BRINGELLY ROAD BUSINESS HUB - LOT 4

Air Quality Impact Assessment

Prepared for:

ESR Australia
Level 29, 20 Bond Street
Sydney 2000 NSW

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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 ESR Australia (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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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.17734-R12-v1.0	14 August 2020	D Dsouza, V Marwaha	J Cox	V Marwaha

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by ESR Australia (ESR), to prepare an Air Quality Impact Assessment (AQIA) for the construction and operation of a warehouse to be located at Lot 4 (the Development Site) within the Bringelly Road Business Hub.

This report has been prepared to inform a Development Application (DA) for the construction and operation of a light industrial warehouse facility for storage and distribution of materials, including the following:

- Bulk delivery and storage of materials;
- Dispatch and distribution; and
- Ancillary office administration.

This AQIA has been prepared by SLR to determine potential air quality impacts associated with the proposed development due to:

- The construction of the Development Site; and
- Potential impacts of air emissions from the development, in the event that the development has the potential to emit air pollutants during operations.

This document has been prepared in consideration of the Planning Secretary's Environmental Assessment Requirements (SEARs) issued for the proposal (SSD - 8586218) issued on 11 August 2020. **Table 1** below summaries all key issues relevant to this report and how they have been addressed in this report.

Table 1 Secretary's Environmental Assessment Requirements (SEARs) – Air Quality

SEAR	Section
A description of all potential sources of odour and emissions during the construction and operational phases of the development.	**Section 2.5**
An assessment of the air quality impacts at receivers during construction and operation of the development, in accordance with the relevant Environment Protection Authority guidelines	**Section 6** (Construction) **Section 7** (Operation)
Details of any mitigation, management and monitoring measures required to prevent and/ or minimise emissions.	**Section 6.2.4** (Mitigation Measures)

2 Project Overview

2.1 Regional Setting

The proposed development will be constructed on Lot 4 of the Bringelly Road Business Hub. The local setting of the Development Site is shown in **Figure 1**. **Figure 1** also shows the neighbouring plot to the east of the business hub which consists of two existing residential buildings approximately 220 m and 270 m from the Development Site boundary and residential areas located to the northeast of the Development Site, approximately 140 m from the Development Site boundary. The indicative layout of the Development Site is shown in **Figure 2**.

Figure 1 Satellite Image of the Development Site

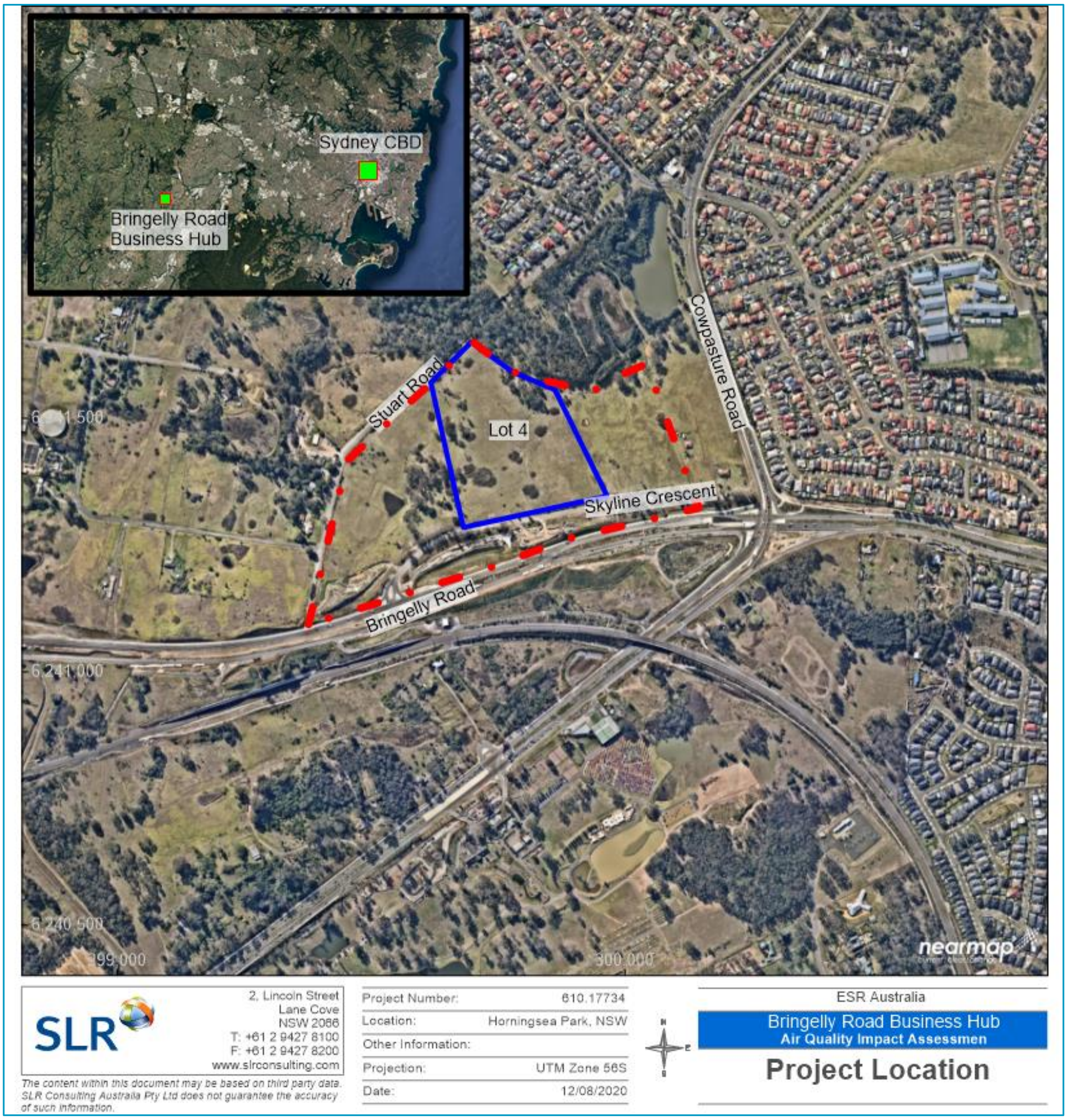
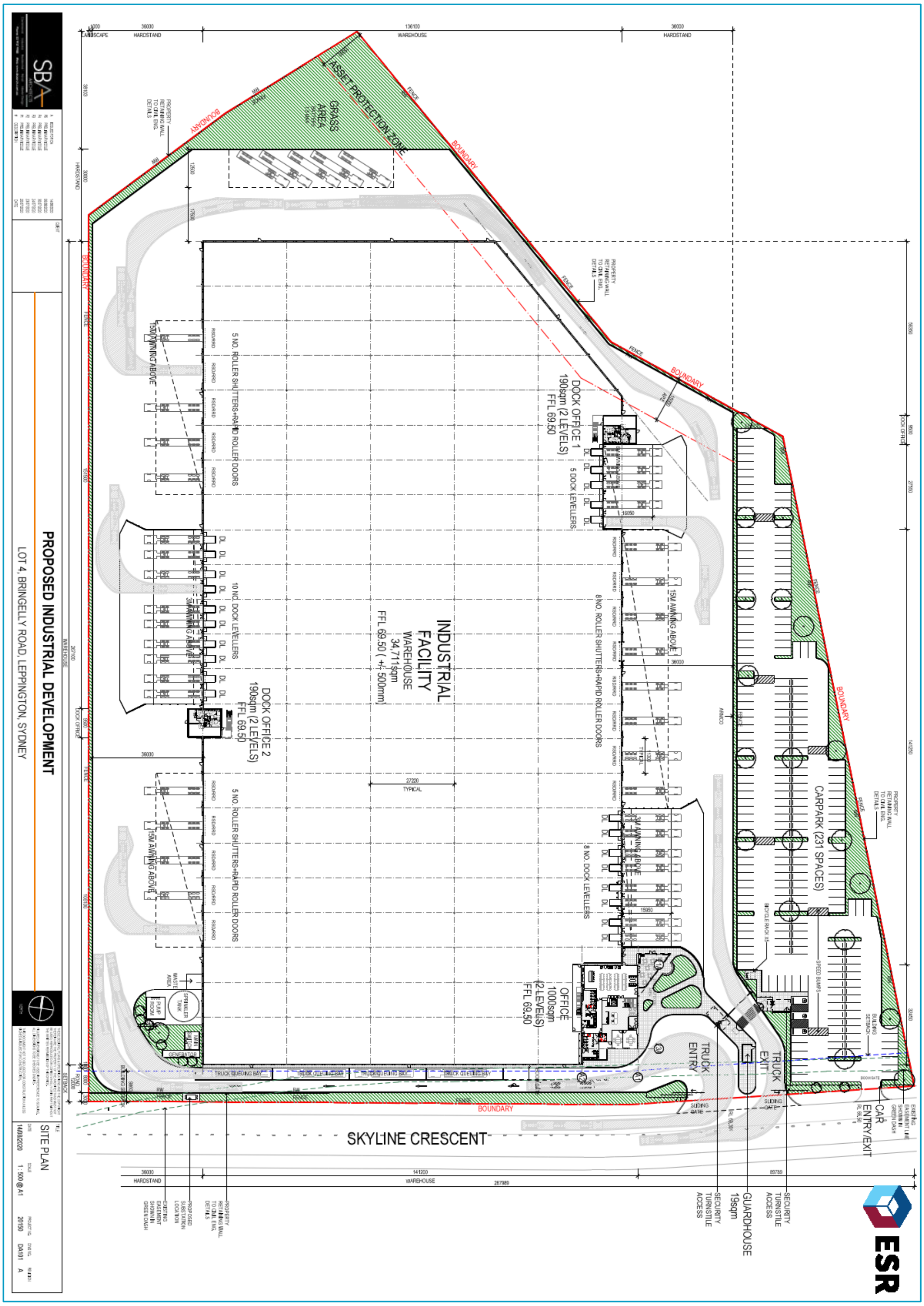


Figure 2 Indicative Site Layout of the Development Site



Source: Site Plan, drawing # DA101, Revision A, created: 14/08.2020.

2.2 Construction Activities

This report includes an assessment of the potential air quality impacts due to the construction works at the Development Site (see **Section 6**) which includes the following activities:

- Removal of existing vegetation, including some trees (approved & completed under SSD 6324);
- Earthworks across the Lot 4 (~69,740 m^2) (Approved under SSD 6324);
- Building works for the warehouse facility with ancillary office space (approximately 36,064 m^2); and
- Structure works for approximately 230 car parking spaces.

The construction works are anticipated to take between eight and nine months. The proposed working hours for the construction period are 7:00am to 6:00pm, Monday to Friday, between 8:00am to 1:00pm on Saturdays, and no work to be conducted on Sundays or public holidays.

It is noted that removal of vegetation and earthworks for the overall Bringelly Road Business Hub are already approved under a separate application SSD 6324, therefore the earthworks are not assessed within this application and not considered any further in this report.

2.3 Operational Activities

Operations at the Development Site will include the storage and distribution of materials to the Greater Sydney market and will include:

- Bulk delivery and storage of materials;
- Temperature control for warehousing facilities;
- Dispatch and distribution; and
- Ancillary office administration.

Warehouse operating hours would be 24 hours per day, seven days per week. Office operating and truck delivery hours would be expected to be between 8:00 am – 5.30 pm Monday to Friday.

A total of 227 truck movements per day are expected as part of the operations, in addition to mechanical plant and forklift (diesel) use for the loading/unloading activities.

The tenants at the Development Site have not been decided as yet, however onsite activities would be comparable to those expected at a warehouse facility. These include storage, material handling and transportation of material. Additionally, temperature control for the warehousing facilities is also expected to be implemented at the Development site. A total of 14 Fusion heating, ventilation, and air conditioning (HVAC) systems are to be installed on site to regulate temperatures between 1.5°C and 22.5°C during summer and -1.5˚C and 17.0°C during winter. In addition, a backup generator is also expected to be installed at the Development Site to be used in emergencies.

2.4 Sensitive Receptors

A number of residential properties have been identified as sensitive receptor locations in the area surrounding the Development Site, with the closest residences located approximately 140 m to the northeast, 220 m and 270 m to the east from the closest Development Site boundary for Lot 4. The locations of these closest identified sensitive receptors are shown in **Figure 3**. It is noted that the residence to the east appears to be in an abandoned condition, but has been included for completeness.

The impact of air emissions on nearby sensitive receivers is dependent on the prevailing meteorological conditions (primarily wind speed and direction), but also the distance from the source to the receiver, and any mitigation between the source and receiver. Such mitigation might be in the form of barriers or vegetation, that may act as a physical obstacle or result in changes to airflow, which may help in reducing air quality impacts.

Figure 3 Location of the Closest Identified Sensitive Receptors

2.5 Identification of Potential Air Emission Sources

As outlined in **Section 1**, the scope of this AQIA covers potential air quality impacts on surrounding sensitive receptors associated with the construction and operation of the proposed development.

During the construction works, there is potential for fugitive dust emissions to be generated which could give rise to nuisance and/or health impacts for the surrounding residential areas if the impacts are inadequately managed. These potential impacts have been assessed in **Section 6**. Where diesel-powered mobile machinery and vehicles are being used, localised elevations in ambient concentrations of combustion-related pollutants would also be anticipated, but fugitive dust emissions generally have the greatest potential to give rise to downwind air quality impacts at construction sites. The impacts of combustion emissions have therefore not been considered further.

During the operational phase, the main source of air emissions would be emissions of wheel generated dust and products of combustion associated with the trucks and other vehicles entering and leaving the site, or idling at the site during loading/unloading operations. No significant sources of air emissions have been identified in the warehouse, with no significant emissions of dust to atmosphere anticipated from the warehousing operations.

The 14 units of Fusion HVAC systems to be installed on the roof of the warehouse are not expected to release any significant air emissions from their operations that could result in potential air quality impacts at the neighbouring sensitive receptors. In addition, the backup diesel generator is expected to be used roughly once per year only in case of emergencies. Thus, any air emissions arising from the use of the backup generator is negligible and hence has not been considered further in this assessment.

3 Legislation, Regulation and Guidance

3.1 Pollutants of Concern

As identified in **Section 2.5**, the key air pollutants of interest are considered to be:

- Nuisance dust from construction at the Development Site; and
- Wheel generated dust and products of combustion associated with the trucks and other vehicles entering and leaving the site, or idling at the site during loading/unloading operations.

The following sections outline the potential health and amenity issues associated with the above pollutants of concern, while **Section 3.2** identifies the relevant air quality assessment criteria.

3.1.1 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 termed total suspended particulates (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.

3.1.2 Products of Combustion

Emissions associated with road traffic and the combustion of fossil fuels (diesel, petrol, 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 also 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 and currently ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria. Hence, SO_2 has not been considered further in this assessment.

3.2 Air Quality Criteria

3.2.1 Particulate Matter and Products of Combustion

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 3.1** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2017) [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.

A summary of the relevant impact assessment criteria for particulate matter and products of combustion is provided in **Table 2**.

Table 2 NSW EPA Goals for Particulate Matter and Combustion Gases

Pollutant	Averaging Period	Concentration	
CO	15 minutes	87 ppm	100 mg/m^3
	1 hour	25 ppm	30 mg/m^3
	8 hours	9 ppm	10 mg/m^3
NO_2	1 hour	12 pphm	246 µg/m^3
	Annual	3 pphm	62 µg/m^3
PM_{10}	24 Hours Annual	- -	50 µg/m^3 30 µg/m^3
$PM_{2.5}$	24 Hours Annual	- -	25 µg/m^3 8 µg/m^3

Source: EPA 2017

3.3 State Environmental Planning Policy (Western Sydney Parklands) 2009

This policy aims to put in place planning controls in to enable the Western Sydney Parklands Trust to develop the Western Parklands into a multi-use urban parkland for the region of western Sydney by:

a. allowing for a diverse range of recreational, entertainment and tourist facilities in the Western Parklands,

b. allowing for a range of commercial, retail, infrastructure and other uses consistent with the Metropolitan Strategy, which will deliver beneficial social and economic outcomes to western Sydney,

c. continuing to allow for and facilitate the location of government infrastructure and service facilities in the Western Parklands,

d. protecting and enhancing the natural systems of the Western Parklands, including flora and fauna species and communities and riparian corridors,

e. protecting and enhancing the cultural and historical heritage of the Western Parklands,

f. maintaining the rural character of parts of the Western Parklands by allowing sustainable extensive agriculture, horticulture, forestry and the like,

g. facilitating public access to, and use and enjoyment of, the Western Parklands,

h. facilitating use of the Western Parklands to meet a range of community needs and interests, including those that promote health and well-being in the community,

i. encouraging the use of the Western Parklands for education and research purposes, including accommodation and other facilities to support those purposes,

j. allowing for interim uses on private land in the Western Parklands if such uses do not adversely affect the establishment of the Western Parklands or the ability of the Trust to carry out its functions as set out in section 12 of the *Western Sydney Parklands Act 2006*,

k. ensuring that development of the Western Parklands is undertaken in an ecologically sustainable way.

The Development Site is located within the Western Sydney Parklands (WSP) and therefore the aims of the WSP State Environmental Planning Policy (SEPP) 2009 apply to this site. There are no air quality specific development standards or provisions identified in the SEPP, however the broader environmental protection context is considered relevant to this air quality assessment.

4 Local Meteorological Conditions

4.1 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 such stations to the proposed development are the Horsley Park Equestrian Centre Automatic Weather Station (AWS) and Badgerys Creek AWS, which are located approximately 11 km north and 11.5 km northwest of the Development Site respectively. Considering the relatively flat terrain between Development Site and Badgerys Creek AWS, it may be assumed that the wind conditions recorded at the Badgerys Creek AWS are a reasonable representation of the wind conditions experienced at the Development Site. Hence, meteorology recorded at the Badgers Creek AWS are presented below.

Annual and seasonal wind roses for the years 2015 to 2019 compiled from data recorded by the AWS at Badgerys Creek are presented 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 particular periods during the day.

The following description of wind speeds at the Development site references the Beaufort Wind Scale, as outlined in **Table 3**. Use of the Beaufort Wind Scale is consistent with terminology used by the BoM.

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 annual wind roses for the years 2015 to 2019 (**Figure 5)** indicate the predominant wind directions in the area are southwest and west-southwest. Lower frequency of winds are recorded to be blowing from the north and north-northeast direction with very low frequency of winds from the western and southern directions. The annual frequency of calm wind conditions was recorded to be 9.1% for the years 2015 to 2019.

Winds from between the south and west directions, which would blow air emissions from the Development Site towards the nearest residential receptors occurred between 30% (2019) to 41% (2015) of the time.

The seasonal wind roses for the years 2015 to 2019 (**Figure 5)** indicate that:

- In summer wind speeds ranged from light to strong (between 0.5 m/s and 13.3 m/s). During this time winds were predominantly observed to be blowing from the east with lower frequency of winds blowing from between the north-northeast to east-northeast and east-southeast to southwest directions. Very low frequency of winds were observed to be blowing from the northwest quadrant. Calm winds conditions were observed to occur for 8.5% of the time during summer.
- In spring, wind speeds ranged from light to strong winds (between 0.5 m/s and 12.9 m/s) with winds predominantly blowing from the southwest direction. Lower frequency of winds were observed to be blowing almost evenly from all directions, with the exception of very low frequency of winds from the northwest quadrant. Calm wind conditions were observed to occur for 8.4% of the time during spring.
- In autumn and winter, wind speeds range from light to strong winds (between 0.5 m/s and 12.6 m/s) with winds predominantly observed to be blowing from the southwest direction. Lower frequency of winds were recorded from the north-northeast direction in autumn and the west-southwest direction in winter. Calm wind conditions were observed to occur 10.5% and 9.0% of the time during autumn and winter respectively.

The wind speed frequency chart for 2019 is shown in **Figure 4**. Wind erosion of dust from exposed surfaces (ie, during the construction phase of the development) 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 exceeding 5 m/s over the year 2019 at Badgerys Creek AWS was approximately 47%.

Figure 4 Wind Speed Frequency Chart for Badgerys Creek AWS (2015 – 2019)

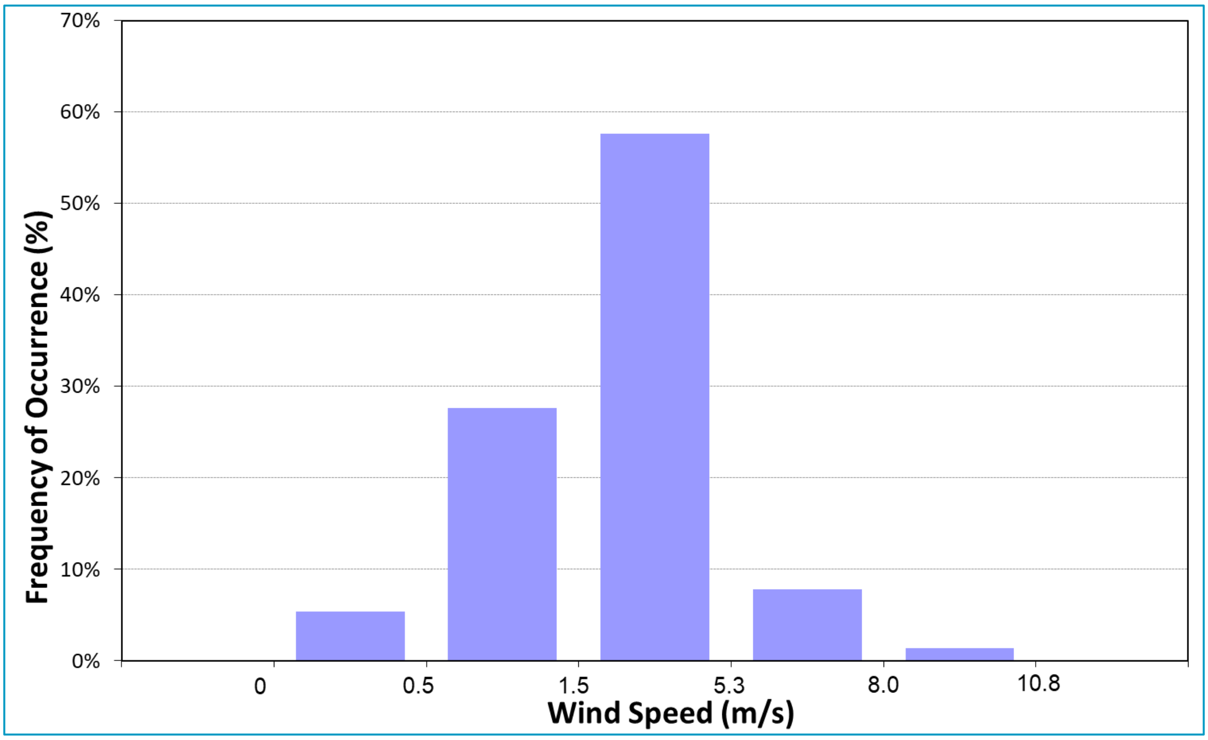
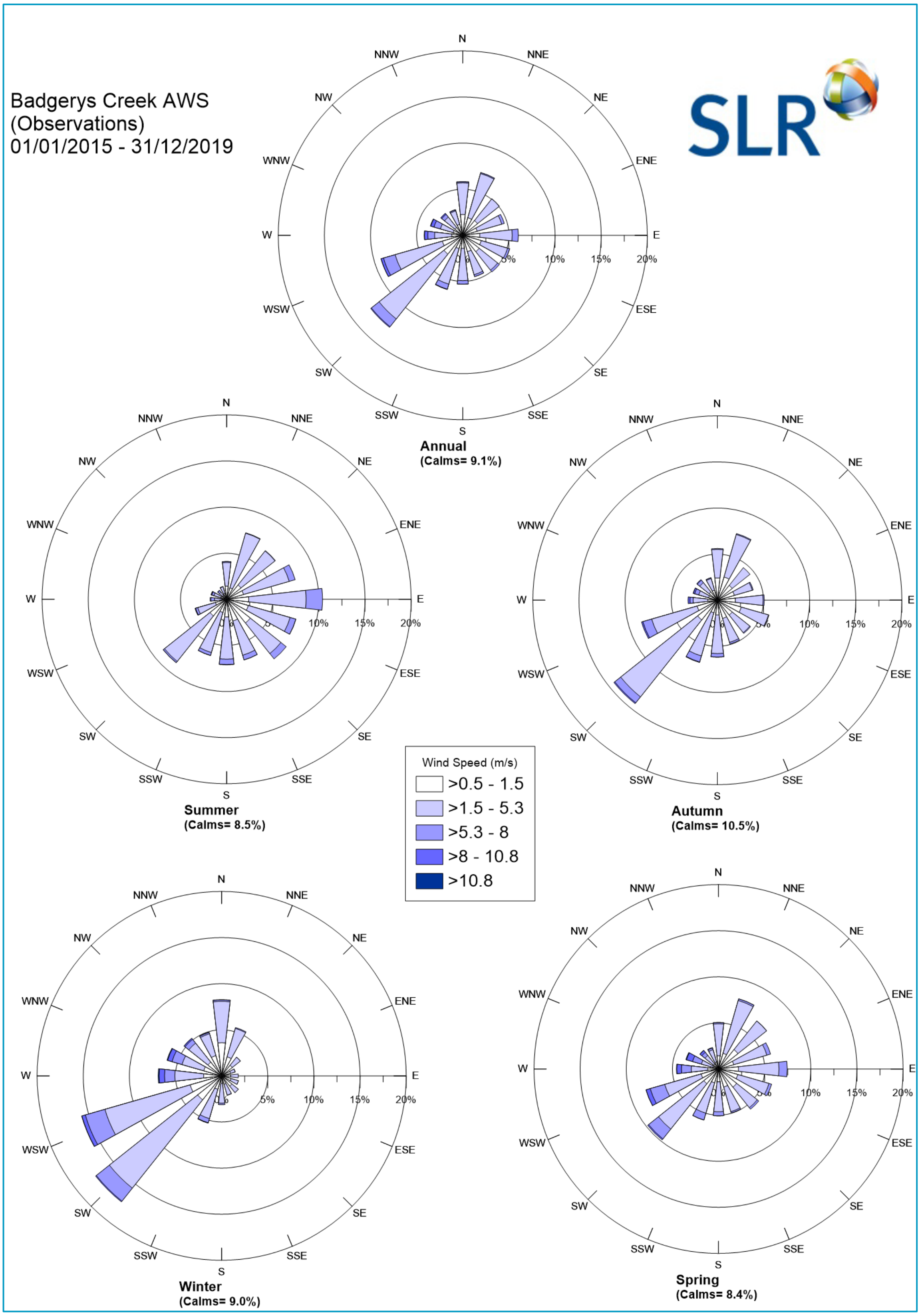


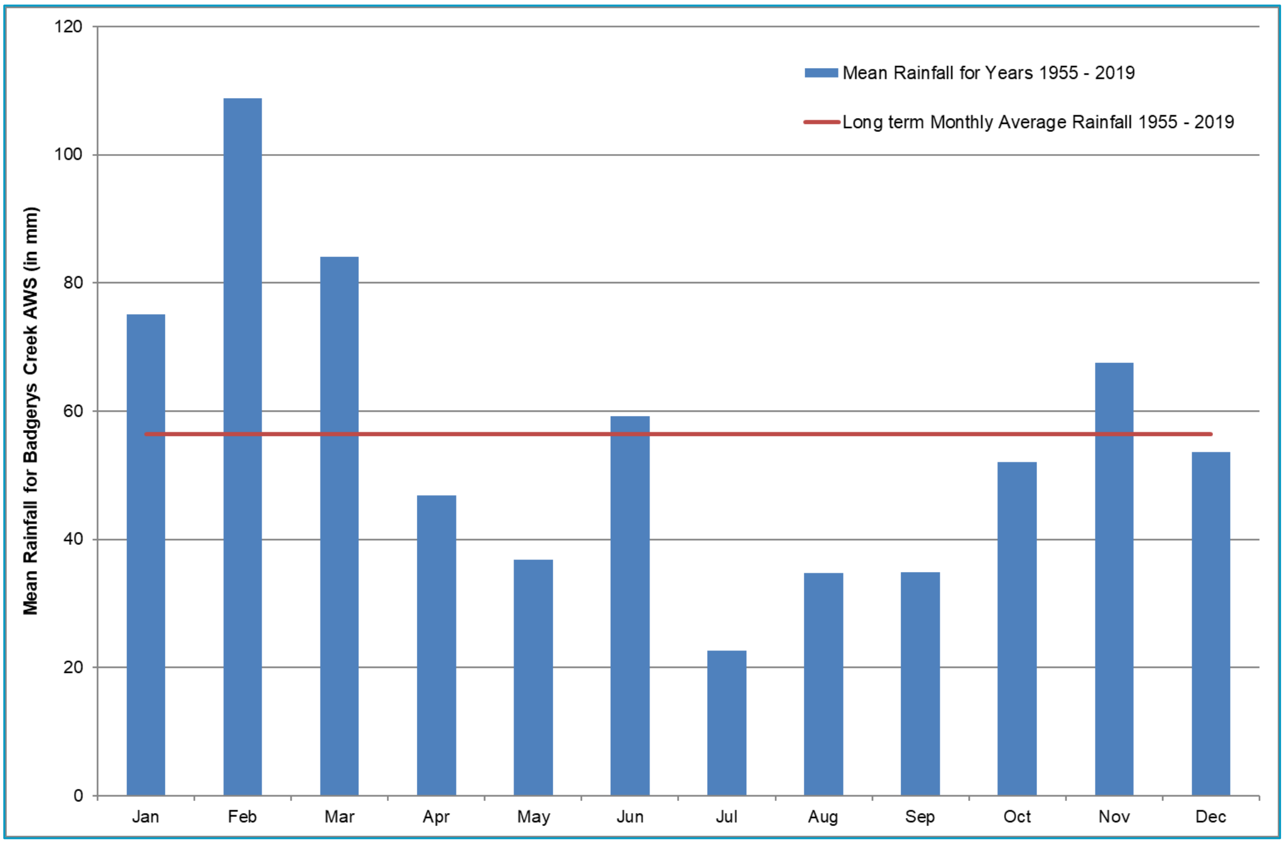
Figure 5 Annual and Seasonal Wind Roses for Badgerys Creek AWS (2015-2019)



4.2 Rainfall

Dry periods (no rainfall) have the greatest potential for fugitive dust emissions during construction. The long term monthly rainfall averages recorded at Badgerys Creek AWS is shown in **Figure 6**. It is noted that generally the periods between April to May and July to October have recorded the lowest monthly rainfalls compared to long term monthly average rainfall.

Figure 6 Long term Mean Rainfall for Badgerys Creek AWS – 1955 to 2019



4.3 Summary

The 2019 wind patterns suggest that the construction and operations at the Development Site have the greatest potential to impact receptors located towards the north and east of the Development Site during the months of autumn and winter, based on the low rainfall and conducive wind directions.

5 Background Air Quality

Air quality at the receptors neighbouring the Development Site will be affected by regional background air quality, as well as the localised impacts of air emission sources within the surrounding area. The following section presents a summary of ambient air quality monitoring data available for the region.

Air quality monitoring is performed by the NSW Department of Planning, Industry and Environment (DPIE) at a number of monitoring stations across NSW. The nearest such station is located at Liverpool approximately 7 km to the northeast, and Bringelly approximately 7.5 km northwest of the proposed development.

Considering the relatively flat terrain between the Development Site and Bringelly Air Quality Monitoring Station (AQMS) as well as similar land use surrounding both locations, it is assumed that the air quality monitoring data recorded at the Bringelly AQMS is a reasonable representation of the air quality experienced at the Development Site. Hence, air quality monitoring data recorded at Bringelly AQMS are presented below.

The Bringelly AQMS is located on the council reserve on Ramsay Road, and is situated in the south of the Hawkesbury basin in a semi-rural area. The Bringelly AQMS monitors concentrations of following air pollutants:

- Oxides of nitrogen (NO, NO_2 and NO_X); and
- Fine particles ($PM_{2.5}$ and PM_{10}).

As Bringelly AQMS does not record CO, the nearest AQMS located at Liverpool has been considered for background CO levels.

A summary of the monitored pollutant concentrations for the last five years (2015-2019) is presented in **Table 4** and the data for 24-hour average PM_{10} and 24-hour average $PM_{2.5}$ are presented graphically in **Figure 7** and **Figure 8.**

Table 4 Summary of Air Quality Monitoring Data at Bringelly and Liverpool AQMS (2015 - 2019)

Pollutant	Bringelly AQMS						Liverpool AQMS	
	NO_2		PM_{10}		$PM_{2.5}$		CO	
	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 8-hour	Maximum 1-hour
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	mg/m³
2015	55.4	7.5	57.0	15.8	ND	ND	0.2	2.9
2016	61.5	9.3	61.6	16.9	21.6	7.6	2.4	2.8
2017	73.8	9.4	83.7	19.8	52.5	7.5	2.3	2.8
2018	73.8	10.7	92.9	21.2	55.6	8.0	2.4	3.0
2019	69.7	10.4	134.0	23.6	178.0	11.3	2.3	4.6
Criterion	**246**	**62**	**50**	**25**	**25**	**8**	**10**	**30**

ND – No data, as the $PM_{2.5}$ monitoring commenced on 30 June 2016.

The monitoring data for NO_2 and CO indicate that the concentrations for these pollutants are well below the respective air quality criteria (short term and long term) at the Bringelly and Liverpool AQMS sites. Thus, it could be interpreted that these pollutants are unlikely to pose a significant risk to the receptors in the vicinity of the Development Site and hence have not been considered further in this assessment.

Exceedances of the 24-hour average PM_{10} criterion were recorded by the Bringelly AQMS in all years. A review of the exceedances recorded during these years indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns.

Based on their review of ambient monitoring data from their 43 station air quality monitoring network, NSW EPA (in their publication *NSW* Annual Air Quality Statement 2018 [OEH 2019]), concluded that the air quality index was in the 'very good', 'good' or 'fair' category for at least 87% of the time in any Sydney region.

Figure 7 Measured 24-Hour Average PM_{10} Concentrations at Bringelly AQMS (2015 - 2019)

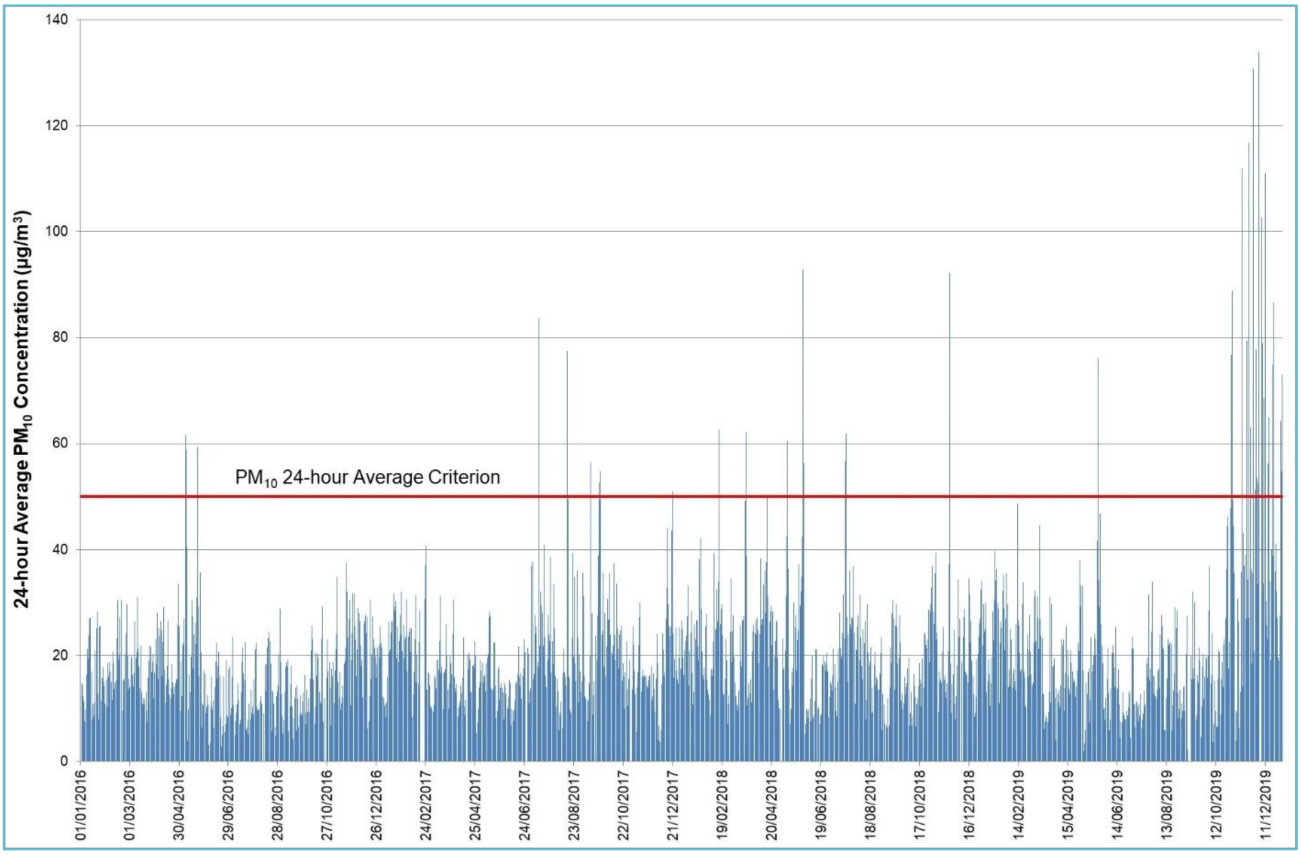
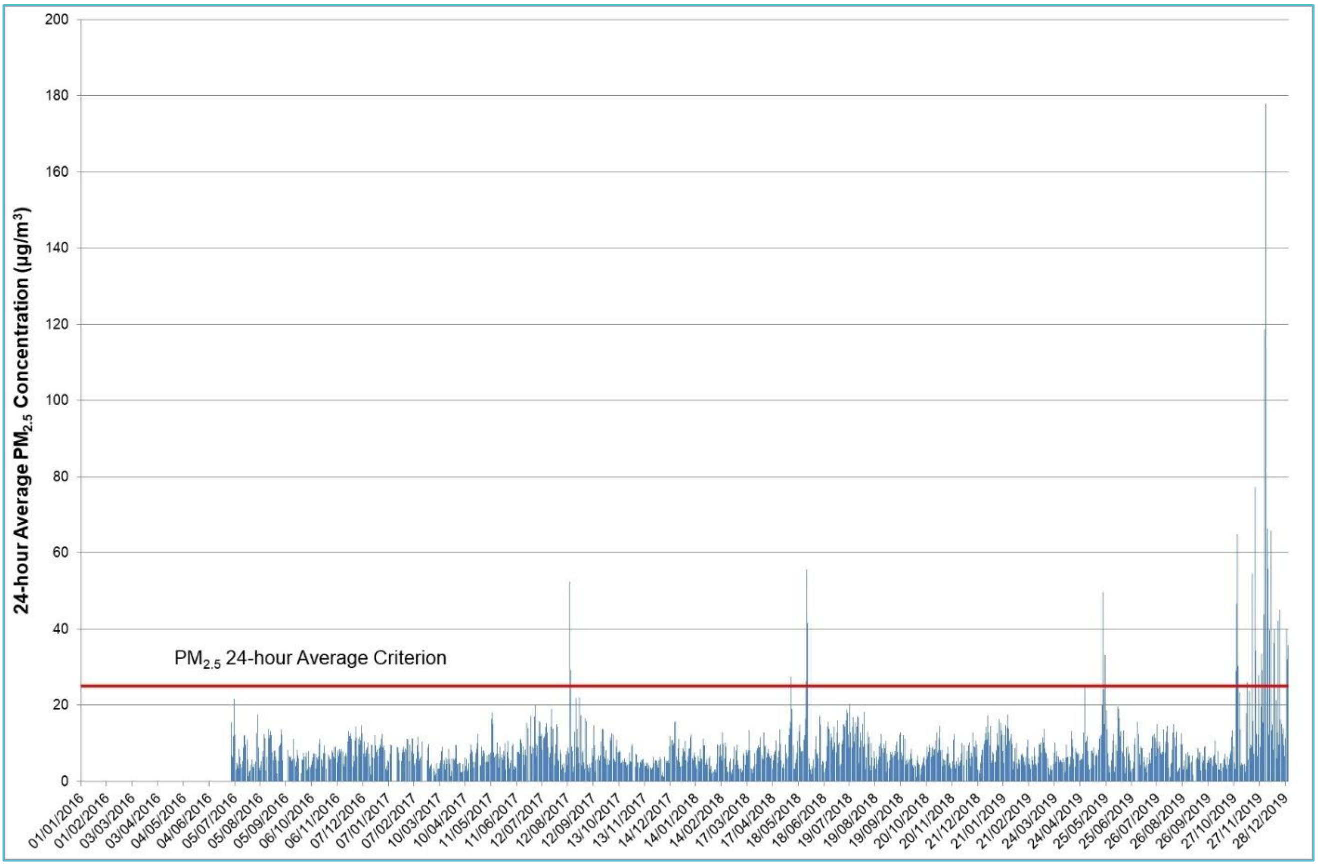


Figure 8 Measured 24-Hour Average $PM_{2.5}$ Concentrations at Bringelly AQMS (2015 - 2019)



Ambient monitoring of toxic air pollutants is not routinely carried out as part of the NSW DPIE's air quality monitoring network. The Ambient Air Quality Research Project was completed by NSW EPA in the late 1990s and early 2000s, which analysed the ambient levels of air toxics (including dioxins, organics, PAHs and heavy metals) at sites representative of general urban air quality in the Sydney, Newcastle and Wollongong area (EPA 2002). The aim of the study was to obtain data on the concentrations of a wide range of air toxics. The study ran for 5.5 years from early 1996 to August 2001 and examined dioxins, 41 organic compounds, 11 PAHs and 12 heavy metals. The study concluded:

> *"In summary, the study found that most air toxics levels in NSW are low and well below current international standards and benchmarks."*

Even though the study is almost 20 years old, current air toxic levels are expected to still be low compared to ambient air quality criteria given the ongoing technical improvements in car engine technology and emissions controls.

6 Assessment of Dust Emissions During Construction

The key potential air pollution and amenity issues associated with construction at the Development Site are:

- Annoyance due to dust deposition (soiling of surfaces) and visible dust plumes.
- Elevated suspended particulate concentrations (PM_{10}) due to dust-generating activities.

Modelling of dust from construction projects is generally not considered appropriate as emission rates can vary significantly depending on a combination of the construction activity and prevailing meteorological conditions (ie rainfall and wind speed), which cannot be reliably predicted. The following sections therefore describe the methodology used to perform a qualitative assessment of the potential risks to air quality associated with dust from construction activities at the Development Site.

6.1 Construction Dust Risk Assessment Methodology

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 (Holman *et al* 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 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.

6.2 Construction Phase Dust Risk Assessment

6.2.1 Step 1 – Screening Based on Separation Distance

The nearest existing residential receptors have been identified as being located approximately 140 m to the northeast, 220 m and 270 m to the east of the of the Development Site boundary.

As the sensitive receptors are located within 350 m from the boundary of the site, less than 50 m from the route used by construction vehicles on public roads, and within 500 m from the site entrance, further assessment is required.

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

Based on the above assumptions and the IAQM definitions presented in **Appendix A**, the dust emission magnitudes have been categorised as presented in **Table 5**. As noted in **Section 2.2**, the earthworks required during the construction phase are already approved and have not been considered in this assessment.

Table 5 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Construction	Medium	Total building volume greater than 100,000 m^3. *Note: The height of warehouse buildings are assumed to be 13.7 m and total area of 36,064 m^2, equating to a total building volume of approximately 484,100 m^3. Also, it is noted that onsite batching and sand blasting will be very unlikely to be employed, so a classification of 'medium' is considered to be more realistic based on the IAQM definition.*
Trackout	Medium	Estimated 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.

6.2.3 Step 2b – Risk Assessment

6.2.3.1.1 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 <u>*high*</u> for health impacts and <u>*medium*</u> 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.

6.2.3.1.2 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 <u>*low*</u> and the sensitivity of the surrounding area to health effects (**Table A3** in **Appendix A**) has been classified as <u>*low*</u>. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 23.6 µg/m^3 recorded at Bringelly Air Quality Monitoring Station (AQMS) for 2019 (as presented in **Section 5**) and the anticipated number of receptors present (>100 within 350 m for dust soiling, and >100 within 200 m for health impacts).

6.2.3.1.3 Risk Assessment

Given the sensitivity of the general area is classified as <u>*low*</u> for dust soiling and <u>*low*</u> for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 5**, the resulting risk of air quality impacts is as presented in **Table 6**. The results indicate that there is a low risk of adverse dust soiling and medium risk for human health impacts occurring at the off-site sensitive receptor locations if no mitigation measures were to be applied to control emissions from the building construction and trackout.

Table 6 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

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

6.2.4 Step 3 - Mitigation Measures

Table 7 lists the relevant mitigation measures designated as *highly recommended* (H) and *desirable* (D) by the IAQM methodology for a development shown to have a low risk of adverse impacts. Not all these measures would be practical or relevant to the Development Site, hence a detailed review of the recommendations should be performed as part of the development of the Construction Environmental Management Plan (CEMP) and the most appropriate measures adopted.

Table 7 Site-Specific Management Measures Recommended by the IAQM

1	Communications	
1.1	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
1.2	Display the head or regional office contact information.	H
1.3	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	D
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
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 are 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.	D
4.4	Avoid site runoff of water or mud.	H
4.5	Keep site fencing, barriers and scaffolding clean using wet methods.	D
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.	D
4.7	Cover, seed or fence stockpiles to prevent wind erosion.	D

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 20 km/h on surfaced and 10 km/h on unsurfaced haul roads and work areas.	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.	D
7	**Waste Management**	
7.1	Avoid bonfires and burning of waste materials.	H
8	**Construction**	
8.1	Avoid scabbling (roughening of concrete surfaces) if possible.	D
8.2	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.	D
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.	D
9.2	Avoid dry sweeping of large areas.	D
9.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
9.4	Record all inspections of haul routes and any subsequent action in a site log book.	D
9.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D

H = Highly recommended; D = Desirable;

6.2.5 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 8**.

Table 8 Residual Risk of Air Quality Impacts from Construction

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

The mitigated dust deposition and human health impacts for trackout and construction phase activities are anticipated to be *low*. For almost all construction activity, 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.

7 Assessment of Impacts from Warehouse Operations

As discussed in **Section 2.5**, air quality issues associated with the proposed warehouse operations predominantly relate to emissions of wheel generated dust and products of combustion 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 Bringelly and Cowpasture Roads. However, the scale and magnitude of emissions from the Development Site will be significantly lower (227 truck movements per day for the Development Site, compared to the estimated annual average daily traffic on Bringelly Road of 29,000 vehicles/day-43,000 vehicles per day). It is noted that the traffic volumes for Bringelly Road are estimated based on 2019 traffic volumes available (sourced from RMS Traffic Volume Viewer [1]) for similar arterial roads ie Campbelltown Road and Elizabeth Drive. To assess the risk of air emissions from the Development Site impacting on surrounding sensitive receptors during the operational phase, the following "risk based" approach has therefore been adopted.

The risk-based assessment (detailed in **Appendix B)** 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 *neutral* to the environment.

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

  The nearest sensitive receptors to the Development Site include residences approximately 140 m to the northeast, 220 m and 270 m to the east (see **Section 2.4**). In terms of the methodology in **Appendix B**, the sensitivity of the surrounding residential areas to emissions from the Development Site should be considered *high*.

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

  Based on the small amount of traffic movements on site, the magnitude of these emissions considered to be *negligible*.

Given the above considerations, and the scale of operations, the potential impact of the Development Site on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 9**).

[1] http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=12&q=Bringelly%20Road,%20Leppington%20NSW,%20Australia&lat=-33.92608696754494&lon=150.8095037734979&id=62001&yr=2018

Table 9 Impact Significance

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

Further, a vegetative buffer exists between the Development Site and the existing sensitive receptors located to the north. This will assist in screening the existing residents to the north from any air impacts.

8 Conclusion

SLR was commissioned ESR, to prepare an AQIA for the construction and operation of a warehouse to be located at Lot 4 within the Bringelly Road Business Hub.

Available meteorological data collected in close proximity to the Development site have been examined to provide an estimate of the prevailing wind environment in the region. This review indicated that winds from between the south and west directions, which would blow air emissions from the Development Site towards the nearest residential receptors, occur between 30% to 41% of the time. In addition, construction activities at the Development Site have the greatest potential to impact on receptors located towards the north and east of the Development Site during the months of autumn and winter, based on the low rainfall and conducive wind directions during these seasons. Additional controls may be required (higher levels of watering for example) if construction occurs at these times.

The findings of the assessment are as follows:

- Off-site impacts associated with dust deposition and suspended particulate during the construction phase are anticipated to be *low* for trackout and building construction activities. A range of mitigation measures have been recommended for consideration as part of the CEMP.
- Based on the activities (storage, handling and distribution) to be used in the processes, the potential for offsite air impacts from the operations at the Development Site is concluded to *neutral*.
- The existing vegetative buffer would also assist in screening any dust or other air emissions being blown towards the existing residences to the north.

Based on the above, it is concluded that the risk of any exceedances of air quality criteria at nearby residential areas due to air emissions from the Development Site is expected to be low.

9 References

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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.

Note: No demolition of existing structures will be performed as part of this Development.

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 A1**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A1 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 PM10.*	*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 A2**. The sensitivity of the area should be derived for each of activity relevant to the project (ie construction and earthworks).

Table A2 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 A3**. 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 (ie an annual average of 19.8 µg/m³ 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 A3 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 A4** (earthworks and construction) and **Table A5** (track-out) to determine the risk category with no mitigation applied.

Table A4 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 A5 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

APPENDIX B

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 B1 outlines the methodology used in this study to define the sensitivity of receptors to air quality impacts.

Table B1 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 B2 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 B3 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

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