WESTLINK STAGE 2

Air Quality Impact Assessment

Prepared for:

ESR Developments (Australia) Pty Ltd
Level 24, 88 Phillip Street
Sydney NSW 2000

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SLR

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by ESR Developments (Australia) Pty Ltd (ESR) to undertake an Air Quality Impact Assessment (AQIA) to inform a State Significant Development (SSD) application (SSD 46983729) for Westlink Stage 2, which is a proposed warehousing and distribution development (the Project) at 1030-1048 and 1050-1064 Mamre Road, and 59-62 & 63 Abbotts Road, Kemps Creek (the Site) located within the Mamre Road Precinct (MRP).

1.1 Secretary's Environmental Assessment Requirements

This report presents an assessment of the potential construction and operational air quality impacts associated with the Project in consideration of the Planning Secretary's Environmental Assessment Requirements (SEARs) issued for the proposal (SSD-42544484) on 10 August 2022. **Table 1** below summaries The SEARs relevant to air quality and how they have been addressed in this report.

Table 1 SEARs – Air Quality

Secretary's Environmental Assessment Requirements	Section
Identify significant air emission sources at the proposed development (during construction and operation)	**Section 2.3** and **Section 2.3.2**
Assess their potential to cause adverse off-site impacts	**Section 6**
Detail proposed management and mitigation measures that would be implemented.	**Section 6.1.4**
Where air emissions during operation have the potential to cause adverse off-site impacts, provide a quantitative air quality impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines.	**Not Required**

1.2 Test of Adequacy Comments

On 27 October 2023, following a review of the draft Environmental Impact Statement (EIS) for the Project, the NSW Department of Planning and Environment requested that the EIS be updated to address a number of comments. The comments relevant to the AQIA along with SLR's responses are listed in **Table 2**.

Table 2 Test of Adequacy Comments

Requirements	Response
Section 2.3.2 of the Air Quality Impact Assessment (AQIA) states that information on the future site-specific operations is not available. However, as the tenant for the proposed warehouse is known and operational requirements are outlined in the traffic assessment, a more detailed assessment should be undertaken.	SLR understands that the activities within the Site are limited to warehousing and distribution; therefore, the only emissions from the operational phase of the Project are expected to be products of combustion due to vehicle movements which were qualitatively assessed in the original air quality assessment and found to have a neutral potential for offsite air quality impacts. This updated report quantifies the potential air quality impacts associated with emissions from vehicle movements generated by the Project using the Tool for Roadside Air Quality (TRAQ) (refer **Appendix D** and **Section 6.2**). The TRAQ results confirm the findings of the original assessment.
Clarify why residential receivers in Mount Vernon to the south and east of the site were not identified as residential receptors in Figure 5, some of which adjoin the Stage 2 construction area identified in Figure 1.	The surrounding receptors are updated in **Figure 5** and **Figure 15**. It is noted that air pollutant concentrations generally reduce with an increase in distance. As such, impacts at residential receptors in further away from the Site are expected to be lower than those in the immediate vicinity of the Site.
As required by the SEARS, the AQIA should be prepared in accordance with relevant NSW Environment Protection Authority (EPA) guidelines, rather than UK assessment guidelines.	As mentioned in **Appendix A**, the IAQM method has been slightly modified for use in this assessment to account for NSW EPA ambient air quality criteria. The NSW EPA does not provide specific guidelines for the assessment of air quality impacts from construction activities. Modelling assessment of construction impacts in accordance with the EPA guidelines is generally not deemed to be appropriate as quantification and dispersion modelling of construction dust emissions is subject to a very high level of uncertainty. This means the outputs of such a study would not in itself be useful for the identification of appropriate mitigation measures. It is noted that even for major projects in close vicinity to densely built-up urban areas (Westconnex, Waterloo Precinct, Sydney Fish Markets, etc.) only a qualitative assessment of construction phase impacts (typically in line with IAQM methodology) is performed.

1.3 Mamre Road Precinct Development Control Plan

The MRP Development Control Plan (DCP) also applies to the Project. The requirements of the MRP DCP relevant to Air Quality are reproduced below:

Objectives

a) To maintain existing air quality or improve local air quality to protect public health.

b) To ensure future development does not adversely affect existing air quality.

Controls

1) Any development likely to, or capable of, generating air emissions must comply with Protection of the Environment Operations Act 1997 and associated regulations.

2) An Air Quality and Odour Assessment is required for development that may have an adverse impact on local and regional air quality, including construction impacts on adjoining rural-residential areas.

3) The Air Quality and Odour Assessment should be in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2017) and/or the Technical Framework -Aassessment and Management of Odour from Stationary Sources in NSW (EPA 2006) and include but not be limited to:

- *Characterisation of all emissions;*
- *Measures to mitigate air impacts, including best practice measures; and*
- *Details of any monitoring programs to assess performance of any mitigation measures and to validate any predictions as a result of the assessment.*

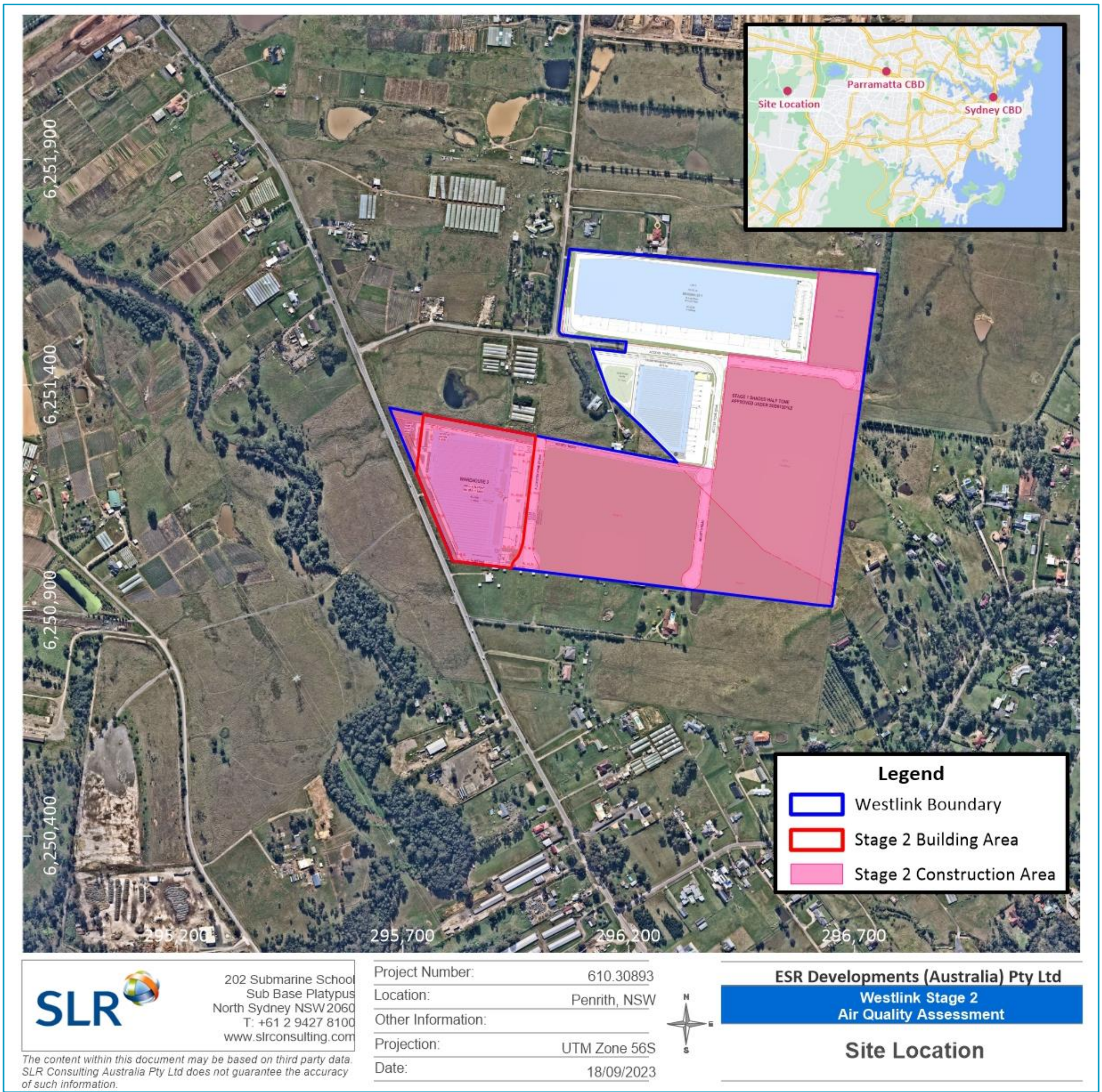
4) Developments that involve back up power generation of electricity with diesel equipment that has the capacity to burn more than 3 megajoules of fuel per second must include a best practice review of reasonable and feasible diesel emission reduction technology.

2 Project Overview

2.1 Site Location

The Site is located at 292-308 Aldington Road, 59 -62 Abbotts Road, and 63 Abbotts Road, Kemps Creek, NSW within the Penrith Local Government Area (LGA), approximately 20 kilometres (km) southwest of the Parramatta Central Business District (CBD) and 39 km west of the Sydney CBD. The location of the Site is shown in **Figure 1**.

Figure 1 Site Location



2.2 Masterplan

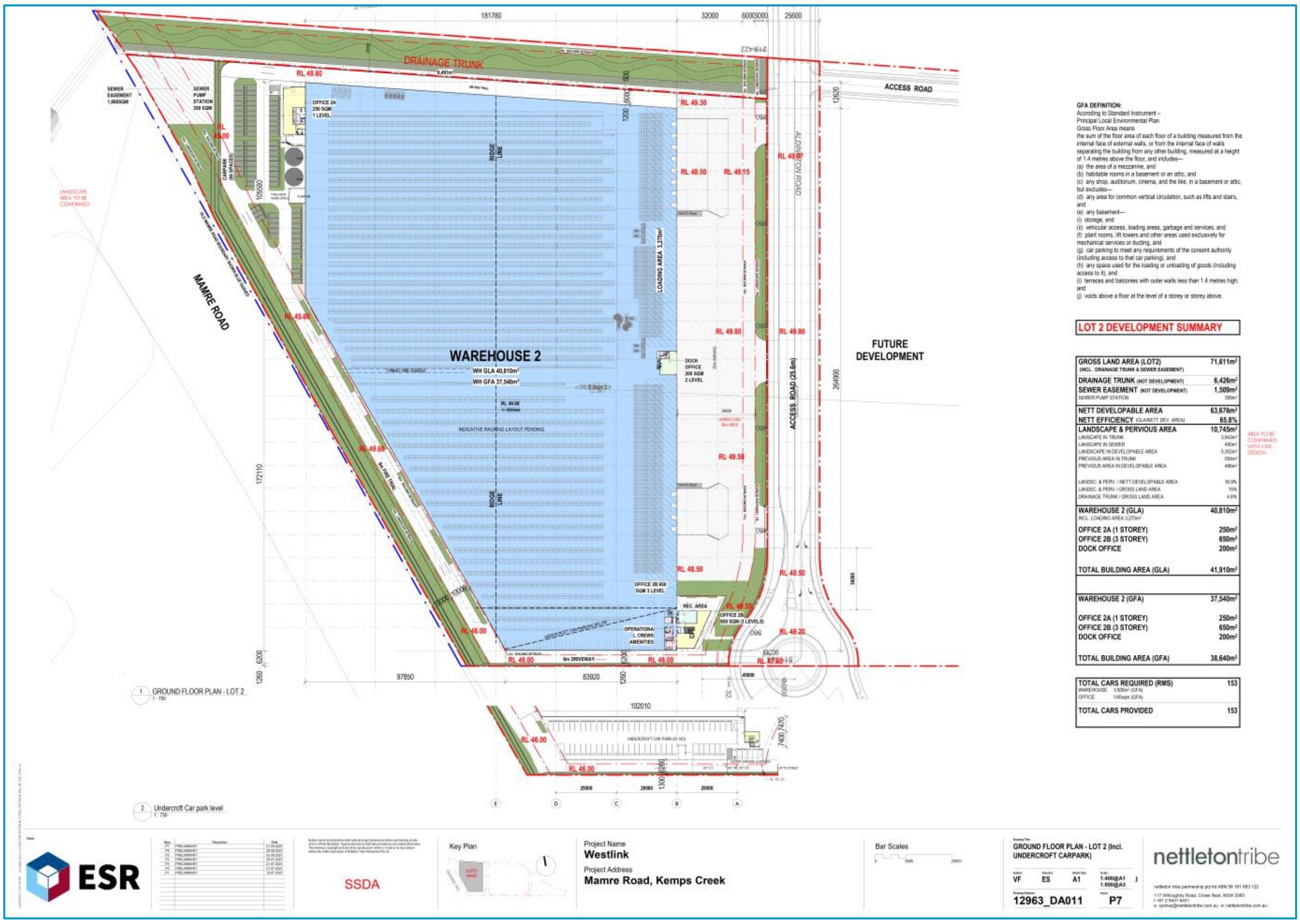
The Project comprises the following:

- Site preparatory works, including bulk earthworks to create flat development platforms for the proposed buildings, and topsoiling, grassing and site stabilisation works
- Subdivision of the Site into six individual lots, with two being residual lots for future development
- Construction of a new internal road layout, including connectivity to the internal access road proposed under Westlink Stage 1, and car parking areas
- Associated site servicing works and ancillary facilities, including an on-site detention (OSD) basin located on one of the allotments
- Site landscaping and signage.

The proposed MRP Masterplan design is shown in **Figure 2** and the proposed Stage 2 design is shown in **Figure 3**.

Figure 2 Proposed Westlink Masterplan

Figure 3 Stage 2 Development



2.3 Potential Sources of Emissions to Air

2.3.1 Construction Phase

The main air quality issue associated with construction works relates to emissions of fugitive dust. The potential for dust to be emitted during the construction works will be directly influenced by the nature of the activities being performed at any given time. Generally, the activities that are most likely to lead to short-term emissions of dust, include:

- Grading
- Loading and unloading of materials
- Wheel-generated dust and combustion emissions from construction equipment
- Wheel-generated dust from trucks travelling on unpaved surfaces
- Wind erosion of exposed surfaces.

Temporary elevations in local dust levels are most likely to occur when construction 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.

A number of environmental factors may affect the generation and dispersion of dust emissions, including:

- Wind direction - determines whether dust and suspended particles are transported in the direction of the sensitive receptors;
- Wind speed - determines the potential suspension and drift resistance of particles;
- Surface type - more erodible surface material types have an increased soil or dust erosion potential;
- Surface material moisture - increased surface material moisture reduces soil or dust erosion potential; and
- Rainfall or dew - rainfall or heavy dew that wets the surface of the soil reduces the risk of dust generation.

Where diesel-powered mobile machinery and vehicles are being used, localised elevations in ambient concentrations of combustion-related pollutants may also occur, however any potential for the relevant impact assessment criteria for these pollutants to be exceeded at surrounding sensitive areas will be minimal. Fugitive dust emissions are generally considered to have the greatest potential to give rise to downwind air quality impacts at construction sites and combustion emissions during construction have not been considered further.

2.3.2 Operational Phase

SLR understands that the Site will be used by a third-party logistics (3PL) provider with no manufacturing and combustion sources on site. Therefore, during the operational phase, the main source of air emissions would be emissions of products of fuel combustion and particulate matter (associated with brake and tyre wear as well as re-entrainment of road dust) associated with the trucks and other vehicles entering and leaving the Site or idling at the Site during loading/unloading operations. Emissions associated with the combustion of fuel (diesel, petrol, etc.) in road vehicles will include carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM10 and PM2.5), sulfur dioxide (SO2) and volatile organic compounds (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. According to the Transport Management & Accessibility Plan prepared by Ason Group for the roject (ASON, 2023) (hereafter the Transport Report), the daily Project generated traffic volume is estimated to be 420 vehicles per day (vpd) of which 79 (19%) are heavy vehicles and 19% occur during the morning peak hour (9 am).

To put the Project traffic generation rates in context, existing traffic volumes on Mamre Road, north of Bakers Lane exceed 18,000 vpd [1].

[1] *Summit at Kemps Creek SSD-30628110 Noise Impact Assessment* (SLR, 2022).

2.4 Pollutants of Concern

As identified in **Section 2.3** and **Section 2.3.2**, the key air pollutants of interest are considered to be particulate matter from construction works, and products of fuel combustion from construction and operations.

The following sections outline the potential health and amenity issues associated with particulate matter and products of fuel combustion, while **Section 4** identifies the relevant air quality assessment criteria.

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 health effects of particulate matter are strongly influenced by the size of the airborne particles. Smaller particles can penetrate further into the respiratory tract, with the smallest particles having a greater impact on human health as they penetrate to the gas exchange areas of the lungs. Larger particles primarily cause nuisance associated with coarse particles settling on surfaces.

The term "particulate matter" refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is called total suspended particulate (TSP). Particulate matter with an aerodynamic diameter of 10 microns or less is referred to as PM_{10}. The PM_{10} size fraction is sufficiently small to penetrate the large airways of the lungs, while $PM_{2.5}$ (2.5 microns or less) particulates are generally small enough to be drawn in and deposited into the deepest portions of the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

Nuisance Dust

In addition, nuisance impacts need also to be considered, mainly in relation to deposited dust. Dust can cause nuisance by settling on surfaces and possessions, affecting visibility and contaminating tank water supplies. High rates of dust deposition can also adversely affect vegetation by blanketing leaf surfaces.

Products of Combustion

Emissions associated with road traffic and the combustion of fossil fuels (diesel, petrol, AVGAS etc.) will include carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and volatile organic compounds (VOCs).

CO is an odourless, colourless gas formed from the incomplete burning of fuels in motor vehicles. It can be a common pollutant at the roadside and highest concentrations are found at the kerbside with concentrations decreasing rapidly with increasing distance from the road. CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow. The incomplete combustion of fuel in diesel powered vehicles can generate particulate in the form of black soot.

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 (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 soon after leaving the engine exhaust.

Engine exhausts can contain emissions of sulfur dioxide (SO_2) due to impurities in the fuel. The sulfur content in diesel fuel has significantly reduced over the years ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria.

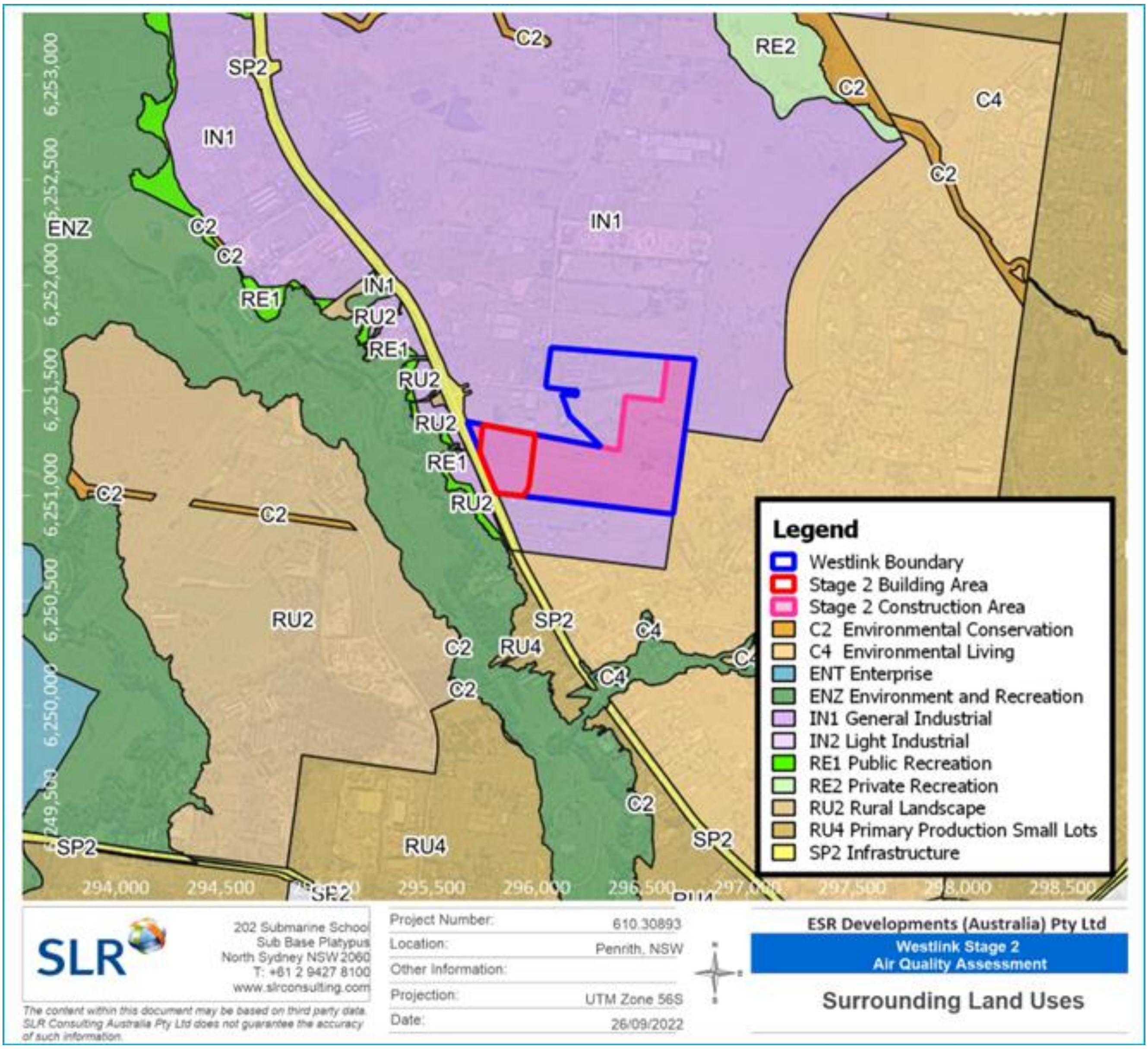
Volatile organic compounds (VOCs) may be emitted as a result of the incomplete combustion of fuel. VOC emissions are reducing significantly due to the improved combustion processes offered by modern engines.

3 Receiving Environment

3.1 Surrounding Land Uses and Sensitive Receptors

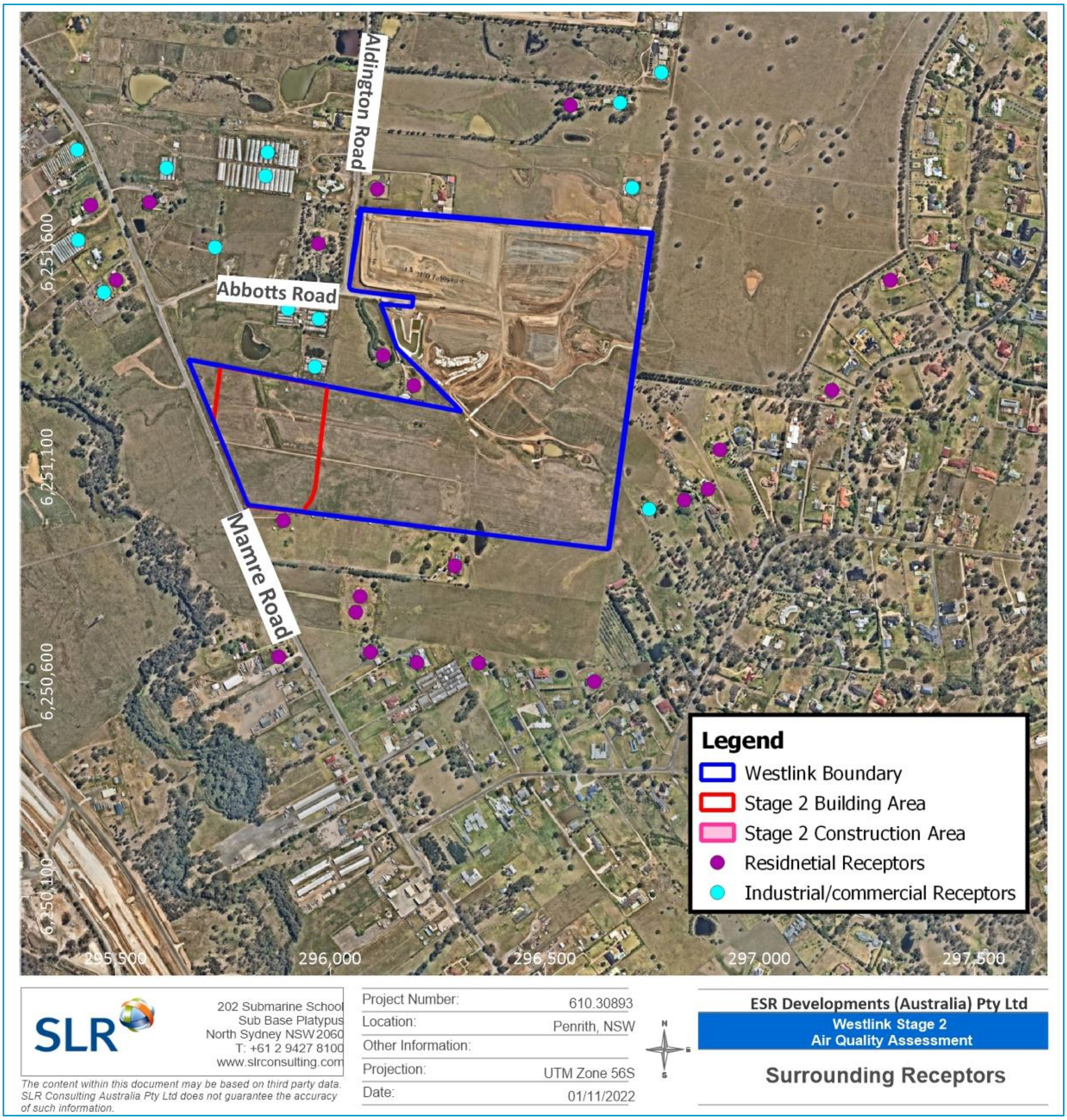
As shown in **Figure 4**, the Site and its adjacent areas to the north, south, and east of are zoned as General Industrial (IN1), the areas southeast of the Site are zoned as Environmental Living (C4), and the areas to the west of the Site are zoned as Infrastructure (SP2).

Figure 4 Surrounding Land Uses



There are several residential receptors located approximately 60 meters (m) to the north, south and east of the Site and the nearest commercial receptors are located approximately 30 m to the north and south of the Site (see **Figure 5**). Individuals in these areas could potentially experience air quality impacts due to the construction works and operational activities at the Site.

Figure 5 Surrounding Receptors

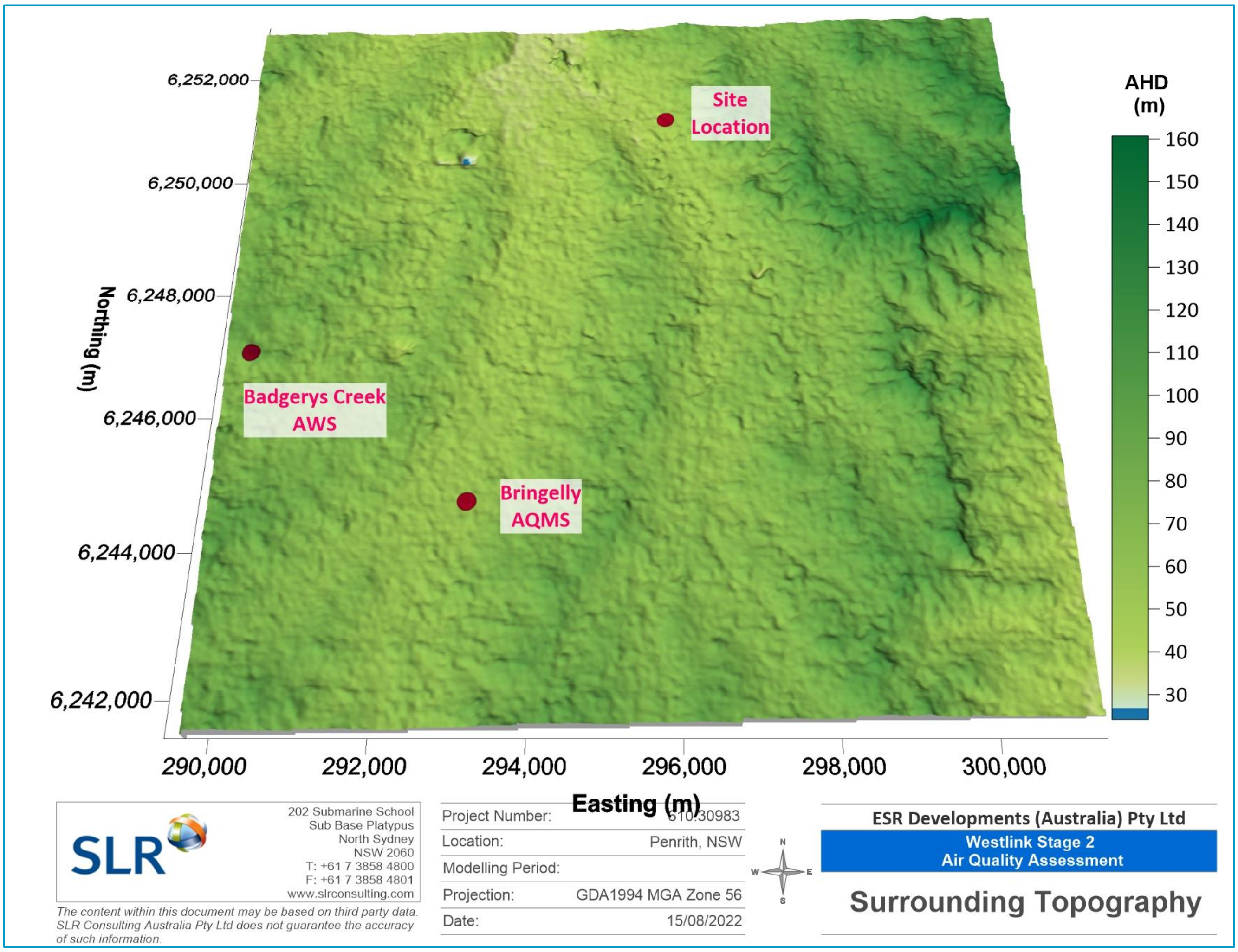


3.2 Topography

Local 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.

The topography of the Site and near surrounds is relatively flat, with an elevation of the approximately 45 m Australian Height Datum (AHD). A three-dimensional representation of the area surrounding the Site is presented in **Figure 6**. The locations of Badgerys Creek automatic weather station (AWS; refer **Section 3.3**) and Bringelly air quality monitoring station (AQMS; refer **Section 5**) are also indicated.

Figure 6 Regional Topography



3.3 Local Meteorological Conditions

Wind Speed and Wind Direction

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

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest station recording wind speed and wind direction data is the Badgerys Creek AWS (Station ID 607108), located approximately 4 km east-southeast of the Site (see **Figure 6**). Considering the relatively flat terrain between the Site and the Badgerys Creek AWS, it is considered reasonable to assume that the wind conditions recorded at the Badgerys Creek AWS are representative of the wind conditions experienced at the Site.

Annual and seasonal wind roses for the past five years, 2017 to 2021, compiled from data recorded by the Badgerys Creek AWS are presented in **Figure 7** and **Figure 8**. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The 'Beaufort Wind Scale' (consistent with terminology used by the BoM) presented in **Table 3** was used to describe the wind speeds experienced at the Site.

Table 3 Beaufort Wind Scale

Beaufort Scale #	Description	m/s	Description on land
0	Calm	0-0.5	Smoke rises vertically
1	Light air	0.5-1.5	Smoke drift indicates wind direction
2-3	Light/gentle breeze	1.5-5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3-8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0-10.8	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.8	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

The average annual wind rose (**Figure 7)** for the years 2017-2021 indicates that winds at Badgerys Creek AWS are predominantly of moderate strength (between 5.5 m/s and 8.0 m/s). Calm wind conditions were predicted to occur 2.6% of the time over the 5-year period reviewed.

The seasonal wind roses (**Figure 8**) indicate that typically:

- In spring and summer, there are winds present from each direction with less frequent winds from the northwestern quadrant. On average, calm winds are experienced 3.1% of the time during spring and 2.7% of the time during summer.
- In autumn, winds predominantly blow from the southwestern quadrant, with the lowest frequency of winds from the northwest. On average, calm winds are experienced 2.7% of the time during autumn.
- In winter, winds predominantly blow from the southwest, with winds from the north also featuring. This season has the lowest frequency of winds from the southeastern quadrant. On average, calm winds are experienced 1.9% of the time during winter.

As identified in **Section 3.1**, the closest sensitive receptors are located to the north, northeast, and south of the Site. Winds from south, southwest and north, which would blow air emissions from the Site towards the closest sensitive receptors, occur approximately 15% of the time.

Figure 7 Annual Wind Roses for Badgerys Creek AWS (2017 to 2021)

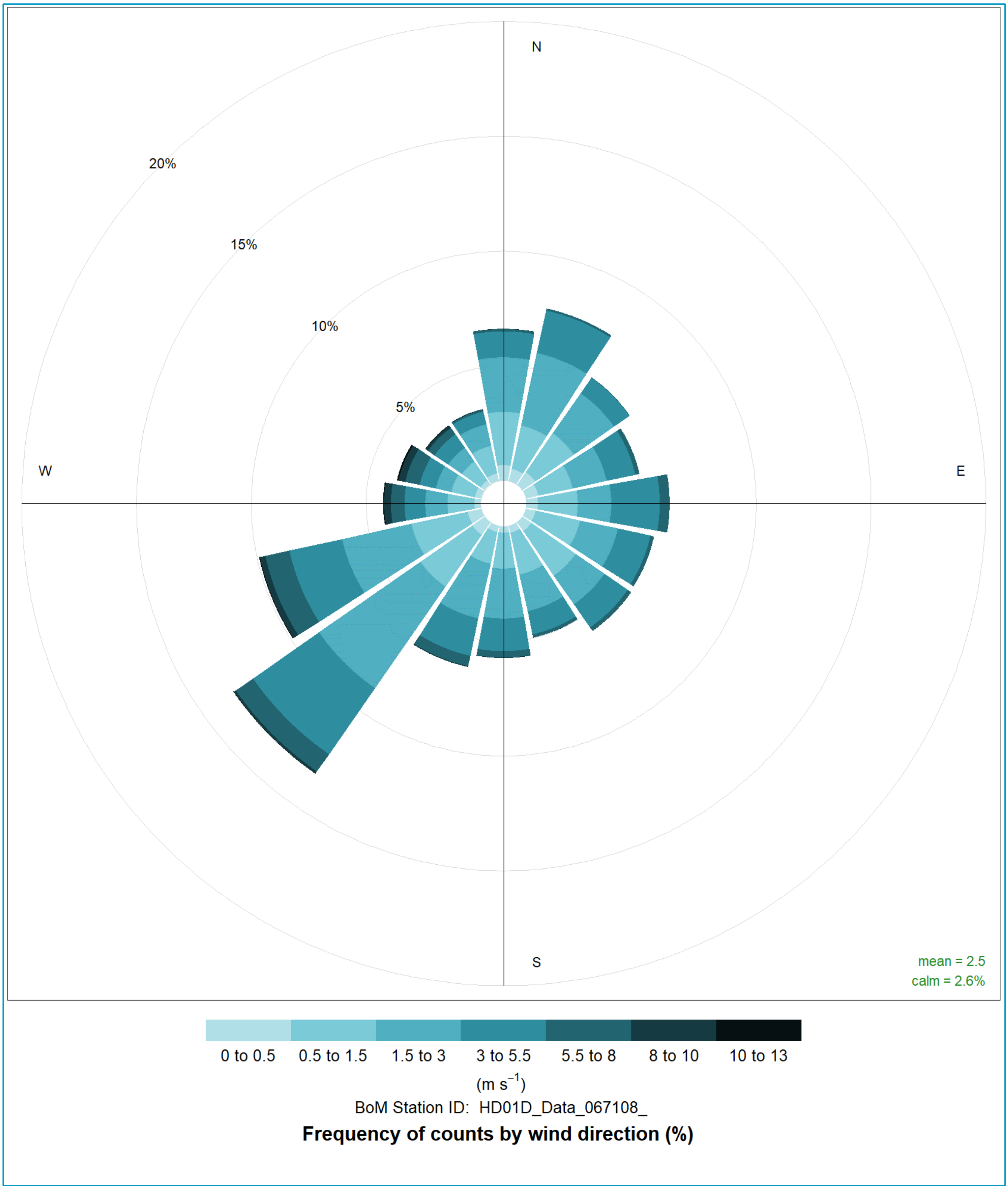
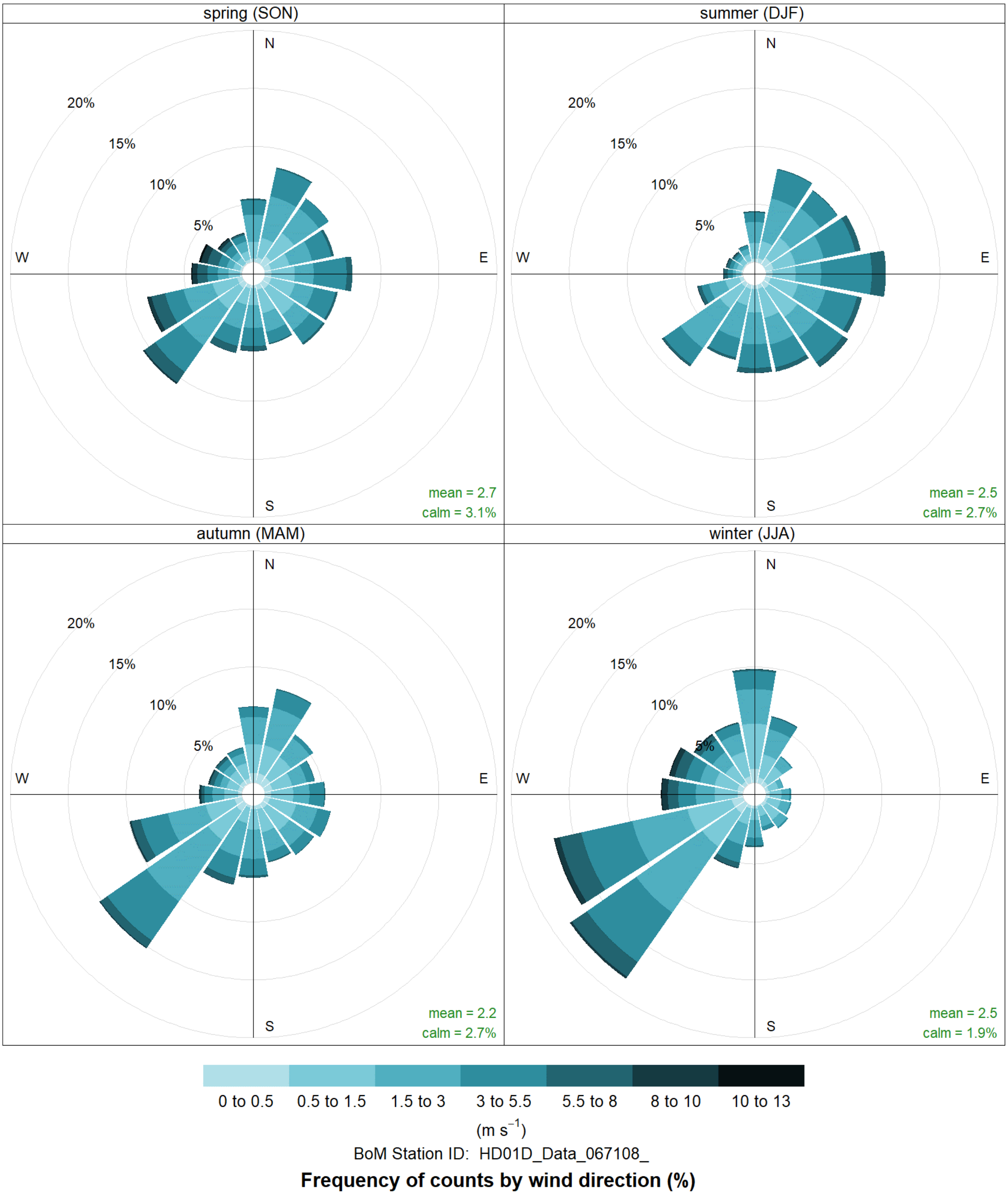
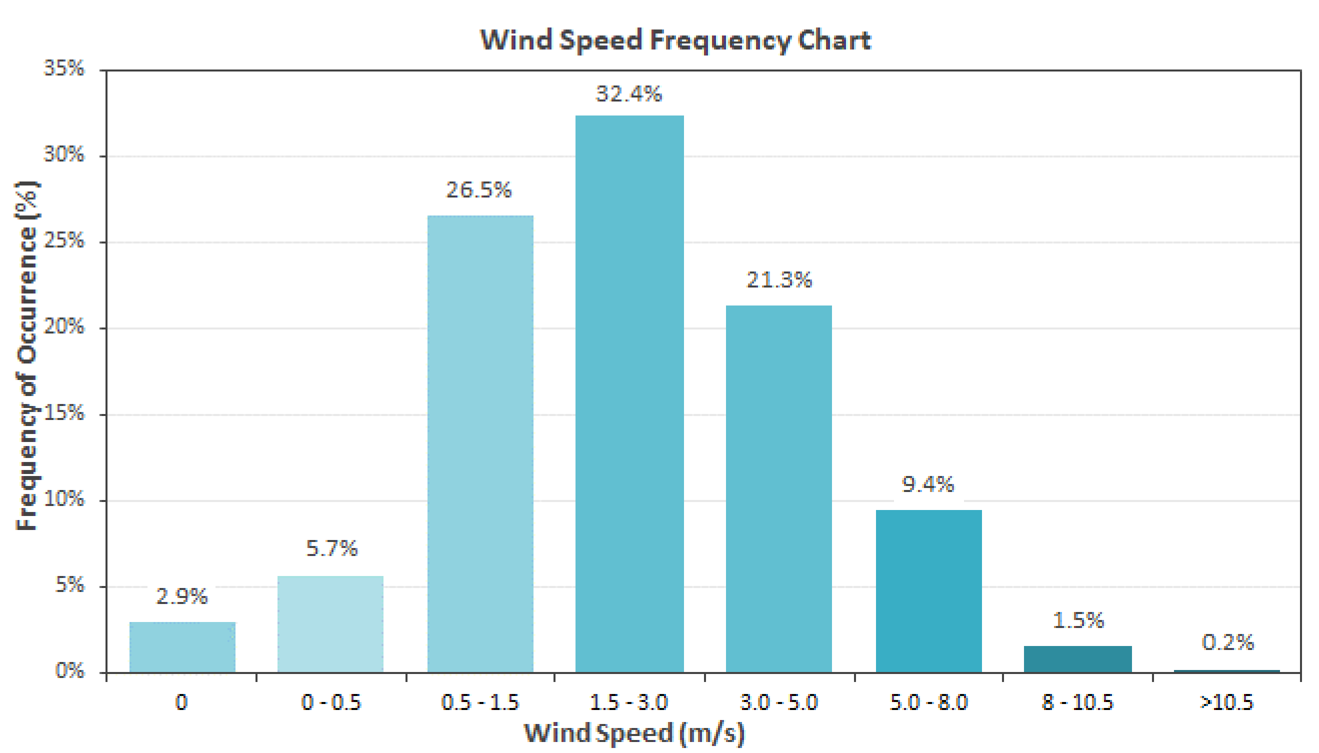


Figure 8 Seasonal Wind Roses for Badgerys Creek AWS (2017 to 2021)



Wind erosion of dust from exposed surfaces is usually initiated when wind speeds exceed the threshold friction velocity for a given surface or material, however, a general rule of thumb is that wind erosion can be expected to occur above 5 m/s (USEPA, 2006). The frequency of wind speeds for the period of 2017-2021 is presented in **Figure 9**. The plot shows that the frequency of wind speeds exceeding 5 m/s for the period 2017-2021 at Badgerys Creek AWS was approximately 11%.

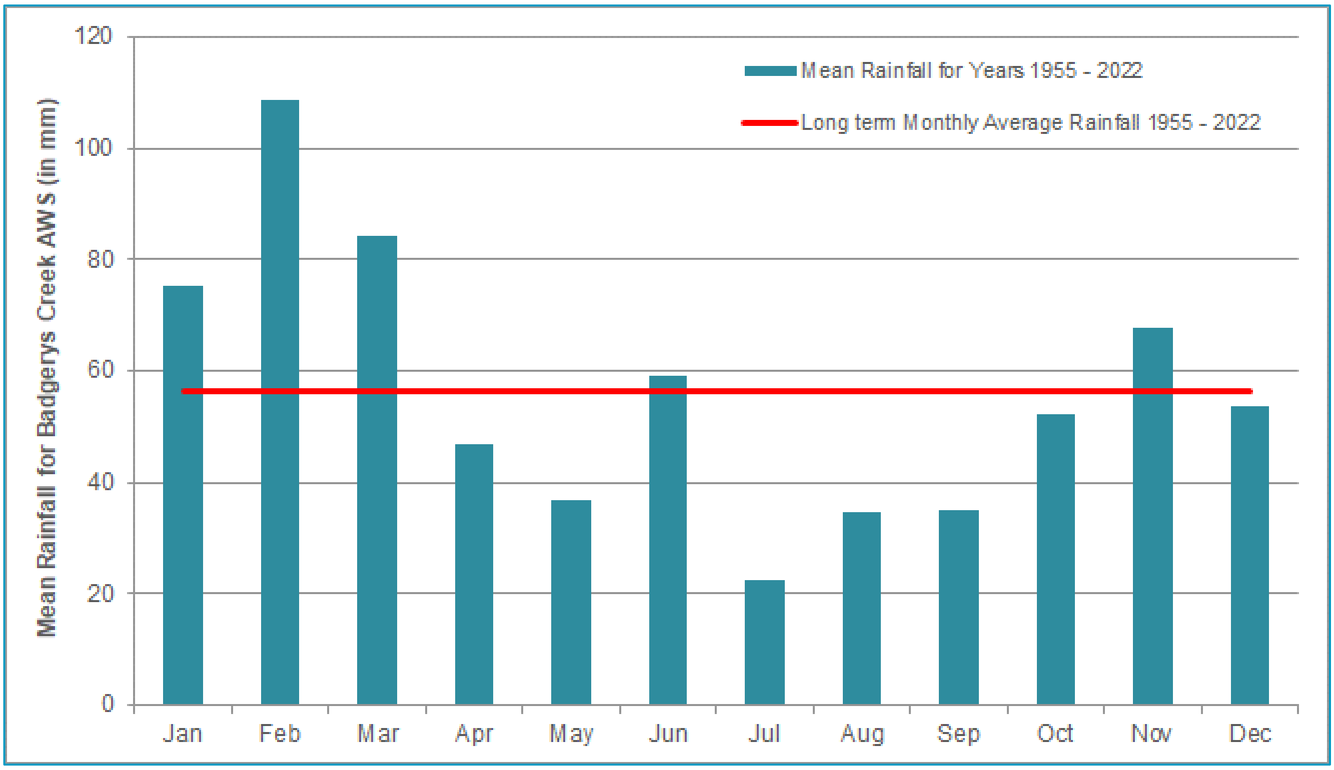
Figure 9 Wind Speed Frequency Chart for Badgerys Creek AWS – 2017-2021



Rainfall

Periods of low or no rainfall have the greatest potential for fugitive dust emissions during construction works. The long-term monthly rainfall averages recorded by the Badgerys Creek AWS rain gauge are shown in **Figure 10**. The plot shows that rainfall is lowest from May to September, with a small peak in June. This rainfall pattern suggests that dust emissions from the construction works at the Site have the greatest potential to impact on nearby sensitive receptors during the mid-autumn to early spring.

Figure 10 Long term Mean Rainfall for Badgerys Creek AWS – 1995 to 2022



4 Air Quality Criteria

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 2.4** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2022) [hereafter 'Approved Methods']. The ground level air quality impact assessment criteria listed in Section 7 of the Approved Methods have been established by NSW EPA to achieve appropriate environmental outcomes and to minimise risks to human health. They have been derived from a range of sources and are the defining ambient air quality criteria for NSW and are considered to be appropriate for use in this assessment.

The impact assessment criteria listed in the Approved Methods for particulate matter and nuisance dust are shown in **Table 4**. A summary of the relevant impact assessment criteria for products of combustion is provided in **Table 5**.

Table 4 NSW EPA Impact Assessment Criteria for Particulate Matter and Nuisance Dust

Pollutant	Averaging Period	Assessment Criteria (µg/m³)
Total Suspended Particulate (TSP)	Annual	90
Particulate Matter (PM_{10})	Annual	50
	24-hour	25
Particulate Matter ($PM_{2.5}$)	Annual	25
	24-hour	8
Deposited Dust	Annual	2 (maximum increase in deposited dust level)
		4 (maximum total deposited dust level)

Table 5 NSW EPA Impact Assessment Criteria for Combustion Gases

Pollutant	Averaging Period	Assessment Criteria
CO	15 minutes	87 ppm
	1 hour	25 ppm
	8 hours	9 ppm
NO_2	1 hour	8 pphm
	Annual	1.5 pphm
SO_2	1 hour	10 pphm [a]
	24 hours	2 pphm

[a] For assessments performed prior to January 2025

5 Background Air Quality

Air quality monitoring is performed by the NSW Department of Planning and Environment (DPE) at a number of monitoring stations across NSW. The closest station with data for the last five years is the Bringelly Air Quality Monitoring Station (AQMS), located approximately 7 km to the southwest of the Site (see **Figure 6**). The following air pollutants are monitored at this station:

- Oxides of nitrogen (NO, NO_2 and NO_x)
- Sulfur dioxide (SO_2)
- Fine particles as $PM_{2.5}$
- Fine particles as PM_{10}

A summary of the monitored pollutant concentrations for the last five years (2017-2021) is presented in **Table 6** and the data are presented graphically in **Figure 11** to **Figure 14**.

Table 6 Summary of Air Quality Monitoring Data at Bringelly AQMS (2017-2021)

Pollutant	PM_{10}		$PM_{2.5}$		NO_2		SO_2
Averaging Period	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual	Maximum 1-hour
Units	µg/m³	µg/m³	µg/m³	µg/m³	pphm	pphm	pphm
2017	83.7 (6)	19.8	55.7 (2)	7.5	3.6	0.5	0.9
2018	92.9 (8)	21.2	55.6 (4)	8.0	3.6	0.6	1.1
2019	134.0 (24)	23.6	178.0 (27)	11.3	3.4	0.5	2.8
2020	241.8 (11)	18.3	78.1 (12)	8.5	3.0	0.3	2.2
2021	69.0 (1)	15.3	57.4 (3)	7.2	2.4	0.3	0.9
Criterion	**50**	**25**	**25**	**8**	**8**	**1.5**	**10**

Note: The numbers in brackets represent number of exceedances of relevant criteria recorded each year

As show in **Table 6**, a number of exceedances of the 24-hour average PM_{10} and $PM_{2.5}$ criteria were recorded by the Bringelly AQMS in all years. A review of the available compliance monitoring reports indicates that these exceedances were primarily due to exceptional events such as bushfires, dust storms or hazard reduction burns. In particular, very elevated PM_{10} and $PM_{2.5}$ concentrations were recorded along the east coast of Australia in late 2019 and early 2020 during the 'Black Summer' bushfire event.

Exceedances of the annual average $PM_{2.5}$ criterion were also recorded for the years 2019 and 2020; which were associated with the Black Summer bushfire event.

Figure 11 Measured Daily Maximum 1-Hour Average NO_2 Concentrations at Bringelly AQMS (2017-2021)

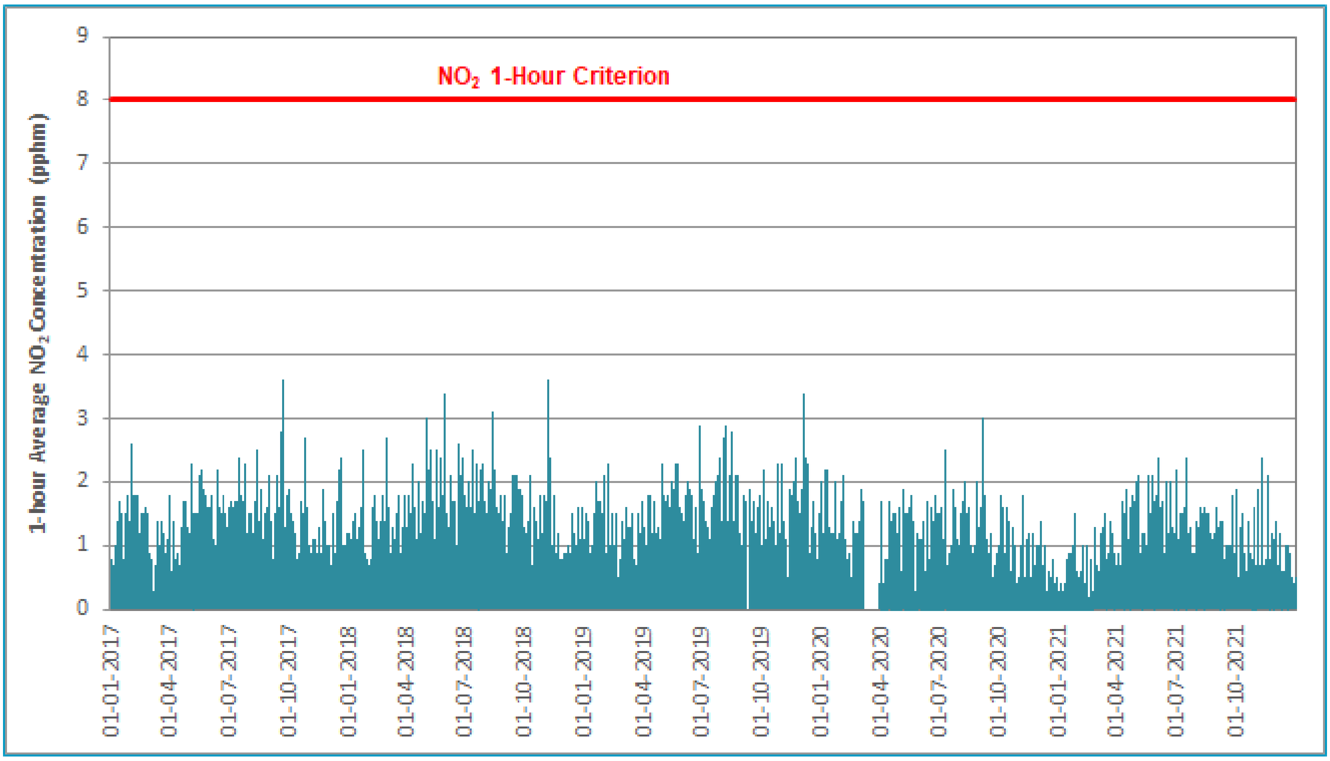


Figure 12 Measured Daily Maximum 1-Hour Average SO_2 Concentrations at Bringelly AQMS (2017-2021)

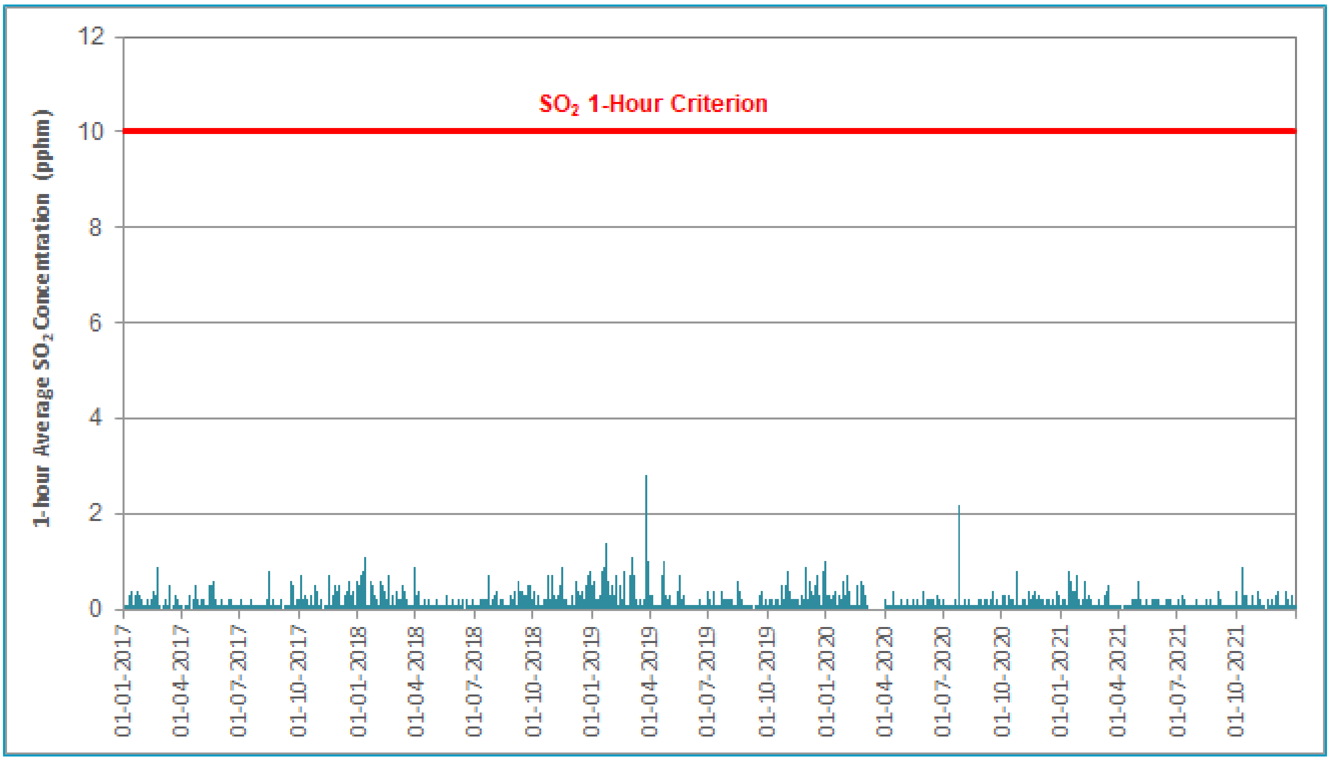


Figure 13 Measured 24-Hour Average PM_{10} Concentrations at Bringelly AQMS (2017-2021)

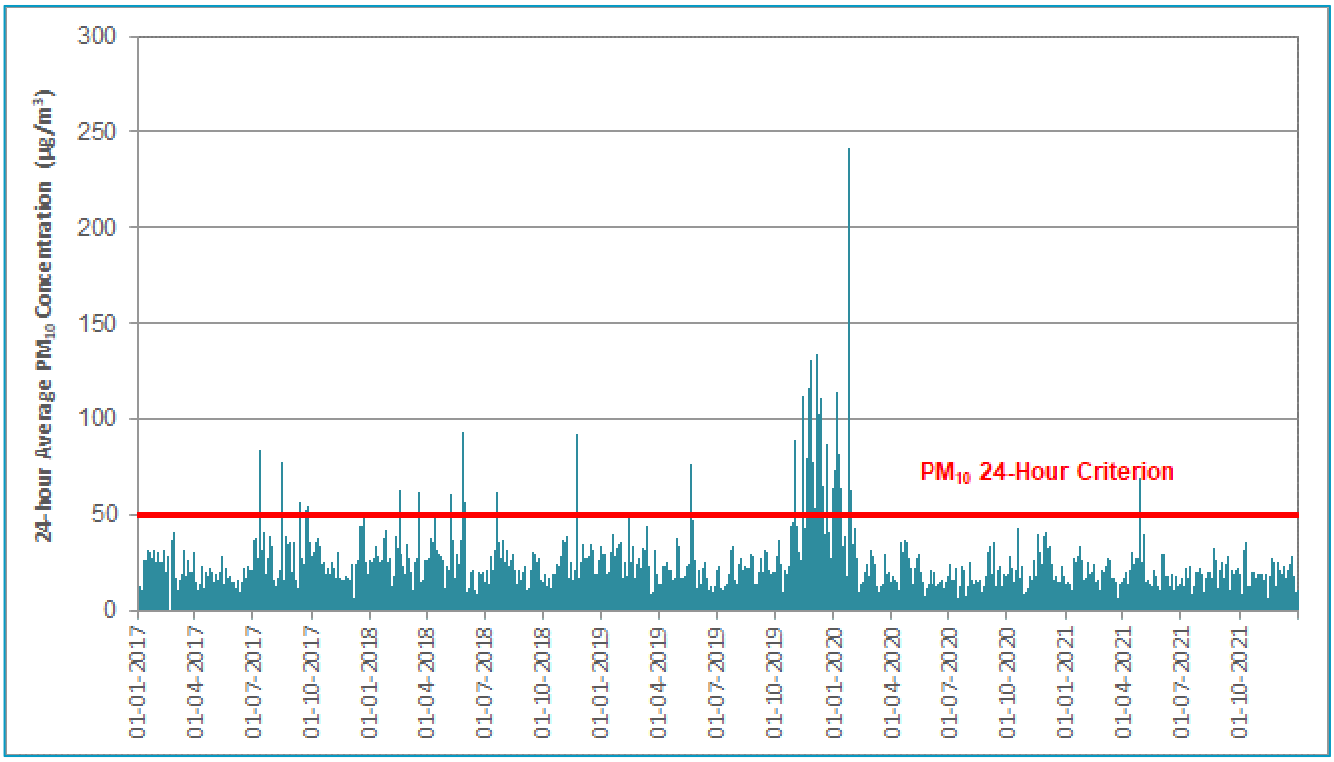
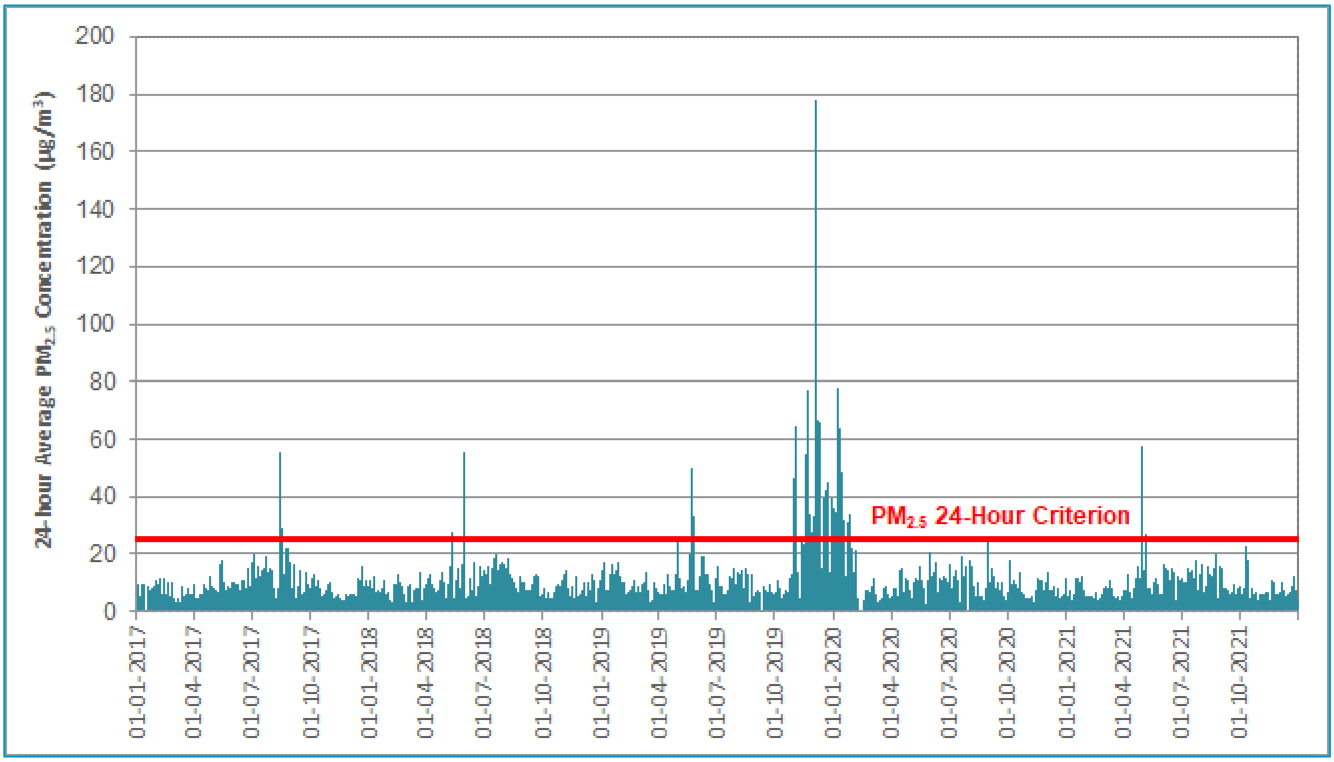


Figure 14 Measured 24-Hour Average $PM_{2.5}$ Concentrations at Bringelly AQMS (2017-2021)



6 Air Quality Assessment

6.1 Assessment of Dust Emissions During Construction

For this assessment, 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], Holman *et al* 2014) has been used to provide a qualitative assessment method (refer to **Appendix A** for full methodology). The IAQM method uses a four-step process for assessing dust impacts from construction activities:

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

6.1.1 Step 1 – Screening Based on Separation Distance

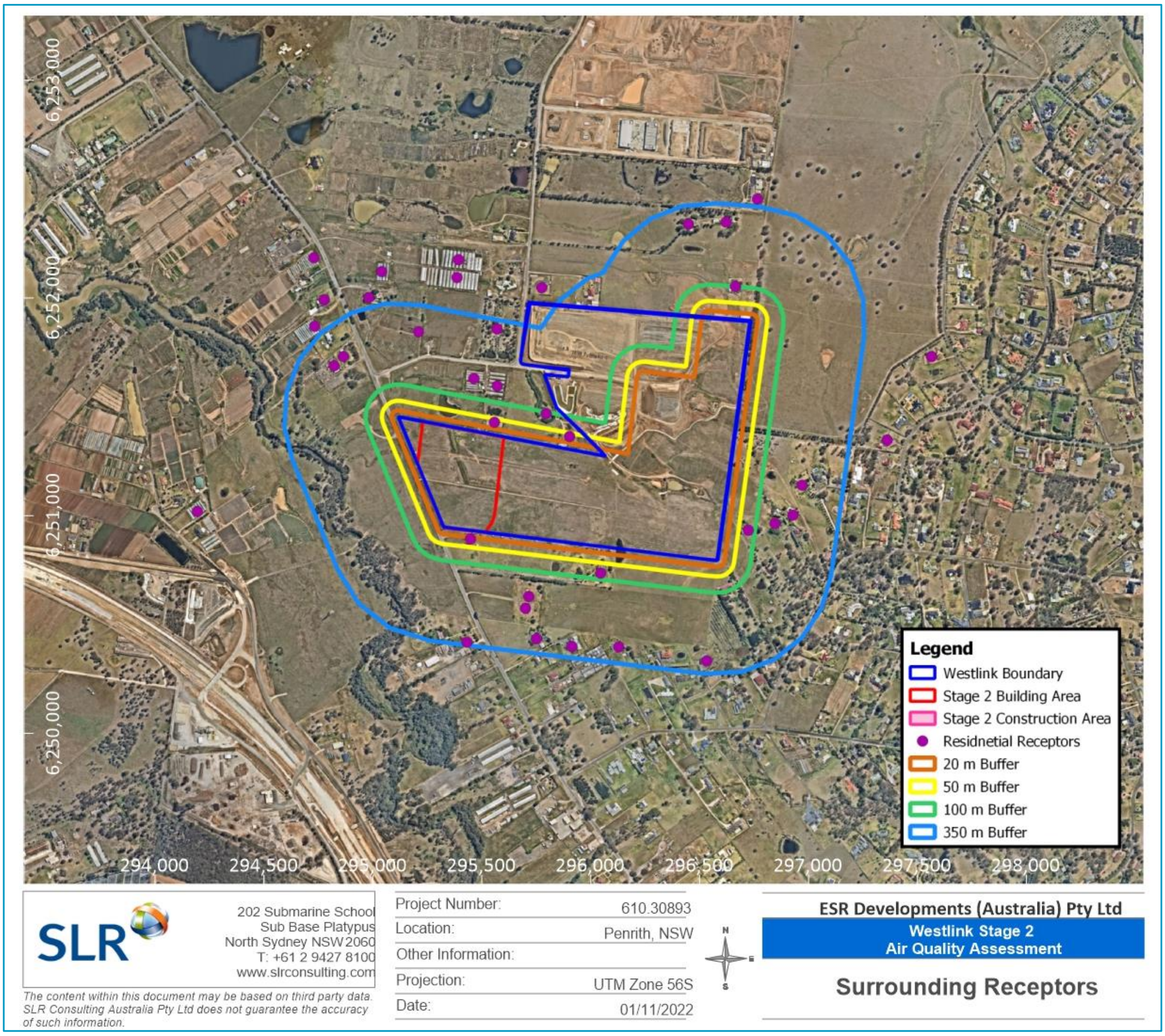
As noted in **Section 3.1**, a number of sensitive receptors are located within 10 m from the nearest Site boundary.

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 a 'human receptor' is located within 350 m of the boundary of the Site, and within 500 m of the Site entrance, further assessment is required. For the purpose of this assessment, the number of sensitive receptors is estimated to be between 1 to 10 within 20 m to 50 m of the Site boundary and 10 to 100 within 100 to 350 m of the Site boundary (see **Figure 15**).

Figure 15 Density of Sensitive Receptors in the Vicinity of the Site



6.1.2 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 7**. No significant demolition activities are proposed as part of the works, hence the risk of dust impacts from demolition activities have not been assessed.

Table 7 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Earthworks	Large	**IAQM Definition:** Total site area greater than 10,000 m^2, potentially dusty soil type (eg 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. **Relevance to this Project:** *Total area of the Site is estimated to be approximately 72,500 m^2.*
Construction	Large	**IAQM Definition:** Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting. **Relevance to this Project:** *The total building area is 41,910 m^2. Considering a height of 16.8 m for the buildings, the estimated total building volume will be 704,000 m^3.*
Trackout	Large	**IAQM Definition:** 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. **Relevance to this Project:** *It is estimated that more than 50 heavy vehicles movements per day will occur during the peak construction period.*

6.1.3 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 are located where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

Sensitivity of an Area

Based on the classifications shown in **Table A2** and **Table A3** in **Appendix A**, the sensitivity of the area to both dust soiling and health effects may be classified as ***medium***. This categorisation has been made taking into account the individual receptor sensitivities derived above, the 5-year mean background PM_{10} concentration of 19.6 µg/m^3 recorded at Bringelly AQMS (see **Section 5**) and the existing number of sensitive receptors present in the vicinity of the Site (ie between 1 to 10 within 20 m).

Risk Assessment

Given the sensitivity of the general area is classified as ‘***medium***’ for dust soiling and for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 7**, the resulting risk of air quality impacts is as presented in **Table 8**.

Table 8 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude			Preliminary Risk		
		Earthworks	Construction	Trackout	Earthworks	Construction	Trackout
Dust Soiling	Medium	Large	Large	Large	Medium	Medium	Medium
Human Health	Medium				Medium	Medium	Medium

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

6.1.4 Step 3 - Mitigation Measures

Mitigation measures targeting potential impacts from earthworks, construction and trackout recommended by the IAQM for a development shown to have a medium risk of adverse impacts are provided in **Table 9** to **Table 11**.

Implementing these measures should reduce the risk of these impacts from ***medium*** to ***low***. These measures are designated as *highly recommended* (H) or *desirable* (D) by the dust IAQM method.

Table 9 Mitigation Measures Specific to Earthworks

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

H = Highly recommended; D = Desirable

Table 10 Mitigation Measures Specific to Construction

Activity	Highly recommended or Desirable
Avoid scabbling (roughening of concrete surfaces) if possible.	**D**
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	H
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	D

H = Highly recommended; D = Desirable

Table 11 Mitigation Measures Specific to Trackout

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

H = Highly recommended; D = Desirable

Appendix B lists the additional general mitigation measures designated by the IAQM for a development shown to have a medium risk of adverse impacts.

6.1.5 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. These are termed 'residual impacts'. The results of the reappraisal are presented below in **Table 12**.

Table 12 Residual Risk of Air Quality Impacts from Construction

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

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

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

6.2 Assessment of Impacts from Operations

As discussed in **Section 2.3.2**, air quality issues associated with the proposed warehouse operations predominantly relate to emissions of products of combustion and particulate matter from trucks and other vehicles accessing and idling at the Site.

These emissions will be of a similar nature to existing emissions from traffic on Mamre Road, Aldington Road, Abbotts Road, and other local roads. The scale and magnitude of vehicle emissions associated with the Project are significantly lower compared to the annual average daily traffic on the surrounding road network (Refer **Section 2.3.2**). To assess the risk of air emissions from the Site impacting on surrounding sensitive receptors during the operational phase, the following "risk based" approach (informed by quantitative TRAQ modelling) has been adopted.

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, neutral or beneficial environment?

  The nature of impact is anticipated to be ***adverse*** to the environment.

- **Receptor Sensitivity:** how sensitive is the receiving environment to the anticipated impacts?

  The nearest residential receptors to the Site are located approximately 60 m to the north, south and east of the Site and the nearest commercial receptors are located approximately 30 m to the north and south of the Site (see **Section 3.1**). In terms of the methodology in **Appendix C**, the sensitivity of the industrial/commercial receptors is considered to be ***medium***, while the sensitivity of the residential receptors is considered to be ***high***.

- **Magnitude:** *what is the anticipated scale of the impact?*

  In order to obtain an indication of potential offsite emissions from the Project, a first-pass screening of the potential air quality impacts associated with the Project-related operational traffic was completed using the Tool for Roadside Air Quality (TRAQ) assessment tool developed by Roads and Maritime Services (RMS, now TfNSW) (refer **Appendix D**). The screening was completed based a conservative scenario considering all traffic travelling at a low speed of 10 km/hr.

  The results indicate that:

  - For sensitive residential receptors impacted by the highest amount of Project generated traffic (those located on Abbotts Road), the emissions from the Project would contribute less than 1% of the relevant criteria for all pollutants modelled. Therefore, the magnitude of the impact from the Project is considered to be ***negligible*** at the nearest residential areas.
  - For the surrounding industrial/commercial receptors, the emissions from the Project would contribute 3% or less (ranging from less than 1% to 3%) of the relevant criteria at 10 m from the kerb. Considering the relatively small incremental increase in ground level concentration of pollutants modelled and the conservative assumptions made for the TRAQ modelling, the magnitude of the impact from the Project is considered to be ***negligible*** at the nearest industrial/commercial areas.

Given the above considerations, the potential impact of the Project on the surrounding receptors is concluded to be ***neutral*** (see **Table 13**).

Table 13 Impact Significance for Residential Receptors

Magnitude / Sensitivity	Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
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

7 Conclusions

SLR was commissioned by ESR to undertake an air quality impact assessment to inform a SSD application 46983729 for Westlink Stage 2. It was concluded by this assessment that:

- Off-site impacts associated with dust deposition and suspended particulate during the construction phase (including remediation) are anticipated to be low. A range of mitigation measures have been recommended for inclusion in the overarching CEMP.
- Based on the anticipated warehousing activities (storage and distribution) at the Site, the potential for offsite air impacts from the operations is concluded to be neutral.

In summary, air quality at the surrounding receptors should not be considered as a constraint during the construction and operation of the Project.

8 References

Holmen. (2014). IAQM Guidance on the assessment of dust from demolition and construction, http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf. *Institute of Air Quality Management, London*.

NEPM. (2021). *National Environment Protection Council, Variation to the National Environment Protection (Ambient Air Quality) Measure: Impact Statement.*

NSW EPA. (2022, August). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.*

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Appendix A

CONSTRUCTION PHASE RISK 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 track-out (the movement of site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, 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 m^3, 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 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***Small***: Total building volume <20,000 m^3, 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 m^2, potentially dusty soil type (eg 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 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 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 m^2, soil type with large grain size (eg 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 m^3, piling, on site concrete batching; sandblasting.

- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber).

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

- ***Large***: More than 50 heavy vehicle 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 PM_{10}, 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) is 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.
	Examples: Dwellings, museums, medium and long term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}.*	*Examples: Public footpaths, playing fields, parks and shopping street.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;

- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place;
- Any conclusions drawn from local topography;
- The duration of the potential impact (as a receptor may 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 PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (i.e. an annual average of 25 µg/m^3 for PM_{10}) the IAQM method has been modified slightly.

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact; 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/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m³	>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** (track-out) 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 Track-out 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

GENERAL AIR QUALITY MITIGATION MEASURES FOR CONSTRUCTION SITES

Table B-1 lists the relevant general mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the dust IAQM method for a development shown to have a high 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 as part of the Construction Environmental Management Plan (CEMP).

Table B -1 Site-Specific Management Measures Recommended by the IAQM

	Activity	Highly recommended or Desirable
1	Display the name and contact details of person(s) account-able for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H
2	Display the head or regional office contact information.	H
3	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.	D
Site Management		
4	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
5	Make the complaints log available to the local authority when asked.	H
6	Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the logbook.	H
Monitoring		
7	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local 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, with cleaning to be provided if necessary.	D
8	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
9	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
Preparing and Maintaining the Site		
10	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
11	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	H
12	Fully enclose site or specific operations where there is a high potential for dust produc-tion and the site is actives for an extensive period	D
13	Avoid site runoff of water or mud.	H

	Activity	Highly recommended or Desirable
14	Keep site fencing, barriers and scaffolding clean using wet methods.	D
15	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	D
16	Cover, seed, or fence stockpiles to prevent wind whipping.	D
Operating Vehicle/Machinery and Sustainable Travel		
17	Ensure all vehicles switch off engines when stationary - no idling vehicles.	H
18	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H
19	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	D
Operations		
20	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
21	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H
22	Use enclosed chutes and conveyors and covered skips.	H
23	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H
24	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	D
Waste Management		
25	Avoid bonfires and burning of waste materials.	H

Appendix C

OPERATIONAL PHASE RISK ASSESSMENT METHODOLOGY

Nature of Impact

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

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

Receptor Sensitivity

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

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

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

Table C-1 Methodology for Assessing Sensitivity of a Receptor

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

Magnitude

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. Magnitude may be described quantitatively or qualitatively. Where an impact is defined by qualitative assessment, suitable justification is provided in the text.

Table C-2 Magnitude of Impacts

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

Significance

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

Table C-3 Impact Significance Matrix

Magnitude / Sensitivity		[Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by TableB1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Appendix D

TRAQ ASSESSMENT

As discussed in Section **2.3.2** the main potential operational air emissions have been identified as vehicle emissions from trucks etc accessing and idling at the Site.

Pollutants Assessed

TRAQ provides predictions of CO, NO_2 and PM_{10} concentrations at various distances from the road kerb. It does not provide predictions of the other traffic-related pollutants, namely $PM_{2.5}$, SO_2 and VOCs. Given the low level of SO_2 emissions from vehicles and the low ambient concentrations recorded in the region (see Section 6.0), it is reasonable to assume that SO_2 emissions from vehicles accessing the Site during operations are unlikely to result in any exceedances of the relevant criteria at locations beyond the road kerb.

SLR's experience in modelling VOC emissions from roads has also shown that kerbside concentration of VOCs is typically well below the relevant air quality guidelines.

Given the above, SO_2 and VOC traffic emissions have not been considered further. $PM_{2.5}$ emissions, however, have been assessed based on the PM_{10} concentrations given by TRAQ using a conservative $PM_{2.5}/PM_{10}$ ratio estimated from COPERT Australia derived emission factors.

Dispersion Model Configuration

TRAQ requires a number of inputs to describe the incremental impacts from the Project, including:

- Peak hour traffic volumes and vehicle speeds
- Traffic mix (heavy vehicle percentage)
- Road type, number of lanes and gradient
- Year of assessment (vehicle fleet)
- Location land use
- Season

The sources of the required data and assumptions made for the purpose of this assessment are summarised in **Table D-1**.

Table D–1 TRAQ Input Data

Parameter	Value	Description
Road Grade	0	Average gradient estimated from the modelled road section
Peak hour speeds	10 km/hr	Conservative assumption
Daily traffic volumes	420 vpd	The traffic volume was obtained from the Transport Report (refer **Section 2.3.2**).
Peak hour percentage of daily traffic	19%	Calculated based on data provided in Table 7 of the Transport Report
Traffic mix	The TRAQ default traffic mix was adjusted to contain 19% heavy vehicles as listed in **Table D-2**.	Calculated based on data provided in Table 7 of the Transport Report
Road type and number of lanes	Commercial arterial Road, one lane.	-
Year of assessment (vehicle fleet)	2026 vehicle fleet	As per TRAQ default options
Location land use	Rural	-
Season	Worst-case	TRAQ default worst-case season
Cold start emissions	Included	-

The TRAQ default traffic mix for commercial arterial roads has a combined total of 10.8 per cent heavy vehicles. As shown in **Table D-2**, the heavy vehicle proportion assumed in the modelling was assumed to be 19% based on the data provided in the Transport Report . To do this, the default traffic mix was adjusted as shown in **Table D-2**. The proportions of individual heavy and light vehicle classes within each group remained the same but the overall split between the two groups was modified to have a value of 19 per cent heavy vehicles.

Table D-2 Adopted Traffic Mix Used in TRAQ for the Project

Vehicle Category		TRAQ Default Traffic Mix (%)*	Traffic Mix Used in this Assessment (%)
CP	Petrol passenger vehicles	72.8	66.1
CD	Diesel passenger vehicles	2.1	1.9
LDCP	Light-duty commercial petrol vehicles less than 3.5 tonnes	10.2	9.3
LDCD	Light-duty commercial diesel vehicles less than 3.5 tonnes	3.5	3.2
MC	Motorcycles	0.6	0.5
Percentage Light Vehicles		***89.2%***	***81%***
HDCP	Heavy-duty commercial petrol vehicles greater than 3.5	0.2	0.4
RT	Rigid trucks, 3.5-25 tonnes, diesel only	6.5	11.4

Vehicle Category		TRAQ Default Traffic Mix (%)*	Traffic Mix Used in this Assessment (%)
AT	Articulated trucks greater than 25 tonnes, diesel only	3.6	6.3
BusD	Heavy public transport buses, diesel only	0.5	0.9
Percentage Heavy Vehicles		***10.8%***	***19%***

Default TRAQ traffic mix for 'Arterial' road type

The TRAQ screening tool does not include emission factors for $PM_{2.5}$. For the purposes of this assessment therefore, an estimated $PM_{2.5}/PM_{10}$ ratio was derived from the COPERT Australia emission factor database tool (COPERT). Vehicle speeds of 10 km/hr and 65 km/hr were modelled using COPERT to derive PM_{10} and $PM_{2.5}$ emission factors for the 2010 NSW vehicle fleet. The $PM_{2.5}/PM_{10}$ ratio for each vehicle speed scenario was estimated and a ratio of 85% (calculated based on the lower 10 km/hr vehicle speeds, which was worst-case) was adopted as a conservative measure (accounts for both exhaust and non-exhaust emissions). This ratio was applied to the PM_{10} concentrations predicted by TRAQ to derive estimated $PM_{2.5}$ concentrations. It is noted that the average ambient $PM_{2.5}$ and PM_{10} concentration ratio recorded by the Bringelly AQMS is 43%.

Modelling Results

The nearest residential receptors are located at various distances from the kerbside of the three surrounding roads (i.e., Mamre Road, Abbotts Road, and Aldington Road) ranging from 45 m to 120 m. The residential receptors impacted by the greatest number of vehicles (420 vpd) are located on Abbotts Road, the nearest of which is located 100 m from the kerbside. Therefore, the predicted concentrations at 75 m from the road are considered as the worst case potential impacts from the Project on residential receptors. It is noted that not all 420 vehicles will be accessing the site from the same direction/road. Therefore, residential receptors located along Mamre Road and Aldington Road would not be impacted by emissions from 420 Project generated vehicles per day.

Given that the closest industrial/commercial receptor is located 20 m from the kerbside of all three roads, the predicted concentrations at 10 m from the road are considered as the potential worst case impacts from the Project on the industrial/commercial receptors

Results are summarised in **Table D-3** for all pollutants and averaging periods assessed. As shown in the table, the incremental predicted concentrations due to the Project are negligible and none of the predicted concentrations exceed the relevant criteria. Given that TRAQ is a highly conservative screening model, which overestimates actual impacts it can be concluded that the Project would not result in any significant increase in cumulative air quality impacts at the nearest sensitive receptors, and air quality is not considered to be a constraint for the Project.

Table D-3 TRAQ Model Results

Pollutant and Averaging Period	Units	Incremental Impact		Criteria
		Residential Receptors	Industrial Receptors	
Maximum 1-hour CO concentrations	mg/m³	<0.1 (0%)	0.1 (0%)	**30**
Maximum 8-hour CO concentrations	mg/m³	<0.1 (0%)	<0.1 (0%)	**10**
Maximum 1-hour NO_2 concentrations	µg/m³	1.0 (1%)	2.3 (1%)	**164**
Annual NO_2 concentrations	µg/m³	0.2 (1%)	0.5 (2%)	**31**
Maximum 24-hour PM_{10} concentrations	µg/m³	0.2 (0%)	0.6 (1%)	**50**
Annual PM_{10} concentrations	µg/m³	0.1 (0%)	0.3 (1%)	**25**
Maximum 24-hour $PM_{2.5}$ concentrations	µg/m³	0.2 (1%)	0.5 (2%)	**25**
Annual $PM_{2.5}$ concentrations	µg/m³	<0.1 (0%)	0.2 (3%)	**8**

Note: the numbers in brackets show the incremental impact as a percentage of the relevant criteria.

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