cut earthworks</i>
Earthworks	Medium	IAQM Definition: Total site area 2,500 m² to 10,000 m², moderately dusty soil type (e.g., silt), five to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t Relevance to this Project: <i>Total area of the Project site is estimated to be approximately 31000 m² Earthworks are expected to take place on a relatively small area within the Project site (approximately 10,000 m²) over two stages. Based on the preliminary bulk earthworks modelling it is estimated that total cut material that will be moved from site would be approximately 7,500 m³ (~15,000 t). Of this amount, approximately 5,500 m³ (~11,000 t) would be used as fill within the site with the approximately 2,000 m³ excess (~4,000 t) removed from site.</i>
Construction	Medium	IAQM Definition: Total building volume 25,000 m³ to 100,000 m³, potentially dusty construction material (e.g., concrete), piling, on site concrete batching. Relevance to this Project: <i>Total Building volume to be constructed is <u>34,709m³</u> inclusive of Community Facility: lower ground 5,346m³, ground 4,771m³. Centre of Excellence: Lower ground 11,791m³, ground 12,803m³.</i>
Trackout	Medium	IAQM Definition: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length Relevance to this Project: <i>It is estimated that <u>less than 50</u> heavy vehicles movements per day will occur during the peak construction period.</i>

Step 2b – Risk Assessment

Receptor Sensitivity

Based on the criteria listed in **Table A1** in **Appendix A**, the sensitivity of the identified receptors in this study is concluded to be high for health impacts and high for dust soiling, as they include residential areas where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

Sensitivity of an Area

Using the classifications shown in **Table A2** in **Appendix A**, the sensitivity of the area to dust soiling is classified as 'medium' and the sensitivity of the surrounding area to health effects (**Table A3** in **Appendix A**) has been classified as 'low'. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM₁₀ concentration of 20.6 µg/m³ recorded at the Prospect AQMS (see **Section 6**) and the anticipated number of receptors present, i.e., 200 within 100 m for both dust soiling and health impacts. It is noted that the closest residential receptors are located approximately 70 m from the contraction/excavation areas.

Risk Assessment

Given the sensitivity of the general area is classified as 'medium' for dust soiling and 'low' for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 10**, the resulting risk of air quality impacts is as presented in **Table 11**.

The results indicate that there is a medium risk of adverse dust soiling impacts occurring at the off-site sensitive receptor locations during earthworks and construction and low risk of dust soiling impacts during demolition and trackout if no mitigation measures were to be applied to control emissions.

The results further indicate that there is a low risk of human health impacts due to earthworks, construction and trackout and negligible risk of human health impacts due to demolition works, even if no mitigation measures were to be applied to control emissions.

Table 11 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

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

Step 3 - Mitigation Measures

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed 'residual impacts'.

Table 12 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a medium risk of adverse impacts. Not all these measures would be practical or relevant to the Project, therefore a detailed review of the recommendations should be performed, and the most appropriate measures be adopted and implemented as part of the relevant construction certificate. For almost all construction activities, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Table 12 Site-Specific Management Measures Recommended by the IAQM

	Activity	
1	Communications	
1.1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site	H
1.2	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager	H
1.3	Display the head or regional office contact information	H
1.4	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority	H
2	Site Management	
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken	H
2.2	Make the complaints log available to the local authority when asked	H
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book	H
3	Monitoring	
3.1	Perform daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary	D
3.2	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority, when asked	H
3.3	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions	H
3.4	Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction	H
4	Preparing and Maintaining the Site	
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible	H
4.2	Erect solid screens or barriers around dusty activities or the site boundary that is at least as high as any stockpiles on site	H
4.3	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period	H
4.4	Avoid site runoff of water or mud	H
4.5	Keep site fencing, barriers and scaffolding clean using wet methods	H
4.6	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H

	Activity	
4.7	Cover, seed, or fence stockpiles to prevent wind erosion	H
5	Operating Vehicle/Machinery and Sustainable Travel	
5.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
5.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.3	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable	H
5.4	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	D
5.5	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials	H
5.6	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	D
6	Operations	
6.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems	H
6.2	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.3	Use enclosed chutes and conveyors and covered skips	H
6.4	Minimise drop heights from loading shovels and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
6.5	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods	H
7	Waste Management	
7.1	Avoid bonfires and burning of waste materials	H
8	Demolition	
8.1	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)	D
8.2	Ensure effective water suppression is used during demolition operations	H
8.3	Avoid explosive blasting, using appropriate manual or mechanical alternatives	H
8.4	Bag and remove any biological debris or damp down such material before demolition	H
9	Earthworks	
9.1	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
9.2	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	D
9.3	Only remove the cover in small areas during work and not all at once	D
10	Construction	
10.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
10.2	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place	H
10.3	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery	D
10.4	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust	D

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

H = Highly recommended; D = Desirable

Step 4 - Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies as shown in **Table 12**. These are termed 'residual impacts'. The results of the reappraisal are presented below in **Table 13**.

Table 13 Residual Risk of Air Quality Impacts from Construction

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

The mitigated dust deposition and human health impacts for demolition, earthworks, construction and trackout phases of the works are anticipated to be *low to negligible*.

7.1.2 Products of Fuel Combustion

As outlined in **Section 6**, ambient air quality monitoring performed in the Sydney area over the last few decades has shown that the city's air quality has typically improved and is continuing to improve. A major driver of this improvement in urban air quality is the fact that newer vehicles produce significantly less emissions than older vehicles. Despite the steady increases in vehicle kilometres travelled (VKT), more stringent vehicle emission standards in Australia, as well as the improved national fuel quality standards and improved engine designs have progressively resulted in significant reductions in the total fleet emissions. According to the New South Wales Environmental Protection Authority (NSW EPA, 2017), cars built from 2013 onwards emit only 3% of the NO_x emissions compared to vehicles built in 1976, and diesel trucks built from 2011 onwards emit just 8% of the particles emitted by vehicles built in 1996. Thus, even as Sydney's population and total VKTs each year have increased (NSW EPA, 2017), key measures of air pollution have dropped significantly, and this trend is expected to continue.

The results from the background air quality concentrations show that the monitored concentrations have been well below the respective criteria for CO, NO₂ and SO₂ for six years running (2015-2020) (see **Section 6**).

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

7.2 Operational Phase

This section presents a high-level assessment of the potential risks of adverse air quality impacts at sensitive receptors due to the proposed operations at the Project site. The impact assessment uses the methodology summarised in **Section 1.1.2** of this report, which integrates the receptor sensitivity with impact magnitude to derive the potential significance of that change. Details of the operational risk assessment methodology used are provided in **Appendix B**. In the context of this methodology, the resultant risk is termed "impact significance".

The nearest existing residential receptors have been identified as being located less than 50 m from the Project site boundary. With regards to the methodology outlined in **Appendix B**, the sensitivity of the surrounding residential areas to air pollutant emissions generated by the Project site has been classified as **high**.

7.2.1 Odour Emissions from Cafe Operations

As discussed in **Section 4.2.1**, odour emissions will occur from activities at the proposed kitchen facility. The new café kitchen is proposed to be equipped with AS and BCA compliant air extraction systems.

By addressing the FIDOL factors, the potential for odour impacts from this source at the sensitive receptors may be determined.

- Frequency – the closest residential areas have the potential to experience impacts whenever the kitchen is operational and when winds blow towards the receptors. As outlined in **Section 3.3** winds blow in the direction of the nearest sensitive receptors approximately 20% of the time during the year, therefore there is a low/medium likelihood they would experience frequent potential odour impacts.

- **Intensity** – The intensity of released odour is dependent on a number of factors including cooking method and the level of filtration. It is understood that air extraction and filtration systems compliant with the relevant Australian Standards are being considered for the kitchen exhaust systems. It is further understood that solid fuel-fired cooking (which could lead to high odour emissions) is not proposed to be used. Therefore, the intensity of odours from the kitchen would likely be low.
- **Duration** – the duration of a potential odour impact may last as long as the kitchen is operational and wind is blowing in the direction of the sensitive receptors. Given the kitchens will operate throughout the day and winds blow in the direction of the nearest sensitive receptors approximately 20% of the time during the year, the duration of any odour impact is likely to be low/medium.
- **Offensiveness** – Based on SLR's experience, the hedonic tone of odours from café operations with no solid fuel-fired cooking typically ranges between mildly pleasant to mildly unpleasant, therefore the offensiveness is likely to be low.
- **Location** – the impact of location on the acceptability of odours from the Site has been accounted for by the receptor sensitivity classifications discussed in **Section 7.1.1** as high.

Given the above considerations, the magnitude for nearby sensitive receptors is predicted to be **negligible** (i.e. Impact is predicted to cause no significant consequences, **Table B2**). Given the **high sensitivity** of the potentially affected receptors and the **negligible magnitude** of the potential odour impact of the processing facility, the potential impact significance for the local receptors is concluded to be of **neutral significance** (see **Table 14**).

Table 14 Risk Assessment of Odour Impacts – Kitchen Operations

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Considering the neutral impact significance for receptors due to the kitchen operations, additional mitigation measures (beyond compliance with relevant Australian Standards) are not deemed necessary. In order to further reduce the impact significance, additional mitigation can be put in place to reduce or remove these impacts (refer to **Section 8**).

7.2.2 Products of Combustion from Operational Phase Traffic

As outlined in **Section 7.1.2**, improvements in the quality and composition of fuels as well as improved engine designs and fuel efficiency, have led to continuously improving air quality in the Sydney area.

These emissions from operational phase traffic will be of a similar nature to existing emissions from traffic visiting the site and travelling along the surrounding road network. Given the scale of on-site vehicle parking and anticipated traffic generation rates, it is considered that the emissions generated due to the combustion of fuel in light and heavy vehicles generated by Project operations are small compared to the emissions generated by traffic on the surrounding road network (see **Section 4.2.2**). Further, it is noted that the car park is approximately 40 m away from the nearest residential receptor to the east.

Given the above considerations, the magnitude for nearby sensitive receptors is predicted to be **negligible** (i.e. impact is predicted to cause no significant consequences, **Table B2**).

Given the **high sensitivity** of the potentially affected receptors and the **negligible magnitude** of the potential impacts from products of combustion from operational phase traffic activities, the potential impact significance for the local receptors is concluded to be of **neutral significance** for the closest receptors.

Table 15 Risk Assessment of Impacts from Products of Combustion – Operational Phase Traffic

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

8 Mitigation Measures and Monitoring

In order to further reduce the potential for off-site air quality impacts during operation, additional mitigation measures can be put in place. The following outlines a number of possible mitigation measures relevant to the proposed activities at the Site. It is noted that some of these measures are being considered by the design team. Recommended mitigation measures for the construction phase are provided in **Section 7.1**.

- As outlined in **Section 4.2.1**, BCA/AS standard compliant extraction systems are being designed for the Project in order to extract emissions and discharge them to atmosphere via dedicated discharge vents. Air pollution control devices may be implemented to further reduce emissions where complaints are received in relation to nuisance odour or where prolonged smoke is visible during normal or peak operations (i.e., not during start up or shut down).
- Signage should be displayed to remind drivers to turn off vehicle engines when idling at the Project site for longer than 1 minute to minimise exhaust emissions.
- General environmental awareness training should be provided to relevant staff and contractors, including:
 - Potential air quality and odour impacts that may be caused by activity during normal and abnormal circumstances;
 - Prevention of accidental air emissions and actions to be taken when accidental emissions occur;
 - Efficient and appropriate use and maintenance of equipment used on the Project site (where relevant to their role); and
 - Procedures for complaint handling.
- All staff and contractors should be instructed to report any undue pollutant release (including odour) and visible emissions from the exhaust vents to the Site manager.

8.1 Monitoring

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

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

9 Conclusions

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

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

The potential for off-site air quality impacts due to operational phase activities was also assessed using a qualitative risk-based approach. Based on this qualitative assessment, considering the nature of the operations proposed, it has been concluded that the risk of relevant air quality criteria being exceeded as a result of the operation of the Project is negligible.

Based on the qualitative assessment performed, which takes into account the scale and nature of the proposed operations, site location and mitigation measures adopted, SLR concludes that any exceedances of the relevant air quality criteria due to the Project are highly unlikely and further quantitative assessment is not appropriate or warranted. The additional mitigation measures recommended in this report will assist in further reducing the risk of any adverse off-site air quality impacts.

10 References

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APPENDIX A CONSTRUCTION ASSESSMENT METHODOLOGY

APPENDIX A - Construction Assessment Methodology

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the Site, more than 50 m from the route used by construction vehicles on public roads, and more than 500 m from the Site entrance. This step is noted as having deliberately been chosen to be conservative and will require assessments for most projects.

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

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

Demolition (Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time):

- **Large:** Total building volume >50,000 m³, potentially dusty construction material (e.g., concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- **Medium:** Total building volume 20,000 m³ – 50,000 m³, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- **Small:** Total building volume <20,000 m³, construction material with low potential for dust release (e.g., metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks (Covers the processes of soil-stripping, ground-levelling, excavation and landscaping):

- **Large:** Total site area greater than 10,000 m², potentially dusty soil type (e.g., clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- **Medium:** Total site area 2,500 m² to 10,000 m², moderately dusty soil type (e.g., silt), five to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- **Small:** Total site area less than 2,500 m², soil type with large grain size (e.g., sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction (Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc):

- **Large:** Total building volume greater than 100,000 m³, piling, on site concrete batching; sandblasting.
- **Medium:** Total building volume 25,000 m³ to 100,000 m³, potentially dusty construction material (e.g., concrete), piling, on site concrete batching.

- **Small:** Total building volume less than 25,000 m³, construction material with low potential for dust release (e.g., metal cladding or timber).

Trackout (*The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network*):

- **Large:** More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.
- **Medium:** Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- **Small:** Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

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

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

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

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

Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in **Table A-1**. It is noted that user expectations of amenity levels (dust soiling) are dependent on existing deposition levels.

Table A-1 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	<i>Examples: Dwellings, museums, medium- and long-term car parks and car showrooms.</i>	<i>Examples: Parks and places of work.</i>	<i>Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.</i>
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	<i>Examples: Residential properties, hospitals, schools and residential care homes.</i>	<i>Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM₁₀.</i>	<i>Examples: Public footpaths, playing fields, parks and shopping street.</i>

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

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place;
- Any conclusions drawn from local topography;
- The duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts); and
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

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

Table A-2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

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

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

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;

- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A-3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM ₁₀ conc.	Number of receptors ^{a,b}	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m ³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m ³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g., the total within 350 m and not the number between 200 and 350 m); noting that only the highest level of area sensitivity from the table needs to be considered.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A-4** (demolition), **Table A-5** (earthworks and construction) and **Table A-6** (trackout) to determine the risk category with no mitigation applied.

Table A-4 Risk Category from Demolition Activities

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

Table A-5 Risk Category from Earthworks and Construction Activities

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

Table A-6 Risk Category from Trackout Activities

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

Step 3 - Site-Specific Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the site is a low-, medium- or high-risk site.

Step 4 – Residual Impacts

Following Step 3, the residual impact is then determined after management measures have been considered.

APPENDIX B OPERATIONAL ASSESSMENT METHODOLOGY

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APPENDIX B - Operational Assessment Methodology

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

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

The integration of receptor sensitivity with impact magnitude is used to derive the predicted **significance** of that change.

Nature of Impact

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

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

Receptor Sensitivity

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

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the broad categories outlined in **Table B1**, which has been used in this assessment to define the sensitivity of receptors to air quality impacts.

Table B1 Methodology for Assessing Sensitivity of a Receptor to Air Quality Impacts

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

Magnitude of Impact

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. **Table B2** outlines the methodology used in this assessment to define the magnitude of the identified potential air quality impacts.

Table B2 Methodology for Assessing Magnitude of Impacts

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

Significance of Impact

The risk-based matrix provided below illustrates how the definition of the sensitivity and magnitude interact to produce impact significance.

Table B3 Impact Significance Matrix

Sensitivity		Magnitude			
		[Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

ASIA PACIFIC OFFICES

ADELAIDE

60 Halifax Street
Adelaide SA 5000
Australia
T: +61 431 516 449

BRISBANE

Level 16, 175 Eagle Street
Brisbane QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CAIRNS

Level 1 Suite 1.06
Boland's Centre
14 Spence Street
Cairns QLD 4870
Australia
T: +61 7 4722 8090

CANBERRA

GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN

Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST

Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY

21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE

Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE CBD

Suite 2B, 125 Bull Street
Newcastle West NSW 2302
Australia
T: +61 2 4940 0442

NEWCASTLE

10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH

Grd Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY

Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE

12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG

Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND

Level 4, 12 O'Connell Street
Auckland 1010
New Zealand
T: 0800 757 695

NELSON

6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628

WELLINGTON

12A Waterloo Quay
Wellington 6011
New Zealand
T: +64 2181 7186

SINGAPORE

39b Craig Road
Singapore 089677
T: +65 6822 2203