Air Quality Impact Assessment

Oakdale Central

Lots 1C, 2B and Site 3

Report Number 670.10585-R2

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Air Quality Impact Assessment

Oakdale Central

Lots 1C, 2B and Site 3

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Mckenzie Group on behalf of Goodman Property Services (Aust) Pty Ltd (The Proponent) to perform an Air Quality Impact Assessment (AQIA) for the proposed development of Lots 1C, 2B and Site 3 at Oakdale Central, NSW.

The modelling has been conducted following the "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC, 2005) (hereafter the 'Approved Methods'). The requirements for conducting an AQIA, as outlined in the Approved Methods, are as follows:

- Description of local topographic features and sensitive receptor locations (**Section 2.1** and **Section 2.3** respectively).
- Establishment of air quality assessment criteria (**Section 3.2**).
- Analysis of climate and dispersion meteorology for the region (**Sections 5**).
- Description of existing air quality environment (**Section 3.3**).
- Compilation of a comprehensive emissions inventory for proposed operations (**Section 4**).
- Preparation of an air quality impact assessment report comprising the above.

Potential emissions to air from the proposed operation have been identified, and where appropriate emission rates have been estimated using relevant emission factors published in the literature. These emission rates have then been used in an air dispersion modelling study to assess the potential for any off-site air quality impacts in the surrounding area.

2 PROJECT OVERVIEW

The proponent is seeking to develop Warehouse Distribution Centres on lots 1C, 2B and 3 consistent with the building footprints approved for Oakdale Central Concept Plan (MP08_0666).

Ropes Creek forms the western extent of the Oakdale Central precinct and is separated from Lot 3 by a riparian/biodiversity reserve. Lots 1B and 2C are located immediately east of a biodiversity area comprising Ropes Crossing, which bisects the precinct in a north-south direction. Concept development plan for each lot are presented in **Appendix A**. A brief description of each site is outlined in **Table 1**.

Table 1 Development Description

Property	Description
Lot 1C	27,505 m^2 of built area comprising office (600 m^2), warehouse (26,700 m^2) and dock office (190 m^2) 169 car parking spaces (including 11 provisional) Ancillary landscaping
Lot 2B	33,025 m^2 of built area comprising warehouse (29,480 m^2), dock office (380 m^2), office (1,000 m^2), office entry (100 m^2) and gatehouse (15 m^2) 194 car parking spaces (including 40 provisional) Ancillary landscaping
Lot 3	89,295 m^2 of built area comprising warehouse (87,105 m^2), dock office (190 m^2) and office (2,000 m^2) 502 car parking spaces Ancillary landscaping

2.1 Local Setting

The site is located at Horsley Park in Fairfield, NSW and is regulated by the State Environmental Planning Policy (Western Sydney Employment Area). The site is an important regional hub for major logistics, distribution, warehousing and production industries, with strategic access to Sydney's key arterial road network including M7 and M4 motorway. The location of the site is shown in **Figure 1**.

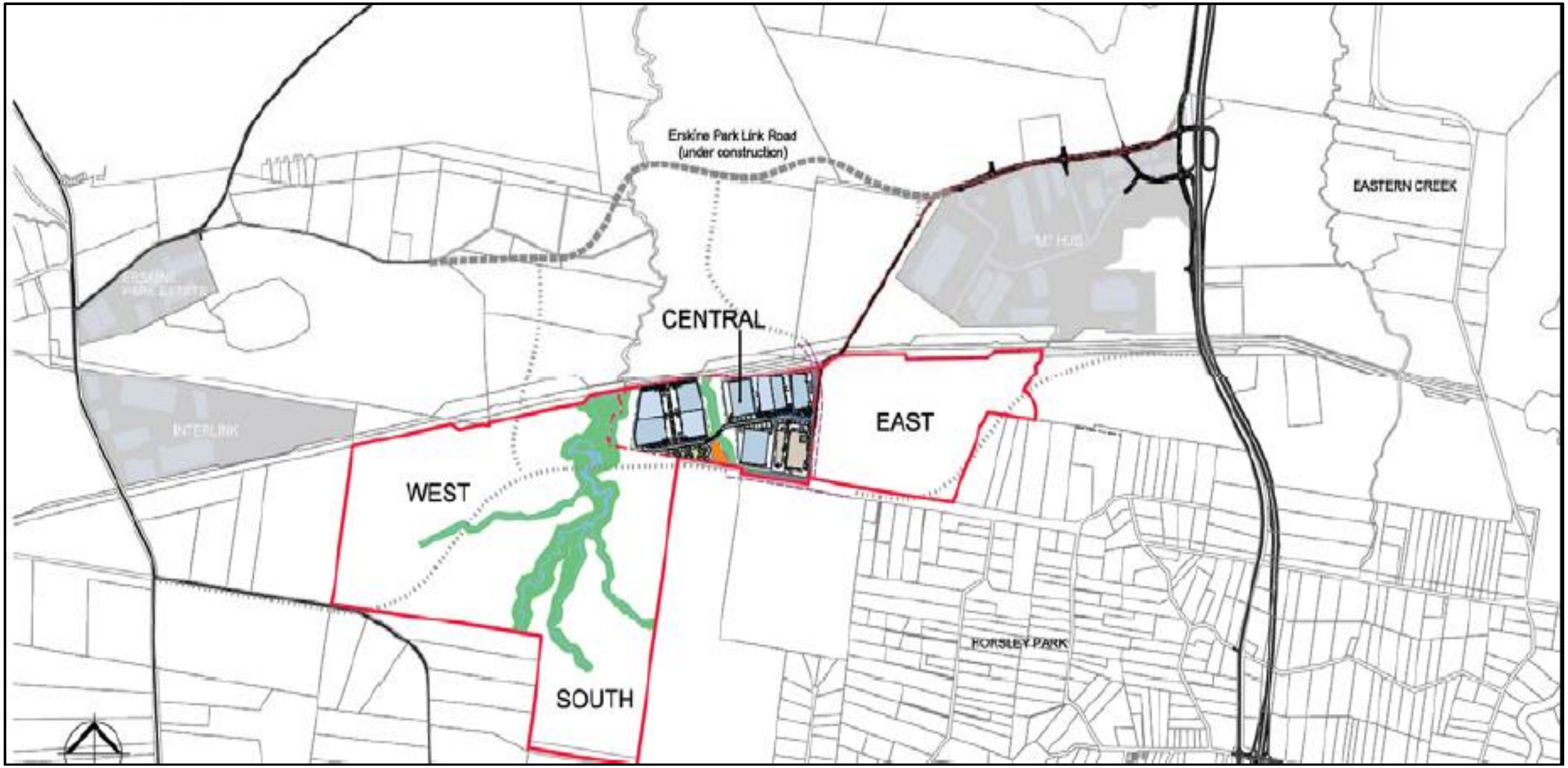
The surrounding topography of the Oakdale Central precinct is relatively flat and comprises of an area of 61.2 hectares. The site is surrounded by the following land uses.

- North: Sydney Water Supply Pipeline Corridor with Sydney West Electrical Substation and Employment Lands (DOP site 6 of the Western Sydney Employment Hub) beyond;
- East: Old Wallgrove Road with Austral's quarry/brickmaking plant beyond; and
- South: Burley Road Corridor (to be made) with CSR/PGH quarry/brickmaking plant and vacant employment land beyond.

The future character of the locality is anticipated to be of a similar industrial/employment lands character. The local context is shown in **Figure 2**.

Figure 1 Site Location

Figure 2 Local Context



2.2 Proposed Project Activities

2.2.1 Construction Phase

The construction activities will include construction of buildings and associated infrastructure, such as sedimentation basins and estate roads across the entire site.

Key construction works associated with the Project comprises of construction of four warehouses and associated infrastructure.

2.2.2 Operational Activities

Operational activities that are anticipated to occur on the proposed sites are receipt, storage and dispatch of products as part of the distribution centres' bulk warehousing and distribution services. These activities will involve:

- unloading and loading of goods via trucks and shipping containers;
- management of inventory in a racked and stacked environment;
- order fulfilment including picking and packing of finished orders for customers;
- loading of transport vehicles;
- management of product returns;
- inspection of goods for quality assurance purposes; and
- product embellishment.

Due to the nature of the proposed site operations, heavy vehicle movements will be involved in most activities. Detailed information on expected traffic movements, including vehicle category, traffic frequency for each category etc, were not available at the time of preparing this assessment report and will depend on the requirements of the future tenants. Therefore, vehicle categories and traffic data used in this assessment were estimated based on the proposed site layouts and relevant information from a similar warehouse distribution facility recently assessed by SLR (SLR, 2013). These estimated activity data for the proposed operational phase are presented in **Table 2**.

Table 2 Operational Data

Variable	Data
Proposed hours of operation	24 hours/day, 7 days a week
Anticipated number of vehicle movements per day	56 Semi-trailers 84 B-Doubles 280 Pickup and Delivery vehicle (PUDs)
Peak hourly traffic frequency	25 Semi-trailers 39 B-Doubles and 187 PUDs
Maximum on-site travel distances	3.7 km

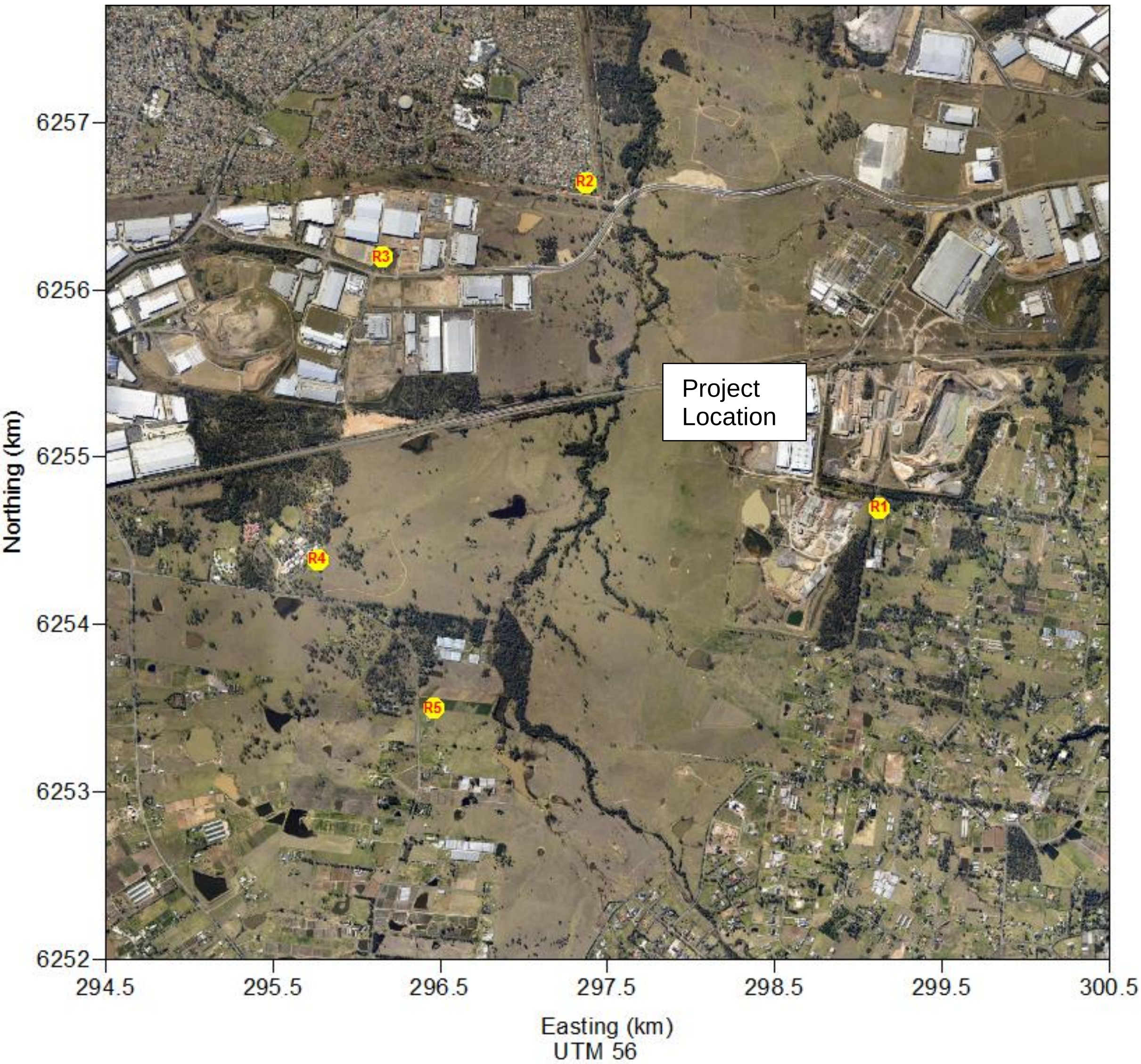
2.3 Sensitive Receptors

The site is surrounded by rural activities (grazing, market gardens etc) and rural residential houses to the southeast, south and west, residential areas to the north, extractive industries to the east and industrial zones at Eastern Creek to the north and Erskine Park to the northwest. The closest residential area is approximately 0.5 km to the southeast at Burley Road, Horsley Park. Surrounding sensitive receptors identified for this assessment are listed in **Table 3** and presented in **Figure 3**.

Table 3 List of Identified Sensitive Receptors

ID	Easting (m)	Northing (m)	Description
R1	299,124	6,254,696	315-321 Burley Road (Residential)
R2	297,367	6,256,640	Weaver Street (Residential)
R3	296,149	6,256,196	206 Lenore Lane (Residential)
R4	295,765	6,254,388	Emmaus Catholic College (Educational)
R5	296,458	6,253,501	Aldington Road (Residential)

Figure 3 Locations of Identified Sensitive Receptors



3 AIR QUALITY ENVIRONMENT

3.1 Pollutants of Interest

The main emissions to air during the construction phase will be emissions of particulate matter or dust, from clearing, demolition, excavation and material handling activities. Dust from the construction activities will be controlled using the best management practices outlined in **Section 7**.

During the operational phase, wheel-generated dust from vehicles, travelling on sealed roads and exhaust emissions from heavy vehicles idling at the site are likely to be the main sources of emissions. On this basis, particulate emissions from traffic movements on paved roads and oxides of nitrogen (NO_x) emissions from vehicle exhausts have been identified as the key pollutants of concern from the proposed operations.

3.2 Criteria Applicable to Air Quality

The NSW Office of Environment and Heritage (OEH) has established ground level air quality impact assessment criteria for key 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 impact assessment criteria relevant to this project is given in **Table 4**.

Table 4 NSW OEH Air Quality Assessment Criteria

Pollutant	Averaging Period	Concentration (µg/m³)	Source
$PM_{2.5}$	24-hours	25	NEPC (1998)
	Annual	8	NEPC (1998)
PM_{10}	24-hours	50	NEPC (1998)
	Annual	30	EPA (1998)
Total suspended particulates (TSP)	Annual	90	NHMRC (1996)
NO_2	1-hour	246	NEPC (1998)
	Annual	62	NEPC (1998)

3.3 Background Air Quality

In order to perform a cumulative impact assessment, data from the nearest OEH ambient air quality monitoring site, located approximately 5 km northwest of the proposed site at St. Marys, was used in this assessment. Due to its close proximity to the project site, the ambient environment at the selected monitoring site is likely to be similar to the environment surrounding the project site and has therefore been considered as representative of background levels for this assessment. Ambient monitoring data for the 2011 calendar year was used for this assessment.

The 24-hour average PM_{10} concentrations recorded during 2011 at the St. Marys monitoring site are presented in **Figure 4**. The data shows that the highest 24-hour average PM_{10} concentration at the St. Marys monitoring site was 73.9 µg/m³ recorded on 17th September 2011. The second highest 24-hour average PM_{10} concentration was 37.6 µg/m³ recorded on 2nd February 2011. Further investigation showed that controlled hazard-reduction burns were conducted by the NSW Rural Fire Service in Blue Mountains area on 16th and 17th September 2011, which may have contributed to the elevated PM_{10} level recorded in the St Marys and Bringelly areas at this time. This is an unusual event and therefore the elevated PM_{10} concentration measured at St Marys on 17th September 2011 has not been included in the assessment of potential cumulative impacts. The annual average PM_{10} concentration recorded at the St. Marys monitoring site during 2011 was 14.5 µg/m³.

$PM_{2.5}$ and TSP data are not available at the St. Marys monitoring site, therefore the modelling results for these indicators have been presented as incremental impacts only and a qualitative cumulative impact assessment has been included in this report.

The daily maximum 1-hour average NO_2 concentrations recorded at the St. Marys monitoring site for the 2011 calendar year are presented in **Figure 5**. The data indicates that the highest 1-hour average NO_2 concentration at the St Marys monitoring site was 67.7 µg/m³, recorded on 19th April 2011 and 1st August 2011. The annual average NO_2 concentration recorded at St. Marys monitoring site during 2011 was 26.2 µg/m³.

Figure 4 24-Hour Average PM_{10} Concentrations (µg/m³) at St. Marys, 2011

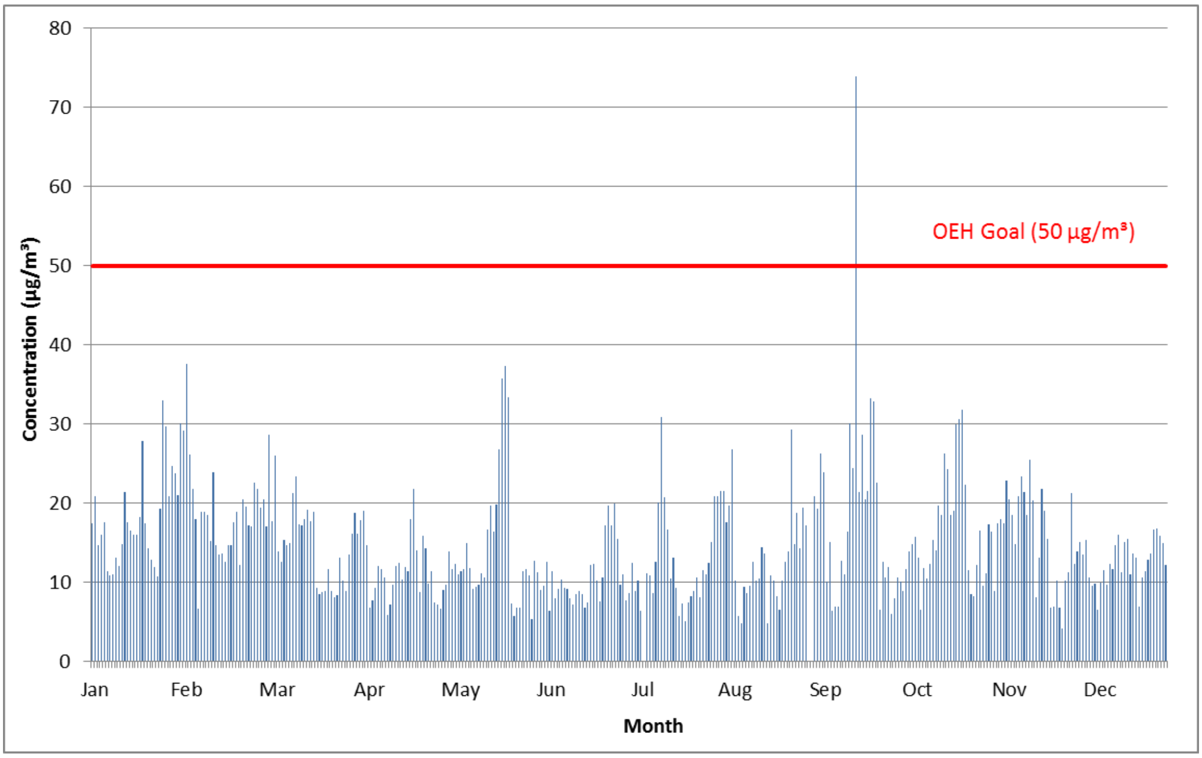
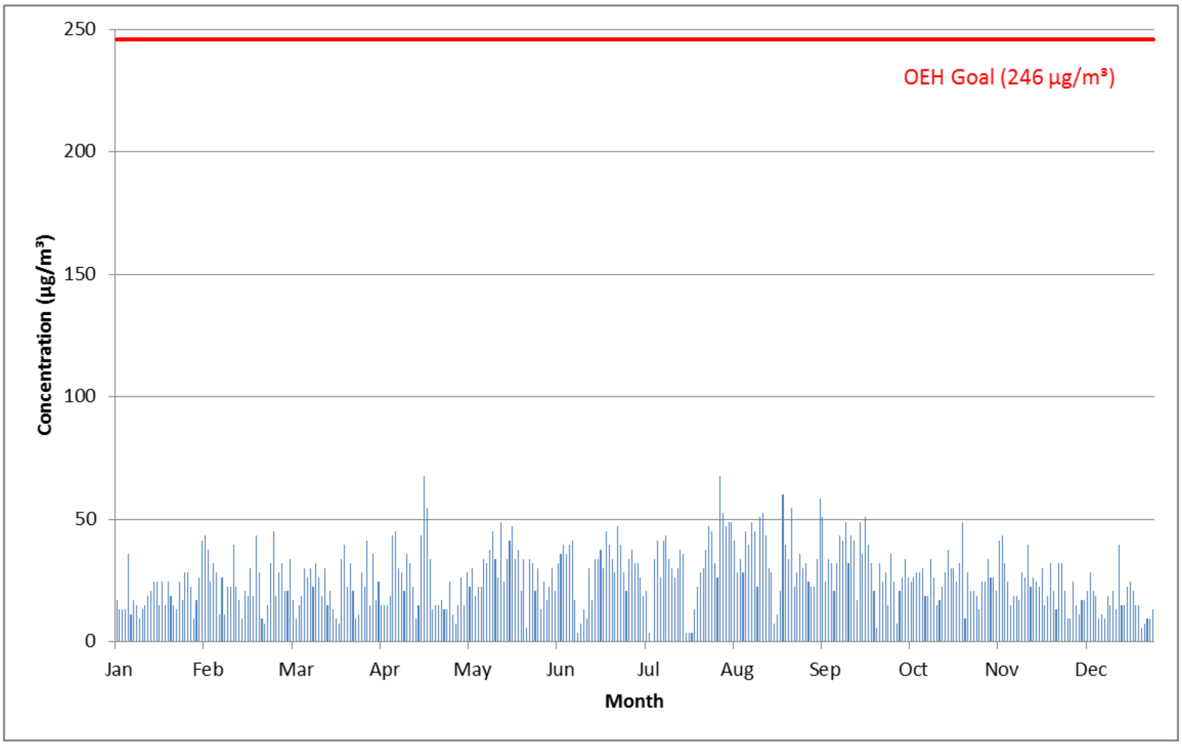


Figure 5 Daily Maximum 1-Hour Average NO_2 Concentrations (µg/m³) at St. Marys, 2011



A summary of the background air quality data used to assess the cumulative impacts for the proposed operations is presented in **Table 5**.

Table 5 Background Air Quality Data (2011)

Pollutant	Averaging Period	Data (µg/m³)
PM_{10}	24-hours	Daily varying
	Annual	14.5
NO_2	1-hour	67.7
	Annual	26.2

4 EMISSION ESTIMATION

As stated in **Section 3.1**, wheel-generated dust from the on-site traffic movements and combustion emissions from vehicles idling on-site have been identified as the main sources of potential emissions for the proposed operational phase. All on-site traffic movement areas will be sealed and the operational fleet is likely to include a range of vehicles including pick-up and delivery vehicles (PUD's), semi-trailers and B-Doubles.

Potential particulate emissions from the on-site traffic movements were estimated using emission factor equations sourced from the United States Environmental Protection Agency (US EPA) AP-42 Emission Factor Handbook (US EPA 2006). Potential NO_x and particulate emissions from idling trucks were sourced from US EPA documents on "*Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity*" (US EPA 2004).

The emission factors used in estimating potential emissions from the proposed operations are summarised in **Table 6**. The estimated total emission rates for the proposed operations are presented in **Table 7**.

Table 6 Emission Factors

Activity	Emission Factor Equation	Units	Source	Variables
Wheel generated dust	$EF_{TSP} = 24 \times \left(\frac{SL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - 0.1317$ $EF_{PM10} = 4.6 \times \left(\frac{SL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - 0.1317$	g/VKT	US EPA 2006	SL = road surface silt loading (0.2 g/m²) W = average weight of vehicles: 22.5 t for PUD's , 62.5 t for B Doubles 42.5 t for Semi trailers
Idling combustion	$EF_{PM10} = 3.68$ $EF_{NOx} = 135$	g/hr	US EPA 2004	

Table 7 Estimated Emission Rates

Pollutant	Emission Rate[1] (kg/hr)
$PM_{2.5}$	0.6
PM_{10}	2.7
TSP	13.8
NO_x	2.03

[1]It has been estimated that up to 15 vehicles will be idling on-site concurrently based on available information.

5 LOCAL METEOROLOGY

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component.

The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field.

Spatial variations and diurnal and seasonal changes in the wind field and stability regime are functions of atmospheric processes operating at various temporal and spatial scales. Atmospheric processes at macro- and meso-scales need therefore be taken into account in order to accurately parameterise the atmospheric dispersion potential of a particular area.

Hourly meteorological data for 2011 calendar year were sourced from the nearby Bureau of Meteorology (BOM) station located at the Horsley Park Equestrian Centre, NSW. Observational meteorological data from the Horsley Park Equestrian Centre meteorological station, in conjunction with the cloud cover data from Bankstown Airport BOM station, were used to generate a 1-year, hourly, site-representative meteorological file suitable for use in the AUSPLUME model. A long term (2008 – 2012) meteorological data analysis was conducted to select the meteorological year for this study.

5.1 Wind Conditions

A wind speed frequency plot of the year 2011 is presented in **Figure 6**. A summary of the 2011 annual wind behaviour for the project site is presented as a wind rose in **Figure 7**. This wind rose is representative of the meteorological input file used in the modelling, and displays occurrences of winds from all quadrants.

The annual wind rose indicates the prevailing wind direction is from the southwest quadrant, occurring over 30% of the time. Winds experienced at the site are predominantly light to moderate. Winds for the dominant wind directions are also light to moderate in nature, having wind speeds ranging between 1.5 m/s and 8 m/s. Calm wind conditions (wind speeds less than 0.5 m/s) were predicted to occur 13.9% of the time throughout 2011.

Figure 6 Wind Speed Frequency Distribution for the Project Site

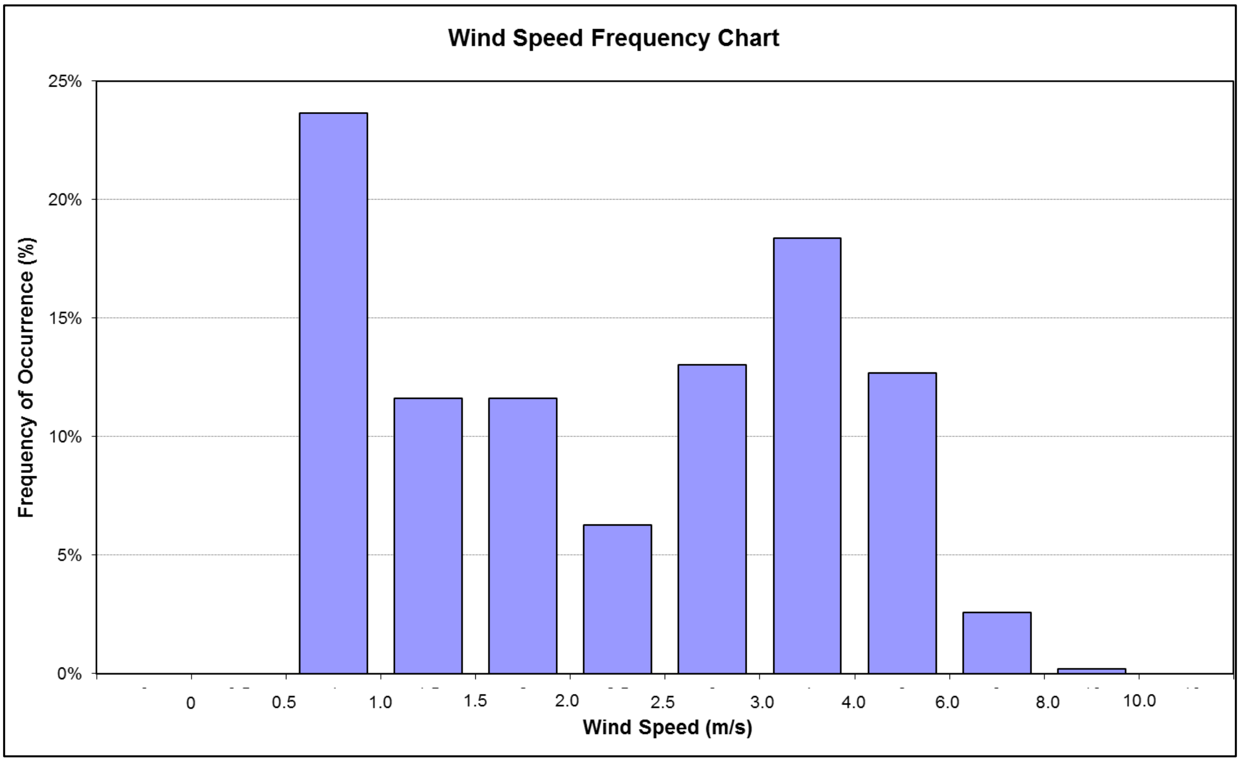
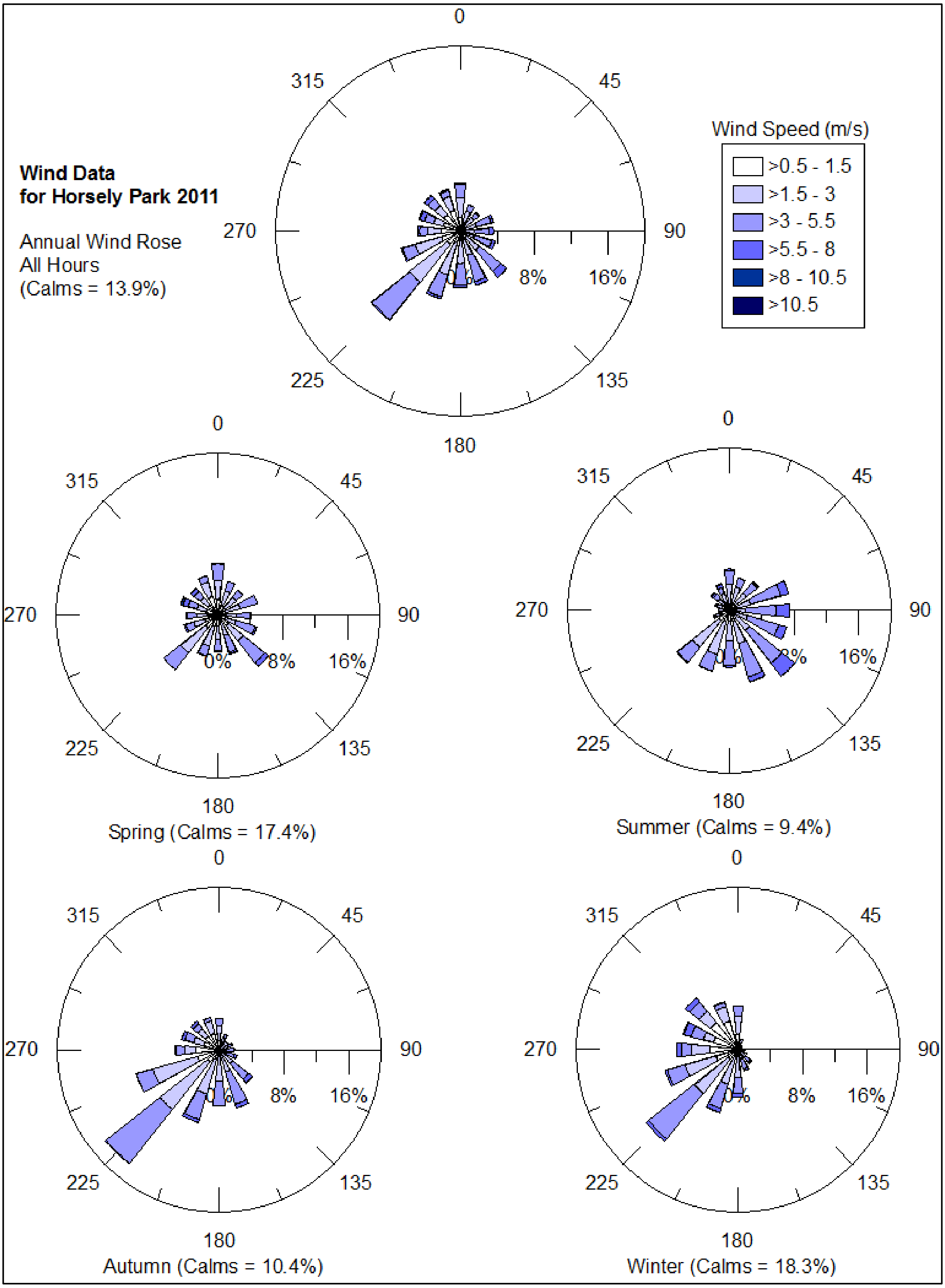


Figure 7 Wind Roses for the Project Site



5.2 Atmospheric Stability

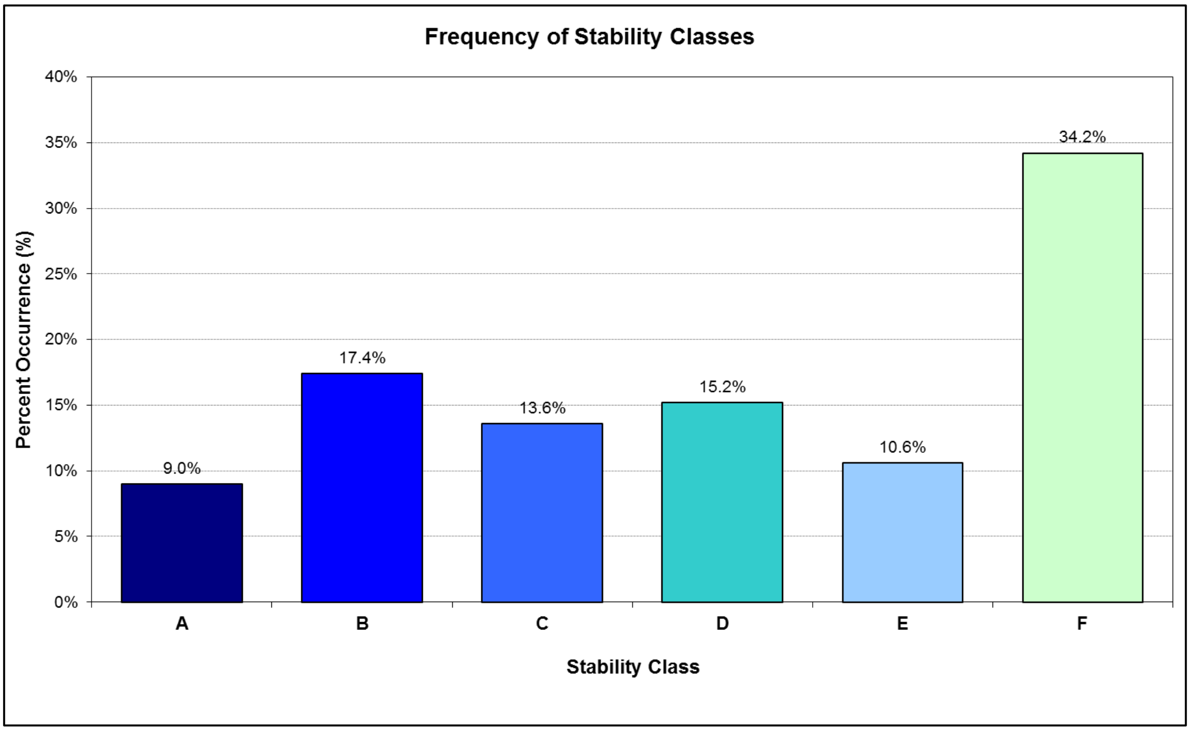
Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability (see **Table 8**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

The frequency of each stability class at the Project Site during 2011 is presented in **Figure 8**. The results indicate a high frequency of conditions typical to Stability Class F. Stability Class F is indicative of very stable night time conditions, conducive to a low level of pollutant dispersion due to mechanical mixing.

Table 8 Description of Atmospheric Stability Classes

Atmospheric stability class	Category description
A	Very unstable: Low wind, clear skies, hot daytime conditions
B	Unstable: Clear skies, daytime conditions
C	Moderately unstable: Moderate wind, slightly overcast daytime conditions
D	Neutral: High winds or cloudy days and nights
E	Stable: Moderate wind, slightly overcast night-time conditions
F	Very stable: Low winds, clear skies, cold night-time conditions

Figure 8 Stability Class Distribution for the Project Site (2011)



6 AIR QUALITY IMPACT ASSESSMENT

The pollutant dispersion modelling carried out in this assessment utilised the Ausplume Gaussian Plume Dispersion Model software developed by EPA Victoria, Version 6.0.

Ausplume is the approved dispersion model for use in the majority of applications in NSW. Default options specified in the Approved Methods have been used to predict the operational-phase air quality impacts at surrounding sensitive receptors. The results of the modelling have been assessed based on compliance with ambient air quality goals set by the NSW OEH and are presented in the following sections.

6.1 $PM_{2.5}$ Emissions

Table 9 shows the predicted incremental impacts for 24-hour and annual average $PM_{2.5}$ concentrations at each receptor identified in **Section 2.3**. The maximum 24-hour average and annual incremental $PM_{2.5}$ concentrations contour plots are presented in **Figure 9** and **Figure 10**.

It can be observed from **Table 9** that the predicted incremental 24-hour and annual average $PM_{2.5}$ concentrations at all receptors are minimal (<20%) compared to the relevant ambient air quality guideline. Considering the relatively small predicted incremental contribution from the proposed operations, it can be concluded that the proposed operational activities are unlikely to cause any exceedences of relevant 24-hour or annual average $PM_{2.5}$ criteria at any surrounding sensitive receptor locations.

Table 9 Maximum Predicted 24-Hour and Annual Average $PM_{2.5}$ Concentrations

Receptor ID	Incremental Impacts Predicted at Sensitive Receptors	
	24 Hour Average ($\mu g/m^3$)	Annual Average ($\mu g/m^3$)
R1	4.9	0.6
R2	1.8	0.2
R3	0.8	0.1
R4	1.1	0.1
R5	1.1	0.1
Assessment Criteria	**25 (cumulative)**	**8 (cumulative)**

Figure 9 Maximum Predicted Incremental 24-Hour Average $PM_{2.5}$ Concentrations

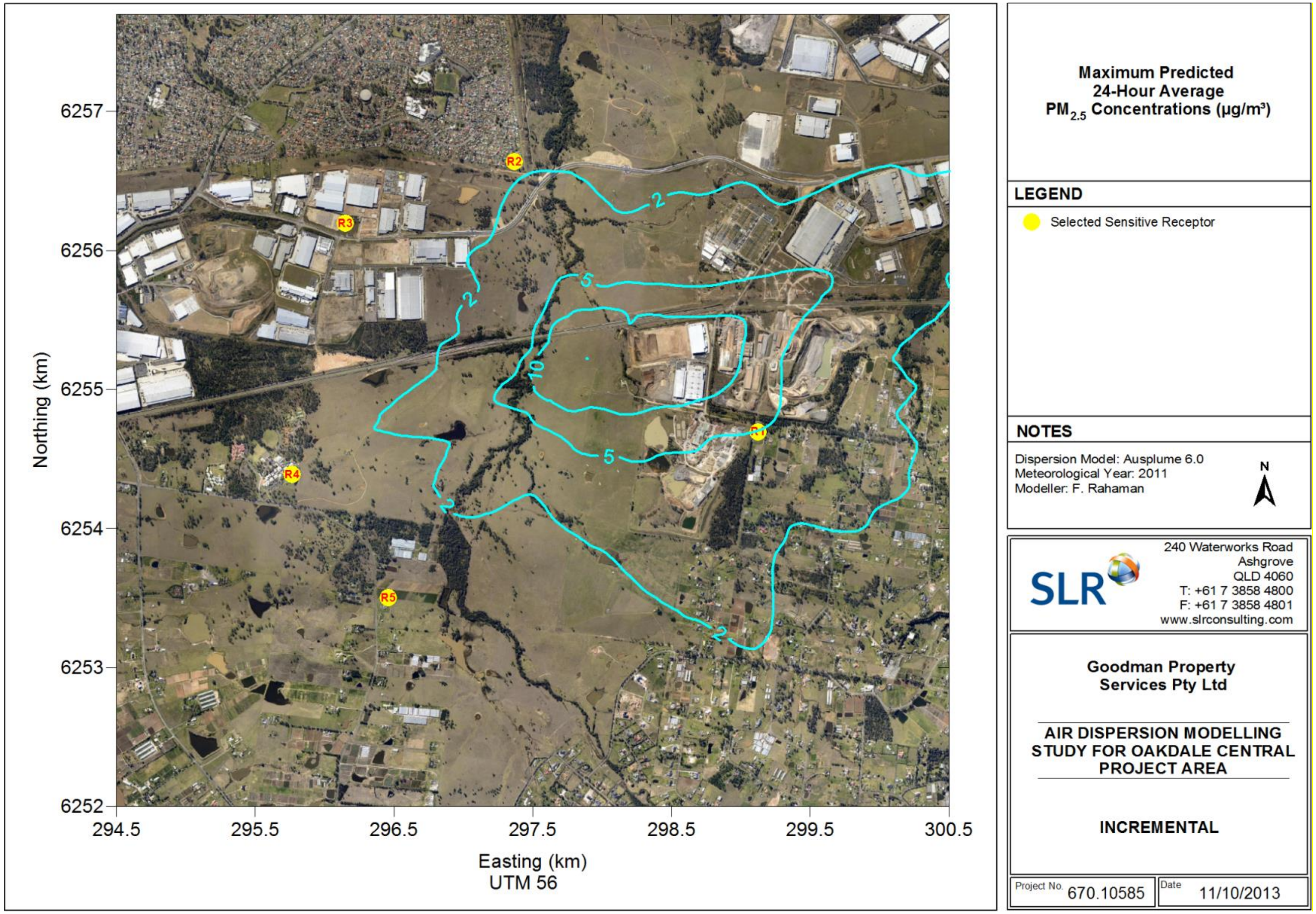
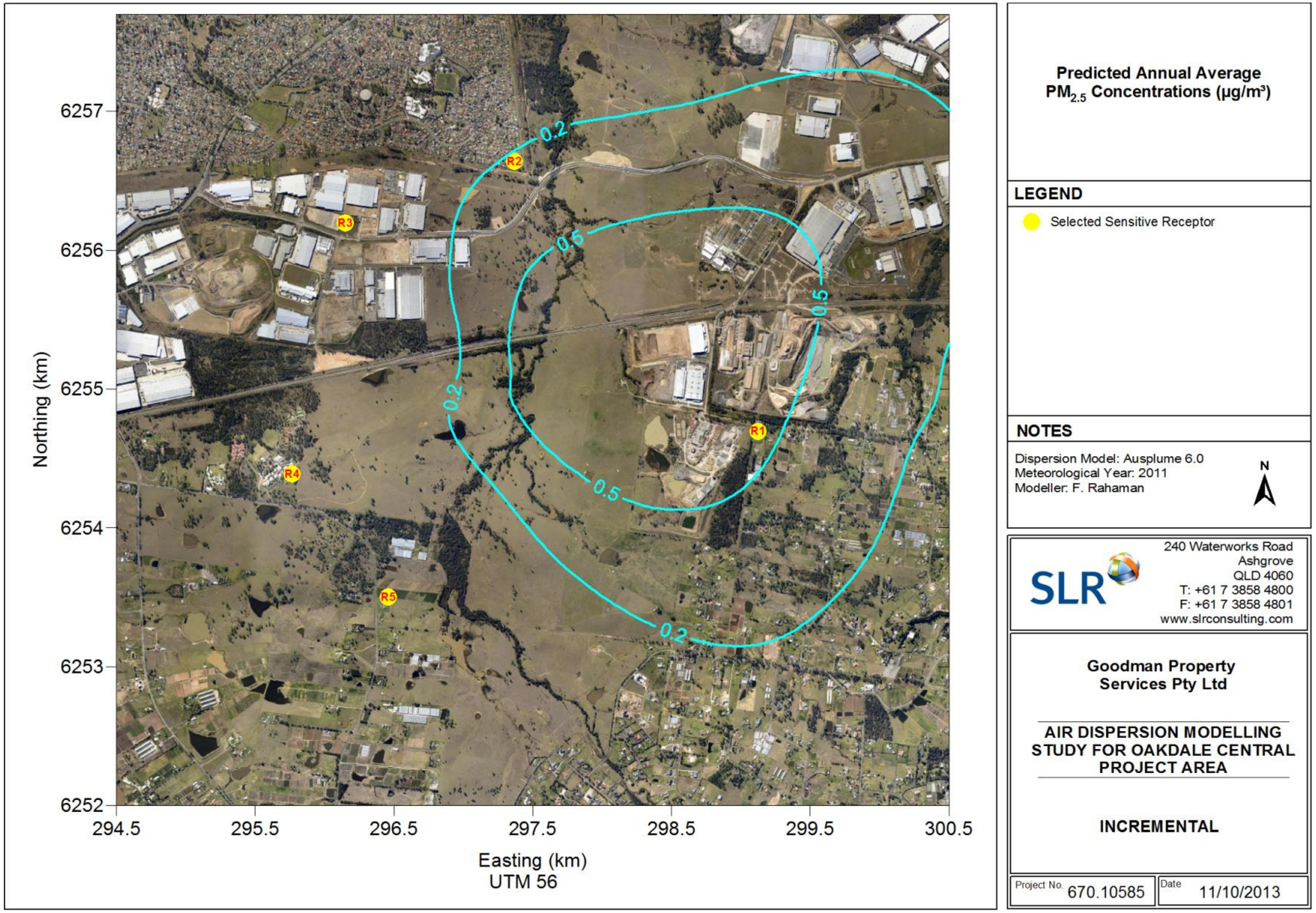


Figure 10 Predicted Incremental Annual Average $PM_{2.5}$ Concentrations



6.2 PM_{10} Emissions

To assess the maximum cumulative 24-hour average PM_{10} concentrations at each of the identified sensitive receptors, a contemporaneous analysis was performed following the Approved Methods. At each receptor, each individual incremental prediction was added to the corresponding day's measured background concentration at the St. Marys OEH monitoring site to predict the cumulative 24-hour average PM_{10} impacts.

Table 10 presents a summary of the contemporaneous analysis at each receptor listed in **Section 2.3**. It can be observed from **Table 10** that the incremental and cumulative 24-hour average PM_{10} concentrations predicted at each surrounding sensitive receptor as a result of operational emissions are well below the relevant OEH guideline. Therefore it is concluded that the proposed operation is unlikely to cause any additional exceedences of the guideline at these locations.

Table 11 presents a summary of the incremental and cumulative annual average PM_{10} concentrations predicted at each identified sensitive receptor location. It can be observed from **Table 11** that the incremental annual average PM_{10} impacts predicted as a result of the proposed operations are minimal and that the cumulative annual average PM_{10} concentrations predicted at all surrounding sensitive receptor locations are well below the relevant OEH guideline.

Contour plots of the maximum 24-hour and annual average incremental PM_{10} concentrations are presented in **Figure 11** and **Figure 12**.

Table 10 Summary of 24-Hour PM_{10} Cumulative Impact Analysis

Receptor ID	Date	PM_{10} 24-Hour Average Concentrations (µg/m³)			Date	PM_{10} 24-Hour Average Concentrations (µg/m³)		
		Highest Background	Incremental Impact	Total Impact		Background	Highest Increment	Total Impact
R1	02-02-2011	37.6	<0.1	<37.7	16-07-2011	10.4	20.1	30.5
R2	02-02-2011	37.6	<0.1	<37.7	31-07-2011	20.9	7.2	28.1
R3	02-02-2011	37.6	0.7	38.3	16-09-2011	24.4	3.4	27.8
R4	02-02-2011	37.6	0.6	38.2	13-10-2011	15.3	4.3	19.6
R5	02-02-2011	37.6	0.5	38.1	06-10-2011	14.8	4.6	19.4
Criterion				**50**				**50**

Note: Data recorded on 17th September 2011 is likely to be biased by the controlled burning in Blue Mountain region (see **Section 3.3**) and has been excluded from this study.

Table 11 Predicted Maximum Annual Average PM_{10} Concentrations at Sensitive Receptors

Receptor ID	Annual Average PM_{10} Concentrations (µg/m³)	
	Incremental Impact	Cumulative Impact
R1	2.6	17.1
R2	0.9	15.4
R3	0.4	14.9
R4	0.3	14.8
R5	0.3	14.8
Assessment Criterion	**-**	**30**

Figure 11 Maximum Predicted Incremental 24-Hour Average PM_{10} Concentrations

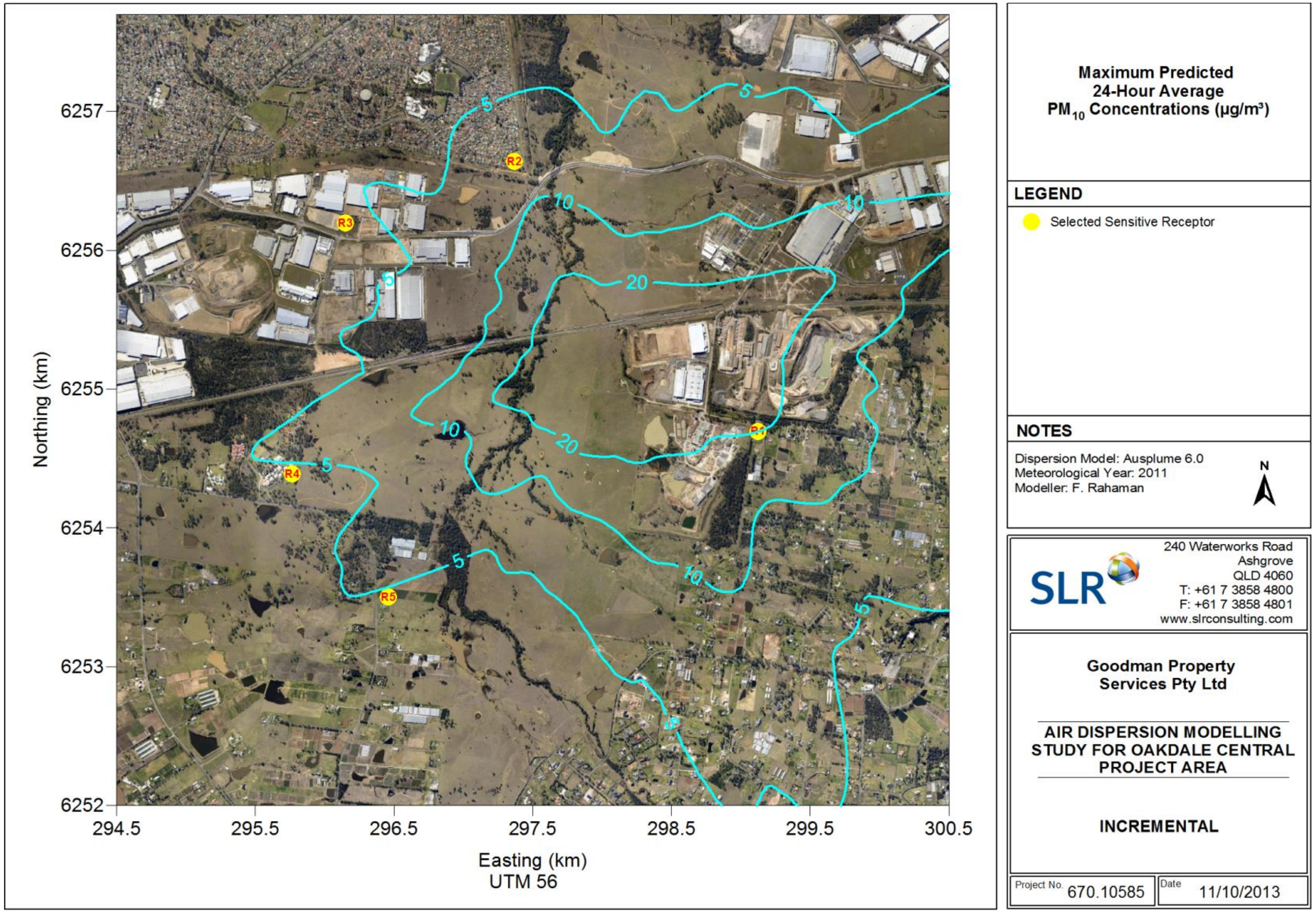
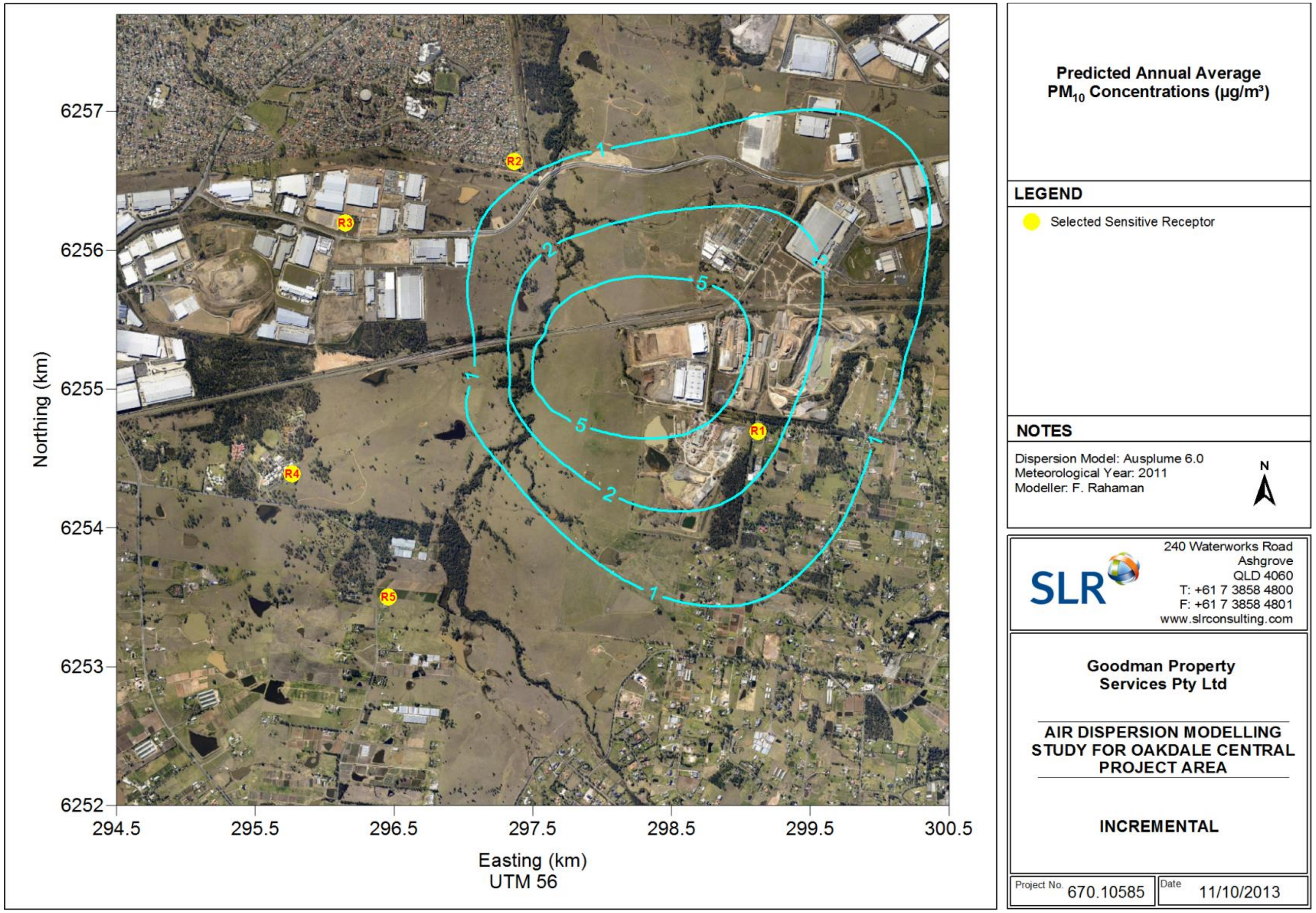


Figure 12 Predicted Incremental Annual Average PM_{10} Concentrations



6.3 TSP Emissions

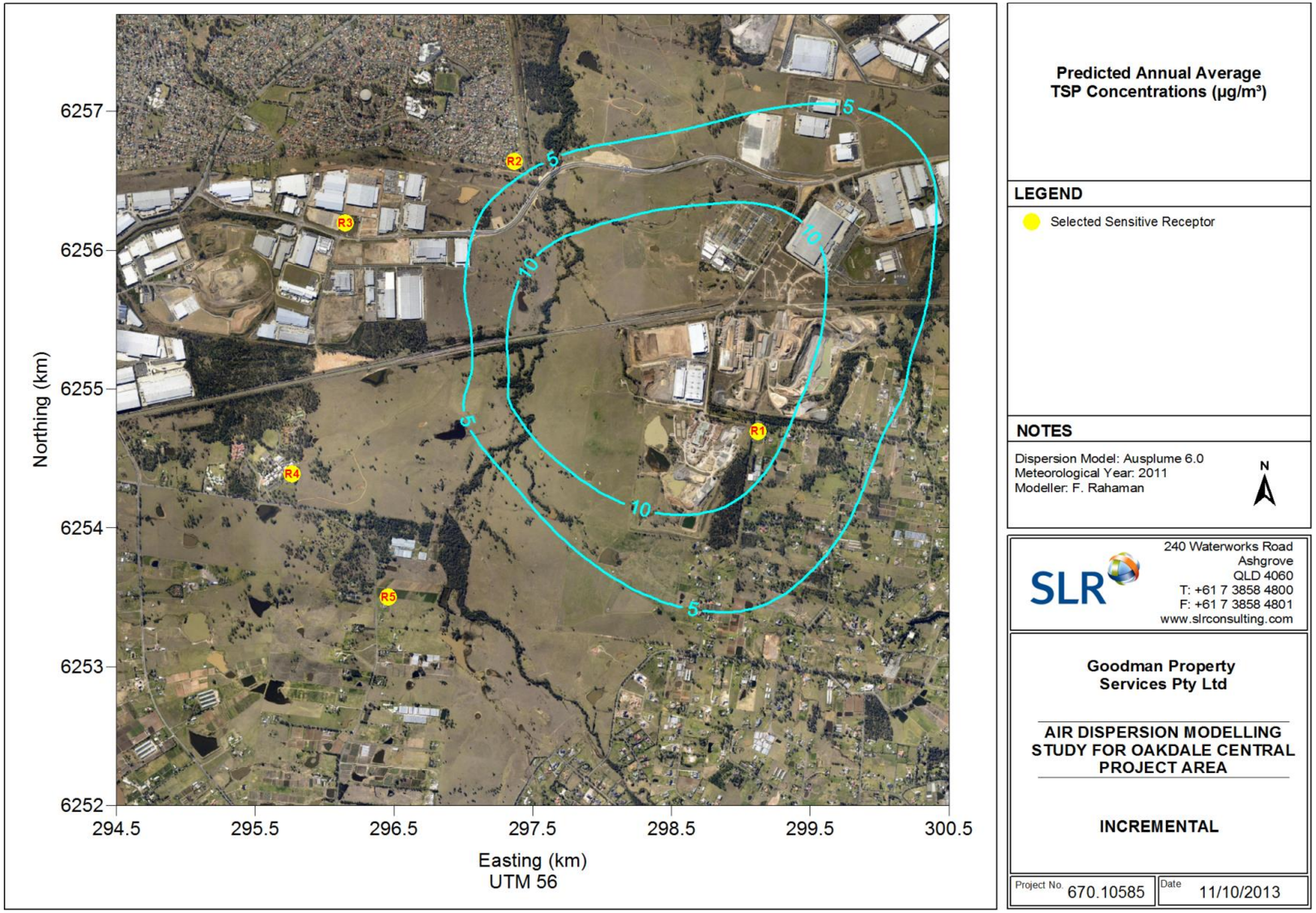
Table 12 presents the incremental annual average TSP concentrations predicted at surrounding representative sensitive receptors. It can be observed from **Table 12** that the predicted incremental annual average TSP concentrations at all receptors are minimal compared to the relevant OEH guideline (<15% of the criterion).

Contour plots of the predicted incremental annual average TSP concentrations are presented in **Figure 13**.

Table 12 Predicted Annual Average TSP Concentrations at Sensitive Receptors

Receptor ID	Incremental Impact ($\mu g/m^3$)
R1	13.4
R2	4.5
R3	1.8
R4	1.4
R5	1.5
Criterion	**90 (cumulative)**

Figure 13 Predicted Incremental Annual Average TSP Concentrations



6.4 NO_2 Emissions

Table 13 presents the incremental and cumulative 1-hour and annual average NO_2 concentrations predicted at each receptor identified in **Section 2.3**. It is noted that the cumulative concentrations are based on the sum of the maximum predicted incremental impact and maximum measured background concentrations. This is a highly conservative screening approach as it assumes that the highest incremental impact from the proposed operation occurs on the same hour as the highest background concentration. In addition, as a conservative approach, 100% conversion of NO_x to NO_2 was applied in predicting the incremental and cumulative impacts from the proposed operation at surrounding areas. This is very conservative as it is highly unlikely that all NO released from the onsite vehicles will be converted to NO_2 when the plume reaches the nearest sensitive receptor. It is noted that due to these conservative assumptions, the modelling results are likely to overestimate the incremental and cumulative NO_2 impacts at surrounding sensitive receptors by a significant margin.

The results presented in **Table 13** show that the predicted cumulative 1-hour and annual average NO_2 concentrations are well below the relevant OEH criteria at all receptors.

The maximum 1-hour and annual average incremental NO_2 concentrations predicted for each scenario are presented as contour plots in **Figure 14** and **Figure 15**.

Table 13 Predicted Maximum 1-Hour and Annual Average NO_2 Concentrations at Sensitive Receptors

ID	1-Hour Averages		Annual Averages	
	Incremental Impact ($\mu g/m^3$)	Cumulative Impact ($\mu g/m^3$)	Incremental Impact ($\mu g/m^3$)	Cumulative Impact ($\mu g/m^3$)
R1	87	155	1.9	28
R2	39	107	0.6	27
R3	40	108	0.3	26
R4	42	109	0.2	26
R5	37	105	0.2	26
Criteria		**246**		**62**

6.5 Odour Impact Assessment

Based on a review of available information regarding the proposed activities, no significant odour sources were identified at the proposed site. There is an on-site wastewater storage system that is currently connected to an on-site sewer system, however no wastewater/sewerage treatment is conducted on-site. The wastewater and sewerage are stored in a fully sealed underground holding tank under a reinforced concrete slab. The pump well and pumps are all located below ground level. No significant odour emissions are expected to occur from the holding tank system.

The holding tank is emptied every two days into a truck by a liquid waste contractor for transport to an off-site treatment facility. The pumps are located underground, and under normal operating conditions the potential release of odour during transfer operations is minimal and would not have the potential to cause odour nuisance at any nearby sensitive receptors. In the unlikely event of a spill, immediate action would be taken to clean up the affected area.

Figure 14 Maximum Predicted Incremental 1-Hour Average NO_2 Concentrations

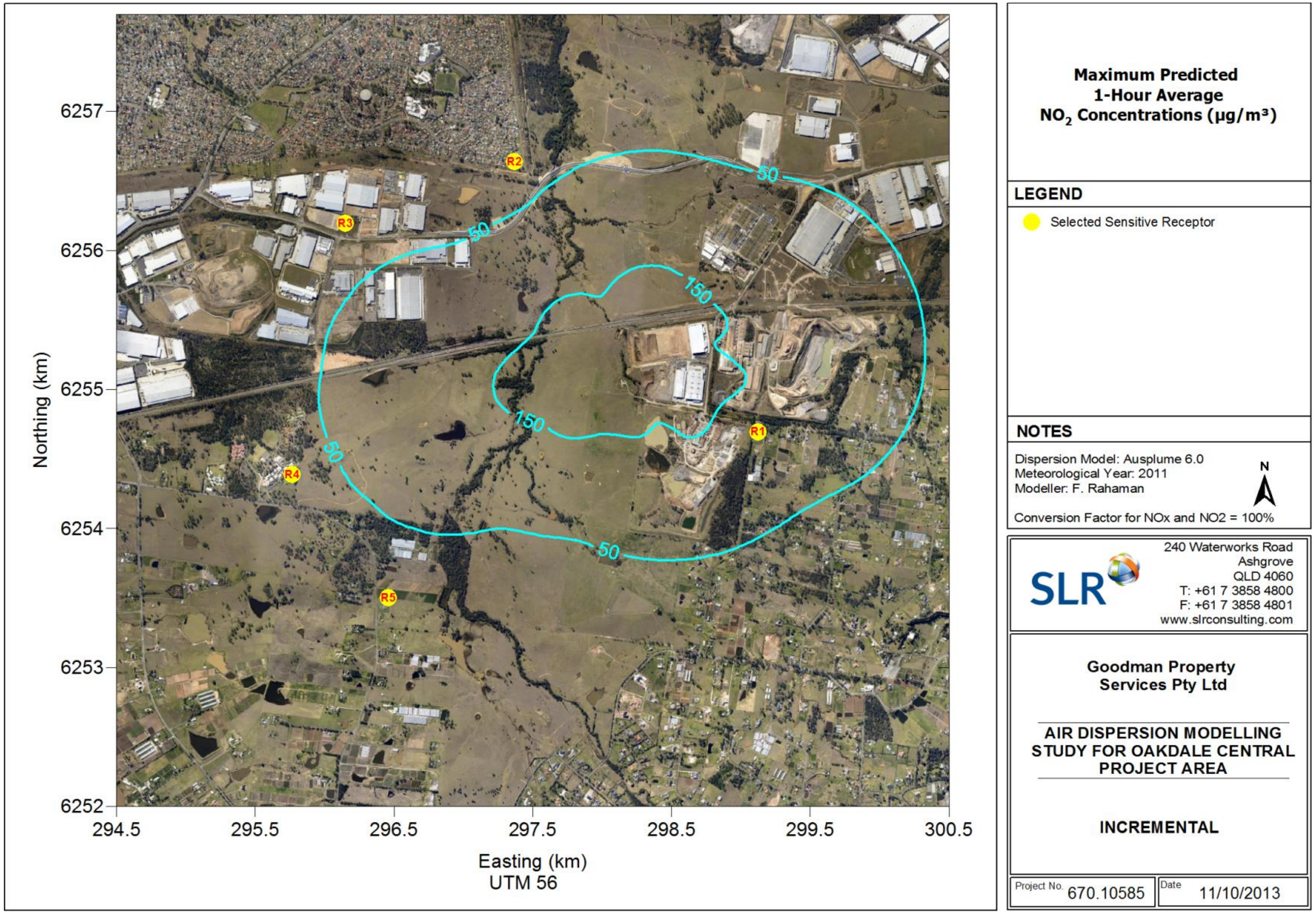
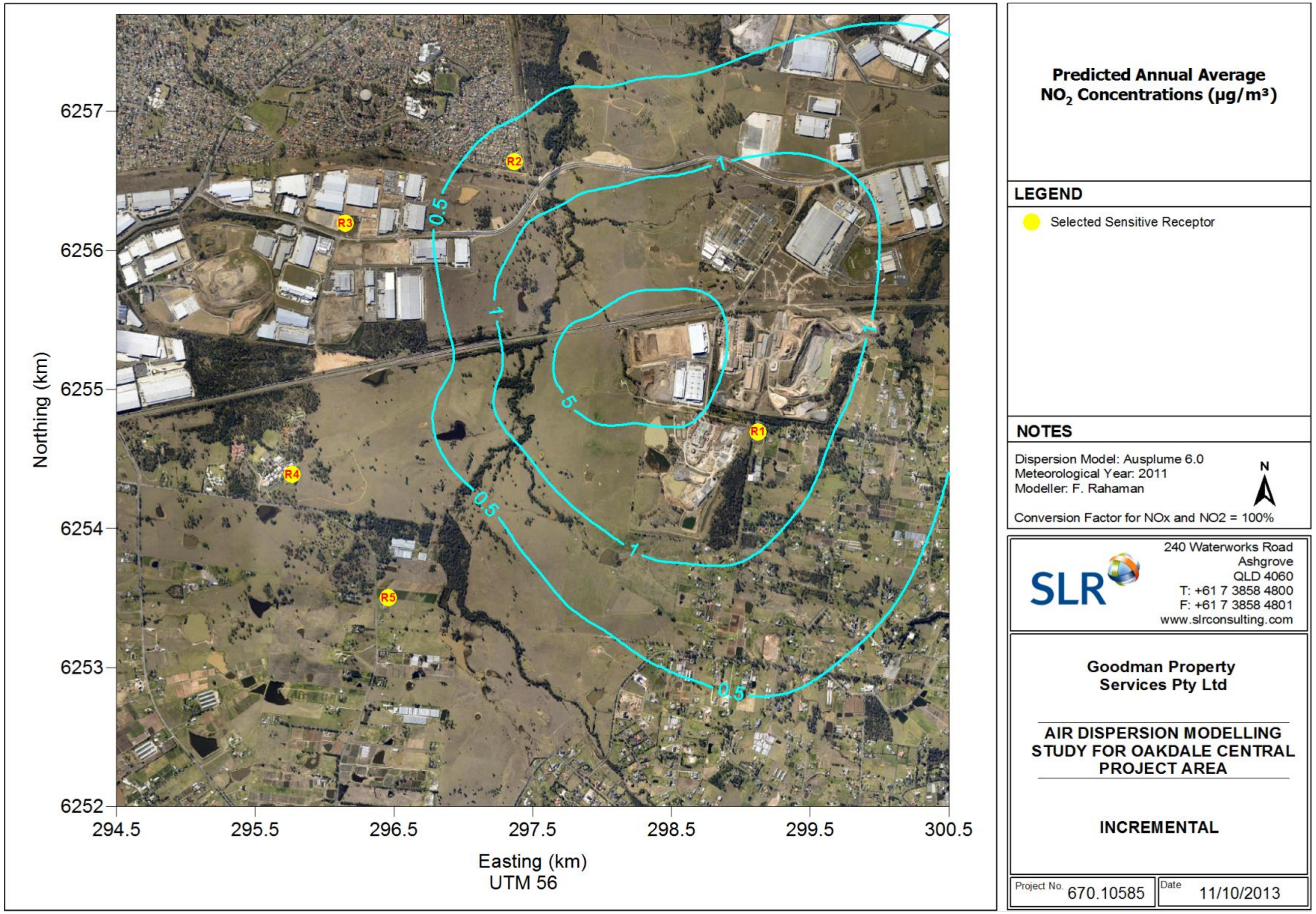


Figure 15 Predicted Incremental Annual Average NO_2 Concentrations



7 CONSTRUCTION PHASE MITIGATION MEASURES

Key construction works associated with the Project will comprise of construction of 4 warehouses and associated infrastructures.

The following mitigation measures are proposed to ensure that best practice is employed and potential air quality impacts associated with the development are minimised as far as practicable.

It is noted that construction works on individual lots are planned at different times and will not occur simultaneously therefore cumulative dust impacts due to multiple construction sites is not likely.

7.1 Dust Management

Best Available Techniques (BAT) was introduced as a key principle of the European Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC). The European Commission produced BAT Reference Documents (BREFs) for a number of industries which are intended to be used as an input into determination of BAT for specific cases.

The essence of BAT is that the selection of techniques to protect the environment should achieve an appropriate balance between realising environmental benefits and the costs incurred by the person carrying out the activities. In other words, it would be possible to spend infinite time and money to attempt to reduce dust impacts to zero but the cost involved may be grossly disproportionate to the benefit gained.

While no legislative driver exists in Australia at present, some of the relevant BAT mitigation measures for dust control are summarised below:

- Water sprays are a commonly used control method for particulate matter emissions. The addition of dust control suppressants such as polymers and acrylics to the water increases the effectiveness of the spraying.
- Stockpiles can be sprayed with a lime slurry (or similar polymer) which forms a hard crust and prevents dust emissions.
- Spraying of the shovel/bucket for excavators/front end loaders when loading trucks.
- Spraying the bucket of trucks before loading.
- Sprays/atomisers to moisten ambient air during operations with the potential to generate high volumes of dust.
- Wheel-wash, truck shaker grids and visual inspection of trucks prior to exiting the construction site onto public roads.
- Vacuuming (or equivalent cleaning method) of dirt track-out out onto public roads.
- Use water sprays to moisten dusty surfaces on a systematic basis to maintain minimum moisture content at the potentially dusty surface.
- Design and installation of wind breaks, wind barriers and enclosures at key points, such as truck unloading stations, to avoid falling dusty material being exposed to external winds.

In addition to the above, the following procedures and requirements should be followed during the construction phase of the project to minimise the impact of dust and particulate generated in association with the proposed development:

- Sealing of roads (where possible) and regular watering of roads (as noted above) utilising water carts or a wet spray system.

- All unsealed trafficable areas should be kept sufficiently damp during working hours to minimise windblown or traffic generated dust emissions. Continued use of water on dirt roads helps the formation of a crust so that dust is not as easily generated.
- Truck loads should always be covered with a lid or tarpaulin.
- Truck movements should be controlled on site and restricted to designated roadways.
- Truck wheel washes or other dust removal procedures should be installed to minimise transport of dust off-site.
- No dust, soil or mud should be deposited from any vehicle on public roads. Where wheel washing facilities and/or truck shaker grids are provided at the construction works area, all drivers of construction vehicles shall utilise the wheel wash prior to leaving the works area and entering public roads.
- Any dust soil or mud deposited on public roads by sub-contractors construction activities and vehicle movements should be removed immediately and disposed of appropriately.
- If necessary, modifying construction activities during periods of high wind.
- Vegetated buffers should be considered for implementation around the site boundary to act as a physical barrier to the transport of pollutants in the direction of sensitive land uses (ie residences). Plant species considered should include primarily native, evergreen plant species of a diverse variety and height.

Dust and particulate can also result from the incomplete combustion of fuels (i.e. vehicle or equipment exhaust). The following measures relate to the operation and maintenance of plant and other equipment:

- Trucks entering and leaving the site should be well maintained in accordance with the manufacturer's specification to comply with all relevant regulations. Fines may be imposed on vehicles which do not comply with smoke emission standards.
- If visible smoke can be seen from any equipment (while working on a construction site) for longer than 10 seconds duration, the equipment will be taken out of service and adequately repaired or tuned so that smoke is no longer visible for periods longer than 10 seconds.
- Hire agreements will contain provisions to stand down equipment which has excessively smoky exhaust.

Additional dust control measures that should be considered during the construction phase of the project are provided in **Table 14**.

Table 14 Active Dust Control Measures

Source	Control Measures
General	
Visual Inspection	• Carry out visual inspections of the site during site preparatory/ construction activities and employ measures where necessary to minimise any visible air pollution generated by the Project.
Regular Maintenance	• Regularly inspect and perform maintenance on dust control technologies (ie water sprays nozzles) and measures to ensure the effectiveness of these controls.
Erosion Control Structures	• Silt and other material should be removed frequently from around erosion control structures to ensure deposits do not become a dust source.
Vegetated Buffers	• Retain existing vegetation where appropriate and implement additional vegetated buffers around the boundary of the site to provide act as a physical barrier to the transport of pollutants in the direction of sensitive receptors.
Waste Materials	• Cleared vegetation, demolition materials and other combustible waste material shall not be burnt on site.

Source	Control Measures
	• All waste materials should be appropriately contained (in skips, bins) and covered during adverse weather conditions[1] and handled in accordance with the site's Waste Management Plan.
Wind-Blown Dust Sources	
Disturbed Areas	• Disturb only the minimum area necessary. • Stabilise all disturbed areas as soon as practicable to prevent or minimise windblown dust. • Rehabilitate disturbed areas as soon as practicable with a layer of inert material and vegetation (generally a minimum of 500mm). • Regularly assess weather conditions to identify adverse weather conditions[1] that are unfavourable in terms of dust levels at receptor locations surrounding the site (i.e. on dry days, during strong winds, and particularly north easterly winds blowing in direction of the school).
Stockpile/s	• Water sprays and/or covers will be employed for material stockpiles, particularly during adverse weather conditions, to minimise dust generation. • Stockpiles will be covered overnight. • Use of chemical dust suppressants will also be used where necessary. • Fencing, bunding or shelterbelts should be used to reduce ambient wind speeds (in some areas).
Transportation (Trucks)	• Truck loads must be covered with tarpaulin or lid prior to transport of dusty materials by road. • Minimise truck queuing and unnecessary trips through logistical planning of materials delivery and work practices. • Reduce vehicle / truck idling times. • Maintain a following distance of trucks of 20 seconds minimum to allow for dust clouds generated by the lead truck to dissipate. • Install a truck wheel wash or shaker grid to remove any loose dirt.
Activity-Generated Dust Sources	
Internal Road Dust	• Roads and trafficked areas will be watered down using a water cart and/or sprinklers to minimise the generation of dust. • Haulage vehicles will be restricted to the most direct route and minimal manoeuvring areas to prevent indiscriminate driving over non-active areas. • Haul roads and hard stand areas will have designated speed limits (ie generally 20 km/hour). • Enforce speed limits on all on-site vehicles to minimise wheel-generated dust. • Stabilise access roads and work areas as soon as practicable to prevent or minimise windblown dust. • Maintain roads on a regular basis to ensure roads are clearly marked, pot holes and corrugations are eliminated, and extra material build up is removed or redistributed on the road. • Chemical dust suppressants will be used where necessary.
External Road Dust	• Vehicles causing dirt track out onto main roads will be cleaned up on a regular basis to prevent this becoming an additional source of dust. • Material spillages will be cleaned up promptly.
Excavation	• Apply water sprays to trucks and loading points for dust suppression.
Loading and Dumping	• Dump heights will be minimised wherever possible (reduce to 5 m).
Plant and Equipment	• All plant and equipment used during mining activities will be maintained and operated in a proper and efficient condition. • Reduce idling times of trucks and other machinery. • Fixed plant should be located as far from local receptors as possible.
Excessive Dust Events[2]	
Internal Roads	• Employ additional water spraying / water carts.

Source	Control Measures
	• Further reduce speed on haul roads during high winds. • Halt traffic movements.
Stockpiles	• Cover stockpiles of material.
Project Site	• Temporarily halt activities and resume once weather conditions have improved.

Notes:

1. Adverse weather conditions include hot, dry and windy conditions (i.e. winds over 5 m/s blowing in the direction of sensitive receptors).
2. An excessive dust event includes prolonged visual dust in a particular area and winds at 15 m/s.

7.1.1 Daily Environmental Inspections

The Site Manager (or delegated employee) will undertake daily environmental inspections of the works and worksite. This may include, but not be limited to:

- Visual inspection of airborne dust.
- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network.
- Inspection of erosion and sediment controls.
- Inspection of stockpiles.
- Inspection of internal roads.
- Inspection of waste storage areas.
- Inspection of any rehabilitated areas (where relevant).
- Ensure site signage is clear and appropriate.

The daily environmental inspection reports should include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions will be reported to the Site Manager as soon as is practicable. These reports should be issued on a weekly basis to the Project Manager (or equivalent role) for review.

7.1.2 Weather Monitoring for Reactive Dust Management

A wind sock that is visible to each active area on site will be installed to assist in reactive response measures for dust control (i.e. to determine when activities should be postponed, minimised or relocated in windy conditions). Ideally, an on-site recording and alarmed anemometer should be installed, maintained and records kept.

In lieu of an on-site weather station, anemometer or wind sock, the nearest available BoM weather station should be referred to (i.e. Liverpool station).

During high wind conditions (>5 m/s), additional dust mitigation measures should be carried out to ensure the minimisation of emissions off site. An average wind speed of over 15 m/s is commonly used as the trigger for stopping certain dust-generating operations.

7.1.3 Dust Monitoring for Compliance

Where monitoring is required for compliance, it is recommended that dust deposition monitoring utilising Dust Deposition Gauges (DDGs) is undertaken. Dust Deposition Gauges (DDGs) record dust fallout, which can result from mining or non-mining activities and are a useful measure of changing air quality.

A baseline air quality monitoring program performed prior to site preparatory and construction works will enable suitable background concentrations and deposition levels of relevant pollutants to be derived so that the increment due to Project activities can be estimated.

It is understood that a program of compliance dust deposition monitoring comprising a network of four (4) DDGs has been ongoing at the Oakdale site since May 2010. DDGs are located at northeast/northwest and southeast/southwest corners of the site. The results of this monitoring to date indicate that the overall site average is below the long-term average Project air quality target for deposited dust concentrations (an annual average of 4 g/m^2/month insoluble solids) at all monitoring locations.

Monitoring locations were sited in accordance with AS/NZS 3580.1.1:2007 *Methods for sampling and analysis of ambient Air - Guide to siting air monitoring equipment.*

Dust deposition monitoring is undertaken in accordance with AS/NZS 3580.10.1:2003 *Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method*.

It is recommended that dust deposition monitoring continue at all four locations during the construction phase of the Project to monitor ongoing compliance with Project air quality goals.

8 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR Consulting) has conducted an Air Quality Impact Assessment (AQIA) at the request of Goodman Property Services (Aust) Pty Ltd on behalf of Mckenzie Group in preparing the development application for Lots 1C, 2B and Site 3 of Oakdale Central, NSW.

The potential dust-generating and fuel combustion activities for the proposed future operations have been identified and potential emissions from these activities were estimated based on available Project information and emission factors from the literature. These estimated emissions from the proposed operations have then been assessed through atmospheric dispersion modelling techniques. The predicted results indicate that the proposed operational activities would comply with all relevant OEH ambient air quality criteria at all surrounding representative sensitive receptors.

It is noted that the predicted impacts are based on worst case operational activity data and assume worst case background concentrations. As a result, all predictions in the assessment should be viewed as conservatively high, with levels expected to be lower during normal operation of the facility.

Due to the irregularity and relatively short duration of the construction phase, a quantitative assessment has not been performed for these activities. Instead a range of control measures to minimise fugitive dust emissions have been outlined for inclusion in the Construction Environmental Management Plan for the project.

No off-site impacts would be expected as a result of the proposed development.

9 REFERENCES

OEH (2005). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Office of Environment and Heritage (OEH)

National Environmental Protection Council (NEPC), “National Environmental Protection Measure for Ambient Air Quality”, 1998

National Health and Medical Research Council, 92nd Session, 1981

US EPA (2004) Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity, Office of Transportation and Air Quality January 2004

US EPA (2006) Compilation of Air Pollutant Emission Factors AP-42

Sturman A.P. and Tapper N.J. (2006). The Weather and Climate of Australia and New Zealand, Second Edition, Oxford University Press, 541 pp.

WBCSD, 2005, The Greenhouse Gas Protocol for Project Accounting, World Business Council for Business Development, 6 Dec 2005.

Appendix A

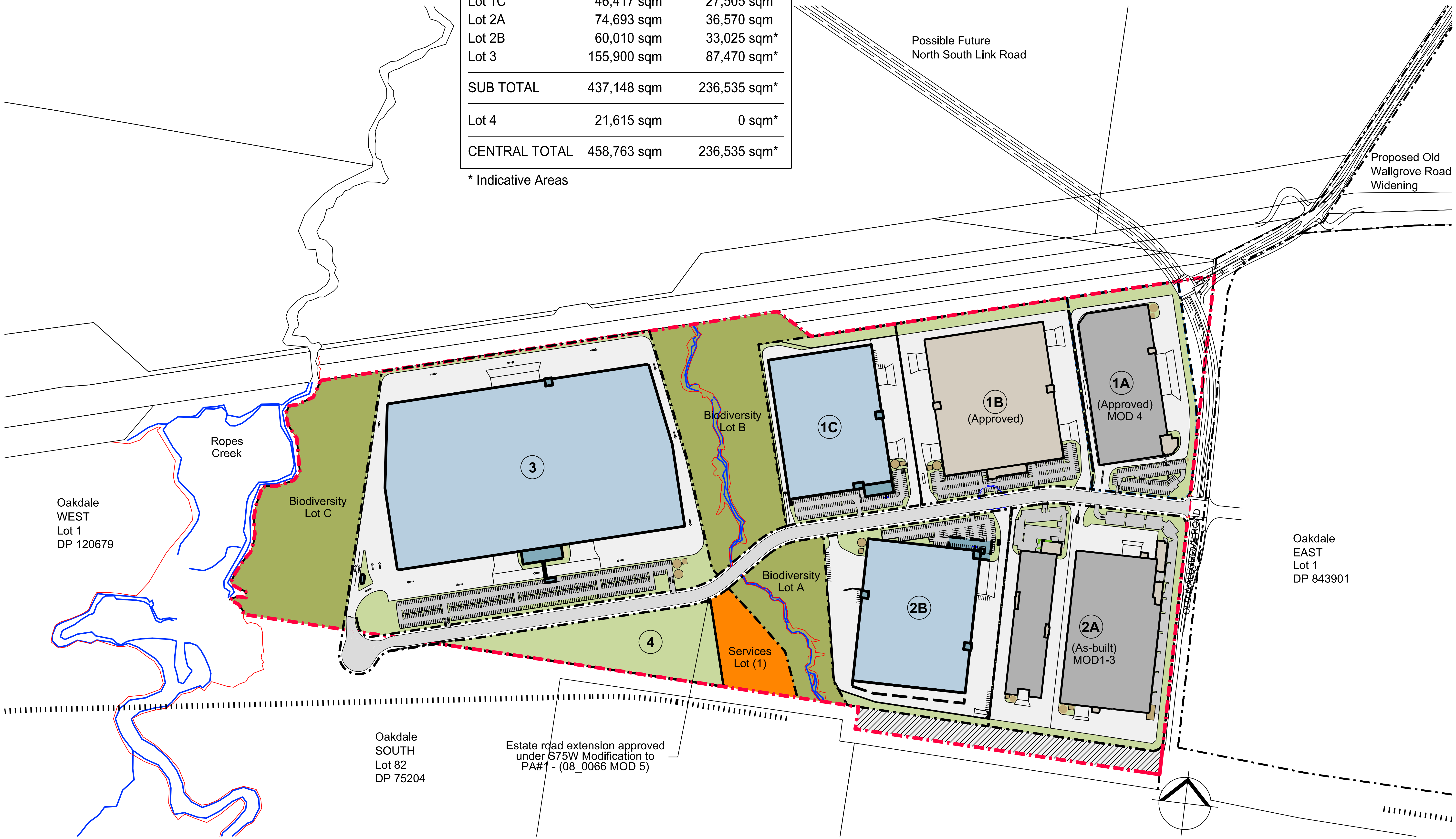
Report 670.10585-R2
Development Plan

Goodman

CENTRAL Area Schedule

Lot	Site Area	Building Area
Lot 1A	41,368 sqm	20,220 sqm
Lot 1B	58,760 sqm	31,745 sqm*
Lot 1C	46,417 sqm	27,505 sqm*
Lot 2A	74,693 sqm	36,570 sqm
Lot 2B	60,010 sqm	33,025 sqm*
Lot 3	155,900 sqm	87,470 sqm*
SUB TOTAL	437,148 sqm	236,535 sqm*
Lot 4	21,615 sqm	0 sqm*
CENTRAL TOTAL	458,763 sqm	236,535 sqm*

* Indicative Areas



SBA ARCHITECTS

Oakdale CENTRAL Proposed Industrial Facilities - Lot 1C, 2B, and 3

Horsley Park

Estate Masterplan

1:2500 @ A1
1:5000 @ A3

17 Oct 2013

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