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Air Quality Assessment

Wallarah Rezoning

Development Site 5

Report Number 610.17693-R02

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ADW Johnson Pty Ltd

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TUGGERAH

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Air Quality Assessment

Wallarah Rezoning

Development Site 5

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Reference	Date	Prepared	Checked	Authorised
610.17693-R02-v1.0	20 December 2017	Varun Marwaha	K Lawrence	K Lawrence

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by ADW Johnson Pty Ltd (ADW) on behalf of the Darkinjung Local Aboriginal Land Council (DLALC) to conduct an air quality impact assessment to accompany a rezoning application for land located within the Wyong Local Government Area (LGA). Specifically, the land proposed to be rezoned is located on Motorway Link in Wallarah (Site 5).

The DLALC holds a portfolio of approximately 3,500 hectares (ha) and is the largest non-government landowner on the Central Coast. The DLALC has undertaken a review of its land holdings within the region and identified three sites with potential for residential development (Sites 3 and 4) or industrial development (Site 5).

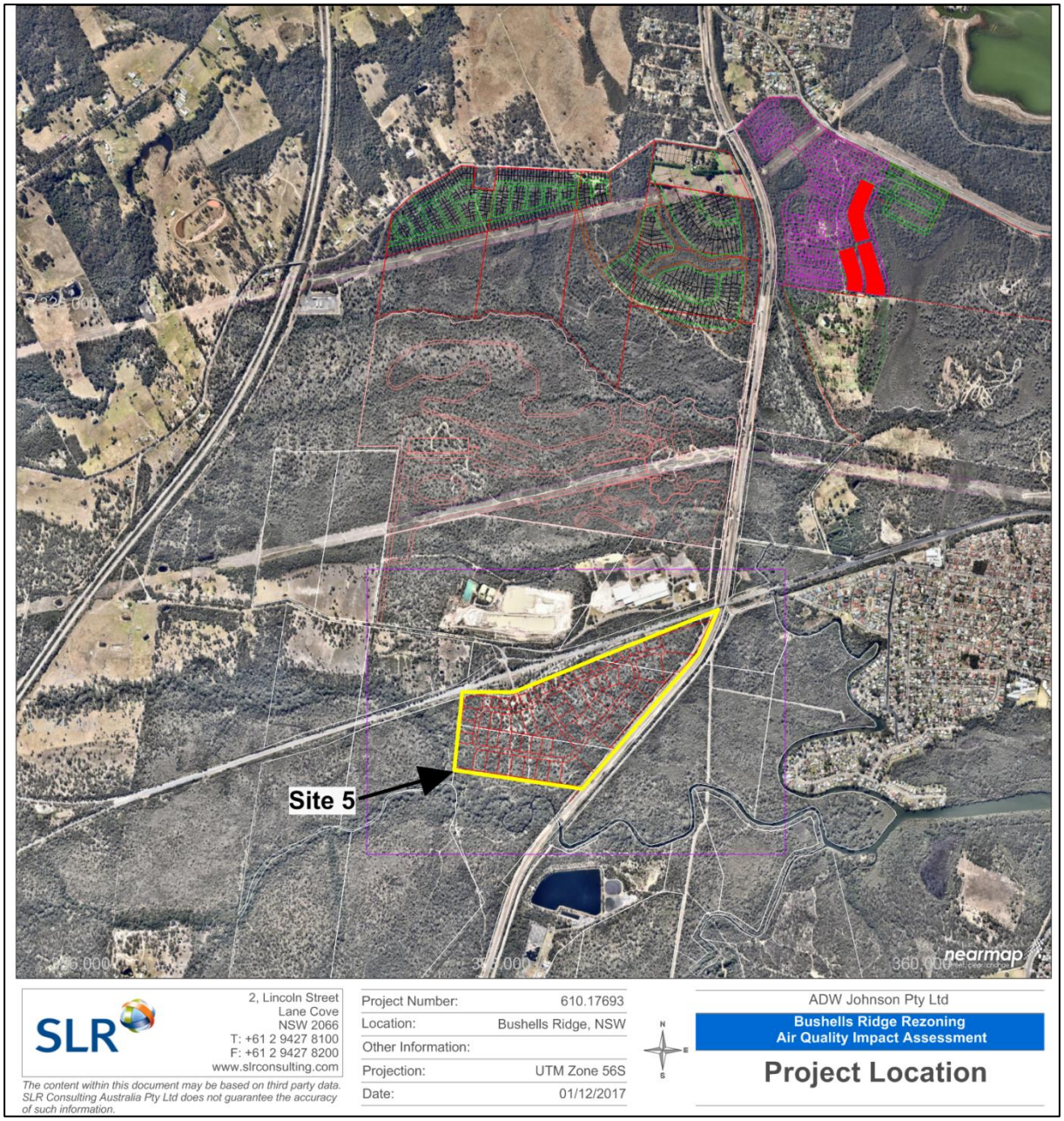
This report has been prepared to accompany the rezoning application for Site 5. The aim of this report is to assess the suitability of Site 5 for industrial purposes. Specifically, the air quality impacts on Site 5 from the regional sources and the likelihood of air quality impacts from Site 5 on nearby residential receptors are assessed in this report.

A separate assessment report will be prepared for the proposed rezoning of Sites 3 and 4 for residential use.

2 PROJECT DESCRIPTION

Site 5 comprises approximately 42 ha of land located on the corner of Motorway link road and the Sydney-Newcastle Railway, at the northeastern end of the township of Wallarah. The nearest existing residences are located approximately 500 m from the northeastern boundary of Site 5, on Waterhen Close in Blue Haven. The location of Site 5 is shown in **Figure 1**.

Figure 1 Locality of Development Site 5



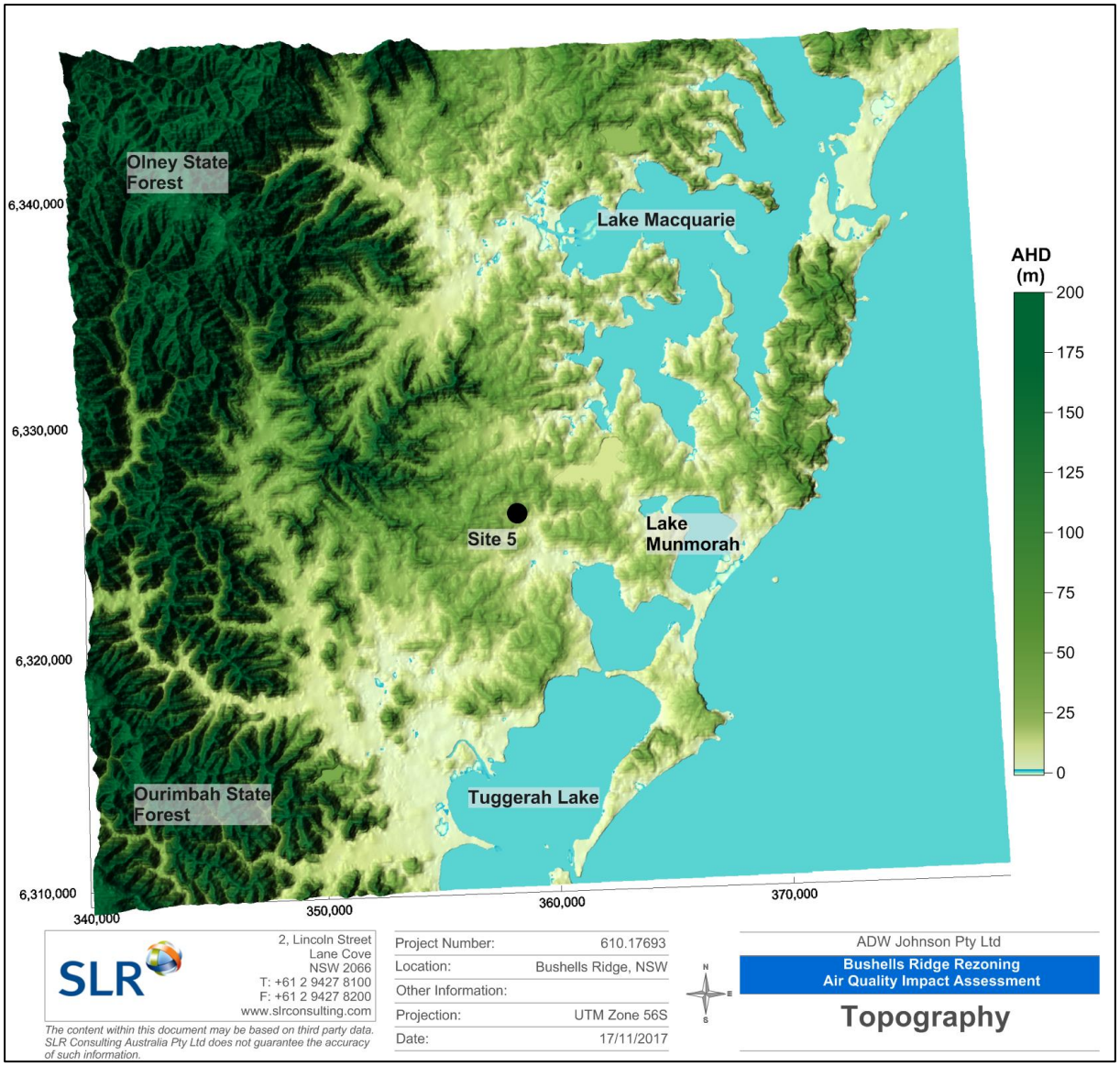
3 SURROUNDING ENVIRONMENT

3.1 Topography

Topography is important in air quality studies as local atmospheric dispersion can be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies around the project site.

A three dimensional representation of the area is shown in **Figure 2**. The elevation of the development sites ranges from approximately 20 m to 40 m Australian Height Datum (AHD). The areas southwest and northwest of the development sites are covered by Ourimbah State Forest and Olney State Forest respectively. The eastern coastline is approximately 9 km to the southeast, beyond Tuggerah Lake.

Figure 2 Regional Topography



3.2 Identified Local Air Emission Sources

The following existing sources of air pollutants have been identified in the area surrounding the development site:

- Montoro tile factory;
- Traffic on the Pacific Motorway and local road network;
- Newcastle – Sydney Rail line (coal trains); and
- Charmhaven sewage treatment plant (STP).

The following proposed sources of air pollutants have also been identified in the area:

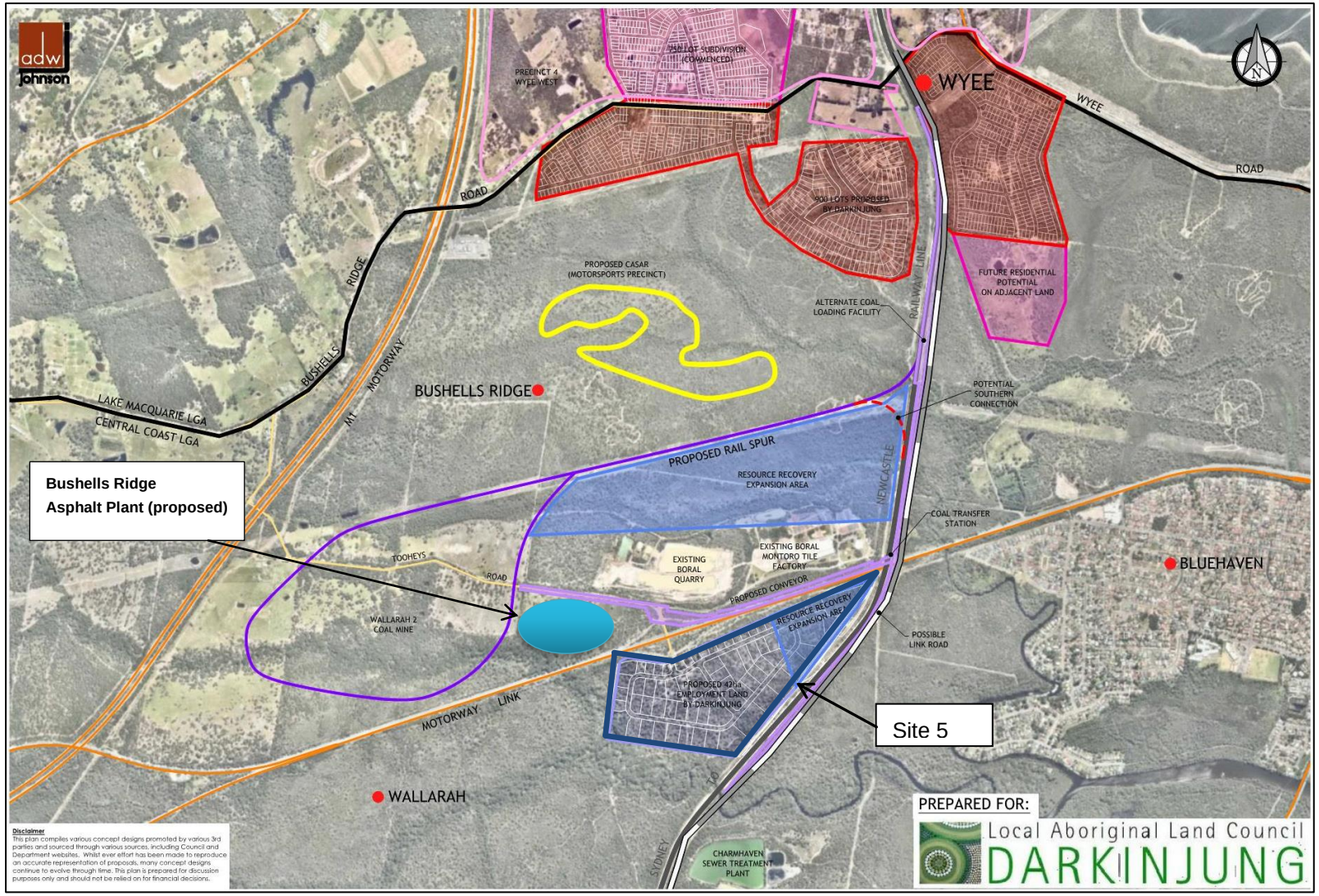
- CASAR Motorsport Park;
- Wallarah 2 coal project including a rail spur and coal loading facility; and
- Bushells Ridge asphalt plant.

The locations of these existing and proposed sources of air pollutants relative to Site 5 are shown in **Figure 3**.

Based on the existing and proposed sources of air pollutants located within the airshed, as identified above, the key air pollutants of interest are considered to be:

- Products of fuel combustion (including particulates) from local road traffic, surrounding industry (i.e. the Monaro Tile Factory and the proposed Wallarah 2 Coal mine), the proposed CASAR Motorsport Park and locomotives on the Sydney-Newcastle rail line;
- Fugitive particulate emissions from coal wagons on the Sydney-Newcastle rail line and the proposed Wallarah 2 Coal mine; and
- Odour from the Charmhaven STP and the proposed Bushells Ridge asphalt plant.

Figure 3 Wyong-Wyee Development Corridor



3.3 Meteorological Conditions

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

The Bureau of Meteorology (BoM) maintains Automatic Weather Stations (AWS) and publishes data recorded at those stations across Australia. The closest such weather station is located in the Cooranbong area, which is located approximately 11 km to the north of the development sites, and records wind speed and wind direction, among other parameters. Considering the relatively flat terrain between the Cooranbong (Lake Macquarie) AWS and the development sites, it may be assumed that the wind conditions recorded at the Cooranbong (Lake Macquarie) AWS are a reasonable representation of the wind conditions experienced at the development sites.

Annual wind roses for the years 2012 to 2016 and seasonal wind roses compiled from data recorded by the Cooranbong (Lake Macquarie) AWS during 2016 are presented in **Figure 4** and **Figure 5** respectively. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The following description of wind speeds references the Beaufort Wind Scale, as outlined in **Table 1**. Use of the Beaufort Wind Scale is consistent with terminology used by the BoM.

Table 1 Beaufort Wind Scale

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

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

The wind roses for the years 2012 to 2016 (**Figure 4**) indicate the predominant wind directions experienced in the area are consistently from the east, south-west and north to northwest directions. A very low frequency of winds from the northeast was recorded across all years. The annual frequency of calm wind conditions was recorded to range between 20% (2016) and 23% (2015). The following is noted from **Figure 4**:

Winds from between the south and southwest directions, which would blow air emissions from the existing industrial sources (Montoro tile factory, Charmhaven STP), as well as the proposed Wallarah 2 Coal Mine, CASAR Motorsport Park and Bushells Ridge asphalt plant, towards the development sites, occur approximately 21% (2016) to 31% (2012) of the time.

Figure 4 Annual Wind Roses for Cooranbong (Lake Macquarie AWS) (2012 to 2016)

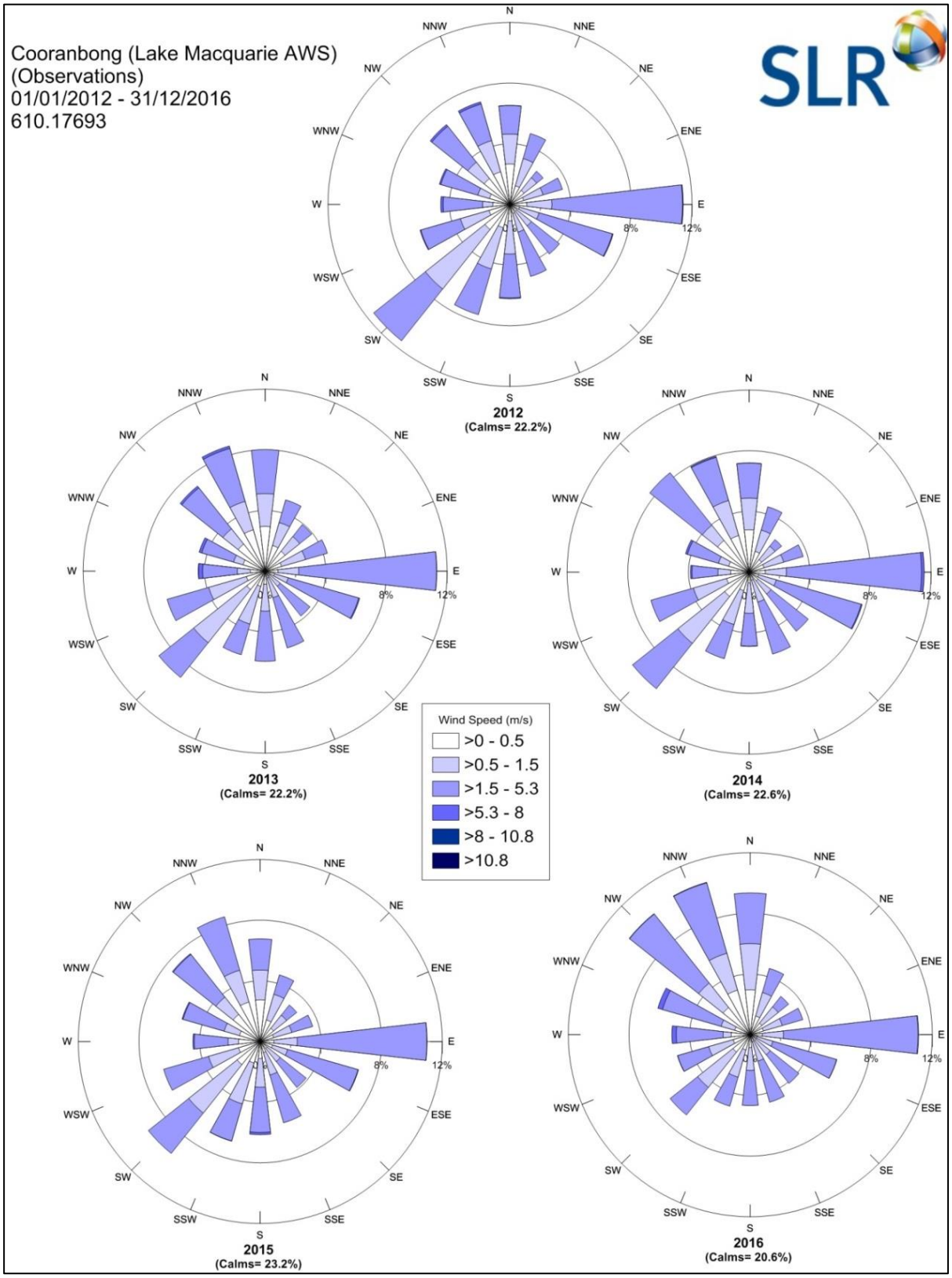
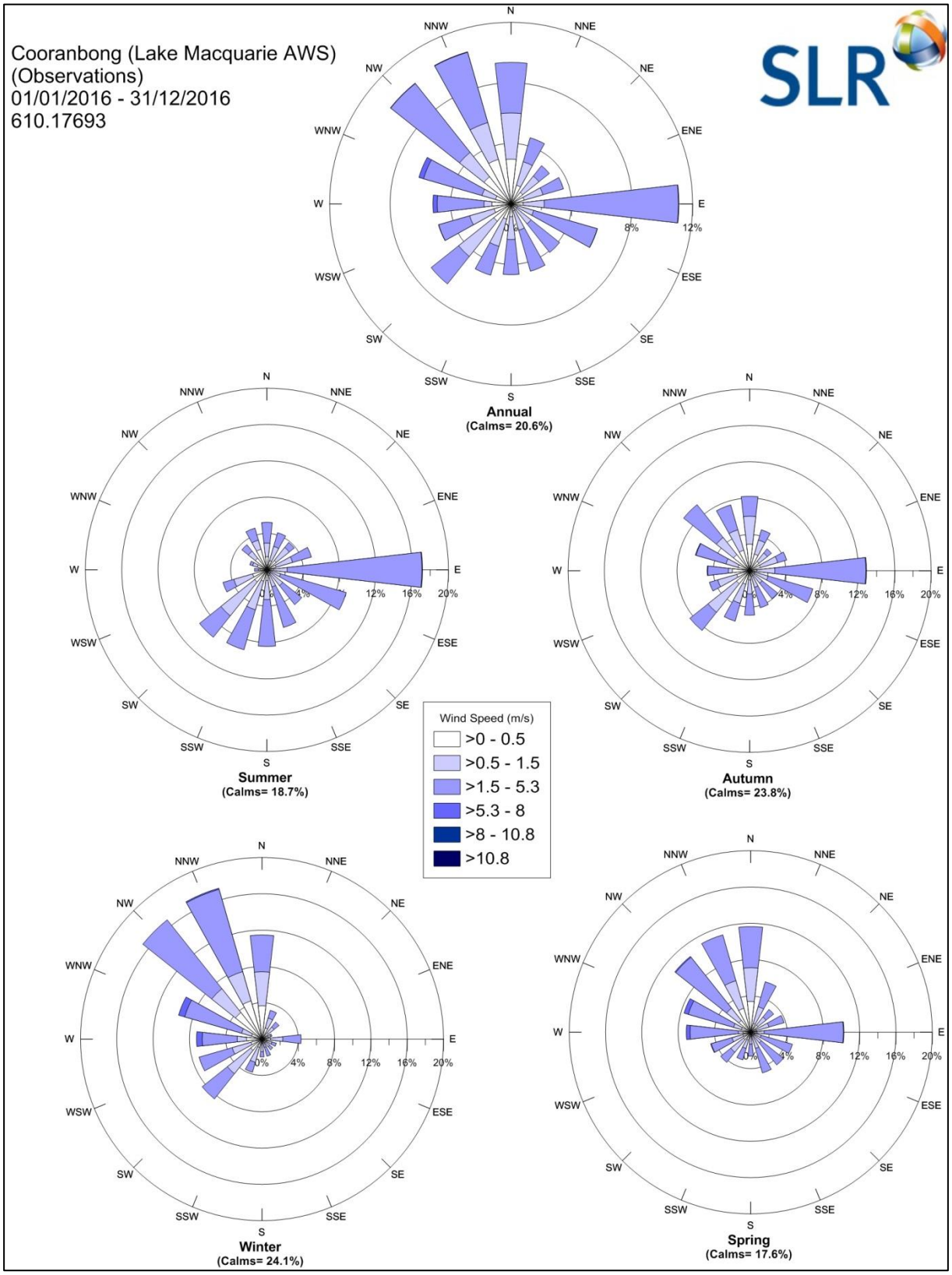


Figure 5 Annual and Seasonal Wind Roses for Cooranbong (Lake Macquarie AWS) (2016)



The seasonal wind roses for 2016 (**Figure 5**) indicate that:

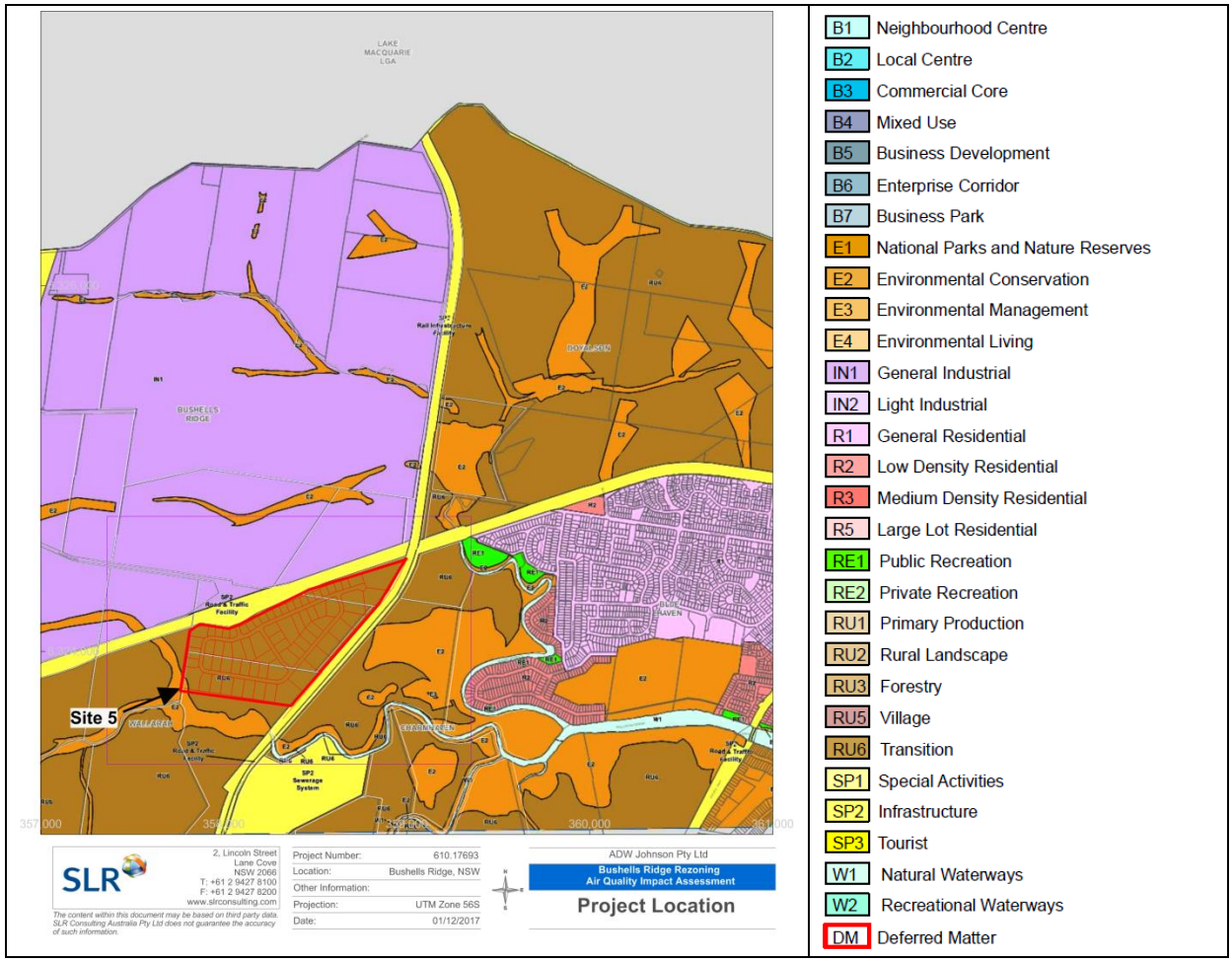
- In summer, wind speeds ranged from light to gentle breeze (between 0.5 m/s and 5.3 m/s). The majority of winds blew from between the east, with very few winds from the west. Calm wind conditions were observed to occur approximately 19% of the time during summer.
- In autumn, wind speeds ranged from light to gentle breeze (between 0.5 m/s and 5.3 m/s). The majority of winds blew from between the east, with very few winds from the northeast. Calm wind conditions were observed to occur approximately 24% of the time during autumn.
- In winter, wind speeds ranged from light to moderate winds (between 0.5 m/s and 8 m/s). The majority of winds blew from between the north and northwest directions, with very few winds from between the northeast and south-southwest. Calm wind conditions were observed to occur approximately 24% of the time during winter.
- In spring, wind speeds ranged from light to moderate winds (between 0.5 m/s and 8 m/s). The majority of winds blew from between the north and northwest directions and from the east direction, with very few winds from between the south. Calm wind conditions were observed to occur approximately 18% of the time during winter.

Overall, **Figure 5** indicates that there is significant seasonal variation for wind directions, however wind speeds experienced at the Cooranbong (Lake Macquarie) AWS are relatively consistent throughout the year.

4 WYONG SHIRE COUNCIL LOCAL ENVIRONMENTAL PLAN 2013

The Site 5 is located within the 'RU6 – Transition' zone as per the Wyong Shire Council Local Environmental Plan (WSCLEP 2013) land zoning map (LZN_012) shown in **Figure 6**.

Figure 6 Wyong Shire Council Local Environmental Plan 2013 - Land Zoning Map (LZN_012)



Source: https://www.legislation.nsw.gov.au/maps/caf5bd35-c1c6-4953-b618-ad113dcafa34/8550_COM_LZN_012_020_20131219.pdf

Part 2 (Permitted or prohibited development) of WSCLEP 2013 explains the land use types and permissible and non-permissible development types within the respective zones.

As noted above, Site 5 is currently zoned RU6 – Transition and is proposed to be rezoned to IN1 General Industrial.

The objectives of zone RU6 – Transition are:

- To protect and maintain land that provides a transition between rural and other land uses of varying intensities or environmental sensitivities.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To ensure that interim land uses do not have an adverse impact on the conservation or development potential of land identified for future investigation in the North Wyong Shire Structure Plan or Wyong Settlement Strategy.

The following activities are permitted with consent within RU6:

- Air transport facilities; Animal boarding or training establishments; Bed and breakfast accommodation; Building identification signs; Business identification signs; Community facilities; Dual occupancies; Dwelling houses; Electricity generating works; Emergency services facilities; Environmental facilities; Environmental protection works; Extensive agriculture; Farm buildings; Flood mitigation works; Home-based child care; Home businesses; Home industries; Home occupations; Horticulture; Information and education facilities; Recreation areas; Recreation facilities (outdoor); Research stations; Roads; Waste or resource management facilities; Water recreation structures; Water supply systems.

No activities are listed as being permitted without consent within RU6.

If the land is to be rezoned as IN1, the following activities would be permitted with consent:

- Depots; Food and drink premises; Freight transport facilities; Garden centres; General industries; Hardware and building supplies; Industrial training facilities; Kiosks; Landscaping material supplies; Light industries; Liquid fuel depots; Neighbourhood shops; Places of public worship; Plant nurseries; Roads; Rural supplies; Timber yards; Vehicle sales or hire premises; Warehouse or distribution centres.

The following activities are prohibited within IN1:

- Agriculture; Boat launching ramps; Boat sheds; Camping grounds; Caravan parks; Cemeteries; Charter and tourism boating facilities; Commercial premises; Correctional centres; Eco-tourist facilities; Educational establishments; Entertainment facilities; Environmental facilities; Exhibition homes; Exhibition villages; Extractive industries; Farm buildings; Forestry; Function centres; Heavy industries; Heavy industrial storage establishments; Home-based child care; Home businesses; Home occupations; Home occupations (sex services); Information and education facilities; Jetties; Marinas; Mooring pens; Moorings; Open cut mining; Passenger transport facilities; Public administration buildings; Recreation facilities (indoor); Recreation facilities (outdoor); Registered clubs; **Residential accommodation**; Tourist and visitor accommodation; Water recreation structures; Wharf or boating facilities

No activities are listed as being permitted without consent within IN1.

As shown in **Figure 6**, Site 5 is surrounded by land zoned as IN1 to the north, and RU6 – Transition or E2- Environmental Conservation to the southeast and west. Residential uses are not permitted within both of these zones, and the nearest residentially zoned land is located 500 m to the northeast at Blue Haven.

There are a number of industrial activities listed under the currently permitted activities for RU6. Rezoning Site 5 as IN1 will allow a range of other light industry uses however heavy industries will not be permitted. Any future industrial activities proposed within Site 5 would need to ensure that air emissions associated with those industrial activities do not adversely impact on the amenity and health of occupants in the nearest residentially zoned land in Blue Haven.

5 RELEVANT AIR QUALITY CRITERIA

5.1 Pollutants of Concern

As identified in **Section 3.2**, the key air pollutants of interest for the area are considered to be:

- Products of fuel combustion (including particulates) from local road traffic and locomotives on the Sydney-Newcastle rail line, the existing Monaro Tile Factory and the proposed Wallarah 2 Coal mine and CASAR Motorsport Park;
- Fugitive particulate emissions from coal wagons on the Sydney-Newcastle rail line and the proposed Wallarah 2 Coal mine; and
- Odour from the Charmhaven STP and the proposed Bushells Ridge asphalt plant.

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

5.1.1 Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The health effects of particulate matter are strongly influenced by the size of the airborne particles. Smaller particles can penetrate further into the respiratory tract, with the smallest particles having a greater impact on human health as they penetrate to the gas exchange areas of the lungs. Larger particles primarily cause nuisance associated with coarse particles settling on surfaces.

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

5.1.2 Products of Combustion

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

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

Oxides of nitrogen (NO_X) is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 soon after leaving a vehicle exhaust.

Vehicle exhausts can contain emissions of sulfur dioxide (SO_2) due to impurities in the fuel. The sulfur content in diesel fuel has significantly reduced over the years and a timeline of the sulfur content in diesel fuels in Australia is shown in **Table 2**.

Table 2 The Environmental and Operability Standard in Australia – Diesel Fuel Quality Standard

Pollutant	National Standard	Date of Effect	Test Method
Sulfur Content of Fuel	10 ppm (max)	1-Jan-09	ASTM D5453
	50 ppm (max)	1-Jan-06	
	500 ppm (max)	31-Dec-02	

Source: http://www.environment.gov.au/topics/environment-protection/fuel-quality/standards/diesel, accessed on 17 November 2017.

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

5.1.3 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 (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 wastewater treatment works.
- *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.

An example for this can be shown in a theoretical case of a bakery. A person walking past the bakery may smell the bakery odours and like these baking odours (it can be shown that people generally react positively to baking odours). However, a person living next to the bakery and who experiences the baking odours throughout their house and garden on a continuous basis may find the baking odours offensive to the point where they complain to local authorities.

Other factors may also come into play when assessing odour impacts, such as:

- *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.

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 ou (detection) is likely to represent the level below which "offensive" odours should not occur for an individual with a 'standard sensitivity' to odours. The NSW Environment Protection Authority (EPA) therefore recommends within the Odour Framework that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 ou (detection). This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour performance goals need to be designed to take into account the range of sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas. It is often not possible or practical to determine and assess the cumulative odour impacts of all odour sources that may impact on a receptor in an urban environment. Therefore, the odour performance goals allow for population density, cumulative impacts, and anticipated odour levels during adverse meteorological conditions and community expectations of amenity.

Where a number of the factors above simultaneously contribute to making an odour "offensive", an odour goal of 2 ou (detection) at the nearest residence (existing or any likely future residences) is appropriate, which generally occurs for affected populations equal or above 2000 people.

5.2 Air Quality Criteria

5.2.1 Particulate Matter and Products of Combustion

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 5.1** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2017) [hereafter 'Approved Methods']. The ground level air quality impact assessment criteria listed in Section 7 of the Approved Methods have been established by NSW EPA to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. They have been derived from a range of sources and are the defining ambient air quality criteria for NSW, and are considered to be appropriate for use in this assessment.

A summary of the relevant impact assessment criteria for particulate matter and products of combustion is provided in **Table 3**.

Table 3 NSW EPA Goals for Particulate Matter and Combustion Gases

Pollutant	Averaging Period	Concentration		Source
CO	15 minutes	87 ppm	100 mg/m^3	WHO (2000)
	1 hour	25 ppm	30 mg/m^3	WHO (2000)
	8 hours	9 ppm	10 mg/m^3	NEPC (1998)
NO_2	1 hour	12 pphm	246 µg/m^3	NEPC (1998)
	Annual	3 pphm	62 µg/m^3	NEPC (1998)
PM_{10}	24 Hours Annual	-	50 µg/m^3 30 µg/m^3	DoE (2016)
$PM_{2.5}$	24 Hours Annual	-	25 µg/m^3 8 µg/m^3	DoE (2016)
SO_2	10 minutes	25 pphm	712 µg/m^3	NHMRC (1996)
	1 hour	20 pphm	570 µg/m^3	NEPC (1998)
	24 hours	8 pphm	228 µg/m^3	NEPC (1998)
	Annual	2 pphm	60 µg/m^3	NEPC (1998)

Source: EPA 2017

5.2.2 Odour

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the Odour Framework, is expressed as follows:

$$\text{Impact assessment criterion (ou)} = (\log_{10}(\text{population})-4.5)/-0.6$$

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in **Table 4**.

Table 4 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (ou) (nose-response-time average, 99th percentile)
Urban area ($\geq$ 2000)	2.0
~300	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence ($\leq$ 2)	7.0

Source: DEC 2006

The Odour Framework 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).

As mentioned in **Section 2**, Site 5 is proposed to be used an industrial site and may be expected to occupied by up to 2,000 people. Based on this, an odour impact assessment criterion of 2 ou (expressed as the 99th percentile for a nose response average, i.e. 1-second average) is considered appropriate and has been adopted for this assessment.

6 AIR QUALITY ASSESSMENT

The air quality at Site 5 will be affected by regional background air quality, as well as the localised impacts of air emission sources within the surrounding area. The proposed rezoning of Site 5 from RU6 – Transitional to IN1 will reduce the sensitivity of the permitted land uses to local air quality compared to the current zoning. For example, bed and breakfast accommodation, dual occupancies, dwelling houses and home-based child care would no longer be permitted with consent. However permitted uses within IN1 still include some uses, such as food and drink premises and places of public worship that could be sensitive to localised air quality issues.

The following section presents a summary of ambient air quality monitoring data available for the region as well as an assessment of the potential impacts on air quality at Site 5 of the emission sources identified in **Section 3.2**. The potential impacts of these identified emission sources have been assessed based on publicly available air quality impact assessments for the relevant sources and recommended minimum separation distances for relevant activities.

6.1 Background Air Quality

Air quality monitoring is performed by the NSW OEH at a number of monitoring stations across NSW. The closest such station is the Wyong Air Quality Monitoring Station (AQMS) located within the Central Coast region of NSW, located approximately 9 km southwest of Site 5. The Wyong AQMS is located on the northern apron of Wyong racecourse within a residential/semi-rural area, as shown in **Figure 7**. The Wyong AQMS started monitoring air pollutant concentrations in October 2012. The following air pollutants are monitored by the Wyong AQMS:

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

A summary of the monitored pollutant concentrations for the last five years (2012-2016) is presented in **Table 5** and the data are presented graphically in **Figure 8** to **Figure 12**.

Table 5 Summary of Air Quality Monitoring Data at Wyong AQMS (2012 – 2016)

Pollutant	CO	NO_2		PM_{10}		$PM_{2.5}$		SO_2	
Averaging Period	Rolling 8-hour	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual
Units	mg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2012	0.5	59.5	7.9	37.4	21.8	14.7	7.3	85.8	2.9
2013	1.0	84.1	10.3	70.2	16.6	55.8	6.7	82.9	1.9
2014	0.6	69.7	10.2	41.9	15.1	19.7	5.5	114.4	1.6
2015	0.5	65.6	9.3	58.6	14.9	13.2	5.2	197.3	1.4
2016	0.8	94.3	9.7	46.0	15.2	19.8	5.7	91.5	1.5
Criterion	**10**	**246**	**62**	**50**	**30**	**25**	**8**	**570**	**60**

Figure 7 Location of Wyong AQMS

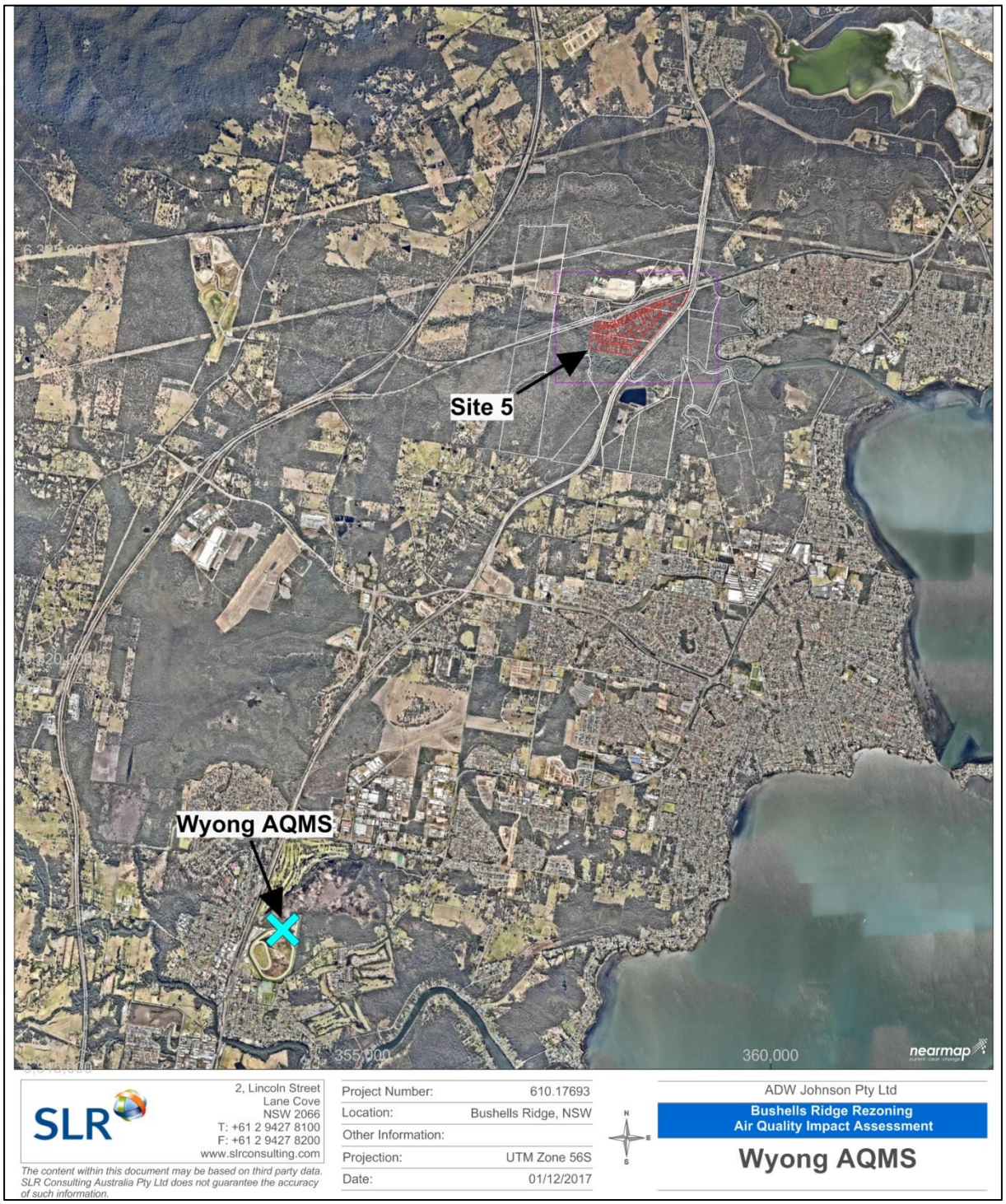


Figure 8 Measured Rolling 8-hour Average CO Concentrations at Wyong AQMS (2012-2016)

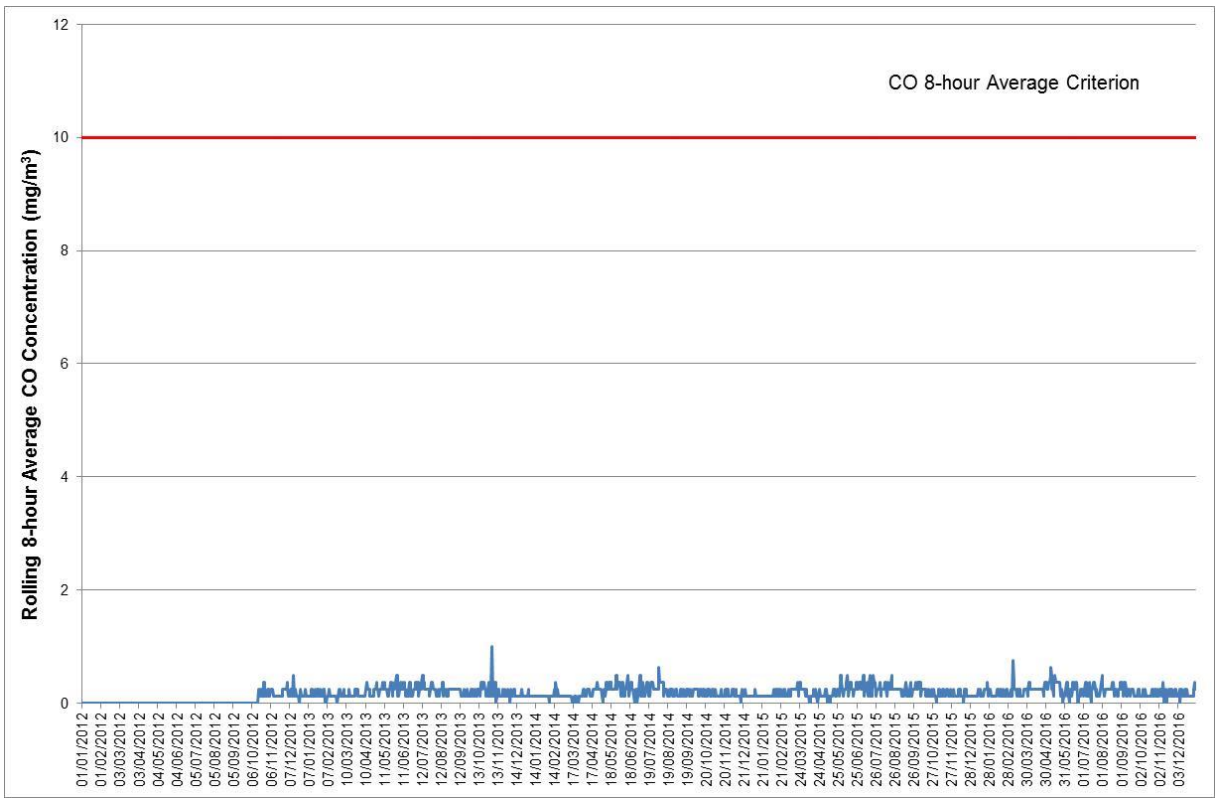


Figure 9 Measured Daily Maximum 1-hour Average NO_2 Concentrations at Wyong AQMS (2012-2016)

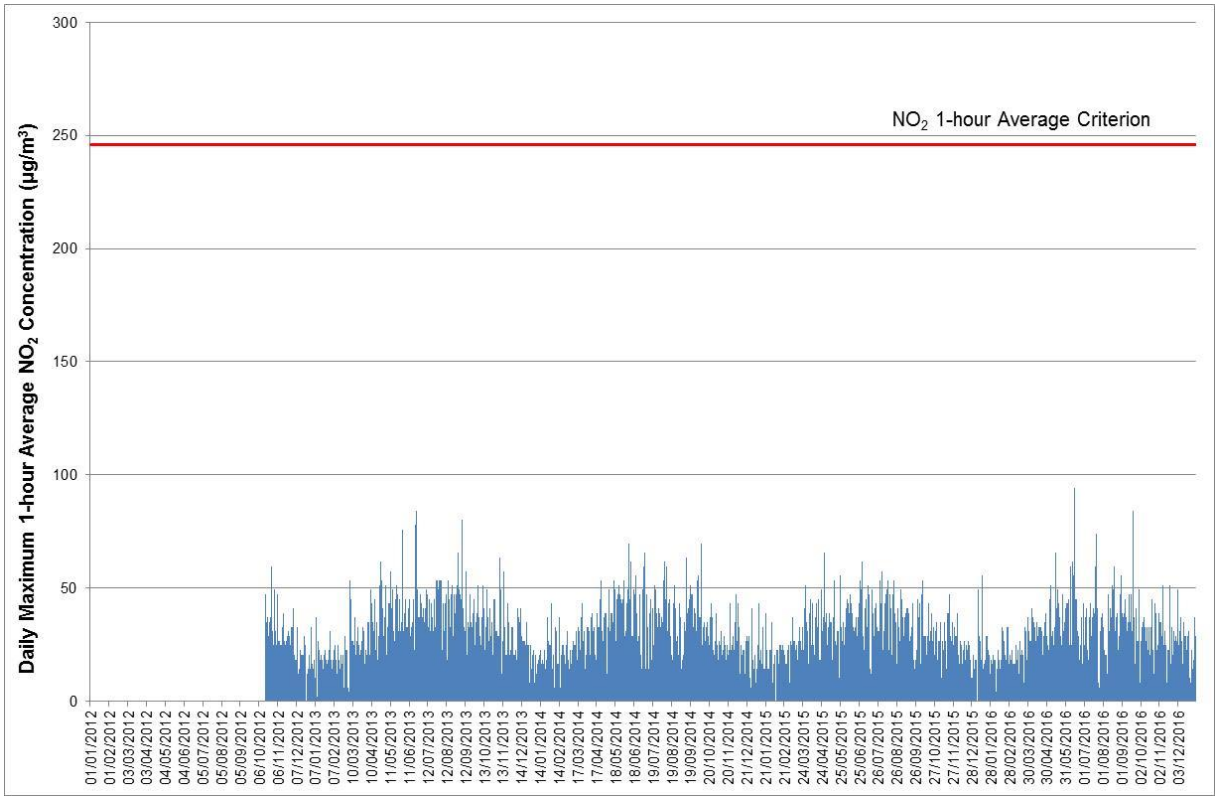


Figure 10 Measured 24-hour Average PM_{10} Concentrations at Wyong AQMS (2012-2016)

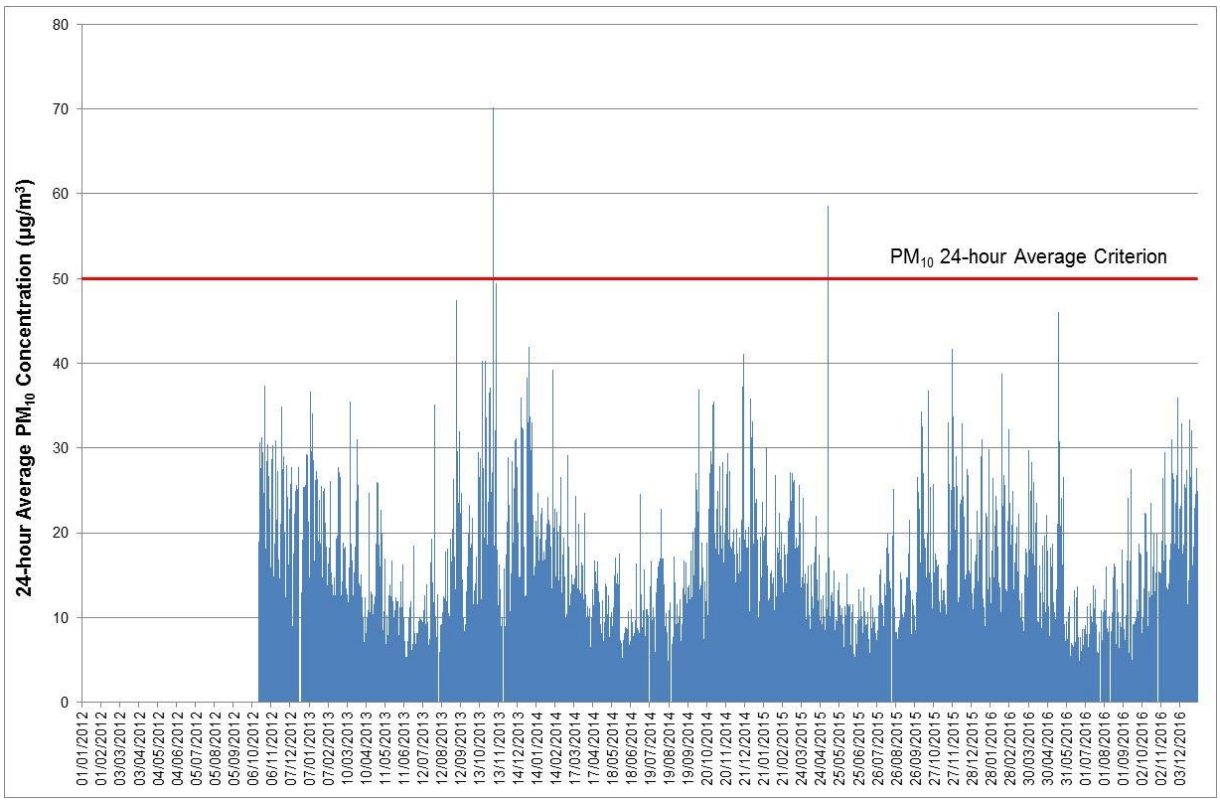


Figure 11 Measured 24-hour Average $PM_{2.5}$ Concentrations at Wyong AQMS (2012-2016)

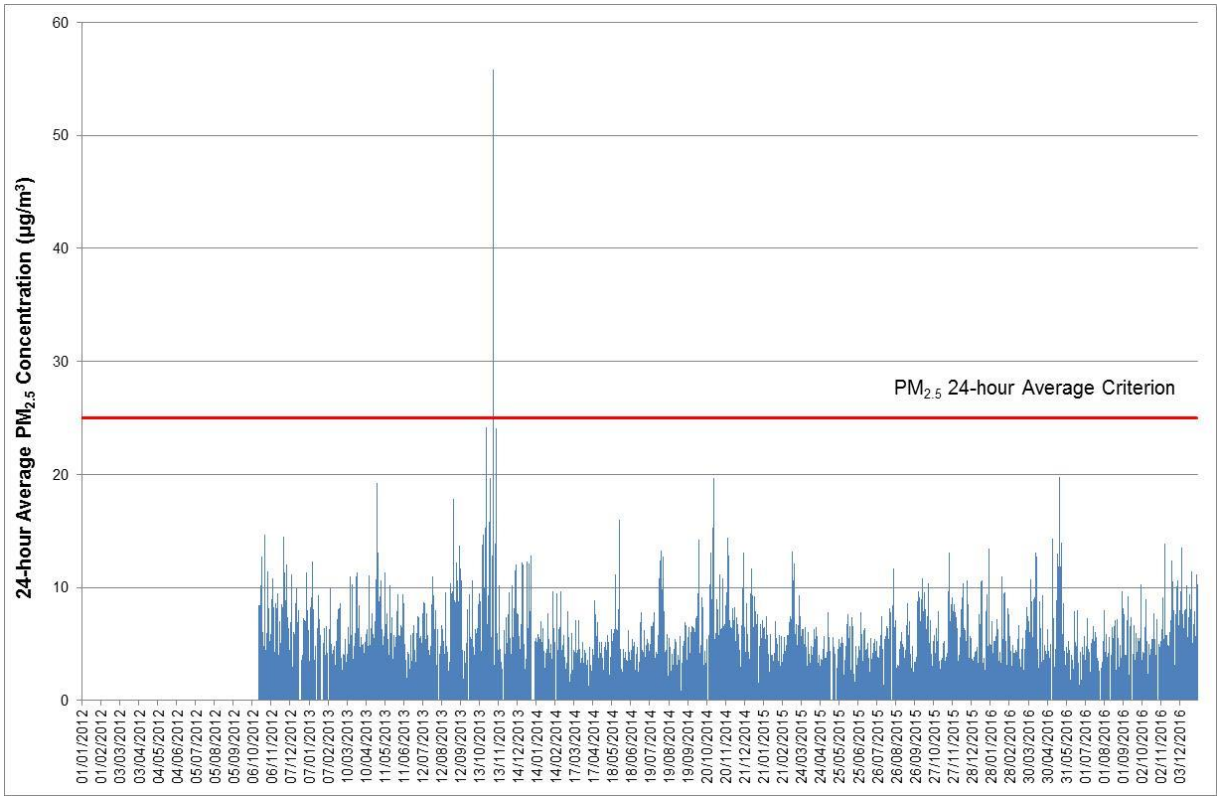
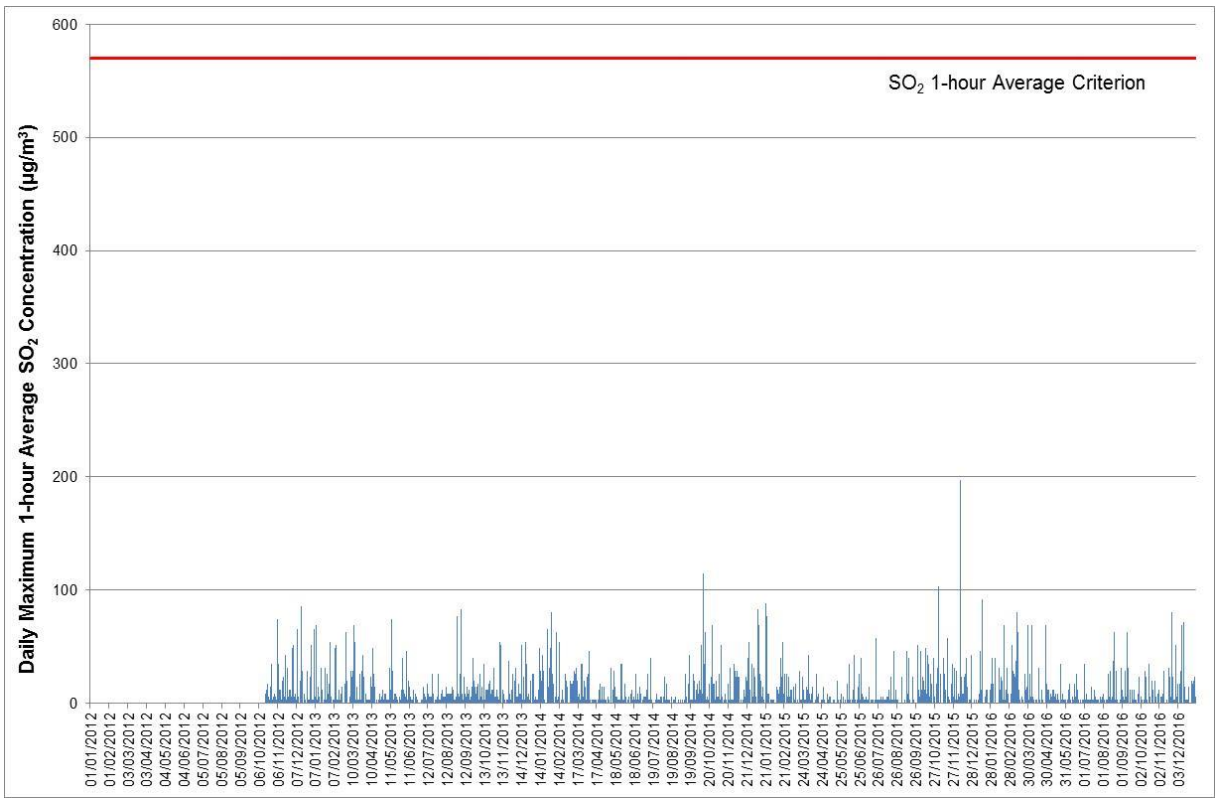


Figure 12 Measured Daily Maximum 1-hour Average SO_2 Concentrations at Wyong AQMS (2012-2016)



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

The monitoring data for PM_{10} and $PM_{2.5}$ indicate that exceedances of the relevant short term criteria (24-hour average) were recorded during 2013 (both PM_{10} and $PM_{2.5}$) and 2015 (PM_{10} only) at Wyong AQMS.

A review of the NEPM compliance report for 2013 (OEH 2014) indicates that the exceedance recorded on 3 November 2013 was attributable to a 'bushfire emergency'. A review of the NEPM compliance report for 2015 (OEH 2017) indicates that the exceedance that occurred on 6 May 2015 was a 'result of a state-wide dust storm that originated from the Victorian Mallee and Southern NSW regions and travelled throughout NSW during the 5 & 6 May (NSW Air Quality Statement 2015)'.

6.2 Localised Impacts of Existing Industrial Sources of Airborne Pollutants

6.2.1 Montoro Tile Factory

The Montoro tile factory is located approximately 130 m north of the nearest boundary of Site 5. The processes undertaken at the Montoro tile factory include the manufacture of terracotta roof tiles on the site, quarrying, crushing clay, extrusion, pressing, drying and firing the product.

No air quality impact assessment reports or air quality monitoring data could be sourced for the Montoro tile factory. Total PM_{10} emissions from the Montoro tile factory were reported to be approximately 21,360 kg/year for the year 2015/2016 (NPI 2017). In the absence of any publicly available air quality impact assessment reports for the Montoro tile factory, comparison is made to the total calculated PM_{10} emissions from the W2CP (53,460 kg/year, see **Section 6.3.2**). The total PM_{10} emissions from Montoro tile factory represent approximately 40% of the emissions from the W2CP.

Based on the air dispersion modelling study performed for the W2CP, which is based on local meteorological conditions and the surrounding topography, it can be estimated that the maximum 24-hour PM_{10} impact from the Montoro tile factory is likely to be between 4 µg/m^3 and 8 µg/m^3 (see **Figure 18**) within the Site 5 boundary.

6.2.2 Traffic on the M1 Pacific Motorway and Local Road Network

The M1 Pacific Motorway is located approximately 1.7 km west of the closest boundary of Site 5.

The Annual Average Daily Traffic (AADT) volume on the M1 Pacific Motorway recorded during 2016 approximately 3.5 km northwest of Site 5 (counting station 60 m south of Hue Hue Road, ID 5222) was 47,323 vehicles per day (sourced from RMS Traffic Volume Viewer).

A review of air quality monitoring data collected as part of the M4 East Project has been performed to provide an indication of the ambient pollutant concentrations that may be anticipated near the M1 Pacific Motorway. Monitoring data from the M4E:04 peak (roadside) station, located approximately 10 m from Parramatta Road at Concord Oval (approximately 57,000 vehicles per day in 2012, and approximately 74,500 vehicles per day in 2016) has been reviewed. The maximum concentrations of air pollutants recorded by this station between June 2015 and August 2015 are presented in **Table 6**. The maximum measured concentrations recorded during the 3-month period reviewed were below the relevant criteria.

Table 6 Pollutant Concentrations Measured Beside Parramatta Road (M4 East Project)

Pollutant[a]	Averaging Period	Maximum Concentration (June – August 2015) [c]	Relevant Criterion[b]
CO	Maximum 1 hour	2.3 mg/m^3	30 mg/m^3
NO_2	Maximum 1 hour	119.3 µg/m^3	246 µg/m^3
PM_{10}	Maximum 24 hour	32.8 µg/m^3	50 µg/m^3

Notes:

[a] No monitoring of SO_2, TVOC or $PM_{2.5}$ performed.

[b] Table 7.1 of the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2017)*.

[c] More recent publicly available monitoring data could not be sourced at the time of writing.

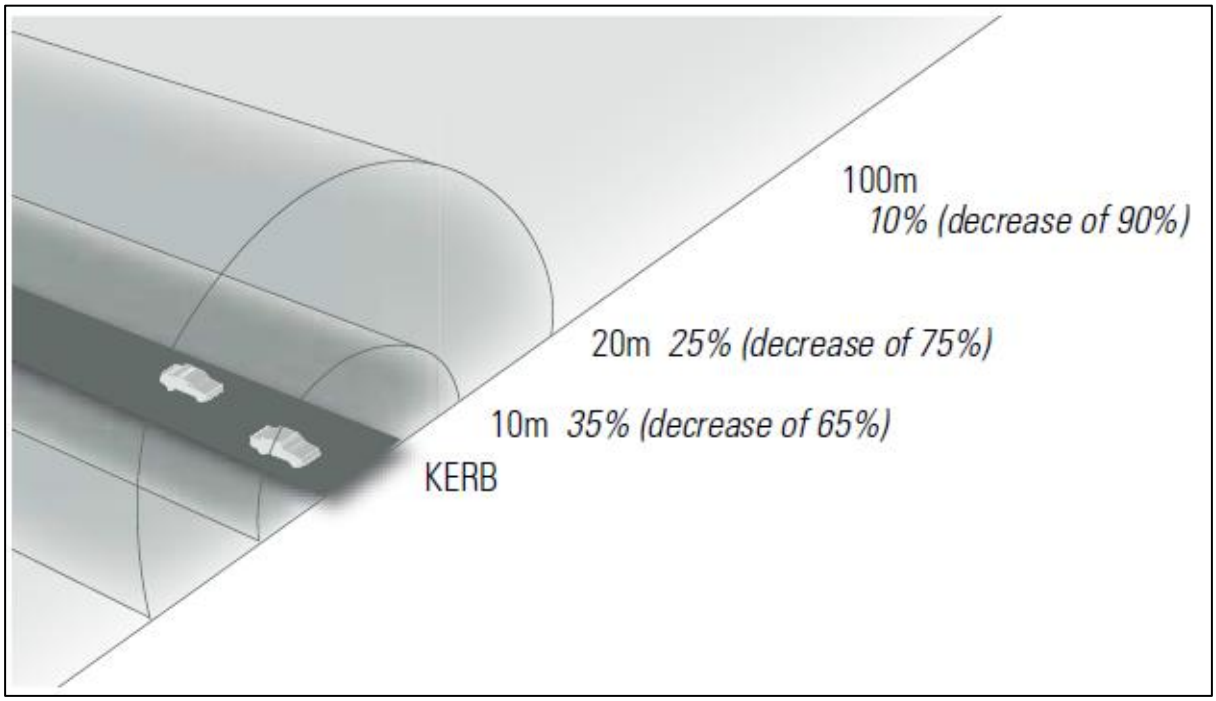
Taking into account the relative 2014 traffic volumes along Parramatta Road (101,375 vehicles per day east of M4 (two-way)) (AECOM 2015) compared to the M1 Pacific Motorway (47,323 vehicles per day in 2016) it is expected that pollutant concentrations that would be measured 10 m from the M1 Pacific Motorway would be lower than the levels shown in **Table 6**.

As outlined in the guideline 'Development near Rail corridors and Busy Roads' (DoP 2008) air pollutant concentrations from road traffic tend to decrease with increasing distance from the road. An indication of the relative decrease in pollutant concentrations with respect to the distance from the road is shown in **Figure 13**.

The review of the M4 East monitoring data indicates that the incremental impact of emissions from the M1 Pacific Motorway at Site 5 would be minor. The potential for these emissions to contribute significantly to exceedances of the relevant ambient air quality criteria at Site 5, given the background air quality data presented in **Section 6.1**, is therefore expected to be low.

Based on the above, air emissions from the M1 Pacific Motorway are not considered to be a constraint to the rezoning of Site 5 as IN1.

Figure 13 Percentage of Pollutant Concentration relative to Kerbside Concentration



Source: DoP 2008

6.2.3 Newcastle – Sydney Rail Line (Coal Trains)

The NSW freight and ports strategy (TfNSW 2013) shows the movements of major commodities across NSW as shown in **Figure 14**. As can be seen there are no coal freight movements between Sydney and Newcastle, however coal movements occur between Centennial Coal's Newstan mine and the Port of Newcastle. Newstan mine is located approximately 28 km north of Site 5.

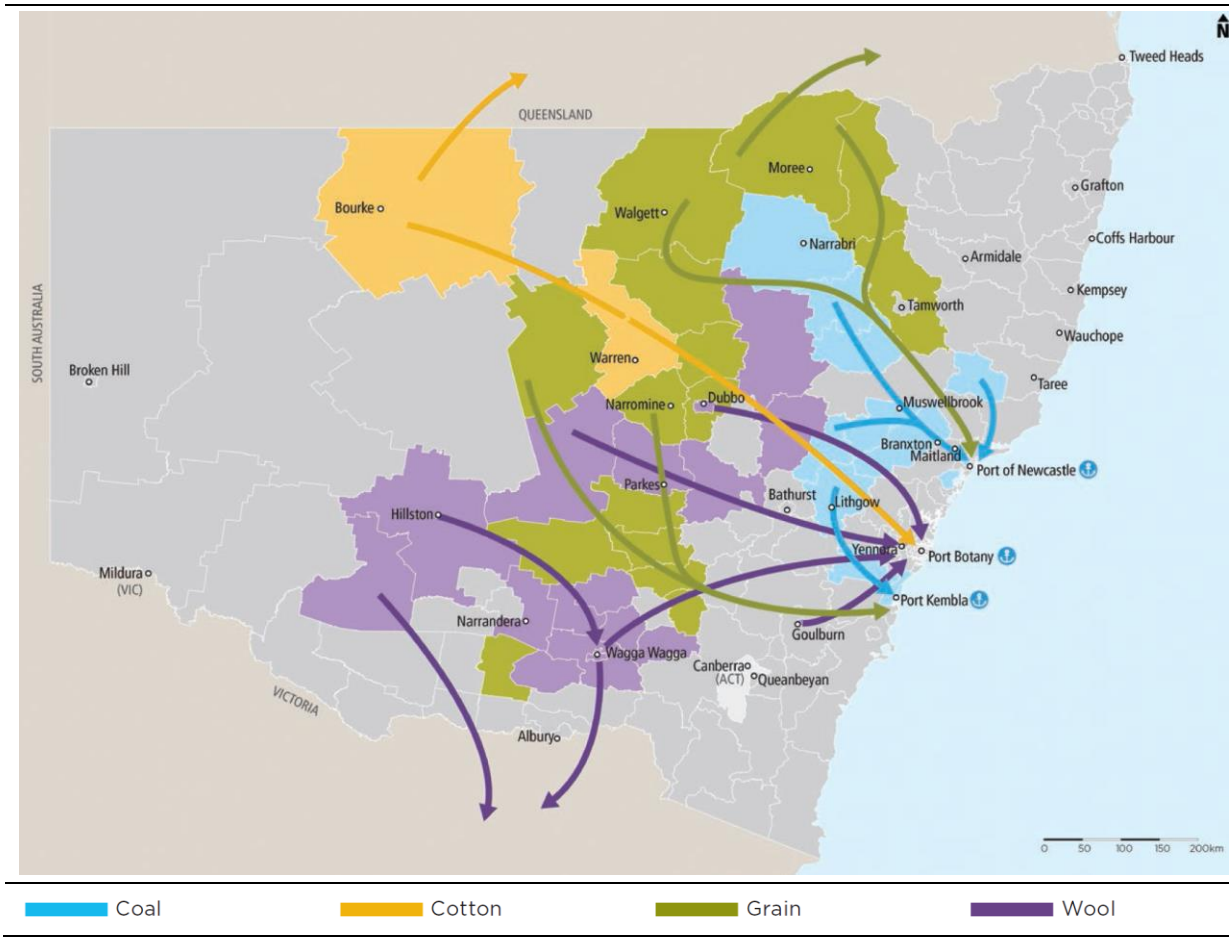
Notwithstanding the above, reference is made to a study – 'Coal Train Dust Management' by NSW Minerals Council (NSWMC 2016). The report was prepared in response to the concerns raised by members of the community regarding potential impact of coal dust emissions from coal trains operating in the Hunter Valley, with particular concerns about the air around the rail corridor in the Lower Hunter and Newcastle areas.

Based on the analysis of trackside monitoring data, it was concluded that:

- The scientific evidence indicates that coal trains do not have a significant impact on ambient air quality and that air quality around the rail corridor and the Lower Hunter more broadly is good.
- Trackside monitoring (approximately 3 m from the tracks) indicates loaded coal trains, unloaded coal trains and freight trains all generate a small, temporary increase in dust levels as they pass, similar to a vehicle travelling on a road and stirring up dust.
- Dust deposition monitoring around the rail corridor shows that dust levels are well within amenity criteria and that coal makes a small contribution to deposited dust
- Wind tunnel testing of coal samples indicated a low risk of dust emissions from the surface of loaded coal wagons.

Based on the above, air emissions from the Newcastle – Sydney rail line are not considered to be a constraint to the rezoning of Site 5 as IN1.

Figure 14 Selected Commodity Movements in NSW for 2011



Source: NSWMC 2016

6.2.4 Charmhaven Sewage Treatment Plant (STP)

Wyong Shire Council operates and maintains over 1,000 km of sewers, 140 pumping stations and six sewage treatment plants (STPs). The STPs are located at Bateau Bay, Wyong South, Charmhaven, Mannering Park, Gwandalan and Toukley and there are two ocean outfalls located at Norah Head and Wonga Point, Bateau Bay (Blue Planet 2017).

The Charmhaven STP is located approximately 400 m south of Site 5 and has therefore been considered for further investigation in regards to the potential odour impacts.

There are no specific guidelines issued in NSW for estimating minimum separation distances required for STPs. In the absence of NSW specific guidelines, reference has been made to the document '*Recommended separation distances for industrial residual air emissions*', published by EPA Victoria (EPAV 2013). This document prescribes a methodology to calculate separation distances for STPs based on the equivalent population (EP) they are serving.

Equation 1 below is specified for calculating the recommended separation distance for a 'mechanical/biological waste water plant':

$$D = 10 \times n^{1/3}$$ **Equation 1**

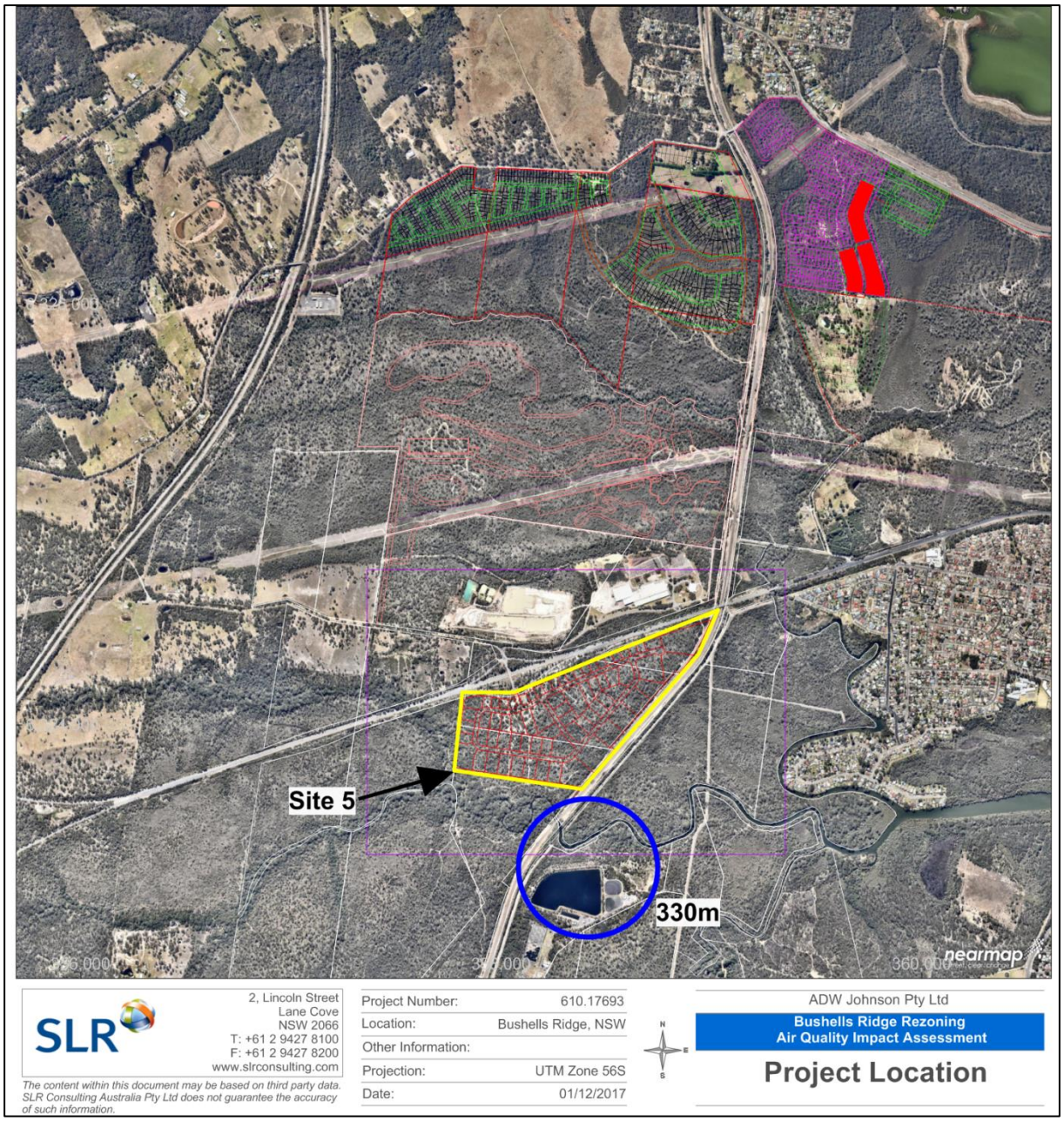
Where:

n equivalent population (EP) that the plant is serving

Variable separation distances are measured from the closest point of the STPs to the closest point of a receptor.

Using Equation 1, the recommended separation distance for the Charmhaven STP (based on the plant capacity of 40,000 EP) to the nearest sensitive land uses (i.e. residences) is calculated to be 330 m.

Figure 15 Separation Distance from Charmhaven STP



Note: Separation distance measured from the closest point of Charmhaven STP

Given the separation distance from Charmhaven STP does not encroach upon Site 5 boundary, it is concluded that odours from the STP are unlikely to have any impact on amenity levels at Sites 5, and it would therefore not be a constraint to the rezoning of Site 5 as IN1.

6.3 Proposed Industrial Sources of Airborne Pollutants

6.3.1 CASAR Motorsport Park

The CASAR Motorsports Park (CASAR Park) is currently in the planning phase and involves the proposed development of a car race track to the north of Sites 5 (see **Figure 3**).

A Development Application (DA) was lodged by CASAR Park on 30 June 2015 to the Wyong Shire Council for the development of a community-based motor sports and driver training facility (CASAR 2015). The approval is sought for:

- the main race track over a distance of approximately 3.5 km;
- pit garages;
- kiosk and amenities;
- administration building;
- associated out-buildings including first aid (medical) building, scrutineering shed, maintenance shed, control tower;
- a new access road off Bushells Ridge Road, and formal and overflow parking areas;
- a skid pan (concrete pad for driver training); and
- a go kart circuit, reception and workshops.

In the long term it is anticipated that CASAR Park may also include a number of other components:

- A showground/speedway;
- A caravan and camping ground;
- An outdoor activities area;
- Playground and retail/workshop facilities.

The DA for CASAR Park concluded that the most likely potential adverse impact arising from the development relates to the effect of noise on surrounding rural and suburban areas and no detailed air quality impact assessment was performed. At the time of writing this report, there had been no decision recorded against this application.

Given the number of vehicles that would be expected to be using the track at any point in time, no air quality impacts associated with vehicle exhaust emissions and tyre wear etc., would be anticipated at Site 5.

The CASAR Park development would therefore not be a constraint to the rezoning of Site 5 as IN1.

6.3.2 Wallarah 2 Coal Project (W2CP)

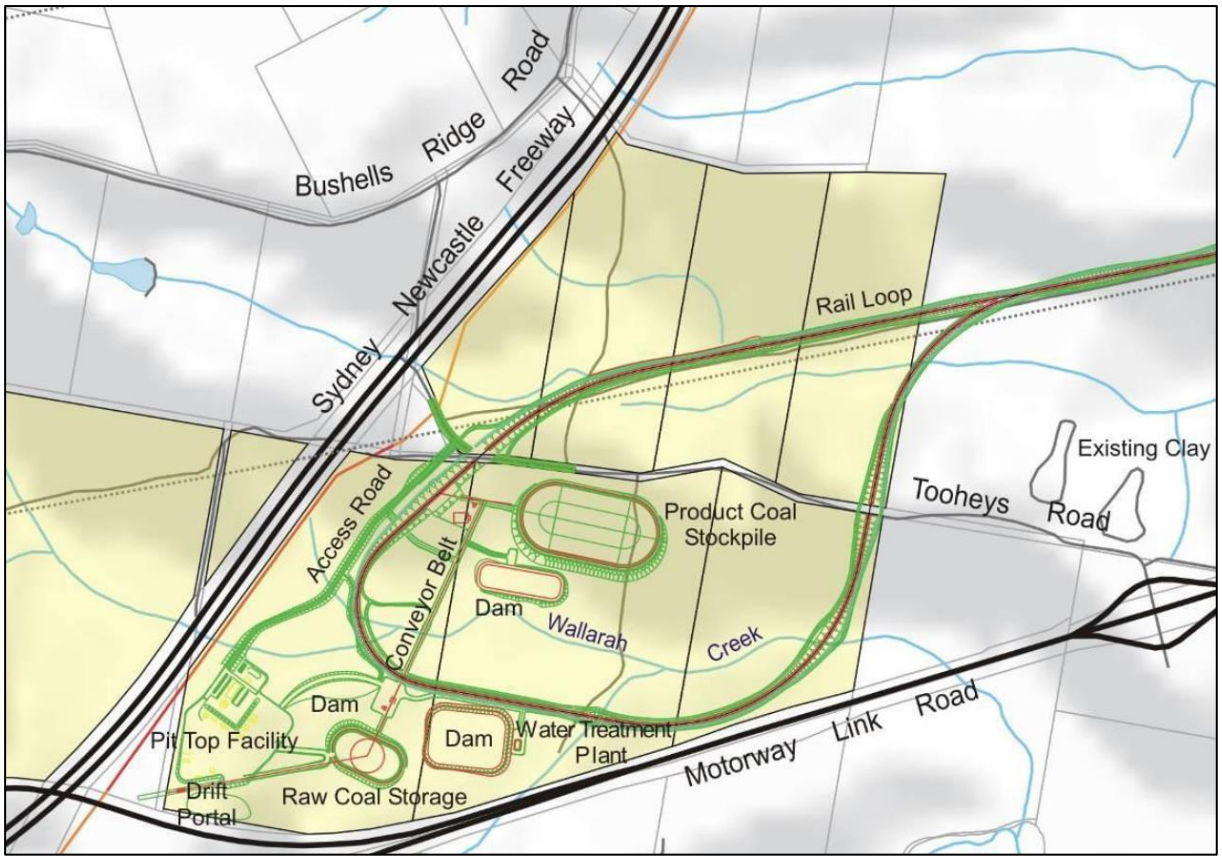
An AQIA was completed by PAE Holmes in November 2009 (PAE Holmes 2009) which assessed the air quality impacts associated with the W2CP, which includes a proposed underground longwall mine, a coal handling plant, rail loop and loading infrastructure, an underground drift facility and ventilation shafts, and gas and water management facilities. The W2CP includes extracting up to 5 million tonnes per annum (Mtpa) of coal from underground workings for a period of up to 28 years using longwall mining methods and transporting coal from the mine by rail.

The W2CP comprises two sites; the ‘Buttondery Site’ and the ‘Tooheys Road Site’, each located approximately 5.5 km and 1.5 km respectively from Site 5.

The upcast and downcast ventilation shafts are proposed to be located at the Buttonderry site along with the other office facilities. Given the nature and scale of these activities, the Buttondery Site is considered to be located too far to have any cumulative impact on Site 5, therefore it is not considered further in this assessment.

The location of potential air emission sources at the Tooheys Road Site is shown in **Figure 16**.

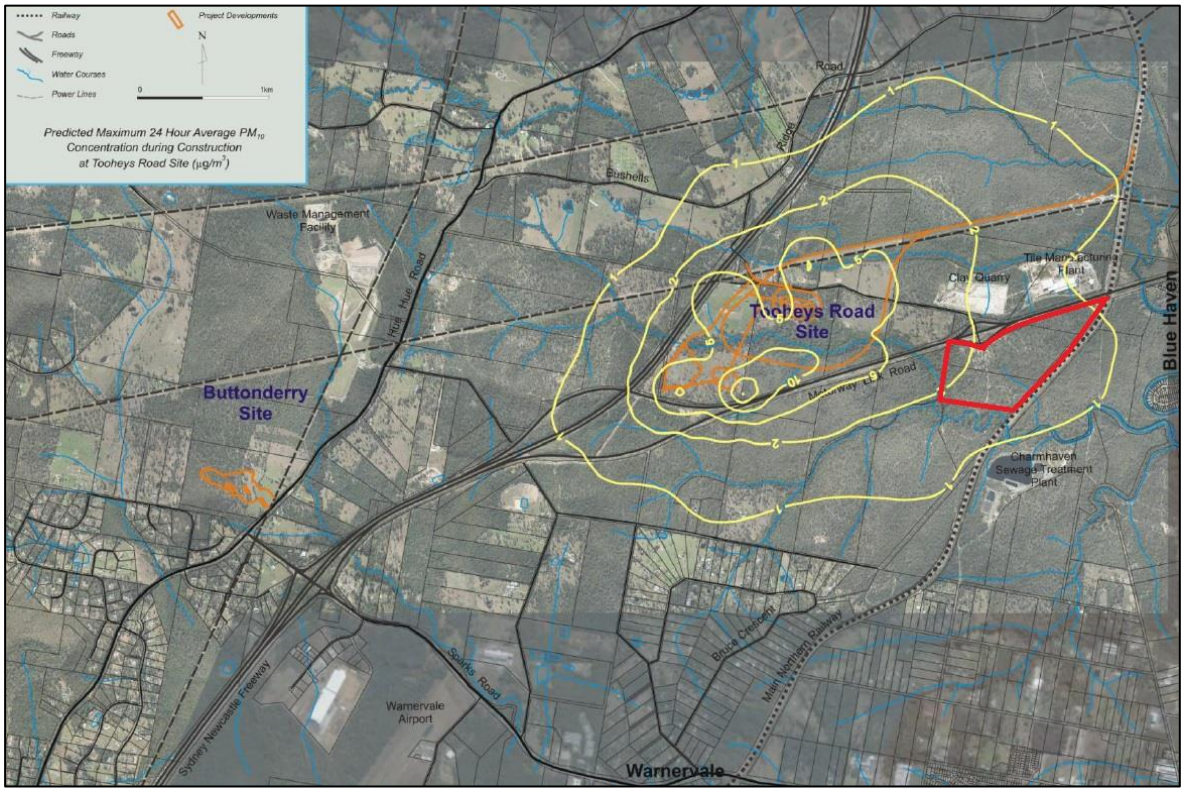
Figure 16 Proposed Layout of Surface Facilities



Source: Figure 3 (PAE Holmes 2009)

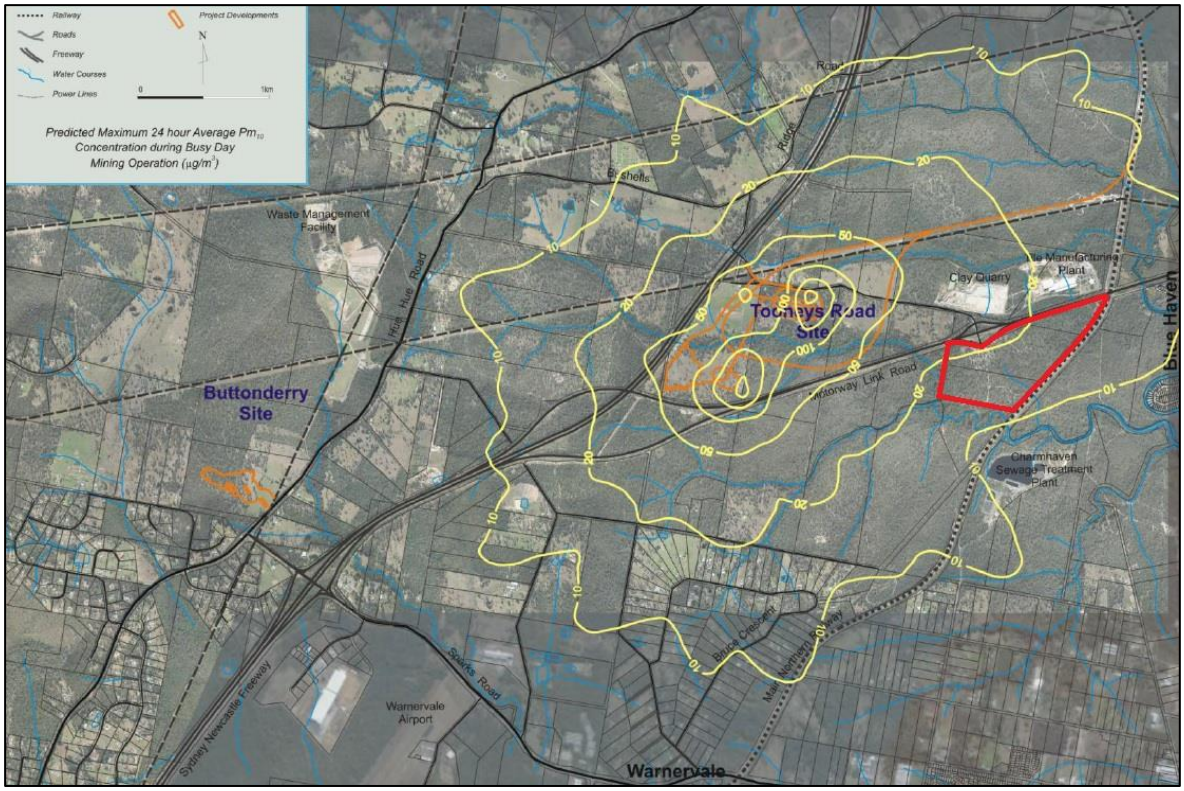
In order to assess the potential air quality impacts from W2CP on Site 5, the predicted short term (24-hour average) PM_{10} concentrations presented in the AQIA (PAE Holmes 2009) for construction and operational scenarios have been reviewed. A contour plot of the 24-hour average PM_{10} concentrations predicted by the modelling for the proposed construction and operational (busy period) activities are reproduced in **Figure 17** and **Figure 18** respectively, with the Site 5 boundary highlighted in red.

Figure 17 Predicted 24-Hour Average PM_{10} Concentrations for W2CP Construction Scenario



Source: Figure 14 (PAE Holmes 2009), location of Site 5 shown in red.

Figure 18 Predicted 24-Hour Average PM_{10} Concentrations for W2CP Operational (Busy Period) Scenario



Source: Figure 18 (PAE Holmes 2009), location of Site 5 shown in red.

As shown in **Figure 17** and **Figure 18**, the incremental 24-hour average PM_{10} concentrations predicted within the boundary of Site 5 were between 1 µg/m^3 and 5 µg/m^3 during construction and between 10 µg/m^3 and 20 µg/m^3 during operation (busy period), of the Tooheys Road Site, with north-western boundary predicted to experience greater than 20 µg/m^3.

These modelling results indicate that the incremental impact of emissions from the W2CP at Site 5 would be minor during construction, but do have potential to contribute to exceedances of short-term PM_{10} air quality criteria during the operational phase, given the background air quality data presented in **Section 6.1**.

The preliminary assessment for the W2CP conducted by the NSW Department of Planning and Infrastructure (DPI 2014) notes that WACJV has committed to a variety of management measures including fixed water sprays on all stockpiles, wind shielding applied to the roof and side wall of conveyors, belt cleaning and spillage minimisation, a variable height stack and a telescopic chute with water sprayers. WACJV has also committed to augmenting the existing air quality monitoring program with a continuous PM_{10} monitoring instrument at a location representative of receivers who may experience short term elevated dust concentrations.

Further, it was noted that the "Department is satisfied that air quality impacts in terms of both community amenity and human health are likely to be very low. Both EPA and NSW Health have no residual concerns about air quality impacts, and have recommended conditions of consent that the Department has taken into account."

At the time of writing this report, there had been no decision recorded against this application (State Significant Development 4974).

Based on the above, air emissions from the W2CP are not considered to be a constraint to the rezoning of Site 5 as IN1.

6.3.3 Bushells Ridge Asphalt Plant

An AQIA was completed by SLR in December 2016 (SLR 2016) which assessed the air quality impacts associated with a proposed asphalt plant to be located at 203 Tooheys Road, Bushells Ridge. The ancillary development onsite would include the receiving and processing of Reclaimed Asphalt Pavement (RAP) as well as raw materials storage, office/administration building, and car and truck parking areas.

Potential emissions to air from the operation of the proposed asphalt plant were estimated based on measured data from similar facilities (where available) and appropriate NPI or USEPA AP-42 emission factors/equations. The emission calculations were based on a maximum potential throughput of 160 tph and the dryer being diesel-fired. The emissions investigated in this assessment included odour, particulate matter (as TSP, PM_{10} and $PM_{2.5}$), NO_X, CO, SO_2 and VOCs (benzene, toluene, ethyl benzene and xylenes).

Based on the results of the modelling, it was concluded that air emissions from the operation of the asphalt plant would not have a significant impact on local air quality, and would not be anticipated to give rise to any adverse amenity (odour) or health impacts in the surrounding area. Contour plots of the predicted 24-hour average PM_{10} and 99th percentile odour concentrations for the operations are reproduced in **Figure 19** and **Figure 20** respectively, with the Site 5 boundary highlighted.

As shown in **Figure 19**, the incremental 24-hour average PM_{10} concentrations predicted within the boundary of Site 5 were between 0.5 µg/m^3 and 5 µg/m^3 during operation of the Bushells Ridge Asphalt Plant.

At the time of writing this report, there had been no decision recorded against this application (DA 1511/2016).

Based on the above, air emissions from the proposed asphalt plant are not considered to be a constraint to the rezoning of Site 5 as IN1.

Figure 19 24-hour Average PM_{10} Concentrations for Operational Scenario

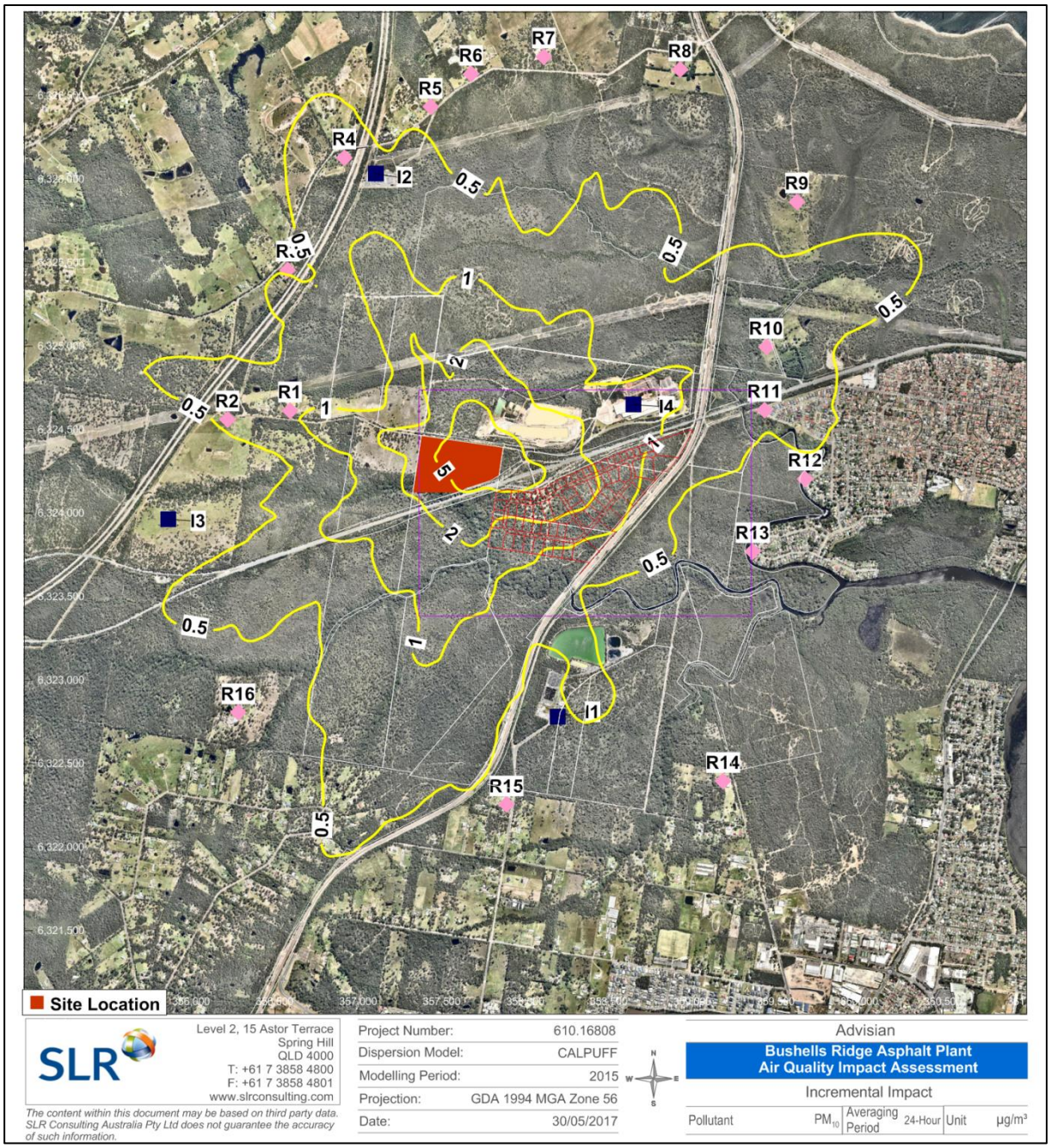
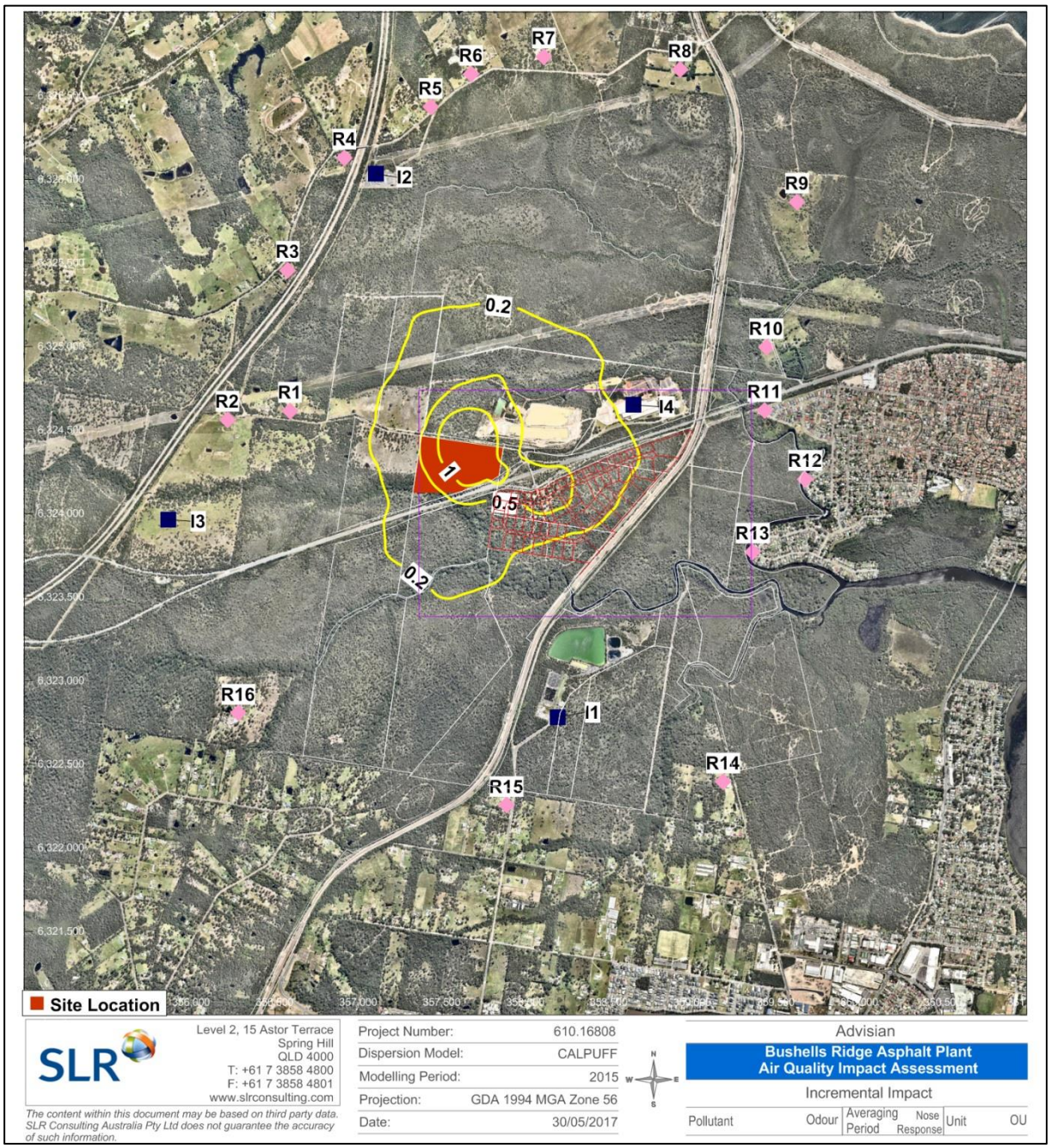


Figure 20 99th percentile Odour Concentrations for Operational Scenario



6.4 Air Quality Impacts from Site 5

As discussed in **Section 4**, Site 5 is proposed to be rezoned as IN1 – General Industrial zone. The following activities are permitted with consent within IN1:

- Depots; Food and drink premises; Freight transport facilities; Garden centres; General industries; Hardware and building supplies; Industrial training facilities; Kiosks; Landscaping material supplies; Light industries; Liquid fuel depots; Neighbourhood shops; Places of public worship; Plant nurseries; Roads; Rural supplies; Timber yards; Vehicle sales or hire premises; Warehouse or distribution centres.

The permitted activities under zone 'IN1' in the Wyong Shire Council Local Environmental Plan (WSCLEP 2013) are generally noted to be low impact industry types. Notwithstanding above, an assessment of the future industry types is conducted based on the generic separation distance guidelines.

In the absence of NSW specific guidelines, reference has been made to the document '*Recommended separation distances for industrial residual air emissions*', published by EPA Victoria (VIC EPA 2013) and Western Australia Environment Protection Authority (WA EPA) policy documentation for minimum recommended separation distances - *Separation distances between Industrial and Sensitive Land Uses* (WA EPA 2015).

These documents list the recommended separation distances for a variety of industry types. The recommended separation distances for the permitted actives under zone 'IN1' in the Wyong Shire Council Local Environmental Plan (WSCLEP 2013) range from 250 m (liquid fuel depots) to 500 m (landscaping material supplies).

The nearest existing residential receptors are located approximately 500 m away from the nearest boundary of Site 5. Therefore, potential future industries that would be permissible within Site 5 would not be expected to have significant potential for impact on the existing residential receptors. It is recommended however, that the air quality impacts from proposed future industries within Site 5 that would have associated air emissions be assessed individually by conducting site-specific air quality assessments.

7 CONCLUSIONS

SLR was commissioned by ADW on behalf of Darkinjung Local Aboriginal Land Council (DLALC) to conduct an air quality impact assessment to accompany the rezoning application of land located within the Wyong Local Government Area (LGA).

Site 5 is located on the corner of Motorway Link Road and the Sydney-Newcastle Railway, at the northeastern end of the township of Wallarah. The nearest existing residences are located approximately 500 m from the northeastern boundary of Site 5, on Waterhen Close in Blue Haven.

Background air quality has been assessed by analysing ambient air quality monitoring data recorded in Wyong for the last five years. It was noted that generally local air pollutant concentrations were well below the air quality criteria listed by NSW EPA. A small number of exceedances of the 24-hour average PM_{10} and $PM_{2.5}$ guidelines have been recorded, however these exceedances were associated with regional events such as bush fires and dust storms and not representative of typical air quality in the region.

Air quality impacts from localised sources of air pollution i.e. existing Montoro tile factory (includes quarry), traffic on the M1 Pacific Motorway and local road network, Newcastle – Sydney rail line (coal trains), existing Charmhaven STP and the proposed CASAR Motorsport Park, W2CP and the Bushells Ridge asphalt plant were analysed. This review concluded:

- The existing Charmhaven STP and proposed Bushells Ridge asphalt plant are unlikely to have any odour impacts on Site 5.
- Air quality impacts associated with particulate and combustion product emissions from the proposed CASAR Park, proposed Bushells Ridge asphalt plant, and existing traffic levels on the M1 Pacific Motorway are likely to be negligible.
- Air quality impacts associated with particulate emissions from coal trains on the Newcastle-Sydney rail line and the proposed W2CP are likely to be minor when compared to regional air pollutant levels, however there is potential for the cumulative short term impacts to exceed the 24-hour average PM_{10} criterion during busy periods of operation at the W2CP and Montoro tile factory. A range of dust control measures and a real-time particulate monitoring programme is proposed for the W2CP to ensure off-site concentrations of particulate are well controlled.
- No air quality impact assessment reports or air quality monitoring data could be sourced for the Montoro tile factory. Based on the PM_{10} emission load reported by this facility in the most recent National Pollutant Inventory report and the air dispersion modelling study performed for the W2CP, it was estimated that the maximum 24-hour PM_{10} impact from the Montoro tile factory may be in the region of 4 µg/m^3 to 8 µg/m^3 within the boundary of Site 5. If the exceedance events associated with dust storms and bush fires are excluded from the background monitoring data, an incremental impact of 8 µg/m^3 would not cause an exceedance of the 24-hour average PM_{10} guideline when the cumulative impacts are considered.

The potential for air quality impacts from any future industrial sources within Site 5 on the nearest residentially zoned land was assessed based on the recommended separation distances by regulatory agencies for activities permitted within IN1. It was concluded that potential future industries that would be permissible within Site 5 would not be expected to have significant potential for impact on the existing residential receptors. It is recommended however, that the air quality impacts from proposed future industries within Site 5 (which would have associated air emissions) be assessed individually by conducting site-specific air quality assessments.

Based on the above review of existing background air quality and the localised incremental impacts of existing and future pollutant emission sources in the region, it is concluded that air quality is not expected to be a deterrent to the rezoning application of Site 5.

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