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Minchinbury Employment Park

60 Wallgrove Road, Eastern Creek

Air Quality Impact Assessment

Report Number 610.14984-R1

27 May 2015

Mirvac
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Air Quality Impact Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street Lane Cove NSW 2066 Australia

(PO Box 176 Lane Cove NSW 1595 Australia)
T: 61 2 9428 8100 F: 61 2 9427 8200
E: sydney@slrconsulting.com www.slrconsulting.com

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DOCUMENT CONTROL

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Executive Summary

A qualitative assessment of the potential impacts on air quality resulting from the construction and operation of the Minchinbury Employment Park has been performed.

Current concentrations of air pollutants measured in the local area have been examined and compared to relevant NSW EPA air quality criteria. Local weather conditions have also been examined to determine potential dispersion conditions at the site.

Based on the qualitative assessment of the potential impacts of the proposed development, it is concluded that impacts during the construction phase would be appropriately managed through the implementation of a Construction Dust Management Plan and implementation of a number of mitigation measures.

During operation of the proposed development, it has been demonstrated that only a very minor increase in vehicle traffic (~1%) is anticipated on roads close to nearby sensitive receptors, and given the current air quality environment would represent a negligible impact on these receptors.

It is not considered that any further quantitative assessment of air quality impacts is required.

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1 INTRODUCTION

The proposed Minchinbury Employment Park (the Project site) is located at 60 Wallgrove Road, Eastern Creek within the Blacktown City Council Local Government Area. It is located in the Western Sydney Employment Area (WSEA) on approximately 22 hectares (ha) of land at the intersection of the M4 and M7 Motorways.

The Project site is located adjacent to:

- The Pinegrove Memorial Park Lawn Cemetery to the north and east which adjoins low density residential development on Eskdale Street approximately 270 metres (m) from the northern boundary of the Project site.
- The M4 Motorway and Minchinbury Reservoir to the south.
- Wallgrove Road and the M7 Motorway to the west. Rural residential dwellings on Pikes Lane are located to the west of the M7 Motorway, approximately 310 m to the west of the Project site.

The Project site is currently leased by the Commonwealth from Mirvac and is utilised as the Sydney Quarantine Station operated by the Australian Quarantine and Inspection Service (AQIS). The Project site currently comprises of a number of covered greenhouses and warehouses, detention basins, water tanks, on-site at-grade car parking and an internal road network.

The Project site and surrounding land uses are presented in **Figure 1** which indicates the current state of the land use and extent of development.

Figure 1 Project Site Location

1.1 Proposed Development

1.1.1 Background

Concept Plan Approval (CPA) MP 09_0099 was granted by a delegate of the (then) Minister for Planning on 29 June 2010 for the:

- Subdivision of the Project site and bulk earthworks.
- Development of warehouses, distribution centres, light industry, office premises, high technology uses, freight logistics and associated infrastructure, consisting of lots of 0.4-1ha, 65% coverage, minimum frontage of 45 m and heights of 15-20 m and 24 hour per day, seven day per week operations.
- Provision of infrastructure including internal roads, detention basins, landscaping, and intersection improvements on Wallgrove Road.

Since this approval, the CPA has been the subject of three modifications:

- Modification No. 1 (MOD1) extended the requirement for the CPA to be entered into prior the release of any subdivision or occupation certificate and was approved by a delegate of the Minister on 4 July 2011.
- Modification No. 2 (MOD2) extended the lapse date of the approval to 1 October 2016 and was approved by a delegate of the Minister on 13 December 2013.

- Modification No. 3 (MOD3) provides for larger industrial buildings with the flexibility of being split into multiple tenancies, a modified internal road layout, repositioning of the Wallgrove Road intersection, and a revised approach to onsite stormwater management. Mod 3 was approved by a delegate of the Minister on 5 March 2015.

A Stage 1 Infrastructure Works development application (DA 13-683) was approved by Blacktown Council on 26 August 2013. This development application approved the provision of essential lead-in services and infrastructure works including a new signalised intersection, road works, sewer connection, water main connection, electrical and communications connections. The Stage 1 infrastructure works approval does not provide for any works on the site (apart from works required to build the new signalised intersection on Wallgrove Road).

1.1.2 Proposal

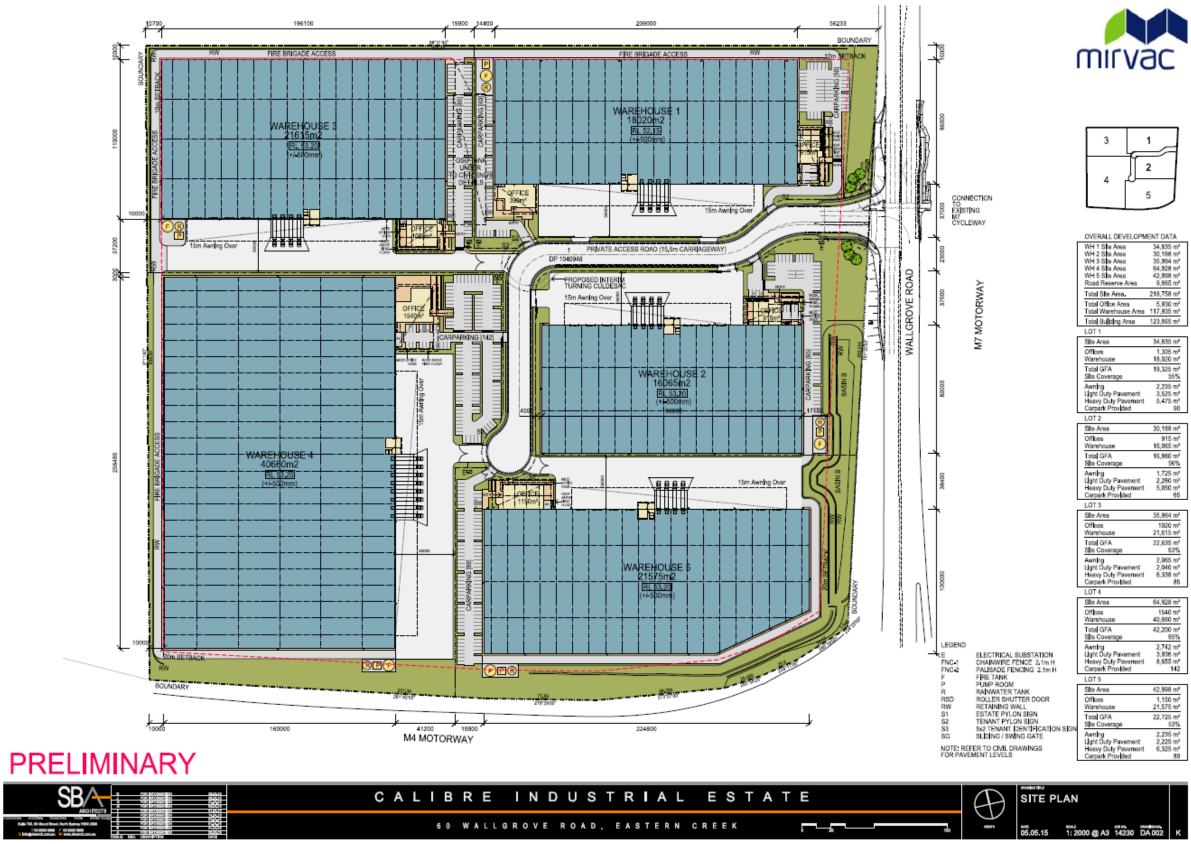
This proposal seeks development approval to develop the Project site pursuant to Concept Plan Approval MP 09_0099, being for the following key components:

- Demolition of all existing structures on the site;
- Clearance of all vegetation on the site;
- Bulk earthworks across the site;
- Construction of multiple warehouse structures and distribution-related facilities across the site;
- Construction of reticulated site services and site infrastructure, including on-site stormwater detention structures;
- Construction of the internal access road that will be capable of accommodating both heavy and light vehicles;
- Construction of lead-in services including electricity, sewer and potable water; and
- Construction of a new traffic signalised intersection at Wallgrove Road to provide entry into the site.

The masterplan currently approved by Concept Plan MOD 3 is shown in **Figure 2**. This masterplan has since been developed further in response to market demand, resulting in a minor alteration to the layout of the site, as shown in the current masterplan illustrated in **Figure 2**.

The masterplan includes five warehouses of between 16,065 m^2 to 40,660 m^2. A private access road will service the Project site, accessed from Wallgrove Road to the east of the development. The potential impacts of the operation of the development on traffic flows to/from the site have been addressed in a report prepared on behalf of Mirvac by Transport and Traffic Planning Associates (May 2015). Further discussion of the findings and implications of this assessment with regard to air quality is provided in **Section 4.2**.

Figure 2 Proposed Site Layout



Source: Mirvac, May 2015

This proposal will seek to concurrently modify the Concept Plan to reflect the modified site layout. This layout may be subject to further refinement.

1.2 Approach to Air Quality Impact Assessment

The objectives of this Air Quality Impact Assessment (AQIA) include:

- Review of proposed Project information including site layouts and identification of nearby sensitive receptors.
- Review appropriate background air quality data from the nearest/most relevant air quality stations to determine the existing ambient air environment.
- Qualitative assessment of potential air emissions sources for both construction and operational phases of the Project.
- Review existing data from the most appropriate Bureau of Meteorology (BoM) monitoring station to determine existing meteorological conditions at the Project site and determine potential dispersion patterns.
- Provide a qualitative assessment of construction phase impacts, including particular matter emissions and mobile vehicle emissions.
- Provide a qualitative assessment of operational phase impacts.
- On basis of qualitative assessment, recommend construction and operational management measures to minimise or mitigate potential air quality impacts on sensitive receptors.

2 ADOPTED STANDARDS AND GUIDELINES

State air quality guidelines adopted by the NSW EPA are published in the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005) (hereafter 'the Approved Methods').

The guidance provided in the Approved Methods has been consulted during the preparation of this assessment report. The Approved Methods lists the statutory methods that are to be used to assess the emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Proposal. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC and WHO). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

2.1 Particulate Matter

2.1.1 Particulates as TSP, PM_{10} and $PM_{2.5}$

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms "dust" and "particulates" are often used interchangeably. The term "particulate matter" refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3) (NHMRC, 1996).

The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

Emissions of particulate matter less than 10 µm and 2.5 µm in diameter (referred to as PM_{10} and $PM_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 50 µg/m^3; and
- an annual average of 30 µg/m^3.

The Approved Methods do not set any assessment goals for $PM_{2.5}$. In December 2000, the National Environment Protection Council (NEPC) initiated a review to determine whether a national ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and
- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

The review concluded that there was sufficient community concern regarding $PM_{2.5}$ to consider it an entity separate from PM_{10}.

As such, in July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting the following Interim Advisory Reporting Standards for $PM_{2.5}$ (NEPC, 2003):

- a 24-hour average concentration of 25 µg/m^3; and
- an annual average concentration of 8 µg/m^3.

It is noted that the NEPM Advisory Reporting Standards relating to $PM_{2.5}$ particles are reporting guidelines only at the present time and not intended to represent air quality criteria. A summary of the particulate guidelines is shown in **Table 1**.

Table 1 EPA Goals for Particulates

Pollutant	Averaging Time	Goal
TSP	Annual	90 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 (interim advisory reporting standard only) 8 µg/m^3 (interim advisory reporting standard only)

Source: (NSW DEC, 2005), (NEPC, 2003)

2.1.1.1 Potential Changes to the Ambient Air Quality NEPM

On 29 April 2014, Environment Ministers signalled their intent to vary the Ambient Air Quality NEPM based on the latest scientific understanding of the health risks resulting from airborne particulate pollution. The variation to the Ambient Air Quality NEPM was the subject of consultation with the wider affected community until 10 October 2014 although the standards presented in **Table 2** have been proposed as a potential ‘preferred option’ (NEPC, 2014).

Table 2 Proposed Variation to the Ambient Air Quality NEPM

Metric	Averaging Period	Current Standard	Options for Standard	Allowed Exceedances
PM_{10}	Annual average	None	No standards with consideration of 20 µg/m^3	N/A
	24-hour mean	50 µg/m^3	50 µg/m^3, with consideration of 45 µg/m^3 and 40 µg/m^3	See note below
$PM_{2.5}$	Annual average	8 µg/m^3 (advisory)	8 µg/m^3	N/A
	24-hour mean	25 µg/m^3 (advisory)	25 µg/m^3	See note below

Source: (NEPC, 2014)

The four options for the form of the 24-hour standards, and specifically the treatment of exceedances, for both PM_{10} and $PM_{2.5}$ are as follows:

- Business as usual option; a rule that allows a fixed number of exceedances of a PM standard in a given year, with no exclusion of data for exceptional events.
- A rule that allows a fixed number of exceedances of a PM standard in a given year, but with exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, with no exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, but with exclusion of data for exceptional events.

It has been identified by the NEPC that it is likely that jurisdictions will want to identify local issues that affect the form of the standards and therefore the options for this standard were left open for the consultation phase, which closed in October 2014.

For the purposes of this assessment, discussion is provided on the basis of an adopted annual average PM_{10} concentration of 20 µg/m^3 and adoption of the current advisory $PM_{2.5}$ standards (24-hour and annual average).

Limited discussion is provided on the potential 24-hour PM_{10} standard of 40 µg/m^3 (in addition to the current standard of 50 µg/m^3). Only limited discussion is provided as the current background PM_{10} concentrations in the local area are already shown to be in exceedance of the potential 40 µg/m^3 criterion and the adopted standard will likely require consideration of this.

2.1.2 Particulates (as Deposited Dust)

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m^2/month).

Table 3 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 3 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

Source: (NSW DEC, 2005)

2.2 Odour

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

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

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

- *Odour Quality*: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.

- *Source characteristics:* whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- *Health Effects:* whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

Where a number of the factors above simultaneously contribute to making an odour “offensive”, an odour goal of 2 OU at the nearest residence (existing or any likely future residences) is appropriate, which generally occurs for affected populations equal or above 2,000 people. The NSW OEH Air Policy Unit has historically taken the view that the Sydney Metropolitan region is a contiguous urban area for the purposes of odour assessment, thus recommending the implementation of an odour impact criterion of 2 OU.

The Approved Methods states that the impact assessment criteria for complex mixtures of odorous air pollutants must be applied at the nearest existing or likely future off-site sensitive receptor(s).

2.3 Combustion-related Pollutants

Emissions associated with road traffic and the combustion of automotive fuel (diesel, petrol, etc.) will include carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_x), particulates (TSP and PM_{10}), volatile organic compounds (VOCs) and lead (Pb).

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 car exhaust.

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 cars can generate particulate in the form of black soot. Particulates may also be generated due to brake and tyre wear, and road abrasion.

Vehicle exhausts can contain emissions of sulphur dioxide (SO_2) due to impurities in the fuel.

Volatile organic compounds (VOC) are emitted from the incomplete combustion of fuel. VOC emissions are reducing significantly due to the improved combustion processes offered by modern engines.

Emissions of lead (Pb) have reduced significantly with the reduction in use of leaded fuels however some cars in NSW still use leaded fuel.

The NSW OEH has established ground level air quality impact assessment criteria for air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. A summary of the relevant impact assessment criteria is given in **Table 4**.

Table 4 EPA Goals for Combustion Related Pollutants

Pollutant	Averaging Period	Concentration		Source
		(pphm)	(µg/m³)	
Sulphur dioxide (SO_2)	10 minutes	25	712	NHMRC (1996)
	1 hour	20	570	NEPC (1998)
	24 hours	8	228	NEPC (1998)
	Annual	2	60	NEPC (1998)
Nitrogen dioxide (NO_2)	1 hour	12	246	NEPC (1998)
	Annual	3	62	NEPC (1998)
Lead	Annual	-	0.5	NEPC (1998)
		ppm	**mg/m³**	
Carbon monoxide (CO)	15 minutes	87	100	WHO (2000)
	1 hour	25	30	WHO (2000)
	8 hours	9	10	NEPC (1998)

Note: Particulate criteria as presented in **Table 1**

Experience in performing assessments of the impact of combustion-related emissions determines that the principal 'indicator' pollutants from fuel combustion are NO_2 and PM_{10}, and the risk of non-compliance with the relevant criteria is typically associated with the short-term criteria rather than the annual averages.

2.4 Summary of Proposal Air Quality Goals

The air quality goals adopted for this assessment, which confirm to current EPA and Federal air quality criteria, are summarised in **Table 5**. All criteria are referenced as mass concentration.

The impact assessment criteria are required to be applied as follows:

- At the nearest existing or likely future off-site sensitive receptor.
- The incremental impact (predicted impacts due to the pollutant source alone) for each pollutant must be reported in units and averaging periods consistent with the impact assessment criteria.
- Background concentrations must be included using the procedures specified in Section 5 of the Approved Methods.
- Total impact (incremental impact plus background) must be reported as the 100th percentile (maximum) (or 99th percentile for odour) in concentration or deposition units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

Table 5 Proposal Air Quality Goals

Pollutant	Averaging Time	Goal (µg/m³)	Source
Sulphur dioxide (SO_2)	10 minutes	712	NHMRC (1996)
	1 hour	570	NEPC (1998)
	24 hours	228	NEPC (1998)
	Annual	60	NEPC (1998)
Nitrogen dioxide (NO_2)	1 hour	246	NEPC (1998)
	Annual	62	NEPC (1998)
Lead	Annual	0.5	NEPC (1998)
PM_{10}	24 hours	50	NEPC (1998)
	Annual	30	EPA (1998)
$PM_{2.5}$	24 hours	25	NEPC (2003)
	Annual	8	NEPC (2003)
TSP	Annual	90	NHMRC (1996)
		Goal (g/m²/month)	
Deposited dust	Annual	2 (maximum increase in deposited dust level) 4 (maximum total deposited dust level)	NERDDC (1988)
		Goal (mg/m³)	
Carbon monoxide (CO)	15 minutes	100	WHO (2000)
	1 hour	30	WHO (2000)
	8 hours	10	NEPC (1998)
		Goal (OU)	
Odour	Nose response time	2 (99th Percentile)	EPA (2001)

Source: The Approved Methods, NSW DEC 2005, WHO 2005.

3 EXISTING ENVIRONMENT

3.1 Baseline Air Quality Monitoring

Air quality monitoring is performed by the NSW OEH at two Air Quality Monitoring Stations (AQMS) within a 10 km radius of the Project site. Details of these stations are provided in **Table 6**.

Table 6 Details of AQMS Surrounding the Project Site

AQMS Name	Distance / Direction from Project Site	Location (km, Australian Map Grid, zone 56)		Parameters Measured	AQMS Commissioned
		Easting	Northing		
St Mary's Located off Mamre Road	7.8 km / W	293.2	6258.1	Ozone (O_3) NO, NO_2, NO_X Fine particles (by nephelometry) Fine particles (PM_{10} using a TEOM) Wind speed, wind direction and sigma theta) Ambient temperature Relative humidity	October 1992
Prospect William Lawson Park, Myrtle St	5.5 km / E	306.9	6258.7	O_3 NO, NO_2, NO_X SO_2 CO Fine particles (by nephelometry) Fine particles (PM_{10} using a TEOM) Wind speed, wind direction and sigma theta) Ambient temperature Relative humidity Solar radiation	February 2007

Note: TEOM – Tapered Element Oscillating Microbalance

Available air quality monitoring data has been obtained for each of these AQMS for the years 2010, 2011, 2012 and 2013 and is presented in **Table 7**. The 1-hour, 8-hour and 24-hour values shown are maximum concentrations recorded for each pollutant for the relevant averaging period in each year. Also shown is the percentage of the appropriate criterion represented by each measured value.

It can be seen that for NO_2, SO_2 and CO, the maximum measured values represent between 4% and 42% of the relevant criteria. Particulate matter (PM_{10}) measurements are closer to criteria values and are shown to exceed these values in some instances. Exceedances of particulate matter criteria are often due to regional dust and haze events.

No monitoring of odour, lead, TSP, $PM_{2.5}$ or deposited dust is performed in the area surrounding the Project site and existing background concentrations/levels cannot be quantified.

Table 7 Air Quality Monitoring Data – St Mary's and Prospect 2010 to 2013

Pollutant	Averaging Time	Goal (µg/m³)	St Mary's				Prospect			
			2010	2011	2012	2013	2010	2011	2012	2013
Sulphur dioxide (SO_2)	1 hour	**570**	-	-	-	-	51.5 (9%)	40.0 (7%)	34.3 (6%)	57.2 (10%)
	24 hours	**228**	-	-	-	-	11.4 (5%)	8.6 (4%)	8.6 (4%)	11.4 (5%)
	Annual	**60**	-	-	-	-	2.9 (5%)	2.9 (5%)	2.9 (5%)	2.9 (5%)
Nitrogen dioxide (NO_2)	1 hour	**246**	73.8 (30%)	73.8 (30%)	88.2 (36%)	75.9 (31%)	88.2 (36%)	80.0 (33%)	102.5 (42%)	100.5 (41%)
	Annual	**62**	12.3 (20%)	12.3 (20%)	10.3 (17%)	10.3 (17%)	24.6 (40%)	20.5 (33%)	20.5 (33%)	22.6 (36%)
PM_{10}	24 hours	**50**	***52.1*** (***104%***)	***73.9*** (***148%***)	34.3 (69%)	***93.0*** (***186%***)	40.1 (80%)	41.5 (83%)	38.7 (77%)	***81.8*** (***164%***)
	Annual	**30**	15.1 (50%)	14.7 (49%)	14.5 (48%)	16.0 (53%)	14.9 (50%)	15.1 (50%)	16.3 (54%)	17.6 (59%)
Carbon monoxide (CO)	8 hours	**10**	-	-	-	-	2.4 (24%)	2.1 (21%)	2.3 (23%)	2.0 (20%)

Note: All values are presented as µg/m³ with the exception of CO which is presented as mg/m³. Values in exceedance of the stated criterion are highlighted in ***bold red***.

3.2 Local Meteorology

Long-term meteorological data are available from the Bureau of Meteorology (BOM) station located at Horsley Park Equestrian Centre, located 6.2 km to the south of the Project site. The station has data available from 1997 to 2015 for the following parameters:

- Temperature (°C);
- Rainfall (mm);
- Relative humidity (%); and
- Wind speed (m/s) and wind direction (degrees).

A review of the long term data collected is provided in the following sections.

3.2.1 Temperature

Long-term temperature statistics for Horsley Park Equestrian Centre are summarised in **Figure 3**.

Mean maximum temperatures range from 17.2°C in winter to 29.8°C in summer, while mean minimum temperatures range from 5.9°C in winter to around 17.8°C in summer. Maximum temperatures above 40°C and minimum temperatures less than -2°C have been recorded.

3.2.2 Rainfall

Long-term rainfall statistics for Horsley Park Equestrian Centre are summarised in **Figure 4**.

Mean rainfall is relatively high in summer, reducing from autumn to winter with the lowest average of 36.1 mm recorded during September. This month also recorded an average of around eight rain days per month. The highest rainfall was recorded in June 2007.

Figure 3 Long Term (1997-2015) Temperature Data for Horsley Park Equestrian Centre

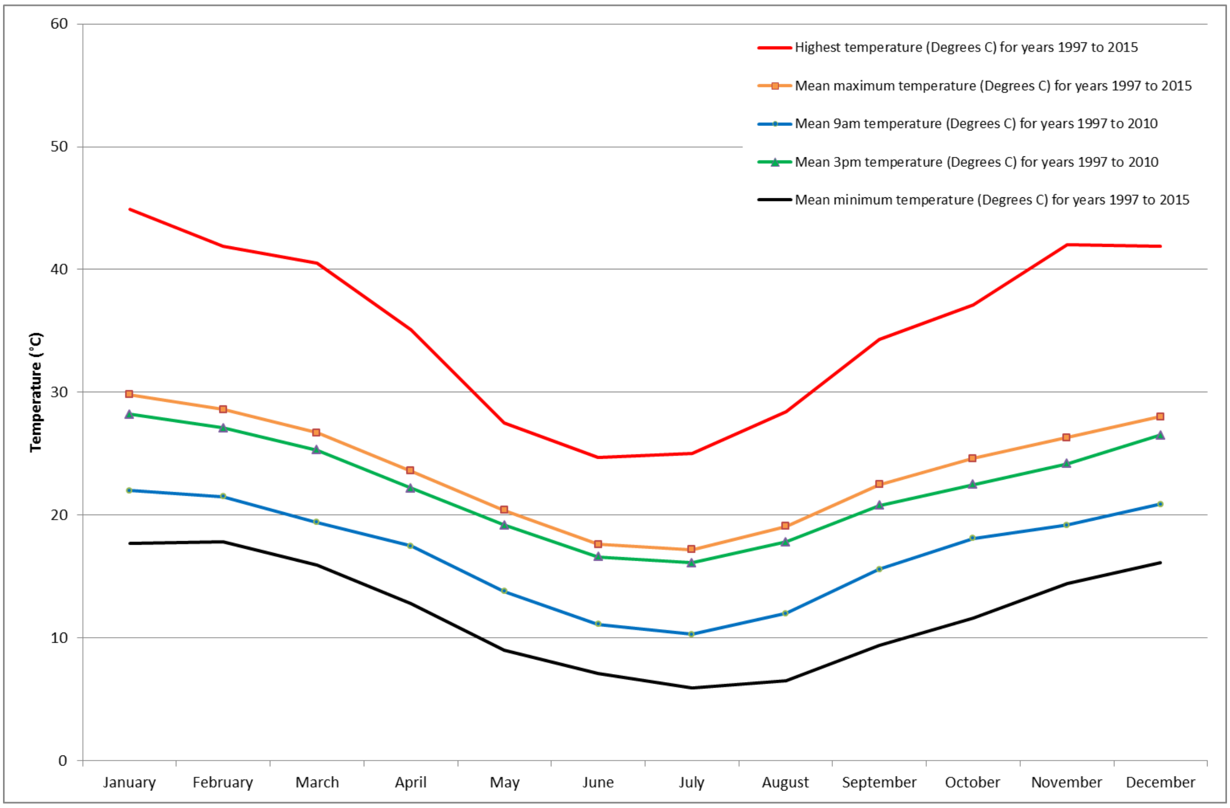
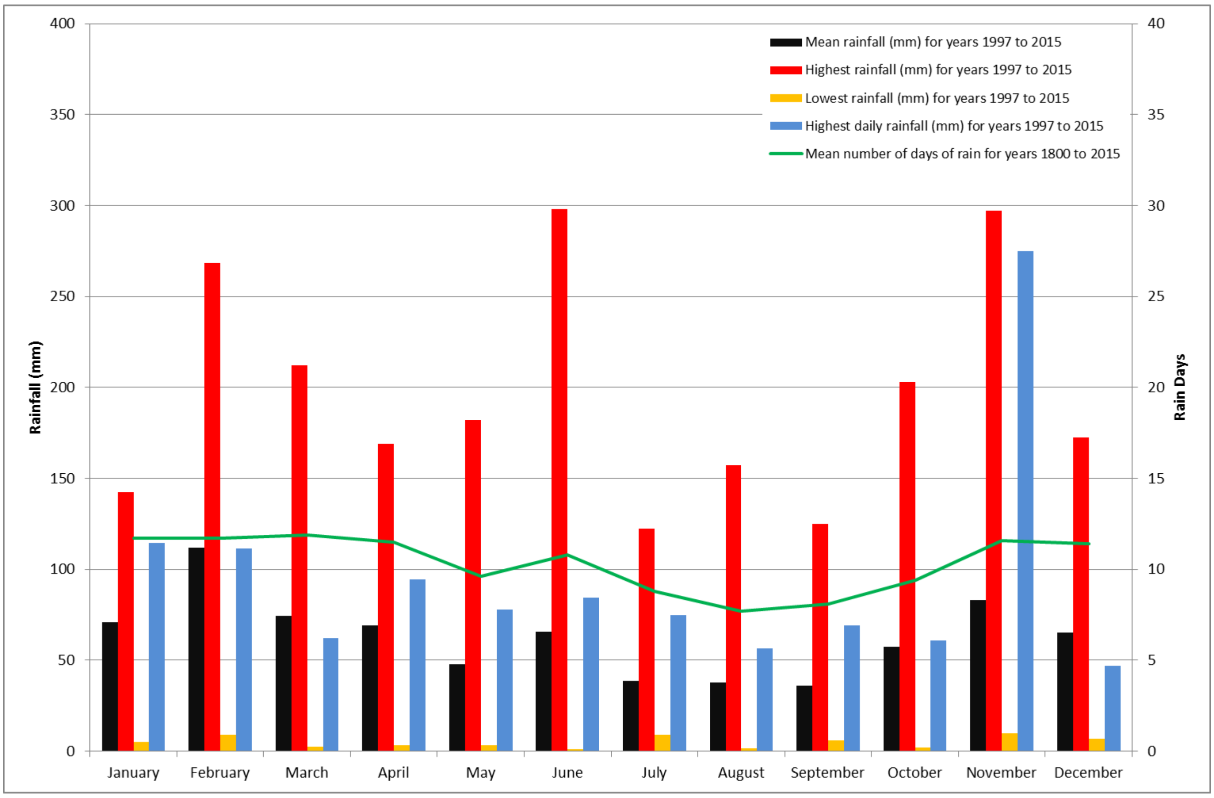


Figure 4 Long Term (1997-2015) Rainfall Data for Sydney Olympic Park



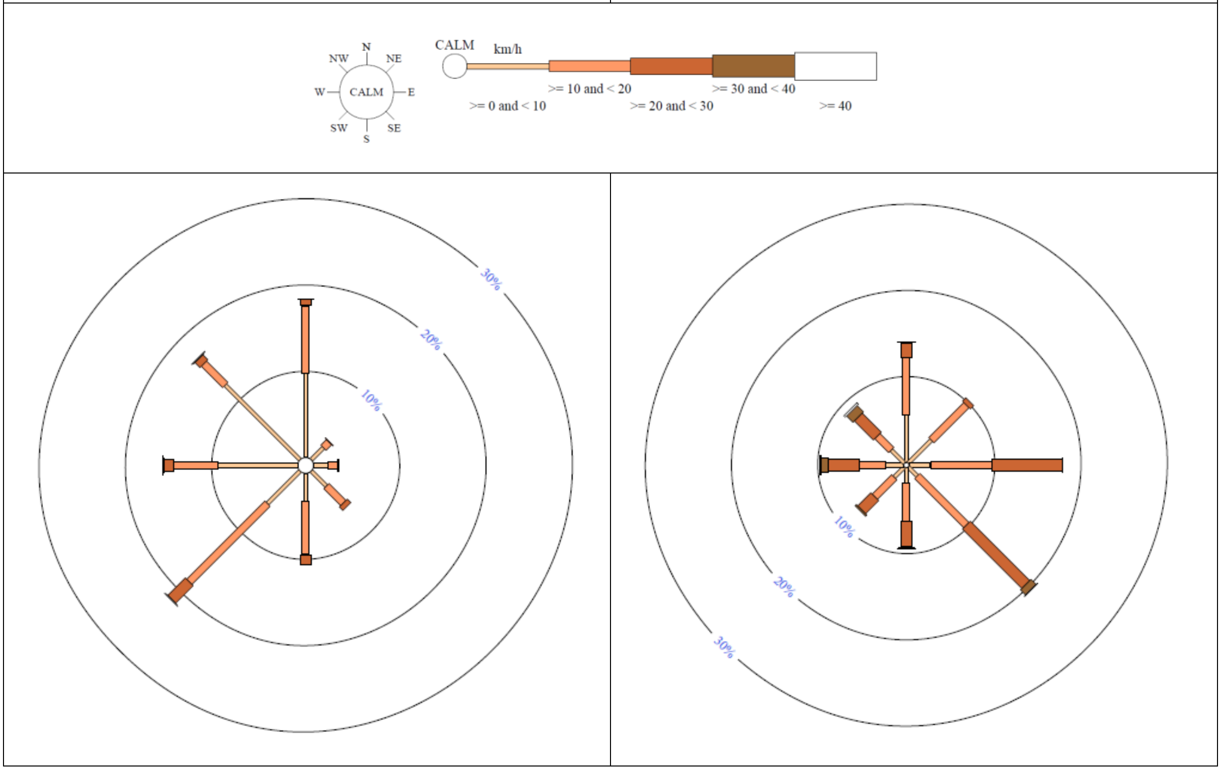
3.2.3 Wind Speed and Direction

Long term wind data (9 am and 3 pm) for Horsley Park Equestrian Centre are presented as windroses in **Figure 5**.

The windroses show that winds from the southwestern quadrant are predominant in the morning and winds from the southeastern quadrant are predominant in the afternoon periods.

Figure 5 Rose of Wind Direction vs Wind Speed (km/hr) at Horsley Park Equestrian Centre (1997-2015)

9 AM	3 PM



Based on the review of long term climate statistics for the local area, emissions of air pollutants from the proposed development during construction and operation may be expected to be transported towards the receptors on Pikes Lane more predominantly during the morning, and towards receptors on Eskdale Street more predominantly during the afternoon.

Material located in stockpiles, areas worked by equipment and exposed areas are more likely to become a source of particulate emissions in the summer months, when temperatures are higher. However, higher mean rainfall totals in the summer months may also provide some level of mitigation.

Site specific management measures as outlined in **Section 4.1.3** should be adopted.

4 POTENTIAL AIR QUALITY IMPACTS OF THE PROPOSAL

Impacts upon air quality in the area surrounding the Project site may be anticipated during both the construction and operational phases. The following sections outline a qualitative approach to the assessment of these potential risks.

In the absence of detailed information on the construction schedule, a qualitative risk based approach to assess the potential for construction-phase impacts has been undertaken and is presented in **Section 4.1**. A qualitative assessment of the risks associated with Project operation has also been performed and is presented in **Section 4.2**. Given the nature of the development, it is considered that air quality impacts during construction works would present a greater risk to health and amenity than those during ongoing operation.

4.1 Construction Phase

The proposed construction works would involve:

- Demotion of all existing structures on the site;
- Clearance of all vegetation on the site;
- Bulk earthworks across the site;
- Construction of multiple warehouse structures and distribution related facilities across the site;
- Construction of reticulated site services and site infrastructure, including on-site storm water detention structures;
- Construction of the internal access road that will be capable of accommodating both heavy and light vehicles;
- Construction of lead-in services including electricity, sewer and potable water; and
- Construction of a new traffic signalised intersection at Wallgrove Road to provide entry into the site.

The following qualitative risk-based assessment has been performed to determine the potential risks of construction (including demolition works) on air quality at nearby sensitive receptors.

The full risk assessment methodology adopted for use in this AQIA is detailed in **Appendix A**. The overall approach is described below.

4.1.1 Construction Air Quality Risk Assessment Methodology

Construction works, such as the demolition of structure, vegetation clearance and bulk earthworks and construction of the warehouse structures, will result in the generation of fugitive dust emissions. These emissions have the potential to result in elevated TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates in the vicinity of the works. Elevations in emissions of combustion related pollutants due to site vehicle operations would also be anticipated but operations due to construction activities of the scale proposed would generally be limited by impacts of dust.

For this assessment, *IAQM Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) developed in the United Kingdom by the Institute of Air Quality Management (IAQM) has been used to provide a qualitative assessment method. The IAQM method uses a five-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:
    - a the scale and nature of the works, which determines the potential dust emission magnitude; and

b 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.

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 of the assessment provides "dust emissions magnitudes" for each of four dust generating activities; demolition, earthworks, construction, and trackout. The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for demolition, earthworks and construction activities, which are most relevant to this Project, are as follows:

- Demolition:
  - ***Large***: Total building volume greater than 50,000 m^3, demolition activities greater than 20 m above ground, onsite crushing and screening activities or demolition of potentially dusty construction materials.
  - ***Medium***: Total building volume between 20,000 m^3 and 50,000 m^3, demolition activities between 10 m and 20 m above ground or demolition of potentially dusty construction materials.
  - ***Small***: Total building volume less than 10,000 m^3, demolition activities lower than 10 m above ground, demolition performed during wetter months or demolition of construction materials with low potential for dust release.
- Earthworks:
  - ***Large***: Total site area greater than 10,000 m^2, potentially dusty soil type (e.g., clay, which will be prone to suspension when dry to due 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 (e.g., 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 (e.g., sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.
- Construction:
  - ***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 (e.g., concrete), piling, on site concrete batching.
  - ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (e.g., metal cladding or timber).

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.
- 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 to be classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors have not been addressed in this assessment). The IAQM methodology provides the following guidance on the sensitivity of different receptor types to dust soiling and health effects (IAQM, 2014). This guidance is summarised in **Table 8**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Based on the criteria listed in **Table 8**, the sensitivity of the identified receptors in the study area (dwellings) is concluded to be of *high* sensitivity for health impacts and *high* sensitivity for dust soiling, based upon the following assumptions:

- The identified sensitive receptor locations are dwellings where members of the local community have the potential to be exposed to PM_{10} levels for eight hours (or more) in a day.
- In general, the local population could reasonably expect a high level of amenity (i.e. low annual average TSP concentrations and dust deposition rates) given the medium level vegetated nature of the area which would result in little natural wind-blown dust and low background dust levels.
- Given the location and nature of the receptors, the properties would not reasonably be expected to be significantly diminished in appearance, aesthetics or value by dust deposition.

According to the IAQM methodology, 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, the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown **Table 9**.

Table 8 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 members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where human exposure is transient.
	Examples: residential properties, hospitals, schools and residential care homes.	*Examples: office and shop workers, but will generally not include workers occupationally exposed to PM_{10}.*	*Examples: public footpaths, playing fields, parks and shopping street.*

Table 9 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.

The IAQM guidance for assessing the sensitivity of an area to health impacts is shown in **Table 10**. As noted above, for high sensitivity receptors, the methodology takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account. The classifications are also based on the air quality objectives for PM_{10} in the UK set by the Department for Environment, Food and Rural Affairs. As these objectives differ from the ambient air quality criteria adopted for use in this assessment, and given that site-specific background monitoring data are not available for the sensitive receptors considered in this assessment, the IAQM methodology has been adapted slightly, based on the adoption of conservative values for the background PM_{10} level thresholds. All receptors have been classified based on the sensitivity classifications for a background annual average PM_{10} concentration of 17.6 µg/m^3 for Prospect during 2013 as outlined in **Table 7**.

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, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table 10 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	<350
High	15-22.5 µg/m^3	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<15 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low
	-	1-10	Medium	Low	Low	Low
Low	-	>1	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.

(c) The estimated background annual average PM_{10} concentration is taken from monitoring data as outlined within **Table 7**.

On the basis of the information provided above, the sensitivity of the areas surrounding the proposed construction activities has been determined as shown in **Table 11**.

Table 11 Assessment of sensitivity of areas surrounding key construction activities

Value	Area	Sensitivity of receptors	Number of receptors	Distance from source	Sensitivity of the surrounding area
Dust soiling	Areas to the north and west of the site (eg Eskdale St)	High	>100 dwellings	~270 m from the Project site boundary	Low
	Areas to the south and east of the site (eg Pikes Lane)	High	~10-15 dwellings	~310 m from the Project site boundary	Low
Human Health	Areas to the north and west of the site (eg Eskdale St)	High	>100 dwellings	~270 m from the Project site boundary	Low
	Areas to the south and east of the site (eg Pikes Lane)	High	~10-15 dwellings	~310 m from the Project site boundary	Low

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table 12** and **Table 13** to determine the risk category with no mitigation applied. Once the risk categories are determined for each of the relevant activities, site-specific management measures (Step 3) can be identified based on whether the site is a low, medium or high risk site. Following this, the residual impact can be determined after management measures have been considered (Step 4).

Table 12 Risk category from demolition activities

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

Table 13 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

4.1.2 Risk Assessment

A preliminary risk assessment (i.e. no application of mitigation measures) has been performed for each element of the construction works using the tables presented in the preceding sections. The resultant risk ratings are presented below in **Table 14**.

Table 14 Risk of Air Quality Impacts from Demolition, Earthworks and Construction

Sensitivity of Area	Preliminary Risk		
	Demolition	Earthworks	Construction
Low	Medium Risk	Low Risk	Low Risk

The results indicate that there is a *low* to *medium* risk of adverse air quality impacts occurring at offsite receptor locations where no mitigation is applied during the demolition and construction works.

A low level risk rating does not preclude the requirement for suitable mitigation measures to be implemented during redevelopment works. The following section provides a range of appropriate mitigation measures that should be applied during the redevelopment works to ensure that all risks are minimised where ever practicable.

4.1.3 Mitigation Measures

4.1.3.1 Nuisance Dust Control Measures

Ambient dust emissions from wheel-generated dust, excavation and rehabilitation, demolition, clearing and grading, truck loading and unloading, and wind erosion areas will be the primary focus of dust control during construction works at the Project construction site. Typically, emissions from these processes can be minimised through the implementation of water spraying, particularly during periods of heavy on-site activity.

Other dust mitigation measures that may be implemented during the construction phase include:

- Removal of silt and other material from around erosion and sediment control structures to ensure deposits do not become a dust source.
- Amending dust-generating construction activities during adverse wind conditions blowing in the direction of sensitive receptors. A wind sock should be made available and be visible to all areas of an active construction site to assist in reactive response procedures (i.e. to determine when construction activities should be postponed, minimised or relocated in windy conditions).
- Minimising the use of material stockpiles and ensuring 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.
- Erecting solid screens or barriers around dusty activities or the site boundary to prevent windblown dust being transported offsite.
- Ensuring fine powder materials are delivered in enclosed tankers and stored in silos to prevent escape of material during delivery.
- Ensuring smaller bags of powder materials are sealed after use and stored appropriately.
- Minimising drop heights from loading shovels and other loading / unloading equipment and using fine water sprays on such equipment where appropriate.
- Ensuring vehicles entering/exiting the site are covered to prevent escape of materials during transport.
- Reducing vehicle speeds on site will reduce wheel generated dust.
- If dirt track out is causing problems, avoiding dry sweeping of large areas. Manual brushing of the truck's flanks and wheels could be implemented as a further precaution.

4.1.3.2 Plant and Machinery

Control measures relating to plant and machinery that may be utilised during the construction phase include:

- Ensuring vehicles and machinery are maintained in accordance with manufacturer's specifications.
- Minimising truck queuing and unnecessary trips through logistical planning of materials delivery and work practices.
- Ensure all vehicles switch off engines when stationary so that there are no idling vehicles.
- Fixed plant should be located as far from local receptors as practicable.

4.1.3.3 Fuel Storage Areas

The storage of fuels should be performed in accordance with the relevant Australian Standards. The Australian Institute of Petroleum's document, *Guidance for the Safe Above Ground Fuel Storage on Farms and Industrial Sites* (AIP GL12-2003), provides a succinct summary of the above requirements and a checklist to appraise whether the fuel storage facility is deigned and operated in compliance with the relevant Australian Standards. The Australian Capital Territory (ACT) Government has also produced a guidance document entitled *Environmental guidelines for service station sites and hydrocarbon storage* (2011), which provides further clarification and advice concerning environmental monitoring around fuel storage facilities.

Control measures that may be implemented during the construction phase will be referenced from the above AS, and will include:

- Storage areas for all liquids should be appropriately bunded.
- Spill kits including absorbing materials should be provided nearby handling and storage areas.
- Where possible, the delivery of liquid fuels should utilise reciprocal feeds, so that tank vapours are displaced into the delivery vehicle rather than being emitted to the atmosphere as a fugitive emission.
- Empty containers should be managed and disposed of in appropriate manner.

4.1.3.4 Contaminated Soils

Where there is the potential for invasive ground works to cause the emission of odorous ground vapour or contaminated dust particles, these impacts would need to be specifically addressed in the Construction Environmental Management Plan (CEMP), and an odour assessment and management procedure developed to manage the risks of off-site odour impacts and/or health impacts from the volatilisation of ground contaminants.

General odour mitigation measures and controls that may be implemented during the construction phase include:

- Restricting ground invasive works to between the hours of 7am and 6pm, Monday to Friday, and between the hours of 8am and 1pm on Saturdays.
- Keeping excavation surfaces moist.
- Using appropriate covering techniques to cover excavation faces or stockpiles.
- Use of soil vapour extraction systems and regular monitoring of discharges.

4.1.3.5 Site Management

Air emissions associated with all construction activities should also be managed through compliance with the Construction Environmental Management Plan (CEMP). The CEMP would be implemented so that:

- The works are conducted in a manner that minimises the generation of air emissions.
- The effectiveness of the controls being implemented is monitored.

- Additional measures are implemented where required.

Construction contractors should also undertake daily environmental inspections of their works and worksite. The daily environmental inspection reports should include the below observations, with remedial or corrective actions noted (as appropriate).

Any remedial or corrective actions should be reported to the Site Manager as soon as is practicable. Inspections may include, but not be limited to:

- Visual inspection of dust generation.
- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network.
- Inspection of the erosion and sediment controls.
- Inspection of the waste storage areas.
- Inspection of any rehabilitated areas (where relevant).
- Ensure all hazardous goods, including fuel and oil, are adequately stored or bunded.
- Ensure spill kits are appropriately located and stocked.

4.1.3.6 Complaints Handling

An effective complaints logging system should be maintained by Council and the Construction Contractor to monitor complaints, to effectively manage any requests for information or respond to any public concerns in relation to the proposed redevelopment activities throughout the construction phase, and to ensure identified incidents are dealt with through investigation and implementation of corrective treatments.

4.1.4 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 15**.

Table 15 Residual Risk of Air Quality Impacts from Demolition, Earthworks and Construction

Sensitivity of Area	Preliminary Risk		
	Demolition	Earthworks	Construction
Low	Negligible Risk	Negligible Risk	Negligible Risk

The mitigated dust deposition and human health impacts of Project construction works is anticipated to be *negligible*. A detailed CEMP should be constructed and implemented prior to construction works, and should include contingency plans and response procedures (eg proactive response procedures, non-compliance and continued non-compliance response procedures, complaints handling procedures) and suitable reporting and performance monitoring procedures.

4.2 Operational Phase

As discussed in **Section 1.1.2**, the current masterplan includes five warehouses of between 16,065 m^2 to 40,660 m^2.

According to Transport and Traffic Planning Associates (2015, hereafter 'the traffic report'), current annual average daily traffic (AADT) flows along Wallgrove Road (north of the M4 Motorway and parallel to Pikes Lane [~280 m from Pikes Lane])) are 39,304 and 31,827 along the Great Western Highway (north of the Project site and parallel to Eskdale St [~110 m from Eskdale St]). Based on data in Section 4.2 of the traffic report, an additional 419 vehicle trips per day would be generated on local roads by employees of the proposed development, an increase in AADT flow along Wallgrove Road and the Great Western Highway of 1.1% and 1.3%, respectively.

An increased number of vehicle trips would also be experienced due to the increase of vehicles servicing the development (eg deliveries and despatch) and although the use of each warehouse is not currently known, it is not anticipated that the increase in vehicles would represent a constraint for operation of the site.

Given that current NO_2, SO_2 and CO concentrations (as outlined in **Section 3.1**) represent between 4% and 42% of the relevant criteria, increases in traffic generated pollution of 1% are not anticipated to result in a measurable deterioration in air quality in the local area.

Exceedances of particulate matter criteria are observed in the local area, although are often due to regional dust and haze events. Addition of a minor quantity of particulate into the airshed would not represent a constraint to the operation of the development.

5 CONCLUSION

Based on the qualitative assessment of the potential impacts of the proposed development, it is concluded that impacts during the construction phase would be appropriately managed through the implementation of a Construction Dust Management Plan prior to commencing construction and implementation of the mitigation measures as outlined in **Section 4.1.3**.

During operation of the proposed development, it has been demonstrated that a very minor increase in vehicle traffic is anticipated on roads close to nearby sensitive receptors (~1%), and given the current air quality environment would represent a negligible impact on these receptors.

It is not considered that any further quantitative assessment of impacts is required.

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