Greenacre Waste Facility State Significant Development Application SSD-67497708

Air quality impact assessment

Prepared for 4Pillars Environmental Consulting

October 2025

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Approved by

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Executive Summary

ES1 Introduction

Aussie Skips Recycling Pty Ltd (Aussie Recycling) currently operate a waste facility (the facility) at 13 Bellfrog Street, Greenacre (the site), pursuant to development consent DA 2012/175 granted by Strathfield City Council in September 2013.

The site is currently used for the receipt, storage and export of soils, aggregates, virgin excavated natural material (VENM) and other similar waste materials. The site is currently permitted to receive an annual combined throughput of waste material of 199,000 tonnes (t) in any 12-month period.

Aussie Recycling are proposing to lodge a new State Significant Development (SSD) Application (SSD-67497708) (SSDA) seeking approval to develop a mixed waste processing plant at the site, expand the material types received by the facility and to alter operating hours to accommodate the different proposed activities. The proposed processing plant will be a materials recovery facility (MRF) for soils, construction and demolition (C&D) waste including building and demolition (B&D) wastes such as brick, asphalt, concrete and metals. The MRF will have two main buildings, a waste receival building (initial truck unloading and processing plant hopper) and a processing building. These will be connected by an enclosed conveyor. All waste storage, handling and processing will be within the buildings and conveyor. No waste will be stored, handled or processed outside.

4Pillars Environmental Consulting (4Pillars) are engaged by Aussie Recycling to prepare an environmental impact statement (EIS) to accompany the SSDA. 4Pillars has engaged EMM Consulting Pty Limited (EMM) on behalf of Aussie Recycling to prepare this air quality impact assessment (AQIA) to support the EIS and to meet the requirements of the Secretary Environmental Assessment Requirements (SEARs) for SSD-67497708, issued by the Department of Planning, Housing and Infrastructure (DPHI) on 6 March 2024.

ES2 Assessment overview

In accordance with the SEARs, the AQIA has been completed in accordance with the NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2022), including an analysis of existing meteorological and air quality background concentrations, quantification of air pollutant emissions and atmospheric dispersion modelling to predict air quality impacts from the facility.

ES3 Existing air quality and meteorological environment

Background air quality concentrations were adopted from data recorded during the 2023 calendar year at the Department of Climate Change, Energy, the Environment and Water (DCCEEW) air quality monitoring station (AQMS) site at Lidcombe. Meteorological modelling was completed using AERMET, with real-world observations incorporated from Bureau of Meteorology (BoM) Canterbury Racecourse automatic weather station (AWS) and BoM Bankstown Airport monitoring resources.

ES4 Air pollutant emissions inventory

The primary air pollutants emitted by the SSDA facility are related to particulate matter, specifically:

- total suspended particulate matter (TSP)
- particulate matter less than 10 micrometres in aerodynamic diameter (PM_{10})
- particulate matter less than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$).

Emissions of TSP, PM_{10}, and $PM_{2.5}$ associated with the SSDA facility were quantified using publicly available emission estimation techniques for the following two scenarios:

- Scenario 1: MRF enclosure – all waste storage, handling and processing within the waste receival building and the processing building, with an enclosed conveyor transferring waste from the receival building to the processing building. Trucks delivering waste would traverse the open concrete yard between the weighbridge and receival building. No waste would be stored, handled or processed outside.

- Scenario 2: site enclosure – all waste storage, handling and processing within a single building. Trucks delivering waste would be within the building once they leave the weighbridge. No waste would be stored, handled or processed outside.

Scenario 1 is the proposed development. Scenario 2 has been modelled to determine if enclosing the site would substantially reduce the air quality impacts of the development.

The two options have been compared in the AQIA, with a view to assessing their level of 'equivalence'. 'Equivalence' means a situation where, on balance and taking a holistic view of impacts, the two options result in a similar level of residual impact.

Scenario 2, site enclosure, has lower particulate matter emissions from the movement of trucks and other equipment than Scenario 1, MRF enclosure, as the yard is not within a building. Particulate matter emissions from all other source categories (material handling, material processing and wind erosion) are similar for the two scenarios.

ES5 Atmospheric dispersion modelling results

ES5.1 Proposed development

Cumulative impacts (i.e. the incremental increase from the project + Heidelberg CBP + background air quality) were assessed by combining the adopted background concentrations with the predicted incremental concentrations from the Heidelberg CBP and the proposed facility based on background air quality measured for the whole of 2023. Cumulative results indicated that air pollution concentrations associated with emissions from the proposed facility and neighbouring emission sources would be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods, with the following exception:

- 24-hour average PM_{10} – one additional exceedance day at the majority of assessment locations under busy day operations. It is noted that exceedance coincides with an elevated background concentration of 48.8 $\mu g/m^3$ recorded during a backburning smoke emission event (see Section 5.4). The background concentration accounts for between 82% and 98% of the predicted cumulative concentrations.

It is highlighted that if the period of the 2023 background dataset influenced by regional backburning emissions did not occur, there would be no predicted additional exceedances of the applicable cumulative impact criteria.

The relative contribution to total predicted PM_{10} concentrations by emission source type was analysed at each assessment location to understand the most significant emission sources. The analysis identified that for predicted impacts at the majority of assessment locations, the most significant contributing source of emissions from the facility is the movement of vehicles across paved surfaces, with the contribution ranging from approximately 32% to 60% of total PM_{10} concentrations at the presented assessment locations. Therefore, the reduction of truck movement emissions at the facility will return the highest benefit to offsite impacts.

ES5.2 Assessment of site enclosure scenario

Atmospheric dispersion model predictions for the proposed activities were undertaken using the AERMOD dispersion modelling system. It is noted that AERMOD cannot account for the influence of built structures, such as buildings or walls, in the dispersion calculation of emissions from the site. An attempt to account for such influences in the emissions inventory has been made through the application of emission reduction factors (e.g. 30% reduction for wind breaks, 70% for three sided and roofed enclosure, etc). In light of this limitation of the AERMOD dispersion model, the dispersion modelling predictions presented in this AQIA, in particular for the proposed development (Scenario 1) which features emission sources in a yard with buildings/walls on three sides, should be viewed as conservatively high.

Cumulative results for Scenario 2 indicated that air pollution concentrations associated with emissions from the facility and neighbouring emission sources would be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods, with the following exception:

- 24-hour average PM_{10} due to site contributions – one additional exceedance day at assessment locations R1, R2, R4, R5, and R15 under busy day operations. It is noted that exceedance coincides with an elevated background concentration of 48.8 µg/m^3 (backburning event, as detailed above), which accounts for between 94% and 98% of the predicted cumulative concentrations.

As for the proposed development (Scenario 1), if the period of the 2023 background dataset influenced by regional backburning emissions did not occur, there would be no predicted additional exceedances of the applicable cumulative impact criteria for Scenario 2.

The results of the modelling undertaken for Scenario 1 and 2 are summarised below:

- Scenario 2 (site enclosure) returns lower predicted air quality impacts at surrounding receptors relative to Scenario 1 (MRF enclosure). Both emission scenarios return predicted incremental concentrations well below the NSW EPA impact assessment criteria.

- When background concentrations are taken into consideration, an additional exceedance day is predicted for 24-hour average concentrations under both Scenario 1 and 2 under the conservative assumption of continuous busy day emissions. It is noted that the additional exceedance day is coincident with background particulate matter concentrations influenced by regional backburning smoke events.

- The busy day modelling assumes continual upscaled activity rates over a 12-month period and should be viewed as highly conservative for short-term impacts.

- Model predictions from typical, average throughput are low for both Scenario 1 and 2, and are not predicted to exceed cumulative impact assessment criterion.

- Both scenarios are built on conservative emission estimation assumptions relating to the type of material being processed and transferred (e.g. 100% of material is low moisture, high dust potential material).

It is considered that on the basis of the predicted cumulative concentrations relative to the applicable NSW EPA impact assessment criteria, the MRF enclosure (Scenario 1) achieves a comparable outcome of compliance relative to the site enclosure (Scenario 2).

ES6 Mitigation measures

The following mitigation measures are incorporated into the proposed design of the facility:

- All tipping of inbound waste material and loading of processing circuit hopper will be within an enclosed building.
- All processing equipment and waste storage bays will be within a building.
- All conveyors will be covered.
- No waste will be stored, handled or processed outside.
- Dust suppression sprays in receival building and misters on building openings.
- Water suppression will be installed on the fixed processing plant within the processing building.
- Dust extraction will be installed on the fixed processing plant within the processing building, with extracted air directed to a baghouse.
- Water will be used for dust suppression in the concrete yard.
- The concrete yard will be routinely cleaned to minimise dust build up.

Where practical to do so, these measures were taken into account in the emissions estimation and dispersion modelling.

A best practice mitigation measures review was undertaken against on the European Union Best Available Technology (EU BAT) document, *Emissions from Storage* (European Commission 2006), was referenced as the primary guidance document. The EU BAT document provides examples of best available technology for the control of air pollutant emissions from a range of emission sources relevant to the facility including:

- material transportation – relevant to emissions from truck movements on paved roads
- material handling, processing and storage – relevant to emissions from material transfers, material processing areas.

The review identified that the measures proposed would align with the identified examples of best practice mitigation measures for vehicle movements, material processing and transfers, and material storage.

As listed above, the initial inbound material tipping area and loading hopper will be fully enclosed. Further, the fixed processing plant will feature particulate matter mitigation measures, including dust extraction with capture at all significant material processing points, covered conveyors, water sprays, conveyor transfer chutes, material storage bunkers for final product and the three-sided building.

It is considered that the measures proposed for material processing, transfer and storage are consistent with the identified EU BAT mitigation measures and would achieve near equivalent emission control relative to a full enclosure of the facility.

For material transportation emissions, EU BAT mitigation measures for wheel-generated dust relate to:

- the pavement of transport routes
- the use of conveyors wherever possible
- the reduction of truck travel speed

- the control of pavement silt loading through sweeping and wet suppression.

All of these mitigation measures are incorporated into the proposed development.

To mitigate emission generation from the movement of vehicles within the facility, Aussie Recycling will prioritise the control of paved surface silt loading through regular sweeping and wet suppression. It is noted that a conservative silt loading of 7.2 g/m^2 has been adopted in the emission calculations for yard vehicle movements from the default silt loading value for municipal solid waste landfills specified in US EPA emission estimation literature.

In addition to the particulate matter emission reduction measures accounted for in the dispersion modelling, Aussie Recycling will install and operate real-time particulate matter monitoring units at the boundary of the facility. Results from the monitoring would be used to inform a trigger action response plan (TARP) to facilitate the reactive management of particulate matter emissions from the site. The TARP would be integrated into the air quality management plan (AQMP) for the site.

ES7 Alternative site enclosure scenario

The proposed MRF enclosure (Scenario 1) features a range of particulate matter emission reduction measures that are consistent with accepted international best practice measures for material storage, processing and transportation.

The modelling presented in this AQIA identifies that site enclosure (Scenario 2) would achieve lower facility-only impacts at assessment locations relative to MRF enclosure (Scenario 1). However, based on the results of the cumulative assessment presented in the AQIA and the number of predicted additional exceedance days for the two scenarios (i.e. one additional day for either scenario), it is considered that site enclosure is not necessary to satisfy applicable NSW EPA impact assessment criteria relative to the proposed MRF enclosure.

In summary:

- The proposed MRF enclosure aligns with accepted international best practice emission mitigation techniques for material storage, processing and transportation emission sources, without the need for full enclosure.

- The material processing and transfer emission sources for the MRF enclosure will feature equivalent emission controls as the site enclosure, with the implantation of targeted dust extraction and capture, covered conveyors, wet suppression, wind shielding by built structures and storage bunkers and full enclosure of the initial material tipping area.

- The proposed MRF enclosure is predicted to comply with applicable cumulative NSW EPA impact assessment criteria at a comparable level to the site enclosure (i.e. one additional cumulative exceedance day associated with an elevated background concentration for each scenario).

Consideration should also be given to whether the site enclosure is a reasonable and feasible management measure. ‘Feasible’ is taken to be what is possible and practical in the circumstances, while ‘reasonable’ requires the application judgement in arriving at a decision, taking into account: mitigation benefits, costs of mitigation versus benefits provided, community views, and the nature and extent of potential improvements.

It is understood that a site enclosure is feasible, in that it a single building covering the majority of the site could be constructed and that the proposed activities could occur within this building, although with some restrictions as discussed elsewhere within the EIS.

However, the following air quality-related factors should be considered whether the site enclosure is a reasonable requirement. According to guidance received by Aussie Recycling, the estimated net cost of the proposed project with MRF enclosure is $11.8 million (Rider Levett Bucknall 2025a) and the estimated net cost of site enclosure is $17.015 million (Rider Levett Bucknall 2025b), i.e. site enclosure will increase costs by about $5.2 million.

The high costs associated with the installation of a full enclosure at the facility is not justified, relative to targeted control of vehicle movements through lower cost methods (i.e. frequent sweeping of paved surfaces, wet suppression of travel routes, wheel bath at site entrance).

Waste materials are currently handled and stored outside. The proposed MRF enclosure would ensure that no wastes are handled, stored or processed outside providing a better outcome for the community.

In addition, an air extraction system for the site enclosure would have significantly higher electricity demands than the MRF enclosure.

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1 Introduction

1.1 Facility context and overview

Aussie Skips Recycling Pty Ltd (Aussie Recycling) is proposing to upgrade the existing waste facility located at 13 Bellfrog Street, Greenacre (Lot 15/DP1133214) (the 'site’).

The site is currently used for the receipt, storage and export of soils, aggregates, virgin excavated natural material (VENM) and other similar waste materials. The site is currently permitted to receive an annual combined throughput of waste material of 199,000 tonnes (t) in any 12-month period.

Aussie Recycling is proposing to lodge a new State Significant Development (SSD) application (SSD-67497708) seeking approval to construct and operate a materials recovery facility (MRF) on the site (the proposal). The proposal includes minor demolition, alterations to existing site components, installation of a fixed waste processing plant and site infrastructure, construction of environmental conservation measures, and the ongoing operation of the MRF.

The MRF will have two main buildings, a waste receival building and a processing building. These will be connected by an enclosed conveyor. There will be an open yard between these buildings to allow truck access for delivery of waste and dispatch of recovered products and residual waste.

The MRF will accept and recycle, construction and demolition (C&D) waste, commercial and industrial (C&I) waste and non-putrescible municipal solid waste (MSW), including building and demolition (B&D) wastes such as brick, asphalt, concrete and metals. It is proposed that up to 199,000 t of waste will be accepted and processed in any 12-month period. It is proposed to amend the site’s operating hours compared to those currently approved.

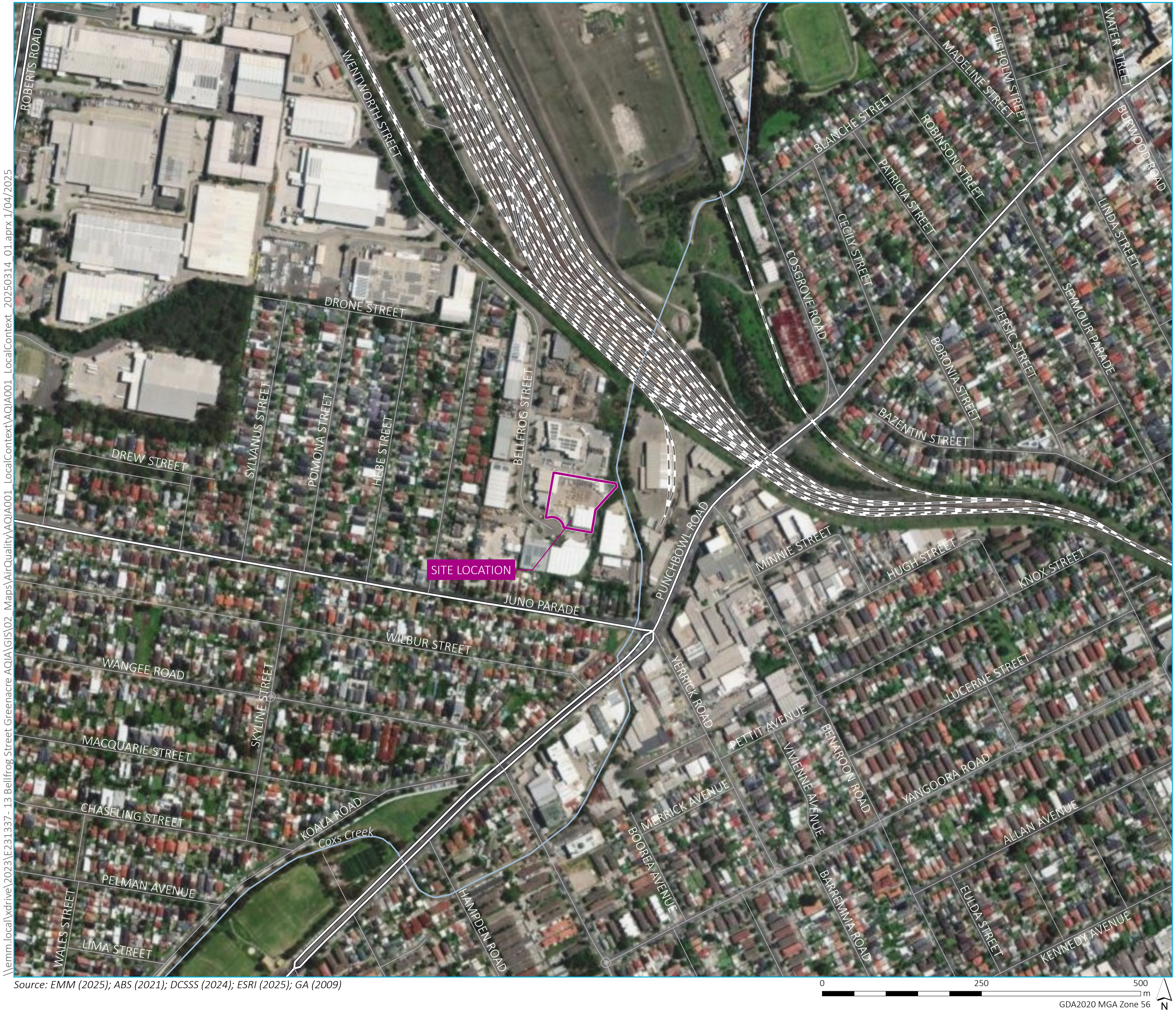
MRF operations will include:

- receipt of waste via heavy road vehicles
- storage of waste in the receival building
- handling of waste by the conveyor and mobile plant
- processing of waste, including sifting, picking and screening, using mobile plant and the fixed waste processing plant
- storage of recovered products and residual waste
- dispatch of recovered products and residual waste by heavy road vehicles
- ancillary activities including operation of a workshop, employee parking, overnight truck parking, equipment storage, maintenance, diesel fuel storage in a self-contained fuel tank, water treatment, waste sampling, quality assurance and use of the site’s existing facilities.

All waste storage, handling and processing will be within the buildings and conveyor. No waste will be stored, handled or processed outside.

The proposal will allow a broader wider range of wastes to be accepted at the site (C&D, C&I and non-putrescible MSW). It will allow these wastes to be sorted on site to produce recovered products for further recycling, so reducing the amount of waste sent to landfill, as advocated by the NSW Environment Protection Authority's Draft NSW Waste and Circular Infrastructure Plan (EPA 2025). The proposal includes site changes to enhance the site's environmental measures, in particular, construction of a roof over the concrete yard so that all waste will remain under cover. The proposal will not increase existing operational footprint or the site's throughput over a year.

4Pillars Environmental Consulting (4Pillars) are engaged by Aussie Recycling to prepare an environmental impact statement (EIS) for the State Significant Development Application (SSDA) to modify the approved operations of the facility (SSD-67497708). 4Pillars has engaged EMM Consulting Pty Limited (EMM) on behalf of Aussie Recycling to prepare this air quality impact assessment (AQIA) to meet the requirements of the Secretary Environmental Assessment Requirements (SEARs) for the State Significant Development Application (SSDA) (SSD-67497708), issued by the Department of Planning, Housing and Infrastructure (DPHI) on 6 March 2024.



KEY

- Site boundary
- Rail line
- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2025); ABS (2021); DCSSS (2024); ESRI (2025); GA (2009)

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Local context

13 Bellfrog Greenacre
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Figure 1.1

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1.2 Overview of the proposed SSDA operations

The activities to be carried out at the proposed facility under the SSDA are as follows:

- receipt of waste materials via heavy road vehicles
- handling of waste material by mobile plant
- processing of waste material by sifting, picking and mechanised screening (fixed MRF equipment plant)
- storage of waste materials and processed recovered products
- export of waste materials by heavy road vehicles
- various ancillary activities such as operation of a workshop, overnight truck parking, general storage of equipment, maintenance, storage of diesel fuel and operation of a self-contained fuel tank, waste sampling and quality assurance etc.

Waste material accepted at the facility will be taken directly to the waste receival building to be unloaded before being transferred to a hopper and conveyer system within the waste receival building. Waste material is then transferred by a covered conveyer system to the material recovery plant (MRP) where the waste material is processed and sorted into the respective storage bays before being transferred offsite.

Additional holding material holding bays in the yard, external to the MRP, will be periodically used for the storage of materials (i.e. recovered fines) when required.

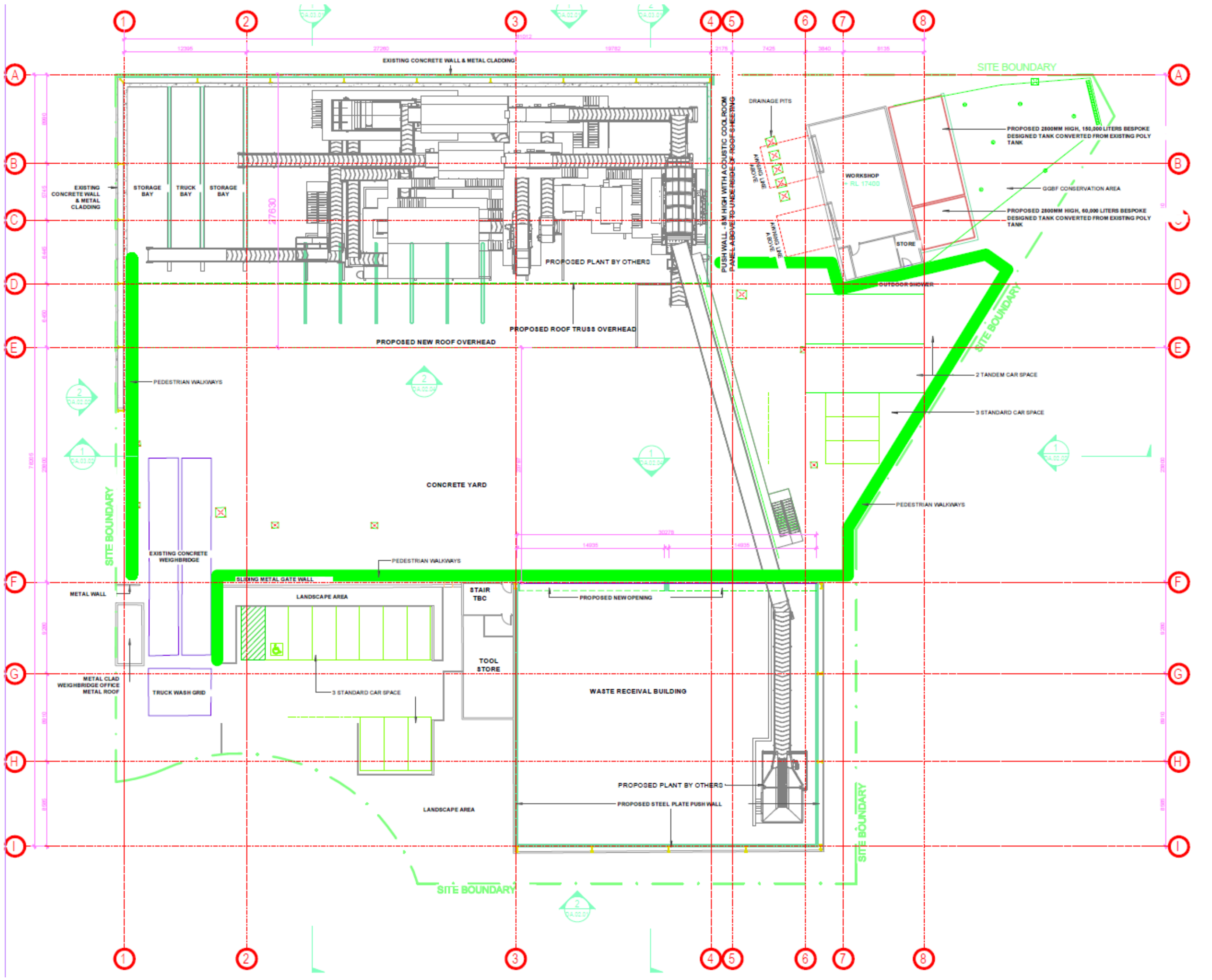
A summary of approved and proposed activities are provided in Table 1.1 and proposed facility layout are provided in Figure 1.2.

Table 1.1 Summary of approved and proposed SSDA activities

Site element	Approved activities	Proposed SSDA activities
Site	13 Bellfrog Street, Greenacre Lot 15 DP 1133214	No change
Hours of operation	• Monday to Friday: 6:00 AM – 5:00 PM • Saturday to Sunday: 7:00 AM – 5:00 PM • Public holidays: no operations permitted	• Monday to Saturday: – processing: 7:00 AM – 6:00 PM – transporting and material handling: 5:00 AM – 10:00 PM – workshop and low impact works*: 24hr • Sunday and public holidays: – processing: no processing to occur – transporting and material handling: 7:00 AM – 6:00 PM – workshop and low impact works: 24hr
Throughput	199,000 t in any 12-month period	No change
Waste types	• Mixed waste: – 98% soils/ VENM – 2% mixed concrete, brick or asphalt	• Mixed C&D waste: – 85% B&D – 5% mixed concrete, brick or asphalt – 10% soils/ VENM
Activities to occur onsite	• Waste storage	• Waste storage • Resource recovery

Site element	Approved activities	Proposed SSDA activities
Infrastructure	• Warehouse (currently used for the storage of equipment and vehicles) • Materials storage bays (under awning) • Workshop	As approved with the addition of: • MRP • Extension of existing awning and addition of eastern wall to form the waste processing building • Structural modifications to existing warehouse (to be used for waste material receival) • Penstock valve and engineering controls

Note: *low impact activities include – cleaning of site and equipment, vehicle and plant machinery maintenance and sampling and testing of materials.



Source: Place Studio

Figure 1.2 Indicative facility layout

1.3 Assessment approach and requirements

This AQIA report has been conducted in accordance with the guidelines specified by the NSW Environmental Protection Authority (EPA) in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2022), 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 modelling approach using site-specific/representative inputs.

This report comprises:

- a description of the local setting and surrounding area
- relevant pollutants for assessment and applicable impact assessment criteria
- a description of the existing environment, specifically:
  - meteorology and climate
  - existing air quality environment
- a detailed air pollution emissions inventory
- results of atmospheric dispersion modelling conducted for the facility, including analysis of facility-only and cumulative impacts accounting for background air quality
- an overview of best practice and proposed dust mitigation measures.

1.4 Assessment requirements

The SEARs identify air quality matters needed to be addressed as part of the EIS. The individual requirements relevant to the AQIA and where they are addressed in this report is provided in Table 1.2.

Table 1.2 Air quality related SEARs

Requirement	Section addressed
Air quality and odour – including:	
• a quantitative assessment of the potential air quality, dust and odour impacts of the development (construction and operation) on surrounding landowners, businesses and sensitive receptors, in accordance with relevant Environment Protection Authority guidelines, including:	This report
– details of air handling systems within operational buildings and strong justification for any material handling, processing or stockpiling external to buildings	Chapter 6 and Chapter 8
– a cumulative impact assessment inclusive of impacts from other nearby development	Section 7.3
– details of proposed mitigation, management and monitoring measures	Section 6.3 and Chapter 8

Additionally, the NSW EPA provided site specific requirements for the SSDA as input to SEARs dated 29 February 2024. Within this input, the NSW EPA presented the expectation that *all waste and materials are stored and processed inside an enclosed building for the Proposal*.

In order to respond to the NSW EPA's position on enclosure of material processing and storage activities, a theoretical "site enclosure" emissions scenario has been developed in this AQIA for comparison to the SSDA facility as designed the MRF enclosure. Details relating to the emission scenarios developed for this AQIA are provided in Section 6.2.

2 Site setting and sensitive receptors

2.1 Site and surrounding area

The site is located within an existing industrial area in Greenacre, NSW. The surrounding lots along Bellfrog Street are a mixture of warehouses and industrial operations, including the Heidelberg Materials concrete batching plant (CBP) immediately to the north of the site. Further afield from Bellfrog Street is the Sydney Ports Enfield Intermodal site to the north and an additional industrial site to the east.

The site is currently zoned as E4 General Industrial with land classifications in the surrounding area including R2 Low Density Residential, C2 Environmental conservation, SP2 Rail Infrastructure and E4 General Industrial. The closest residences are approximately 0.1 km to the south and west of the site boundary.

2.2 Assessment locations

A selection of representative residential and industrial properties surrounding the site have been chosen as assessment locations for this modelling study. The assessment locations are presented in Table 2.1 and shown in Figure 2.1.

These locations are used as points for detailed model analysis of air quality impacts from operations at the site. Compliance with applicable assessment criteria at these representative assessment locations would indicate the criteria will be met at other more distance locations.

It is noted that several of these receptor locations, including the Heidelberg Materials CBP, are themselves potential sources of air pollution emissions (further discussed in Section 5.2). These locations, however, are included within this AQIA.

Table 2.1 Assessment locations

Location ID	Classification	Coordinates (MGA, 56)	
		Easting (m)	Northing (m)
R1	Industrial	321932	6246346
R2	Industrial	321891	6246341
R3	Industrial	321847	6246361
R4	Industrial	321846	6246439
R5	Industrial	321894	6246394
R6	Industrial	321885	6246446
R7	Industrial	322004	6246385
R8	Industrial	321898	6246509
R9	Industrial	321845	6246472
R10	Industrial	321851	6246506
R11	Industrial	321855	6246564
R12	Industrial	321861	6246595
R13	Industrial	321908	6246638
R14	Industrial	321875	6246661

Location ID	Classification	Coordinates (MGA, 56)	
		Easting (m)	Northing (m)
R15	Industrial	322072	6246418
R16	Residential	321940	6246276
R17	Residential	321821	6246287
R18	Residential	321791	6246372
R19	Residential	321808	6246508
R20	Residential	321817	6246588

Source: EMM (2025); DCSSS (2024); GA (2009)

Assessment locations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure 2.1

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3 Pollutants and assessment criteria

3.1 Potential air pollutants

Operations at the site have the potential to generate emissions of various pollutants to the ambient atmosphere. Emission sources will comprise of a mixture of fugitive sources (material handling and transfer, material processing, the movement of mobile plant and equipment, wind erosion of exposed surfaces) and mobile combustion sources (diesel combustion by site equipment fleet and trucks).

The main air pollutants emitted by the SSDA facility will include:

- particulate matter, specifically
  - total suspended particulate matter (TSP)
  - particulate matter less than 10 micrometres in aerodynamic diameter (PM_{10})
  - particulate matter less than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$)
- oxides of nitrogen (NO_X)[1], including nitrogen dioxide (NO_2)
- sulfur dioxide (SO_2)
- carbon monoxide (CO)
- volatile organic compounds (VOCs).

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

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.

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 Environmental Protection (Ambient Air Quality) Measure (AAQ NEPM) national reporting standards (Department of the Environment 2021).

TSP, which relates to air borne particulates less than 50 micrometres (µm) in diameter, is used as a metric for assessing amenity impacts (reduction in visibility, dust deposition and soiling of building and surfaces) rather than health impacts (NSW EPA 2013). Particles less than 10 µm and 2.5 µm in diameter 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.

[1] By convention NO_X = nitrous oxide (NO) + NO_2

The Approved Methods for Modelling classifies TSP, PM_{10}, $PM_{2.5}$ and dust deposition as 'criteria pollutants'. The impact assessment criteria for criteria pollutants are applied at the nearest existing or likely future off-site sensitive receptors[2], and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction for the relevant averaging. Both the incremental (facility only) and cumulative (facility + background) impacts need to be presented, with the latter requiring consideration of the existing ambient background concentrations.

For dust deposition, the NSW EPA (2022) specify the criteria for facility-only increment and cumulative dust deposition levels. Dust deposition impacts are derived from TSP emission rates and particle deposition calculates in the dispersion modelling process.

Table 3.1 Impact assessment criteria for primary pollutants

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 (facility increment only)
		4 g/m^2/month (cumulative)

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

2 NSW EPA (2022) defines a sensitive receptor as a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area.

4 Meteorology and climate

4.1 Monitoring data resources and selection of representative year

There are no meteorological measurements taken at the site. In reviewing the meteorological environment of the local area, the following publicly available data sources were used:

- Bureau of Meteorology (BoM) Automatic weather station (AWS) at Canterbury Racecourse (station 066194), located approximately 3.6 km east of the site. One-hour average measurements of wind speed, wind direction, standard deviation of wind direction, temperature and relative humidity were sourced from this AWS.

- BoM Bankstown Airport AWS (station 066137) located approximately 8.2 km west of the site. One-hour average measurements of station-level barometric pressure and cloud observations were sourced from this AWS.

The meteorological data recorded by the BoM Canterbury Racecourse AWS were analysed for the five-year period between 2019 and 2023 (see Appendix A). The analysis demonstrated a similarity across years in the most important parameters for pollutant dispersion, such as wind speed and wind direction winds. The annual average recorded wind speed ranged from 2.7 m/s to 3.0 m/s, while the frequency of calm conditions (wind speeds less than 0.5 m/s) ranged from 15.8% to 20.8% of the time.

The inter-annual profiles for air temperature and relative humidity were also generally comparable between 2019 and 2023 (Appendix A). The 2022 datasets showed higher relative humidity, which is likely linked to the high rainfall influenced by the La Niña event.

For the purpose of this AQIA, on the basis of similarities in inter-annual trends of wind speed and direction for the years between 2019 and 2023, 2023 was considered suitably representative of the two reference monitoring stations for use in the assessment to meet the requirements of the Approved Methods for Modelling. At the time of commencing this AQIA, 2023 represented the most recent and complete calendar year of hourly varying measurements available.

4.2 Meteorological modelling

Atmospheric dispersion modelling for this assessment has been completed using the AMS[3]/USEPA[4] regulatory model (AERMOD (model version v24142, further discussion presented in Section 7). The meteorological inputs for AERMOD were generated using the AERMET meteorological processor (model version v23132), using local surface observations and upper air profiles generated by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) TAPM meteorological modelling module.

Further details of the TAPM meteorological modelling and AERMET data processing completed to prepare the inputs for AERMOD are documented in Appendix A.

4.3 Prevailing winds

The annual wind rose showing the wind speed direction from BoM Canterbury Racecourse AWS recorded during 2023 is presented in Figure 4.1. The wind rose shows a prevailing wind alignment from the north-east, south-east and south-west to north-west.

[3] AMS – American Meteorological Society

[4] USEPS – United States Environmental Protection Agency

The annual wind speed for the year 2023 was 2.7 m/s. The annual average frequency of calm conditions was 20.8%. Calm winds are typically associated with stable atmospheric conditions (see Section 4.4 for additional discussion) which have lower potential for the dispersion of pollutant emissions.

Seasonal wind roses from the BoM Canterbury Racecourse AWS for the year 2023 are shown in Figure 4.2. The mean wind speed ranges from 2.0 m/s in winter and 3.3 m/s in summer. The frequency of calm conditions ranges from 13.1% in summer to 27.9% in winter. The summer and spring months show prevailing north-easterly and south-easterly winds, while winds from the north-west are more dominant in the autumn and winter months.

Diurnal wind roses from the BoM Canterbury Racecourse AWS for the year 2023 are shown in Figure 4.3. The wind direction patterns during both the daylight and nighttime hours exhibit a notable north-east, south-east and south-west to the north-west. Wind speeds are higher during the daylight hours, with an average wind speed of 3.5 m/s compared to 1.8 m/s at night-time, while the percentage of calms is higher at night (34.1% versus 8.1% during the day).

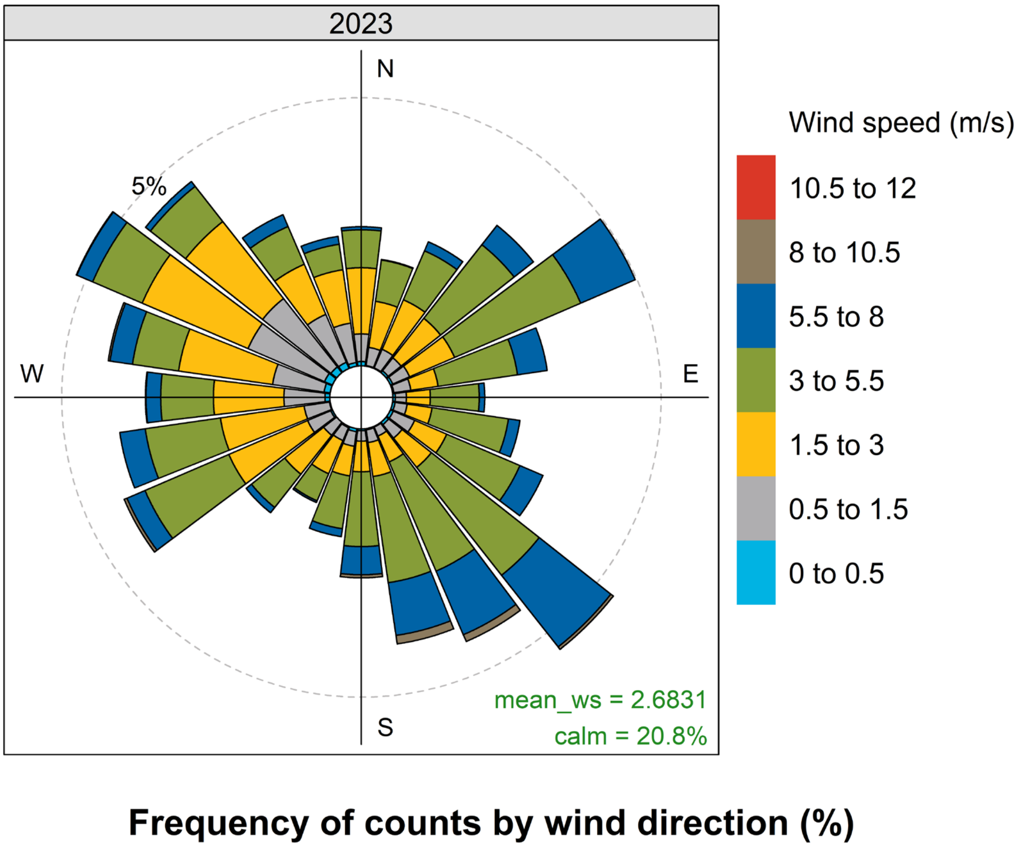


Figure 4.1 Annual wind speed and direction – Canterbury Racecourse AWS 2023

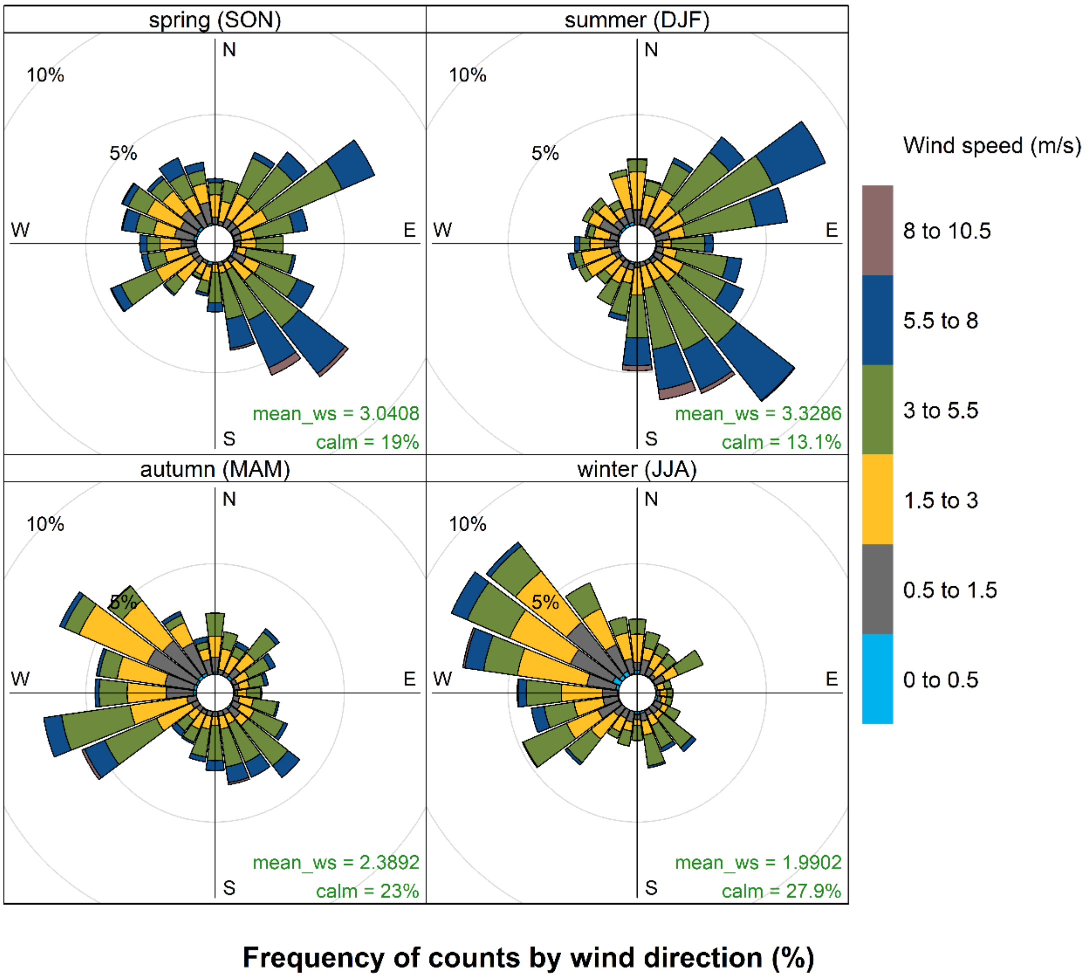


Figure 4.2 Seasonal wind speed and direction – BoM Canterbury Racecourse - 2023

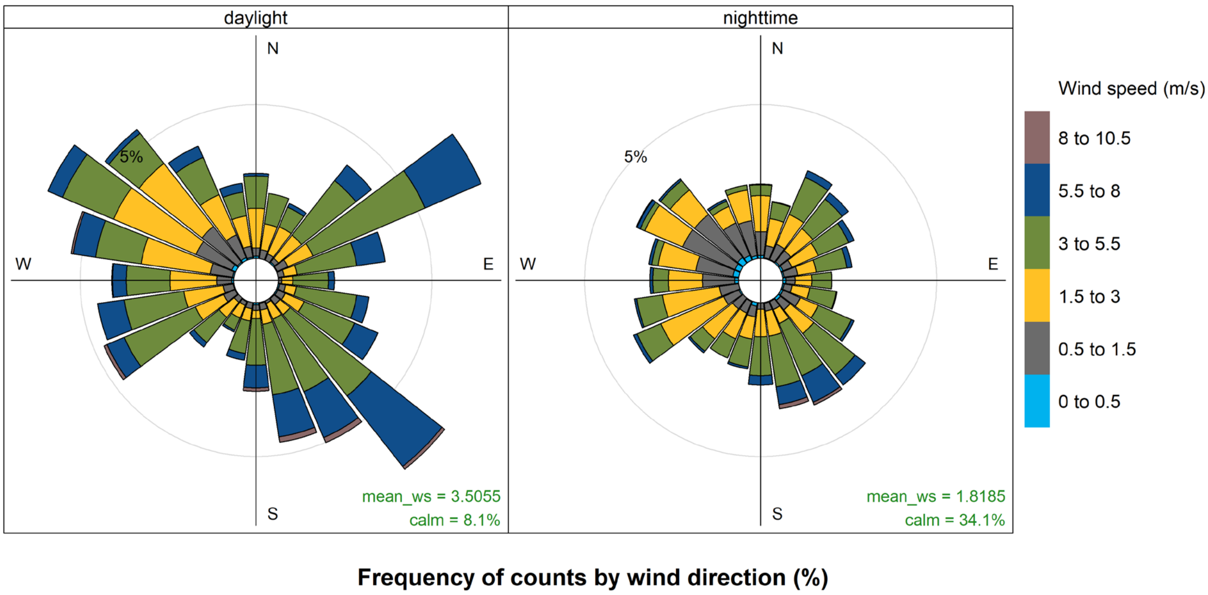


Figure 4.3 Diurnal wind speed and direction – BoM Canterbury Racecourse - 2023

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 (i.e. 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 4.4 illustrates the diurnal variation of atmospheric stability, derived from the Monin-Obukhov length calculated by AERMET based on observation data collected from the BoM Canterbury Racecourse AWS in 2023.

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 daytime hours and lowest during evening through to early morning hours.

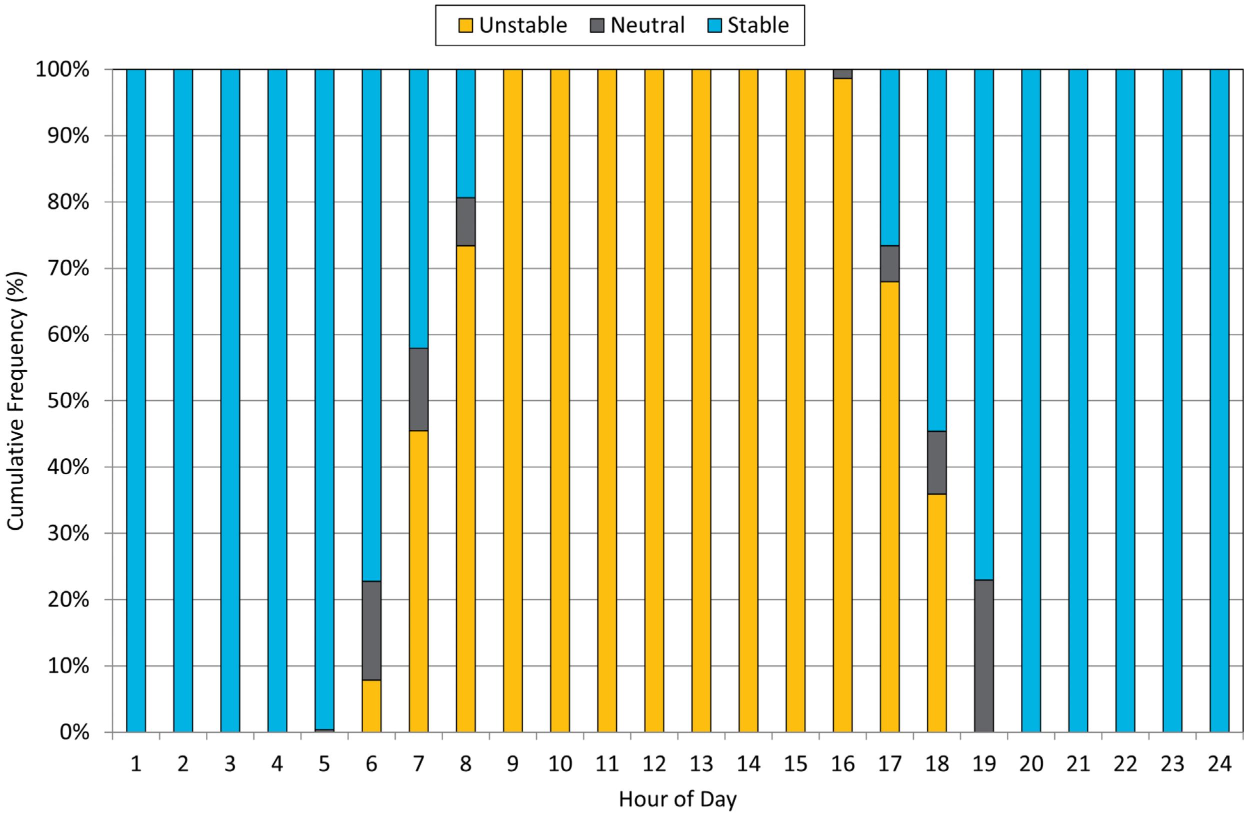
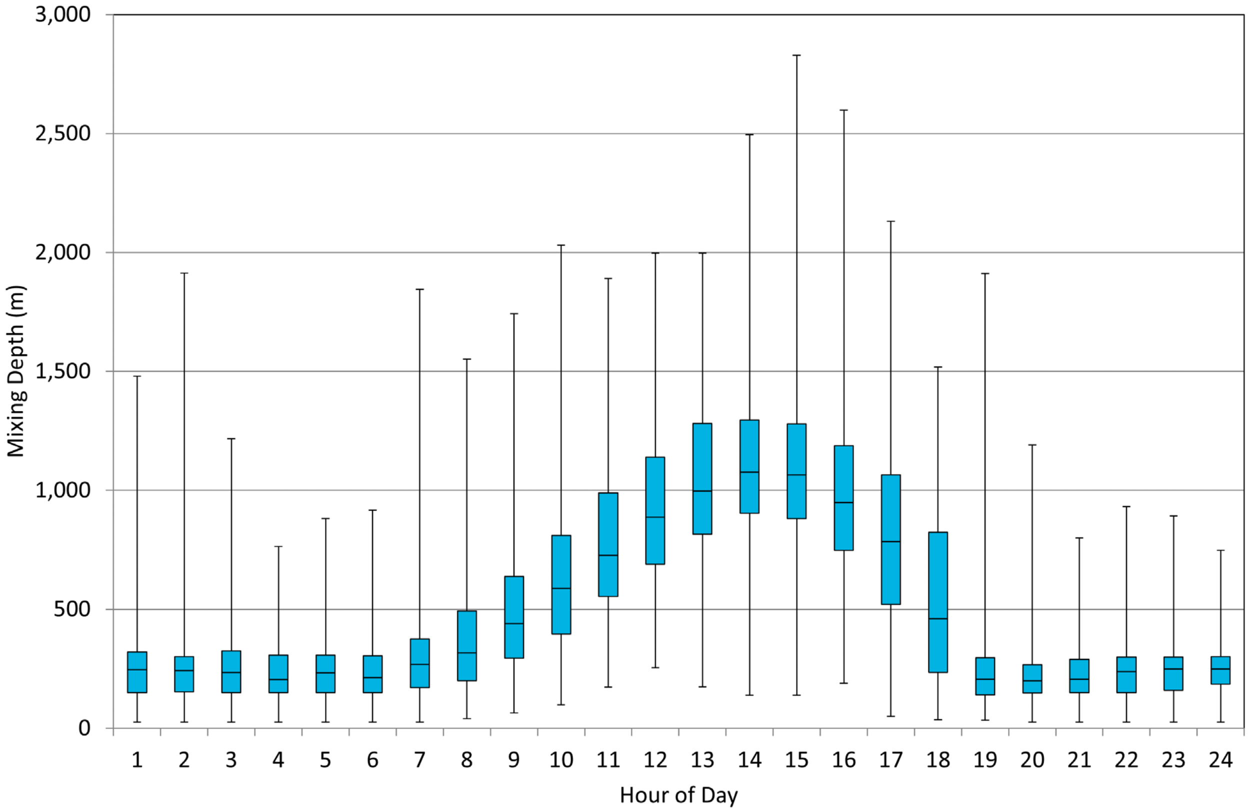


Figure 4.4 AERMET-generated diurnal variation in atmospheric stability – BoM Canterbury Racecourse AWS – 2023

Hourly-varying atmospheric boundary layer depths were calculated by AERMET and refers to the height of the atmosphere above ground level within which the dispersion of air pollution occurs. The variation in boundary layer depth by hour of the day is illustrated in Figure 4.5. The profile presented in Figure 4.5 shows that greater boundary layer depths are experienced during the daytime hours between mid-morning and 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.



Note: Blue bars indicate the interquartile range (IQR), or middle 50% of the data, while the whiskers indicate highest and lowest values.

Figure 4.5 AERMET-generated diurnal variation in atmospheric boundary layer depth – BoM Canterbury Racecourse AWS – 2023

5 Background air quality

5.1 Existing sources of emissions

As previously mentioned, the site is located in south-western Sydney, predominantly surrounded by industrial and residential properties.

Existing neighbouring sources include the Heidelberg Materials CBP Greenacre, immediately north of the site, D & M Excavations and Asphalting, approximately 80 m north of the site, Sydney Ports Enfield Intermodal Terminal, approximately 500 m north of the site, and Bingo Greenacre recycling facility, approximately 700 m north of the site.

Other sources that contribute to particulate matter concentrations in the vicinity of the site include:

- dust entrainment and tyre break wear due to vehicle movements along public roads
- petrol and diesel emissions from vehicle movements along public roads
- diesel emissions from goods delivery trains
- wind generated dust from exposed areas within the surrounding region.

Other remote sources which contribute episodically to suspend particulate in the region include dust storms and bushfires.

With the exception of the Heidelberg Materials CBP, operations from the surrounding industrial sources are likely to be minor in emissions or are sufficiently distant from the site to avoid direct cumulative impacts at the surrounding assessment locations.

5.2 Heidelberg Materials CBP emissions and impacts

In order to account for emissions from the Heidelberg Materials CBP Greenacre, relevant emissions estimates in the public domain were referenced. The Heidelberg Materials CBP Greenacre was approved in 2010 (previously Hanson Greenacre CBP) and no relevant air quality impact assessment for that operation could be sourced from the public domain. However, it is noted that the traffic assessment for the Hanson Eastern Creek CBP (Transport and Planning Associates 2019) used traffic count data from the Hanson Greenacre CBP (now Heidelberg Materials CBP Greenacre) on the basis that the production capacity was very similar between the two operations. Therefore, the particulate matter emission inventory presented in the air quality impact assessment completed for the Hanson Eastern Creek CBP (Pacific Environment 2018) has been adopted to represent emissions from the Heidelberg Materials CBP Greenacre.

Annual emission totals based on average day and peak day activity rates from the Hanson Eastern Creek CBP (Pacific Environment 2018) and adopted for the Heidelberg Materials CBP Greenacre are presented in Table 5.1.

Table 5.1 Adopted annual particulate matter emissions for Heidelberg Materials CBP Greenacre

Pollutant	Annual emissions (kg/annum)	
	Average day	Peak day
TSP	530	1,364
PM_{10}	211	488
$PM_{2.5}$	29	73

Source: Table 6-1 of Pacific Environment 2018

In order to account for the local impact from the Heidelberg Materials CBP at the selected assessment locations, emissions presented in Table 5.1 were modelled as a volume source at the Heidelberg Materials CBP site. Average day emissions were used to predict emissions generated by the Heidelberg Materials CBP. Further discussion relating to atmospheric dispersion modelling conducted is presented in Section 7.

The results from the indicative dispersion modelling completed for the Heidelberg Materials CBP are summarised in Table 5.2.

Table 5.2 Incremental concentrations and deposition results for Heidelberg Materials CBP

Assessment location ID	Predicted incremental concentrations (µg/m³) or dust deposition rates (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R1	0.5	2.0	0.4	0.3	0.1	<0.1
R2	0.3	1.5	0.3	0.2	<0.1	<0.1
R3	0.3	0.8	0.3	0.1	0.0	<0.1
R4	0.5	1.4	0.4	0.2	0.1	<0.1
R5	0.7	1.2	0.4	0.2	0.1	<0.1
R6	1.3	2.6	0.8	0.4	0.1	0.1
R7	0.8	2.3	0.6	0.3	0.1	<0.1
R8*	1.9	3.9	1.0	0.5	0.1	0.1
R9	0.6	1.5	0.4	0.2	0.1	<0.1
R10	0.7	1.8	0.4	0.2	0.1	<0.1
R11	0.5	1.7	0.4	0.2	0.1	<0.1
R12	0.5	1.2	0.3	0.2	<0.1	<0.1
R13	0.4	1.0	0.2	0.1	<0.1	<0.1
R14	0.3	0.7	0.2	0.1	<0.1	<0.1
R15	0.8	2.6	0.5	0.4	0.1	<0.1
R16	0.2	1.0	0.2	0.1	0.0	<0.1

Assessment location ID	Predicted incremental concentrations (µg/m³) or dust deposition rates (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R17	0.2	0.5	0.1	0.1	<0.1	<0.1
R18	0.2	0.5	0.2	0.1	<0.1	<0.1
R19	0.3	1.0	0.2	0.1	<0.1	<0.1
R20	0.3	0.9	0.2	0.1	<0.1	<0.1

*Note – Assessment location R8 is the Heidelberg Materials CBP site

5.3 Air quality monitoring data resources

There are no air quality measurements available for the site. The NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) maintains air quality monitoring stations (AQMS) at Chullora approximately 3.1 km north-west of the site and at Lidcombe approximately 3.8 km north-west of the site.

Data from these AQMS was collated for the five-year period between 2019 and 2023. During this period, the Chullora AQMS was decommissioned in November 2022, while the Lidcombe AQMS was commissioned in March 2020. Data from both stations is considered in this AQIA.

5.4 Baseline air quality environment

5.4.1 PM_{10}

A timeseries of 24-hour average PM_{10} concentrations recorded at the Chullora AQMS and the Lidcombe AQMS between 2019 and 2023 is presented in Figure 5.1. Recorded 24-hour average PM_{10} concentrations fluctuate throughout the presented period. Recorded 24-hour average PM_{10} concentrations throughout the period are typically below the applicable NSW EPA impact assessment criterion of 50 µg/m³; however, a higher frequency of elevated concentrations occurred between 2019 and early 2020 relative to the later years of the data period.

Exceedance of the 24-hour average criterion occurred in three of the five years studied between 2019 and 2023, ranging from no days in 2021 and 2022 to 20 days for 2019. There was an increasing trend in the magnitude of recorded concentrations from 2019 through to early 2020, coinciding with the Black Summer bushfires between October 2019 and February 2020.

The recorded PM_{10} concentrations decrease during 2020 relative to 2019, associated with the onset of La Niña conditions (i.e. increasing rainfall and reduction in drought conditions). Annual average PM_{10} concentrations are below the applicable criterion of 25 µg/m³ for all years.

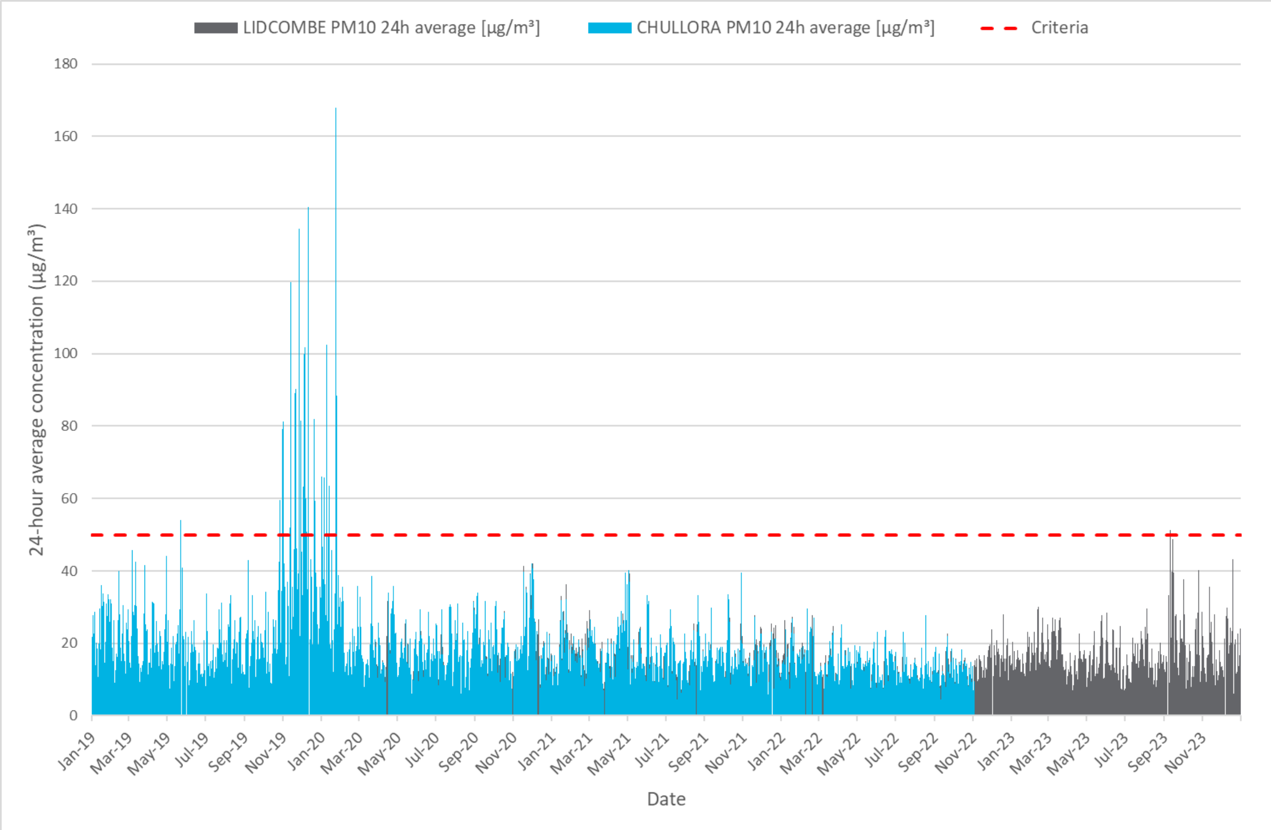


Figure 5.1 Time series of 24-hour average PM_{10} concentrations – Chullora and Lidcombe AQMS dataset – 2019 to 2023

Key statistics for the five years of data from the Chullora AQMS dataset and Lidcombe AQMS dataset are presented in Table 5.3 and Table 5.4 respectively. The presented statistics of recorded concentrations also illustrates the higher frequency of elevated concentrations through 2019 to 2020. Relative to the preceding three years, the recorded PM_{10} concentrations decrease in 2021, likely due to the onset of La Niña and associated increased rainfall and reduction in drought conditions.

For the purpose of this AQIA, the 2023 calendar year monitoring dataset has been adopted as a representation of local background PM_{10} concentrations.

Table 5.3 Statistics for PM_{10} concentrations – Chullora AQMS dataset – 2019 to 2023

Year	Maximum	99th percentile	75th percentile	Median	Average	Days > 50 µg/m³
	24-hour average PM_{10} concentration (µg/m³)					
2019	140.4	100.6	27.1	20.2	24.6	20
2020	167.9	65.3	23.8	17.5	20.5	8
2021	40.3	36.6	19.4	15.2	16.5	0
2022	29.6	25.8	15.0	12.0	13.6	0
2023	No data	No data	No data	No data	No data	No data

Table 5.4 Statistics for PM_{10} concentrations – Lidcombe AQMS dataset – 2019 to 2023

Year	Maximum	99th percentile	75th percentile	Median	Average	Days > 50 µg/m³
	24-hour average PM_{10} concentration (µg/m³)					
2019	No data	No data	No data	No data	No data	No data
2020	42.0	35.4	17.6	12.9	16.1	0
2021	39.2	35.1	18.7	14.6	15.7	0
2022	27.9	27.1	15.7	12.7	13.3	0
2023	51.4	39.9	19.6	15.4	16.6	1

5.4.2 $PM_{2.5}$

A time series of recorded 24-hour average $PM_{2.5}$ concentrations from the Chullora AQMS and the Lidcombe AQMS recorded between 2019 and 2023 is presented in Figure 5.2. 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.

Exceedances of the NSW EPA criterion exceedances were experienced occasionally across the reviewed period at both AQMS locations. Exceedances were associated with regional scale events such as dust storms, hazard reduction burns and during 2019 and 2020, extensive bushfire events across NSW. Annual average $PM_{2.5}$ concentrations were above the applicable criterion of 8 µg/m³ for the years 2019 and 2020.

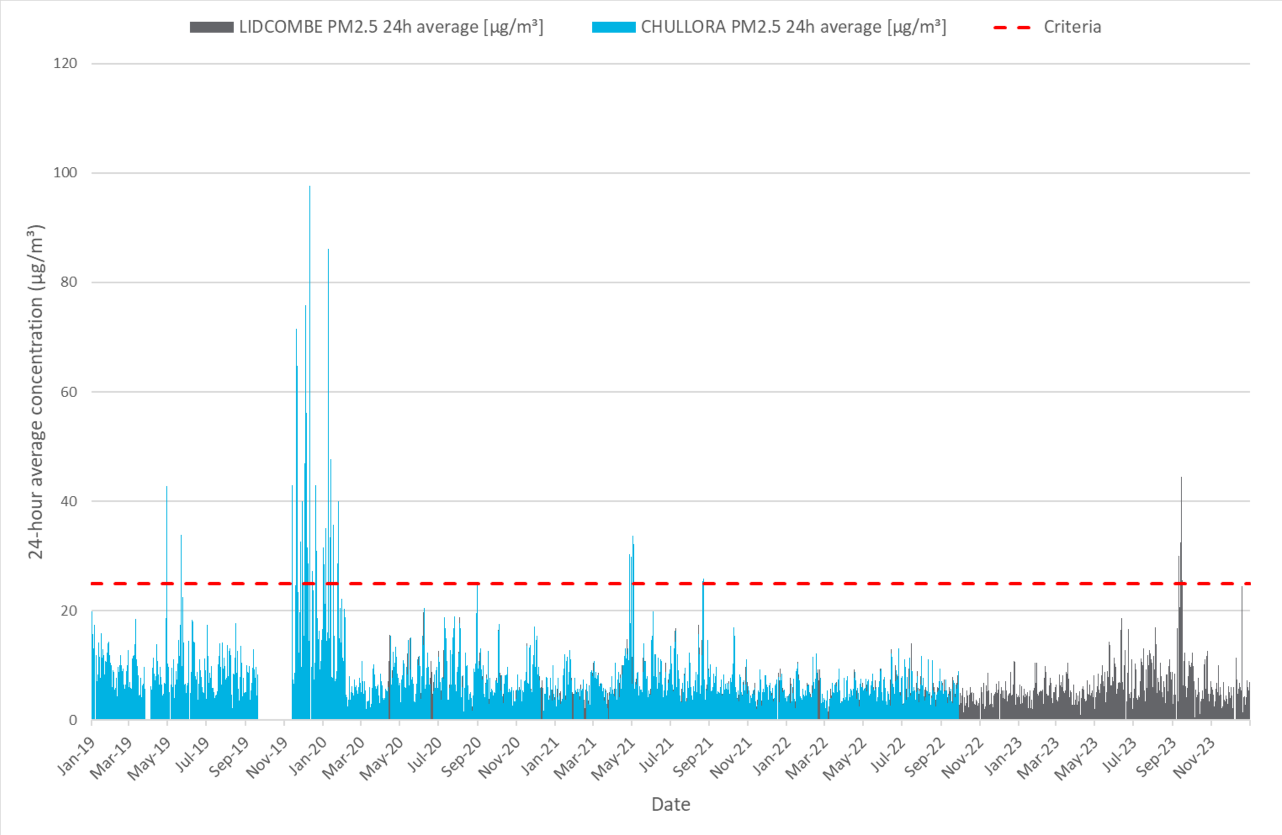


Figure 5.2 **Time series of 24-hour average $PM_{2.5}$ concentrations – Chullora and Lidcombe AQMS dataset – 2019 to 2023**

Key statistics for the five years of data from the Chullora AQMS dataset and Lidcombe AQMS dataset are presented in Table 5.3 through to Table 5.6. Across the five years of analysed data, 2019 and 2020 feature a notably higher occurrence of elevated concentrations. The remaining two years of data are reasonably comparable.

Consistent with PM_{10}, the 2023 calendar year monitoring dataset has been adopted as a representation of local background $PM_{2.5}$ concentrations.

Recorded exceedances of $PM_{2.5}$ in 2023 were largely attributed to hazard reduction burns and low wind conditions impacting the region[5].

[5] https://www.abc.net.au/news/2023-12-19/nsw-sydney-city-smoke-haze/103247526

Table 5.5 Statistics for $PM_{2.5}$ concentrations – Chullora AQMS dataset – 2019 to 2023

Year	Maximum	99th percentile	75th percentile	Median	Average	Days > 25 µg/m³
	24-hour average $PM_{2.5}$ concentration (µg/m³)					
2019	97.6	67.2	11.4	7.9	11.7	18
2020	86.2	35.3	9.8	6.8	8.8	9
2021	33.7	27.3	8.2	5.9	7.2	6
2022	13.1	11.7	5.9	4.4	5.6	0
2023	No data	No data	No data	No data	No data	No data

Table 5.6 Statistics for $PM_{2.5}$ concentrations – Lidcombe AQMS dataset – 2019 to 2023

Year	Maximum	99th percentile	75th percentile	Median	Average	Days > 25 µg/m³
	24-hour average $PM_{2.5}$ concentration (µg/m³)					
2019	No data	No data	No data	No data	No data	No data
2020	22.9	18.6	7.2	4.5	6.9	0
2021	31.5	24.2	7.0	5.1	6.1	3
2022	14.0	10.9	5.8	4.5	4.7	0
2023	44.5	24.9	7.8	5.4	6.6	4

5.4.3 TSP

There are no measurements of TSP available for the site. The typical ratio between ambient annual average PM_{10} and TSP concentrations is 0.4. 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 2023 from the Lidcombe AQMS dataset, and annual average TSP background concentration of 41.6 µg/m³ was derived.

5.4.4 Dust deposition

There are no measurements of dust deposition available at the site. This assessment therefore focuses on the incremental contribution from site 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.

5.4.5 Adopted background summary

In summary, the following background values were adopted for cumulative assessment:

- 24-hour PM_{10} concentration – daily varying with one day above impact assessment criterion (existing exceedances)
- annual average PM_{10} concentration – 16.6 µg/m³
- 24-hour $PM_{2.5}$ concentration – daily varying with four days above impact assessment criterion (existing exceedances)

- annual average $PM_{2.5}$ concentration – 6.6 µg/m^3
- annual average TSP concentration – 41.6 µg/m^3 assuming PM_{10} is 40% of TSP.

In order to assess cumulative impacts for the site, the recorded background concentrations have been combined with the corresponding model predictions from site and the Heidelberg Materials CBP. Further discussion on model results and compliance with impact assessment criteria is presented in Section 7.3.

Without consideration of model predicted concentrations from site emissions, it is noted that the pairing of daily-varying PM_{10} model predictions from the Heidelberg Materials CBP with the corresponding daily-varying background PM_{10} concentrations from the 2023 Lidcombe AQMS dataset increases the number of existing exceedance days from one to two at assessment locations R6, R7 and R8. These additional exceedance days occur when the background at Lidcombe was 48.8 µg/m^3 and was due to smoke from hazard reduction burns experienced across the Sydney region[6].

5.5 Cumulative impacts

To summarise, for this AQIA, cumulative impacts have been assessed by combining the following values at each assessment location:

- the adopted background concentrations/dust deposition levels (see Section 5.4.5)
- the model-predicted concentrations/dust deposition levels from neighbouring emission sources (see Section 5.2)
- the model-predicted concentrations/dust deposition levels from the proposed operations at the site (see Chapter 7).

6 https://www.abc.net.au/news/2023-09-14/sydney-smoke-air-quality-poor-marathon/102855050

6 Emissions inventory

6.1 Sources of operational emissions

Sources of atmospheric emissions associated with the facility include:

- the movement of vehicles along paved roads and surfaces
- unloading, handling and sorting of materials within the waste receival building
- transfer, screening and picking in the MRP line
- loading and transfer of processed materials to storage bunkers and bins
- loading of product to truck for dispatch to market
- diesel fuel combustion by on-site plant, equipment and vehicles
- wind erosion associated with material stockpiles and storage bunkers.

Fugitive dust sources associated with the operation of the facility were quantified through the application of National Pollution Inventory (NPI) 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).

\\emm.local\xdrive\2023\E231337 - 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA003_ModelSourceLocation\AQIA003_ModelSourceLocation_20250610_03.aprx 10/06/2025

Source: EMM (2025); DCSSS (2024); GA (2009)

0 50 100
m
GDA2020 MGA Zone 56
N

KEY

- Site boundary
- Area source
- Line volume source
- Volume source

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse

Model source location

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure 6.1

EMM
creating opportunities

6.2 Emission scenarios

To assess the potential impacts associated with the proposed operations of the facility, two emissions scenarios were configured, accounting for the following:

- Scenario 1: MRF enclosure – all waste storage, handling and processing within the waste receival building and the recycling plant building, with an enclosed conveyor transferring waste from the receival building to the recycling plant building. Trucks delivering waste would traverse the open concrete yard between the weighbridge and receival building. No waste would be stored, handled or processed outside.
- Scenario 2: site enclosure **–** all waste storage, handling and processing within a single building. Trucks delivering waste would be within the building once they leave the weighbridge. No waste would be stored, handled or processed outside. All emissions generated within the site enclosure would be diverted to a baghouse device.

The operation of the facility under the new SSDA relates to Scenario 1 as designed and represents the future expected case operations for the facility. The Scenario 2 configured for the AQIA, featuring a site enclosure is provided for the purpose of comparison against Scenario 1. The two options have been compared in the AQIA, with a view to assessing their level of 'equivalence'. 'Equivalence' means a situation where, on balance and taking a holistic view of impacts, the two options result in a similar level of residual impact.

Under 199,000 tpa of materials processing, the following is an indicative inbound break down of material for the site operating at a peak future throughput:

- mixed B&D waste direct to the automated processing plant: 169,150 tpa
- brick, concrete and aggregate direct to the automated processing plant: 9,950 tpa
- soil waste direct to the automated processing plant: 19,900 tpa.

This is considered to be conservative as C&I waste and MSW (non-putrescible) is expected to have lower airborne particulate emissions.

Material processed by the automated processing plant will be relatively consistent on a day-to-day basis between the hours of 7:00 am and 6:00 pm Monday to Saturday. Materials deliveries to the site will occur between 5:00 am and 10:00 pm Monday to Saturday and 7:00 am to 6:00 pm Sunday. For modelling purposes these activities were assumed to occur across every day of the week.

4Pillars has provided indicative average and busy day inbound and outbound truck loads at the site, these totals for weekday operations are presented in Table 6.1. In order to predict busy day impacts (24-hour average PM_{10} and $PM_{2.5}$) a scaling factor of 1.5 was applied based on the indicative relationship between expected worst-case day (busy day) and mean operating scenario (average day) inbound and outbound vehicle movements at the site.

Table 6.1 Indicative average and busy day truck loads

Total truck movements per day	Average day	Busy day
Inbound	277	417
Outbound	105	158

A diurnal variation profile for truck inbound and outbound movements was developed based on the indicative average day inbound and outbound truck loads and is presented in Figure 6.2.

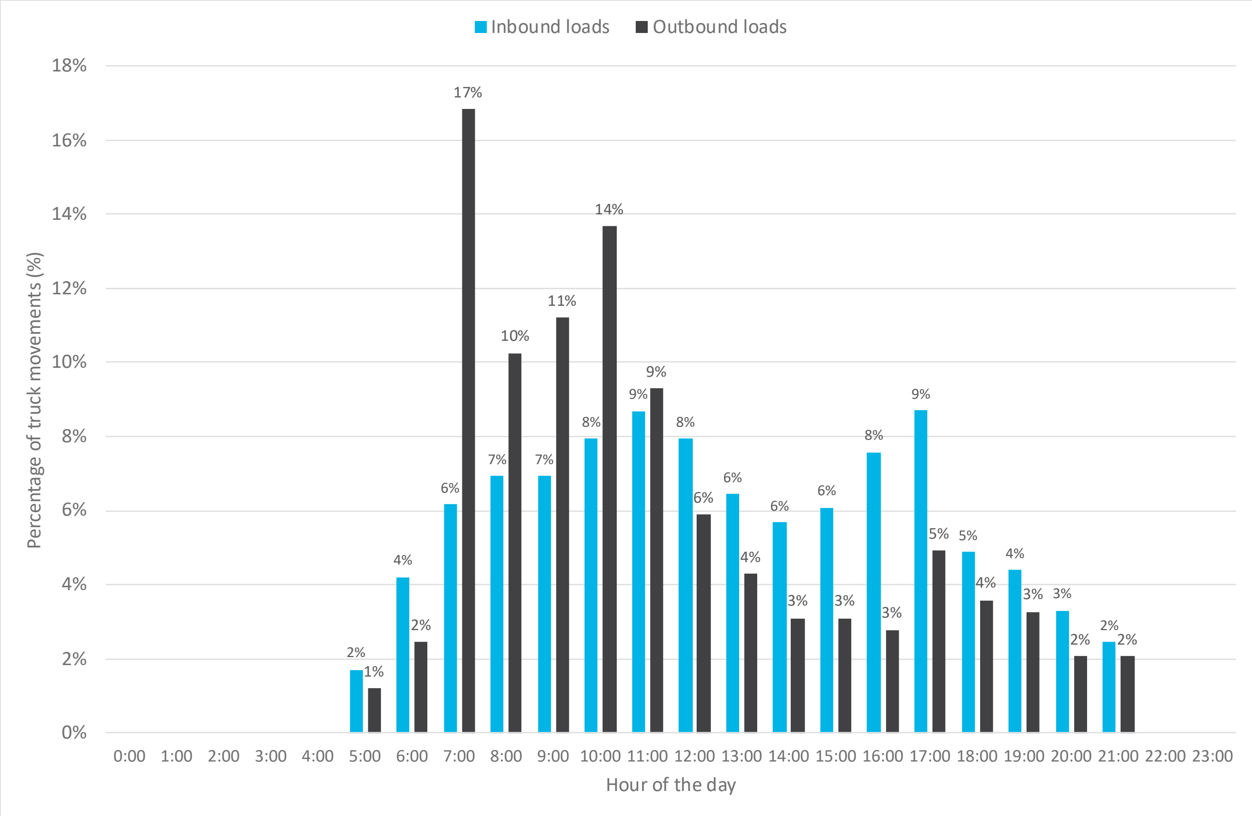
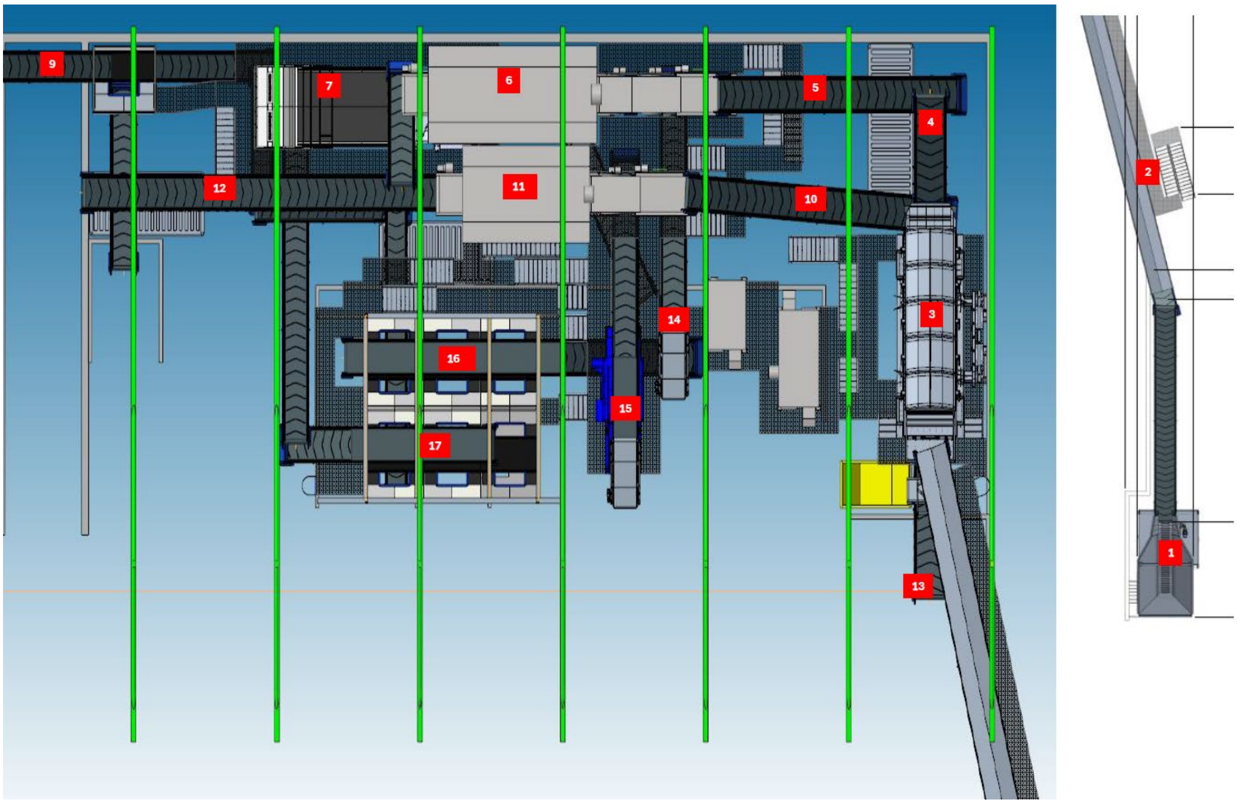


Figure 6.2 Diurnal profile of truck movements for inbound and outbound loads

6.3 MRP

A key component of the facility is the operation of the MRP. Information has been provided by the technology provider Skala Environmental relating to the design of the MRP and associated air pollutant mitigation technologies integrated into the design. The layout of the MRP as provided by Skala Environmental is illustrated in Figure 6.3.



Source: Skala Environmental (2025)

Figure 6.3 Proposed MRP layout (see notes below for information about each numbered point).

The following overview was provided by Skala Environmental:

- Item 1 is the plant feed hopper, which will be contained within the waste receival building which will be fully enclosed and fitted with water sprays.
- Item 2 is the transfer conveyor to the MRP, and will feature wind shielding.
- The entire MRP (following points) is to be housed under the three-sided building.
- Item 3 is a combi screen, designed to filter out fine materials (approximately 14% of total feed, transferred to Item 13). The combi screen will feature a tarpaulin cover and a water spray at the end of the screening process prior to transfer to the next conveyor.
- Items 4 and 5 are conveyor belt transfer of 57% of plant feed to item 6, a dual deck screen (DDS), which will feature dust extraction and collection by filters.
- Item 7 is an optical sorter screen, of 22% of plant feed, and will feature dust extraction and collection by filters.
- Item 9 is the wood conveyor to storage bunker, at 13% of the plant feed.
- Item 10 is a conveyor belt transfer of 27% of plant feed (as 10-mm to 70-mm heavies material) to item 11, a single deck screen (SDS), which will feature dust extraction and collection by filters.
- Item 12 is the lights conveyor to storage bunker, at 22% of plant feed.

- Item 14 and 15 are heavies conveyor transfers, with a combined 43% of plant feed. Item 15 also features an eddy current screen.

- Item 16 and 17 are manual picking lines for mid heavies and heavies, comprising of 51% of the plant feed.

Skala Environmental have advised that all significant screening points from an emissions perspective will be fitted with dust hooding and extraction to filters. Water sprays will be fitted to all potentially dust generating transfer points.

6.4 Emission reduction factors

A range of dust mitigation measures to control emissions will be incorporated into the proposed facility.

The following emissions reduction factors were applied to account for controls at the proposed facility (Scenario 1):

- Use of bob-cat mounted sweeper around paved surface at site and wheel bath at site entrance – controlled silt loading at site entrance road based on EMM sampling at a similar facility.

- Paved internal haul roads between weigh bridge, waste receival building and product load out areas, combined reduction factor of 80% applied:

  - use of water sprays, reduction of 50% (NPI 2012)

  - wind breaks by surrounding buildings and sheds, reduction of 30% (NPI 2012)

  - controlled speed limit of 10 km/h, reduction of 44% (Countless Environmental 2006).

- Material unloading, handling and processing within the waste receival building, combined reduction of 85% applied:

  - use of water sprays, reduction of 50% (NPI 2012)

  - three-sided and roofed enclosure, reduction of 70% (Katestone 2011).

- Materials screening within the processing building, combined reduction factor of 97%:

  - use of water sprays, reduction of 50% (NPI 2012)

  - three-sided and roofed enclosure, reduction of 70% (Katestone 2011)

  - use of dust hooding with fabric filters, reduction of 83% (NPI 2012).

- Materials transfers to the processing building and unloading of processed materials in storage bunkers, combined reduction factor of 85% applied:

  - use of water sprays, reduction of 50% (NPI 2012)

  - three-sided and roofed enclosure, reduction of 70% (Katestone 2011).

For Scenario 2 (site enclosure), all site activities, with the exception of truck movements between the site main entrance and the enclosure entrance, are assumed to be contained within an enclosure and all generated emissions are ducted to a common baghouse system. The associated emission reduction factor was derived as follows:

- Activities within the site enclosure, combined reduction factor of 97%:
  - use of water sprays, reduction of 50% (NPI 2012)
  - three-sided and roofed enclosure, reduction of 70% (Katestone 2011)
  - use of dust hooding with fabric filters, reduction of 83% (NPI 2012).
- Wind erosion emissions under Scenario 2 are eliminated by the site enclosure.

6.5 Particulate matter emissions

A summary of the calculated average day TSP, PM_{10} and $PM_{2.5}$ emissions rates by source type for Scenario 1 and Scenario 2 are presented Table 6.2. The significance of key source types by particulate size for Scenario 1 and Scenario 2 are illustrated in Figure 6.4 and Figure 6.5, respectively. Particulate matter control measures, as documented in Section 6.3, are accounted for in the daily emissions totals. The data shows that the movements of vehicles on paved surfaces is the key contributing source to daily site emissions.

Busy day emissions were calculated using an upscaling ratio based on the indicative mean day and worst-case day traffic numbers (see Section 6.2), excluding wind erosion from storage bunkers and stockpiles. For all other activities a scaling factor of 1.5 was applied to the average day particulate matter emissions.

Further details regarding emission estimation factors and assumptions are provided in Appendix B.

Table 6.2 Calculated average daily TSP, PM_{10} and $PM_{2.5}$

Emission source	Scenario 1 emission rates (kg/day)			Scenario 2 emission rates (kg/day)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Material transportation - yard						
Inbound material - truck movement from entrance to weighbridge	0.2631	0.0505	0.0122	0.1480	0.0284	0.0069
Inbound material - truck movement from weighbridge to waste receival building	1.6387	0.3146	0.0761	0.1194	0.0229	0.0055
Outbound material - truck movement from stockpiles to weighbridge	0.3628	0.0696	0.0169	0.0264	0.0051	0.0012
Outbound material - truck movement from weighbridge to exit	0.1165	0.0224	0.0054	0.0655	0.0126	0.0030

Emission source	Scenario 1 emission rates (kg/day)			Scenario 2 emission rates (kg/day)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Materials processing – waste receival building						
Material unloading (in waste receival building)	0.128	0.061	0.009	0.022	0.010	0.002
Material transfer to primary hopper (in waste receival building)	0.128	0.061	0.009	0.022	0.010	0.002
Material conveying (in waste receival building)	0.128	0.061	0.009	0.022	0.010	0.002
Materials processing – MRP						
Material conveying to initial screen (under MRF enclosure)	0.128	0.061	0.009	0.022	0.010	0.002
Material screening (under MRF enclosure)	0.351	0.121	0.008	0.351	0.121	0.008
Material conveying (under MRF enclosure)	0.007	0.003	0.001	0.007	0.003	0.001
Transfer to storage bins (under MRF enclosure)	0.022	0.010	0.002	0.022	0.010	0.002
Loading product material to trucks (under MRF enclosure)	0.128	0.061	0.009	0.022	0.010	0.002
Wind erosion						
Wind erosion - storage bins (MRF enclosure)	0.021	0.010	0.003	-	-	-
Diesel combustion						
Diesel combustion - onsite plant	0.010	0.010	0.009	0.003	0.003	0.003
Diesel combustion - trucks	0.002	0.002	0.002	0.0001	0.0001	0.0001
Total average daily emissions	**3.435**	**0.917**	**0.181**	**0.852**	**0.258**	**0.038**

Note: '-' = not included due to full enclosure

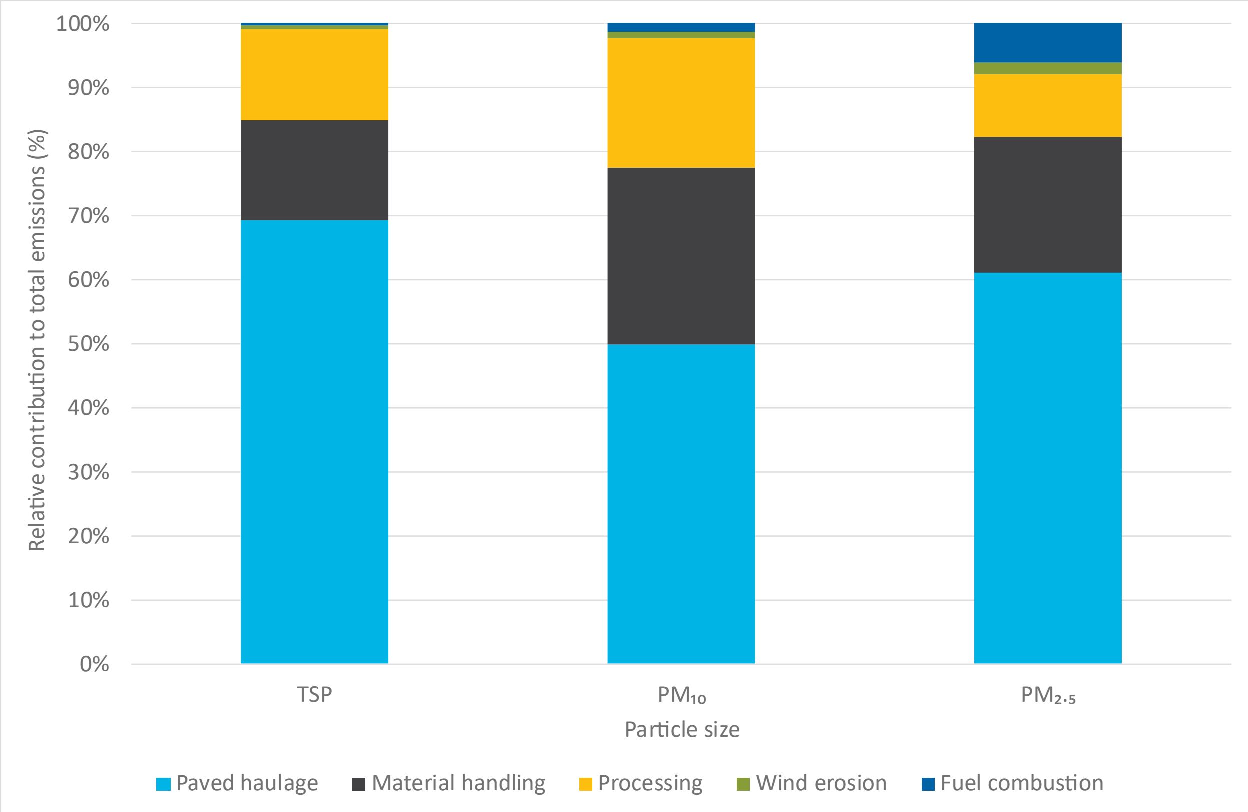


Figure 6.4 Significance of emission sources to daily emissions – Scenario 1 – TSP, PM_{10} and $PM_{2.5}$

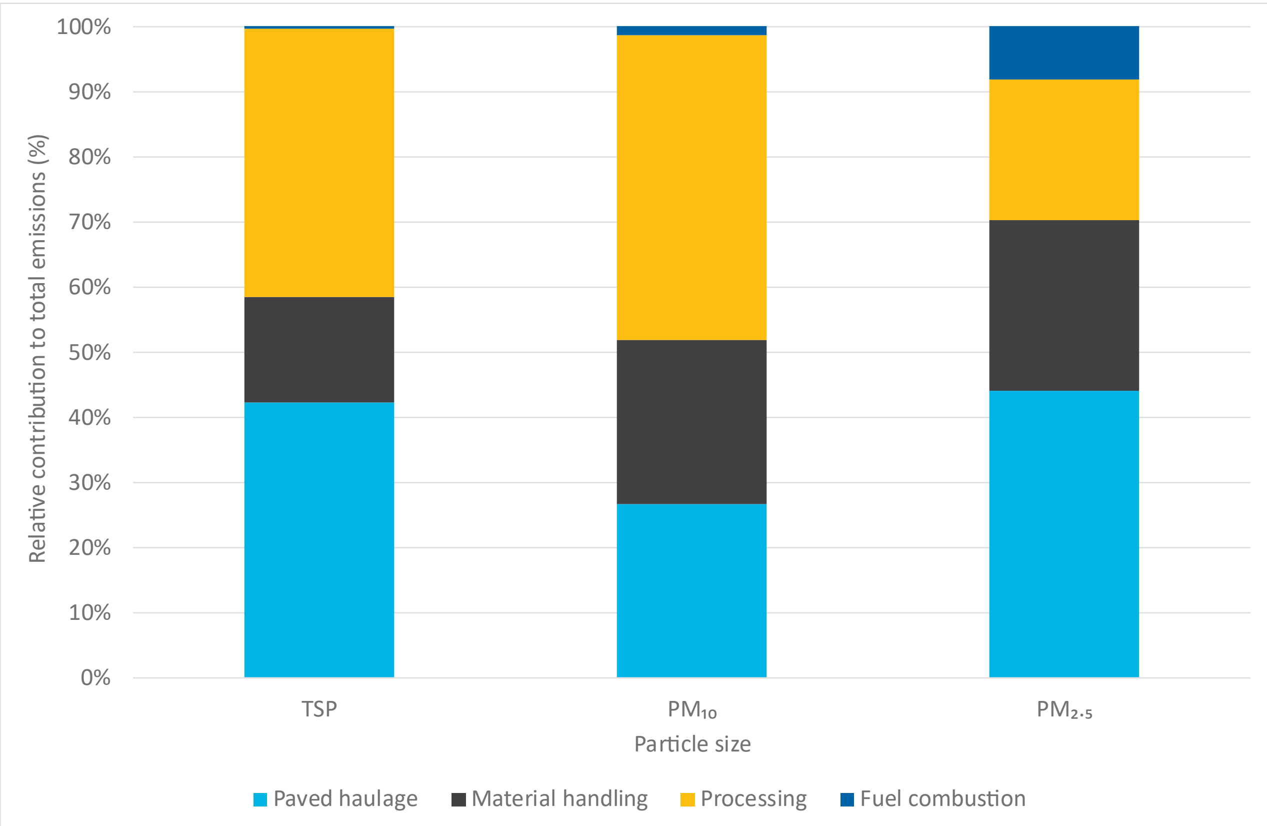


Figure 6.5 Significance of emission sources to daily emissions – Scenario 2 – TSP, PM_{10} and $PM_{2.5}$

A comparison between the emission totals for Scenario 1 and Scenario 2 is provided in Figure 6.6. It can be seen from Figure 6.6 that relative to Scenario 1, the inclusion of a full enclosure has the greatest emission reduction benefits for paved road haulage movements.

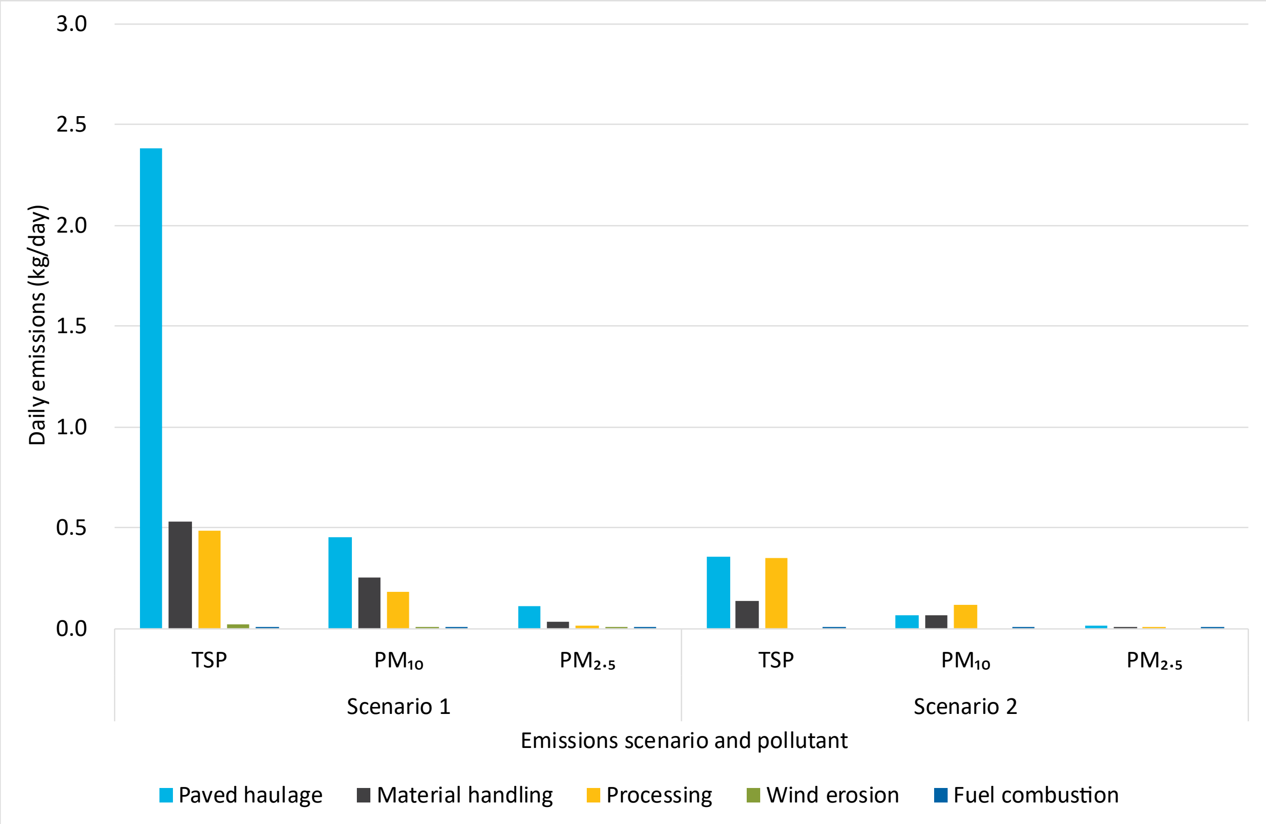


Figure 6.6 Particulate matter daily emission rate comparison – Scenario 1 vs Scenario 2

6.6 Conservatism in emissions estimates

The following conservative assumptions should be noted when considering the emission calculations presented for the proposed facility:

- The adopted emission factor for screening is sourced from the US EPA AP-42 emission literature for *crushed stone processing operations* which according to the literature corresponds to material with a moisture content of less than 1.3%. Given the wide range of materials to be processed by the MRF, this assumption is highly conservative for dust emission calculations.

- All conveying and transfer emission calculations using the US EPA AP-42 material batch drop equation assume a moisture content 2.1%, which is the default for stone quarrying and processing. Similar to the previous point, this moisture content is considered highly conservative for the facility.

- For busy day emission calculations, the assumption made is that all emission sources are upscaled by the traffic derived increase factor of 1.5.

6.7 Odour emissions

The majority of material received by the site is inert construction, demolition, commercial and industrial waste. There are no stockpiles for green waste material kept at the site and no composting will occur. The site does not currently accept odour generating materials, such as putrescible wastes, and will not in the future.

No odour related complaints have been received by the existing site to date since the commencement of operations in 2019.

On this basis, odour emissions and impacts from the site are assumed to be negligible and therefore are not considered further in this assessment.

6.8 Construction phase

As previously mentioned, a number of components at the existing site are proposed to be constructed to facilitate future operations at the facility, these include:

- installation of the MRP
- extension of existing awning and addition of eastern wall to form the waste processing building
- structural modifications to the existing warehouse to form the receival building
- installation of penstock valve and other engineering controls.

Activities associated with the establishment of the components listed above are expected to be minor and short of duration in comparison to operational activities with relation to dust emissions. On this basis, emissions from construction activities have not been quantified for this assessment.

7 Air dispersion modelling

7.1 Dispersion model selection and configuration

The atmospheric dispersion modelling completed for this assessment used the AERMOD dispersion model (version v24142). 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 20 individual assessment locations (documented in Section 2.2), air pollutant concentrations were predicted over a nested grid domain with an inner grid of 0.5 km by 0.5 km with spacing of 20 m, a middle grid of 1.1 km by 1.1 km with a spacing of 50 m and an outer grid of 3.1 km by 3.1 km with a spacing of 150 m (totalling 1,504 receptor points).

Each emission source activity has been represented in the model as either an area, volume, or line-volume source. The modelled source locations are shown in Figure 6.1. It is noted for Scenario 2 (site enclosure), emissions from a single common baghouse have been released from a volume source located on the eastern wall of the enclosure structure.

Simulations were undertaken for the 12-month period of January to December 2023 using the AERMET generated meteorological domain file (see Chapter 4 for description of input meteorology).

7.2 Incremental (facility-only) results

Predicted incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates from the facility under Scenario 1 and Scenario 2 are presented in Table 7.1 and Table 7.2, respectively. Maximum predicted incremental 24-hour average PM_{10} and $PM_{2.5}$ concentrations given are for busy day operations occurring on a continual basis throughout the 12-month modelling period and are therefore considered highly conservative.

Furthermore, it is noted that AERMOD cannot account for the influence of built structures, such as buildings or walls, in the dispersion calculation of emissions from the site. An attempt to account for such influences in the emissions inventory has been made through the application of emission reduction factors (e.g. 30% reduction for wind breaks). In light of this limitation of the AERMOD dispersion model, the dispersion modelling predictions presented in this AQIA should be viewed as conservatively high.

The predicted incremental concentrations and deposition rates for all pollutants and averaging periods are below the applicable NSW EPA assessment criteria at all assessment locations. Aside from dust deposition, the assessment criteria are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in Section 7.3.

The relative contribution to total predicted PM_{10} concentrations for Scenario 1 by emission source type was analysed at each assessment location to understand the most significant emission sources at the proposed facility. A breakdown of predicted PM_{10} concentrations at each assessment location is presented in Figure 7.1.

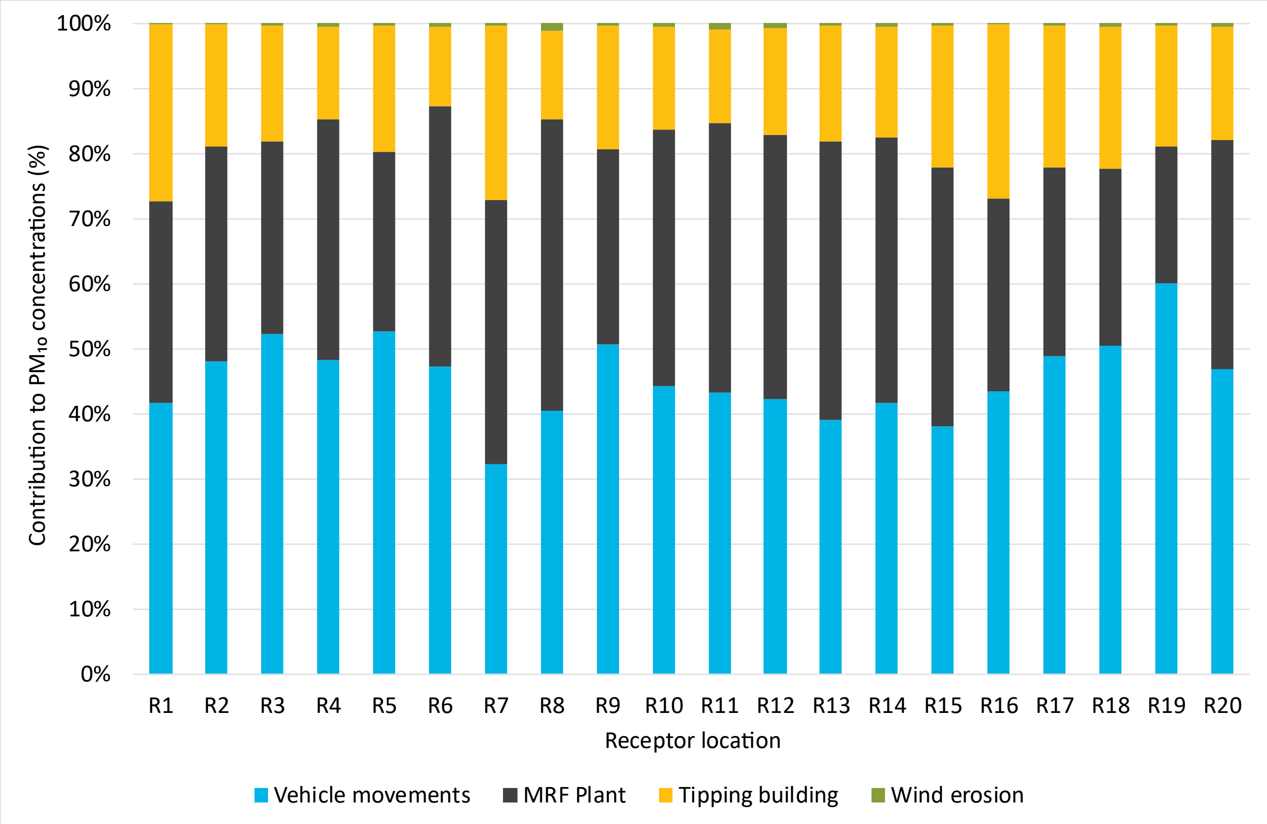


Figure 7.1 Facility-only emission source contribution to PM_{10} predictions by assessment location – Scenario 1

Figure 7.1 clearly shows that the most significant contributing source of emissions from the facility to impacts at the majority of assessment locations is the movement of vehicles across paved surfaces, with the contribution ranging from approximately 32% to 60% of total PM_{10} concentrations at the presented assessment locations. Therefore, the reduction of truck movement emissions at the facility will return the highest benefit to offsite impacts. Further discussion relating to mitigation measures associated with the facility is provided in Chapter 8.

Contour 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. Contour 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 2023 modelling period.

Table 7.1 Incremental (facility-only) concentrations and deposition results – Scenario 1

Assessment location ID	Predicted incremental concentrations ($\mu g/m^3$) or dust deposition rates ($g/m^2/month$)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R1	4.6	8.2	1.6	1.6	0.3	0.4
R2	2.8	5.6	1.0	1.1	0.2	0.3
R3	1.9	3.9	0.7	0.8	0.1	0.2
R4	2.3	4.6	0.9	0.9	0.2	0.2
R5	8.8	10.9	2.5	2.3	0.5	0.9
R6	6.0	9.2	1.9	1.7	0.4	0.6
R7	5.9	11.5	2.1	2.0	0.4	0.5
R8	2.2	6.2	0.9	1.1	0.2	0.2
R9	1.8	4.3	0.8	0.9	0.2	0.2
R10	1.4	4.2	0.6	0.8	0.1	0.1
R11	0.8	2.8	0.4	0.5	0.1	0.1
R12	0.6	2.8	0.3	0.5	0.1	0.1
R13	0.4	2.7	0.2	0.5	<0.1	<0.1
R14	0.4	2.4	0.2	0.4	<0.1	<0.1
R15	1.4	3.3	0.6	0.6	0.1	0.1
R16	1.1	3.0	0.5	0.6	0.1	0.1
R17	0.8	2.2	0.4	0.4	0.1	0.1
R18	0.9	2.6	0.4	0.5	0.1	0.1
R19	0.9	2.9	0.4	0.6	0.1	0.1
R20	0.5	2.2	0.3	0.4	0.1	<0.1

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

Table 7.2 Incremental (facility-only) concentrations and deposition results – Scenario 2

Assessment location ID	Predicted incremental concentrations (µg/m³) or dust deposition rates (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R1	1.0	1.6	0.3	0.2	<0.1	0.1
R2	0.7	1.2	0.2	0.2	<0.1	0.1
R3	0.4	0.8	0.1	0.1	<0.1	<0.1
R4	0.4	0.7	0.1	0.1	<0.1	<0.1
R5	2.9	2.8	0.6	0.6	0.1	0.4
R6	0.7	0.9	0.2	0.2	<0.1	0.1
R7	1.9	4.0	0.6	0.5	0.1	0.2
R8	0.3	0.7	0.1	0.1	<0.1	<0.1
R9	0.3	0.5	0.1	0.1	<0.1	<0.1
R10	0.2	0.5	0.1	0.1	<0.1	<0.1
R11	0.1	0.4	0.1	0.1	<0.1	<0.1
R12	0.1	0.3	<0.1	<0.1	<0.1	<0.1
R13	0.1	0.3	<0.1	0.1	<0.1	<0.1
R14	0.1	0.3	<0.1	<0.1	<0.1	<0.1
R15	0.4	1.2	0.2	0.1	<0.1	0.1
R16	0.2	0.6	0.1	0.1	<0.1	<0.1
R17	0.2	0.5	0.1	0.1	<0.1	<0.1
R18	0.2	0.5	0.1	0.1	<0.1	<0.1
R19	0.1	0.4	0.1	0.1	<0.1	<0.1
R20	0.1	0.3	<0.1	<0.1	<0.1	<0.1

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

7.3 Cumulative (facility + Heidelberg + background) results

Predicted cumulative TSP, PM_{10} and $PM_{2.5}$ concentrations for the facility under Scenario 1 and Scenario 2 are presented in Table 7.3 and Table 7.4, respectively. Maximum predicted cumulative 24-hour PM_{10} and $PM_{2.5}$ concentrations are for busy day operations and are therefore highly conservative.

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

- For 24-hour average concentrations – each daily varying predicted 24-hour concentration for PM_{10} and $PM_{2.5}$ from the proposed facility and Heidelberg Materials CBP have been combined with the corresponding concentrations from the adopted assessment period background concentration datasets (Section 5.4.5).

- For annual average concentrations – the predicted annual concentrations from the proposed facility and Heidelberg Materials CBP have been paired with the corresponding background annual average concentrations (Section 5.4.5).

As detailed in Section 5.4, there is one existing exceedance of the 24-hour average PM_{10} criterion and four existing exceedances of the 24-hour-average $PM_{2.5}$ criterion in the Lidcombe AQMS background dataset. For cumulative impact assessment purposes, these are classed as existing exceedances.

Section 5.1.3 of the Approved Methods for Modelling states that in the event of existing ambient air pollutant concentration in exceedance of applicable impact assessment the criteria, the assessment must:

> …demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical.

To demonstrate that no additional exceedances of the applicable criteria will occur as a result of emissions from the facility, the 2nd highest cumulative PM_{10} concentration and 5th highest cumulative $PM_{2.5}$ concentration at each assessment location are reported in Table 7.3 and Table 7.4, respectively. Data has not been removed from the analysis but simply, the next highest result not affected by background above the criterion is shown in this section.

As stated in Section 5.4, the combination of predictions for the Heidelberg materials CBP and the Lidcombe AQMS dataset (not accounting for contributions from the site) results in one additional exceedance day at the neighbouring industrial assessment locations R6, R7 and R8 (it is noted that assessment location R8 is the Heidelberg materials CBP).

The predicted cumulative concentrations for all pollutants and averaging periods comply with the applicable NSW EPA assessment criteria at all assessment locations, with the following exceptions:

- 24-hour average PM_{10} (Scenario 1) – one additional exceedance day at the majority of assessment locations under busy day operations. It is noted that the additional exceedance coincides with an elevated background concentration of 48.8 $\mu g/m^3$ recorded during a backburning smoke emission event (see Section 5.4). The background concentration accounts for between 82% and 98% of the predicted cumulative concentrations.

- 24-hour average PM_{10} (Scenario 2) – one additional exceedance day at assessment locations R1, R2, R4, R5, and R15 under busy day operations. It is noted that additional exceedance coincides with an elevated background concentration of 48.8 $\mu g/m^3$ (backburning event, as detailed above), which accounts for between 94% and 98% of the predicted cumulative concentrations.

Table 7.3 Cumulative (facility + Heidelberg + background) concentrations results – Scenario 1

Assessment location ID	Predicted cumulative concentrations (µg/m³)				
	TSP	PM_{10}		$PM_{2.5}$	
	Annual	2nd highest 24-hour maximum	Annual	5th highest 24-hour maximum	Annual
Criterion	**90**	**50**	**25**	**25**	**8**
R1	46.9	**53.5**	18.3	24.9	7.0
R2	44.8	**52.1**	17.7	24.7	6.9
R3	44.0	**51.7**	17.4	24.6	6.8
R4	44.6	**51.9**	17.6	24.6	6.8
R5	51.2	**54.8**	19.2	24.9	7.2
R6	49.0	**54.6**	18.6	24.8	7.1
R7	48.5	**54.8**	18.8	24.9	7.1
R8	45.8	**52.4**	17.6	24.7	6.9
R9	44.2	**51.3**	17.5	24.6	6.8
R10	43.9	**51.0**	17.3	24.6	6.8
R11	43.0	**50.4**	17.1	24.6	6.7
R12	42.8	**50.1**	17.0	24.5	6.7
R13	42.6	49.7	16.9	24.5	6.7
R14	42.4	49.5	16.9	24.5	6.7
R15	44.0	**51.3**	17.3	24.6	6.8
R16	43.1	**50.5**	17.2	24.6	6.7
R17	42.7	**50.2**	17.1	24.5	6.7
R18	42.9	**50.6**	17.1	24.5	6.7
R19	42.9	**50.0**	17.1	24.5	6.7
R20	42.6	49.8	17.0	24.5	6.7

Notes: Exceedance of criteria marked by bold and grey shading.

Table 7.4 Cumulative (facility + Heidelberg + background) concentrations results – Scenario 2

Assessment location ID	Predicted cumulative concentrations (µg/m³)				
	TSP	PM_{10}		$PM_{2.5}$	
	Annual	2nd highest 24-hour maximum	Annual	5th highest 24-hour maximum	Annual
Criterion	**90**	**50**	**25**	**25**	**8**
R1	43.2	**50.4**	17.0	24.6	6.7
R2	42.7	**50.0**	16.9	24.6	6.7
R3	42.5	49.8	16.8	24.5	6.7
R4	42.6	**50.1**	16.8	24.5	6.7
R5	45.3	**51.2**	17.3	24.6	6.8
R6	43.7	**51.1**	16.9	24.6	6.8
R7	44.5	**51.4**	17.3	24.7	6.8
R8	43.9	**50.8**	16.8	24.6	6.8
R9	42.7	49.7	16.8	24.5	6.7
R10	42.7	49.8	16.8	24.5	6.7
R11	42.4	49.7	16.8	24.5	6.7
R12	42.3	49.5	16.7	24.5	6.7
R13	42.2	49.2	16.7	24.5	6.6
R14	42.1	49.1	16.7	24.5	6.6
R15	43.0	**50.1**	16.9	24.5	6.7
R16	42.2	49.4	16.8	24.5	6.6
R17	42.1	49.3	16.8	24.5	6.6
R18	42.1	49.4	16.8	24.5	6.6
R19	42.2	49.2	16.8	24.5	6.6
R20	42.1	49.2	16.7	24.5	6.6

Notes: Exceedance of criteria marked by bold and grey shading.

To illustrate the daily variations in the predicted incremental concentrations from the site, the Heidelberg Materials CBP and corresponding background concentrations, time series plots of the cumulative concentration breakdowns have been generated for:

- daily-varying cumulative 24-hour average PM_{10} concentrations of busy day operations for scenario 1 at the residential assessment location with the highest site-only contribution (R16) – Figure 7.2
- daily-varying cumulative 24-hour average PM_{10} concentrations of busy day operations for scenario 1 at the industrial assessment location with the highest site-only contribution (R7) – Figure 7.3
- daily-varying cumulative 24-hour average PM_{10} concentrations of busy day operations for scenario 2 at the industrial assessment location with the highest site-only contribution (R7) – Figure 7.4.

These charts demonstrate that, even at the most impacted locations, the background concentrations are the dominant contributor to cumulative concentrations on a daily varying basis.

Predicted cumulative annual average TSP, PM_{10} and $PM_{2.5}$ concentrations by assessment location associated with the facility and the Heidelberg Materials CBP for Scenario 1 are presented in Figure 7.5, Figure 7.6 and Figure 7.7 respectively, and for Scenario 2 are presented in Figure 7.8, Figure 7.9 and Figure 7.10, respectively. As shown, compliance with the applicable impact assessment criteria is predicted for annual TSP, PM_{10} and $PM_{2.5}$ concentrations for both scenarios.

To summarise the results of the modelling undertaken for Scenario 1 and 2:

- In direct comparison, Scenario 2 (full enclosure) returns lower predicted air quality impacts at surrounding receptors relative to Scenario 1 (facility as designed).
- Additional exceedance days are predicted for 24-hour average concentrations under both Scenario 1 and 2 under busy day emissions, when coincident with background particulate matter concentrations influenced by regional backburning smoke events. The busy day modelling assumes continual upscaled activity rates over a 12-month period and should be viewed as highly conservative for short-term impacts.
- Model predictions from typical, average throughput are low for both Scenario 1 and 2, and are not predicted to exceed cumulative impact assessment criterion.
- Both scenarios are built on conservative emission estimation assumptions relating to the type of material being processed and transferred (e.g. 100% of material is low moisture, high dust potential material).

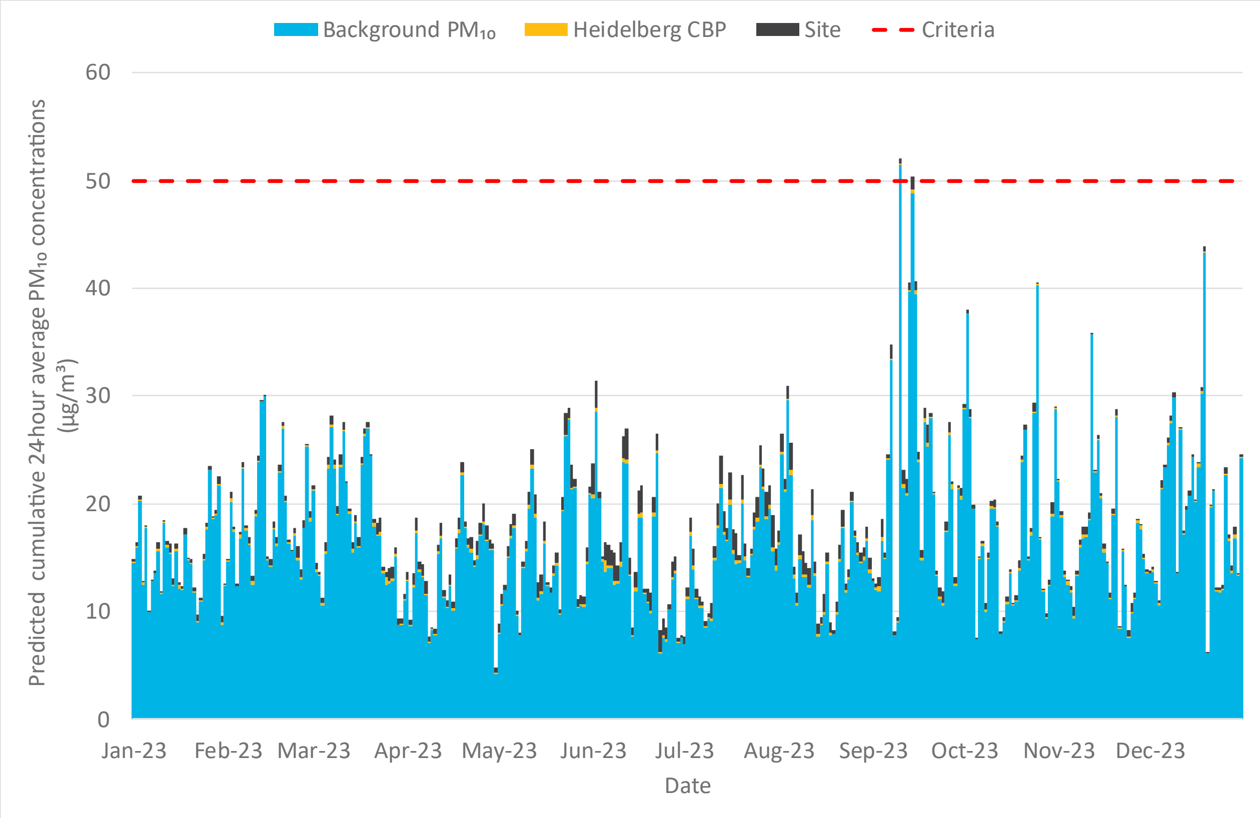


Figure 7.2 Daily-varying cumulative 24-hour average PM_{10} concentrations – R16 – Busy day - Scenario 1

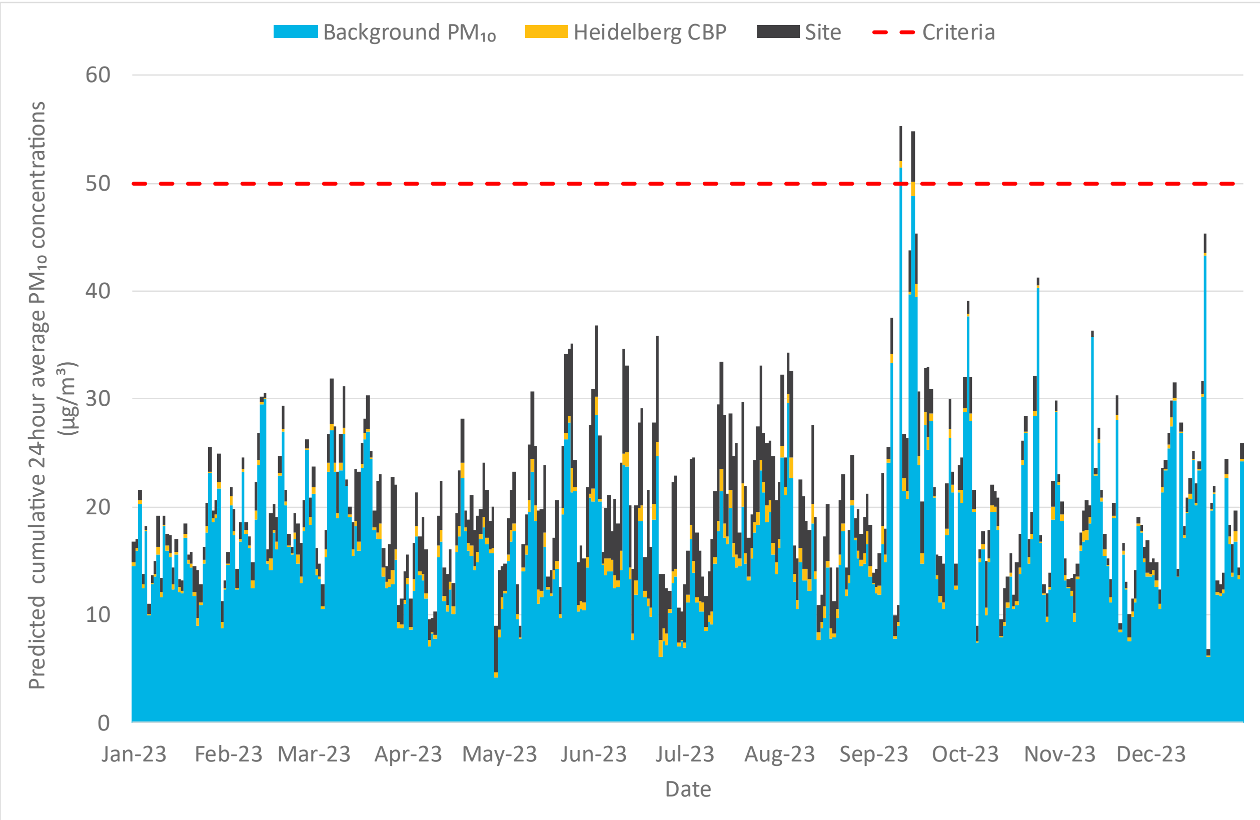


Figure 7.3 Daily-varying cumulative 24-hour average PM_{10} concentrations – R7 – Busy day - Scenario 1

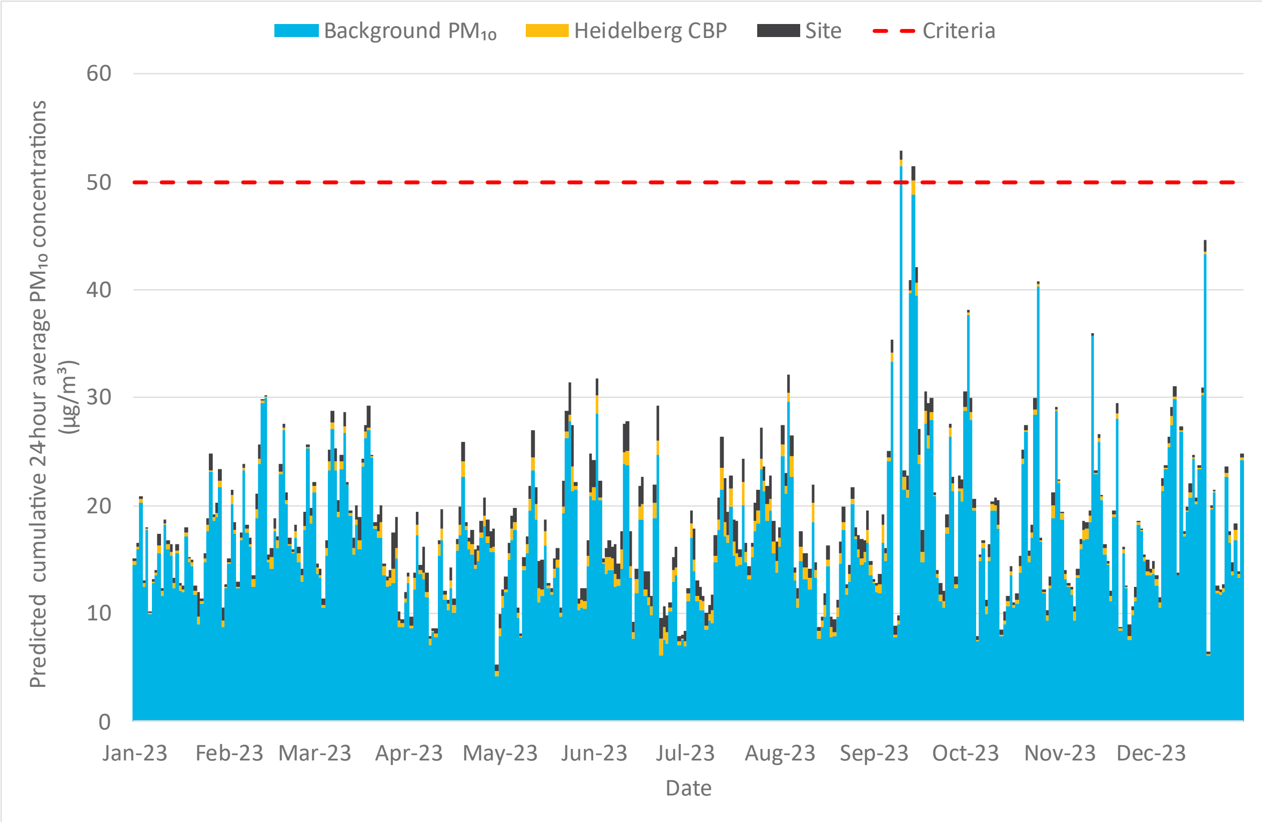


Figure 7.4 Daily-varying cumulative 24-hour average PM_{10} concentrations – R7 – Busy day - Scenario 2

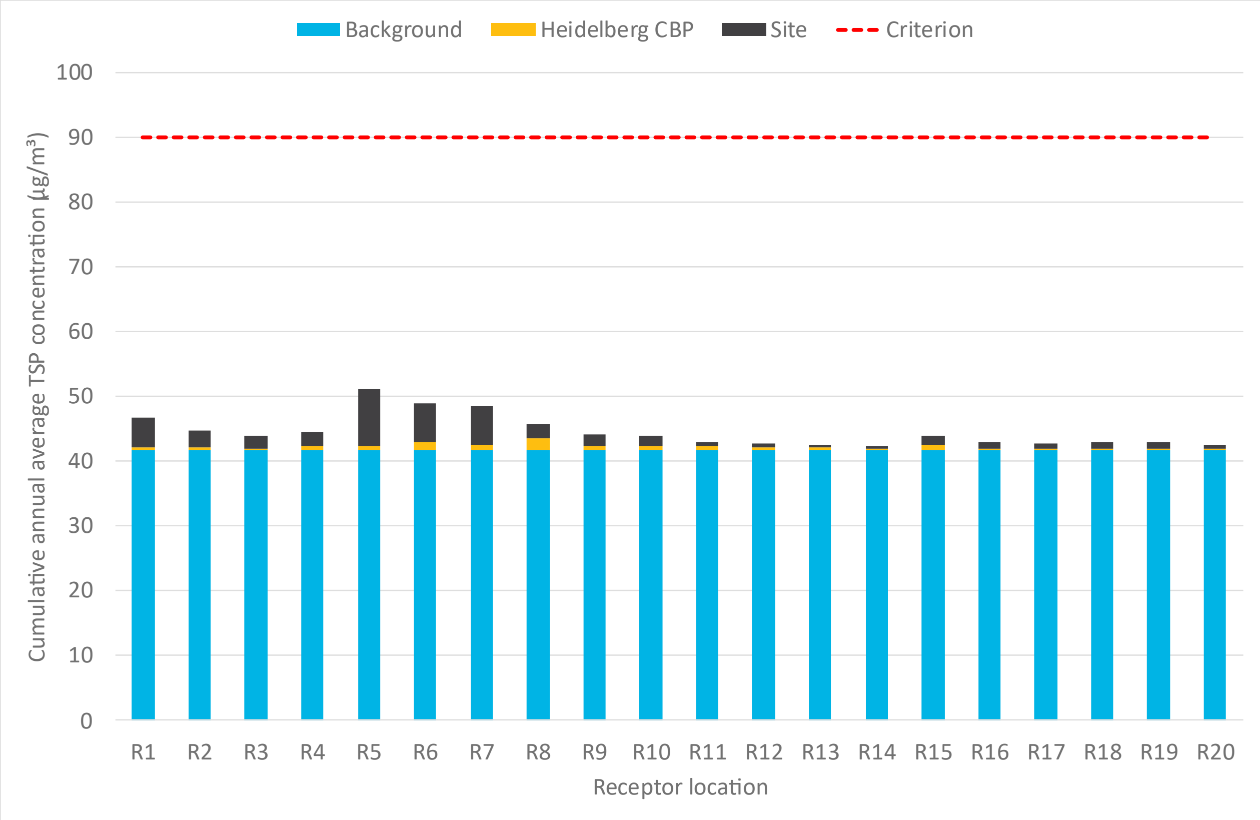


Figure 7.5 Predicted cumulative annual average TSP concentrations – Scenario 1

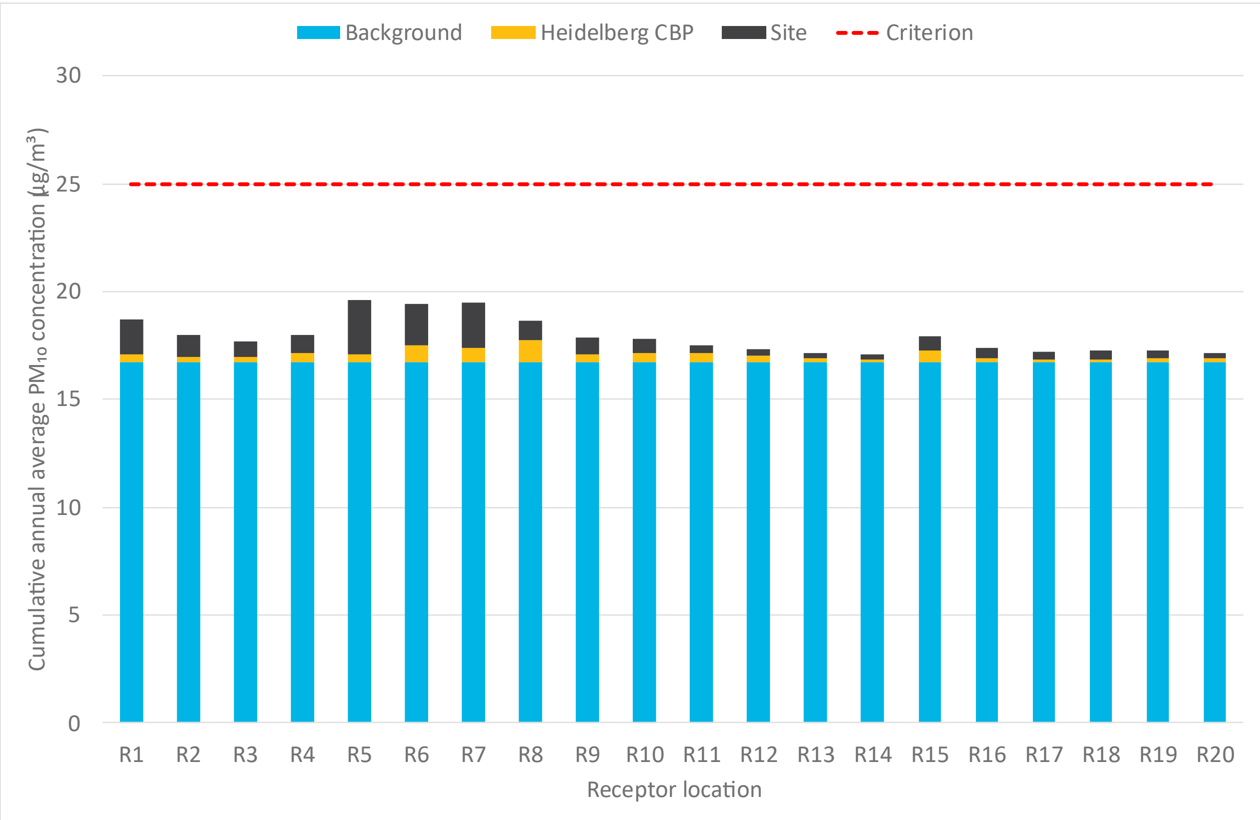


Figure 7.6 Predicted cumulative annual average PM_{10} concentrations – Scenario 1

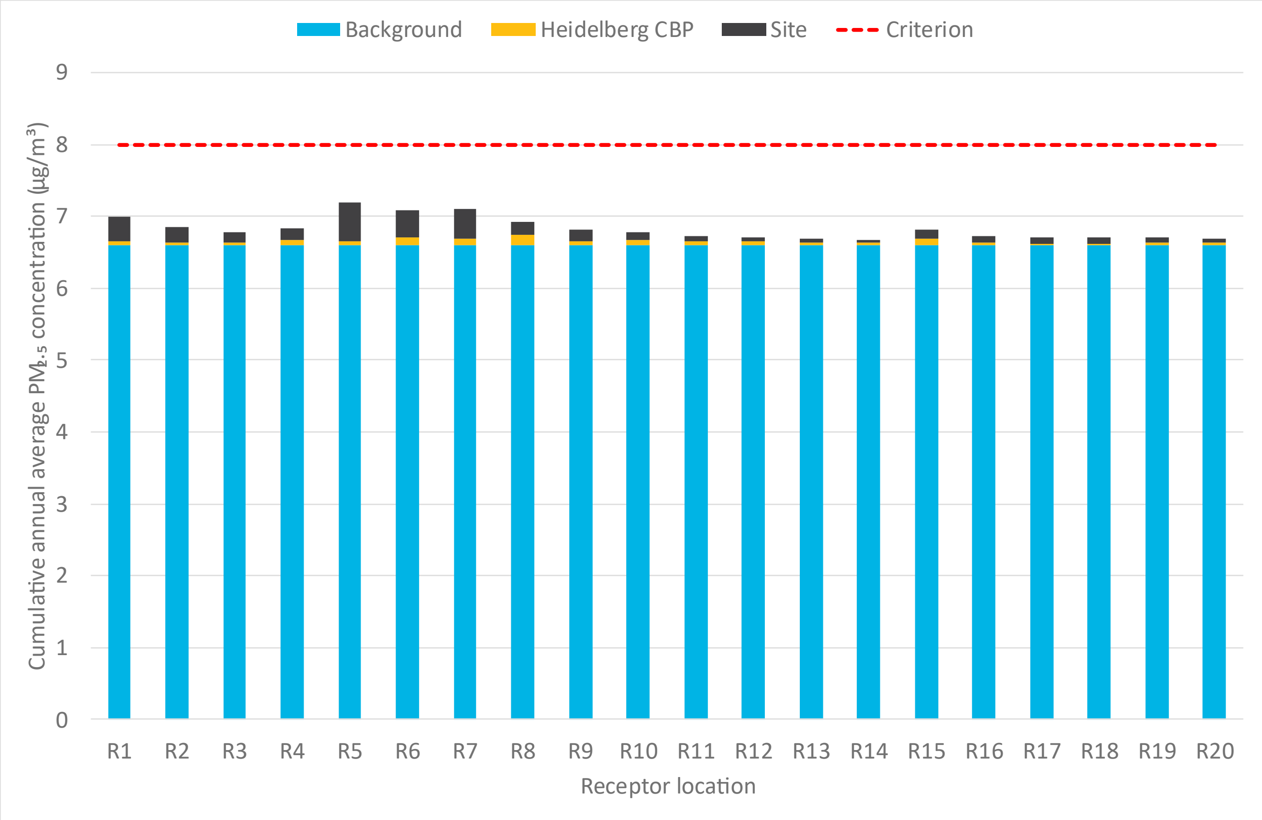


Figure 7.7 **Predicted cumulative annual average $PM_{2.5}$ concentrations – Scenario 1**

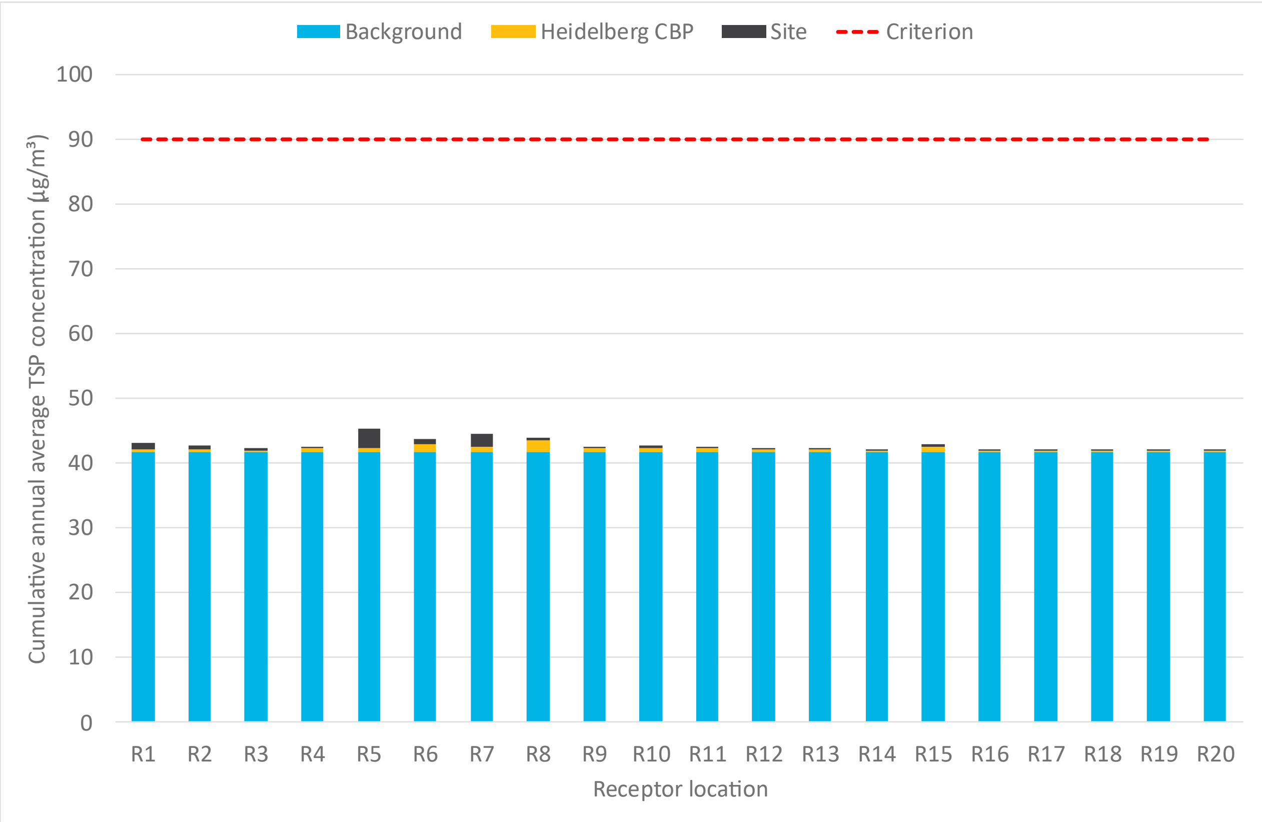


Figure 7.8 **Predicted cumulative annual average TSP concentrations – Scenario 2**

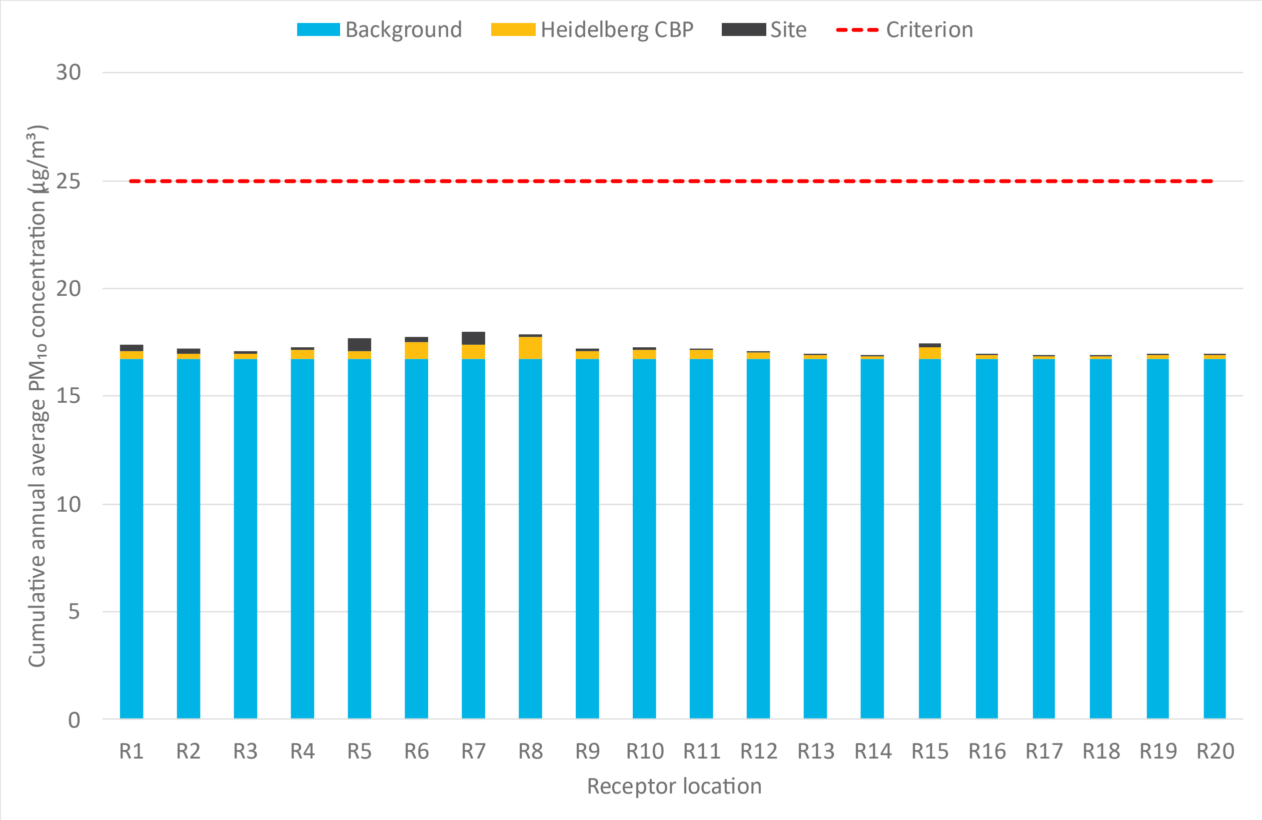


Figure 7.9 **Predicted cumulative annual average PM_{10} concentrations – Scenario 2**

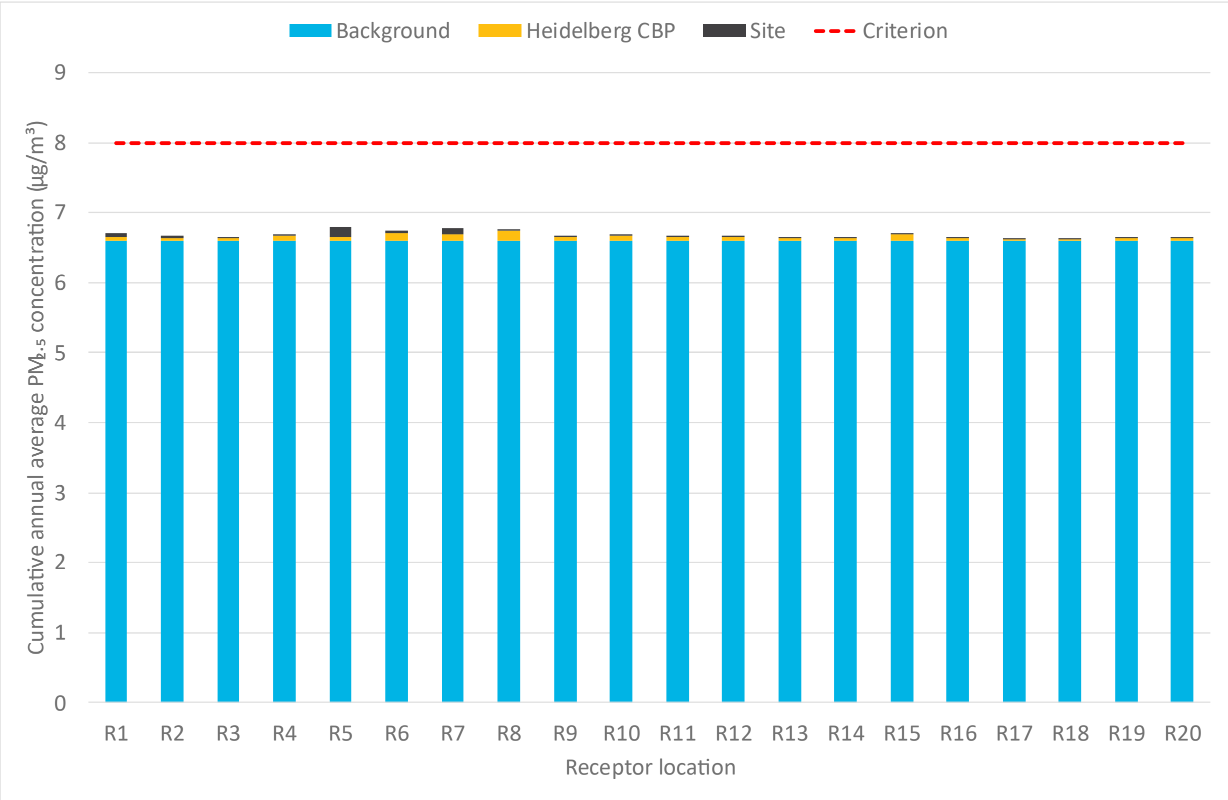


Figure 7.10 **Predicted cumulative annual average $PM_{2.5}$ concentrations – Scenario 2**

8 Management and mitigation

8.1 Dust management and control measures

A range of mitigation measures are currently implemented at the site and additional future mitigation measures will be implemented for the proposed facility. Mitigation measures were incorporated into the emissions calculations and dispersion modelling wherever an appropriate emissions control factor (or reduction factor) was available, and are discussed in more detail in Section 6.3, these include:

- use of bob-cat mounted sweeper around paved surface at site
- use of water sprays in yard
- water misters at waste receival building entry
- use of water sprays at waste material hopper
- enclosed conveyor system between waste receival building and MRP
- wind breaks, water sprays, hooding and dust extraction at the MRP
- active wheel wash system at site entrance to clean the wheels of existing trucks.

8.2 Best practice mitigation measures review

The significance of individual particulate matter emission source categories to total annual emissions from the proposed project (Scenario 1) was reviewed in Section 6.2.

This analysis identified that the key emission sources associated with the site in Scenario 1 are:

- wheel-generated dust from vehicle movements on paved road
- material handling and transfers
- material processing.

Focus is given to these emission sources for the implementation of best practice mitigation measures at the site given that control of these sources would achieve the most material difference to emissions generation and associated offsite impacts.

For the purpose of identifying relevant best practice mitigation measures, the European Union Best Available Technology (EU BAT) document, *Emissions from Storage*[7], has been referenced as the primary guidance document. The EU BAT document provides examples of best available technology for the control of air pollutant emissions from a range of emission sources relevant to the site including:

- material transportation – relevant to emissions from truck movements on paved roads
- material handling, processing and storage – relevant to emissions from material transfers, material processing areas.

[7] https://eippcb.jrc.ec.europa.eu/reference/emissions-storage

8.2.1 Material movements

Specific mitigation measures implemented by the Aussie Recycling at the site in relation to the control of wheel-generated emissions include:

- wheel-wash sprays at the facility entrance
- a bobcat mounted sweeper to clean silt loading on paved surfaces and manage material tracking from the site
- water sprays to apply wet suppression to transport routes.

The EU BAT presents emission controls relevant to the movement of vehicles under Section 5.4 “Transfer and handling of solids”. The examples of BAT for vehicle movements are summarised in Table 8.1.

Table 8.1 BAT measures for material movements on paved roads

BAT measure	BAT implemented at the site	Details	Emission reduction factor applied
Make travel distances as short as possible	Yes	Haulage of inbound to the receivals building and outbound material from storage bunkers to exit is minimised as much as is practicable	n/a – haulage distance reflected in emissions inventory vehicle kilometres travelled (VKT) assumptions
Use continuous transport (i.e. conveyors) in place of trucks wherever possible	Yes	Conveyors are utilised between the material receivals building and the MRP, and within the MRP to the storage bunkers	n/a – this control is captured in the reduction in truck movements at site.
Reduce speed of vehicles to avoid or minimise dust being swirled up	Yes	Speed is limited to 10 km/hr inside the site	No reduction applied in the emission calculations.
Apply hard surfaces (concrete/asphalt) where possible.	Yes	The entire site is paved	n/a – paved road emission factor equation applied truck movements within the site.
Clean paved roads with street sweeper and wet suppression	Yes	A bobcat mounted sweeper is currently deployed to control silt loading on paved surfaces. Water sprays will be installed to apply wet suppression to paved surfaces.	Yes – 50% applied for control from watering and low silt content value applied to site exit road
Cleaning of vehicle tyres	Yes	The site features a wheel spray system at the site exit.	n/a – no numerical control applicable for the emissions inventory however wheel washes would assist with the minimisation of silt loading on paved surfaces

The details provided in Table 8.1 highlight that the identified BAT measures for the control of emissions material movements would be implemented at the facility where applicable.

8.2.2 Storage of material

The EU BAT presents emission controls relevant to the storage of material under Section 5.3 “Storage of Solids”. The examples of BAT for handling, conveying and processing of material are summarised in Table 8.2.

Table 8.2 BAT measures for storage of material

BAT measure	BAT implemented at the site	Details	Emission reduction factor applied
Apply enclosed storage by using, silos, bunkers, hoppers and containers, to eliminate the influence of wind and to prevent the formation of dust by wind as far as possible. However, for large quantities of not or only moderately drift sensitive and wettable material, open storage might be the only option.	Yes	The materials receivals building will be full enclosed. The MRP will feature a three sided and roofed building. All material stockpiles will be stored within walled bunkers underneath the three sided and roofed building.	As per Section 6.4: • a combined reduction factor of 85% was applied to the waste receival building and MRF material transfers and handling to account for water sprays and enclosure. • a combined reduction factor of 97% was applied to the MRF screening to account for dust hooding and extraction, water sprays and three-sided and roofed building.
BAT for open storage is to carry out regular or continuous visual inspections to see if dust emissions occur and to check if preventive measures are in good working order. Following the weather forecast by, e.g., using meteorological instruments on site, will help to identify when the moistening of heaps is necessary and will prevent unnecessary use of resources for moistening the open storage.	n/a - no open storage proposed at the site	All material stockpiles will be stored within walled bunkers underneath the three sided and roofed building structure. Water sprays will be applied to storage areas.	n/a
Short-term open storage BAT are one, or a proper combination, of the following techniques: • moistening the surface using durable dust-binding substances • moistening the surface with water • covering the surface, e.g. with tarpaulins	n/a - no open storage proposed at the site	All material stockpiles will be stored within walled bunkers underneath the three sided and roofed building structure. Water sprays will be applied to storage areas.	n/a
Placing longitudinal axis of the heap parallel with the prevailing wind	No	All material stockpiles will be stored within walled bunkers underneath the three sided and roofed building structure.	n/a

BAT measure	BAT implemented at the site	Details	Emission reduction factor applied
Applying protective plantings, windbreak fences or upwind mounds to lower the wind velocity	Yes	The materials receivals building will be full enclosed. All material stockpiles will be stored within walled bunkers underneath the three sided and roofed building structure.	As per Section 6.4: • a combined reduction factor of 85% was applied to the waste receival building and MRF material transfers and handling to account for water sprays and enclosure. • a combined reduction factor of 97% was applied to the MRF screening to account for dust hooding and extraction, water sprays and three-sided and roofed building.
Only one heap instead of several heaps as far as possible	No	Material specific storage bunkers are required at the site. All material stockpiles will be stored within walled bunkers underneath the three sided building.	n/a – this measure is not practical for implementation.
Applying storage with retaining walls reduces the free surface, leading to a reduction of diffuse dust emissions. This reduction is maximised if the wall is placed upwind of the heap	Yes	The materials receivals building will be full enclosed. The MRP will feature a three sided and roofed building. All material stockpiles will be stored within walled bunkers underneath the three sided building.	As per Section 6.4: • a combined reduction factor of 85% was applied to the waste receival building and MRF material transfers and handling to account for water sprays and enclosure. • a combined reduction factor of 97% was applied to the MRF screening to account for dust hooding and extraction, water sprays and the building.

The summary in Table 8.2 shows that with regard to the storage of material, the measures proposed at the facility are aligned with the EU BAT measures where it is practical or justified to do so.

8.2.3 Material handling and processing

The EU BAT presents emission controls relevant to the handling and processing of material under Section 5.4 “Transfer and handling of solids”. Similar to the discussion presented in Section 8.2.1, the dispersiveness of the material handed and processed is of relevance to the EU BAT measures.

The examples of BAT for handling, conveying and processing of material are summarised in Table 8.3.

Table 8.3 BAT measures for handling, conveying and processing of material

BAT measure	BAT implemented at the Proposal Site	Details	Emission reduction factor applied
Scheduling the transfer as much as possible when the wind speed is low	Yes	Most material handling activities are sheltered either within a building, within the pit shell or adjacent to earth bunds.	n/a – this measure is a day to day management practice and not reflected in the emissions inventory prepared for the AQIA.
Reduce the drop height and to choose the best position during discharging into a truck	Yes	Material drop heights during truck unloading and loading operations are minimised as much as practicable.	n/a – this measure is an operational practice and not actively reflected in the emissions inventory
Moisten the product	Yes	Water sprays are active throughout the site.	50% control factor for water sprays or controlled emission factors (crushing/screening) are implemented in the emissions inventory.
Minimise the speed of descent and the free fall height (not critical for S4 and S5 material)	Yes	Material drop heights during truck unloading and loading operations are minimised as much as practicable.	n/a – this measure is an operational practice and not actively reflected in the emissions inventory.
Design conveyor to conveyor transfer chutes in such a way that spillage is reduced to a minimum	Yes	The design of the MRP limits the potential for material spill.	n/a
Non drift sensitive material (S4 and S5), open belt conveyor with one or more of: - lateral wind protection - spraying water and jet spraying at the transfer points - belt cleaning	Yes	Conveyors at the MRF are either covered (main feed conveyor) or contained within a building. Water sprays are applied at key transfer points throughout the MRP.	As per Section 6.4: • a combined reduction factor of 85% was applied to the waste receival building and MRF material transfers and handling to account for water sprays and enclosure. • a combined reduction factor of 97% was applied to the MRF screening to account for dust hooding and extraction, water sprays and the building.
Filtration of extracted air	Yes	The proposed MRP will feature dust extraction and transfer to filters to reduce emissions from screening activities.	As per Section 6.4, a combined reduction factor of 97% was applied to the MRF screening to account for dust hooding and extraction, water sprays and the building.

Table 8.3 highlights that the EU BAT for handling, conveying and processing of material would be achieved at the facility where applicable.

8.3 Additional mitigation measure review

In addition to the comparison with the EU BAT measures, a comparison of existing and proposed dust control measures at the site is made with reference to best practice dust measures outlined in the following:

- Best practice dust measures relating to resource recovery operations, as detailed by Sustainability Victoria in the *Guide to Best Practice at Resource Recovery Centres* (Sustainability Victoria 2019). The documented best practice dust-control measures, and a commentary on whether each measure will be implemented at the site, are provided in Table 8.4.

- The NSW EPA guidance document *Environmental Guidelines: Solid Waste Landfills* (NSW EPA 2016) describes dust-control methods for solid-waste landfill operations. While the site is not a solid waste landfill, the dust-control measures listed in this guideline document is referenced as an example of NSW EPA best practice dust-control measures for the waste industry in NSW. The dust-control measures and their relevance to the site are provided in Table 8.5.

Table 8.4 Comparison of site dust-control measures with Sustainability Victoria *Guide to Best Practice at Resource Recovery Centres*

Dust control method (Sustainability Victoria 2019)	Measures implemented at site	Justification
Minimise the area of exposed soils	Yes	Entire site is paved.
Stabilise exposed areas (e.g. through revegetation) and stockpiles of dusty materials as soon as practicable	N/A	While dusty materials are controlled through wet suppression, stockpiles are continually active, and therefore additional stabilisation of surface is not practical.
Water sprinklers at crushing/screening plant	Yes	The MRF processing area features misting sprays and dust extraction to filters.
Paving of all operating, storage, unloading and loading areas	Yes	The entire site is sealed with concrete.
Sealing of roads if dust is considered likely to be an issue	Yes	The entire site is sealed with concrete.
Minimising areas of exposed earth through suitable landscaping	Yes	The entire site is sealed with concrete.
Utilising dust suppressants (e.g. light water spray)	Yes	The site features water misting sprays at processing shed, as well as sprinklers at stockpiles.
Installing windbreaks to prevent particulates becoming airborne	Yes	All material is stored in bunkers featuring three-sided walls and entire site features wind breaks from boundary walls or built structures.
Regular cleaning/sweeping of paved surfaces	Yes	Cleaning of paved surfaces through and sweeping.

Note: N/A – not applicable.

Table 8.5 Comparison of site dust-control measures with NSW EPA Environmental Guidelines: Solid Waste Landfills, Second edition 2016

Dust-control method (NSW EPA 2016)	Measure implemented at site	Justification
Minimise the area of exposed soils.	Yes	Entire site is paved.
Stabilise exposed areas (e.g. through revegetation) and stockpiles of dusty materials as soon as practicable.	N/A	While dusty materials are controlled through wet suppression, stockpiles are continually active, and therefore additional stabilisation of surface is not practical.
Revegetate completed areas as soon as practicable.	N/A	Not practical given the active nature of stockpiles. The remainder of the site is sealed.
Use sealed or gravel roads, particularly from the public roadway to the gatehouse or waste reception section of the landfill.	Yes	The entire site is sealed with concrete.
Reduce drop heights, where applicable.	Yes	Material drop heights during truck unloading and loading operations are minimised as much as practicable.
Spray water for dust suppression, particularly over exposed surfaces, at key material transfer points, and on unsealed haul roads to minimise wheel-generated dust.	Yes	The site features water misting at processing shed, and sprinklers at stockpiles.
Appropriately modify excavation works and operations on dry, windy days or when the wind is blowing towards sensitive receptors.	N/A	Site does not feature excavation works.
Enforce speed limits to minimise wheel-generated dust.	Yes	Site travel speeds are restricted to 10 km/h.
Cover loads of dusty material transported by road in open-topped trucks.	Yes	All in-coming and out-going truck loads are covered.
Minimise dirt tracked from the site to external roads; measures include visual inspection of trucks leaving the site, use of wheel-wash and shaker grids, and construction of sealed haul roads.	Yes	All roads are paved and wheel-wash bay currently exists at the exit from the site.
Install wind barriers and enclosures (where practicable) to deflect wind from erodible areas and to minimise exposure of falling dusty materials to winds.	Yes	All material is stored in bunkers featuring three-sided walls and entire site features wind breaks from boundary walls or built structures.

Note: N/A – not applicable

It can be seen from the tables that the dust-control methods implemented at the site are consistent, or in the case of dust extraction and filtration exceeding, are consistent with documented best practice dust control measures for the resource recovery and waste industry.

For diesel combustion emissions, the following measures will be implemented:

- Any new trucks purchased for site must meet the Euro V emission standards.
- All plant and equipment will be regularly serviced and maintained to meet manufacturers emissions specifications.
- Idling of trucks, plant and equipment onsite will be minimised wherever practicable.

8.4 Monitoring

Aussie Recycling are committed to the utilisation of real-time particulate matter monitors at the site.

If approved, prior to the commencement of operations at the site, Aussie Recycling will install two real-time particulate matter monitors along the site boundary (likely the southern and eastern boundaries, with consideration given to prevailing winds, neighbouring receptors and constraints associated with surrounding structures.

Results from the monitoring would be used to inform a trigger action response plan (TARP) to facilitate the reactive management of particulate matter emissions from the site. The TARP would be integrated into the air quality management plan (AQMP) for the site.

9 Conclusion

EMM was engaged by 4Pillars on behalf of Aussie Recycling to undertake an AQIA for the proposed MRF at 13 Bellfrog Street, Greenacre. This AQIA has been conducted following the methods prescribed in the *Approved Methods for Modelling* (NSW EPA 2022).

Background air quality concentrations were adopted from data recorded during the 2023 calendar year at the DCCEEW AQMS site at Lidcombe. Meteorological modelling was completed using AERMET, with real-world observations incorporated from BoM Canterbury Racecourse AWS and BoM Bankstown Airport monitoring resources.

Emissions of TSP, PM_{10}, and $PM_{2.5}$ associated with the facility were quantified using publicly available emission estimation techniques for two scenarios (MRF enclosure and site enclosure). Atmospheric dispersion model predictions for the proposed activities were undertaken using the AERMOD dispersion modelling system.

Cumulative impacts (i.e. the incremental increase from the project + Heidelberg CBP + background air quality) were assessed by combining the adopted background concentrations with the predicted incremental concentrations from the Heidelberg CBP and the proposed facility based on background air quality measured for the whole of 2023. Cumulative results indicated that air pollution concentrations associated with emissions from the proposed facility and neighbouring emission sources would be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods, with the following exception:

- 24-hour average PM_{10} – one additional exceedance day at the majority of assessment locations under busy day operations. It is noted that exceedance coincides with an elevated background concentration of 48.8 µg/m^3 recorded during a backburning smoke emission event (see Section 5.4). The background concentration accounts for between 82% and 98% of the predicted cumulative concentrations.

It is highlighted that if the period of the 2023 background dataset influenced by regional backburning emissions did not occur, there would be no predicted additional exceedances of the applicable cumulative impact criteria.

Cumulative results for Scenario 2 (site enclosure) indicated that air pollution concentrations associated with emissions from the facility and neighbouring emission sources would be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods, with the following exception:

- 24-hour average PM_{10} due to site contributions – one additional exceedance day at assessment locations R1, R2, R4, R5, and R15 under busy day operations. It is noted that exceedance coincides with an elevated background concentration of 48.8 µg/m^3 (backburning event, as detailed above), which accounts for between 94% and 98% of the predicted cumulative concentrations.

As for the proposed development (Scenario 1), if the period of the 2023 background dataset influenced by regional backburning emissions did not occur, there would be no predicted additional exceedances of the applicable cumulative impact criteria for Scenario 2.

To summarise the results of the modelling undertaken for Scenario 1 and 2:

- Scenario 2 (site enclosure) returns lower predicted air quality impacts at surrounding receptors relative to Scenario 1 (MRF enclosure). Both emission scenarios return predicted incremental concentrations well below the NSW EPA impact assessment criteria.

- When background concentrations are taken into consideration, an additional exceedance day is predicted for 24-hour average concentrations under both Scenario 1 and 2 under the conservative assumption of continuous busy day emissions. It is noted that the additional exceedance day is coincident with background particulate matter concentrations influenced by regional backburning smoke events.

- The busy day modelling assumes continual upscaled activity rates over a 12-month period and should be viewed as highly conservative for short-term impacts.
- Model predictions from typical, average throughput are low for both Scenario 1 and 2, and are not predicted to exceed cumulative impact assessment criterion.
- Both scenarios are built on conservative emission estimation assumptions relating to the type of material being processed and transferred (e.g. 100% of material is low moisture, high dust potential material).
- It is considered that on the basis of the predicted cumulative concentrations relative to the applicable NSW EPA impact assessment criteria, the MRF enclosure (Scenario 1) achieves a comparable outcome of compliance relative to the site enclosure (Scenario 2).

A review of best practice mitigation measures associated with Scenario 1 was undertaking giving reference to EU and Australian guidance. The review identified that the measures proposed under operations of the facility under Scenario 1 would align with best practice mitigation measures for vehicle movements, material processing and transfers, and material storage.

These measures include the integrated design of dust extraction and filtration at the MRP, enclosure by the proposed three-sided and roofed building for the MRP and storage bunkers, enclosure of the material unloading area and MRF feed hopper, application of water sprays at primary transfer points and across paved surfaces in the yard and cleaning of paved surfaces. Where practical to do so, these measures have been taken into account in the emissions estimation and dispersion modelling.

In addition to the particulate matter emission reduction measures accounted for in the dispersion modelling, Aussie Recycling will install and operate real-time particulate matter monitoring units at the boundary of the facility. Results from the monitoring would be used to inform a trigger action response plan (TARP) to facilitate the reactive management of particulate matter emissions from the site. The TARP would be integrated into the air quality management plan (AQMP) for the site.

The modelling presented in this AQIA identifies that the site enclosure would achieve lower facility-only impacts at assessment locations relative to the MRF enclosure facility. However, based on the results of the cumulative assessment presented in the AQIA and the number of predicted additional exceedance days for the two scenarios (i.e. one additional day for either scenario), it is considered that the site enclosure is not necessary to satisfy applicable NSW EPA impact assessment criteria relative to the MRF enclosure as designed.

However, the following air quality-related factors should be considered whether the site enclosure is a reasonable requirement. According to guidance received by Aussie Recycling, the estimated net cost of the proposed project with MRF enclosure is $11.8 million (Rider Levett Bucknall 2025a) and the estimated net cost of site enclosure is $17.015 million (Rider Levett Bucknall 2025b), i.e. site enclosure will increase costs by about $5.2 million.

The high costs associated with the installation of a full enclosure at the facility is not justified, relative to targeted control of vehicle movements through lower cost methods (i.e. frequent sweeping of paved surfaces, wet suppression of travel routes, wheel bath at site entrance).

Waste materials are currently handled and stored outside. The proposed MRF enclosure would ensure that no wastes are handled, stored or processed outside providing a better outcome for the community.

In addition, an air extraction system for the site enclosure would have significantly higher electricity demands than the MRF enclosure.

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Abbreviations

Abbreviation	Meaning
AAQNEPM	Ambient Air Quality National Environment Protection Measure
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AWS	Automatic weather station
BAT	Best available technology
BoM	Bureau of Meteorology
CBP	concrete batch plant
CO	carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
EIS	environmental impact statement
EMM	EMM Consulting Pty Limited
ha	hectares
km	kilometres
LGA	local government area
MRF	materials recovery facility
MRP	material recovery plant
NSW EPA	NSW Environmental Protection Authority
NO_x	oxides of nitrogen
NO_2	nitrogen dioxide
NPI	National Pollution Inventory
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
tpa	tonnes per annum
TSP	Total suspected particulates
US-EPA	United States Environmental Protection Agency
VKT	Vehicle Kilometres Travelled
VOC	Volatile organic compounds

Appendix A
Meteorological modelling

EMM
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A.1 Meteorological data analysis for the Canterbury Racecourse AWS – 2019 to 2023

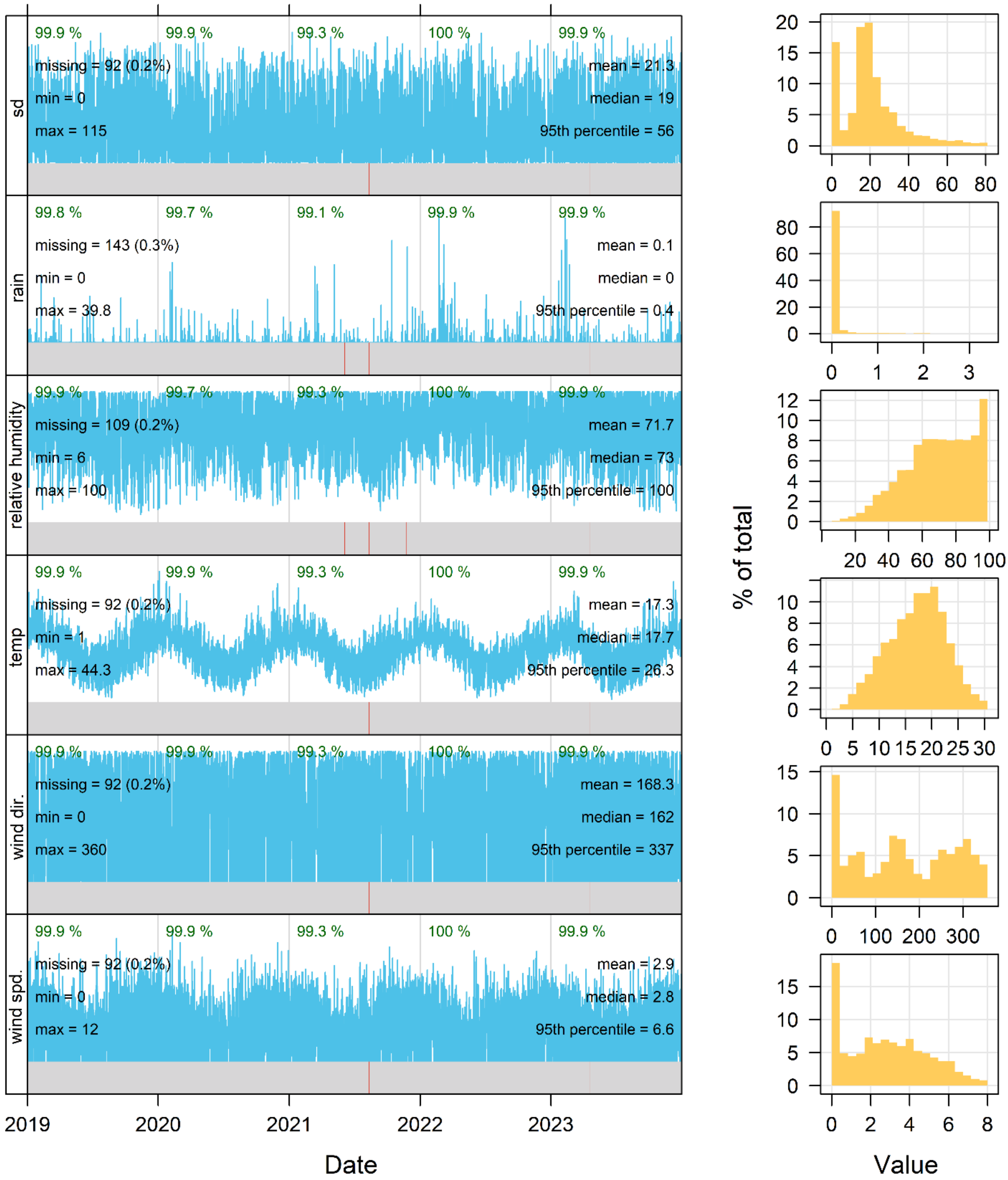


Figure A.1 Data completeness analysis plot – BoM Canterbury Racecourse AWS – 2019 to 2023

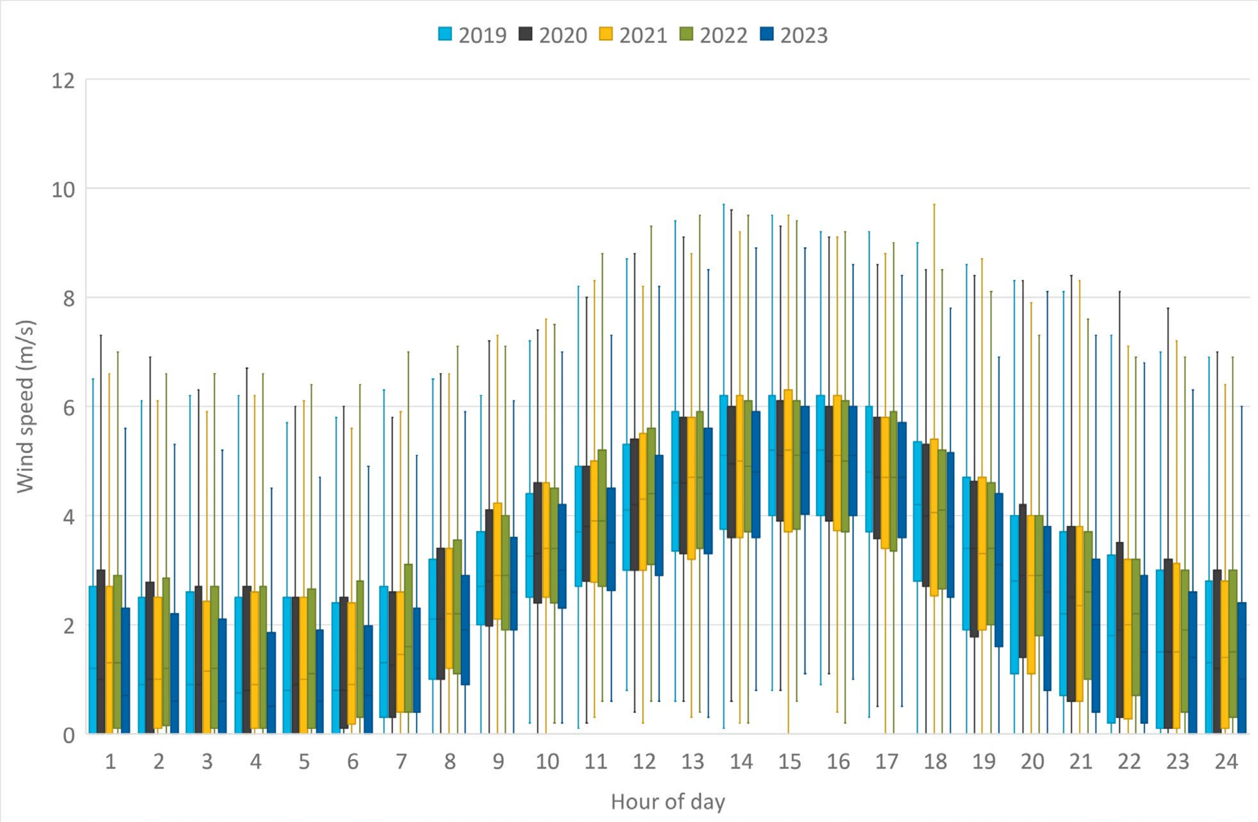


Figure A.2 **Inter-annual variability in diurnal wind speed – Canterbury Racecourse– 2019 to 2023**

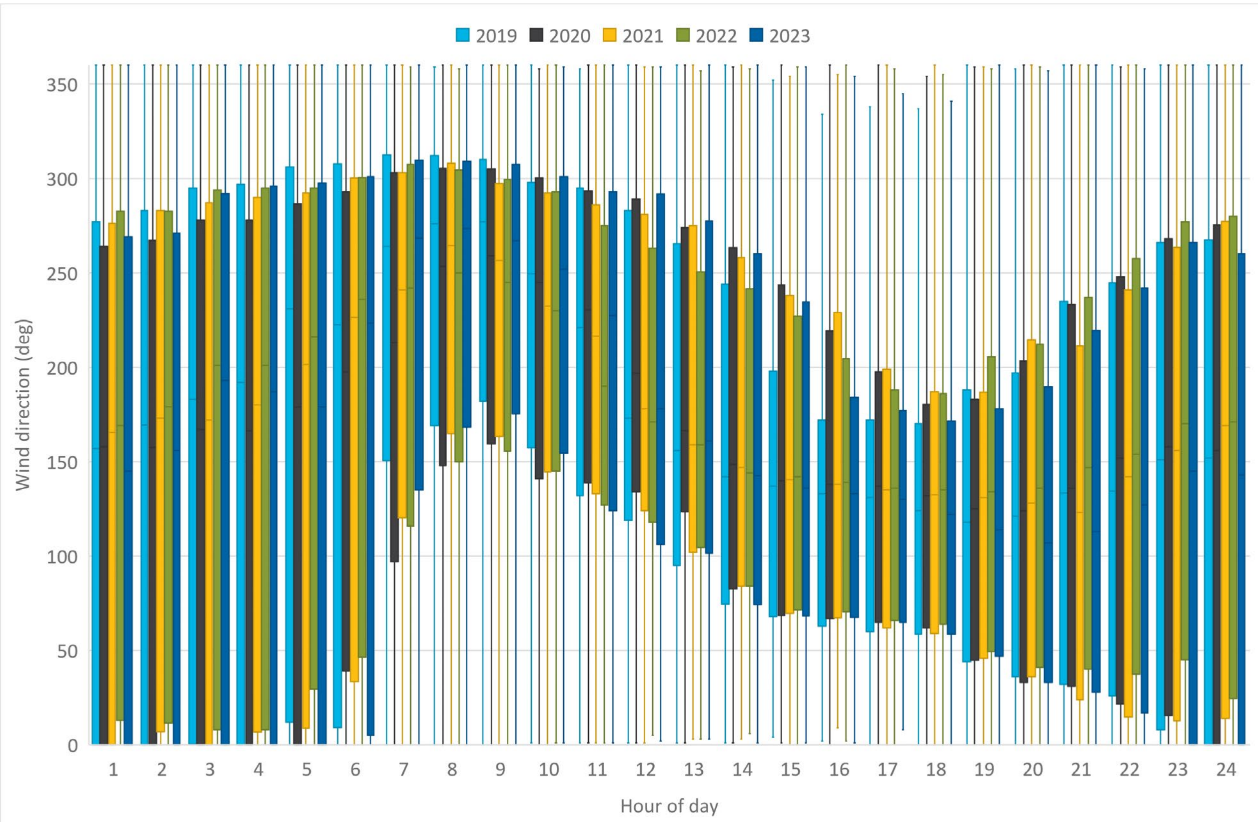


Figure A.3 **Inter-annual variability in diurnal wind direction– Canterbury Racecourse– 2019 to 2023**

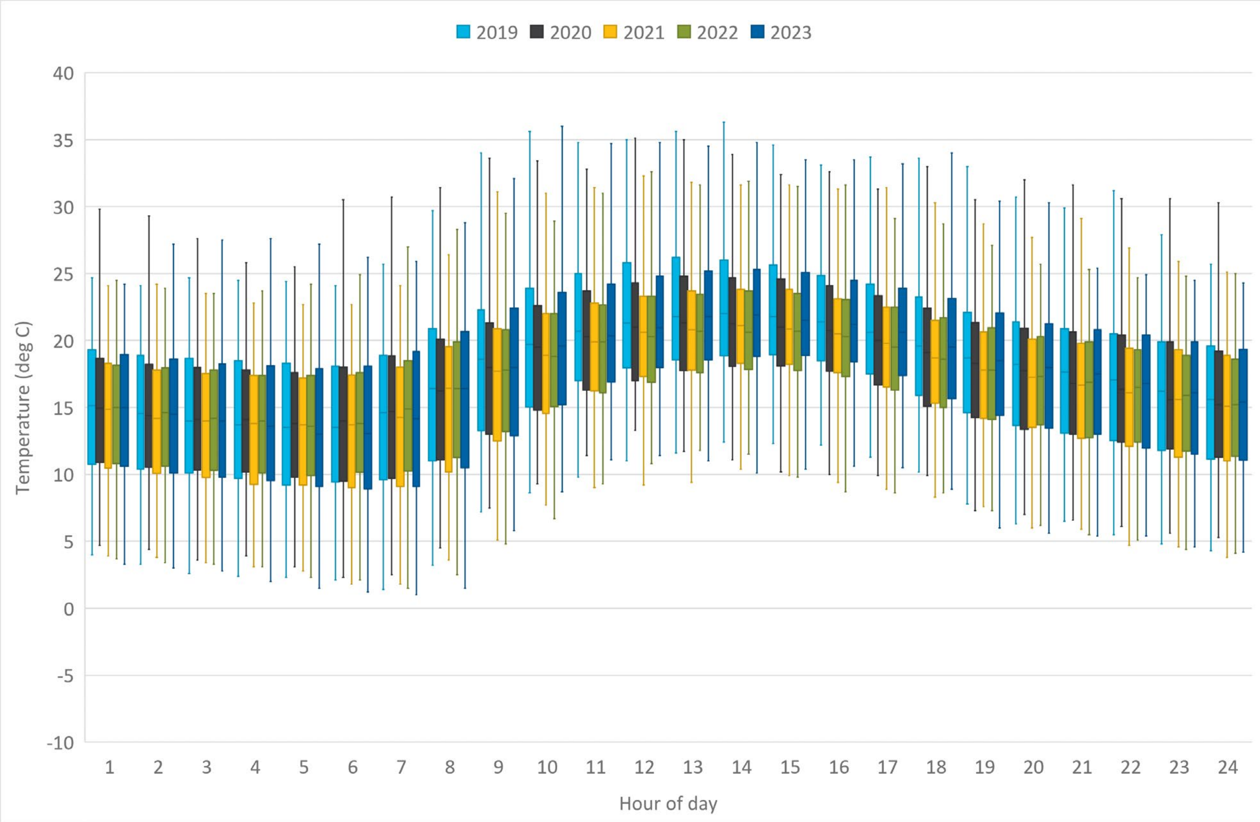


Figure A.4 Inter-annual variability in diurnal air temperature – Canterbury Racecourse– 2019 to 2023

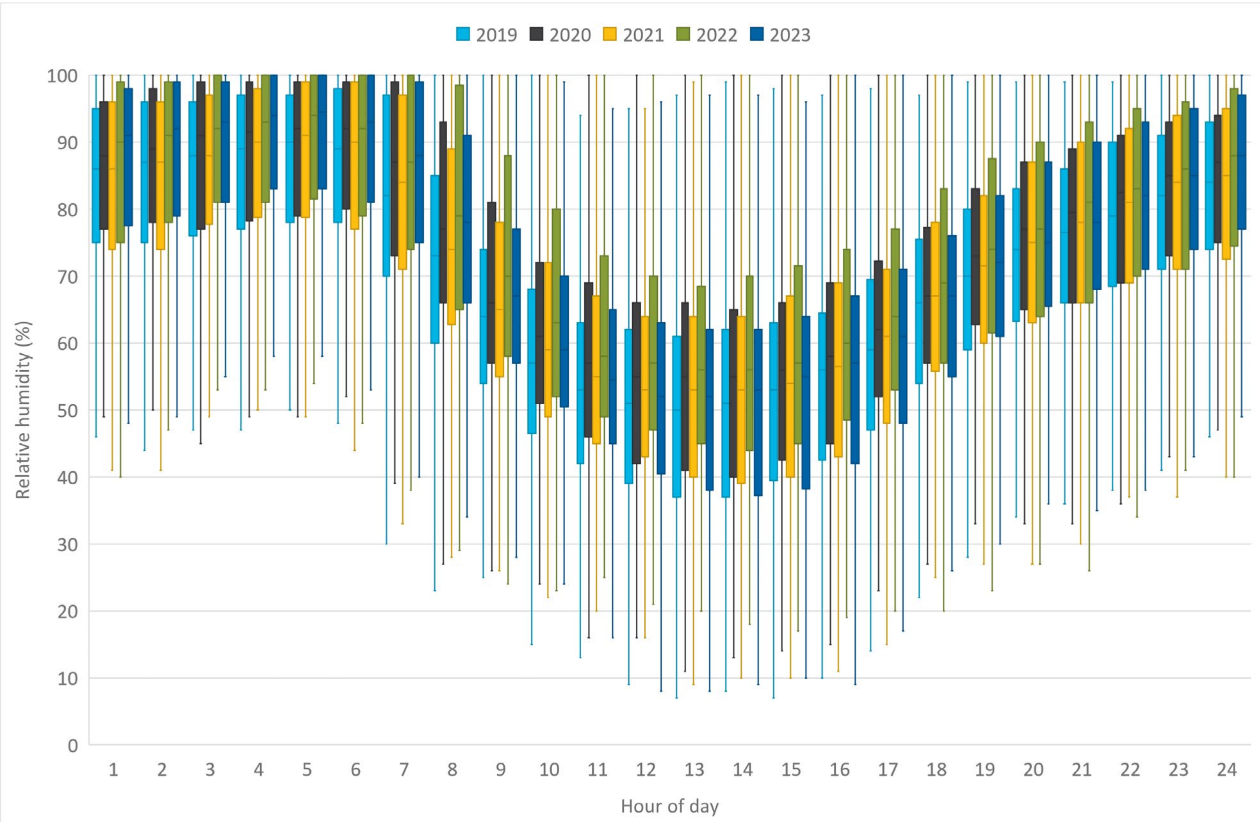


Figure A.5 Inter-annual variability in diurnal relative humidity – Canterbury Racecourse– 2019 to 2023

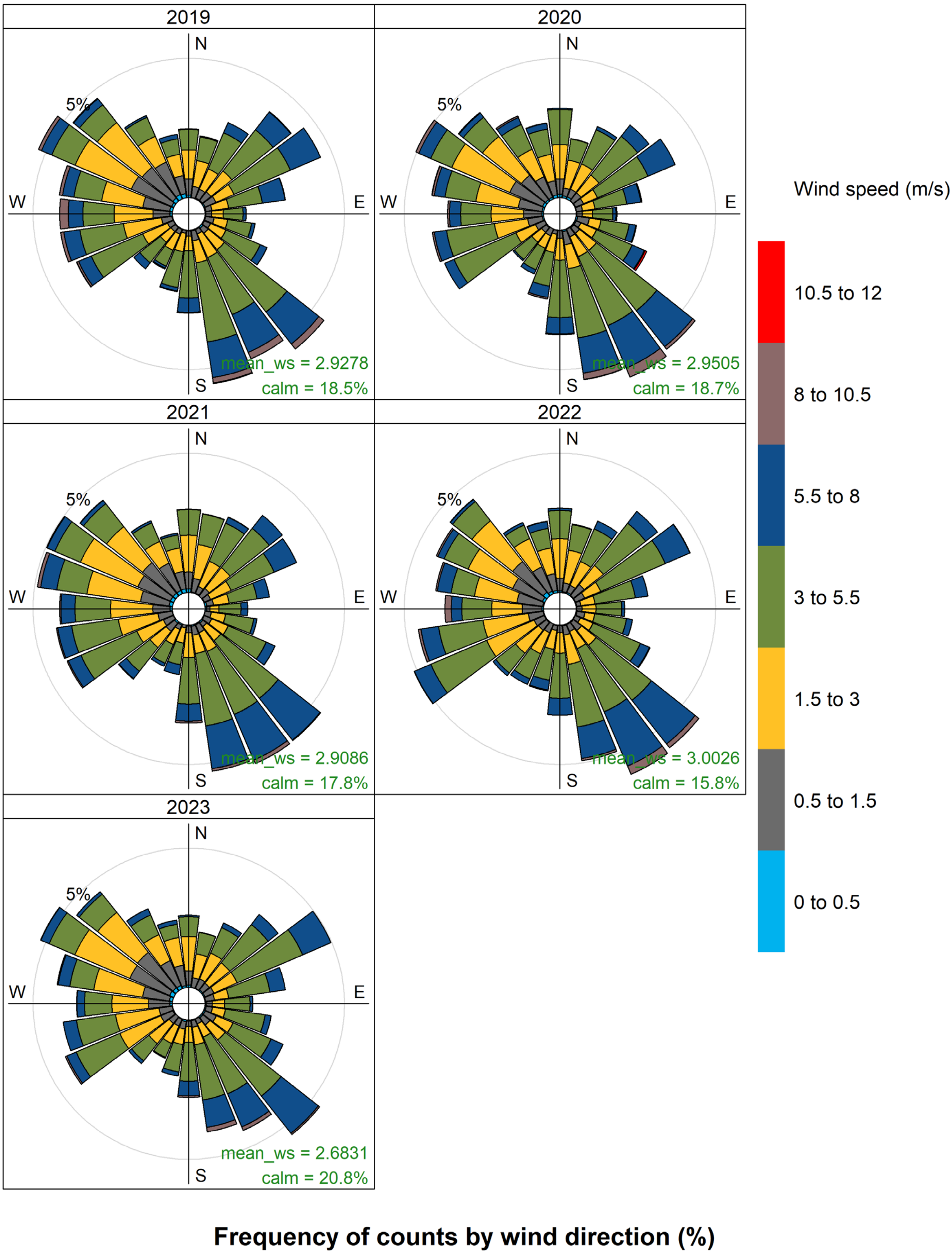


Figure A.6 Inter-annual comparison of recorded wind speed and direction – Canterbury Racecourse AWS – 2019 to 2023

A.2 Meteorological modelling

A.2.1 TAPM modelling

The CSIRO prognostic meteorological model TAPM was used to generate the required upper air prognostic dataset required for AERMET modelling.

TAPM was configured and run as follows:

- TAPM version 4.0.4
- inclusion of high resolution (90 m) regional topography (improvement over default 250 m resolution data)
- grid domains with cell resolutions of 30 km, 10 km, 3 km, 1 km and 0.3 km. Each grid domain features 25 x 25 horizontal grid points and 25 vertical levels
- TAPM default databases for land use, synoptic analyses and sea surface temperature
- TAPM defaults for advanced meteorological inputs
- surface meteorological data from the BoM Canterbury Racecourse AWS location were incorporated into the modelling
- two 'spin-up' days allowed at the beginning and end of the run.

A.2.2 AERMET meteorological processing

The meteorological inputs for AERMOD were generated using the AERMET meteorological processor. The following sections provide an overview of meteorological processing completed for this assessment.

A.2.3 Surface characteristics

Prior to processing meteorological data, the surface characteristics of the area surrounding the adopted monitoring station require parameterisation. The following surface parameters are required by AERMET:

- surface roughness length
- albedo
- Bowen ratio.

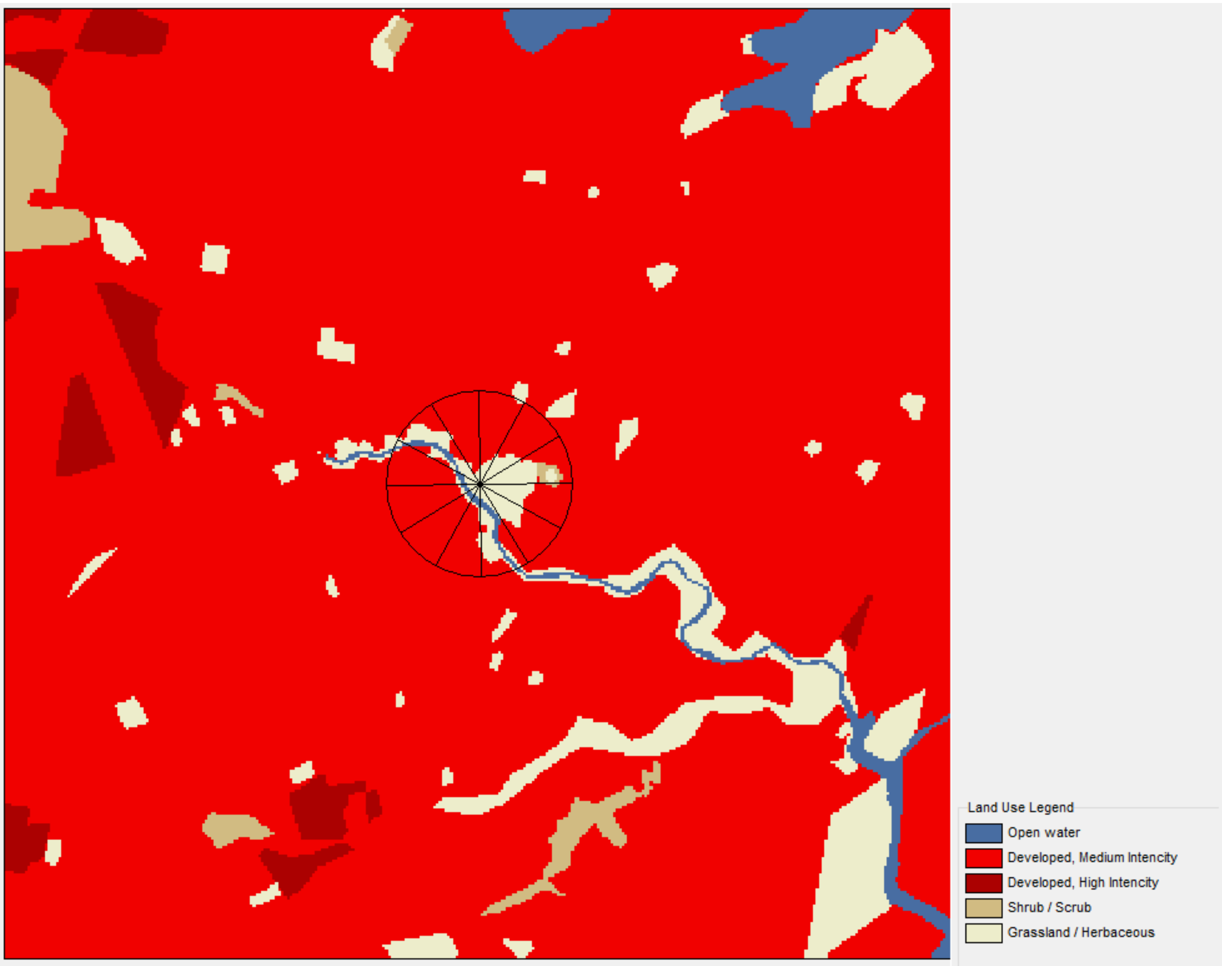
As detailed by USEPA (2013), the surface roughness length is related to the height of obstacles to the wind flow (e.g. vegetation, built environment) and is, in principle, the height at which the mean horizontal wind speed is zero based on a logarithmic profile. The surface roughness length influences the surface shear stress and is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

The land cover of the 10 km by 10 km area surrounding the site was mapped (see Figure A.7). Using the AERSURFACE tool and following the associated guidance of USEPA (2013), surface roughness was determined for 12 (30 degree) sectors grouped by similar land use types within a 1 km radius around the on-site meteorological station, while the Bowen ratio and albedo were determined for the total area. Monthly-varying values for surface roughness, Bowen ratio and albedo were allocated to each sector based on the values prescribed by USEPA (2013).

Surface moisture characteristics for the 2023 modelling period was determined by comparing the period rainfall total to the previous 30-year rainfall records from the following BoM long term rainfall stations:

- Strathfield bowls club (066070)
- Canterbury Racecourse (066194)
- Marrickville Golf club (066036).

Annual rainfall modelling was 1,015 mm, which places the 12-month period on average with the 70th percentile rainfall totals for the previous 30 years. An 'average' surface moisture classification was allocated. It is noted that the rainfall records are not incorporated into dispersion model predictions (i.e. no wet deposition is modelled).



Note: Marked in figure are the 1 km radius for surface roughness (12 sectors defined) and 10 km x 10 km for albedo/Bowen ratio (total image shown)

Figure A.7 Land use map for AERSURFACE processing

Table A.1 Monthly surface roughness length values by sector

Month	Surface roughness length (m) by sector (degrees)											
	0-30	30-60	60-90	90-120	120-150	150-180	180-210	210-240	240-270	270-300	300-330	330-0
Jan	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271
Feb	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271
Mar	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271
Apr	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271
May	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271
Jun	0.119	0.06	0.032	0.057	0.049	0.016	0.145	0.134	0.163	0.076	0.023	0.219
Jul	0.119	0.06	0.032	0.057	0.049	0.016	0.145	0.134	0.163	0.076	0.023	0.219
Aug	0.119	0.06	0.032	0.057	0.049	0.016	0.145	0.134	0.163	0.076	0.023	0.219
Sep	0.185	0.129	0.092	0.125	0.116	0.039	0.169	0.167	0.19	0.114	0.057	0.254
Oct	0.185	0.129	0.092	0.125	0.116	0.039	0.169	0.167	0.19	0.114	0.057	0.254
Nov	0.185	0.129	0.092	0.125	0.116	0.039	0.169	0.167	0.19	0.114	0.057	0.254
Dec	0.223	0.179	0.145	0.175	0.168	0.056	0.181	0.185	0.202	0.136	0.084	0.271

Table A.2 Monthly Bowen ratio and albedo values (all sectors)

Month	Monthly value (all sectors)	
	Bowen ratio	Albedo
January	1.03	0.18
February	1.03	0.18
March	1.13	0.18
April	1.13	0.18
May	1.13	0.18
June	1.13	0.18
July	1.13	0.18
August	1.13	0.18
September	0.98	0.18
October	0.98	0.18
November	0.98	0.18
December	1.03	0.18

A.2.4 Meteorological inputs

Monitoring data from the Canterbury Racecourse AWS were combined with TAPM meteorological modelling outputs for input to AERMET. The following parameters were input as on-site data to AERMET:

- wind speed and directions – Canterbury Racecourse AWS
- temperature (heights of 10 m and 50 m) – Canterbury Racecourse AWS
- relative humidity – Canterbury Racecourse AWS
- station level pressure – Bankstown Airport AWS
- cloud cover – Bankstown Airport AWS
- solar insolation – TAPM
- mixing depth – TAPM.

The period of meteorological data input to AERMET was 1 January 2023 to 31 December 2023.

A.2.5 Upper air profile

Due to the absence of necessary local upper air meteorological measurements, the hourly profile generated by TAPM at the on-site meteorological station location was adopted. Using the temperature difference between levels, the TAPM-generated vertical temperature profile for each hour was adjusted relative to the hourly surface (10 m) temperature observations from the Canterbury Racecourse AWS.

Appendix B
Emissions inventory

creating opportunities

B.1 Introduction

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

- NPI Emissions Estimation Technique Manual for Combustion Engines (NPI 2008)
- NPI Emission Estimation Technique Manual for Mining (NPI 2012)
- US-EPA AP-42 Chapter 11.9, Table 11.9-4 – Wind erosion of exposed areas (US-EPA 1998)
- US-EPA AP-42 Chapter 11.9, Table 11.19.2-1 – Screening (US-EPA 2004)
- US-EPA AP-42 Chapter 13.2.4 – Aggregate handling and storage piles (US-EPA 2006)
- US-EPA AP-42 Chapter 13.2.1 – Paved Roads (US-EPA 2011).

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

B.2 Emissions inventory assumptions

Material parameters adopted within the emissions inventory are presented in Table B.1.

Table B.1 Assumed material parameters

Material / site area	Parameter	Value	Source
Site entry and exit haul roads	Silt loading (g/m^2)	0.33	EMM collected sample for similar waste recycling centre
Site internal haul roads between processing areas	Silt loading (g/m^2)	7.4	Default silt loading for Municipal solid waste landfill – Paved Roads AP-42 13.2.1
Raw and processed material	Moisture content (%)	2.1	Default moisture content for stone quarrying and processing

B.3 Onsite diesel combustion emissions

Emissions generated by onsite plant and equipment diesel consumption was quantified through the following assumptions:

- site operations with average daily diesel consumption rate of 1,071 L
- the corresponding USEPA (USEPA 2016) Tier 4 emissions standards for PM of 0.02 g/kWh was selected
- the g/kWh emission standard was converted to g per litre of diesel by applying a scaling factor of 3, as per the notes for Table 35 in *NPI Emissions Estimation Technique Manual for Combustion Engines* (NPI 2018)
- the PM emission standard is assumed to correspond to PM_{10} with $PM_{2.5}$ emissions derived from the relationship between PM_{10} and $PM_{2.5}$ emission factors presented in Table 35 in NPI 2008 (91.7%).

B.4 Particulate matter emissions inventory

A summary of the emissions inventory for average day operations for scenario 1 are presented in Table B.2 and average day operations for scenario 2 are presented in Table B.3.

Table B.2 Emissions inventory – Scenario 1

Source name	Source type	Emission estimate TSP (kg/year)	Emission estimate PM_{10} (kg/year)	Emission estimate $PM_{2.5}$ (kg/year)	Activity rate	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Parameter 1	Unit	Parameter 2	Unit	Parameter 3	Unit	Parameter 4	Unit	Reduction factor	Emission control
Inbound material - truck movement from weighbridge to waste receival building	Paved haulage	1.6387	0.3146	0.0761	28	VKT/day	0.2960	0.0568	0.01375	kg/VKT	7.4	Road silt loading (g/m²)	120	Haul distance (m)	235	Loads per day	12.8	Ave Truck Weight (t)	80%	Water sprays + wind breaks (buildings) + speed limit
Outbound material - truck movement from stockpiles to weighbridge	Paved haulage	0.3628	0.0696	0.0169	5	VKT/day	0.3801	0.0730	0.01765	kg/VKT	7.4	Road silt loading (g/m²)	60	Haul distance (m)	81	Loads per day	16.3	Ave Truck Weight (t)	80%	Water sprays + wind breaks (buildings) + speed limit
Inbound material - truck movement from entrance to weighbridge	Paved haulage	0.2631	0.0505	0.0122	15	VKT/day	0.0175	0.0034	0.00081	kg/VKT	0.33	Road silt loading (g/m²)	64	Haul distance (m)	235	Loads per day	12.8	Ave Truck Weight (t)		Street sweeper and water cart (controlled silt loading)
Outbound material - truck movement from weighbridge to exit	Paved haulage	0.1165	0.0224	0.0054	5	VKT/day	0.0224	0.0043	0.00104	kg/VKT	0.33	Road silt loading (g/m²)	64	Haul distance (m)	81	Loads per day	16.3	Ave Truck Weight (t)		Street sweeper and water cart (controlled silt loading)
Material unloading (in waste receival building)	Material handling	0.128	0.061	0.009	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					85%	Water sprays + 3-sided enclosure
Material transfer to primary hopper (in waste receival building)	Material handling	0.128	0.061	0.009	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					85%	Water sprays + 3-sided enclosure
Material conveying (in waste receival building)	Processing	0.128	0.061	0.009	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					85%	Water sprays + 3-sided enclosure
Material conveying to initial screen (under MRF enclosure)	Material handling	0.128	0.061	0.009	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					85%	Water sprays + 3-sided enclosure
Material screening (under MRF enclosure)	Processing	0.351	0.121	0.008	1,102	t/day	0.0125	0.0043	0.00029	kg/t									97%	Water sprays + 3-sided enclosure + ducting
Material conveying (under MRF enclosure)	Processing	0.007	0.003	0.001	195	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Water sprays + 3-sided enclosure + ducting

Source name	Source type	Emission estimate TSP (kg/year)	Emission estimate PM_{10} (kg/year)	Emission estimate $PM_{2.5}$ (kg/year)	Activity rate	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Parameter 1	Unit	Parameter 2	Unit	Parameter 3	Unit	Parameter 4	Unit	Reduction factor	Emission control
Transfer to storage bins (under MRF enclosure)	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Water sprays + 3-sided enclosure + ducting
Loading product material to trucks (under MRF enclosure)	Material handling	0.128	0.061	0.009	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					85%	Water sprays + 3-sided enclosure
Wind erosion - storage bins (under MRF enclosure)	Wind erosion	0.021	0.010	0.003	0.098	Area (ha)	0.400	0.200	0.060	kg/ha/hour	1,281	Hours >5.4m/s							85%	Water sprays + 3-sided enclosure
Diesel combustion - onsite plant	Fuel combustion	0.010	0.010	0.009															85%	Water sprays + 3-sided enclosure
Diesel combustion - trucks	Fuel combustion	0.002	0.002	0.002																

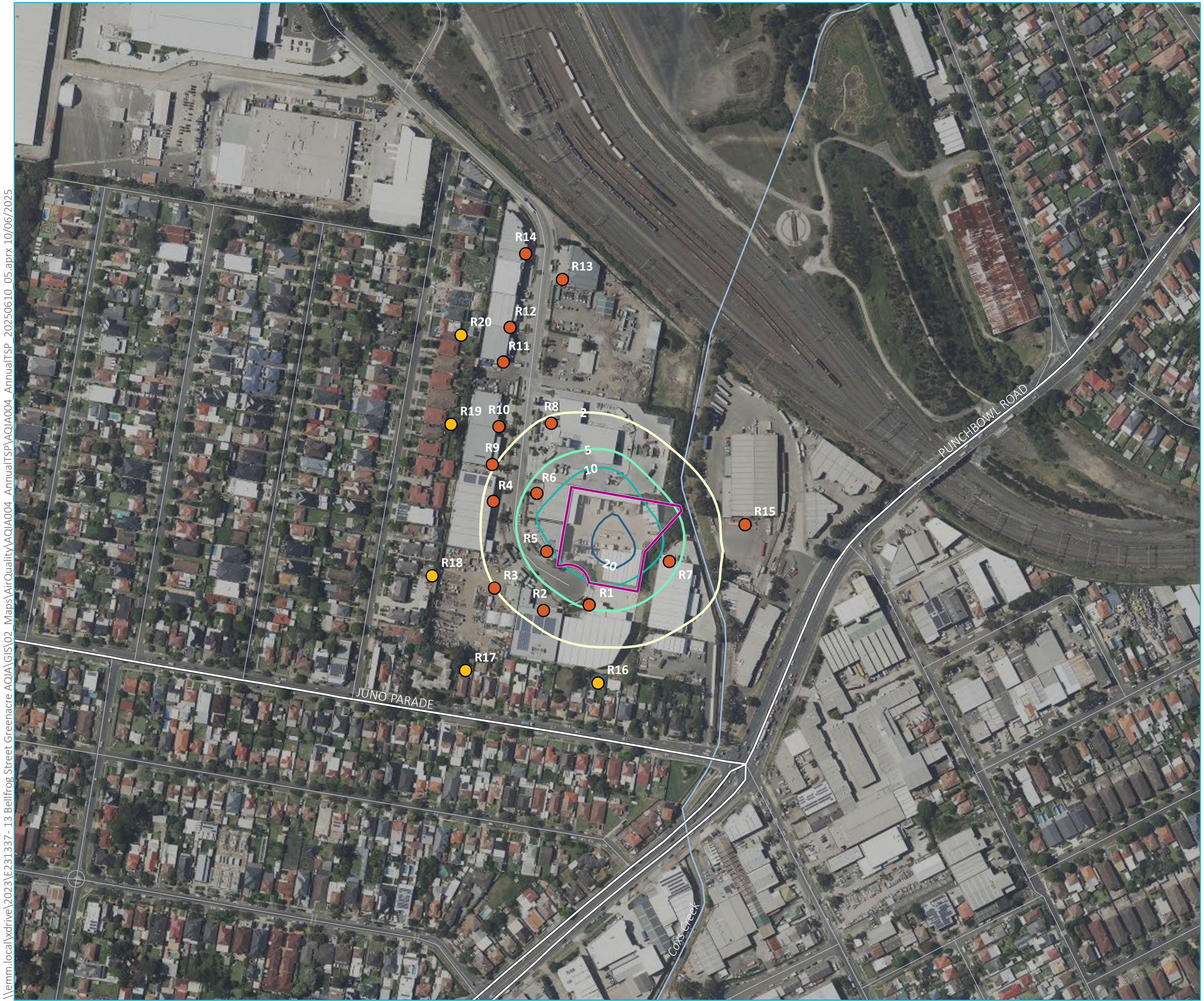
Table B.3 Emissions inventory – Scenario 2

Source name	Source type	Emission estimate TSP (kg/year)	Emission estimate PM_{10} (kg/year)	Emission estimate $PM_{2.5}$ (kg/year)	Activity rate	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Parameter 1	Unit	Parameter 2	Unit	Parameter 3	Unit	Parameter 4	Unit	Reduction factor	Emission control
Inbound material - truck movement from weighbridge to waste receival building	Paved haulage	0.1194	0.0229	0.0055	28	VKT/day	0.2960	0.0568	0.01375	kg/VKT	7.4	Road silt loading (g/m²)	120	Haul distance (m)	235	Loads per day	12.8	Ave Truck Weight (t)	99%	Enclosure + speed limit +watering + ducting to baghouse
Outbound material - truck movement from stockpiles to weighbridge	Paved haulage	0.0264	0.0051	0.0012	5	VKT/day	0.3801	0.0730	0.01765	kg/VKT	7.4	Road silt loading (g/m²)	60	Haul distance (m)	81	Loads per day	16.3	Ave Truck Weight (t)	99%	Enclosure + speed limit +watering + ducting to baghouse
Inbound material - truck movement from entrance to weighbridge	Paved haulage	0.1480	0.0284	0.0069	8	VKT/day	0.0175	0.0034	0.00081	kg/VKT	0.33	Road silt loading (g/m²)	36	Haul distance (m)	235	Loads per day	12.8	Ave Truck Weight (t)		Street sweeper and water cart (controlled silt loading)
Outbound material - truck movement from weighbridge to exit	Paved haulage	0.0655	0.0126	0.0030	3	VKT/day	0.0224	0.0043	0.00104	kg/VKT	0.33	Road silt loading (g/m²)	36	Haul distance (m)	81	Loads per day	16.3	Ave Truck Weight (t)		Street sweeper and water cart (controlled silt loading)
Material unloading (in waste receival building)	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Material transfer to primary hopper (in waste receival building)	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Material conveying (in waste receival building)	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Material conveying to initial screen (in waste receival building)	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Material screening (in waste receival building)	Processing	0.351	0.121	0.008	1,102	t/day	0.0125	0.0043	0.00029	kg/t									97%	Enclosure + watering + ducting to baghouse
Material conveying (in waste receival building)	Material handling	0.007	0.003	0.001	195	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse

Source name	Source type	Emission estimate TSP (kg/year)	Emission estimate PM_{10} (kg/year)	Emission estimate $PM_{2.5}$ (kg/year)	Activity rate	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Parameter 1	Unit	Parameter 2	Unit	Parameter 3	Unit	Parameter 4	Unit	Reduction factor	Emission control
Transfer to storage bins	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Loading product material to trucks	Material handling	0.022	0.010	0.002	592	t/day	0.0014	0.0007	0.00010	kg/t	2.7	Average wind speed (m/s)	2.1	Moisture content (%)					97%	Enclosure + watering + ducting to baghouse
Diesel combustion - onsite plant	Fuel combustion	0.003	0.003	0.003															95%	Enclosure+ ducting to baghouse
Diesel combustion - trucks	Fuel combustion	0.0001	0.0001	0.0001															95%	Enclosure+ ducting to baghouse

Appendix C
Contour plots

EMM
creating opportunities



KEY

Site boundary

Assessment location

Industrial

Residential

Annual TSP concentrations (µg/m³)

2

5

10

20

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); DCSSS (2024); GA (2009)

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA004_AnnualTSP\AQIA004_AnnualTSP_20250610_05.aprx 10/06/2025

Predicted annual average TSP concentrations (µg/m³)-site-only increment (scenario 1)- average day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.1

creating opportunities

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA005_24HrPM10\AQIA005_24hrPM10_20250610_05.aprx 10/06/2025

Source: EMM (2025); DCSSS (2024); GA (2009)

KEY

Site boundary

Assessment location

- Industrial
- Residential

24-hour PM_{10} contour (µg/m³)

- 3
- 5
- 10
- 20

Existing environment

- Major road
- Minor road
- Named watercourse

Maximum predicted 24-hour average PM_{10} concentrations (µg/m³) – site-only increment (scenario 1)-busy day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.2

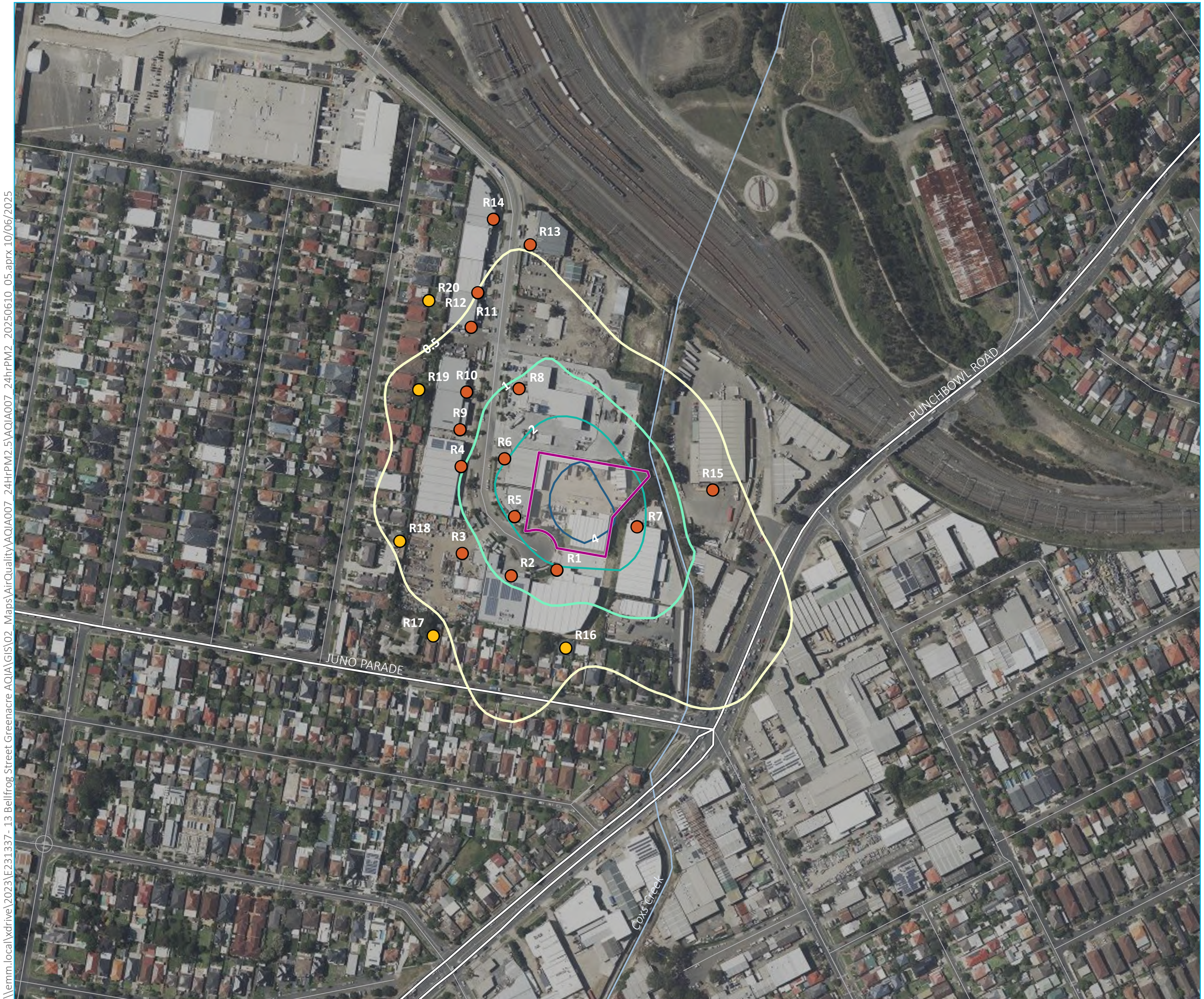
EMM
creating opportunities

Source: EMM (2025); ABS (2021); DCSSS (2024); ESRI (2025); GA (2009)

Predicted annual average PM_{10} concentrations (µg/m³) – site-only increment (scenario 1)- average day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.3

EMM creating opportunities



Source: EMM (2025); DCSSS (2024); GA (2009)

0 100 200 m
GDA2020 MGA Zone 56
N

KEY

Site boundary

Assessment location

Industrial

Residential

24-hour $PM_{2.5}$ contour ($\mu g/m^3$)

0.5

1

2

4

Existing environment

Major road

Minor road

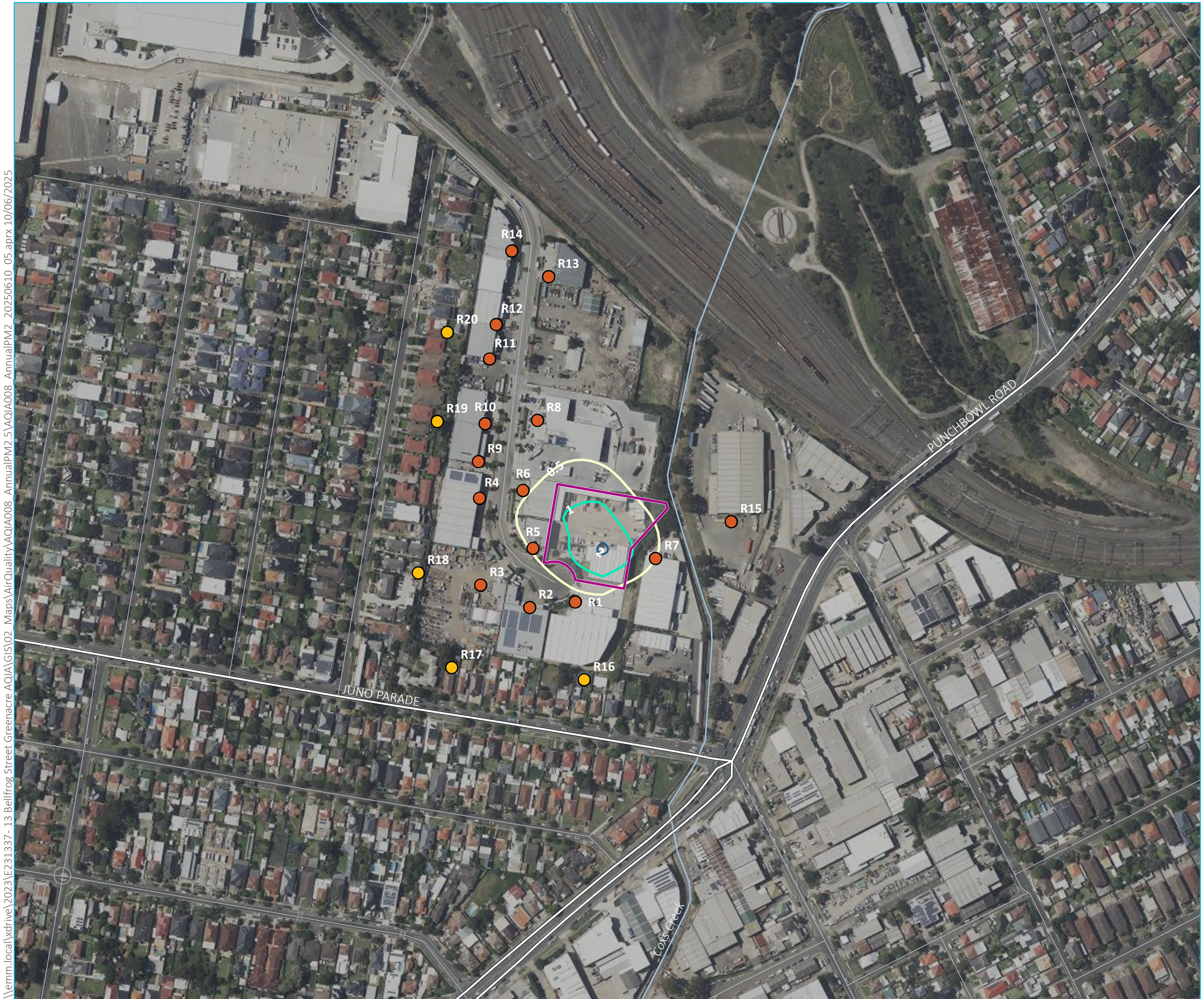
Named watercourse

Maximum predicted 24-hour average $PM_{2.5}$ concentrations ($\mu g/m^3$) – site-only increment (scenario 1)- busy day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.4

EMM
creating opportunities

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA007_24HrPM2.5\AQIA007_24hrPM2_20250610_05.aprx 10/06/2025



\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA008_AnnualPM2.5\AQIA008_AnnualPM2_20250610_05.aprx 10/06/2025

Source: EMM (2025); DCSSS (2024); GA (2009)

KEY

Site boundary

Assessment location

Industrial

Residential

Annual $PM_{2.5}$ contour (µg/m³)

0.5

1

2

Existing environment

Major road

Minor road

Named watercourse

Predicted annual average $PM_{2.5}$ concentrations (µg/m³) – site-only increment (scenario 1)- busy day operation

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.5

EMM
creating opportunities

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA009_DustDep\AQIA009_DustDep_20250610_05.aprx 10/06/2025

Source: EMM (2025); DCSSS (2024); GA (2009)

KEY

Site boundary

Assessment location

Industrial

Residential

Dust deposition contour (g/m²/month)

0.5

1

2

Existing environment

Major road

Minor road

Named watercourse

Predicted annual average dust deposition levels (g/m²/month) – site-only increment (scenario 1) - average day operations

13 Bellfrog Greenacre

Air Quality Impact Assessment

Figure C.6

EMM creating opportunities

KEY

Site boundary

Assessment location

Industrial

Residential

Annual TSP concentrations (µg/m³)

0.5

1

2

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); DCSSS (2024); GA (2009)

\\emm.local\xdrive\2023\E231337 - 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA010_AnnualTSPScen2\AQIA010_AnnualTSPScen2_20250610_03.aprx 10/06/2025

Predicted annual average TSP concentrations (µg/m³)-site-only increment (scenario 2)- average day operations

13 Bellfrog Greenacre

Air Quality Impact Assessment

Figure C.7

EMM creating opportunities

KEY

Site boundary

Assessment location

Industrial

Residential

24-hour PM_{10} contour (µg/m³)

1

2

5

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); DCSSS (2024); GA (2009)

0 100 200 m

GDA2020 MGA Zone 56

N

Maximum predicted 24-hour average PM_{10} concentrations (µg/m³) – site-only increment (scenario 2)-busy day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.8

EMM creating opportunities

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA011_24hrPM10Scen2\AQIA011_24hrPM10Scen2_20250610_03.aprx 10/06/2025

KEY

Site boundary

Assessment location

Industrial

Residential

Annual PM_{10} contour (µg/m³)

0.1

0.5

1

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); DCSSS (2024); GA (2009)

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA012_AnnualPM10Scen2\AQIA012_AnnualPM10Scen2_20250610_03.aprx 10/06/2025

Predicted annual average PM_{10} concentrations (µg/m³) – site-only increment (scenario 2)- average day operations

13 Bellfrog Greenacre

Air Quality Impact Assessment

Figure C.9

EMM

creating opportunities

KEY

Site boundary

Assessment location

Industrial

Residential

24-hour $PM_{2.5}$ contour (µg/m³)

0.05

0.1

0.5

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); ABS (2021); DCSSS (2024); ESRI (2025); GA (2009)

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA013_24hrhrPM2.5_Scen2\AQIA013_24hrhrPM2.5_Scen2_20250610_03.aprx 10/06/2025

Maximum predicted 24-hour average $PM_{2.5}$ concentrations (µg/m³) – site-only increment (scenario 2)- busy day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.10

EMM creating opportunities

\\emm.local\xdrive\2023\E231337- 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA014_AnnualPM2.5_Scen2\AQIA014_AnnualPM2.5_Scen2_20250610_03.aprx 10/06/2025

KEY

Site boundary

Assessment location

Industrial

Residential

Annual $PM_{2.5}$ contour (µg/m³)

0.01

0.05

0.1

Existing environment

Major road

Minor road

Named watercourse

Source: EMM (2025); DCSSS (2024); GA (2009)

0 100 200 m

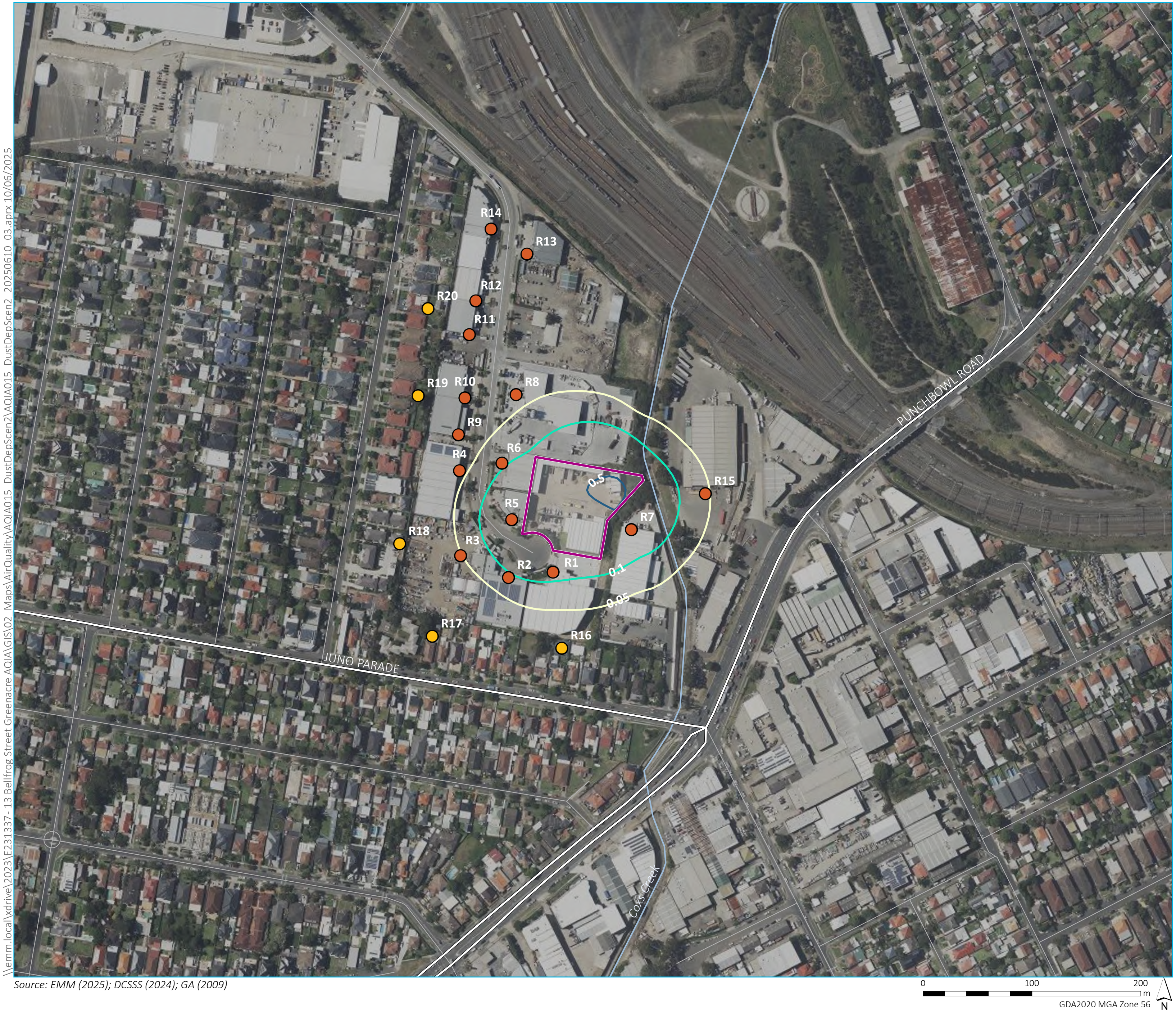
GDA2020 MGA Zone 56

N

Predicted annual average $PM_{2.5}$ concentrations (µg/m³) – site-only increment (scenario 2)- busy day operation

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.11

EMM
creating opportunities



\\emm.local\xdrive\2023\E231337 - 13 Bellfrog Street Greenacre AQIA\GIS\02_Maps\AirQuality\AQIA015_DustDepScen2\AQIA015_DustDepScen2_20250610_03.aprx 10/06/2025

Source: EMM (2025); DCSSS (2024); GA (2009)

KEY

Site boundary

Assessment location

Industrial

Residential

Dust deposition contour (g/m²/month)

0.05

0.1

0.5

Existing environment

Major road

Minor road

Named watercourse

Predicted annual average dust deposition levels (g/m²/month) – site-only increment (scenario 2) - average day operations

13 Bellfrog Greenacre
Air Quality Impact Assessment
Figure C.12

creating opportunities

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