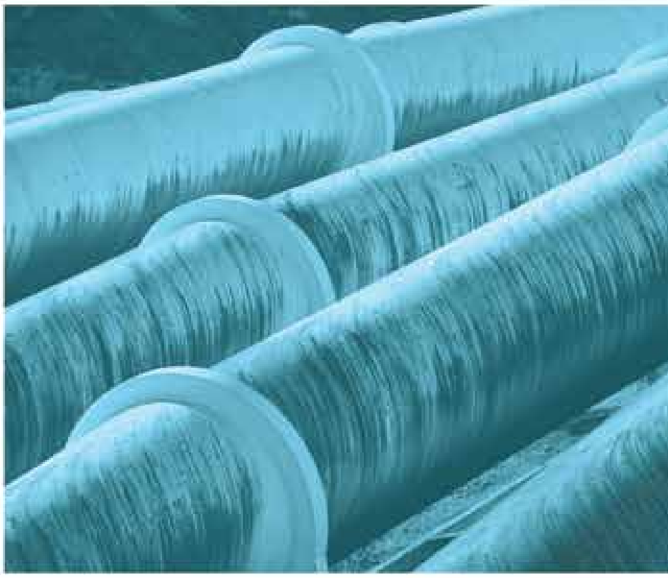
Air quality impact assessment

Kingsgrove resource recovery facility | 2F The Crescent Kingsgrove NSW 2208

Prepared for W & J Lee Property Investments Pty Ltd
December 2019



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Air quality impact assessment

Kingsgrove resource recovery facility | 2F The Crescent Kingsgrove NSW 2208

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Client

W & J Lee Property Investments Pty Ltd

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5 December 2019

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5 December 2019

Executive Summary

EMM Consulting Pty Ltd (EMM) was engaged by W & J Lee Property Investments Pty Ltd to undertake an air quality impact assessment (AQIA) for a proposed resource recovery facility at 2F The Crescent, Kingsgrove.

Existing environment conditions were quantified primarily using the Bureau of Meteorology monitoring station at Canterbury Racecourse and the NSW Office of Environment and Heritage air quality monitoring station at Earlwood.

Emissions of total suspended particulates (TSP), particulate matter less than 10 microns in aerodynamic equivalent diameter (PM_{10}) and particulate matter less than 2.5 microns in aerodynamic equivalent diameter ($PM_{2.5}$) associated with proposed operations of the site were quantified using publicly available emission estimation techniques. Busy day operations were quantified through the application of a 1.5 scaling factor to average day emissions. Odour emissions from the storage of green waste at the facility were also quantified.

Atmospheric dispersion modelling predictions of air pollution emissions for proposed activities were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that proposed operations at the site are unlikely to result in exceedances of the applicable particulate matter or odour impact assessment criteria at any of the surrounding assessment locations. Impacts generated by the facility are minor relative to ambient background air quality.

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1 Introduction

1.1 Overview

W & J Lee Property Investments Pty Ltd proposes to construct and operate a resource recovery facility (the facility) at 2F The Crescent, Kingsgrove (the site), within the Georges River local government area (LGA).

The facility would receive, sort and process of up to 35,000 tpa of dry, general solid waste (non-putrescible) as defined by the NSW *Protection of the Environment Operations Act 1979* (POEO Act) and the *Waste Classification Guidelines* (EPA 2014a). The incoming material would be primarily sourced from the construction and demolition, commercial, industrial and residential sectors.

The facility would receive, sort and dispatch waste and recyclable materials. It is not proposed to use the site for long term storage of any waste or recyclable material. Processed materials will be dispatched directly to customers/retailers for re-use or to other specialist waste facilities for further processing to achieve marketable recycled products. These products will meet the relevant recycled recovery order specifications, allowing for the recovery of materials that would otherwise be disposed to landfill.

No asbestos, liquid waste, hazardous waste or radioactive waste, as defined in the POEO Act or the guidelines would be accepted at the facility. All of the materials brought onto the site would be taken from the site as products or as rejects for disposal at an EPA licensed landfill. Odorous materials will not be received. There would be no materials land-filled or otherwise disposed anywhere within the site as a result of this proposal.

The facility will operate Monday to Saturday from 6:00 am to 5:30 pm, receival of material is opened 24 hours a day. Operation on Sundays and public holidays is not proposed.

1.2 Assessment approach and requirements

This air quality impact assessment (AQIA) has been conducted in general accordance with the guidelines specified by the NSW Environment Protection Authority in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016), hereafter "the Approved Methods for Modelling". Consistent with Section 2.1 of the Approved Methods for Modelling, this AQIA is classed as a Level 2 assessment and implements a refined dispersion modelling approach using site-specific/representative input.

The AQIA is comprised of the following sections:

- a description of the local setting and surrounds of the site;
- relevant pollutants for assessment and applicable impact assessment criteria;
- a description of baseline inputs, specifically:
  - meteorology and climate; and
  - existing air quality environment;
- a detailed air pollution emissions inventory for the facility; and
- results of atmospheric dispersion modelling conducted for the facility, including an analysis of facility-only and cumulative impacts accounting for background air quality.

2 Site description and setting

2.1 Site description

The site is on a two-lane road (The Crescent) which provides access to a number of industrial lots to the south of Vanessa Street and the T8 rail line (Figure 2.1). The Crescent forms a loop and connects with the local through road – Vanessa Street - at two points. Heavy vehicles exceeding 6 m long cannot turn right onto Vanessa Street when exiting The Crescent from either of the intersections.

The Crescent adjoins Beverly Hills Park to the west. The M5 Motorway is located approximately 57 m to the north of the site.

The nearest residential dwellings are located approximately 190 m to the north of the site (separated from the site by M5 Motorway), and there are also dwellings approximately 250 m to the west (separated by Beverly Hills Park).

The land surrounding the site to the east, west and south are all zoned IN2 Light Industrial.

The M5 Motorway, which is located approximately 57 m from the site, is currently under major development works. There are tunnelling works along the M5 Motorway and two construction compounds (Kingsgrove north and Kingsgrove south) located to the north and north-east of the site. The construction work is part of the new M5 Beverly Hills to St Peters project.

2.2 Assessment locations

As stated, the facility is located in an industrial estate with residential receptors further afield. A mix of residential and industrial receptors, selected as representative of the neighbouring community, are presented in Table 2.1 and are shown in Figure 2.2. These locations are used as points for detailed model analysis of air quality impacts from the site. Compliance with applicable air quality impact assessment criteria at these locations would indicate that air quality criteria will be met at other surrounding receptors.

Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

Site boundary

Rail line

Main road

Local road

Watercourse/drainage line

Waterbody

Local setting

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Figure 2.1

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Table 2.1 Representative assessment locations

ID	Location (m, MGA56s)		Type
	Easting	Northing	
R1	323682	6242923	Residential
R2	323610	6242944	Residential
R3	323562	6242927	Residential
R4	323471	6242939	Residential
R5	323254	6242665	Residential
R6	323284	6242608	Residential
R7	323326	6242526	Residential
R8	323356	6242456	Residential
R9	323777	6242267	Residential
R10	323830	6242354	Residential
R11	323891	6242402	Residential
R12	323918	6242438	Residential
R13	323617	6242694	Industrial
R14	323491	6242605	Industrial
R15	323541	6242623	Industrial
R16	323743	6242578	Industrial
R17	323516	6242710	Industrial

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Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Assessment locations

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Figure 2.1

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3 Pollutants and assessment criteria

3.1 Potential air pollutants

The operation of the project has the potential to generate emissions of various air pollutants to the ambient atmosphere. Emission sources will comprise of a mixture of fugitive (material handling and transfers, processing activities, movement of mobile plant and equipment) and mobile combustion sources (diesel combustion by site equipment fleet and trucks). Air pollutants will comprise of:

- particulate matter, specifically:
  - total suspended particulate matter (TSP);
  - particulate matter less than 10 microns in aerodynamic diameter (PM_{10});
  - particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$).
- oxides of nitrogen (NO_x);
- sulphur dioxide (SO_2);
- carbon monoxide (CO); and
- volatile organic compounds (VOCs).

Particulate matter pollutants (TSP, PM_{10} and $PM_{2.5}$) are anticipated to be the key pollutants with regards to both magnitude of emissions generated by the project and the associated compliance with impact assessment criteria at surrounding receptors. This assessment will therefore focus on the quantification of particulate matter emissions and impacts (fugitive releases and diesel combustion related particulate matter).

In addition to particulate matter, the project has the potential to generate odorous emissions, particularly associated with the storage of green waste, although no composting will be allowed to occur. Odour emissions are therefore quantified and assessed in this report.

Emissions and impacts from other pollutants associated with diesel combustion (NO_x, SO_2, CO and VOCs) are expected to be minor and have not been addressed further in this assessment.

Criteria applicable to particulate matter and odour is presented in the following sections. The project should demonstrate compliance with the impact assessment criteria outlined in the Approved Methods for Modelling (EPA, 2016). The impact assessment criteria are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being.

3.2 Applicable air quality assessment criteria

3.2.1 Particulate matter

The NSW EPA's impact assessment criteria for particulate matter, as documented in Section 7 of the Approved Methods for Modelling, are presented in Table 3.1. The assessment criteria for PM_{10} and $PM_{2.5}$ are consistent with the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) national reporting standards (Department of the Environment, 2016).

TSP, which relates to air borne particles less than 50 micrometres (µm) in diameter, is used as a metric for assessing amenity impacts (reduction in visibility, dust deposition and soiling of buildings and surfaces) rather than health impacts (EPA, 2013). Particles less than 10 µm and 2.5 µm in diameter, a subset of TSP, are fine enough to enter the human respiratory system and can lead to adverse human health impacts. The NSW EPA impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore used to assess the potential impact to human health from particulate matter concentrations.

The Approved Methods for Modelling classifies TSP, PM_{10}, $PM_{2.5}$ and dust deposition as 'criteria pollutants'. Assessment criteria for 'criteria pollutants' are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be presented, requiring consideration of existing ambient background concentrations for the criteria pollutants assessed.

For dust deposition, the NSW EPA (2016) specify criteria for project-only increment and cumulative dust deposition levels. Dust deposition impacts are derived from TSP emission rates and particle deposition calculations in the dispersion modelling process.

Table 3.1 Impact assessment criteria for particulate matter

PM metric	Averaging period	Assessment criteria
TSP	Annual	90 µg/m^3
PM_{10}	24 hour	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hour	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual	2 g/m^2/month (project increment only)
		4 g/m^2/month (cumulative)

Notes: µg/m^3: micrograms per cubic meter; g/m^2/month: gram per square meter per month

3.2.2 Odour

The odour performance criteria are expressed in terms of odour units. The detectability of an odour is defined as 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 criterion of less than 1 OU would theoretically result in no odour impact being experienced.

A concentration of 7 OU means that the sample requires a dilution with clean air 7 times to become odour free; thus an odour concentration expressed as 7 OU coincides with a dilution-to-threshold (D/T) ratio of 7, and 2 OU equates to a D/T ratio of 2 (and so on).

The *NSW Technical Framework - Assessment and Management of Odour from Stationary Sources* (EPA, 2006) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU. Although the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU, experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 OU is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours) (EPA, 2006).

Odour performance criteria are designed to take into account the range in 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 criteria 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.

Where a number of the factors simultaneously contribute to making an odour "offensive", an odour goal of 2 OU at the nearest residence (existing or any likely future residences) is appropriate, which generally occurs for affected populations equal or above 2000 people. The EPA odour performance criteria are therefore based on considerations of risk of odour impact rather than on differences in odour acceptability between urban and rural areas.

Odour performance goals for various population densities are outlined in Table 7.5 of the Approved Methods for Modelling (EPA, 2016), and summarised in Table 3.2. They are expressed as the 99th percentile value, nose response time average (approximately one second).

For this assessment, an odour performance criteria of 2 OU is adopted.

Table 3.2 NSW EPA odour performance criteria vs. population density

Population of affected community	Odour performance criteria (OU[1])
Urban area (> 2000)	2
500 – 2000	3
125 – 500	4
30 – 125	5
10-30	6
Single residence (< 2)	7

Note 1: Odour concentration over a nose response time averaging period (1 second), with permissible frequencies of occurrence at 99th percentile for Level 2 assessments

4 Meteorology and climate

4.1 Monitoring data resources

There are no meteorological measurements collected at the site. In reviewing the meteorological and climate environments of the project area, the following data were used:

- 1-hour average meteorological data and historical climate data from the Bureau of Meteorology (BoM) Automatic Weather Station (AWS) at Canterbury Racecourse (Station Number 066194) and Bankstown Airport (Station Number 061078) located 4.5 km east-northeast and 10 km west-northwest of the site, respectively.

4.2 Meteorological modelling

Section 4.1 of the Approved Methods for Modelling specifies that meteorological data representative of a site can be used in the absence of suitable on-site observations. Data should cover a period of at least one year with a percentage completeness of at least 90%. Site representative data can be obtained from either a nearby meteorological monitoring station or synthetically generated using the CSIRO prognostic meteorological model The Air Pollution Model (TAPM).

As stated, hourly average meteorological data from the BoM Canterbury Racecourse and Bankstown Airport monitoring stations were obtained in the absence of onsite monitoring at the site. Data from the Canterbury Racecourse AWS was used as the primary resource, with observations from the Bankstown Airport AWS adopted for cloud cover observations.

To supplement these meteorological observation datasets, the CSIRO meteorological model TAPM was used to generate parameters not routinely measured, specifically the vertical temperature profile.

TAPM was configured and run in accordance with the methodology provided in Section 4.5 of the Approved Methods for Modelling (NSW EPA, 2005), with the following refinements:

- modelling to 300 m grid cell resolution (beyond 1 km resolution specified); and
- inclusion of high resolution (90 m) regional topography (improvement over default 250 m resolution data).

The TAPM vertical temperature profile for every hour was adjusted by first substituting the predicted 10 m above ground temperature with hourly recorded temperature at 10 m (sourced from the Canterbury Racecourse AWS). The difference between the TAPM predicted temperature and the measured 10 m temperature was applied to the entire predicted vertical temperature profile.

At the time of reporting, synoptic resources required to undertake meteorological modelling for the 2018 calendar year were not yet available. Consequently, the 2017 calendar year was chosen for the baseline meteorological year for this assessment. On the basis of similarities in inter-annual trends in wind speed and direction (Section 4.3) for the years between 2014 and 2018, 2017 was considered suitably representative of the Canterbury Racecourse AWS for use in the assessment to meet the requirements of the Approved Methods for Modelling.

4.3 Prevailing winds

A wind rose showing wind speed and direction data recorded at the Canterbury Racecourse AWS by year between 2014 and 2018 is presented in Figure 4.1. Across all years of analysed data, the annual recorded wind pattern is dominated by a general northwest and southeast alignment or air flow, with an additional northeast element evident. Highest wind speeds recorded are most frequently experienced from the southeast and northeast.

The average recorded wind speed across all years was between 2.9 m/s and 3.1 m/s, with a frequency of calm conditions (wind speeds less than 0.5 m/s) between 18.4% and 19.4% of the time across all analysed years.

Seasonal and diurnal wind roses for the Canterbury Racecourse AWS data recorded between 2014 and 2018 are provided in Appendix A.

Seasonal and diurnal (dividing each 24-hour period into night and day) wind roses for the Canterbury Racecourse AWS meteorological dataset are presented within Appendix A. Pronounced seasonal variation is evident in the data recorded at the Canterbury Racecourse AWS. The southeast and northeast components are most defined in summer and spring. Air flow from the west to northwest are most prevalent in winter. Wind speed is greatest during summer and spring, while the incidence of calms is greatest during the autumn months.

Diurnal variation is also evident at the Canterbury Racecourse AWS. While the directional pattern between night and day hours is similar, the wind speeds are notably lower during the night and early morning hours. Calm conditions are notably higher during the night hours.

4.4 Atmospheric stability and mixing depth

Atmospheric stability refers to the degree of turbulence or mixing that occurs within the atmosphere and is a controlling factor in the rate of atmospheric dispersion of pollutants.

The Monin-Obukhov length (L) provides a measure of the stability of the surface layer (ie the layer above the ground in which vertical variation of heat and momentum flux is negligible; typically about 10% of the mixing height). Negative L values correspond to unstable atmospheric conditions, while positive L values correspond to stable atmospheric conditions. Very large positive or negative L values correspond to neutral atmospheric conditions.

Figure 4.2 illustrates the seasonal variation of atmospheric stability derived from the Monin-Obukhov length calculated by AERMET based on the Canterbury Racecourse AWS dataset. The diurnal profile presented illustrates that atmospheric instability increases during daylight hours as convective energy increases, whereas stable atmospheric conditions prevail during the night-time. This profile indicates that the potential for atmospheric dispersion of emissions would be greatest during day time hours and lowest during evening through to early morning hours.

Hourly-varying atmospheric boundary layer depths were generated by AERMET, the meteorological processor for the AERMOD dispersion model. The variation in average boundary layer depth by hour of the day is illustrated in Figure 4.3. Greater boundary layer depths are experienced during the day time hours, peaking in the mid to late afternoon. Higher day-time wind velocities and the onset of incoming solar radiation increases the amount of mechanical and convective turbulence in the atmosphere. As turbulence increases so too does the depth of the boundary layer, generally contributing to higher mixing depths and greater potential for atmospheric dispersion of pollutants.

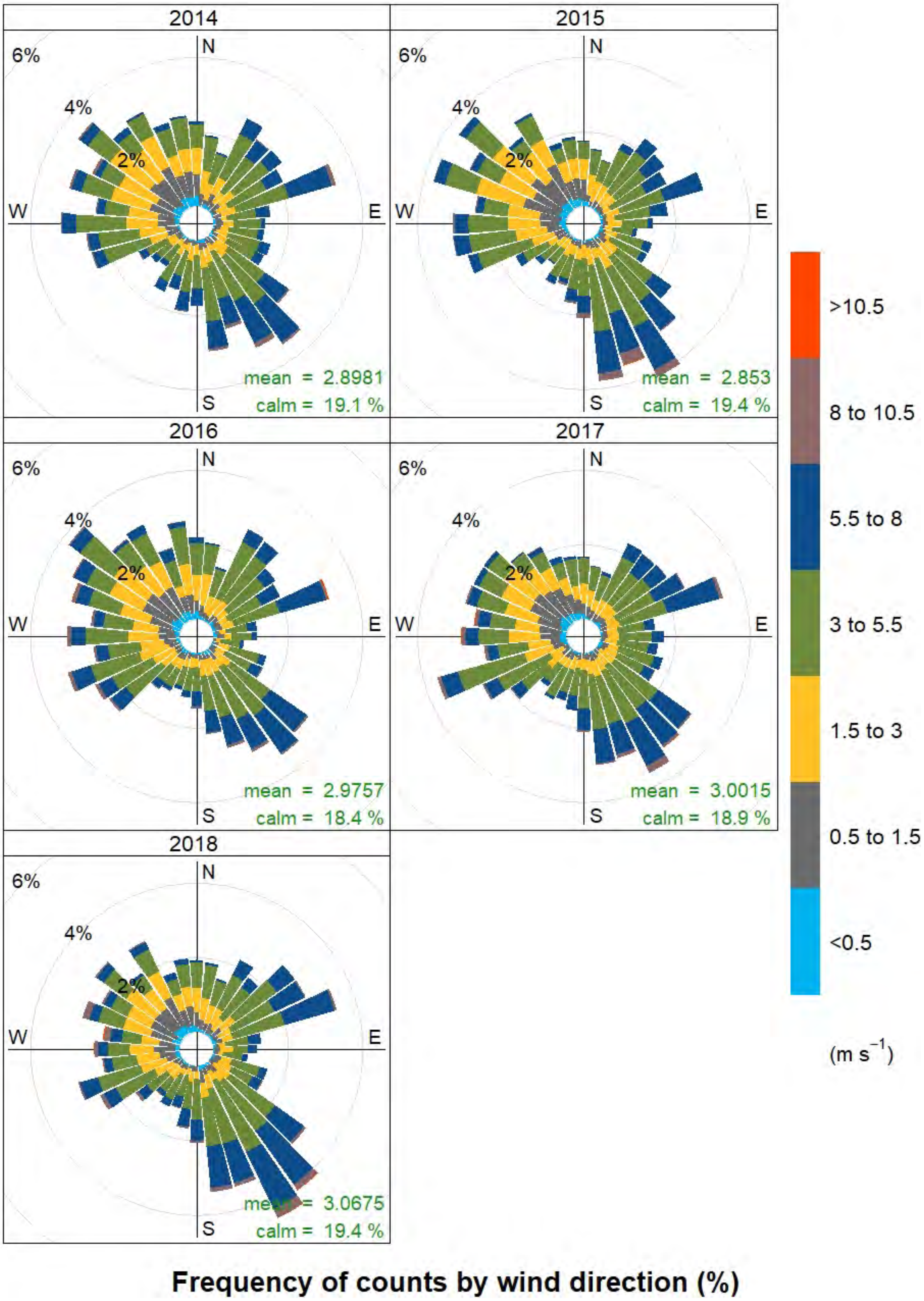

Figure 4.1 **Inter-annual comparison of recorded wind speed and direction – Canterbury Racecourse Airport AWS– 2014 to 2018**

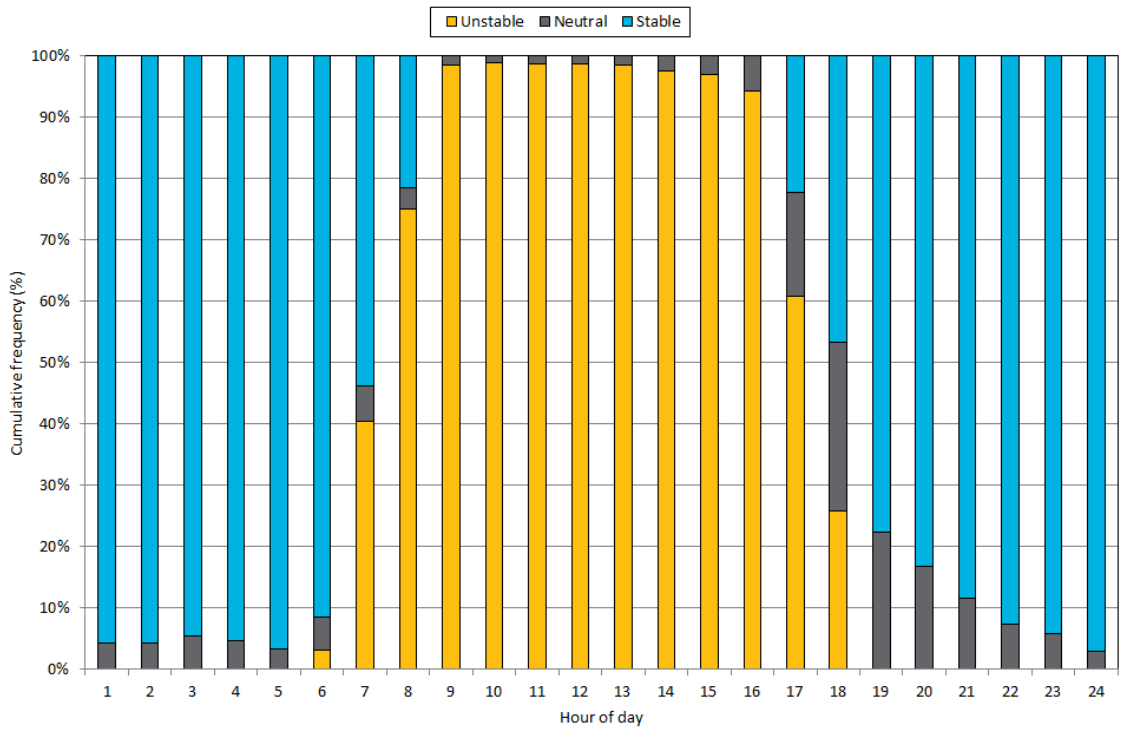

Figure 4.2 AERMET-calculated diurnal variation in atmospheric stability– Canterbury Racecourse AWS 2017

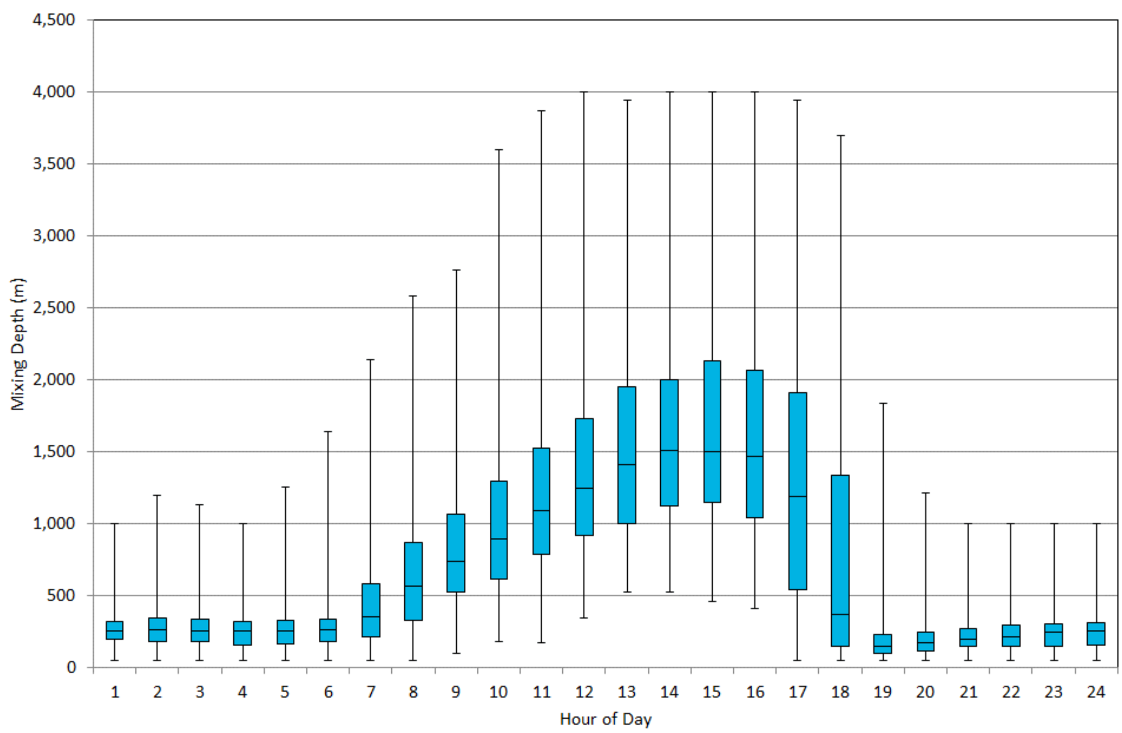

Figure 4.3 AERMET-calculated diurnal variation in atmospheric mixing depth – Canterbury Racecourse 2017

5 Background air quality

5.1 Existing sources of emissions

The site is located within an existing industrial estate with several potential emission sources and is also in close proximity to the M5 motorway. The emissions from local emission sources are assumed to be accounted for in the background air quality described in Section 5.3.

In addition to local area industrial operations, it is considered that the following sources contribute to air pollution emissions in the vicinity of the site:

- Dust entrainment and tyre and break wear due to vehicle movements along public roads;
- Petrol and diesel emission from vehicle movements along public roads;
- Wind generated dust from exposed areas within the surrounding region;
- Seasonal emissions from household wood burning fires;
- Sea salts contained in sea breezes.

More remote sources which contribute episodically to suspended air quality levels in the region include dust storms and bushfires.

5.2 Air quality monitoring data resources

There are no air quality measurements available for the site. The NSW OEH maintains air quality station (AQS) locations at Earlwood, approximately 5 km northeast of the site. Daily average concentrations of PM_{10} and $PM_{2.5}$ from the AQS location were collated for the period between 2014 and 2018. Analysis of the data collected at the Earlwood AQS is provided in the following sections.

5.3 Background air quality environment

5.3.1 PM_{10}

A time series of recorded 24-hour average PM_{10} concentrations at the Earlwood AQS for the period between January 2014 and December 2018 is presented in Figure 5.1. Recorded 24-hour average PM_{10} concentrations fluctuate throughout the presented period. Concentrations of 24-hour average PM_{10} at the Earlwood AQS are typically below the applicable NSW EPA impact assessment criterion of 50 µg/m³. The 24-hour average criterion was exceeded once in 2015, twice in 2017 and five times in 2018, the majority of which were attributed to regional scale bushfire or dust storm events.

Key statistics for the five years of analysed data from the Earlwood AQS are presented in Table 5.1. Additionally, the frequency of recorded PM_{10} concentrations at the Earlwood AQS by year for the period 2014 to 2018 is illustrated in Figure 5.2. The increasing trend in annual average PM_{10} concentrations and 24-hour average criteria exceedances from 2014 to 2018 is reflective of the increasing duration of drought conditions across NSW and potential for wide-spread dust storm events.

Annual average PM_{10} concentrations are below the applicable criterion of 25 µg/m³ for all analysed years.

Consistent with the 2017 calendar year meteorological dataset adopted for the modelling period (see Section 4), the 2017 calendar year PM_{10} dataset from the Earlwood AQS has been adopted to represent background conditions.

Table 5.1 Statistics for PM_{10} concentrations – OEH Earlwood AQS – 2014 to 2018

Year	Maximum	95th percentile	90th percentile	75th percentile	Median	Average	Days > 50 µg/m³
	24-hour average PM_{10} concentration (µg/m³)						
2014	45.2	30.3	27.9	21.7	17.0	18.2	0
2015	66.5	28.4	25.3	20.8	16.2	17.1	1
2016	42.9	30.5	27.7	22.0	16.5	17.1	0
2017	59.8	30.6	27.0	21.5	16.2	18.0	2
2018	86.5	33.4	29.2	23.5	18.3	19.5	5

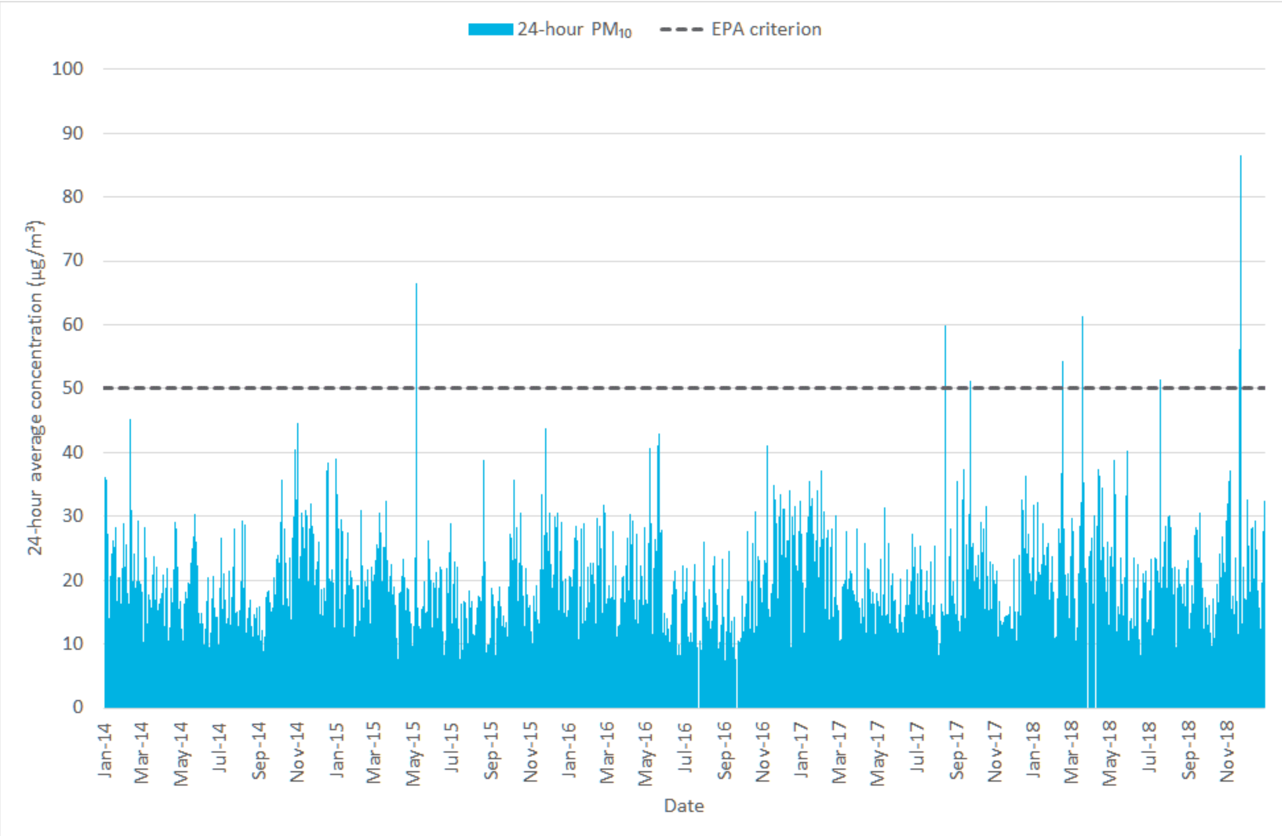

Figure 5.1 Time series of 24-hour average PM_{10} concentrations – OEH Earlwood AQS – 2014 to 2018

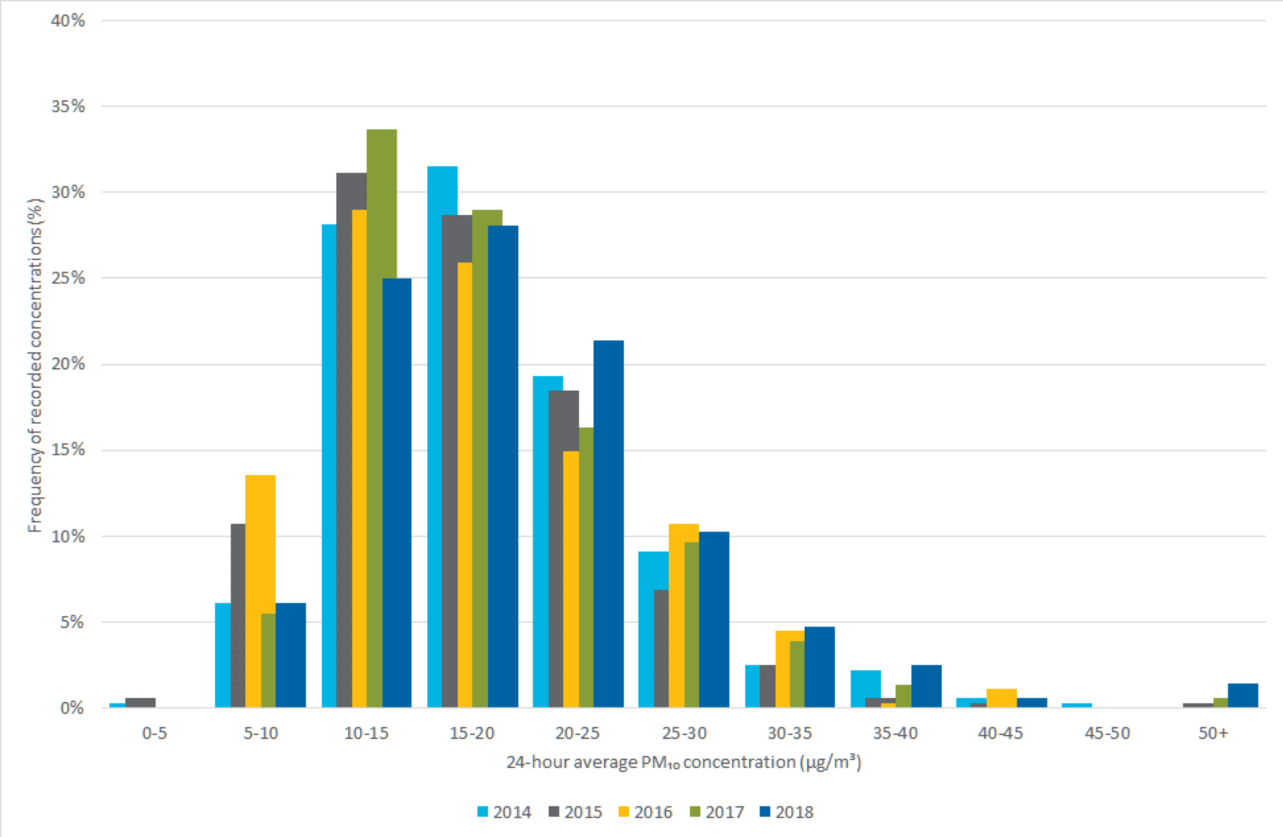

Figure 5.2 Frequency distribution of PM_{10} monitoring data – OEH Earlwood AQS – 2014 to 2018

5.3.2 $PM_{2.5}$

A time series of recorded 24-hour average $PM_{2.5}$ concentrations at the Earlwood AQS is presented in Figure 5.3. Similar to PM_{10} concentrations, the recorded 24-hour average $PM_{2.5}$ concentrations fluctuate throughout the presented period. Recorded 24-hour average $PM_{2.5}$ concentrations were generally below the NSW EPA impact assessment criterion of 25 µg/m³. The 24-hour average criterion was exceeded twice in 2015, five times in 2016, three times in 2017 and once in 2018. Exceedances of the 24-hour average criteria are linked with regional-scale vegetation burning (bush fires, hazard reduction burns) and dust storms.

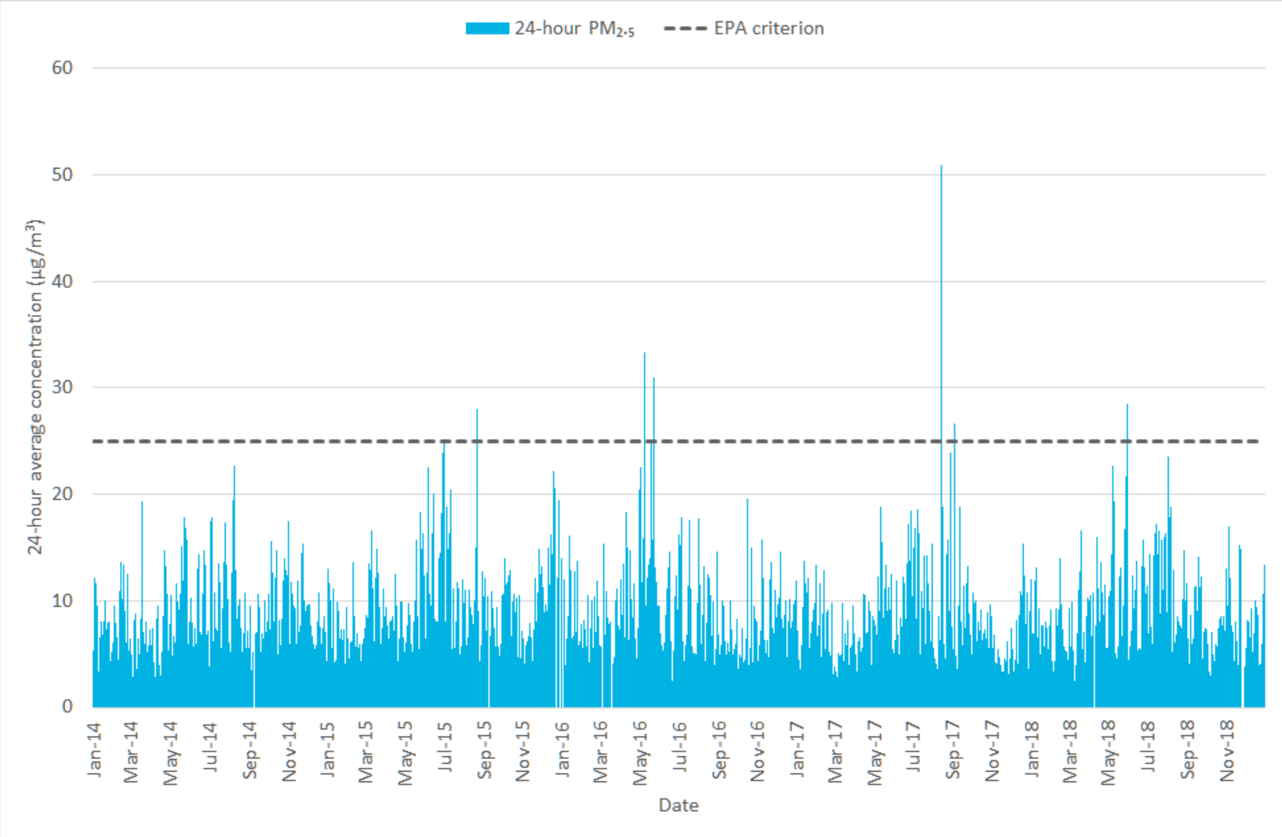

Figure 5.3 Time series of 24-hour average $PM_{2.5}$ concentrations – OEH Earlwood AQS – 2014 to 2018

Key statistics for the five years of analysed $PM_{2.5}$ monitoring data from the Earlwood AQS are presented in Table 5.2. and the inter-annual frequency histogram of recorded $PM_{2.5}$ concentrations illustrated in Figure 5.4. From the five-year period analysed, it is considered that the 2017 year provides a conservatively high estimate of background $PM_{2.5}$ concentrations for the local area.

The annual average $PM_{2.5}$ concentration for 2015 equalled the applicable criterion of 8 µg/m³ and was below for all other analysed years.

Table 5.2 Statistics for $PM_{2.5}$ concentrations – OEH Earlwood AQS – 2014 to 2018

Year	Maximum	95th percentile	90th percentile	75th percentile	Median	Average	Days > 25 µg/m³
	24-hour average $PM_{2.5}$ concentration (µg/m³)						
2014	22.7	14.3	12.7	9.6	7.0	7.6	0
2015	28.0	16.3	13.5	10.4	7.2	8.0	2
2016	33.3	15.8	13.2	9.9	6.6	7.7	5
2017	50.9	14.9	11.8	9.0	6.4	7.3	3
2018	28.5	15.8	13.1	9.7	6.9	7.6	1

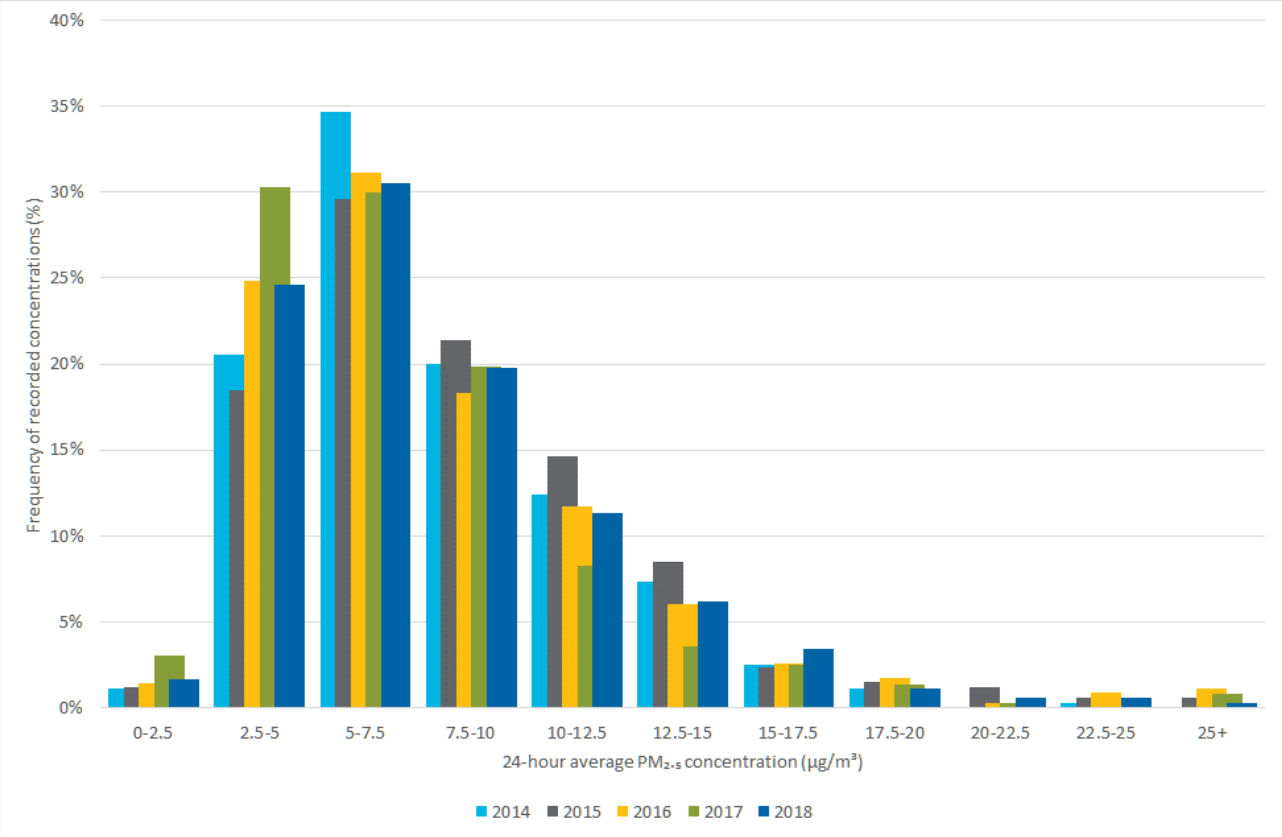

Figure 5.4 Frequency distribution of $PM_{2.5}$ monitoring data – OEH Earlwood AQS – 2014 to 2018

5.3.3 TSP

There are no measurements of TSP at the site. In the absence of locally sourced TSP monitoring data, a PM_{10} to TSP ratio of 0.4 has been adopted. When applied to the annual average PM_{10} concentration for 2017 from the Earlwood AQS (see Section 5.3.1), an annual average TSP background concentration of 45.0 µg/m³ is derived.

5.3.4 Dust deposition

There is no dust deposition monitoring data available suitable to quantify background levels in the area surrounding the site. This assessment has therefore focussed on the incremental contribution from site operational emissions only. This approach is suitable for assessment against the NSW EPA incremental criterion of 2.0 g/m²/month, expressed as an annual average.

5.3.5 Adopted background summary

The adopted background air quality conditions for the site, based on the analysis presented in the preceding sections, are summarised in Table 5.3.

For 24-hour average PM_{10} and $PM_{2.5}$ background, due to the occurrence of criteria exceedances in the 2017 NSW OEH Earlwood monitoring dataset (two for PM_{10} and three for $PM_{2.5}$), the third highest and fourth highest concentrations will be adopted as a conservative background for the project area.

Table 5.3 Summary of adopted background air quality concentrations

Pollutant	Averaging period	Value	Unit
TSP	Annual	45.1	µg/m³
PM_{10}	24-hour	37.3	
	Annual	18.0	
$PM_{2.5}$	24-hour	20.5	
	Annual	7.3	
Dust deposition	Month	No background adopted; focus on incremental impact only	$g/m^2/month$

6 Emissions inventory

Fugitive dust sources associated with the operation of the site were quantified through the application of National Pollution Inventory emission estimation techniques and United States Environmental Protection Agency (US-EPA) AP-42 emission factor equations. Particulate matter emissions were quantified for various particle size fractions, with the TSP fraction being estimated to provide an indication of dust deposition rates. Coarse particles (PM_{10}) and fine particle ($PM_{2.5}$) were estimated using ratios for the different particle size fractions available within the literature (principally the US-EPA AP-42).

6.1 Sources of operational emissions

Sources of atmospheric emissions associated with the site include:

- vehicle entrainment of particulate matter from material delivery and dispatch trucks along the sealed access road from site entrance to the shed;
- unloading of imported material inside the shed;
- sorting of material by excavator inside the shed;
- transport of material within the shed by FEL;
- handling, sorting and screening of material within the shed;
- transfer of processed materials to storage bunkers inside the shed;
- loading of material to trucks within the shed for dispatch from site;
- diesel fuel combustion by on-site plant and equipment; and
- odour emissions from the storage of green waste material.

Emissions of non-particulate matter pollutants (including oxides of nitrogen, carbon monoxide and sulphur dioxide) associated with diesel fuel combustion are likely to be minor in nature relative to particulate matter emissions. Such emissions were not included in this assessment.

6.2 Emissions scenario

To assess the potential impacts from the project, a single emissions scenario representative of planned operations has been quantified. The assumptions in the scenario are:

- annual import and export of material of 35,000 tpa adopted;
- the diurnal distribution of activities by hour of day, based on projected traffic volume distribution, is presented in Figure 6.1;
- consistent with the traffic assessment, incoming truck loads are on average 6 t, while existing dispatch truck loads are 35 t in capacity;
- all material unloading, handling, processing and loading is conducted within the processing shed;

- a front-end loader with bucket capacity of 3.2 t is used within the shed to transfer material; and
- no wind erosion emissions are assumed to be associated with the project.

To account for potential fluctuations in day to day material deliveries, a "busy day" scaling factor of 1.5 has been applied to calculated PM_{10} and $PM_{2.5}$ emission rates and predict 24-hour average concentrations.

To conservatively assess impacts from site for comparison with the 24-hour average criteria for PM_{10} and $PM_{2.5}$, annual emissions have been adjusted through the application of a "busy day" scaling factor of 1.5. For comparison with annual average criteria for TSP, PM_{10}, $PM_{2.5}$ and dust deposition, the annual average emissions and operating days are assumed.

Further, it has conservatively been assumed that 100% of incoming material is heavy construction and demolition waste, such as bricks and concrete. Accordingly, the emissions factors and material characteristics for material handling adopted in the emission calculations are representative of crushed stone. In reality, the site will receive and processes a range of material types, many with higher moisture contents and lower dust generation potential than heavy construction and demolition waste, therefore this assumption is considered highly conservative.

A diurnal profile has been adopted based on incoming and outgoing truck movements to vary operations throughout the day. This profile is applied to emissions from truck movements, material handling and material processing.

6.3 Emission reduction factors

The site has a range of dust mitigation measures to control emissions and minimise potential impacts to the surrounding environment. The primary measures to be implemented are as follows:

- all material unloading, storage, processing and loading will occur within a shed structure; and
- the shed is to be fitted with an internal water fogging system to control dust and odour emissions.

Based on the above information, the following emission reduction factors were applied to all emissions occurring within the shed to account for proposed controls at the site:

- 70% reduction for enclosure (NPI, 2012) for activities occurring within the shed; and
- 50% reduction for water sprays (NPI, 2012) for within the shed.

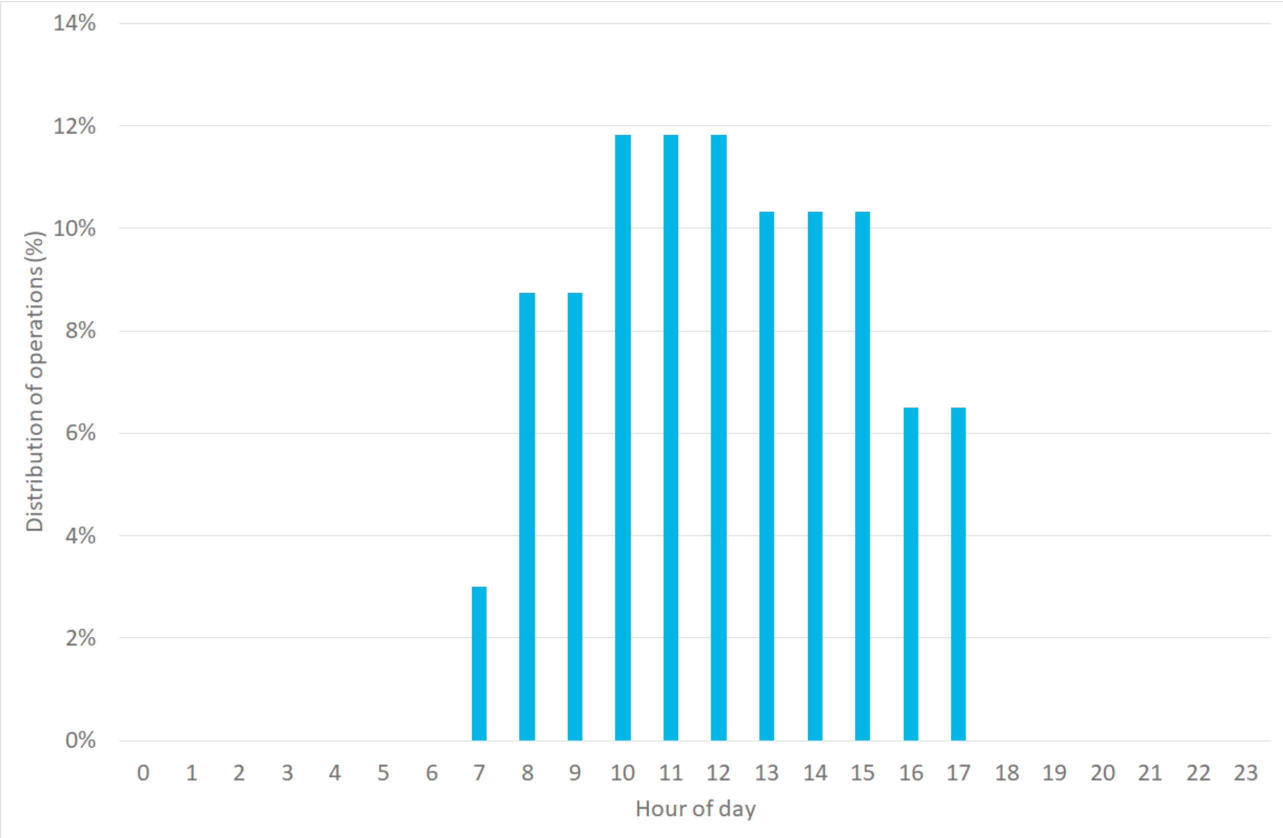

Figure 6.1 Distribution profile for daily operations

6.4 Particulate matter emissions

A summary of calculated annual emissions by source type is presented in Table 6.1. Particulate matter control measures, as documented in Section 6.3 are accounted for in these daily emission totals.

The most significant source of emissions is associated with the movement of vehicles (trucks and FEL) across paved surfaces. The significance of diesel combustion emissions increases with decreasing particle size. The relative significance of key source types by particle size is illustrated in Figure 6.2. Further details regarding emission estimation factors and assumptions are provided in Appendix B.

Table 6.1 Calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions

Emissions source	Calculated peak day emissions (kg/year) by source		
	TSP	PM_{10}	$PM_{2.5}$
Delivery of materials to shed	107.3	20.6	5.0
Material unloading (in shed)	8.7	4.1	0.6
Material transfer to trommel (in shed)	8.7	4.1	0.6
Trommel screen (in shed)	65.6	22.6	0.2
Unloading from trommel (in shed)	8.7	4.1	0.6
Transfer to storage bins (in shed)	8.7	4.1	0.6
FEL movements (in shed)	22.0	4.2	1.0
Loading to product trucks (in shed)	8.7	4.1	0.6
Dispatch of product to market	38.4	7.4	1.8
Diesel combustion - onsite plant	40.1	40.1	36.7
Diesel combustion - trucks	0.4	0.4	0.4
Total annual emissions	**317.2**	**115.8**	**48.2**

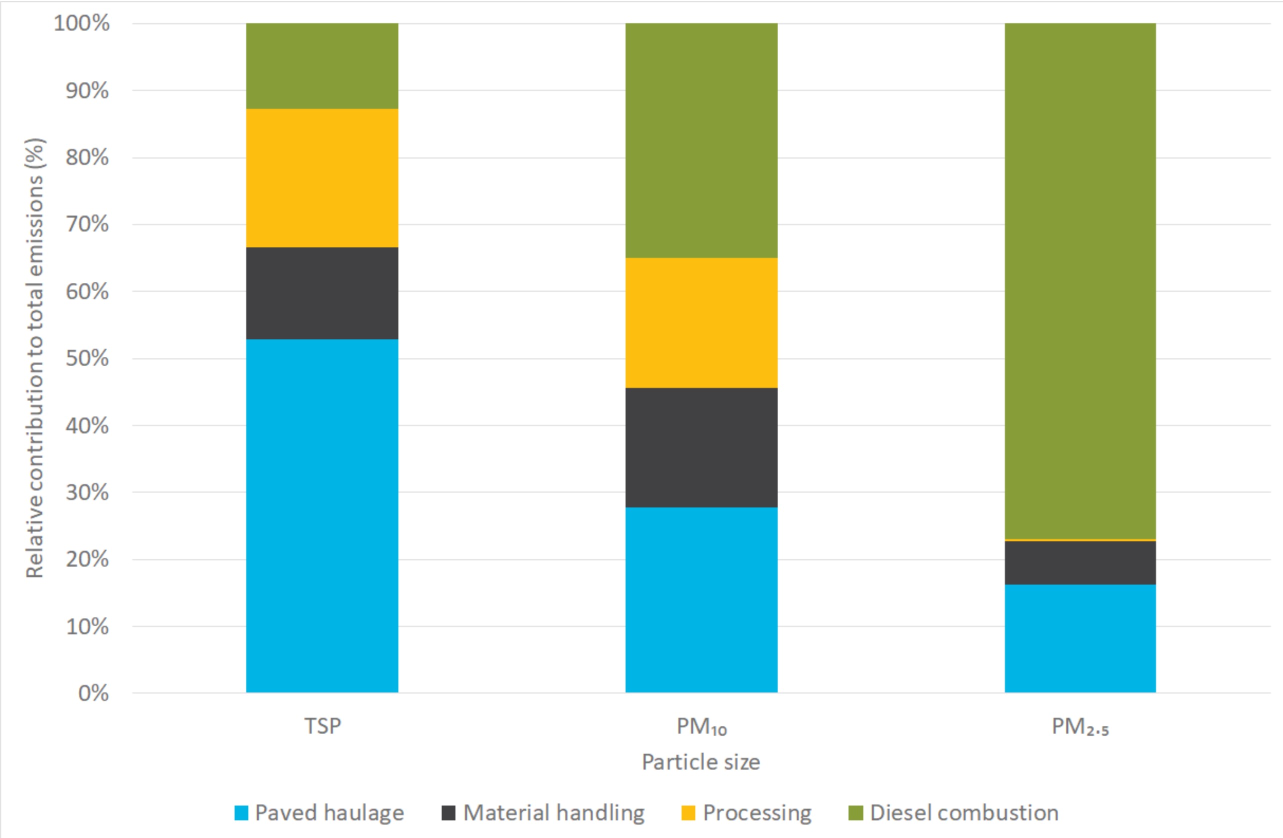

Figure 6.2 Significance of emission sources to total annual emissions - TSP, PM_{10} and $PM_{2.5}$

6.5 Odour emissions

Given that that majority of material received by the recycling facility would be inert building waste, the potential for odour emissions arising from the project would be low. Nevertheless, odour emissions have been quantified for this assessment for the waste streams with the highest odour potential, being green waste, although there will be no composting on site.

To quantify odour emission rates from the storage of green waste, a literature review of publicly available odour impact assessments involving green waste storage in NSW was undertaken. A summary of relevant odour emission rates is presented in Table 6.2.

Table 6.2 Odour Emission Rates – Green Waste Storage

Site	Specific Odour Emission Rate ($OU.m^3/m^2/second$)	Type	Reference
SITA Kemps Creek	0.134	Green waste area	Holmes Air Science, 2007
Spring Farm Advanced Resource Recovery Technology Facility	1.279	Green waste area	Pacific Environment, 2013
Veolia Camellia Recycling Facility	0.28	Dry Waste	CH2M Hill, 2013
Euchareena Road Resource Recovery	0.2	Green waste delivery bays	Heggies, 2009

It can be seen from the odour emissions rates presented in Table 6.2 that a range of variability exists for green waste storage. The maximum odour emission rate presented in Table 6.2 (1.279 OU.m^3/m^2/second) will be adopted in this assessment as a conservative assumption.

Based on information provided by the proponent, the likely green waste stockpile area will total 15 m^2, which has been combined with the adopted odour emission rate from Table 6.2. It is noted that while any odour generating materials would be stored within the shed structure, no control factors have been applied to emission calculations.

7 Air dispersion modelling

7.1 Dispersion model selection and configuration

The atmospheric dispersion modelling completed within this assessment used the AMS/US-EPA regulatory model (AERMOD) (US-EPA, 2004). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

In addition to the 17 individual receptor locations (documented in Section 2.2), concentrations and deposition rates were predicted over a 500 m by 500 m domain with a 100 m grid cell resolution and a nested inner 250 m by 250 m domain with a 50 m grid cell resolution.

Simulations were undertaken for the 12 month period of 2017 using the AERMET-generated file based largely on the BoM Canterbury Racecourse AWS meteorological monitoring dataset as input (see Section 4 for description of input meteorology).

The methodology and results of the emissions inventory developed for this study are presented in Section 6 and Appendix B.

7.2 Incremental (site-only) results

Predicted incremental TSP, PM_{10}, $PM_{2.5}$ and odour concentrations and dust deposition rates from proposed operations are presented in Table 7.1 for each of the selected receptor locations.

The predicted concentrations and deposition rates for all pollutants and averaging periods are below the applicable NSW EPA assessment criterion at all neighbouring receptors.

Except for dust deposition, the assessment criteria listed are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in Section 7.3.

Isopleth plots, illustrating spatial variations in site-related incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates are provided in Appendix C. Isopleth plots of the maximum 24-hour average concentrations presented in Appendix C do not represent the dispersion pattern on any individual day, but rather illustrate the maximum daily concentration that was predicted to occur at each model calculation point given the range of meteorological conditions occurring over the 2017 modelling period.

7.3 Cumulative (site + background) results

Cumulative impacts at each of the sensitive receptor assessment locations surrounding the site have been assessed in the following way:

- for 24-hour average concentrations, the maximum predicted 24-hour average model predictions for PM_{10} and $PM_{2.5}$ from the site have been combined with the adopted background concentrations from the NSW OEH Earlwood 2017 monitoring dataset (Section 5.3.5).

- for annual average concentrations, the predicted annual average concentrations have been paired with the corresponding background annual average concentration (Section 5.3.5).

Predicted cumulative TSP, PM_{10} and $PM_{2.5}$ concentrations associated with site operations are presented in Table 7.2 for each of the selected receptor locations.

The predicted cumulative concentrations for all pollutants and averaging periods comply with the applicable NSW EPA assessment criterion at all neighbouring receptors.

Table 7.1 Incremental (site-only) concentration and deposition results

Receptor ID	Predicted incremental concentration (µg/m³) deposition rate (g/m²/month)						Predicted odour concentration (OU)
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition	
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual	99th percentile 1-second
Criterion	**90**	**50**	**25**	**25**	**8**	**2**	**2**
R1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
R2	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<1
R3	<0.1	0.3	<0.1	0.1	<0.1	<0.1	<1
R4	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<1
R5	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
R6	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
R7	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<1
R8	<0.1	0.4	<0.1	0.2	<0.1	<0.1	<1
R9	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
R10	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<1
R11	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<1
R12	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<1
R13	1.5	5.1	0.7	2.0	0.3	0.3	<1
R14	0.1	1.0	0.1	0.4	<0.1	<0.1	<1
R15	0.3	1.4	0.1	0.5	<0.1	0.1	<1
R16	0.1	0.4	<0.1	0.2	<0.1	<0.1	<1
R17	0.8	1.8	0.3	0.7	0.1	0.2	<1

Notes: Criteria for TSP, PM_{10} and $PM_{2.5}$ is applicable to cumulative (increment + background). Criteria is provided for comparison purposes only.

Table 7.2 Cumulative (site + background) concentration results

Receptor ID	Predicted cumulative concentration (µg/m³)				
	TSP	PM_{10}		$PM_{2.5}$	
	Annual	24-hour maximum	Annual	24-hour maximum	Annual
Criterion	**90**	**50**	**25**	**25**	**8**
R1	45.1	37.4	18.0	20.5	7.3
R2	45.1	37.5	18.0	20.6	7.3
R3	45.1	37.6	18.0	20.6	7.3
R4	45.1	37.5	18.0	20.6	7.3
R5	45.1	37.4	18.0	20.5	7.3
R6	45.1	37.4	18.0	20.5	7.3
R7	45.1	37.5	18.0	20.6	7.3
R8	45.1	37.7	18.0	20.7	7.3
R9	45.1	37.4	18.0	20.5	7.3
R10	45.1	37.5	18.0	20.6	7.3
R11	45.1	37.5	18.0	20.6	7.3
R12	45.1	37.4	18.0	20.6	7.3
R13	46.6	42.4	18.7	22.5	7.6
R14	45.2	38.3	18.1	20.9	7.3
R15	45.4	38.7	18.1	21.0	7.3
R16	45.2	37.7	18.0	20.7	7.3
R17	45.9	39.1	18.3	21.2	7.4

8 Conclusions

An AQIA focusing on the quantification of emissions and resultant air quality impacts from the site has been conducted by EMM.

Emissions of TSP, PM_{10} and $PM_{2.5}$ associated with the operation of the proposed facility were quantified using publicly available emission estimation techniques. Busy day operations were quantified through the application of a 1.5 scaling factor to average day emissions. Odour emissions from the storage of green waste at the facility were also quantified.

Atmospheric dispersion modelling predictions of air pollution emissions were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the site is highly unlikely to result in exceedances of the applicable particulate matter or odour impact assessment criteria at any of the surrounding assessment locations.

References

BoM 2019, Long-term climate statistics and observations from Canterbury Racecourse and Bankstown Airport AWS.

CH2MHILL 2013, *Camellia Recycling Centre- Environmental Impact Statement*

Department of Environment 2016, *National Environment Protection (Ambient Air Quality) Measure*

EPA 2006, *NSW Technical Framework - Assessment and Management of Odour from Stationary Sources.*

EPA 2012, *Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year, On-Road Mobile Emissions*.

EPA 2013, *Air Emissions in My Community web tool Substance information*. NSW EPA

EPA 2014, *Waste Classification Guidelines – Part 1: Classification of Waste*, Environment Protection Authority.

EPA 2016, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*

Heggies 2009, *Euchareena Road Resource Recovery Centre Air Quality Assessment*

Holmes Air Science 2007, *Air Quality Assessment: Proposed SAWT–Biowise Facility Elizabeth Drive, Kemps Creek*

NSW OEH 2017, *Towards Cleaner Air: NSW Air Quality Statement 2016*

NSW OEH 2019, *Air quality monitoring data from Earlwood air quality monitoring station*

NPI 2012, *Emission Estimation Technique Manual for Mining*

Pacific Environment 2013, *Spring Farm Advanced Resource Recovery Technology (ARRT) Facility –Air Quality And Odour Impact Assessment*

US-EPA 2004, AP-42 Chapter 11.19.2 – *Crushed Stone Processing and Pulverized Mineral Processing*

US-EPA 2006, AP-42 Chapter 13.2.4 – *Aggregate Handling and Storage Piles*

US-EPA 2011, AP-42 Chapter 13.2.1 – *Paved Roads*

Abbreviations

AHD	Australian height datum
Approved Methods for Modelling	*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*
AQS	Air quality station
AWS	Automatic weather station
BoM	Bureau of Meteorology
CO	Carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPA	Environment Protection Authority
FEL	Front end loader
NOx	Oxides of nitrogen
LGA	Local government area
OEH	Office of Environment and Heritage
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
SO_2	Sulphur dioxide
TAPM	The Air Pollution Model
The facility	Proposed resource recovery facility
The site	2F The Crescent, Kingsgrove
TSP	Total suspended particulates
US-EPA	United States Environmental Protection Agency
VOC	Volatile organic compounds


Appendix A

Wind roses from Canterbury Racecourse AWS




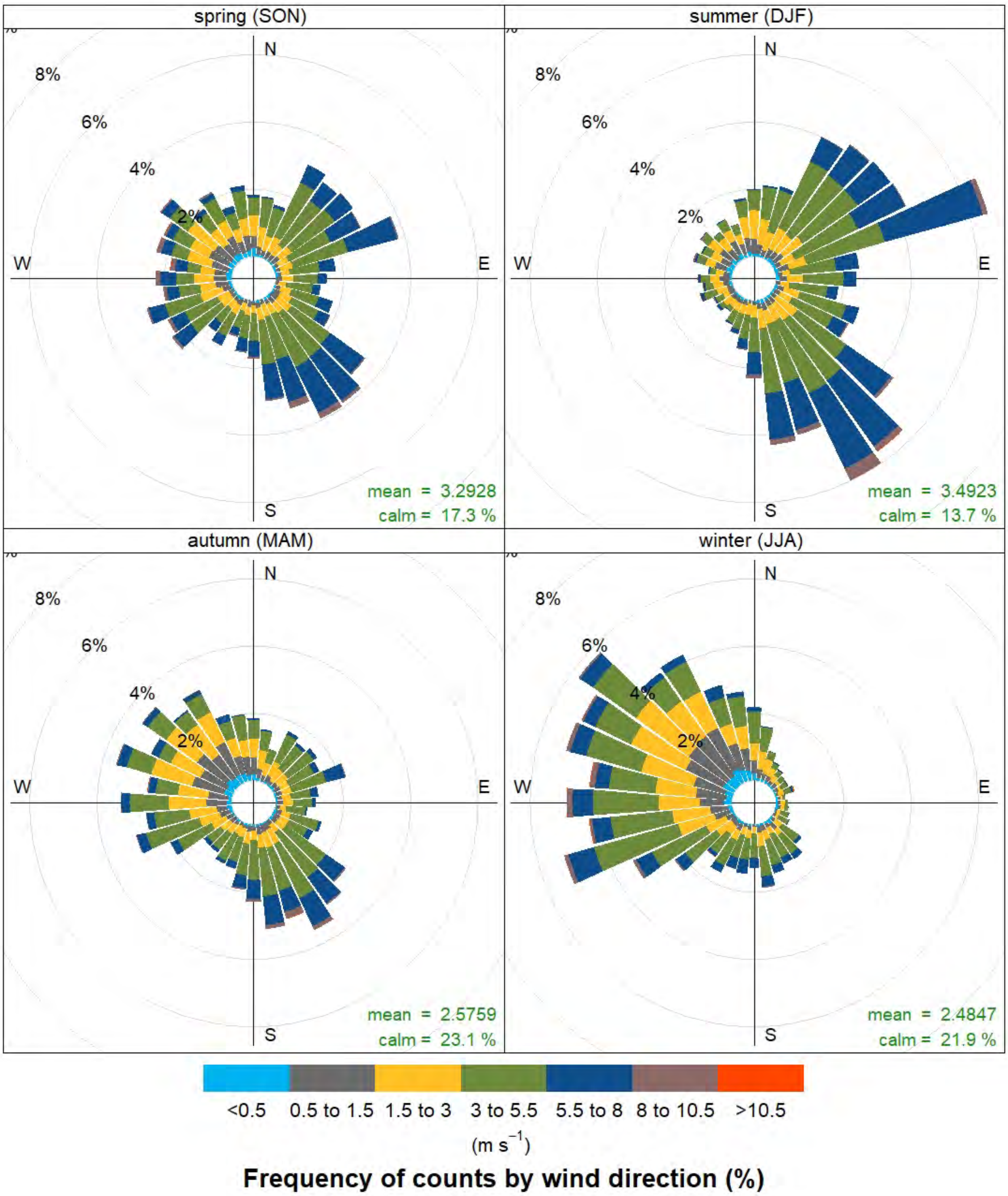

Figure A.1 Seasonal wind roses – Canterbury Racecourse AWS – 2014 to 2018

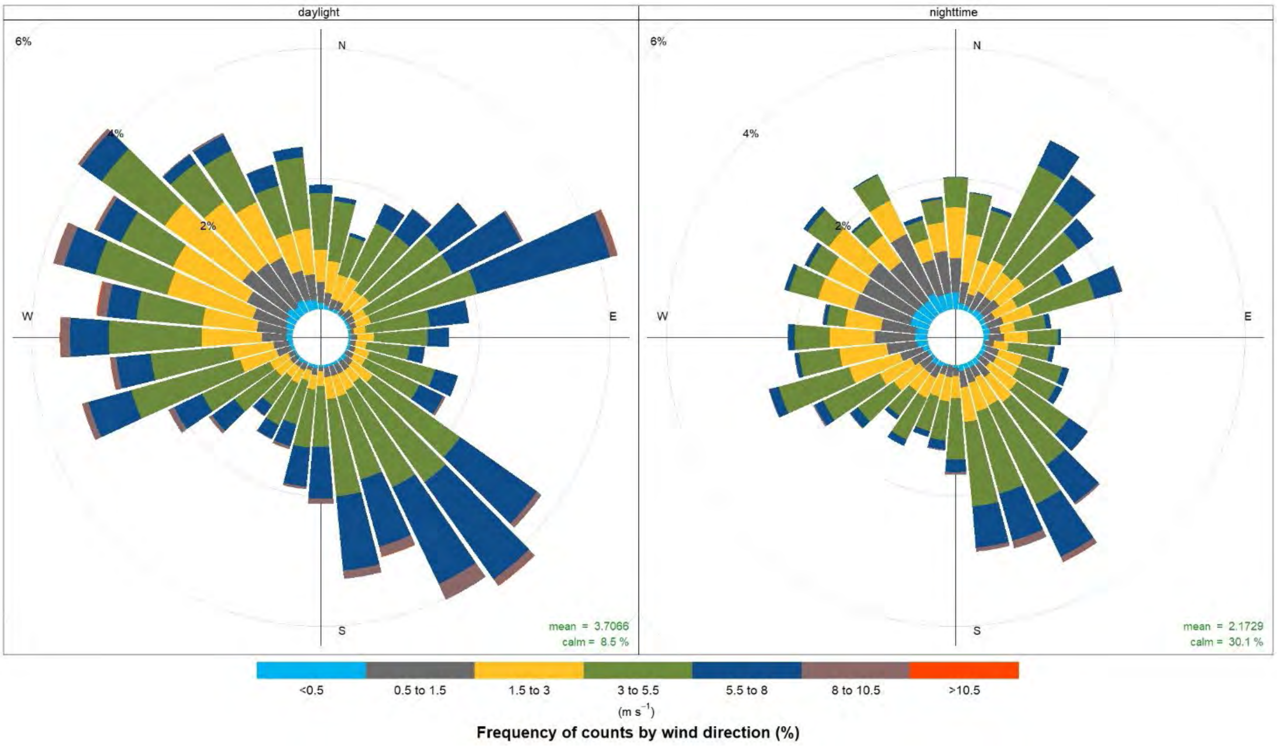

Figure A.2 Diurnal wind roses – Canterbury Racecourse AWS – 2014 to 2018


Appendix B

Emissions inventory background




B.1 Introduction

Particulate matter emissions from the site were quantified through the application of accepted published emission estimation factors, collated from a combination of United States Environmental Protection Agency (US-EPA) AP-42 Air Pollutant Emission Factors and NPI emission estimation manuals, including the following:

- NPI Emission Estimation Technique Manual for Mining (NPI, 2012);
- AP-42 Chapter 11.19.2 – Crushed Stone Processing and Pulverized Mineral Processing (US-EPA, 2004);
- AP-42 Chapter 13.2.1 – Paved Roads (US-EPA 2011);
- AP-42 Chapter 13.2.4 – Aggregate Handling and Storage Piles (US-EPA 2006).

Particulate releases were quantified for TSP, PM_{10} and $PM_{2.5}$ as documented in subsequent sections.

B.2 Sources of Particulate Matter Emissions

Sources of particulate matter emissions associated with the site include:

- vehicle entrainment of particulate matter from material delivery and dispatch trucks along the sealed access road from site entrance to the shed;
- unloading of imported material inside the shed;
- sorting of material by excavator inside the shed;
- transport of material within the shed by FEL;
- handling, sorting and screening of material within the shed;
- transfer of processed materials to storage bunkers inside the shed;
- loading of material to trucks within the shed for dispatch from site;
- diesel fuel combustion by on-site plant and equipment; and
- odour emissions from the storage of green waste material.

B.3 Particulate matter emissions inventory

The emissions inventory developed for the operations at the site is presented in Table B.1.

Table B.1 Emissions inventory – facility operations

Source Name	Emission factor source	Activity Rate	Unit	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Value	TSP EF	PM_{10} EF	$PM_{2.5}$ EF	EF Unit	Emission Controls	Reduction factor	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$ (kg/year)
Delivery of materials to shed	AP-42 13.2.1 - Paved Road Equation	VKT per year	583	Road silt loading (g/m²)	7.4	Haul distance (km)	0.05	Loads per year	5,833	Ave Truck Weight (t)	8	0.1839	0.0353	0.0085	kg/VKT		65%	107.3	20.6	5.0
Material unloading (in shed)	AP-42 13.2.4 - Materials Handling Equation / NPI Mining Equation 10	Tonnes per year	35,000	Average wind speed (m/s)	3.001 89	Moisture content (%)	2.1					0.0017	0.0008	0.0001	kg/tonne	Sprays and enclosure	85%	8.7	4.1	0.6
Material transfer to tommel (in shed)	AP-42 13.2.4 - Materials Handling Equation / NPI Mining Equation 10	Tonnes per year	35,000	Average wind speed (m/s)	3.001 89	Moisture content (%)	2.1					0.0017	0.0008	0.0001	kg/tonne	Sprays and enclosure	85%	8.7	4.1	0.6
Trommel screen (in shed)	USEPA AP-42 11.19.2 - Screening Factor	Tonnes per year	35,000	Stages of Screening	1							0.0125	0.0043	0.0000	kg/tonne	Sprays and enclosure	85%	65.6	22.6	0.2
Unloading from trommel (in shed)	AP-42 13.2.4 - Materials Handling Equation / NPI Mining Equation 10	Tonnes per year	35,000	Average wind speed (m/s)	3.001 89	Moisture content (%)	2.1					0.0017	0.0008	0.0001	kg/tonne	Sprays and enclosure	85%	8.7	4.1	0.6

Table B.1 Emissions inventory – facility operations

Source Name	Emission factor source	Activity Rate	Unit	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Value	TSP EF	PM_{10} EF	$PM_{2.5}$ EF	EF Unit	Emission Controls	Reduction factor	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$ (kg/year)
Transfer to storage bins (in shed)	AP-42 13.2.4 - Materials Handling Equation / NPI Mining Equation 10	Tonnes per year	35,000	Average wind speed (m/s)	3.00189	Moisture content (%)	2.1					0.0017	0.0008	0.0001	kg/tonne	Sprays and enclosure	85%	8.7	4.1	0.6
FEL movements (in shed)	AP-42 13.2.1 - Paved Road Equation	VKT per year	547	Road silt loading (g/m²)	7.4	Haul distance (km)	0.025	Loads per year	10,937	Ave Truck Weight (t)	12	0.2686	0.0516	0.0125	kg/VKT	Sprays and enclosure	85%	22.0	4.2	1.0
Loading to product trucks (in shed)	AP-42 13.2.4 - Materials Handling Equation / NPI Mining Equation 10	Tonnes per year	35,000	Average wind speed (m/s)	3.00189	Moisture content (%)	2.1					0.0017	0.0008	0.0001	kg/tonne	Sprays and enclosure	85%	8.7	4.1	0.6
Dispatch of product to market	AP-42 13.2.1 - Paved Road Equation	VKT per year	50	Road silt loading (g/m²)	7.4	Haul distance (km)	0.05	Loads per year	1,000	Ave Truck Weight (t)	33	0.7682	0.1475	0.0357	kg/VKT			38.4	7.4	1.8

B.4 Diesel combustion emissions

Diesel combustion emissions were calculated using the following assumptions:

- Mobile equipment emissions for the facility were based on the proposed equipment fleet specifications and US-EPA Tier 2 emission factors (as presented in Table B.2); and
- emission from road trucks were quantified through calculated annual VKT and the EPA PM Emission Factor for road trucks (EPA, 2012), based on the specifications of 1996 ADR70/00.

Table B.2 Diesel equipment fleet emissions

Equipment type	Make/Model	Number	Power	Operating hours	Load factor	Emission factor (g/kWh)	Energy (kWh)	Annual emission (kg/annum)		
								TSP emissions	PM_{10} emissions	$PM_{2.5}$ emissions
Excavator	JCB JSI30	1	74	3,636	0.5	0.4	269,064	53.8	53.8	49.3
FEL	JCB – 417 H	1	93	3,636	0.5	0.3	338,148	50.7	50.7	46.5
Loader	JCB 225	1	55	3,636	0.5	0.6	199,980	60.0	60.0	55.0
Screen	Portafill MR-5	1	41	3,636	0.5	0.6	149,076	44.7	44.7	41.0
Conveyors	3m Shifta Mace	3	0.75	3,636	0.5	0.8	8,181	3.3	3.3	3.0
Trommel	Turmec	1	50	3,636	0.5	0.6	181,800	54.5	54.5	50.0

A reduction factor of 85% was applied to all sources within the shed, accounting for emission control from the use of a fogging system and enclosure.


Appendix C

Incremental (site-only) isopleth plots




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Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Maximum 24-hour average PM_{10} concentration

- 0.5 $\mu g/m^3$
- 1 $\mu g/m^3$
- 2.5 $\mu g/m^3$
- 5 $\mu g/m^3$
- 10 $\mu g/m^3$

Maximum predicted 24-hour average PM_{10} concentrations – site only – busy day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.1

EMM
creating opportunities

Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

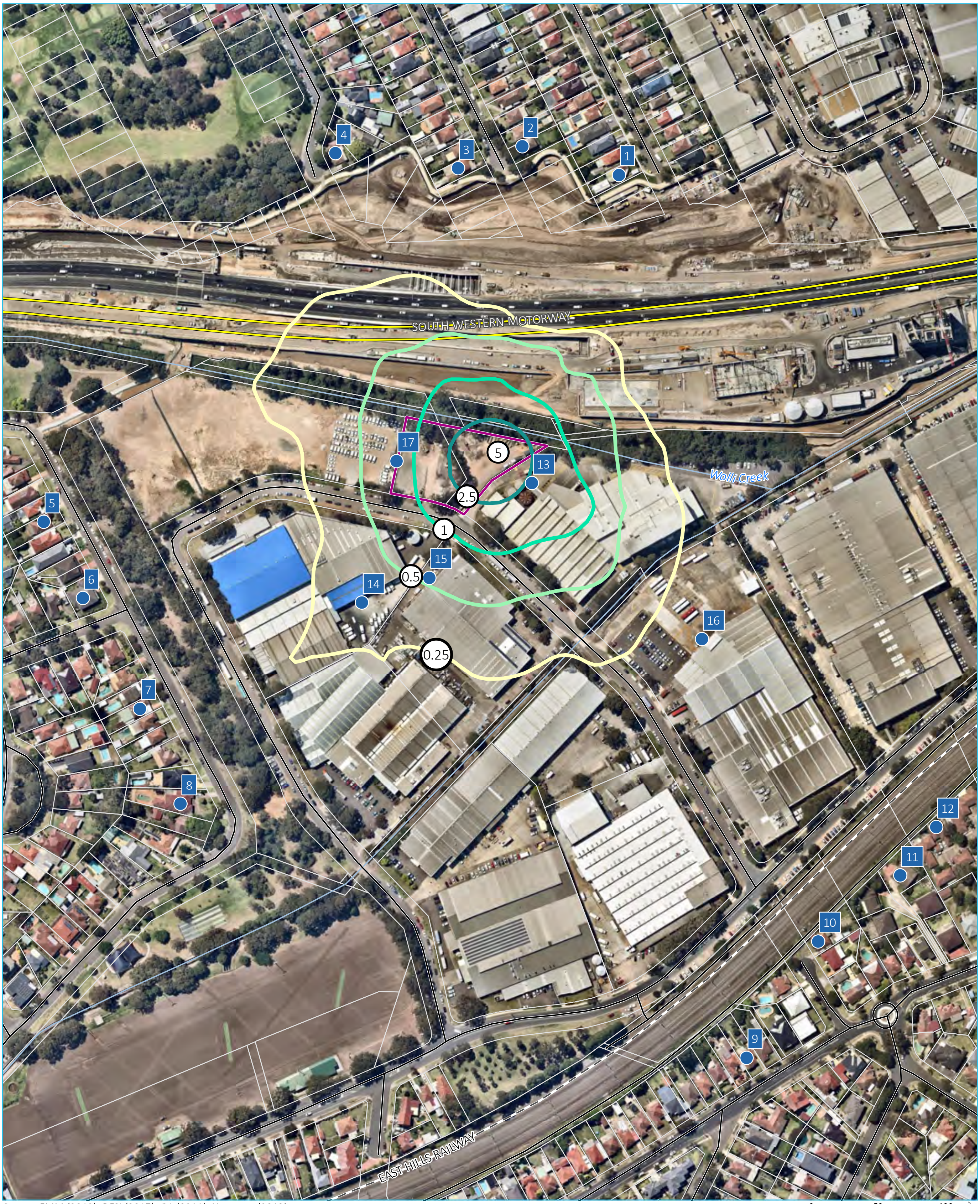
Annual average PM_{10} concentration

- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³
- 3 µg/m³

Predicted annual average PM_{10} concentrations – site only – average day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.2

EMM creating opportunities



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Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Maximum 24-hour average $PM_{2.5}$ concentration

- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³

Maximum predicted 24-hour average $PM_{2.5}$ concentrations – site only – busy day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.3

EMM
creating opportunities

Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56
N

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KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Annual average $PM_{2.5}$ concentration

- 0.1 µg/m³
- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³

Predicted annual average $PM_{2.5}$ concentrations – site only – average day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.4

EMM
creating opportunities

Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56

KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Annual average TSP concentration

- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³
- 2 µg/m³
- 4 µg/m³

Predicted annual average TSP concentrations – site only – average day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.5

EMM creating opportunities

Source: EMM (2019); DFSI (2017); GA (2011); Nearmap (2019)

0 50 100 m
GDA 1994 MGA Zone 56
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KEY

- Site boundary
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary
- Air quality assessment location

Annual average dust deposition levels

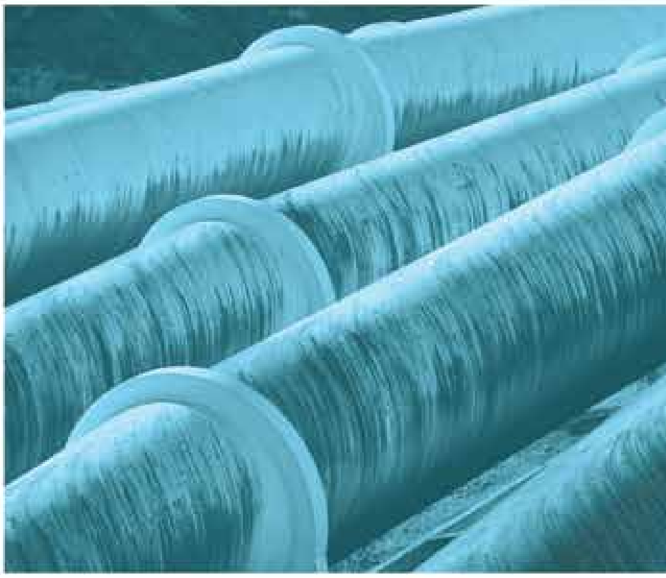
- 0.1 $g/m^2/month$
- 0.25 $g/m^2/month$
- 0.5 $g/m^2/month$
- 1 $g/m^2/month$

Predicted annual average dust deposition levels – site only – average day operations

W & J Lee Property Investments Pty Ltd
Kingsgrove resource recovery facility
Air quality impact assessment
Appendix C.6

EMM
creating opportunities



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