AIR QUALITY ASSESSMENT

Light Horse Interchange Business Hub
[SSD 9667]

Prepared for:

Western Sydney Parklands Trust
PO Box 3064
Parramatta NSW 2124

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SLR

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Western Sydney Parklands Trust (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
610.18514-R01-v1.2	28 March 2019	Varun Marwaha	Fardausur Rahaman	Fardausur Rahaman
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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Western Sydney Parklands Trust (WSPT) to provide an air quality impact assessment (AQIA) for the proposed development of an industrial business hub to be located adjacent to the Light Horse Interchange in the Eastern Creek area (the Development Site).

This report has been prepared to inform a State Significant Development Application (SSDA) and focused on assessing potential air quality impacts associated with the first stage of development works including demolition works, bulk earthworks, installation of infrastructure and subdivision of the site.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) relevant to the Project (SSD 9667) issued 7 November 2018, as reproduced below:

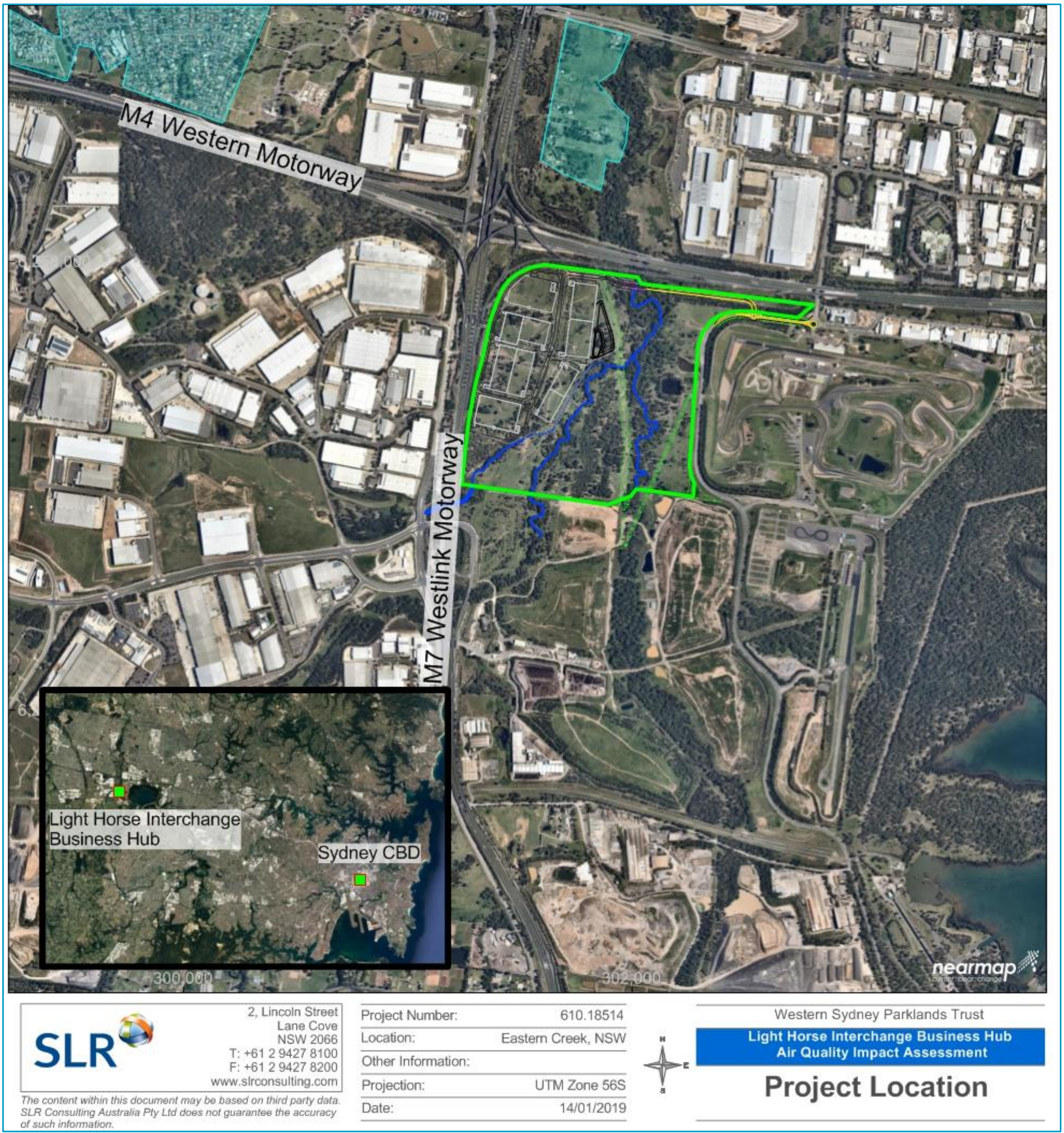
- an assessment of the air quality impacts (including dust) during the development, in accordance with the relevant Environment Protection Authority guidelines
- details of proposed mitigation, management and monitoring measures.

The aim of this AQIA is to determine the potential air quality risks associated with the proposed development, due to the construction of the Development Site.

2 Site Location

The proposed development will be located in Eastern Creek, approximately 33 kilometres (km) west of Sydney Central Business District (CBD), immediately southeast of the intersection of the M4 Western Motorway with the Westlink M7 Motorway. The local setting of the Development Site is shown in **Figure 1**.

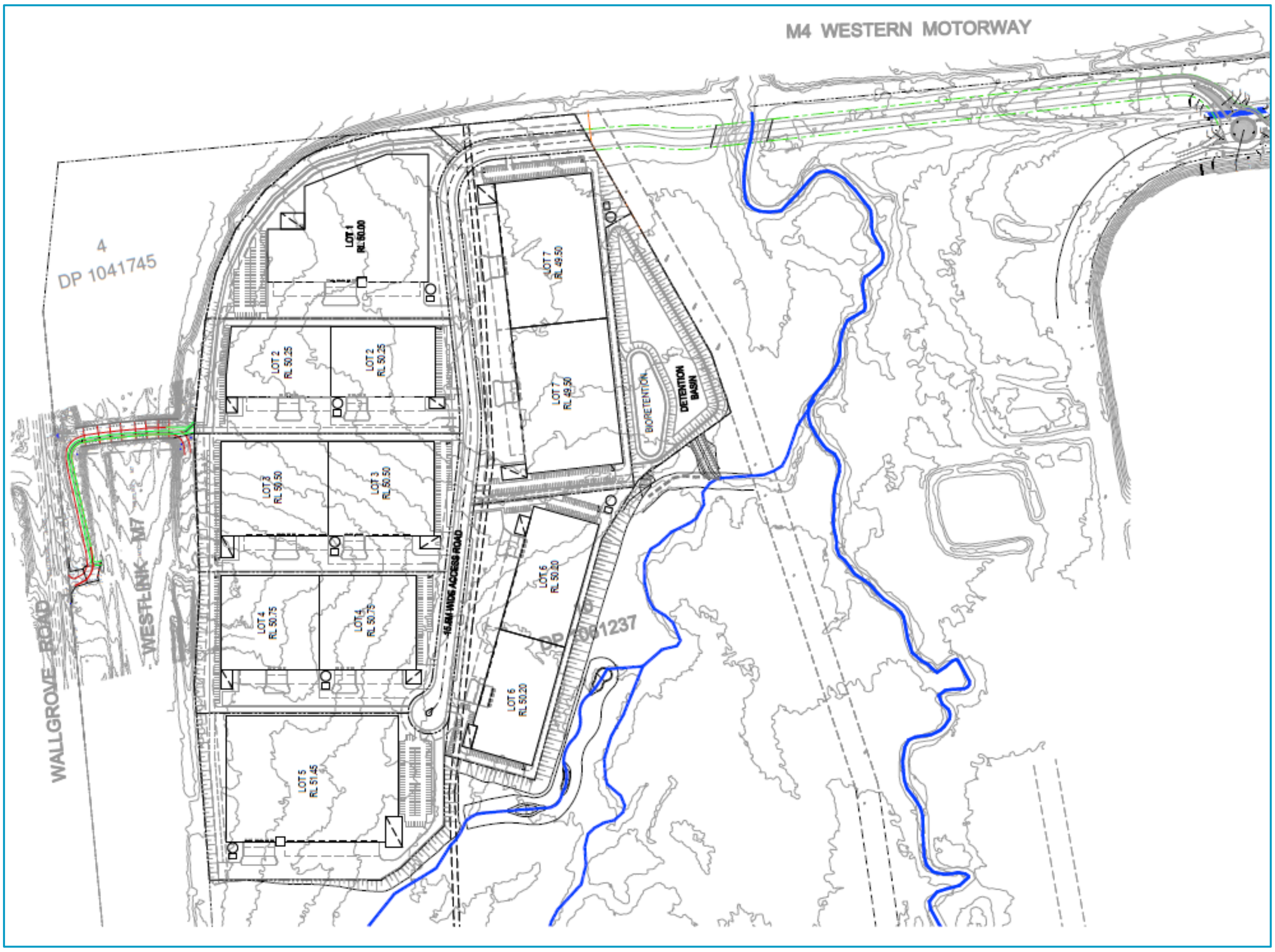
Figure 1 Satellite Image of the Proposed Development Site



As shown in **Figure 1**, the Development Site is surrounded by industrial/recreational facilities with residential receptors to the north, and northwest of the Development Site boundary. The nearest residential receptor is located on the opposite side of the M4 Motorway, approximately 480 m from the Development Site.

The indicative concept base plan is shown in **Figure 2**. The overall development consists of approximately 29.4 hectares (ha) of developable area (Lots 1-7) and associated infrastructure including access road, stormwater and basin works, creek diversion and utility servicing. The total study area is approximately 33.6 ha.

Figure 2 Indicative Site Layout of the Proposed Development Site

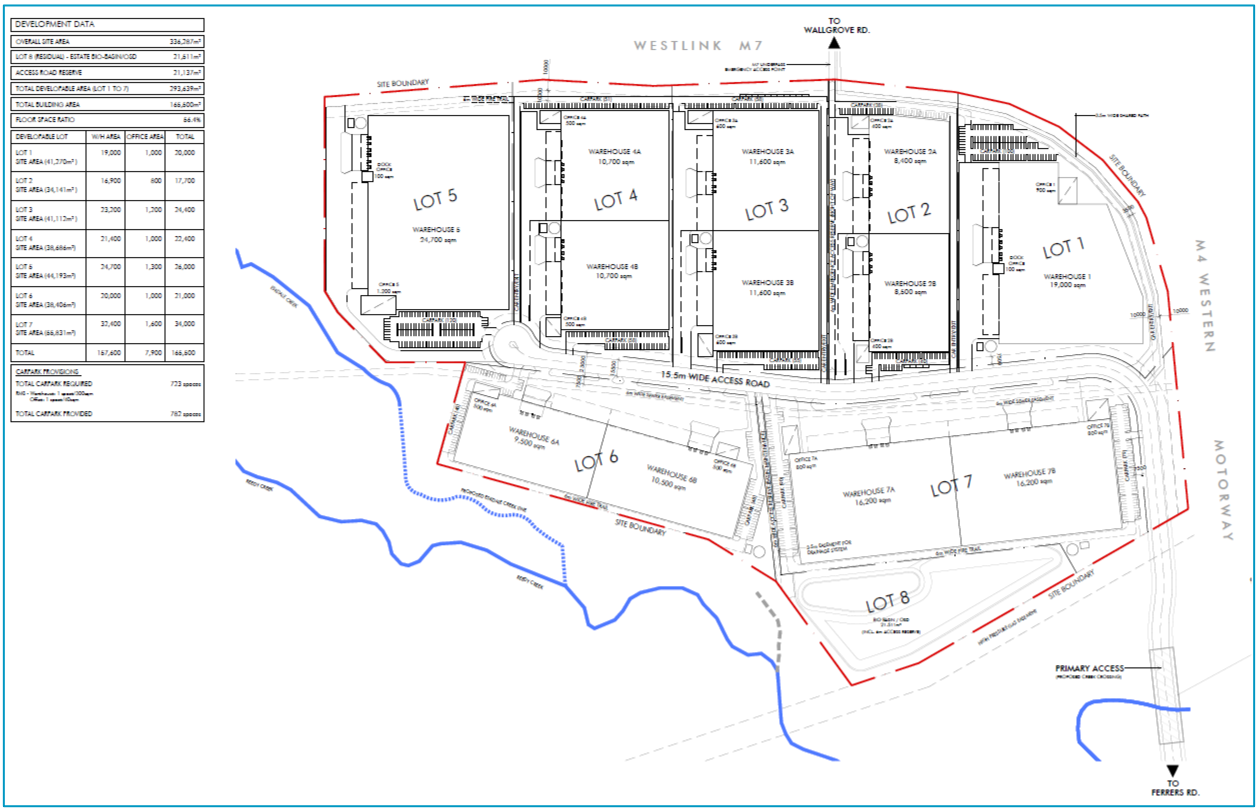


3 Construction Activities

This report includes an assessment of the potential air quality impacts associated with the proposed construction works at the Development Site (see **Section 8**) which includes the following:

- **Demolition and remediation:** removal of existing buildings and structures and completion of any site remediation works required to ensure the site is suitable for its intended use as a business hub.
- **Bulk earthworks:** cut and fill details for the future building pad sites to facilitate the future development of the site as an industrial business hub.
- **Infrastructure:** provision of roads, utility services, stormwater works and flood control measures required to facilitate the future development of the site as a business hub.
- **Subdivision:** creation of development lots, public roads, easements/restrictions and other infrastructures required to facilitate the leasing and development of individual lots to accommodate industrial and light industrial land use activities, including freight and logistics and warehouse and distribution centres. The proposed concept masterplan is shown in **Figure 3**.

Figure 3 Proposed Concept Masterplan of the Proposed Development Site



Source: Concept Base Plan, sketch number # 10935_SK017; created: March 2019.

It is noted that the total building area is estimated to be approximately 165,500 m^2.

The construction works are anticipated to take place 12-18 months. The proposed working hours for the construction period are 7:00am to 6:00pm, Monday to Friday, between 7:00am to 4:00pm on Saturdays and no work to be conducted on Sundays or public holidays, unless approved otherwise.

4 Potential Sources and Impacts of Dust Emissions

During the construction works, fugitive dust emissions are likely to be generated which could give rise to nuisance and/or health impacts for the surrounding sensitive areas. Potential air quality impacts associated with the construction phase of the project have been addressed in **Section 8**. The following key sources of dust associated with the construction of the Development Site have been identified:

- Concrete cutting and breaking up of the existing buildings and/or surfaces;
- Grading;
- Loading and unloading of materials;
- Wheel-generated dust from vehicles travelling on onsite unpaved disturbed surfaces;
- Wind erosion of exposed surfaces; and
- Combustion emissions from on-site mobile and fixed equipment/vehicles.

In addition to the construction activities being carried out at any point in time, a number of other environmental factors may also 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 - governs 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 occur, however considering the scale and duration of work, potential for exceeding the relevant criteria of these pollutants at surrounding sensitive areas can be considered as minimal. Fugitive dust emissions are therefore considered to have the greatest potential to give rise to downwind air quality impacts at construction sites.

5 Relevant Air Quality Criteria and Guidelines

5.1 Pollutants of Concern

As identified in **Section 4**, potential air pollutants of interest for the Subject Site are considered to be:

- Suspended particulate matter;
- Deposited dust; and
- Products of fuel combustion (including particulates).

The following sections outline the potential health and amenity issues associated with the above pollutants, while **Section 5.2** outlines relevant air quality assessment criteria.

5.1.1 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The 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 is termed as 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.

5.1.2 Deposited Dust

Section 5.1.1 is concerned in large part with the health impacts of particulate matter. 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.

The rate of dust deposition is measured by means of a collection gauge, which catches the dust settling over a fixed surface area and over a period of about 30 days.

5.1.3 Products of Combustion

Emissions associated with road traffic and the combustion of automotive fuel (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 a vehicle exhaust.

Vehicle 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 (VOC) 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.

5.2 Ambient Air Quality Criteria

5.2.1 Deposited Dust

A summary of the relevant impact assessment criteria for deposited dust is provided in **Table 1**.

Table 1 NSW EPA Approved Methods for Modelling & Assessment of Air Pollutants – Assessment Criteria

Pollutant	Averaging Period	Assessment Criteria (g/m^2/month)
Deposited dust	Annual	2 (maximum increase in deposited dust level) 4 (maximum total deposited dust level)

5.2.2 Particulate Matter and Products of Combustion

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 5.1** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2017a) [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 associated risks to human health as published in the Approved Methods. 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	-	50 µg/m^3
	Annual		25 µg/m^3
$PM_{2.5}$	24 Hours	-	25 µg/m^3
	Annual		8 µg/m^3
SO_2	10 minutes	25 pphm	712 µg/m^3
	1 hour	20 pphm	570 µg/m^3
	24 hours	8 pphm	228 µg/m^3
	Annual	2 pphm	60 µg/m^3

Source: EPA 2017a

5.3 Local Government Air Quality Toolkit

The NSW EPA has developed the Local Government Air Quality Toolkit (EPA 2018), in response to requests from local Council officers for information and guidance on the common air quality issues they manage. Guidance is available under Part 3 of the Local Government Air Quality Toolkit for Construction Sites.

This document lists the common sources of emissions and mitigation and management measures to control airborne dust levels from construction sites and has been consulted in the development of this AQIA.

6 Local Meteorological Conditions

6.1 Wind Conditions

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

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station recording wind speed and wind direction data is the Horsley Park Automatic Weather Station (AWS), located approximately 5.5 kilometres (km) south of the Development Site (Station ID 67119). Considering the relatively flat terrain between Development Site and Horsley Park AWS, it is considered reasonable to assume that the wind conditions recorded at the Horsley Park AWS are representative of the wind conditions experienced at the Development Site.

Annual wind roses for the years 2013 to 2017 compiled from data recorded by the Horsley Park AWS are presented in **Figure 4**, with seasonal wind roses for 2017 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 'Beaufort Wind Scale' (consistent with terminology used by the BoM) presented in **Table 3** was used to describe the wind speeds experienced at the Development 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 annual wind roses for the years 2013 to 2017 (**Figure 4**) indicate that predominant wind directions in the area are consistently from the southwest quadrant. Very low frequencies of winds from the north-eastern quadrant were recorded across all years. The annual frequency of calm wind conditions was recorded to be approximately 12%-14.5% for all the years between 2013 and 2017.

A review of the annual wind roses (**Figure 4**) indicates that:

- Winds that would blow fugitive dust emissions from the demolition/construction works towards the nearest sensitive receptors located to the north and northwest of the proposed construction activities occur approximately 15-20% of the time.

The seasonal wind roses for the year 2017 (**Figure 5**) indicate that:

- In summer, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 8.9 m/s). The majority of winds originated from eastern and south eastern quadrants, with very few winds from western directions. Calm wind conditions were recorded approximately 13% of the time during summer.
- In autumn, wind speeds ranged from calm to moderate winds (between 0.5 m/s and 6.4 m/s). The majority of winds originated from southwest quadrant, with very few winds from other directions. Calm wind conditions were observed to occur approximately 16% of the time during autumn.
- In winter, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 10.1 m/s). The majority of winds originated from southwest quadrant, with very few winds from other directions. Calm wind conditions were observed to occur approximately 16% of the time during winter.
- In spring, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 8.5 m/s). The frequency of winds are mostly even in each directions, with relatively low frequency of winds originating from southern quadrant. Calm wind conditions were observed to occur approximately 14% of the time during spring.

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 for the period of 2013-2017 is presented in **Figure 6**. The plot showed that the frequency of wind speeds exceeding 5 m/s for the period 2013-2017 at Horsley Park AWS was approximately 8%.

Figure 4 Annual Wind Roses for Horsley Park (2013 to 2017)

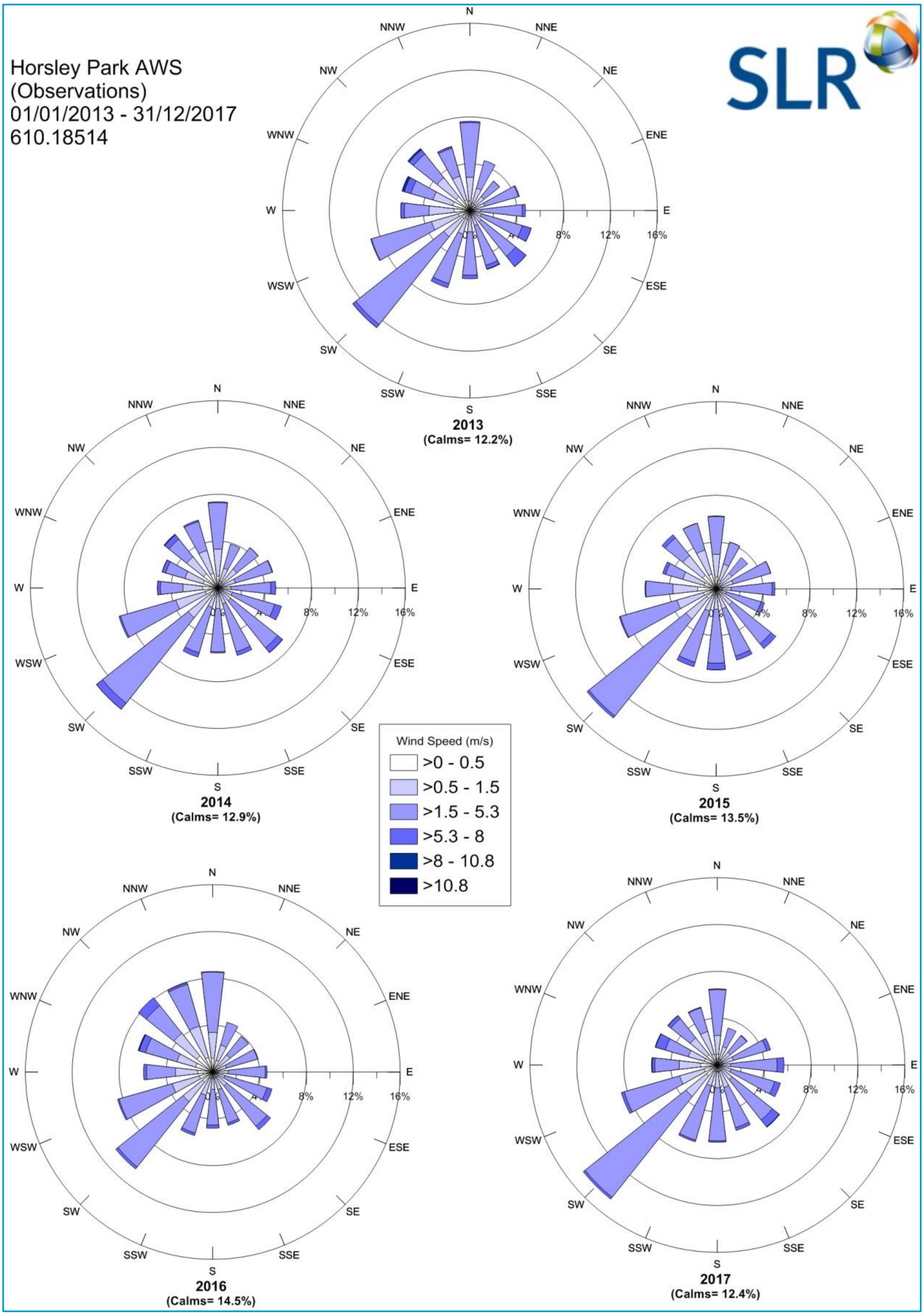


Figure 5 Annual and Seasonal Wind Roses for Horsley Park (2017)

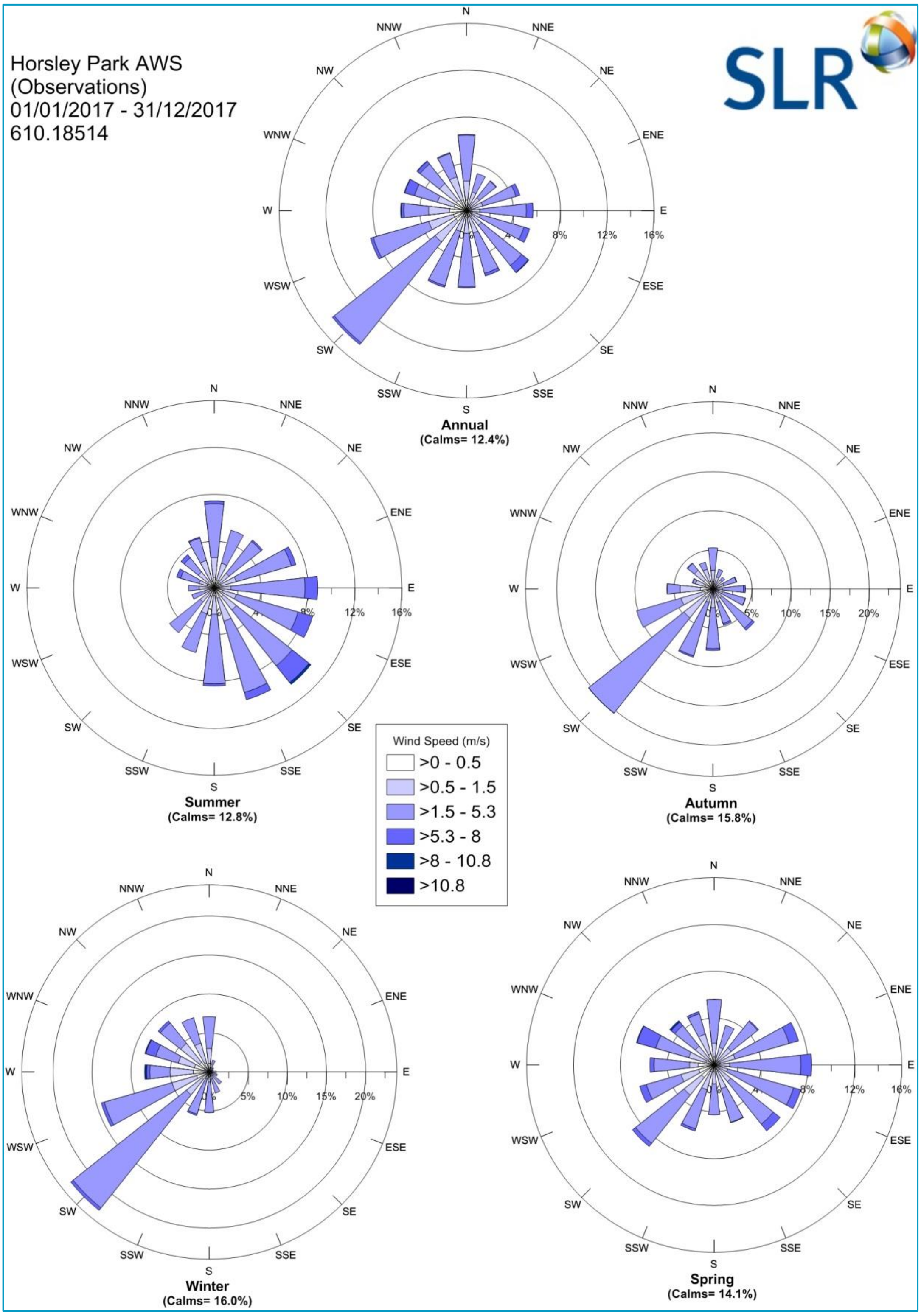
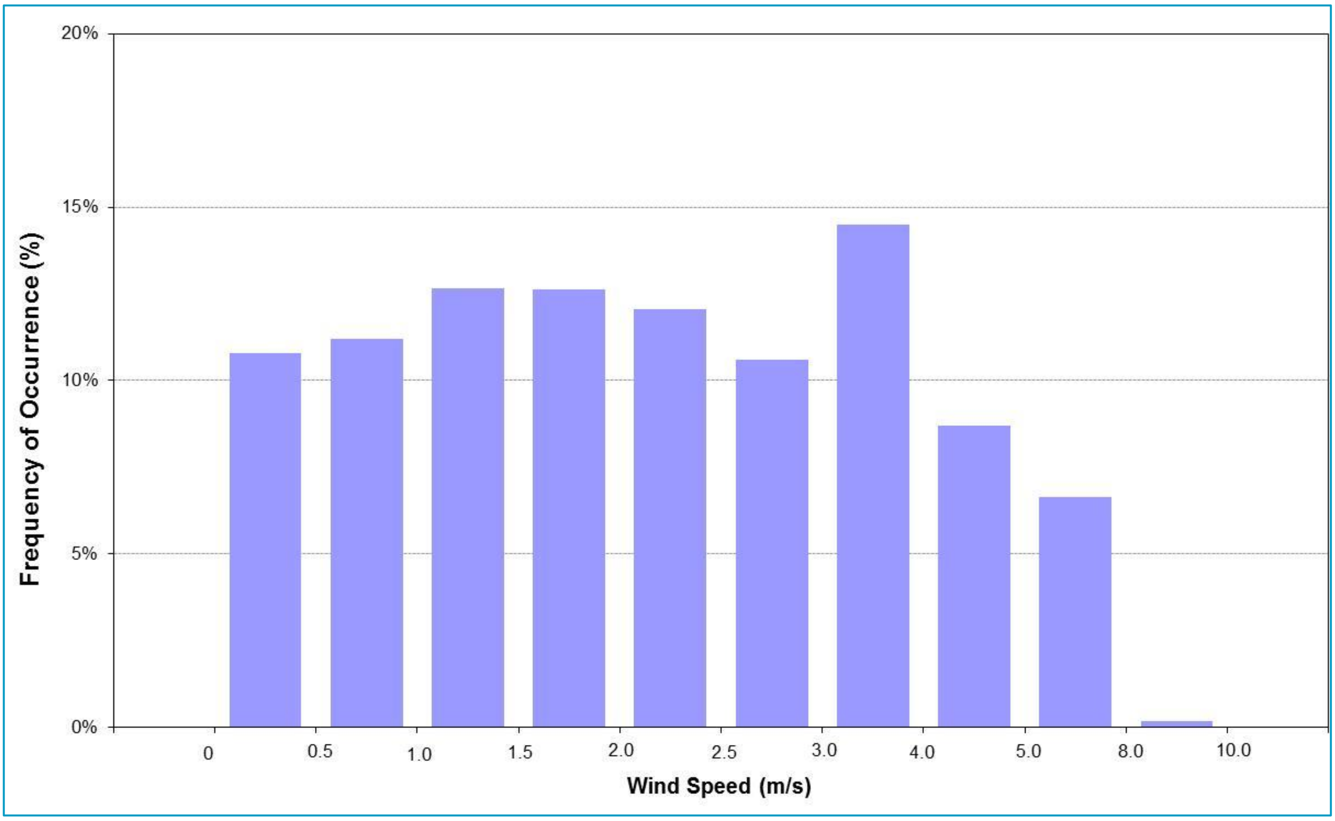


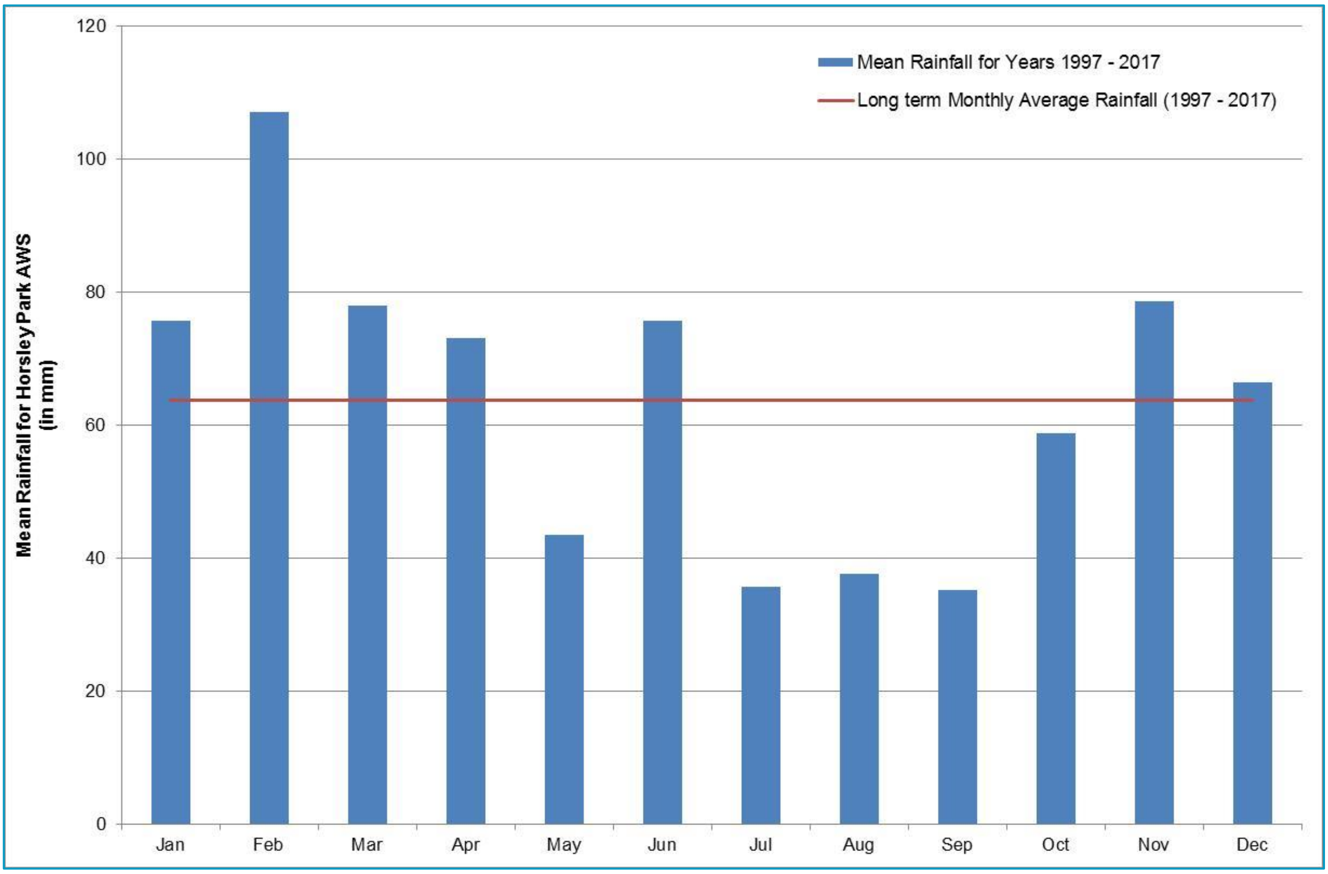
Figure 6 Wind Speed Frequency Chart for Horsley Park AWS – 2013-2017



6.2 Rainfall

Dry periods (no rainfall) have the greatest potential for fugitive dust emissions during construction. The long term monthly rainfall averages recorded at Horsley Park AWS rain gauge are shown in **Figure 7**. It is noted that generally rainfall is relatively low in mid-winter to mid spring periods. This rainfall pattern suggests that dust emissions from the demolition/construction activities at the Development Site have the greatest potential to impact on receptors for the period of late autumn to early spring.

Figure 7 Long term Mean Rainfall for Horsley Park AWS – 1997 to 2017



6.3 Summary of Meteorological Conditions

Overall, the seasonal wind roses (**Figure 5**) and long term rainfall patterns (**Figure 7**) indicate that:

- Winds that would blow fugitive dust emissions from the demolition/construction works towards the nearest sensitive receptors located to the north and northwest of the proposed construction activities occur rarely during autumn and winter, and are more likely to occur during summer and spring.
- The long term wind and rainfall patterns suggest that the construction at the Development Site have the greatest potential to impact on surrounding sensitive receptors during the months of May (autumn), and July (winter) to October (spring).

7 Background Air Quality

Air quality monitoring is performed by the NSW OEH at a number of monitoring stations across NSW. The closest such station is the Prospect Air Quality Monitoring Station (AQMS) located approximately 5.5 km east of the Development Site. The Prospect AQMS is located in William Lawson Park on Myrtle Street within a residential area. The Prospect AQMS monitors measures the concentration levels of following air pollutants:

- Carbon monoxide (CO);
- Oxides of nitrogen (NO, NO_2 and NO_X);
- Fine particles ($PM_{2.5}$ and PM_{10}); and
- Sulfur dioxide (SO_2).

A summary of the available measured ambient pollutant concentrations for the last five years (2013-2017) is tabulated in **Table 4** and presented graphically in **Figure 8** to **Figure 12**.

Table 4 Summary of Air Quality Monitoring Data at Prospect AQMS (2013 – 2017)

Pollutant	CO	NO_2		PM_{10}		$PM_{2.5}$		SO_2	
Averaging Period	Maximum 8-hour	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual
Units	mg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2013	ND	100.5	21.7	81.8	19.2	ND	ND	57.2	2.2
2014	ND	96.4	21.0	44.3	17.6	14.0	7.5	54.3	1.9
2015	ND	108.7	21.7	68.7	17.6	29.6	8.2	77.2	1.6
2016	1.9	108.7	20.1	110.1	18.9	84.9	8.7	60.1	1.7
2017	1.4	123.0	20.0	61.1	18.9	30.1	7.7	65.8	2.0
Criterion	10	246	62	50	25	25	8	570	60

Figure 8 Measured 8-Hour Rolling Average CO Concentrations at Prospect AQMS (2013 – 2017)

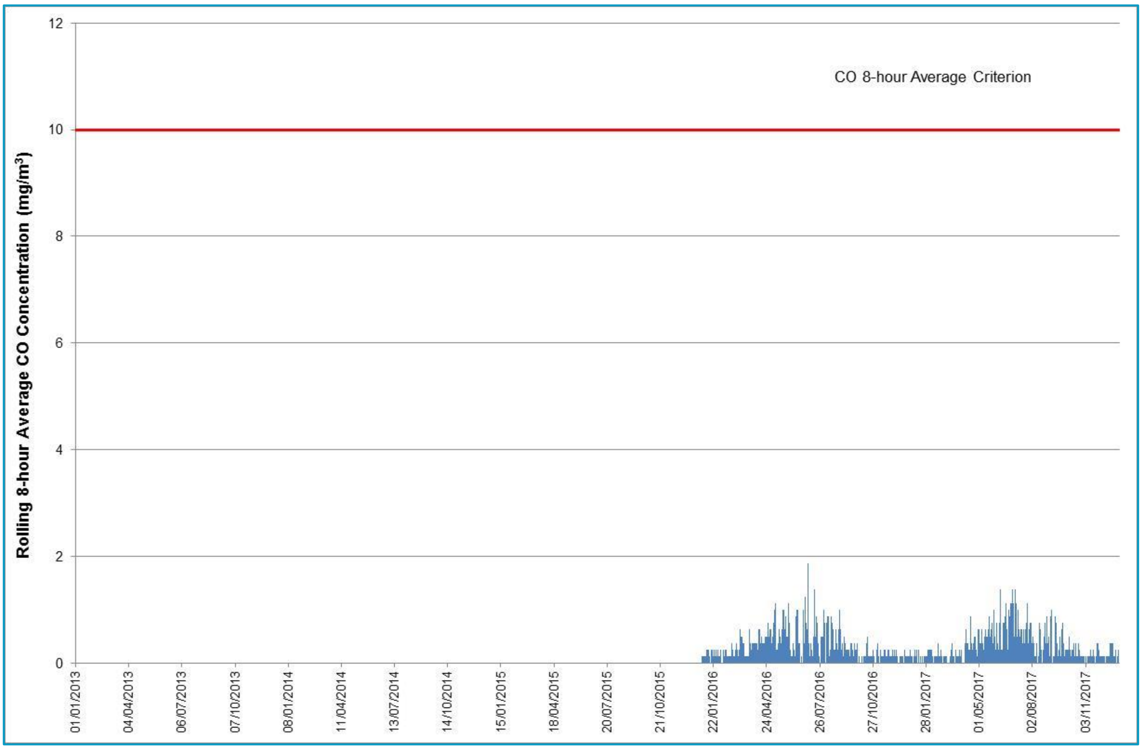


Figure 9 Measured 1-Hour Average NO_2 Concentrations at Prospect AQMS (2013 – 2017)

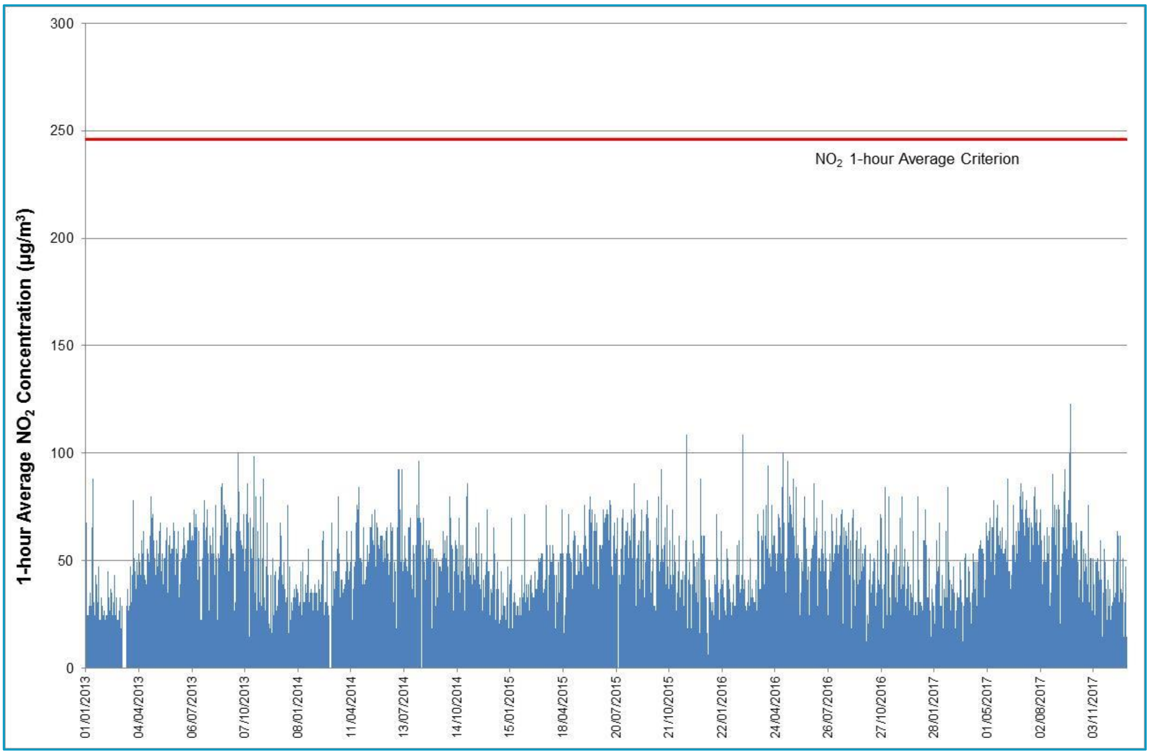


Figure 10 Measured 24-Hour Average PM_{10} Concentrations at Prospect AQMS (2013 – 2017)

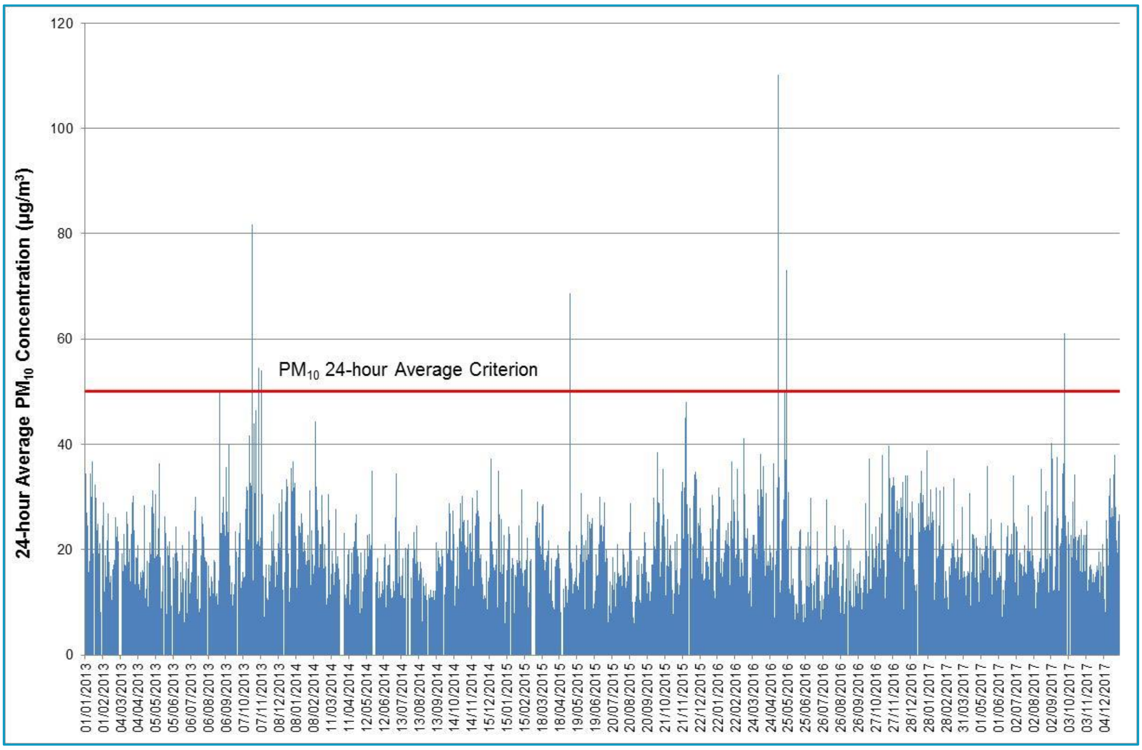


Figure 11 Measured 24-Hour Average $PM_{2.5}$ Concentrations at Prospect AQMS (2013 – 2017)

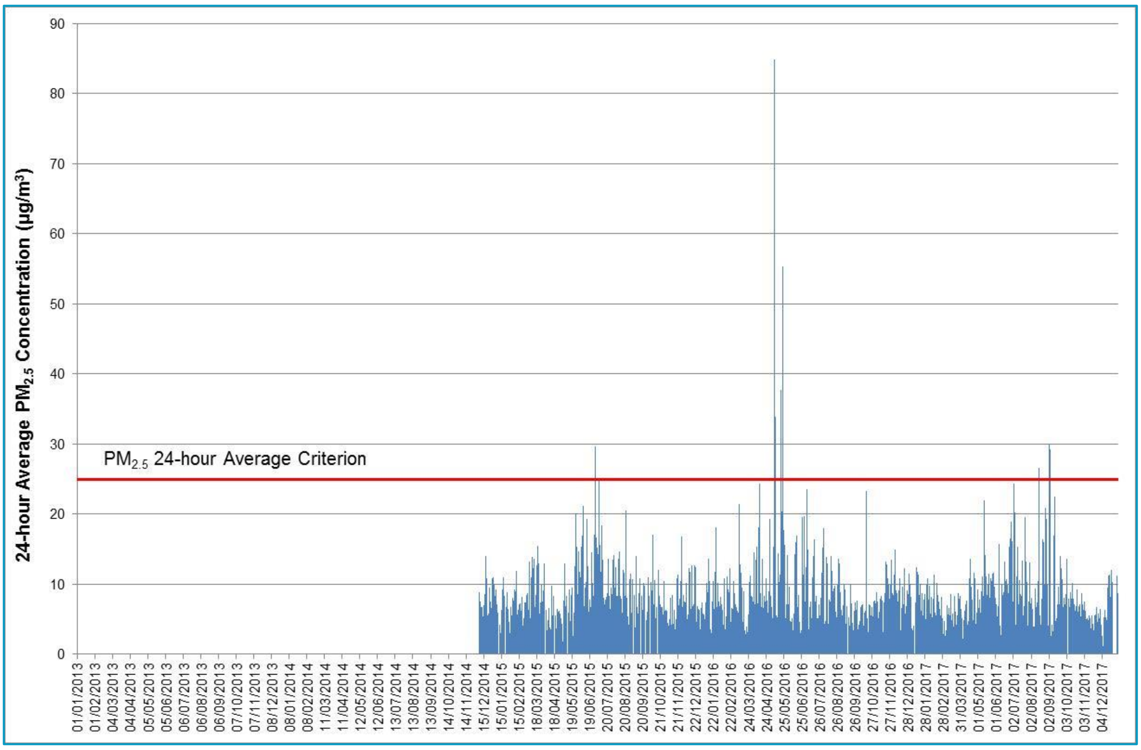
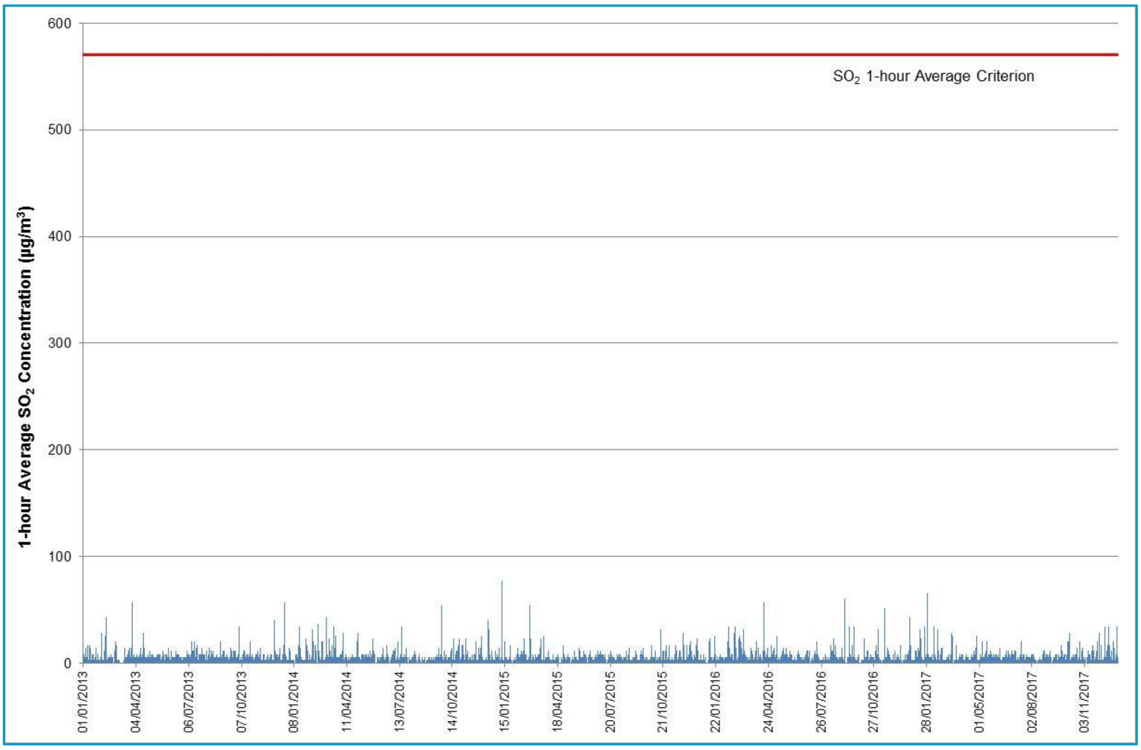


Figure 12 Measured 1-Hour Average SO_2 Concentrations at Prospect AQMS (2013 – 2017)



The monitoring data for CO, NO_2 and SO_2 indicate that the respective air quality criteria (short term and long term) for these pollutants are achieved at the Prospect AQMS site.

The monitoring data for fine particulates indicate that exceedances of the relevant short term average criterion (24-hour average) were recorded in the following years:

- 24-hour average PM_{10} concentrations were exceeded in 2013, 2015, 2016 and 2017; and
- 24-hour average $PM_{2.5}$ concentrations were exceeded in 2015, 2016 and 2017.

A summary of the duration of these exceedances and potential reason for elevated concentrations in the area are presented in **Table 5**.

Table 5 Summary of Exceedances of the Criteria for Fine Particles

Date of Exceedance	Value (µg/m³)	Comments	Source
Maximum 24-hour Average PM_{10}			
25/08/2013	50.4	Hazard reduction burn	OEH 2014
21/10/2013	81.8	Bushfire emergency	
03/11/2013	54.6	Bushfire emergency	
08/11/2013	54	Bushfire emergency	
06/05/2015	68.7	Result of a statewide dust storm that originated from the Victorian Mallee and Southern NSW regions and travelled throughout NSW during the 5 & 6 May.	OEH 2017a

Date of Exceedance	Value (µg/m^3)	Comments	Source
07/05/2016	77.5	Hazard reduction burns	OEH 2018a
08/05/2016	110.1	Hazard reduction burns	
19/05/2016	50.2	Hazard reduction burns	
22/05/2016	73.1	Hazard reduction burns	
24/09/2017	61.1	Due to exceptional events	OEH 2018b
Maximum 24-hour Average $PM_{2.5}$			
28/06/2015	29.6	No information available	OEH 2017a
07/05/2016	58	Hazard reduction burns	OEH 2018a
08/05/2016	84.9	Hazard reduction burns	
22/05/2016	55.4	Hazard reduction burns	
14/08/2017	26.6	Exceptional events	OEH 2018b
02/09/2017	30.1	Exceptional events	
03/09/2017	29.3	Exceptional events	

Note: Exceptional events are those related to bushfires, hazard reduction burns and dust storms. These are not counted towards the NEPM goal of 'no days above the particle standards in a year'.

A review of the exceedances recorded during 2013 (OEH 2014), 2015 (OEH 2017a), 2016 (OEH 2018a) and 2017 (OEH 2018b) indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns. There was no information available for the exceedance of the $PM_{2.5}$ criterion on 28 June 2015.

It has been noted the NSW EPA in their publication – Air Quality in NSW (EPA 2017b) that air quality is generally good in New South Wales based on information from the 43 station NSW Air Quality Monitoring Network. For 2013-2017, the air quality was 'very good' or 'good' for 70-85% of days in Sydney. During this time, exceedances of the national air quality standards for particle pollution have usually been associated with regional dust storms and vegetation fires.

Annual average $PM_{2.5}$ levels in Sydney are comparable to levels in other Australian cities and are low by world standards, according to a global comparison of air pollution levels conducted by the World Health Organisation (WHO) in 2016. The Australian annual average $PM_{2.5}$ standard is more stringent than standards or guideline values set by the European Union, United States and the WHO.

PM_{10} concentrations vary across years with higher levels and more exceedances occurring in bushfire and dust storm affected years. Dry El Niño years (2002–2007) have been associated with a greater frequency of bushfires and dust storms and therefore higher particle pollution levels. Lower particle pollution levels have occurred during wetter La Niña years (2010–2012). Regional dust storms, bushfires and planned burns contributed significantly to particle levels in 2009, 2013 and 2016 respectively.

8 Assessment of Dust Emissions During Construction

The key potential air pollution and amenity issues associated with demolition and 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

8.1 Construction Impact Assessment Methodology

A qualitative assessment of potential impacts of dust emissions associated with proposed demolition and construction activities at the Development Site has been performed based on the methodology outlined in the Institute of Air Quality Management (UK) document, "*Assessment of dust from demolition and construction*" (Holman et al 2014). This guidance document provides a structured approach for classifying construction sites according to the risk of air quality impacts, to identify relevant mitigation measures appropriate to the risk (see **Appendix A** for full methodology).

Modelling of fugitive dust emissions from construction projects has limitations due to the highly variable nature of dust generation. The locations of dust sources and magnitude of dust emissions are more likely to vary over the life of the project compared to a mine or quarry, for example, where activity levels, source locations and associated emissions are more likely to remain consistent. It is therefore standard practice to perform modelling assessments for construction projects based on conservative assumptions of peak construction activity levels.

The fugitive dust emission factors available in the literature are also based on monitoring programmes performed at coal and metalliferous mines and the scale of equipment, haul road design and other factors can be expected to be significantly different compared to a construction site. As a result of both these factors, modelling of fugitive dust emissions from construction sites can generally be expected to result in conservative over-estimates of actual impacts.

The IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures, and has been accepted by regulators across all states and territories for a variety of construction projects.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

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

8.2 Step 1 – Screening Based on Separation Distance

As noted in **Section 2**, the nearest sensitive receptor is located approximately 480 m from the nearest Development Site boundary.

Even though the sensitive receptors are located beyond 350 m from the boundary of the site and less than 50 m from the route used by construction vehicles on public roads, it is deemed that the nearest sensitive receptor is located within 500 m from the site entrance, therefore further assessment is required.

8.3 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 have been categorised as presented in **Table 6**.

Table 6 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Demolition	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. *A total of 3 residential buildings and 2 rainwater tanks are to be demolished. The total area for residential buildings and rainwater tanks is estimated to be 3,200 m^2. Assuming average height of 6 m, equates to a total volume of ~19,200 m^3.*
Earthworks	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. *Total area where the earthworks will be undertaken at the Development Site is estimated to be approximately 336,287 m^2* (**Section 2**).
Construction	Large	Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting. *The total volume of new buildings is estimated to be approximately 1,655,000 m^3. This is based on total building area of 165,500 m^2 and average height of 10 m.*
Trackout	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. *The traffic volume during construction is estimated to be 35 vehicle movements per hour.*

8.4 Step 2b – Risk Assessment

8.4.1 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 *high* for health impacts and *high* for dust soiling, as they include residential areas where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

8.4.2 Sensitivity of an Area

As noted in **Section 2**, the nearest sensitive receptor is located approximately 480 m from the nearest Development Site boundary.

Based on the classifications shown in **Table A2** and **Table A3** in **Appendix A**, the sensitivity of the area to dust soiling and health effects maybe classified as '*low*' and '*low*' respectively. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 18.4 µg/m^3 recorded at Prospect AQMS (see **Section 7**) and the anticipated number of sensitive receptors present in the vicinity of the Development Site.

8.4.3 Risk Assessment

Given the sensitivity of the general area is classified as '*low'* for dust soiling and *'low'* for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 6**, the resulting risk of air quality impacts is as presented in **Table 7**.

Table 7 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

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

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

8.5 Step 3 - Mitigation Measures

Even though the risks associated with the construction of the Development Site is likely to be low, it is recommended that a number of mitigation measures are implemented to minimise potential risks at the surrounding sensitive receptors.

Table 8 lists the relevant mitigation measures designated as *highly recommended* (H) or *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 proposed 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 8 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, during periods of greater likelihood of dust generation.	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	Where appropriate, 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	Keep site fencing, barriers and scaffolding clean using wet methods.	D
4.4	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
4.5	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 15 kmph on surfaced and 10 kmph 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 (such as regular water carts along main unsealed road), subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	D

6	Operations	
6.1	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.2	Use enclosed chutes and conveyors and covered skips	H
6.3	Minimise drop heights from loading shovels and other loading or handling equipment anduse fine water sprays on such equipment wherever appropriate	H
7	Waste Management	
7.1	Avoid bonfires and burning of waste materials.	H
7.2	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H
7.3	Avoid explosive blasting, using appropriate manual or mechanical alternatives	H
7.4	Refer to Waste Management Plans recommendations for management measures on onsite waste management.	H
8	Trackout	
8.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	D
8.2	Avoid dry sweeping of large areas.	D
8.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
8.4	Record all inspections of haul routes and any subsequent action in a site log book.	D
8.5	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

8.6 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 9**.

Table 9 Residual Risk of Air Quality Impacts from Construction

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

The mitigated dust deposition and human health impacts for earthworks activities are anticipated to be *negligible*. 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.

9 Conclusion

SLR was commissioned by WSPT to prepare an AQIA for the proposed Stage 1 development of an industrial business hub to be located adjacent to the Light Horse Interchange in the Eastern Creek area (the Development Site).

The aim of this AQIA is to determine the potential air quality risks associated with the concept and Stage 1 construction of the Development Site.

Available meteorological data from nearest meteorological station located at Horsley Park AWS have been examined to provide an estimate of the prevailing wind environment in the local area. This review indicated that:

- Winds that would blow fugitive dust emissions from the demolition/construction works towards the nearest sensitive receptors located to the north and northwest of the proposed construction activities occur rarely during autumn and winter, and are more likely to occur during summer and spring.
- The long term wind and rainfall patterns suggest that the construction at the Development Site have the greatest potential to impact on surrounding sensitive receptors during the months of May (autumn), and July (winter) to October (spring). Additional controls may be required (higher levels of watering for example) if construction occurs at these times.

The off-site impacts associated with dust deposition and suspended particulates during the construction phase are anticipated to be *low*. However a range of mitigation measures have been recommended for consideration as part of the CEMP to reduce the risks to negligible level.

Based on the above, it is concluded that any adverse risk at nearby residential receptors due to air emissions from the Stage 1 construction of the Development Site is anticipated to be minimal and can be appropriately managed.

10 References

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- EPA 2018, Local Government Air Quality Toolkit, Module 3 – Guidelines for Managing Air Pollution, Part 3 – Guidance Notes for Construction Sites, available online at https://www.epa.nsw.gov.au/your-environment/air/air-nsw-overview/local-government-air-quality-toolkit, accessed on 17 July 2018.
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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 $\mu g/m^3$ 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 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), **Table A5** (track-out) and A6 (demolition) 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

Table A6 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

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