Eastern Creek Recycling Ecology Park

Recycling Infrastructure Optimisation Project

Appendix K
Air Quality Impact Assessment

June 2022

Air quality impact assessment

Eastern Creek REP - Recycling Infrastructure Optimisation Project

Prepared for Arcadis (c/- Bingo Industries)
June 2022

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Air quality impact assessment

Eastern Creek REP - Recycling Infrastructure Optimisation Project

Report Number

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Client

Arcadis (c/- Bingo Industries)

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Executive Summary

Dial-A-Dump (EC) (DADEC) Pty Ltd, (the Applicant) (as owned by Bingo Industries Pty Ltd (Bingo) operate the Eastern Creek Recycling Ecology Park (REP), located at 1 Kangaroo Avenue, Eastern Creek (formerly known as the Genesis Waste Management Facility) ('the Proposal Site'). The current approval allows for a total throughput of 2 million tonnes per annum (Mtpa), of which up to 1 Mtpa may be landfilled (excluding residual chute waste) with the remaining 1 Mtpa processed for resource recovery. The Eastern Creek REP comprises of a number of resource recovery facilities and activities including:

- Two materials processing centres known as Materials Processing Centre 1 (MPC1) and Materials Processing Centre 2 (MPC2) which predominantly process dry construction and demolition (C&D) and commercial and industrial (C&I) waste

- A Segregated Materials Area (SMA) which is principally used for the receipt, processing dispatch and stockpiling of inert construction and demolition materials, such as sand, dirt, aggregate, concrete, bricks and asphalt.

The Eastern Creek REP is approaching the current 2 Mtpa throughput limit, with this limit to be reached within the next few years. The Applicant is therefore proposing to increase the total throughput of the Eastern Creek REP by 950,000 tonnes per annum (tpa) over two stages to a total 2.95 Mtpa and carry out minor infrastructure upgrades works across the Proposal Site (the Proposal). The Proposal aims to further unlock the potential of the strategically significant Eastern Creek REP, with benefits of scale and optimal location within the Sydney transport network to respond to market demand and the policies of both the NSW and Commonwealth governments for expanded and enhanced resource recovery infrastructure. The Proposal would consist of predominantly dry C&D and C&I waste, consistent with existing waste streams received at the Eastern Creek REP.

The Proposal is considered as State Significant Development (SSD) under Clause 23 (waste and resource management facilities) of Schedule 1 of the *State Environmental Planning Policy (Planning Systems) 2021*. As a result, this environmental impact statement (EIS) is seeking approval, under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of the proposed throughput increase and required supporting infrastructure. This Air Quality Impact Assessment has been prepared by EMM Consulting to support the preparation of the EIS and assess the Proposal's impact on local air quality.

ES1 Proposal overview

The Proposal would include the upgrade and construction of supporting infrastructure to optimise the current operation at Eastern Creek REP and facilitate the increased throughput proposed to be received at the Proposal Site. It is proposed to develop the Proposal Site in three stages:

- **Stage 1: Initial throughput increase:** Stage 1 would comprise 500,000 tpa of additional throughput to be received at the Eastern Creek REP to enhance resource recovery outcomes by increasing utilisation of onsite processing capabilities

- **Stage 2: Internal site optimisation:** Stage 2 would facilitate the remaining throughput increase (an additional 450,000 tpa of the total 950,000 tpa proposed) to be received and processed across the Eastern Creek REP and operation of one of two proposed new exit connections. Stage 2 would include:

  - The construction and operation of a new exit connection to the Honeycomb Drive extension and installation of two associated outbound weighbridges and a dedicated weighbridge office

  - The construction and operation of a new exit connection to Kangaroo Avenue in the north east of the Proposal Site and the installation of two associated outbound weighbridges and a dedicated weighbridge office
  - Upgrade of existing internal roads as required
  - Earthworks for Stage 3 site establishment
  - Additional carparking and amenities
- **Stage 3: Installation of supporting infrastructure:** Stage 3 would comprise the redevelopment of the north-eastern corner of the Proposal Site. This would comprise:
  - Construction and operation of a Site Workshop (relocating this activity from elsewhere within the Proposal Site to a dedicated enclosed facility)
  - Construction and operation of a skip bin Maintenance and Manufacturing Workshop
  - Installation of landscaping, signage, security fencing and finishing works.

ES2 Purpose of this assessment

This Air Quality Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) as they relate to air quality, including:

- a quantitative assessment of the potential air quality, dust and odour impacts of the development; and
- details of proposed mitigation, management and monitoring measures during both the construction and operation stages of the development.

The assessment presents a quantitative assessment of potential air quality impacts for both the construction and operation phases of the Proposal, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA 2017).

The Approved Methods defines sensitive receptors as "*A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area*". However, Section 5.2 of the Approved Methods also distinguishes "*particularly sensitive receptors*" as "*residences, schools and hospitals*".

Therefore, modelling results are presented separately for residential and commercial receptors, as the adjacent commercial receptors are less sensitive to air pollution than residential receptors. The reasons for this are two-fold. Firstly, for the key pollutants (PM_{10} and $PM_{2.5}$), the assessment criteria are expressed as 24-hour and annual averages and exposure does not occur at commercial receptors over these averaging periods. Secondly, exposure to air pollution for sensitive population groups (children, elderly) is less likely to occur at commercial receptors.

ES3 Stage 1 Operational impacts

There is no construction component for Stage 1, therefore no construction assessment is required. However, modelling results for Stage 1 operations include the dust emission contribution from Stage 2 construction, which is scheduled to occur at the same time as the proposed throughput increase for Stage 1. It is noted that the duration of the Stage 2 construction is approximately 18 months, therefore the modelling predictions for Stage 1 operations plus Stage 2 construction would only occur in the short-term. Modelling predictions for Stage 2 operations represent the longer-term operational conditions given this accounts for the total proposed throughput of 950,000 tpa.

a Residential receptors

For Stage 1 operations, there are no additional days above the 24-hour average impact assessment criterion for PM_{10} and no exceedances of the annual average impact assessment criterion for PM_{10} at residential assessment locations. There is one additional day above the 24-hour average impact assessment criterion for $PM_{2.5}$ for Stage 1 operations at residential assessment locations, however this additional day coincides with a high background concentration of 24.4 $\mu g/m^3$ (compared with a criterion of 25 $\mu g/m^3$). The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria and the contribution from the Stage 1 Proposal to annual average $PM_{2.5}$ is approximately 4% of the impact assessment criteria at residential receptors.

There are no exceedances of the annual average impact assessment criterion for total suspended particle matter (TSP) and dust deposition at residential assessment locations.

b Commercial receptors

The maximum number of additional days above the 24-hour average PM_{10} impact assessment criterion at a commercial assessment location is 28 for Stage 1 operations. It is noted that this is a short-term scenario as it includes the construction activities for Stage 2, and these additional days above the impact assessment criterion would only occur for one year. There are three commercial assessment locations above the annual average PM_{10} impact assessment criterion for Stage 1 operations. The maximum number of additional days above the 24-hour average $PM_{2.5}$ impact assessment criterion at a commercial assessment location is three for Stage 1 operations. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criterion.

There are no exceedances of the annual average impact assessment criterion for TSP and dust deposition at commercial assessment locations.

As described previously, adjacent commercial receptors are considered less sensitive to air pollution than residential receptors. The predicted exceedances of the impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore considered low risk, from both an exposure duration and human health risk point of view.

ES4 Stage 2 Construction impacts

Stage 2 construction activities are included with the Stage 1 operations assessment.

ES5 Stage 2 Operational impacts

a Residential receptors

For Stage 2 operations, there are no additional days above the 24-hour average impact assessment criterion for PM_{10} and no exceedances of the annual average impact assessment criterion for PM_{10} at residential assessment locations. There is one additional day above the 24-hour average impact assessment criterion for $PM_{2.5}$ at residential assessment locations, however this additional day coincides with a high background concentration of 24.4 $\mu g/m^3$ (compared with a criterion of 25 $\mu g/m^3$). The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria and the contribution from the Stage 2 Proposal to annual average $PM_{2.5}$ is approximately 4% of the impact assessment criteria at residential receptors.

c Commercial receptors

The maximum number of additional days above the 24-hour average PM_{10} impact assessment criterion at a commercial assessment location is five for Stage 2 operations and there is one commercial assessment location above the annual average impact assessment criterion for Stage 2 operations

The maximum number of additional days above the 24-hour average $PM_{2.5}$ impact assessment criterion at a commercial assessment location is two for Stage 2 operations. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criterion.

Although Stage 2 operations involve an increase in throughput from Stage 1, modelling results at adjacent commercial assessment locations are reduced compared to Stage 1, as the Stage 2 construction emissions are assumed to occur concurrently with Stage 1 operations only. The peak 24-hour average modelling results at some of the adjacent commercial assessment locations are also reduced compared to approved operations, even though the throughput increases. This is due to the reconfiguration/optimisation of the Eastern Creek REP, which acts to re-distribute dust emissions, particularly from trucks, by re-directing truck exit points to the Honeycomb Drive extension and Kangaroo Avenue in the northeast of the Proposal Site.

There are no exceedances of the annual average impact assessment criterion for TSP and dust deposition, at either residential or commercial assessment locations.

As described previously, adjacent commercial receptors are considered less sensitive to air pollution than residential receptors. The predicted exceedances of the impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore considered low risk, from both an exposure duration and human health risk point of view.

ES6 Stage 3 Construction impacts

Stage 3 construction involves activities with a low potential for dust emissions, and therefore no assessment of Stage 3 construction is required. All significant site establishment activities for the Proposal were considered as part of the Stage 2 construction (assessed concurrently with Stage 1 operations). There are no significant site establishment activities for Stage 3 that would require a standalone construction scenario for Stage 3.

ES7 Stage 3 Operational impacts

There is no throughput increase for Stage 3 operations, therefore modelling results presented for Stage 2 operations are also applicable for Stage 3 operations.

ES8 Peak day scenario

The dispersion modelling results presented in the preceding sections are considered to be a conservative representation of approved and expected operations at the Proposal Site. However, emissions are based on annual throughputs distributed over the entire 12-month modelling period, with no accounting for day to day variability in truck movements and material handling rates. In order to derive results for a theoretical peak day operational scenario, a multiplicative factor of 1.3 corresponding to 95th percentile traffic rates (consistent with Section 3.5) has been applied to the daily varying PM_{10} concentrations predicted by the dispersion modelling completed for Approved, Stage 1 (plus Stage 2 Construction) and Stage 2 operations.

To understand the implications of the theoretical peak day operations for Approved, Stage 1 (plus Stage 2 Construction) and Stage 2 operations, a cumulative frequency analysis has been undertaken at the two selected assessment locations. This analysis was completed by pairing all predicted 24-hour PM_{10} concentrations at either assessment location (366 predictions for 2016 modelling year) with all recorded background concentrations (as stated 1,791 total data points for PM_{10}). Therefore, at each assessment location, there are 655,506 combinations of background and model predicted impacts for 24-hour PM_{10}.

The coincident occurrence of a peak day operations rate with a potential criteria exceedance has been derived by the following:

> Likelihood of occurrence = (indicative days per year of peak day rate/365) x (number of additional days above cumulative criteria/365)

The results show that when the potential for additional cumulative concentrations above the NSW EPA impact assessment criteria is combined with the likely frequency of occurrence for peak day operations in a 12 month period, the likelihood of cumulative criteria exceedance is very low across the three presented scenarios.

While an increase is predicted for Stage 1 (plus Stage 2 Construction), the improvements at the Proposal Site for Stage 2 operations leads to a significant reduction in the likelihood of additional exceedance days when compared with Approved operations, indicating that the Proposal will have a positive influence on air quality impacts from the Proposal Site at surrounding receptors. This is especially the case for the worst affected commercial receptors surrounding the Proposal Site.

ES9 Odour impacts

A future cumulative odour emissions scenario for the Eastern Creek REP was prepared following the collection of site specific odour emissions monitoring at the Proposal Site in June 2022, accounting for existing odour sources as well as emissions from the approved Modification 10 (permanent landfill gas flares) and proposed Modification 9 (relocation of the timber yard and green waste storage area). The odour emissions inventory developed is considered highly conservative as the future improvements in landfill gas extraction are not accounted for in the fugitive odour emission rates applied.

The results of the odour dispersion modelling indicate that the applicable odour goal would be met at all surrounding residential and commercial locations. The expected future improvements in landfill gas extraction associated with the approved Modification 10 mean that the odour results derived are an upper estimate of likely future odour from the Eastern Creek REP.

It is noted that the Proposal will result in a small increase in chute waste to the landfill. It is also noted that chute waste would not be high in organic matter and therefore unlikely to contribute to an increase in LFG generation. The results of the odour modelling conducted support this statement.

ES10 Mitigation measures

Existing and proposed dust controls for the Proposal Site were incorporated into the emission inventory developed for this assessment. A Best Management Practice (BMP) Determination has demonstrated that dust control methods in place at the Proposal Site are consistent with documented best practice dust control measures for the resource recovery and waste industry.

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1 Introduction

Dial-A-Dump (EC) (DADEC) Pty Ltd, (the Applicant) (as owned by Bingo Industries Pty Ltd (Bingo) operate the Eastern Creek Recycling Ecology Park (REP), located at 1 Kangaroo Avenue, Eastern Creek (formerly known as the Genesis Waste Management Facility) ('the Proposal Site'). The current approval allows for a total throughput of two million tonnes per annum (Mtpa), of which up to 1 Mtpa may be landfilled (excluding residual chute waste) with the remaining 1 Mtpa processed for resource recovery. The Eastern Creek REP comprises of a number of resource recovery facilities and activities including:

- two materials processing centres known as Materials Processing Centre 1 (MPC1) and Materials Processing Centre 2 (MPC2) which predominantly process dry construction and demolition (C&D) and commercial and industrial (C&I) waste; and

- a Segregated Materials Area (SMA) which is principally used for the receipt, processing dispatch and stockpiling of inert construction and demolition materials, such as sand, dirt, aggregate, concrete, bricks and asphalt.

The Eastern Creek REP is approaching the current 2 Mtpa throughput limit, with this limit to be reached within the next few years. The Applicant is therefore proposing to increase the total throughput of the Eastern Creek REP by 950,000 tonnes per annum (tpa) and carry out minor infrastructure upgrades works across the Proposal Site (the Proposal). The Proposal aims to further unlock the potential of the strategically significant Eastern Creek REP, with benefits of scale and optimal location within the Sydney transport network to respond to market demand and the policies of both the NSW and Commonwealth governments for expanded and enhanced resource recovery infrastructure. The Proposal would consist of predominantly dry C&D and C&I waste, consistent with existing waste streams received at the Eastern Creek REP.

The Proposal is considered as State Significant Development (SSD) under Clause 23 (waste and resource management facilities) of Schedule 1 of the *State Environmental Planning Policy (Planning Systems) 2021*. As a result, this environmental impact statement (EIS) is seeking approval, under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of the proposed throughput increase and required supporting infrastructure. This Air Quality Impact Assessment has been prepared by EMM Consulting to support the preparation of the EIS and assess the Proposal's impact on local air quality.

1.1 Proposal overview

Bingo are proposing to enhance resource recovery outcomes across the Greater Sydney area by increasing throughput at the Eastern Creek REP to capitalise on the underutilised state-of-the-art processing facilities (namely MPC2), and plant and equipment within the Eastern Creek REP. The Proposal would include the upgrade and construction of supporting infrastructure to optimise the current operation at Eastern Creek REP and facilitate the increased throughput proposed to be received at the Proposal Site. It is proposed to develop the Proposal Site in three stages

- **Stage 1: Initial throughput:** Stage 1 would comprise 500,000 tpa of additional throughput to be received at the Eastern Creek REP to enhance resource recovery outcomes by increasing utilisation of onsite processing capabilities.

- **Stage 2: Internal site optimisation:** Stage 2 would facilitate the remaining throughput increase (an additional 450,000 tpa of the total 950,000 tpa proposed) to be received and processed across the Eastern Creek REP and operation of one of two proposed new exit connections. Stage 2 would include:

- the construction and operation of a new exit connection to the Honeycomb Drive extension and installation of two associated outbound weighbridges and a dedicated weighbridge office;
- the construction and operation of a new exit connection to Kangaroo Avenue in the north east of the Proposal Site and the installation of two associated outbound weighbridges and a dedicated weighbridge office;
- Upgrade of existing internal roads as required
- earthworks for Stage 3 site establishment; and
- additional carparking and amenities.

- **Stage 3: Installation of supporting infrastructure:** Stage 3 would comprise the redevelopment of the north-eastern corner of the Proposal Site. This would comprise:
  - construction and operation of a Site Workshop (relocating this activity from elsewhere within the Proposal Site to a dedicated enclosed facility);
  - construction and operation of a skip bin Maintenance and Manufacturing Workshop; and
  - installation of landscaping, signage, security fencing and finishing works.

1.1 Site location

The Eastern Creek REP key operational area comprises two parcels of land totalling around 54 hectares (ha) at 1 Kangaroo Avenue, Eastern Creek (Lot 1 DP1145808 and Lot 2 DP1247691), shown in Figure 1-1. The Proposal Site is located within the Blacktown Local Government Area (LGA), however, is not zoned under *the Blacktown Local Environmental Plan 2015* (Blacktown LEP) as it falls within the boundary of the *State Environmental Planning Policy (Industry and Employment) 2021*. The Eastern Creek REP falls under the requirements of the *Eastern Creek Precinct – Employment Lands Precinct Plan* (Precinct Plan) prepared under the repealed *State Environmental Planning Policy No 59-Central Western Sydney Economic and Employment Area* (SEPP 59).

The Proposal Site is located within the Eastern Creek industrial precinct / M7 business hub and is surrounded by a large range of industrial developments, primarily to the east. These industrial developments include Techtronic Industries, H&M distribution warehouse, Kuehne + Nagel (Australia) Pty Ltd warehouse, Kmart distribution centre, Bunnings distribution centre and DB Schenker warehouse. To the west of the Eastern Creek REP is the Fulton Hogan asphalt batching plant and a vacant area of undeveloped land.

The Eastern Creek REP is bounded by the Western Motorway (M4) to the north, Kangaroo Avenue to the east and Honeycomb Drive and then Wonderland Drive and Wallgrove Road to the south. The planned future Archbold Road extension will run parallel to the western boundary of the Proposal Site (Transport for NSW (TfNSW), 2019). The Eastern Creek REP is enclosed by commercial and industrial buildings to the immediate north, east and south. The closest residential receivers are located across the M4 Motorway approximately 400 m to the north in the suburb of Minchinbury and approximately 1.2 km west in the suburb of Erskine Park.

Existing access to the Eastern Creek REP is from Kangaroo Avenue which connects to Honeycomb Drive and then Wonderland Drive and Wallgrove Road to the south and provides access to the broader arterial road network including the M4 and M7 motorways.

The surrounding area has generally low relief with no major hills or ridgelines, other than amenity berms adjacent to the landfill that were created from quarry overburden. Angus Creek, a small ephemeral drainage line is located immediately east of the Eastern Creek REP (between the landfill area and Kangaroo Avenue) which drains to the north into Eastern Creek. There are several other ephemeral drainage lines west of the Eastern Creek REP which drain towards Ropes Creek, which is approximately 580 m west of the Eastern Creek REP.

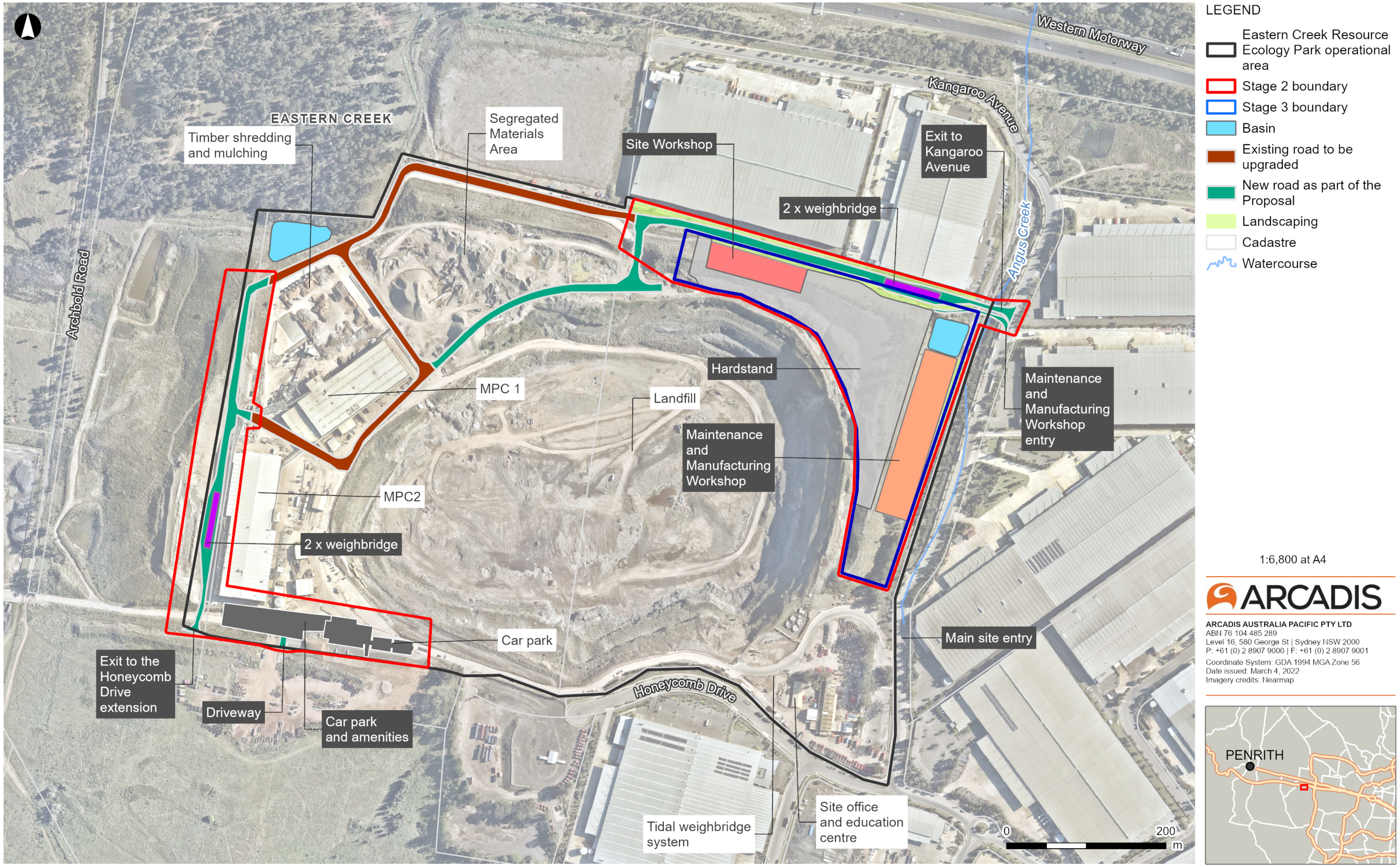

Figure 1-1 Overview of the Proposal

1.2 Site history

During the 1800s, the Eastern Creek REP site was used for both agricultural and breccia quarrying purposes. The quarrying activities had expanded by the 1930s and were then operated by the Ray Fitzpatrick Quarriers in the 1950s. Quarrying activities continued until September 2006, with the final quarry void estimated to be 12 million cubic metres (m^3).

In November 2009, Dial-A-Dump Industries (DADI) acquired the Eastern Creek REP site and gained approval for the construction and operation of the Genesis Xero Waste Management Facility (WMF) (now named the Eastern Creek REP) (MP 06_0139), comprising a resource recovery facility and non-putrescible landfill with a material handling capacity of 700,000 tpa. This facility commenced operations in 2012.

Bingo acquired DADI in February 2019, including all its NSW waste and recycling assets. Bingo took over the operation of the Eastern Creek REP following completion of the acquisition process.

The Eastern Creek REP was originally approved (MP 06_0139) under Part 3A (now repealed) of the EP&A Act in 2009 and commenced operations in 2012 (Project Approval). Following the repeal of Part 3A of the EP&A Act on 1 October 2011, the project was subject to the transitional arrangements provided by the *Environmental Planning and Assessment Regulations 2000* (EP&A Regs). The transitional arrangements provided by EP&A Regs have now ceased, and the project was transitioned to a State Significant Development (SSD) on 2 October 2020.

Since the original project approval, eight modifications have been subsequently submitted and approved, the most recent of which was approved in March 2022. Most recently, Modification 10 which pertains to the installation a gas collection system and permanent landfill gas flares to support the operations of the Eastern Creek REP.A further modification was submitted to the Department of Planning Industry and Environment now the Department of Planning and Environment (DPE) in March 2017 but was subsequently withdrawn. One modification to MP06_139 is also currently being sought. Modification 9 seeks to expand the operational area of the Eastern Creek REP into part Lot 2 DP1145808. The Proposal would constitute a standalone SSD application.

1.3 Purpose of this report

This Air Quality Impact Assessment supports the EIS for the Proposal and has been prepared as part of an SSD Application for which approval is sought under Part 4, Division 4.7 of the EP&A Act. This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSD 11606719) for the Proposal, issued by NSW Department of Planning, Industry and Environment (DPIE) now the Department of Planning and Environment on 1 October 2021.

Table 1.1 provides a summary of the relevant SEARs which relate to air quality and where these have been addressed in this report.

Table 1.1 SEARs

SEARS	Where addressed
Air Quality and Odour – including:	
a quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines. This is to include identification of existing and potential future sensitive receivers and consideration of cumulative local and regional impacts	A quantitative assessment of air quality impacts is presented in this report, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
the details of buildings and air handling systems and strong justification (including quantitative evidence) for any material handling, processing or stockpiling external to buildings; and	Section 10.1
details of proposed mitigation, management and monitoring measures during both the construction and operation stages of the development. This is to include strong justification for continued implementation of existing measures and any additional measures proposed as part of the development.	Section 3.3 and Section 10

Further to the above, Blacktown City Council and NSW Environment Protection Authority (EPA) provide specific requirements relating to their authority. These requirements are discussed throughout the report as indicated in Table 1.2.

Table 1.2 Local and state authority requirements and relevant report section

Agency requirements for Air Quality Assessment	Where addressed
Blacktown City Council	
Submission of a detailed air quality report for both the construction and operational phases	A quantitative assessment of air quality impacts is presented in this report, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
NSW EPA	
The EIS should include a detailed Air Quality Impact Assessment (AQIA) for construction and operation of the project in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. The AQIA should:	A quantitative assessment of air quality impacts is presented in this report, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
demonstrate how the development will comply with the relevant regulatory framework specifically, the POEO Act and the POEO (Clean Air) Regulation (2010)	Section 2.1
include a cumulative local and regional air quality impact assessment, including odour.	Cumulative assessment is presented Section 5, 6 and 7. Odour is addressed in Section 3.6
The EIS should also include how risks of air pollution will be managed and monitored during the operations and construction stages to meet best practice performance expectations and avoid offsite impacts.	Section 10

2 Assessment approach

This section outlines the air quality policy framework and assessment approach for the Proposal.

2.1 Policy framework

The statutory framework for managing air emissions in NSW is provided in the Protection of the Environment Operations Act[1] 1997 (POEO Act). The primary regulations for air quality made under the POEO Act are:

- Protection of the Environment Operations (Clean Air) Regulation 2010[2]; and
- Protection of the Environment Operations (General) Regulation 2009[3].

As a scheduled activity under Schedule 1 of the POEO Act, the Eastern Creek REP operates under two existing environment protection licences (EPLs), as follows:

- EPL No. 13426, for the operation of the landfill; and
- EPL No. 20121, for the operation of the recycling facilities.

Bingo is required to comply with the conditions outlined in EPL 13426 and 20121, including limits, environmental monitoring and reporting requirements and operating conditions, and would continue to do so under the Proposal.

In addition, best management practice (BMP) is a guiding principle in the POEO Act and requires that all necessary practicable means are used to prevent or minimise air pollution in NSW. A BMP determination has been made for the Proposal and is presented in Section 10.2.1, having regard to all reasonable and feasible avoidance and mitigation measures.

2.2 Assessment methodology

The assessment presents a quantitative assessment of potential air quality impacts for both the construction and operation phases of the Proposal, prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA 2017). The assessment follows a Level 2 assessment approach, including the following tasks:

- emissions are estimated for all activities using best practice emission estimation techniques;
- dispersion modelling, using a regulatory dispersion model, is used to predict ground level concentrations for key pollutants at assessment locations;
- cumulative impacts are considered by taking into account the combined effect of existing baseline air quality, other local sources of emissions, reasonably foreseeable future emissions and any indirect or induced effects; and
- air quality impacts are evaluated by comparing against impact assessment criteria presented in NSW EPA 2017.

[1] http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N

[2] http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+428+2010+cd+0+N

[3] http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+211+2009+cd+0+N

2.2.1 Identified emissions to air

The key emissions sources and pollutants applicable to the construction and operation of the Proposal include:

- fugitive dust from waste and products handling and processing, movement of plant and equipment and wind erosion of exposed surfaces, comprising:
  - total suspended particulate matter (TSP);
  - particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}); and
  - particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).
- diesel exhaust emissions from construction equipment, comprising:
  - $PM_{2.5}$;
  - oxides of nitrogen (NO_x)[4], including nitrogen dioxide (NO_2);
  - sulphur dioxide (SO_2);
  - carbon monoxide (CO); and
  - volatile organic compounds (VOCs).

Gaseous air pollutant emissions generated by plant and equipment do not generally result in significant off-site concentrations relative to ambient air quality goals. Accordingly, with the exception of PM, diesel combustion emissions have not been quantitatively assessed.

2.2.2 Assessment criteria

The NSW EPA's impact assessment criteria for particulate matter, as documented in Section 7 of the *Approved Methods for Modelling* (NSW EPA 2017), are presented in Table 2.1. The assessment criteria are applied at the nearest existing or likely future sensitive receptor.

NSW EPA (2017) 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*".

The assessment locations are presented in Section 2.3 and include sensitive receptors such as dwellings, and other assessment locations such as nearby commercial premises.

[4] By convention, NOx = Nitrous oxide (NO) + NO_2.

Table 2.1 Impact assessment criteria – 'criteria' pollutants

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

Notes: µg/m^3: micrograms per cubic meter

TSP, which relates to airborne particles less than around 50 µm in diameter, is used as a metric for assessing amenity impacts (eg reduction in visibility, dust deposition and soiling of buildings and surfaces) rather than health impacts (NSW EPA 2013). Dust deposition impacts are derived from TSP emission rates and particle deposition calculations in the dispersion model.

PM_{10} and $PM_{2.5}$ are a subset of TSP and are fine enough to enter the human respiratory system and can therefore 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 impacts of airborne particulate matter on human health.

The following must be reported for the pollutants in Table 2.1:

- the incremental impact (ie the predicted impact due to the project alone); and
- the cumulative impact (ie the incremental impact plus the existing background concentration). Guidance on the selection of background concentrations is provided in the Approved Methods for Modelling.

In the case of the short-term criteria (24-hour PM_{10} and 24-hour $PM_{2.5}$), the total prediction must be reported as the 100th percentile (ie the highest) value. At some locations, the background concentrations can exceed the impact assessment criteria. This is most commonly the case for PM_{10} and $PM_{2.5}$, which are affected by events such as bushfires and dust storms. In such circumstances, there is a requirement to 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.

2.2.3 Odour

Odour goals are expressed as "odour units" (ou)[5]. The odour nuisance level can be as low as 2 ou and as high as 10 ou (for less offensive odours), whereas an odour assessment criterion of 7 ou is likely to represent the level below which 'offensive' odours should not occur. The Technical Framework for Assessment and Management of Odour from Stationary Sources in NSW (NSW DECC 2006) recommends that, as a design criterion, no individual should be exposed to ambient odour levels of greater than 7 ou. The EPA (2017) prescribes odour goals which take into account the population density for a particular area. The most stringent odour goal of 2 ou is acceptable for the whole population and therefore appropriate for built-up areas, such as the residential areas surrounding the Proposal.

[5] An odour units is the unit of measurement for dynamic olfactometry, and is effectively a "dilution to threshold" (ie number of dilutions required to get to the odour threshold).

Consistent with the AQIA completed for Modification 6 of the Eastern Creek REP (Ramboll 2018), an odour goal of 7 ou is applied at neighbouring commercial/industrial receptors.

2.3 Assessment locations

The Approved Methods defines sensitive receptors as "*A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area*". However, Section 5.2 of the Approved Methods also distinguishes "*particularly sensitive receptors*" as "*residences, schools and hospitals*".

Therefore, modelling results are presented separately for residential and commercial receptors, as the adjacent commercial receptors are less sensitive to air pollution than residential receptors. The reasons for this are two-fold. Firstly, for the key pollutants (PM_{10} and $PM_{2.5}$), the assessment criteria are expressed as 24-hour and annual averages and exposure does not occur at commercial receptors over these averaging periods. Secondly, exposure to air pollution for sensitive population groups (children, elderly) is less likely to occur at commercial receptors.

As described in Section 1.1, the Eastern Creek REP is surrounded by commercial and industrial buildings to the immediate north, east and south. The closest residential receivers are located across the M4 Motorway approximately 400 m to the north in the suburb of Minchinbury and approximately 1.2 km west in the suburb of Erskine Park. The locations of the nearest residential and commercial assessment locations is presented in Figure 2-1.

Assessment locations representative of these locations have been identified. Predicted project increment and cumulative ground level concentrations (GLCs) are tabulated for each assessment location in Section 5 and Section 6.

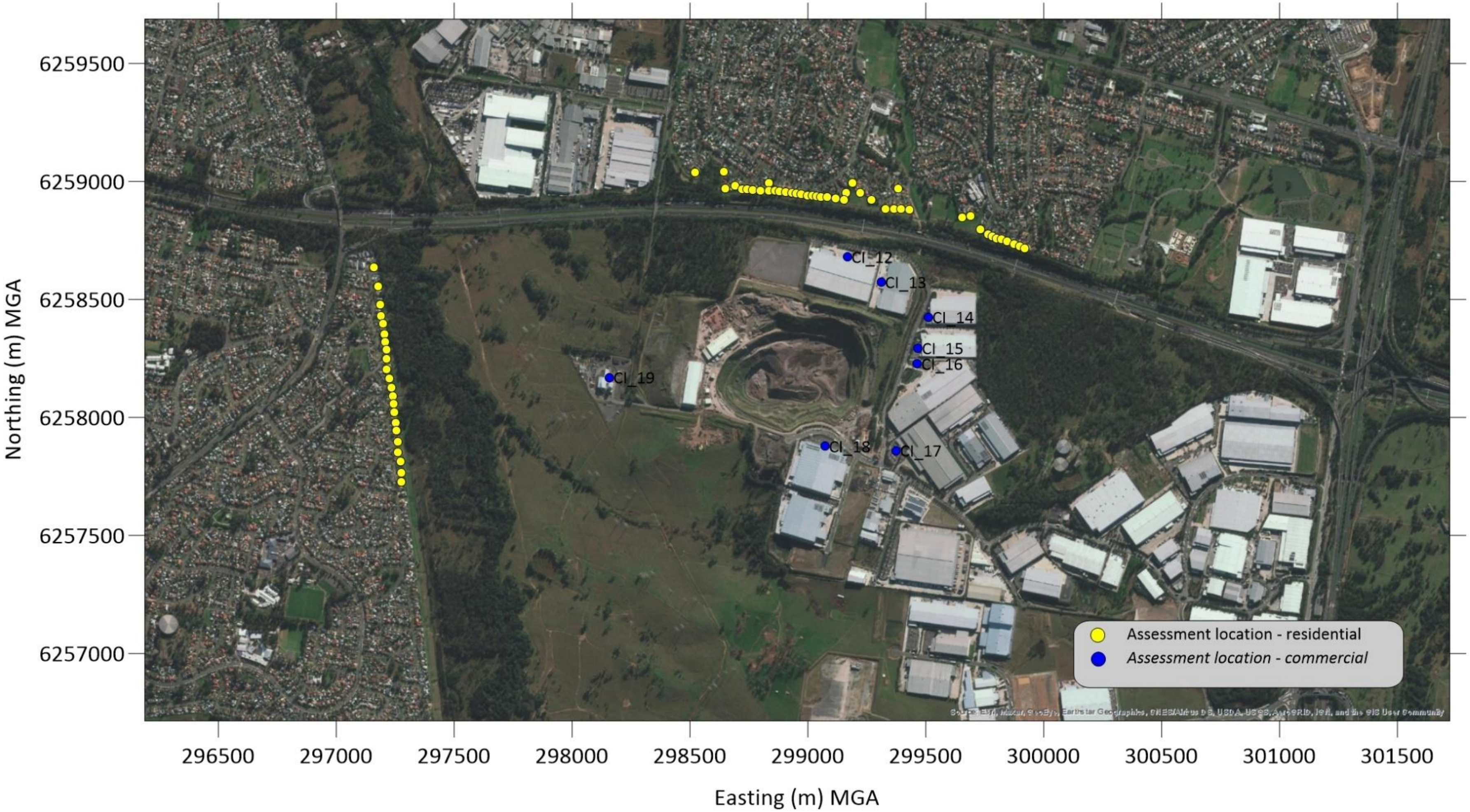

Figure 2-1 Locations of nearest commercial and residential receptors

2.4 Dispersion modelling approach

2.4.1 Dispersion meteorology

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. To adequately characterise the dispersion meteorology of a region, information is needed on the prevailing wind regime, ambient temperature, rainfall, relative humidity, mixing depth and atmospheric stability.

The atmospheric dispersion modelling for this assessment uses the CALMET/CALPUFF model. The CALMET meteorological model was originally configured and run for Modification 6 (the hours of operation and landfill cap modification) Project Approval (MP 06_0139). The CALMET modelling was described and evaluated in the Mod 6 air quality impact assessment (Ramboll 2018) and accepted by the EPA as adequate following the Mod 6 response to submission report (EMM, 2019).

Since the completion of the Mod 6 modelling, Bingo has installed an onsite automatic weather station (AWS). However, at the time of modelling, a complete year of onsite measurements was not yet available for dispersion modelling.

To determine if the existing CALMET model remains representative, wind roses for the period 2012 to 2020 are presented in Appendix A (Figure A.1, Figure A.2 and Figure A.3), for the closest Department of Planning and Environment (DPE) and Bureau of Meteorology (BoM) monitoring sites, as follows:

- St Marys air quality monitoring stations (AQMS) – located approximately 6 km west of the Proposal Site;
- Prospect air quality monitoring stations (AQMS) – located approximately 8 km east of the Proposal Site; and
- Horsley Park Equestrian Centre automatic weather station (AWS)– located approximately 6 km southeast of the Proposal Site.

The wind roses presented in Figure A.1, Figure A.2 and Figure A.3 demonstrates consistency in wind direction, average wind speed and percentage occurrence of calm winds (less than or equal to 0.5 m/s) across all years at all sites.

The high degree of consistency in winds indicates that 2016 remains representative of longer-term conditions. It is noted that the representativeness of the selected year is particularly important for wind conditions, which has the greatest influence on dispersion. The CALMET modelling is described in Ramboll (2018) and summarised in Appendix A.

2.4.2 Model evaluation

CALMET is a non-steady state model which generates a temporal and spatial varying wind field across the modelling domain; therefore, no single wind rose is representative of the dispersion conditions used by the model. However, an evaluation of CALMET performance was presented in Ramboll (2018), by comparing predicted CALMET winds with observations at the Badgerys Creek AWS and comparing CALMET winds at Proposal Site with observations at the Prospect AQMS (approximately 8 km east of the Proposal Site). Neither Badgerys Creek nor Prospect were included as observation sites in the modelling.

The comparison of predicted CALMET winds with observations at Badgerys Creek demonstrated comparable wind directions, wind speeds and percentage occurrence of calm winds and concluded that the model predicts regional wind conditions with a suitable level of accuracy.

The comparison of predicted CALMET winds at the Proposal Site with observations at the Prospect AQMS demonstrated a similar wind direction pattern, with winds recorded from most directions and a slightly higher frequency of occurrence from the southwest quadrant at both sites. Prospect records a slightly higher frequency of occurrence from the north and northwest quadrant. Annual average wind speeds were comparable (1.5 m/s and 1.8 m/s) while the percentage occurrence of calm winds is higher at the Proposal Site (19%) compared to Prospect (10%). The wind rose comparison is presented in Appendix A (Section A.2).

A wind rose comparing the recent onsite measurements (December 2020 to October 2021) with the predicted CALMET winds at the Proposal Site and the Prospect AQMS is presented in Figure 2-2. The onsite measurement displays similar wind directions and mean wind speeds to the Prospect AQMS. The percentage occurrence of calms winds (less than 0.5 m/s) measured onsite (4.3%) is lower than Prospect (10.3%).

The CALMET predicted onsite wind rose displays winds from all directions, similar to the onsite and Prospect observations, albeit with a less dominant northerly and south-westerly component. The CALMET mean wind speed (1.5 m/s) is slightly lower than the onsite measurement (2.2 m/s) and the percentage occurrence of calms winds (less than 0.5 m/s) is significantly higher for CALMET (19.1 %).

The generally higher wind speeds and lower frequency of calm winds in the onsite data means that the actual dispersion potential is higher than what is modelled. In other words, the existing CALMET model provides a conservatively high prediction of potential impact, due to the higher occurrence of conditions associated with poor dispersion.

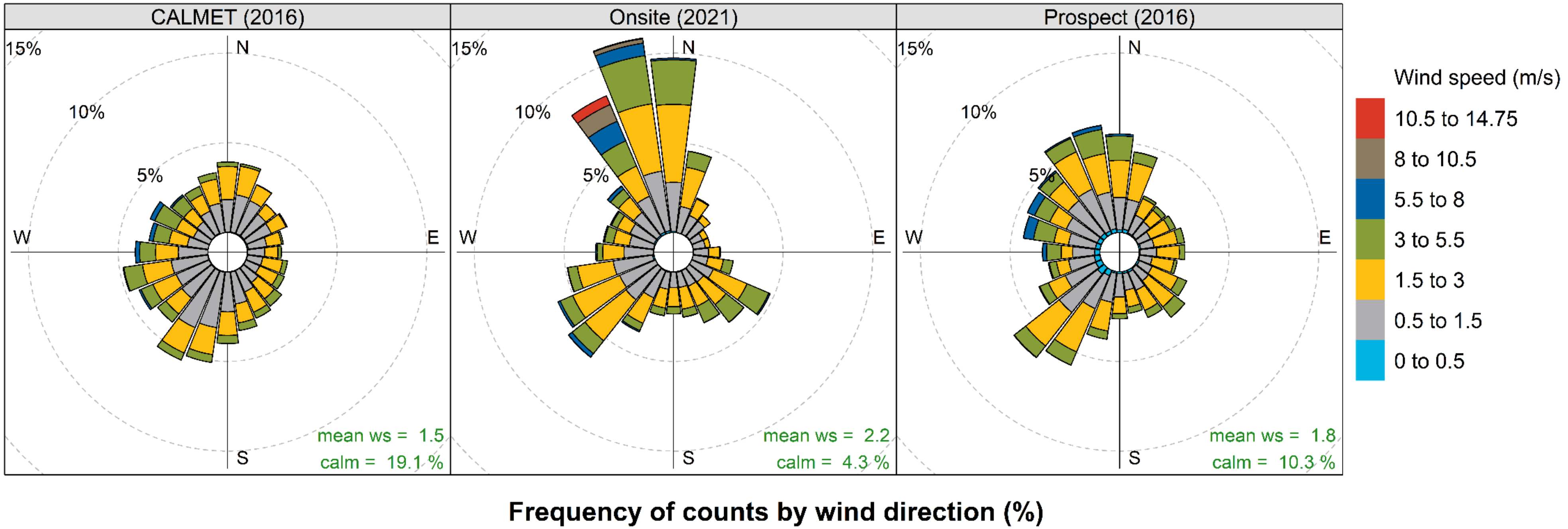

Figure 2-2 Comparison between onsite winds and CALMET predicted winds

2.4.3 CALPUFF modelling

Dispersion modelling for this assessment uses the CALPUFF modelling system, which is commonly used in NSW for applications where non-steady state conditions may occur (ie complex terrain or coastal locations) or when calm wind conditions are important (ie for odour assessment). CALPUFF is particularly useful where there are limited onsite observations and the CALMET meteorological field is derived by incorporating regional observations and local terrain effects.

Fugitive dust emission sources are represented in the model by volume and area sources, as follows:

- Truck movements are represented by a series of volume sources, positioned along the main haulage routes. These volume sources are assigned a horizonal and vertical spread of ~15 m and ~2.4 m respectively.
- The MPC buildings are represented by a series of volume sources, positioned along the centre of the building. These volume sources are assigned a horizonal and vertical spread of ~25 m and ~1.0 m respectively.
- Material handling at the landfill is represented by a series of volume sources, positioned across the landfill surface and assigned a horizonal and vertical spread of ~9 m and ~0.2 m;
- Material handling at the SMA is represented by a series of volume sources, positioned across the SMA area and assigned a horizonal and vertical spread of ~18 m and ~0.5 m;
- Crushing and screening at the SMA is represented by a volume source and assigned a horizonal and vertical spread of ~18 m and ~1.0 m;
- Wind erosion from exposed ground at the landfill and SMA is modelled as an area source, each covering an area of approximately 5 ha with an effective release height and initial vertical spread of 0 m and 0.1 m.

The predicted project increment and cumulative ground level concentrations (GLCs) are tabulated for 73 assessment locations (residential and commercial, as shown in Figure 2-1. Ground level concentrations (GLCs) are also predicted over a sampling grid of 6 km by 6 km with a 250 m spacing and used to generate contour plots.

3 Emission inventory

3.1 Modelling scenarios

Modelling is presented for three scenarios, as follows, with the throughput assumptions for each scenario summarised in **Table 3.1**.

- Approved operations, based on 1 Mtpa of landfilling and 1 Mtpa for resource recovery (total of 2 Mtpa);
- Stage 1 operations, based on 1 Mtpa of landfilling and an additional 0.5 Mtpa for resource recovery (total 2.5 Mtpa);
- Stage 2 operations, based on 1 Mtpa of landfilling and an additional 0.45 Mtpa for resource recovery (total 2.95 Mtpa);
- Stage 2 construction, which involves removal of approximately 1.2 Mtpa from the existing earth bunds in the northeast and southwest corners of the Proposal Site; and
- Peak day scenario to account for days when site throughput may be higher than a typical average day.

All significant site establishment activities occur during Stage 2 construction, which would coincide with Stage 1 operations. Emissions for Stage 2 construction are included with the Stage 1 operations scenario. There are no significant site establishment activities for Stage 3 that would require a standalone construction scenario for Stage 3.

Stage 3 operation of the Proposal relates to the proposed supporting infrastructure in the northeast corner of the site and has no associated increase in throughput or emissions. Therefore, no additional operational scenario is required for Stage 3 (ie no change from Stage 2 in terms of operational emissions). Stage 3 construction involves activities with a low potential for dust emissions (constructing workshops, maintenance sheds, signage, fencing etc) and therefore is not assessed as an additional scenario.

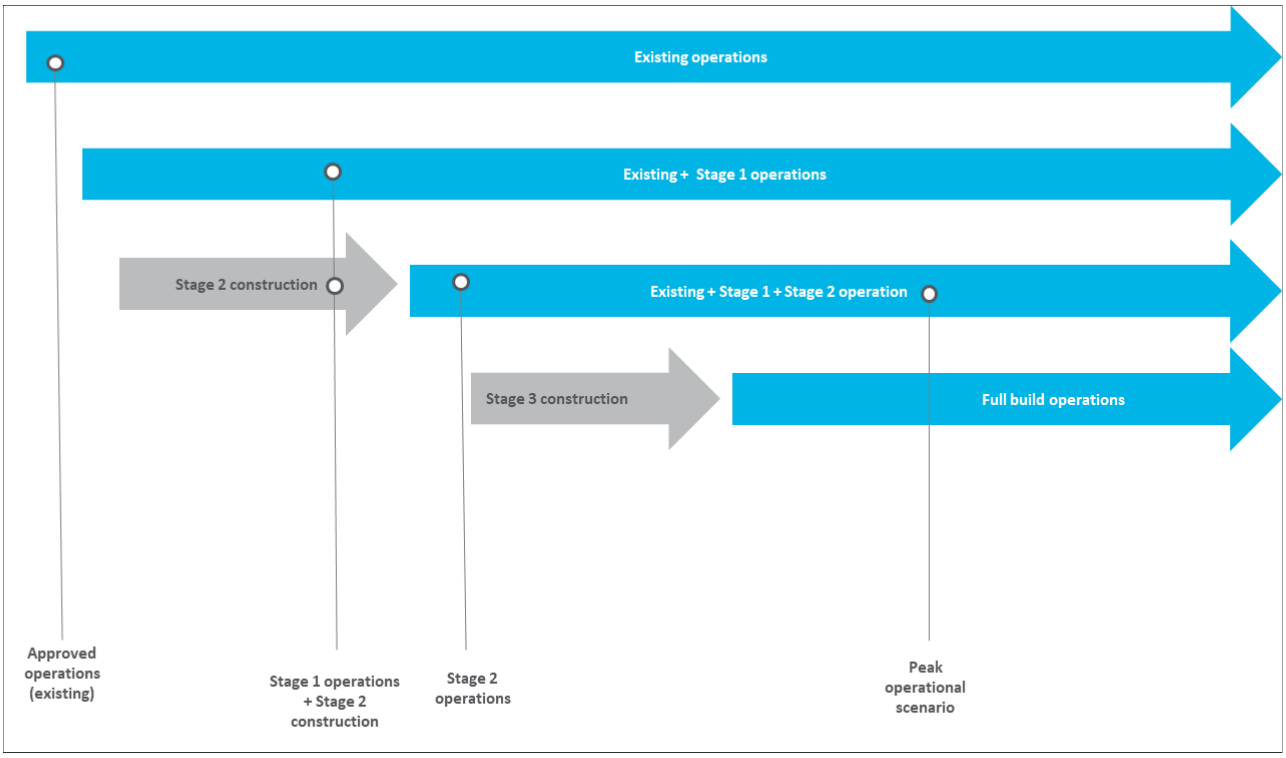

Figure 3-1 Assessment scenarios

Table 3.1 Throughput assumptions for each modelling scenario

Destination	Approved (tpa)	Stage 1 (tpa)	Stage 2 (tpa)	Stage 3 (tpa)
Total waste in	2,000,000	2,500,000	2,950,000	2,950,000
Landfill limit	1,000,000	1,000,000	1,000,000	1,000,000
Resource Recovery (RR) Limit	1,000,000	1,500,000	1,950,000	1,950,000
Waste direct to landfill	1,000,000	1,000,000	1,000,000	1,000,000
Waste to MPC1	Approx. 40% of RR limit	Approx. 30% of RR limit	Approx. 20% of RR limit	Approx. 20% of RR limit
- MPC1 rejected offsite	Approx. 5% of MPC1	Approx. 5% of MPC1	Approx. 5% of MPC1	Approx. 5% of MPC1
- MPC1 processed	Approx. 80% of MPC1	Approx. 80% of MPC1	Approx. 80% of MPC1	Approx. 80% of MPC1
- MPC1 residual to chute	Approx. 15% of MPC1	Approx. 15% of MPC1	Approx. 15% of MPC1	Approx. 15% of MPC1
Waste to MPC2	Approx. 40% of RR limit	Approx. 50% of RR limit	Approx. 65% of RR limit	Approx. 65% of RR limit
- MPC2 rejected offsite	Approx. 5% of MPC2	Approx. 5% of MPC2	Approx. 5% of MPC2	Approx. 5% of MPC2
- MPC2 processed	Approx. 80% of MPC2	Approx. 85% of MPC2	Approx. 85% of MPC2	Approx. 85% of MPC2
- MPC2 residual to chute	Approx. 15% of MPC2	Approx. 10% of MPC2	Approx. 10% of MPC2	Approx. 10% of MPC2
Waste direct to SMA	Approx. 20% of RR limit	Approx. 20% of RR limit	Approx. 15% of RR limit	Approx. 15% of RR limit

3.2 Activities and sources

Fugitive dust emission inventories are developed for the following operation activities:

- wheel generated dust from trucks travelling on paved internal roads (waste and product trucks);
- trucks unloading waste at the MPC1, MPC2 and SMA;
- waste sorting, handling and conveying at the MPC1 and MPC2;
- processing (crushing, screening, shredding) and handling at the SMA;
- wheel generated dust from trucks travelling into the landfill on unpaved internal roads (waste trucks);
- unloading waste at the landfill and handling, spreading and compacting;
- loading product trucks at the SMA;
- wind erosion from exposed ground (landfill and SMA); and
- diesel emissions from onsite plant and equipment.

Construction dust emissions were estimated for the excavation, handling and transport of material from the existing amenity berms in the northeast and southwest corners of the Proposal Site. For emission estimation, approximately 160,000 tonnes of material will be re-used as fill material for construction with the remaining either used as daily cover (approximately 260,000 tonnes) or removed offsite (approximately 775,000 tonnes). Material from the excavation of the amenity berms is loaded to trucks and hauled to the construction areas, landfill or offsite.

Fugitive dust emissions were quantified using US EPA AP-42 emission factor equations (US EPA 1995). A description of the AP-42 emission factor equations, assumptions and inputs used for the development of the emissions inventory are provided in Appendix B.

3.3 Dust controls

Dust mitigation measures have been incorporated into the emission inventory based on emission reduction factors reported by the US EPA AP-42, the National Pollution Inventory (NPI) (NPI 2011) and Katestone (2011). The existing and proposed dust controls accounted for in the emissions estimates are discussed as follows:

- All internal travel routes are paved, except for the ramp into the landfill. Testing of the silt loading for internal roads was completed as part of this study and was found to range from 0.2 g/m^2 (at the site entrance) to 7.8 g/m^2 near MPC1. For emission estimation, various sections of the paved roads were given a weighted average silt loading based on the various measurements. For example, for trucks travelling from the Proposal Site entrance to the weighbridge, a weighted average silt loading of 2.3 g/m^2 was applied (weighted average of 0.2 g/m^2 (measurement at site entrance) and 2.8 g/m^2 (measurement at weighbridge). Further details are provided in Appendix B.
- The measurements of silt loading were taken before any road sweeping or cleaning was applied. An additional control of 70% was applied for road surface sweeping/cleaning which means that the Proposal Site would commit to maintaining internal road surfaces with a silt loading of approximately 1-2 g/m^2. It is also noted that as part of the ongoing improvements at the Proposal Site, all damaged paved surfaces are to be re-paved and upgraded, which will in turn make them easier to control.

- For unpaved haulage into the landfill, a control efficiency of 90% is applied, based on a combination of watering (75%), a reduced speed for travel down the ramp (44%) and wind sheltering from the pit shell (30%), consistent with the assumptions used in the air quality assessment submitted for the Mod 6 approval.
- For all material handling within the MPC1 and MPC2, a control efficiency of 85% is applied, based on a combination of enclosed (70%), and misting sprays at each opening (50%).
- For all activities within the landfill, a control efficiency of 65% is applied, based on a combination of water canon (50%) and wind sheltering (30%).
- For crushing/screening within the SMA, a control efficiency of 50% is applied for watering.
- For wind erosion within the SMA, a control efficiency of 50% is applied for water sprays on product storage areas.

An evaluation of the existing/proposed dust controls against best management practice (BMP) is presented in Section 10.

3.4 Summary of fugitive dust emissions

A summary of the estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions for each Scenario is presented in Table 3.2 and Figure 3-2. The estimated emissions for each activity are presented in Table B.2 (Approved operations), Table B.3 (Stage 1 operations), Table B.4 (Stage 2 operations) and Table B.5 (Stage 3 construction).

It is noted that concurrent to this assessment, Bingo have sought approval for the installation and operation of a landfill gas collection network and associated flares (Modification 10). Annual particulate matter emissions from the proposed flares (3,342.8 kg/annum of particulate matter as $PM_{2.5}$ from two flare units), as quantified by Northstar (2021) have been included in the Stage 1 and Stage 2 operational scenarios.

Table 3.2 Calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions for each scenario

Emission source	Calculated annual emissions (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$
Approved operations	48,776	13,278	1,915
Stage 1 construction	NA	NA	NA
Stage 1 operations	64,469	19,716	5,717
Stage 2 construction	27,746	7,720	936
Stage 2 operation	65,293	20,437	5,675
Stage 3 construction	NA	NA	NA
Stage 3 operation	Same as Stage 2 operation		

Note: NA – not applicable as there are no significant new emissions sources associated with this stage

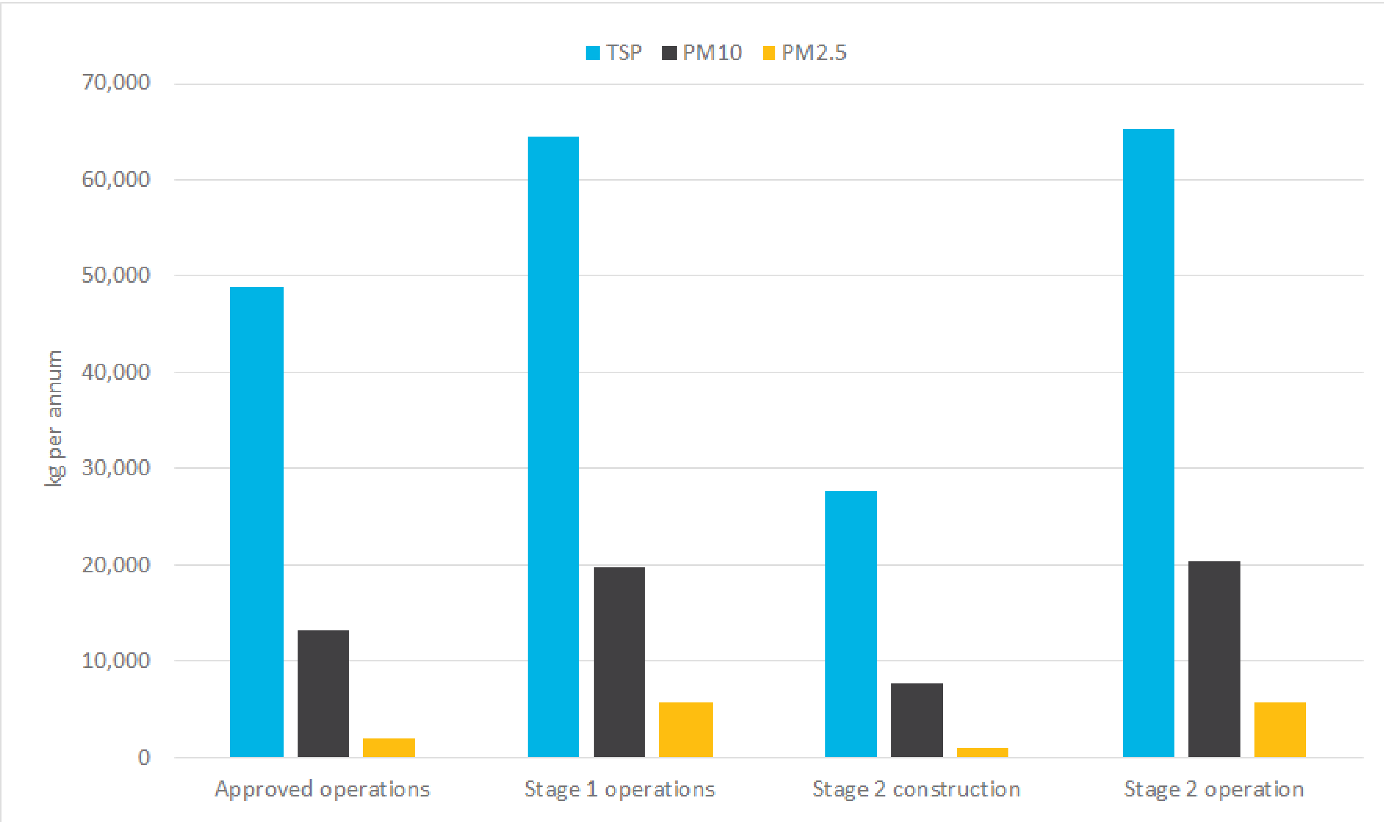

Figure 3-2 Calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions for each scenario

3.5 Peak day scenario

The emissions presented in Table 3.2 are estimated based on annual production rates for each activity / scenario. When modelled, these emissions represent a typical or average day scenario and are equivalent to an average daily waste receival rate for Approved operations, Stage 1 and for Stages 2 and 3 (based on 365 days of operation).

A review of weighbridge data for a period of one year is used to compare how these average day scenarios compare with a peak day for waste receival. The analysis found that, based on total waste in, the maximum daily weighbridge tonnes was 1.6 times higher than the average approved receival rate for Approved operations. The 95th percentile of the daily weighbridge tonnes was 1.3 times higher than the average approved receival rate. Modification 6 to the Project Approval also assumed a 30% increase in emissions from the MPC for the peak day scenario, which is consistent with the 95th percentile of the daily average weighbridge tonnes. Therefore, for consistency, the peak day scenario for this report assumes approximately 30% increase in emissions across the site.

It is noted that the purpose of the Proposal is to improve operational efficiency, which would allow the Eastern Creek REP to operate at a more consistent and higher processing rate and avoid fluctuations in peak days. Therefore, the application of a peak day scaling for modelling results for Stage 1 and 2 is considered highly conservative.

3.6 Odour emissions

The Proposal does not seek to increase the gate tonnage of waste that is transported direct to landfill and the type of waste received would not change from the current approval. There would, however, be a small increase in chute waste associated with the proposed increase in throughput.

The Eastern Creek REP is not licenced to accept putrescible waste and, as such, the risk of odour emissions has historically been low, with few odour complaints attributed to the Eastern Creek REP on an annual basis. However, during 2021, the EPA received a significant increase in odour complaints from residential suburbs surrounding the Eastern Creek REP, prompting EPA to issue a clean-up notice (in April 2021) and EPL variation (in May 2021) to resolve odour issues at Eastern Creek REP. The sudden increase in odour complaint was attributed to atypical rainfall events during March 2021, resulting in significant volumes of rainwater infiltrating the landfill, increasing the potential to produce landfill gas (LFG) and for the generation of fugitive odour. In March and April 2022 there were additional odour complaints. This was also attributed to environmental factors, specifically the substantial increase in rainfall during this period associated with persistent La Nina conditions along the east coast of Australia and the influence of that rainfall on the efficacy of the sites integrated landfill gas collection and treatment system. Covering and capping within the landfill during this period has also been very difficult due to the unseasonable rainfall.

In response to the clean-up notice and licence variation, Bingo installed a temporary LFG extraction and treatment system and lodged a modification application (Modification 10) to install and operate two permanent enclosed LFG flares. The air quality assessment prepared in support of the Modification 10 (Northstar 2021) reported that the temporary LFG extraction and treatment system has been successful in managing off-site odour impacts. Hydrogen sulphide monitoring at seven locations surrounding the site has demonstrated a low frequency of concentrations above the odour detection threshold, coupled with a significant drop in odour complaints. Modification 10 received planning approval from DPE on March 11 2022.

Bingo are seeking approval (Modification 9) to enclose existing and approved processing activities by constructing two new waste facilities within the approved Project Approval boundary, but to the west of the current operational area buildings, an extension of the road network and new hardstand area. The facilities would enclose existing timber receival, processing and storage activities currently undertaken externally in the operational area of the Eastern Creek REP, as well as establish a waste transfer station for non-putrescible organics such as green waste material.

In June 2022, Bingo engaged Assured Environmental to undertake an odour emissions sampling campaign at the Eastern Creek REP. Samples were collected for the leachate dam, landfill surface (active waste tipping face, daily covered material and intermediate waste cover), LFG extraction system pipe and the existing green waste stockpiles.

The analysis results for the collected odour emissions monitoring were provided to EMM to prepare a future cumulative odour emissions scenario for the Eastern Creek REP, accounting for emissions from the approved Modification 10 and proposed Modification 9.

The odour emissions inventory is considered highly conservative for the following reasons:

- The collection of odour samples in June 2022 was completed ahead of the installation of the approved permanent flares and associated increase in LFG extraction. The approved LFG extraction system will be significantly more efficient at extracting LFG from the landfill, expected to increase the rate of extraction from the current temporary system rate of 2,000 m^3/hour to 3,000 m^3/hour. Therefore, the use of June 2022 emission samples is considered to be an overestimate of future fugitive odour emissions from the landfill surface given the permanent flare system will provide significant improvements in the efficacy of gas capture.

- Further, the entire landfill floor area, less the assumed areas for active tipping, daily cover and leachate riser, is assumed to have an odour emission rate equivalent to intermediate (four week old) cover material. This assumption gives no consideration to areas where the landfill capping has been in place for longer periods and more established/thicker cover/capping.

- While full technical details of Modification 9 are yet to be finalised, it is expected that all green waste material would be stored within a shed fitted with roller doors, with minimal potential for any odour emission beyond the shed structure. Nevertheless, for conservative purposes an emission source for Modification 9 has been accounted for with a nominal 90% reduction factor applied for enclosure. For odour emission calculation purposes, it is assumed that a green waste stockpile of 3,200 m^2 is present at all times within the proposed enclosure.

- It is assumed that all four leachate storage tanks located to the south of the Eastern Creek REP are full, active and emitting for all hours of the year.

Details of the odour emissions inventory developed for the Eastern Creek REP, accounting for future operational emissions of the permanent LFG and flare system and potential (conservative) emissions from enclosed green waste storage under Modification 9, are presented in Table 3.3.

Future flare emissions have been quantified through the combination of the LFG extraction system pipe odour sample, a LFG extraction rate of 3,000 m^3/hour equally proportioned between the two flares and a flare destruction efficiency of 99%. Emission source inputs presented in Northstar (2021) for the permanent flares (eg velocity, diameter, height) have been applied in this modelling.

Regarding emissions from the active tipping face area, the emission source is set to the expected future tipping area of 3,900 m^2 split between two separate tipping faces, being mixed waste and contaminated soil material, consistent with the approved Filling Plan.

It is noted that the Proposal will result in a small increase in chute waste to the landfill. It is also noted that chute waste would not be high in organic matter and therefore unlikely to contribute to an increase in LFG generation.

Table 3.3 Odour emissions data – Eastern Creek REP – based on site sampling data from June 2022

Odour source	Area (m^2)	Odour emission flux ($ou.m^3/m^2/sec$)	LFG flow rate (m^3/s)	Odour emission rate ($ou.m^3/$ sec)	Emission control (included in presented emission rate)	Notes
Intermediate/established cover	118,145.8	0.0439	-	-	-	Total landfill floor area less Active, Fresh and Riser areas (below)
Fresh capped material	3,640	0.0733	-	-	-	3,640 m^2 for expected freshly capped material area
Active tipping – soil	1,950	0.0733	-	-	-	Future active tipping face soil material- two faces totalling 3,900m^2 combined
Active tipping – waste	1,950	0.8267	-	-	-	Future active tipping face soil material – two faces totalling 3,900m^2 combined – one waste
Active tipping – waste – night cover	3,900	0.0733	-	-	-	Covered active face outside of tipping hours (ie 9:00 pm to 5:00 am)
Leachate tank #1	50.2	0.0705	-	-	-	Active tank emission rate applied
Leachate tank #2	50.2	0.0705	-	-	-	Active tank emission rate applied
Leachate tank #3	50.2	0.0705	-	-	-	Active tank emission rate applied
Leachate tank #4	50.2	0.0705	-	-	-	Active tank emission rate applied
Leachate riser	314.2	0.0705	-	-	-	Leachate tank emission rate applied
Green waste (Modification 9)	3,200	0.0388	-	-	90%	90% for enclosure applied, assumed 50% of 6,400m^2 shed footprint for stockpile area
Permanent flare 1	-	-	0.417	350	99%	99% flare destruction applied, 1,500m^3/hr
Permanent flare 1	-	-	0.417	350	99%	99% flare destruction applied, 1,500m^3/hr

4 Existing environment

4.1 Background air quality

4.1.1 PM_{10} and $PM_{2.5}$

Bingo operates a PM_{10} monitor at Minchinbury, which has been operational since mid-2012. Summary statistics for the monitoring station are presented in Table 4.1 and compared with the closest DPE AQMS at St Marys and Prospect (within 6-8 km of the Proposal Site). The DPE AQMS measure concentrations of PM_{10} and $PM_{2.5}$ ($PM_{2.5}$ is not measured by Bingo at Minchinbury).

The calendar years 2019 and 2020 recorded elevated levels of PM_{10} and $PM_{2.5}$, compared to all other years, due to the unprecedented bushfire events between November 2019 and February 2020. For example, in 2019, exceptional events led to poor air quality on 127 days, compared with 50 days in 2018 and 18 days in 2017[6]. It is noted that PM_{10} and $PM_{2.5}$ concentrations for 2018 are also elevated, primarily due to intensifying drought conditions. The calendar year 2021 sees a return to more typical background levels observed in 2016 and 2017. The modelled year (2016) is therefore considered suitable as representative of longer-term conditions.

Annual mean PM_{10} concentrations in 2016 across the three sites are 60% to 80% of the impact assessment criteria, while annual mean $PM_{2.5}$ concentrations for the region already at or above the impact assessment criteria. Elevated concentrations of $PM_{2.5}$ for the Western Sydney region are strongly influenced by vehicle emissions (cars, trucks and off-road equipment) and from wood heaters during winter months.

Table 4.1 Summary statistics for background PM_{10} and $PM_{2.5}$

Metric	Year	Minchinbury			Prospect			St Marys		
		Annual mean	24-hour max	Days above IAC	Annual mean	24-hour max	Days above IAC	Annual mean	24-hour max	Days above IAC
PM_{10}	2016	15.3	125.0	2	18.9	110.1	4	16.1	100.2	3
	2017	16.4	45.0	0	18.9	61.1	1	16.2	49.8	0
	2018	18.0	98.0	3	21.9	113.3	8	19.4	100.5	2
	2019	24.6	162.0	25	26.0	182.8	25	24.7	159.8	26
	2020	17.6	175.0	7	20.2	245.8	10	18.9	260.3	11
	2021	15.0	43.0	0	17.3	44.6	0	16.5	54.9	1
$PM_{2.5}$	2016				8.7	84.9	6	7.9	93.2	7
	2017				7.7	30.1	3	7.0	38.2	3
	2018				8.5	47.5	4	7.8	80.5	3
	2019				11.9	134.1	25	9.8	88.3	21
	2020				8.6	70.8	13	7.6	82.5	9
	2021				7.2	37.3	2	6.1	40.3	1

Note: IAC = impact assessment criterion

6 https://www.environment.nsw.gov.au/topics/air/nsw-air-quality-statements/annual-air-quality-statement-2019

A timeseries plot of the 24-hour average concentrations shows the periods when the 24-hour average PM_{10} concentration exceeds 50 µg/m³ and when the 24-hour average $PM_{2.5}$ concentration exceeds 25 µg/m³ (Figure 4-1 and Figure 4-2). Exceedances of the 24-hour average criteria in Sydney are typically associated with periods of bushfire, hazard reduction and/or dust storms.

As outlined in Section 2.2.2, background concentrations can exceed the impact assessment criteria. In such circumstances, there is a requirement to 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.

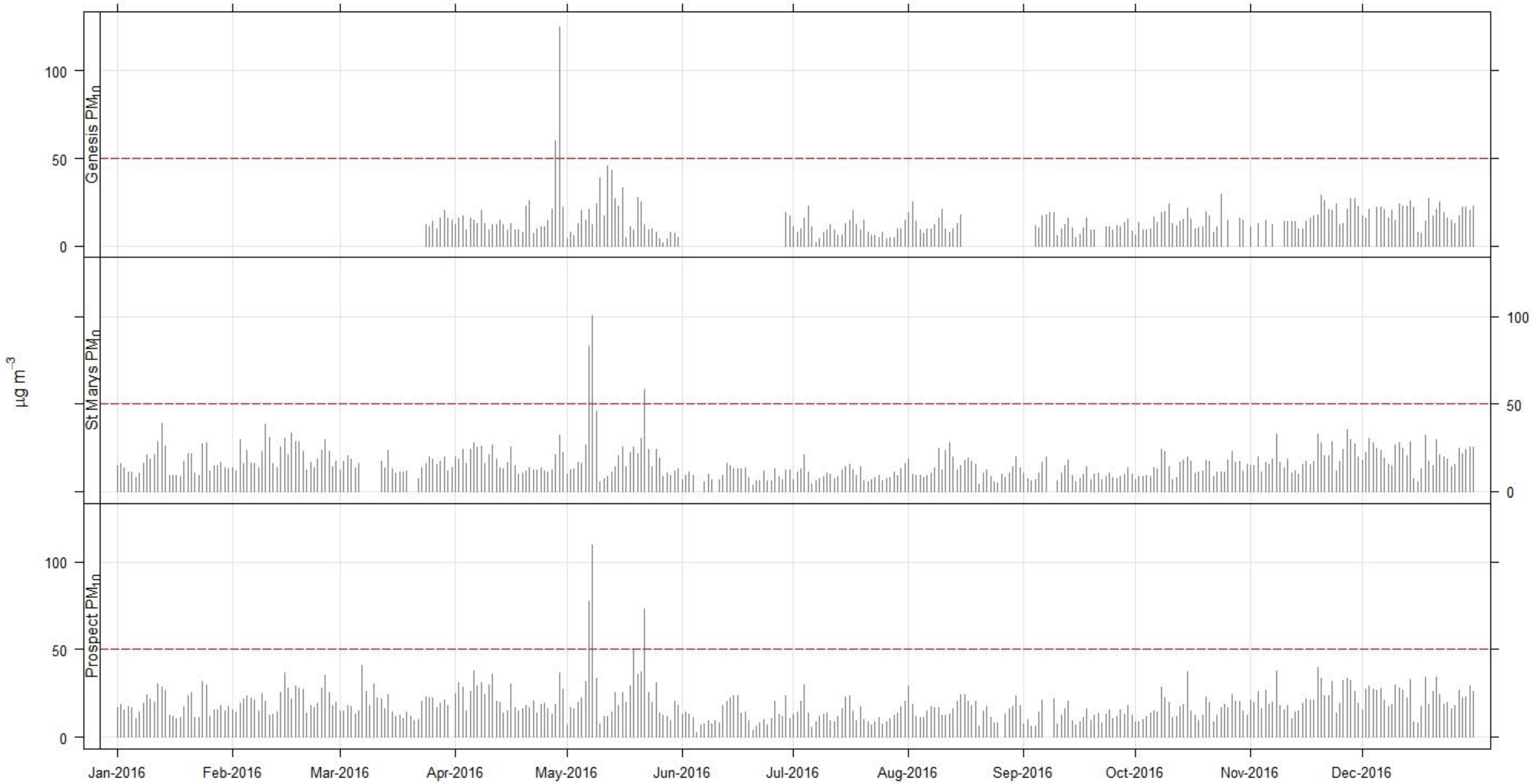

Figure 4-1 24-hour average PM_{10} concentrations

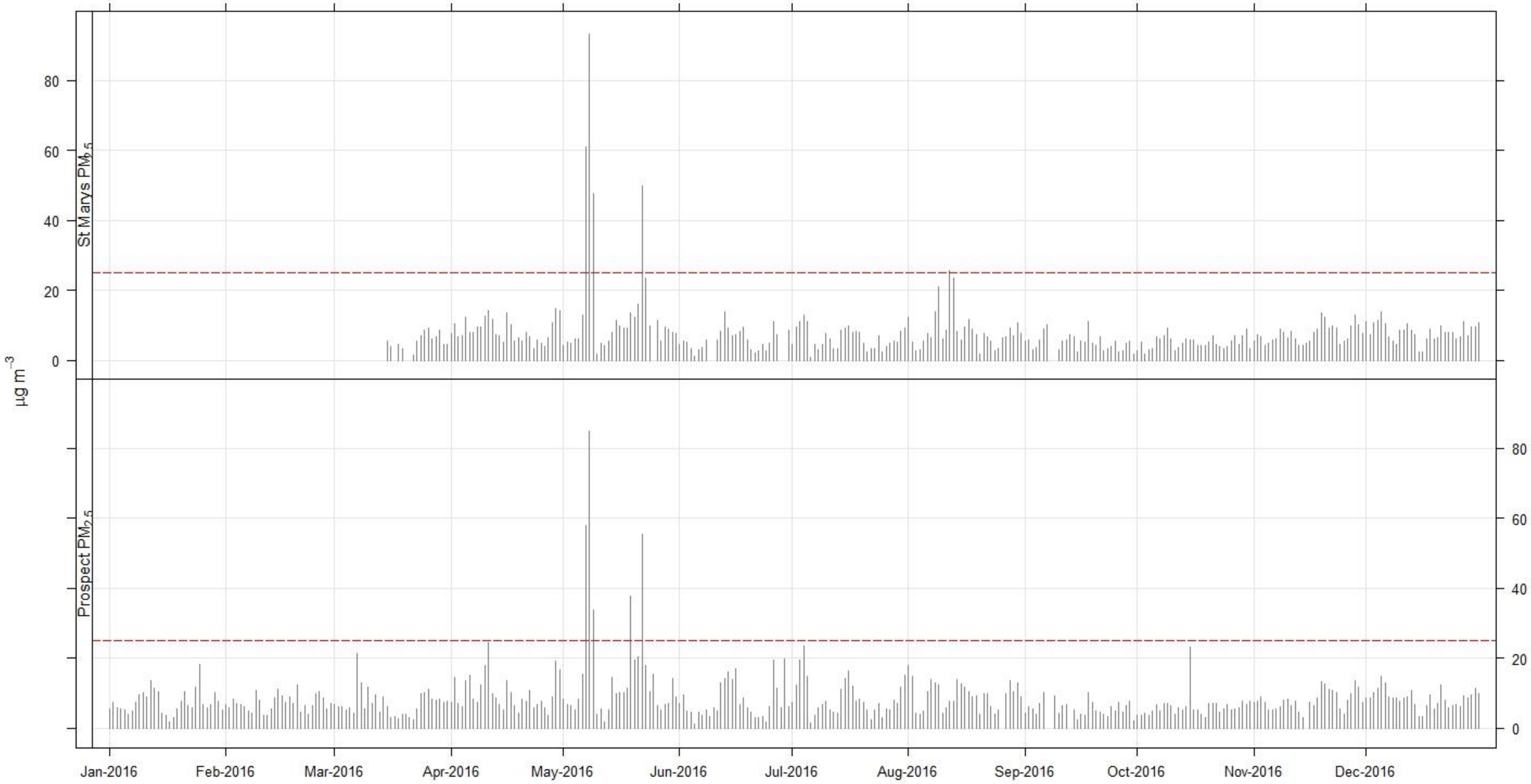

Figure 4-2 24-hour average $PM_{2.5}$ concentrations

4.1.2 TSP

TSP concentrations are not measured in the vicinity of the Eastern Creek REP, however historical measurements of TSP and PM_{10} in Sydney[7] indicate that PM_{10}/TSP ratios in urban areas typically range from 0.4 to 0.5. These ratios can be applied to the PM_{10} concentration data to derive an annual average TSP concentration.

4.1.3 Dust deposition

Dust deposition is measured at four dust deposition gauge (DDG) locations within the Eastern Creek REP boundary and results for the previous eight years are presented in Figure 4-3. The average dust deposition across all four sites and years is 2.1 g/m^2/month.

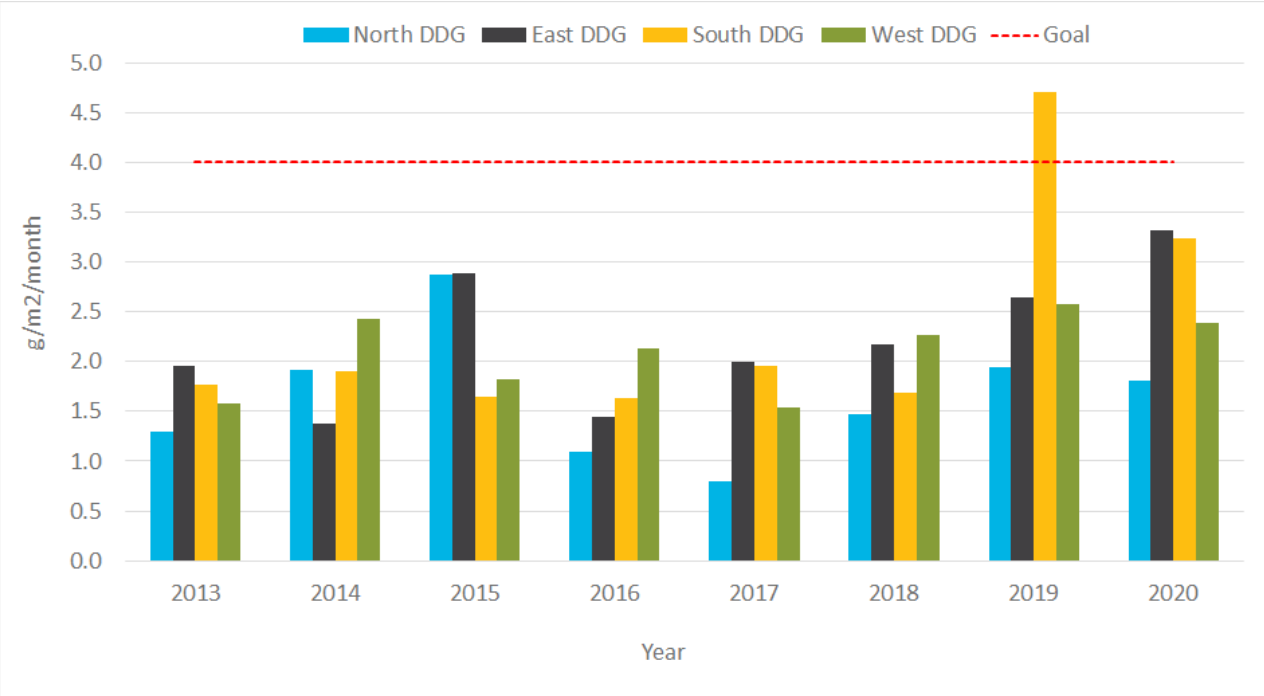

Figure 4-3 Annual average dust deposition

[7]Reported in Quarterly Air Quality Monitoring Reports - http://www.environment.nsw.gov.au/aqms/datareports.htm#quarterlies

4.2 Summary of adopted background for cumulative assessment

For cumulative 24-hour PM_{10} and $PM_{2.5}$ concentrations, a daily varying background dataset for 2016 is added to the Proposal increment for each day of the year. The daily varying background is taken from the DPE Prospect data, which represents the highest, and therefore most conservative, background of the three monitoring sites presented in Section 4.1.1.

There are four days in the Prospect 2016 background dataset above the impact assessment criterion for PM_{10}. The highest 24-hour average PM_{10} concentration that is not above the impact assessment criterion is 41.2 µg/m³. There are five days in the Prospect 2016 background dataset above the impact assessment criterion for $PM_{2.5}$ and the highest 24-hour average $PM_{2.5}$ concentration not above the impact assessment criterion is 24.4 µg/m³.

For annual average PM_{10} and $PM_{2.5}$ concentrations, the Prospect 2016 background concentrations are 18.9 µg/m³ and 8.6 µg/m³ respectively. The annual average background for $PM_{2.5}$ is already above the impact assessment criterion of 8 µg/m³.

4.3 Current site conditions

The key features of the Eastern Creek REP are the landfill (former quarry void), Resource recovery facilities, MPC1 and MPC2 and the SMA. Existing site conditions are shown in Figure 3-1.

The central portion of the Eastern Creek REP comprises the landfill (the former quarry void). The landfill has a total void area of more than 12 million m³ with over half of this void space estimated to be remaining.

The Eastern Creek REP contains two key resource recovery facilities; namely MPC1 and, the newly constructed, MPC2. MPC1 and MPC2 are located on the western side of the landfill, in the south-western corner of the Eastern Creek REP.

The SMA is located in the north-western corner of the Eastern Creek REP and covers an area of approximately five hectares (ha). The SMA has minimal built form, and the area largely comprises stockpiles, such as sand, dirt, aggregate, concrete, brick, tiles and asphalt. Fixed and mobile equipment (e.g. crushing, sorting and mixing equipment) are also located within the SMA. All stockpile heights are limited to within the height of the amenity berms as required by the Project Approval (MP 06_0139) and are maintained in accordance with all current legislative and regulatory requirements.

In addition to the waste management infrastructure across the Eastern Creek REP, operations are supported by a range of ancillary / supporting features including other buildings such as a maintenance shed, internal road network and water management infrastructure.

The Eastern Creek REP is currently accessed via a private access road off Kangaroo Avenue (known as DADI Drive), approximately 150 m north of the intersection of Kangaroo Avenue and Honeycomb Drive.

4.4 Approved operations

The construction and operation of a resource recovery facility (RRF) and General Solid Waste (GSW) landfill at the (then) existing quarry and surrounding land at the Eastern Creek REP were approved under the original Project Approval (MP 06_0139) in 2009. Following subsequent modifications up to and including Modification 8 (approved March 2021), the Eastern Creek REP is now authorised for the following activities:

- Accept up to 2 Mtpa of C&D and C&I waste and landfilling of the quarry void of up to 1 Mtpa of non-putrescible waste (including asbestos and other non-recyclable waste), excluding residual chute waste from the materials processing centres;

- Operation of MPC1 and MPC2 which recover recyclable material from C&D waste and C&I waste streams as well as utilisation of a landfill disposal chute and maintenance activities;
- Crushing, grinding and separating works to process waste masonry material located in an area earmarked as the SMA;
- Stockpile up to 50 tonnes of waste tyres;
- Stockpile up to 20,000 tonnes of green waste.

One modifications to MP06_139 is also currently being sought. Modification 9 seeks to expand the operational area of the Eastern Creek REP into part Lot 2 DP1145808. With, Modification 10 which pertains to the installation a gas collection system and permanent landfill gas flares to support the operations of the Eastern Creek REP recently approved in March 2022.

Modelling results are presented for approved operations to compare and evaluate the change in predicted concentrations from what is already approved. The modelling results for approved operations are based on updated emissions inventories developed using the latest information available from the Proposal Site, including recent weighbridge data and site-specific data for material properties (ie moisture and silt contents). The modelling results are therefore updated from what is presented in the Modification 6 air quality assessment (Ramboll 2018) and incorporate other relevant recent changes since Modification 6 (eg operation of gas flares).

4.4.1 Predictions at residential assessment locations

The predicted incremental and cumulative ground level PM_{10} and $PM_{2.5}$ concentrations for approved operations are presented in Table 4.2. The highest incremental 24-hour average PM_{10} concentration at a residential assessment location is 16.8 µg/m^3. The highest incremental annual average PM_{10} concentration at a residential assessment location is 1.4 µg/m^3. When background concentrations are added, there are no additional days above the 24-hour average impact assessment criterion for PM_{10} at a residential assessment location and no exceedances of the annual average impact assessment criterion for PM_{10} for residential assessment locations.

The highest incremental 24-hour average $PM_{2.5}$ concentration at a residential assessment location is 1.8 µg/m^3. The highest incremental annual average $PM_{2.5}$ concentration at a residential assessment location is 0.2 µg/m^3. When background concentrations are added, there are no additional days above the 24-hour average impact assessment criterion for $PM_{2.5}$ at a residential assessment location. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria; however, the contribution from approved operations to annual average $PM_{2.5}$ is approximately 2.5% of the impact assessment criteria at residential receptors.

Table 4.2 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m^3) at residential assessment locations – approved operations

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
IAC			***50*** **µg/m³**		***25*** **µg/m³**			***25*** **µg/m³**		***8*** **µg/m³**
R_1	11.0	0.7	41.2	0	19.6	1.3	0.1	24.5	0	8.7
R_2	11.8	0.8	41.3	0	19.7	1.4	0.1	24.5	0	8.8
R_3	12.3	0.9	41.2	0	19.8	1.6	0.1	24.5	0	8.8

Table 4.2 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ ($\mu g/m^3$) at residential assessment locations – approved operations

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_4	14.8	1.2	41.2	0	20.1	1.6	0.2	24.5	0	8.8
R_5	15.9	1.3	41.2	0	20.2	1.7	0.2	24.5	0	8.8
R_6	11.4	1.0	41.2	0	19.9	1.5	0.1	24.5	0	8.8
R_7	15.6	1.3	41.2	0	20.1	1.8	0.2	24.5	0	8.8
R_8	14.8	1.3	42.0	0	20.2	1.8	0.2	24.6	0	8.8
R_9	1.4	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_10	1.4	0.1	42.0	0	19.0	0.2	0.0	24.4	0	8.7
R_11	1.5	0.1	41.9	0	19.0	0.2	0.0	24.4	0	8.7
R_12	6.8	0.6	41.3	0	19.5	1.0	0.1	24.5	0	8.7
R_13	12.3	0.8	41.4	0	19.7	1.4	0.1	24.5	0	8.8
R_14	13.1	0.9	41.3	0	19.7	1.5	0.1	24.5	0	8.8
R_15	13.6	0.9	41.3	0	19.8	1.5	0.1	24.5	0	8.8
R_16	14.0	0.9	41.3	0	19.8	1.6	0.1	24.5	0	8.8
R_17	13.5	1.0	41.2	0	19.9	1.6	0.1	24.5	0	8.8
R_18	13.0	1.0	41.2	0	19.9	1.6	0.1	24.5	0	8.8
R_19	12.7	1.1	41.2	0	20.0	1.7	0.1	24.5	0	8.8
R_20	12.4	1.1	41.2	0	20.0	1.7	0.1	24.5	0	8.8
R_21	11.9	1.1	41.2	0	20.0	1.7	0.2	24.5	0	8.8
R_22	12.2	1.1	41.2	0	20.0	1.7	0.2	24.5	0	8.8
R_23	12.6	1.2	41.2	0	20.1	1.7	0.2	24.5	0	8.8
R_24	12.6	1.2	41.2	0	20.1	1.7	0.2	24.5	0	8.8
R_25	12.3	1.2	41.2	0	20.1	1.7	0.2	24.5	0	8.8
R_26	12.4	1.3	41.2	0	20.1	1.7	0.2	24.5	0	8.8
R_27	12.8	1.3	41.2	0	20.2	1.7	0.2	24.5	0	8.8
R_28	13.2	1.3	41.2	0	20.2	1.7	0.2	24.5	0	8.8
R_29	14.3	1.3	41.2	0	20.2	1.7	0.2	24.5	0	8.8
R_30	15.8	1.4	41.2	0	20.2	1.7	0.2	24.5	0	8.8
R_31	16.8	1.4	41.2	0	20.3	1.8	0.2	24.5	0	8.8
R_32	13.0	1.3	42.6	0	20.2	1.7	0.2	24.6	0	8.8
R_33	11.8	1.2	42.3	0	20.1	1.6	0.2	24.6	0	8.8
R_34	11.1	1.2	42.1	0	20.0	1.5	0.2	24.6	0	8.8
R_35	10.5	1.1	41.9	0	20.0	1.5	0.2	24.6	0	8.8

Table 4.2 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ ($\mu g/m^3$) at residential assessment locations – approved operations

Receptor ID	PM10					PM2.5				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_36	9.5	1.0	42.0	0	19.8	1.4	0.1	24.7	0	8.8
R_37	9.2	0.9	42.0	0	19.8	1.4	0.1	24.7	0	8.8
R_38	8.9	1.0	42.8	0	19.9	1.4	0.1	24.8	0	8.8
R_39	8.5	1.0	43.1	0	19.9	1.3	0.1	24.8	0	8.8
R_40	8.5	1.0	43.2	0	19.9	1.3	0.2	24.9	0	8.8
R_41	8.5	1.0	43.3	0	19.9	1.3	0.1	24.9	0	8.8
R_42	8.5	1.0	43.2	0	19.9	1.3	0.1	24.9	0	8.8
R_43	8.4	1.0	43.2	0	19.9	1.3	0.1	24.9	0	8.8
R_44	8.3	1.0	43.1	0	19.8	1.3	0.1	24.9	0	8.8
R_45	8.2	0.9	42.9	0	19.8	1.3	0.1	24.9	0	8.8
R_46	8.1	0.9	42.8	0	19.8	1.3	0.1	24.9	0	8.8
R_47	3.3	0.1	42.1	0	19.0	0.5	0.0	24.4	0	8.7
R_48	2.9	0.1	42.1	0	19.0	0.4	0.0	24.4	0	8.7
R_49	2.3	0.1	42.2	0	19.0	0.4	0.0	24.4	0	8.7
R_50	2.2	0.1	42.2	0	19.0	0.3	0.0	24.4	0	8.7
R_51	2.1	0.1	42.2	0	19.0	0.3	0.0	24.4	0	8.7
R_52	2.0	0.1	42.3	0	19.0	0.3	0.0	24.4	0	8.7
R_53	1.9	0.1	42.3	0	19.0	0.3	0.0	24.4	0	8.7
R_54	1.7	0.1	42.3	0	19.0	0.3	0.0	24.4	0	8.7
R_55	1.6	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_56	1.2	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_57	1.1	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_58	1.1	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_59	1.1	0.1	42.3	0	19.0	0.2	0.0	24.4	0	8.7
R_60	1.1	0.1	42.2	0	19.0	0.2	0.0	24.4	0	8.7
R_61	1.1	0.1	42.2	0	19.0	0.2	0.0	24.4	0	8.7
R_62	1.2	0.1	42.1	0	19.0	0.2	0.0	24.4	0	8.7
R_63	1.3	0.1	42.1	0	19.0	0.2	0.0	24.4	0	8.7
R_64	1.4	0.1	42.0	0	19.0	0.2	0.0	24.4	0	8.7
R_65	1.5	0.1	41.9	0	19.0	0.2	0.0	24.4	0	8.7

Note: IAC = impact assessment criterion

The predicted incremental and cumulative ground level TSP concentrations and dust deposition for approved operations are presented in Table 5.2. The highest incremental annual average TSP concentration at a residential assessment location is 3.6 µg/m³(R_31). When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a residential assessment location is 0.1 g/m²/month. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

It is noted that the modelling predictions for approved operations are based on conservative assumptions and the actual contribution from current operations is expected to be less.

Table 4.3 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – approved operations

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
IAC		*90* µg/m³		*2* g/m²/month
R_1	1.7	49.0	0.1	2.1
R_2	2.0	49.3	0.1	2.1
R_3	2.4	49.6	0.1	2.1
R_4	3.0	50.2	0.1	2.1
R_5	3.4	50.6	0.1	2.1
R_6	2.5	49.7	0.1	2.1
R_7	3.2	50.4	0.1	2.1
R_8	3.3	50.5	0.1	2.1
R_9	0.3	47.5	0.1	2.1
R_10	0.3	47.5	0.1	2.1
R_11	0.3	47.5	0.1	2.1
R_12	1.5	48.7	0.1	2.1
R_13	2.1	49.3	0.1	2.1
R_14	2.3	49.5	0.1	2.1
R_15	2.3	49.6	0.1	2.1
R_16	2.5	49.7	0.1	2.1
R_17	2.6	49.8	0.1	2.1
R_18	2.7	49.9	0.1	2.1
R_19	2.8	50.0	0.1	2.1
R_20	2.9	50.1	0.1	2.1
R_21	3.0	50.2	0.1	2.1
R_22	3.0	50.2	0.1	2.1
R_23	3.1	50.3	0.1	2.1
R_24	3.2	50.4	0.1	2.1

Table 4.3 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – approved operations

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_25	3.2	50.4	0.1	2.1
R_26	3.3	50.5	0.1	2.1
R_27	3.4	50.6	0.1	2.1
R_28	3.4	50.6	0.1	2.1
R_29	3.5	50.7	0.1	2.1
R_30	3.5	50.8	0.1	2.1
R_31	3.6	50.8	0.1	2.1
R_32	3.3	50.5	0.1	2.1
R_33	3.1	50.3	0.1	2.1
R_34	3.0	50.2	0.1	2.1
R_35	2.8	50.0	0.1	2.1
R_36	2.4	49.6	0.1	2.1
R_37	2.3	49.5	0.1	2.1
R_38	2.5	49.7	0.1	2.1
R_39	2.5	49.8	0.1	2.1
R_40	2.5	49.8	0.1	2.1
R_41	2.5	49.7	0.1	2.1
R_42	2.5	49.7	0.1	2.1
R_43	2.4	49.6	0.1	2.1
R_44	2.4	49.6	0.1	2.1
R_45	2.3	49.5	0.1	2.1
R_46	2.3	49.5	0.1	2.1
R_47	0.3	47.5	0.1	2.1
R_48	0.3	47.5	0.1	2.1
R_49	0.3	47.5	0.1	2.1
R_50	0.3	47.5	0.1	2.1
R_51	0.3	47.5	0.1	2.1
R_52	0.3	47.5	0.1	2.1
R_53	0.3	47.5	0.1	2.1
R_54	0.3	47.5	0.1	2.1
R_55	0.3	47.5	0.1	2.1
R_56	0.3	47.5	0.1	2.1
R_57	0.3	47.5	0.1	2.1
R_58	0.3	47.5	0.1	2.1

Table 4.3 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – approved operations

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_59	0.3	47.5	0.1	2.1
R_60	0.3	47.5	0.1	2.1
R_61	0.3	47.5	0.1	2.1
R_62	0.3	47.5	0.1	2.1
R_63	0.3	47.5	0.1	2.1
R_64	0.3	47.5	0.1	2.1
R_65	0.3	47.5	0.1	2.1

Note: IAC = impact assessment criterion

4.4.2 Predictions at commercial assessment locations

The predicted incremental and cumulative ground level PM_{10} and $PM_{2.5}$ concentrations for approved operations at commercial assessment locations are presented in Table 4.4. The highest incremental 24-hour average PM_{10} concentration at a commercial assessment location is 42.9 µg/m³. The highest incremental annual average PM_{10} concentration at a commercial assessment location is 8.4 µg/m³. When background concentrations are added, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is 15. There is one commercial assessment location (CI_18 on Honeycomb Drive) above the annual average impact assessment criterion.

The highest incremental 24-hour average $PM_{2.5}$ concentration at a commercial assessment location is 6.8 µg/m³(CI_19). The highest incremental annual average $PM_{2.5}$ concentration at a commercial assessment location is 1.3 µg/m³. When background concentrations are added to the Proposal increment, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is two. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria.

As described previously, adjacent commercial receptors are considered less sensitive to air pollution than residential receptors. The predicted exceedances of the impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore considered low risk, from both an exposure duration and human health risk point of view.

Table 4.4 Predicted ground level concentrations for PM_{10} (µg/m³) at commercial assessment locations – approved operations

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days>	Annual	24-hour	Annual	24-hour	Days>	Annual
IAC			*50* µg/m³		*25* µg/m³			*25* µg/m³		*8* µg/m³
CI_12	17.6	2.8	47.5	0	21.6	0.2	<0.1	24.4	0	8.7
CI_13	15.2	3.0	46.8	0	21.9	2.2	0.4	**25.1**	**1**	9.0
CI_14	14.3	2.5	47.5	0	21.4	2.3	0.4	**25.4**	**1**	9.1
CI_15	22.3	3.6	49.2	0	22.5	2.2	0.4	**25.6**	**2**	9.0

Table 4.4 Predicted ground level concentrations for PM_{10} (µg/m³) at commercial assessment locations – approved operations

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days>	Annual	24-hour	Annual	24-hour	Days>	Annual
CI_16	26.7	3.9	**52.1**	**1**	22.8	3.4	0.5	**26.5**	**2**	9.2
CI_17	26.9	3.7	**56.1**	**1**	22.6	4.2	0.6	**27.0**	**2**	9.2
CI_18	42.9	8.4	**62.0**	**15**	**27.3**	4.1	0.6	**25.8**	**1**	9.2
CI_19	6.9	0.8	46.8	0	19.7	6.8	1.3	**27.1**	**2**	10.0

Note: IAC = impact assessment criterion

The predicted incremental and cumulative ground level TSP concentrations and dust deposition for approved operations at commercial assessment locations are presented in Table 4.5.

The highest incremental annual average TSP concentration at a commercial receptor is 31.4 µg/m³. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a commercial assessment location is 0.6 g/m²/month. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

It is noted that the modelling predictions for approved operations are based on conservative assumptions and the actual contribution from current operations is expected to be less.

Table 4.5 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at commercial assessment locations – approved operations

Receptor ID	Approved operations			
	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
IAC		*90* µg/m³		*2* g/m²/month
CI_12	7.6	54.9	0.2	2.2
CI_13	8.5	55.7	0.2	2.2
CI_14	7.0	54.2	0.2	2.2
CI_15	10.8	58.0	0.2	2.2
CI_16	12.0	59.3	0.3	2.3
CI_17	12.8	60.1	0.3	2.3
CI_18	31.4	78.6	0.6	2.6
CI_19	2.1	49.3	0.1	2.1

5 Stage 1 Impact Assessment

5.1 Construction impact assessment

Stage 1 would be operational only and therefore no construction assessment is required.

5.2 Operations impact assessment

Modelling results for Stage 1 operations include the dust emission contribution from Stage 2 construction, which is scheduled to occur at the same time as the proposed throughput increase for Stage 1. It is noted that the duration of the Stage 2 construction is approximately 18 months, therefore the modelling predictions for Stage 1 operations plus Stage 2 construction would only occur in the short-term. Modelling predictions for Stage 2 operations (Section 6) represent the longer-term operational conditions.

5.2.1 Predictions at residential assessment locations

i PM$_{10}$ and PM$_{2.5}$

The predicted incremental and cumulative ground level PM$_{10}$ and PM$_{2.5}$ concentrations for Stage 1 operations (plus Stage 2 construction) at residential assessment locations are presented in Table 5.1. The highest incremental 24-hour average PM$_{10}$ concentration at a residential assessment location is 27.6 µg/m^3. The highest incremental annual average PM$_{10}$ concentration at a residential assessment location is 2.2 µg/m^3. When background concentrations are added to the Proposal increment, there are no additional days above the 24-hour average impact assessment criterion for PM$_{10}$ and no exceedances of the annual average impact assessment criterion for PM$_{10}$ for residential assessment locations.

The highest incremental 24-hour average PM$_{2.5}$ concentration at a residential assessment location is 3.1 µg/m^3. The highest incremental annual average PM$_{2.5}$ concentration at a residential assessment location is 0.3 µg/m^3. When background concentrations are added to the Proposal increment, there is one additional day above the 24-hour average impact assessment criterion for PM$_{2.5}$, however this additional day coincides with a background concentration of 24.4 µg/m^3 (compared with a criterion of 25 µg/m^3). The existing background for annual average PM$_{2.5}$ is already above the impact assessment criteria; however, the contribution from the Stage 1 Proposal to annual average PM$_{2.5}$ is approximately 4% of the impact assessment criteria at residential receptors.

Table 5.1 Predicted ground level concentrations for PM$_{10}$ and PM$_{2.5}$ (µg/m^3) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	PM$_{10}$					PM$_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m^3>	Annual	24-hour	Annual	24-hour	Days> 25µg/m^3	Annual
IAC			*50* µg/m^3		*25* µg/m^3			*25* µg/m^3		*8* µg/m^3
R_1	17.1	1.1	41.8	0	20.0	2.1	0.2	24.6	0	8.8
R_2	18.3	1.3	41.9	0	20.2	2.2	0.2	24.6	0	8.8
R_3	19.0	1.5	41.4	0	20.4	2.5	0.2	24.6	0	8.9
R_4	24.6	1.9	41.3	0	20.7	2.8	0.3	24.6	0	8.9

Table 5.1 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ ($\mu g/m^3$) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_5	26.3	2.1	41.9	0	20.9	3.0	0.3	24.6	0	8.9
R_6	19.4	1.5	42.8	0	20.4	2.4	0.2	24.7	0	8.9
R_7	25.9	2.0	42.9	0	20.9	3.0	0.3	24.6	0	8.9
R_8	24.7	2.0	44.2	0	20.9	3.0	0.3	24.7	0	8.9
R_9	2.4	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_10	2.9	0.3	42.4	0	19.1	0.4	0.0	24.4	0	8.7
R_11	2.8	0.3	42.2	0	19.1	0.4	0.0	24.4	0	8.7
R_12	10.6	1.0	42.0	0	19.8	1.4	0.1	24.5	0	8.8
R_13	19.1	1.4	42.2	0	20.2	2.3	0.2	24.6	0	8.8
R_14	20.4	1.4	41.9	0	20.3	2.4	0.2	24.6	0	8.8
R_15	21.0	1.5	41.8	0	20.3	2.5	0.2	24.6	0	8.9
R_16	21.7	1.5	41.8	0	20.4	2.6	0.2	24.6	0	8.9
R_17	20.9	1.6	41.7	0	20.5	2.6	0.2	24.6	0	8.9
R_18	20.1	1.7	41.5	0	20.5	2.6	0.2	24.6	0	8.9
R_19	19.6	1.7	41.4	0	20.6	2.6	0.2	24.6	0	8.9
R_20	19.1	1.8	41.3	0	20.6	2.6	0.2	24.6	0	8.9
R_21	18.6	1.8	41.3	0	20.7	2.6	0.3	24.6	0	8.9
R_22	19.1	1.8	41.3	0	20.7	2.6	0.3	24.6	0	8.9
R_23	19.5	1.9	41.3	0	20.8	2.6	0.3	24.6	0	8.9
R_24	19.3	1.9	41.3	0	20.8	2.6	0.3	24.6	0	8.9
R_25	19.5	2.0	41.3	0	20.8	2.6	0.3	24.6	0	8.9
R_26	20.1	2.0	41.3	0	20.9	2.6	0.3	24.6	0	8.9
R_27	20.7	2.0	41.3	0	20.9	2.6	0.3	24.6	0	8.9
R_28	21.5	2.1	41.3	0	21.0	2.6	0.3	24.6	0	8.9
R_29	23.6	2.1	41.2	0	21.0	2.7	0.3	24.6	0	8.9
R_30	26.0	2.2	41.5	0	21.0	2.9	0.3	24.6	0	8.9
R_31	27.6	2.2	42.7	0	21.1	3.1	0.3	24.7	0	9.0
R_32	22.4	2.0	44.8	0	20.9	2.8	0.3	24.8	0	8.9
R_33	20.5	1.9	44.2	0	20.8	2.6	0.3	24.8	0	8.9
R_34	19.5	1.8	43.9	0	20.7	2.5	0.3	24.8	0	8.9
R_35	18.5	1.7	43.5	0	20.6	2.4	0.2	24.8	0	8.9
R_36	17.5	1.5	43.2	0	20.3	2.4	0.2	24.9	0	8.9

Table 5.1 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m³) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_37	17.1	1.4	43.1	0	20.3	2.4	0.2	24.9	0	8.9
R_38	17.2	1.5	44.0	0	20.4	2.5	0.2	**25.0**	**1**	8.9
R_39	16.6	1.6	44.4	0	20.4	2.4	0.2	**25.1**	**1**	8.9
R_40	16.0	1.6	44.5	0	20.4	2.3	0.2	**25.1**	**1**	8.9
R_41	15.3	1.5	44.6	0	20.4	2.2	0.2	**25.1**	**1**	8.9
R_42	14.3	1.5	44.6	0	20.4	2.1	0.2	**25.1**	**1**	8.9
R_43	13.1	1.5	44.5	0	20.4	2.0	0.2	**25.1**	**1**	8.9
R_44	12.2	1.5	44.5	0	20.3	1.8	0.2	**25.1**	**1**	8.9
R_45	11.9	1.4	44.3	0	20.3	1.8	0.2	**25.1**	**1**	8.9
R_46	11.7	1.4	44.1	0	20.3	1.8	0.2	**25.1**	**1**	8.9
R_47	4.9	0.2	42.4	0	19.1	0.7	0.0	24.4	0	8.7
R_48	4.2	0.2	42.5	0	19.1	0.6	0.0	24.4	0	8.7
R_49	3.4	0.2	42.5	0	19.1	0.5	0.0	24.4	0	8.7
R_50	3.2	0.2	42.5	0	19.1	0.5	0.0	24.4	0	8.7
R_51	3.0	0.2	42.6	0	19.1	0.5	0.0	24.4	0	8.7
R_52	2.8	0.2	42.6	0	19.1	0.5	0.0	24.4	0	8.7
R_53	2.7	0.2	42.6	0	19.1	0.4	0.0	24.4	0	8.7
R_54	2.5	0.2	42.7	0	19.1	0.4	0.0	24.4	0	8.7
R_55	2.5	0.2	42.7	0	19.1	0.4	0.0	24.4	0	8.7
R_56	2.3	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_57	2.4	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_58	2.5	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_59	2.6	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_60	2.7	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_61	2.8	0.2	42.5	0	19.1	0.4	0.0	24.4	0	8.7
R_62	2.9	0.2	42.5	0	19.1	0.4	0.0	24.4	0	8.7
R_63	2.9	0.2	42.4	0	19.1	0.4	0.0	24.4	0	8.7
R_64	2.9	0.3	42.3	0	19.1	0.4	0.0	24.4	0	8.7
R_65	2.8	0.3	42.3	0	19.1	0.4	0.0	24.4	0	8.7

ii TSP and dust deposition

The predicted incremental and cumulative ground level TSP concentrations and dust deposition for Stage 1 operations (plus Stage 2 construction) at residential assessment locations are presented in Table 5.2.

The highest incremental annual average TSP concentration at a residential assessment location is 6.0 µg/m³. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a residential assessment location is 0.2 g/m²/month. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

Table 5.2 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
IAC		*90* µg/m³		*2* g/m²/month
R_1	3.0	50.2	0.1	2.1
R_2	3.5	50.7	0.1	2.1
R_3	4.0	51.2	0.2	2.2
R_4	4.9	52.1	0.2	2.2
R_5	5.5	52.7	0.2	2.2
R_6	4.0	51.2	0.1	2.1
R_7	5.3	52.5	0.2	2.2
R_8	5.4	52.6	0.2	2.2
R_9	0.6	47.8	0.1	2.1
R_10	0.6	47.8	0.1	2.1
R_11	0.6	47.8	0.1	2.1
R_12	2.6	49.8	0.1	2.1
R_13	3.7	50.9	0.2	2.2
R_14	3.8	51.0	0.2	2.2
R_15	4.0	51.2	0.2	2.2
R_16	4.2	51.4	0.2	2.2
R_17	4.3	51.5	0.2	2.2
R_18	4.5	51.7	0.2	2.2
R_19	4.7	51.9	0.2	2.2
R_20	4.8	52.0	0.2	2.2
R_21	4.9	52.1	0.2	2.2
R_22	5.0	52.2	0.2	2.2
R_23	5.1	52.3	0.2	2.2
R_24	5.2	52.4	0.2	2.2

Table 5.2 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_25	5.3	52.5	0.2	2.2
R_26	5.4	52.6	0.2	2.2
R_27	5.5	52.8	0.2	2.2
R_28	5.7	52.9	0.2	2.2
R_29	5.7	52.9	0.2	2.2
R_30	5.8	53.0	0.2	2.2
R_31	6.0	53.2	0.2	2.2
R_32	5.5	52.7	0.2	2.2
R_33	5.1	52.3	0.2	2.2
R_34	4.8	52.0	0.2	2.2
R_35	4.6	51.8	0.2	2.2
R_36	3.8	51.0	0.1	2.1
R_37	3.6	50.8	0.1	2.1
R_38	4.0	51.2	0.1	2.1
R_39	4.1	51.3	0.1	2.1
R_40	4.1	51.3	0.1	2.1
R_41	4.0	51.2	0.1	2.1
R_42	3.9	51.1	0.1	2.1
R_43	3.9	51.1	0.1	2.1
R_44	3.8	51.0	0.1	2.1
R_45	3.7	50.9	0.1	2.1
R_46	3.6	50.8	0.1	2.1
R_47	0.6	47.8	0.1	2.1
R_48	0.6	47.8	0.1	2.1
R_49	0.5	47.7	0.1	2.1
R_50	0.5	47.7	0.1	2.1
R_51	0.5	47.7	0.1	2.1
R_52	0.6	47.8	0.1	2.1
R_53	0.6	47.8	0.1	2.1
R_54	0.6	47.8	0.1	2.1
R_55	0.6	47.8	0.1	2.1
R_56	0.6	47.8	0.1	2.1
R_57	0.6	47.8	0.1	2.1
R_58	0.6	47.8	0.1	2.1

Table 5.2 Predicted ground level concentrations for TSP (µg/m^3) and dust deposition (g/m^2/month) at residential assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_59	0.6	47.8	0.1	2.1
R_60	0.6	47.8	0.1	2.1
R_61	0.6	47.8	0.1	2.1
R_62	0.6	47.8	0.1	2.1
R_63	0.6	47.8	0.1	2.1
R_64	0.6	47.8	0.1	2.1
R_65	0.6	47.8	0.1	2.1

5.2.2 Predictions at commercial assessment locations

i PM$_{10}$ and PM$_{2.5}$

The predicted incremental and cumulative ground level PM$_{10}$ and PM$_{2.5}$ concentrations for Stage 1 operations (plus Stage 2 construction) at commercial assessment locations are presented in Table 5.3.

The highest incremental 24-hour average PM$_{10}$ concentration at a commercial assessment location is 61.3 µg/m^3. The highest incremental annual average PM$_{10}$ concentration at a commercial assessment location is 11.1 µg/m^3. When background concentrations are added to the Proposal increment, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is 28. It is noted that Stage 1 operations plus Stage 2 construction is a short-term scenario (likely duration of 18 months). When background concentrations are added, there are three commercial assessment locations above the annual average impact assessment criterion for Stage 1 operations.

The highest incremental 24-hour average PM$_{2.5}$ concentration at a commercial assessment location 9.8 µg/m^3. The highest incremental annual average PM$_{2.5}$ concentration at a commercial assessment location is 1.8 µg/m^3. When background concentrations are added to the Proposal increment, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is three. The existing background for annual average PM$_{2.5}$ is already above the impact assessment criteria.

As described previously, adjacent commercial receptors are considered less sensitive to air pollution than residential receptors. The predicted exceedances of the impact assessment criteria for PM$_{10}$ and PM$_{2.5}$ are therefore considered low risk, from both an exposure duration and human health risk point of view.

Table 5.3 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m³) at commercial assessment locations – Stage 1 (plus Stage 2 construction)

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
IAC			*50* µg/m³		*25* µg/m³			*25* µg/m³		*8* µg/m³
CI_12	34.7	4.6	**52.7**	**4**	23.5	0.4	<0.1	24.4	0	8.7
CI_13	30.6	5.4	**51.6**	**3**	24.3	4.2	0.6	**25.5**	**2**	9.3
CI_14	27.9	4.4	**51.9**	**3**	23.3	4.1	0.7	**26.1**	**2**	9.4
CI_15	41.8	6.8	**64.1**	**6**	**25.7**	3.7	0.6	**26.5**	**2**	9.3
CI_16	43.9	6.7	**66.2**	**5**	**25.6**	5.8	1.0	**27.8**	**2**	9.6
CI_17	38.0	5.2	**66.8**	**3**	24.0	6.4	1.0	**28.2**	**2**	9.6
CI_18	61.3	11.1	**78.5**	**28**	**29.9**	6.1	0.8	**26.5**	**2**	9.5
CI_19	11.1	1.3	48.9	0	20.2	9.8	1.8	**28.7**	**3**	10.5

ii TSP and dust deposition

The predicted incremental and cumulative ground level TSP concentrations and dust deposition for Stage 1 operations (plus Stage 2 construction) at commercial assessment locations are presented in Table 5.4.

The highest incremental annual average TSP concentration at a commercial receptor is 42.3 µg/m³. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a commercial assessment location is 0.8 g/m²/month. When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

Table 5.4 Predicted ground level concentrations for TSP ($\mu g/m^3$) and dust deposition ($g/m^2/month$) at commercial assessment locations – Stage 1

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
IAC		***90*** **$\mu g/m^3$**		***2*** **$g/m^2/month$**
CI_12	13.4	60.7	0.3	2.3
CI_13	16.4	63.6	0.4	2.4
CI_14	13.2	60.4	0.3	2.3
CI_15	20.9	68.1	0.5	2.5
CI_16	21.3	68.5	0.5	2.5
CI_17	18.2	65.4	0.4	2.4
CI_18	42.3	89.5	0.8	2.8
CI_19	3.8	51.0	0.1	2.1

6 Stage 2 Impact Assessment

6.1 Construction impact assessment

Stage 2 construction impacts are assessed with Stage 1 operations, as the emissions would occur concurrently with this stage of operations. The combined cumulative modelling results for Stage 2 construction are presented in Section 5.

6.2 Operations impact assessment

Modelling results are presented in subsequent sections for approved operations and Stage 2 operations, to compare and evaluate the change in predicted concentrations for Stage 2 from what is already approved.

6.2.1 Predictions for residential assessment locations

i PM$_{10}$ and PM$_{2.5}$

The predicted incremental and cumulative ground level PM$_{10}$ and PM$_{2.5}$ concentrations for Stage 2 operations at residential assessment locations are presented in Table 6.1.

The highest incremental 24-hour average PM$_{10}$ concentration at a residential assessment location is 27.2 µg/m^3 (down from 27.6 µg/m^3 for Stage 1 operations). The highest incremental annual average PM$_{10}$ concentration at a residential assessment location is 2.0 µg/m^3 (down from 2.2 µg/m^3 for Stage 1 operations). When background concentrations are added to the Proposal increment, there are no additional days above the 24-hour average impact assessment criterion for PM$_{10}$ and no exceedances of the annual average impact assessment criterion for PM$_{10}$ for residential assessment locations.

The highest incremental 24-hour average PM$_{2.5}$ concentration at a residential assessment location is 2.9 µg/m^3 (down from 3.1 µg/m^3 for Stage 1 operations). The highest incremental annual average PM$_{2.5}$ concentration at a residential assessment location is 0.3 µg/m^3 (same as Stage 1 operations). When background concentrations are added to the Proposal increment, there is one additional day above the 24-hour average impact assessment criterion for PM$_{2.5}$ (same as Stage 1 operations). The existing background for annual average PM$_{2.5}$ is already above the impact assessment criteria; however, the contribution from the Stage 2 Proposal to annual average PM$_{2.5}$ is approximately 4% of the impact assessment criteria at residential receptors (same as Stage 1 operations).

Table 6.1 Predicted ground level concentrations for PM$_{10}$ and PM$_{2.5}$ (µg/m^3) at residential assessment locations – Stage 2

Receptor ID	PM$_{10}$					PM$_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m^3>	Annual	24-hour	Annual	24-hour	Days> 25µg/m^3	Annual
IAC			***50*** µg/m^3		***25*** µg/m^3			***25*** µg/m^3		***8*** µg/m^3
R_1	16.7	1.0	41.4	0	19.9	1.9	0.1	24.6	0	8.8
R_2	18.2	1.1	41.4	0	20.0	2.0	0.2	24.6	0	8.8
R_3	16.3	1.3	41.3	0	20.2	2.0	0.2	24.6	0	8.8
R_4	24.3	1.7	42.5	0	20.6	2.6	0.3	24.6	0	8.9

Table 6.1 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m³) at residential assessment locations – Stage 2

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_5	25.9	1.9	43.2	0	20.7	2.8	0.3	24.6	0	8.9
R_6	15.4	1.3	43.4	0	20.1	1.9	0.2	24.7	0	8.8
R_7	24.6	1.8	44.3	0	20.6	2.7	0.3	24.7	0	8.9
R_8	21.8	1.7	45.5	0	20.6	2.5	0.3	24.7	0	8.9
R_9	1.7	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_10	2.0	0.2	42.3	0	19.1	0.3	0.0	24.4	0	8.7
R_11	2.1	0.2	42.0	0	19.1	0.3	0.0	24.4	0	8.7
R_12	9.0	0.8	41.8	0	19.7	1.3	0.1	24.5	0	8.8
R_13	19.0	1.2	41.8	0	20.1	2.1	0.2	24.6	0	8.8
R_14	20.3	1.2	41.3	0	20.1	2.2	0.2	24.6	0	8.8
R_15	20.8	1.3	41.3	0	20.2	2.2	0.2	24.6	0	8.8
R_16	21.1	1.4	41.3	0	20.2	2.3	0.2	24.6	0	8.8
R_17	19.4	1.4	41.3	0	20.3	2.2	0.2	24.6	0	8.9
R_18	17.5	1.5	41.3	0	20.4	2.2	0.2	24.6	0	8.9
R_19	16.2	1.5	41.3	0	20.4	2.1	0.2	24.6	0	8.9
R_20	15.6	1.6	41.3	0	20.5	2.1	0.2	24.6	0	8.9
R_21	16.9	1.6	41.3	0	20.5	2.1	0.2	24.6	0	8.9
R_22	17.6	1.6	41.3	0	20.5	2.1	0.2	24.6	0	8.9
R_23	18.2	1.7	41.3	0	20.6	2.2	0.3	24.6	0	8.9
R_24	18.1	1.7	41.3	0	20.6	2.2	0.3	24.6	0	8.9
R_25	18.6	1.7	41.3	0	20.6	2.3	0.3	24.6	0	8.9
R_26	19.3	1.8	41.3	0	20.7	2.4	0.3	24.6	0	8.9
R_27	20.0	1.8	41.3	0	20.7	2.5	0.3	24.6	0	8.9
R_28	21.6	1.9	41.2	0	20.8	2.6	0.3	24.6	0	8.9
R_29	23.8	1.9	41.5	0	20.8	2.6	0.3	24.6	0	8.9
R_30	25.9	1.9	42.7	0	20.8	2.7	0.3	24.6	0	8.9
R_31	27.2	2.0	44.2	0	20.9	2.9	0.3	24.7	0	8.9
R_32	17.4	1.7	45.5	0	20.6	2.2	0.3	24.8	0	8.9
R_33	14.9	1.5	44.6	0	20.4	1.9	0.2	24.8	0	8.9
R_34	13.4	1.4	44.0	0	20.3	1.7	0.2	24.8	0	8.9
R_35	11.8	1.3	43.5	0	20.2	1.6	0.2	24.8	0	8.9
R_36	9.4	1.1	41.7	0	20.0	1.2	0.2	24.9	0	8.8

Table 6.1 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m³) at residential assessment locations – Stage 2

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
R_37	9.0	1.1	41.5	0	19.9	1.2	0.2	24.9	0	8.8
R_38	8.7	1.2	41.6	0	20.0	1.3	0.2	**25.1**	**1**	8.8
R_39	8.9	1.2	41.7	0	20.1	1.3	0.2	**25.1**	**1**	8.8
R_40	9.0	1.2	41.7	0	20.1	1.4	0.2	**25.1**	**1**	8.8
R_41	9.0	1.2	41.7	0	20.1	1.4	0.2	**25.1**	**1**	8.8
R_42	8.9	1.2	41.6	0	20.0	1.3	0.2	**25.1**	**1**	8.8
R_43	8.8	1.1	41.5	0	20.0	1.3	0.2	**25.1**	**1**	8.8
R_44	8.7	1.1	41.4	0	20.0	1.3	0.2	**25.1**	**1**	8.8
R_45	8.5	1.1	41.3	0	20.0	1.3	0.2	**25.1**	**1**	8.8
R_46	8.4	1.1	41.2	0	19.9	1.2	0.2	25.1	1	8.8
R_47	3.3	0.2	42.7	0	19.1	0.4	0.0	24.4	0	8.7
R_48	2.8	0.2	42.7	0	19.1	0.4	0.0	24.4	0	8.7
R_49	2.2	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_50	2.1	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_51	2.0	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_52	1.8	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_53	1.7	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_54	1.7	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_55	1.7	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_56	1.8	0.2	42.7	0	19.1	0.3	0.0	24.4	0	8.7
R_57	1.8	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_58	1.9	0.2	42.6	0	19.1	0.2	0.0	24.4	0	8.7
R_59	1.9	0.2	42.6	0	19.1	0.3	0.0	24.4	0	8.7
R_60	1.9	0.2	42.5	0	19.1	0.3	0.0	24.4	0	8.7
R_61	2.0	0.2	42.5	0	19.1	0.3	0.0	24.4	0	8.7
R_62	2.0	0.2	42.4	0	19.1	0.3	0.0	24.4	0	8.7
R_63	1.9	0.2	42.3	0	19.1	0.3	0.0	24.4	0	8.7
R_64	2.1	0.2	42.2	0	19.1	0.4	0.0	24.4	0	8.7
R_65	2.1	0.2	42.1	0	19.1	0.4	0.0	24.4	0	8.7

ii TSP and dust deposition

The predicted incremental and cumulative ground level TSP concentrations for Stage 2 operations at residential assessment locations are presented in Table 6.2.

The highest incremental annual average TSP concentration at a residential assessment location is 5.5 µg/m^3 (down from 6.0 µg/m^3 for Stage 1 operations). When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a residential assessment location is 0.2 g/m^2/month (same as Stage 1 operations). When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

Table 6.2 Predicted ground level concentrations for TSP (µg/m^3) and dust deposition (g/m^2/month) at residential assessment locations – Stage 2

Receptor ID	**TSP**		**Dust deposition**	
	Increment	**Cumulative**	**Increment**	**Cumulative**
IAC		***90*** **µg/m^3**		***2*** **g/m^2/month**
R_1	2.6	49.8	0.1	2.1
R_2	3.1	50.3	0.1	2.1
R_3	3.6	50.8	0.1	2.1
R_4	4.5	51.7	0.1	2.1
R_5	5.0	52.2	0.1	2.1
R_6	3.3	50.5	0.1	2.1
R_7	4.8	52.0	0.1	2.1
R_8	4.7	51.9	0.1	2.1
R_9	0.5	47.7	0.1	2.1
R_10	0.5	47.7	0.1	2.1
R_11	0.5	47.7	0.1	2.1
R_12	2.2	49.4	0.1	2.1
R_13	3.3	50.5	0.1	2.1
R_14	3.4	50.6	0.1	2.1
R_15	3.5	50.8	0.1	2.1
R_16	3.7	51.0	0.1	2.1
R_17	3.9	51.1	0.1	2.1
R_18	4.1	51.3	0.1	2.1
R_19	4.2	51.5	0.1	2.1
R_20	4.3	51.5	0.1	2.1
R_21	4.5	51.7	0.1	2.1
R_22	4.5	51.7	0.1	2.1
R_23	4.7	51.9	0.2	2.2

Table 6.2 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – Stage 2

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_24	4.7	51.9	0.2	2.2
R_25	4.8	52.0	0.2	2.2
R_26	4.9	52.1	0.2	2.2
R_27	5.0	52.2	0.2	2.2
R_28	5.2	52.4	0.2	2.2
R_29	5.2	52.4	0.2	2.2
R_30	5.3	52.5	0.2	2.2
R_31	5.5	52.7	0.2	2.2
R_32	4.6	51.8	0.1	2.1
R_33	4.1	51.3	0.1	2.1
R_34	3.8	51.0	0.1	2.1
R_35	3.5	50.8	0.1	2.1
R_36	2.9	50.1	0.1	2.1
R_37	2.8	50.0	0.1	2.1
R_38	3.1	50.3	0.1	2.1
R_39	3.1	50.3	0.1	2.1
R_40	3.1	50.3	0.1	2.1
R_41	3.1	50.3	0.1	2.1
R_42	3.0	50.2	0.1	2.1
R_43	2.9	50.2	0.1	2.1
R_44	2.9	50.1	0.1	2.1
R_45	2.8	50.0	0.1	2.1
R_46	2.7	49.9	0.1	2.1
R_47	0.5	47.7	0.1	2.1
R_48	0.5	47.7	0.1	2.1
R_49	0.4	47.6	0.1	2.1
R_50	0.4	47.6	0.1	2.1
R_51	0.4	47.6	0.1	2.1
R_52	0.4	47.7	0.1	2.1
R_53	0.5	47.7	0.1	2.1
R_54	0.5	47.7	0.1	2.1
R_55	0.5	47.7	0.1	2.1
R_56	0.5	47.7	0.1	2.1
R_57	0.5	47.7	0.1	2.1

Table 6.2 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at residential assessment locations – Stage 2

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
R_58	0.5	47.7	0.1	2.1
R_59	0.5	47.7	0.1	2.1
R_60	0.5	47.7	0.1	2.1
R_61	0.5	47.7	0.1	2.1
R_62	0.5	47.7	0.1	2.1
R_63	0.5	47.7	0.1	2.1
R_64	0.5	47.7	0.1	2.1
R_65	0.5	47.7	0.1	2.1

6.2.2 Predictions for commercial assessment locations

i PM_{10} and $PM_{2.5}$

The predicted incremental and cumulative ground level PM_{10} and $PM_{2.5}$ concentrations for Stage 2 operations at commercial assessment locations are presented in Table 6.3.

The highest incremental 24-hour average PM_{10} concentration at a commercial assessment location is 36.6 µg/m³ (down from 42.9 µg/m³ for approved operations and 61.3 µg/m³ for Stage 1 operations). The highest incremental annual average PM_{10} concentration at a commercial assessment location is 7.0 µg/m³ (down from 8.4 µg/m³ for approved operations and 11.1 µg/m³ for Stage 1 operations).

When background concentrations are added to the Proposal increment, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is 5 (down from 15 for approved operations and 28 for Stage 1 operations). There is one commercial assessment location above the annual average impact assessment criterion for Stage 2 operations (same as approved operations and down from three for Stage 1 operations).

The highest incremental 24-hour average $PM_{2.5}$ concentration at a commercial assessment location is 5.7 µg/m³ (down from 6.8 µg/m³ for approved operations and 9.8 µg/m³ for Stage 1 operations). The highest incremental annual average $PM_{2.5}$ concentration at a commercial assessment location is and 1.1 µg/m³ (down from 1.3 µg/m³ for approved operations and 1.8 µg/m³ for Stage 1 operations). When background concentrations are added to the Proposal increment, the maximum number of additional days above the 24-hour average impact assessment criterion at a commercial assessment location is two (same as approved operations and down from three for Stage 1). The existing background for annual average $PM_{2.5}$ is already above the impact assessment criterion.

Although Stage 2 operations involve an increase in throughput from Stage 1, modelling results at adjacent commercial assessment locations are reduced compared to Stage 1, as the Stage 2 construction emissions are assumed to occur concurrently with Stage 1 operations only. The peak 24-hour average modelling results at some of the adjacent commercial assessment locations are also reduced compared to approved operations, even though the throughput increases. This is due to the reconfiguration of the Proposal Site, which acts to re-distribute dust emissions, particularly from trucks, by re-directing truck exit points to the Honeycomb Drive extension and Kangaroo Avenue in the northeast of the Proposal Site.

As described previously, adjacent commercial receptors are considered less sensitive to air pollution than residential receptors. The predicted exceedances of the impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore considered low risk, from both an exposure duration and human health risk point of view.

Table 6.3 Predicted ground level concentrations for PM_{10} and $PM_{2.5}$ (µg/m³) at commercial assessment locations – Stage 2

Receptor ID	PM_{10}					$PM_{2.5}$				
	Increment		Cumulative			Increment		Cumulative		
	24-hour	Annual	24-hour	Days> 50µg/m³>	Annual	24-hour	Annual	24-hour	Days> 25µg/m³	Annual
IAC			*50* µg/m³		*25* µg/m³			*25* µg/m³		*8* µg/m³
CI_12	24.1	3.9	52.3	3	22.7	3.1	0.6	**25.8**	**2**	9.2
CI_13	19.5	3.8	48.7	0	22.7	2.8	0.7	**26.1**	**2**	9.3
CI_14	16.8	2.7	43.8	0	21.6	2.6	0.5	**25.8**	**2**	9.1
CI_15	19.2	3.2	44.7	0	22.1	3.2	0.6	**26.1**	**2**	9.2
CI_16	18.7	3.3	46.1	0	22.2	3.2	0.6	**26.2**	**2**	9.2
CI_17	26.1	3.2	**55.4**	**1**	22.1	3.8	0.5	**25.6**	**1**	9.2
CI_18	36.6	7.0	**61.6**	**5**	**25.9**	5.7	1.1	**26.9**	**2**	9.8
CI_19	8.7	1.1	48.0	0	20.0	1.2	0.2	24.4	0	8.8

ii TSP and dust deposition

The predicted incremental and cumulative ground level TSP concentrations and dust deposition for Stage 2 operations at commercial assessment locations are presented in Table 6.4.

The highest incremental annual average TSP concentration at a commercial assessment location is 25.8 µg/m³ (down from 31.4 µg/m³ for approved operations and 42.3 µg/m³ for Stage 1 operations). When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for TSP.

The highest incremental annual average dust deposition at a commercial assessment location is 0.5 g/m²/month (down from 0.6 g/m²/month for approved operations and 0.8 g/m²/month for Stage 1 operations). When background concentrations are added, there are no exceedances of the annual average impact assessment criterion for dust deposition.

Table 6.4 Predicted ground level concentrations for TSP (µg/m³) and dust deposition (g/m²/month) at commercial assessment locations – Stage 2

Receptor ID	TSP		Dust deposition	
	Increment	Cumulative	Increment	Cumulative
IAC		***90* µg/m³**		***2* g/m²/month**
CI_12	11.8	59.0	0.3	2.3
CI_13	12.4	59.6	0.3	2.3
CI_14	8.9	56.1	0.2	2.2
CI_15	10.2	57.5	0.3	2.3
CI_16	10.4	57.6	0.2	2.2
CI_17	11.1	58.3	0.3	2.3
CI_18	25.8	73.1	0.5	2.5
CI_19	2.9	50.1	0.1	2.1

7 Stage 3 impact assessment

7.1 Construction impact assessment

Stage 3 construction involves activities with a low potential for dust emissions, including constructing workshops, and maintenance sheds, installing signage and fencing. No assessment of Stage 3 construction is therefore required.

7.2 Operations impact assessment

There is no throughput increase for Stage 3 operations, therefore no additional modelling is presented. As discussed previously, modelling predictions for Stage 2 operations (Section 6) represent the longer-term operational conditions and are therefore relevant for Stage 3 operations.

8 Theoretical peak day impact analysis

The dispersion modelling results presented in the preceding sections are considered to be a conservative representation of approved and expected operations at the Proposal Site. However, emissions are based on annual throughputs distributed over the entire 12-month modelling period, with no accounting for day to day variability in truck movements and material handling rates.

In order to derive results for a theoretical peak day operational scenario, a multiplicative factor of 1.3 corresponding to 95th percentile traffic rates (consistent with Section 3.5) has been applied to the daily varying PM_{10} concentrations predicted by the dispersion modelling completed for Approved, Stage 1 (plus Stage 2 Construction) and Stage 2 operations.

Based on the results presented in the preceding sections, 24-hour average PM_{10} concentrations is the key pollutant and averaging period for compliance. For the analysis of theoretical peak day impacts, focus is therefore given to cumulative 24-hour average PM_{10} concentrations.

Predicted 24-hour average PM_{10} concentrations have been extracted at the residential and commercial assessment locations with the highest predicted incremental concentrations from the Proposal, specifically R31 and C18. Focus on these two assessment locations will therefore provide a conservative representation of the frequency of additional cumulative exceedance days at any assessment location presented in this report.

All background concentrations recorded between 2016 and 2021 from the Bingo Minchinbury TEOM were collated into a single dataset (1,791 data points). From this analysis, the PM_{10} monitoring data indicates that the local area typically experiences 7 exceedances of the NSW EPA 24-hour PM_{10} criteria of 50 $\mu g/m^3$ per year. Further details on background PM_{10} concentrations are presented in Section 4.1.1.

These background exceedance days are in general associated with regional scale events (dust storms, hazard reduction burns or bushfires). The collated background datasets have been used to undertake a cumulative concentration frequency analysis.

To understand the implications of the theoretical peak day operations for Approved, Stage 1 (plus Stage 2 Construction) and Stage 2 operations, a cumulative frequency analysis has been undertaken at the two selected assessment locations.

This analysis was completed by pairing all predicted 24-hour PM_{10} concentrations at either assessment location (366 predictions for 2016 modelling year) with all recorded background concentrations (as stated 1,791 total data points for PM_{10}). Therefore, at each assessment location, there are 655,506 combinations of background and model predicted impacts for 24-hour PM_{10}.

This process was repeated for the concentrations derived for each of the three modelling scenarios (ie Approved, Stage 1 (plus Stage 2 Construction) and Stage 2 operations).

For each receptor and emissions scenario, the frequency distribution of cumulative 24-hour PM_{10} concentrations were analysed. Of greatest significance was the potential change in cumulative days above the relevant NSW EPA criterion. The change in potential cumulative days above the NSW EPA criterion of 24-hour average PM_{10} for the three scenarios is illustrated in Figure 8-1 respectively.

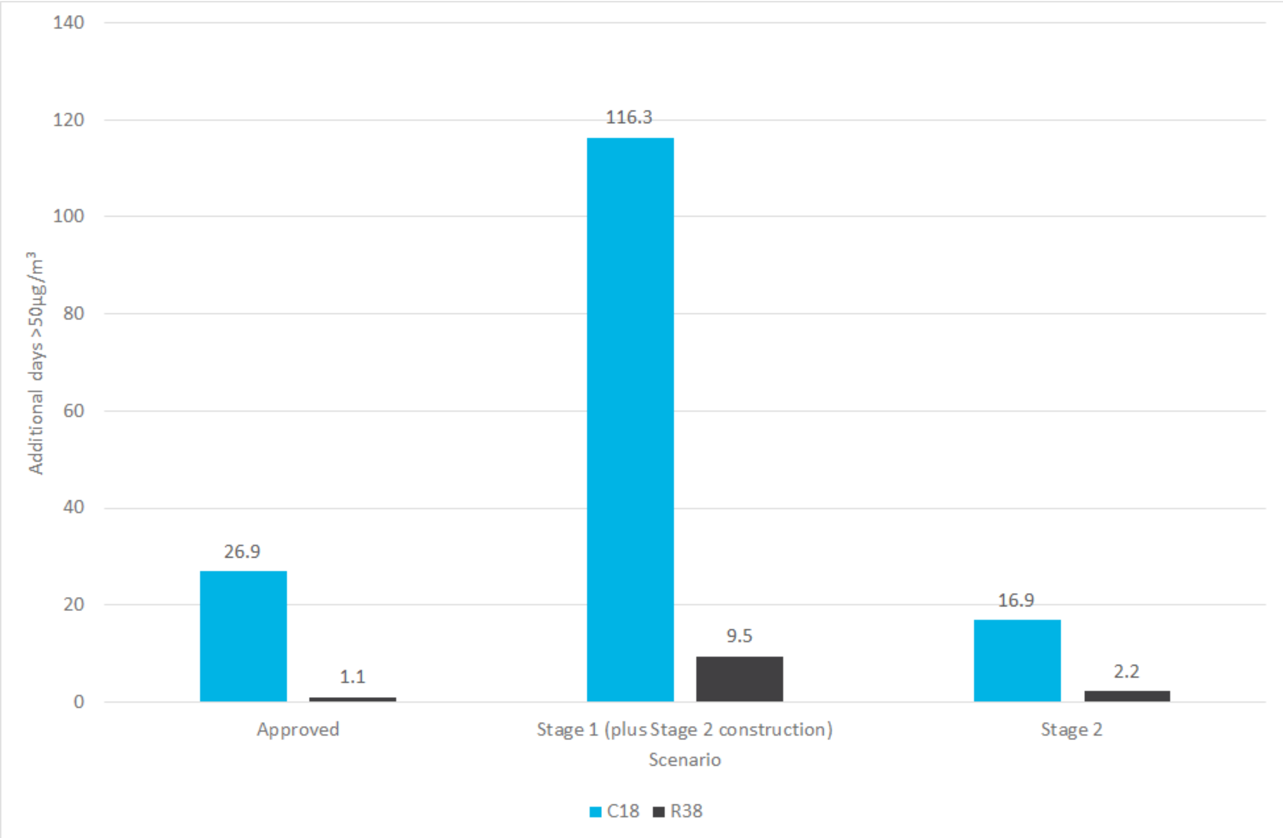

Figure 8-1 Change in days greater than 50µg/m³ relative to background – C18 and R38 – continual application of theoretical peak day emissions

The frequency of additional exceedance days presented in Figure 8-1 assumes that the theoretical peak day rate occurs continually. However, as stated, the 95th percentile daily traffic volumes have been adopted to derive an upscaling factor of 1.3 for the theoretical peak day scenario. This therefore equates to an occurrence of approximately 18 days per year.

The coincident occurrence of a peak day operations rate with a potential criteria exceedance has been derived by the following:

> Likelihood of occurrence = (indicative days per year of peak day rate/365) x (number of additional days above cumulative criteria/365)

For each assessment location and scenario, the likelihood of additional PM_{10} exceedance day relative to existing background was calculated. The results of the calculations are presented in Figure 8-2.

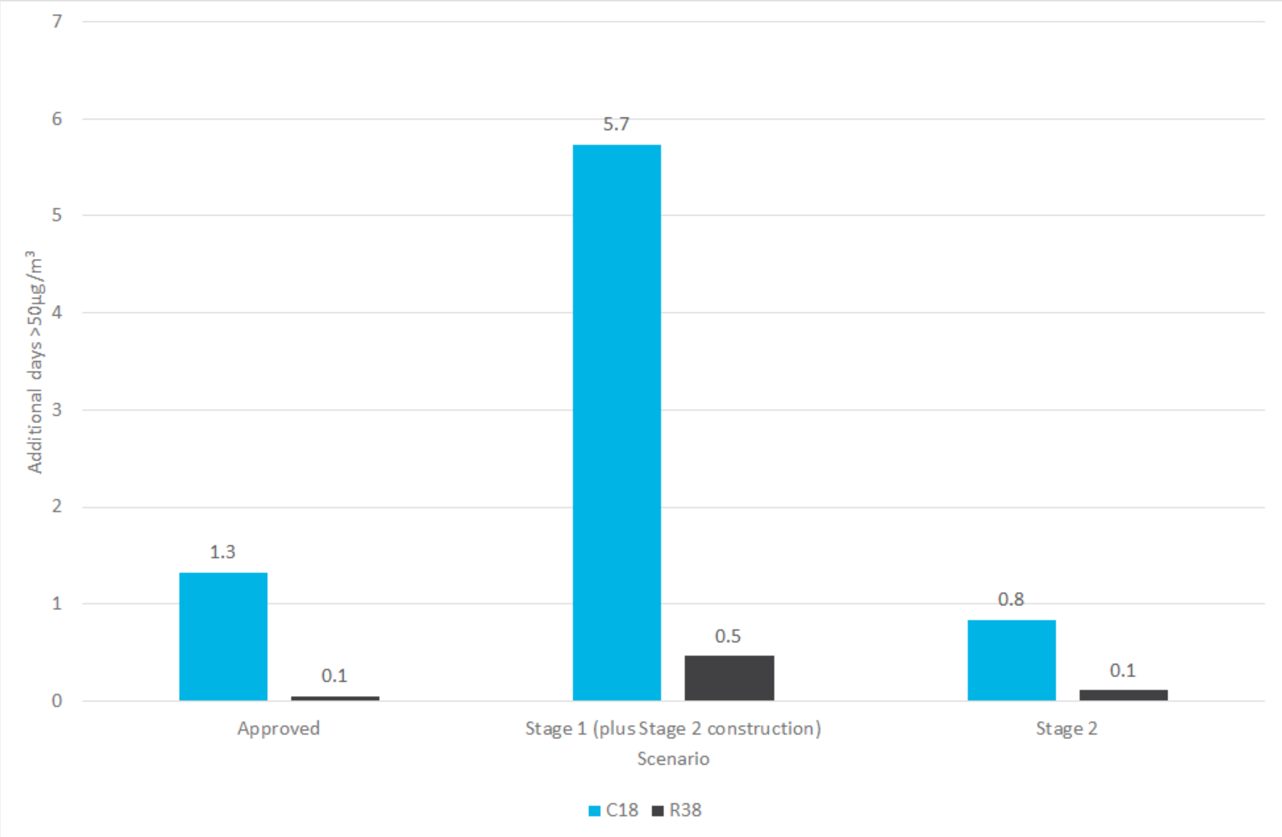

Figure 8-2 Change in days greater than 50µg/m³ relative to background – C18 and R38 – adjusted for frequency of occurrence (95th percentile activity rates)

These figures show that when the potential for additional cumulative concentrations above the NSW EPA impact assessment criteria is combined with the likely frequency of occurrence for peak day operations in a 12 month period (indicative 18 days per year based off 95th percentile for weighbridge data), the likelihood of cumulative criteria exceedance is very low across the three presented scenarios.

While an increase is predicted for Stage 1 (plus Stage 2 Construction), the improvements at the Proposal Site for Stage 2 operations leads to a significant reduction in the likelihood of additional exceedance days when compared with Approved operations, indicating that the Proposal will have a positive influence on air quality impacts from the Proposal Site at surrounding receptors. This is especially the case for the worst affected commercial receptors surrounding the Proposal Site.

As stated, assessment locations R38 and C18 represent the worst case locations for residential and commercial assessment locations respectively, while 24-hour average PM_{10} is the key pollutant and averaging period for compliance. Therefore, the likelihood of additional exceedance at other assessment locations or for other pollutants (eg 24-hour average $PM_{2.5}$) would be lower relative to the results presented in Figure 8-2.

9 Future odour impacts

In addition to the assessment of particulate matter emissions from the Proposal, a cumulative modelling assessment of odour emissions from the Proposal site in combination with sources from the approved Modification 10 and proposed Modification 9 has been undertaken. As indicated in Section 3.6, the cumulative odour emissions inventory developed for the Proposal is based on a number of highly conservative assumptions and a set of odour sampling results that are expected to be an overestimate of future odour emission generation from the Eastern Creek REP.

The results of the odour dispersion modelling scenario are presented in Table 9.1 and Table 9.2 for residential and commercial receptors respectively. Consistent with historical AQIA completed for the Eastern Creek REP (eg Modification 6, Ramboll 2018), the applicable odour goals are 2 ou at residential locations and 7 ou at neighbouring commercial/industrial receptors.

The results of the odour dispersion modelling presented in Table 9.1 and Table 9.2 respectively indicate that the applicable odour goal would be met at all surrounding residential and commercial locations. (). The expected future improvements in LFG generation and extraction associated with the approved Modification 10 means that the results presented in this AQIA are an upper estimate of likely future odour from the Eastern Creek REP. Modification 10 is expected to be fully operational in November 2022.

Table 9.1 Predicted ground level concentrations for odour – residential receptors

Receptor ID	Predicted 99th percentile 1-second (nose response) odour concentration
Odour goal	**2**
R_1	2
R_2	2
R_3	2
R_4	2
R_5	2
R_6	2
R_7	2
R_8	2
R_9	1
R_10	1
R_11	1
R_12	2
R_13	2
R_14	2
R_15	2
R_16	2
R_17	2
R_18	2
R_19	2

Table 9.1 Predicted ground level concentrations for odour – residential receptors

Receptor ID	Predicted 99th percentile 1-second (nose response) odour concentration
Odour goal	**2**
R_20	2
R_21	2
R_22	2
R_23	2
R_24	2
R_25	2
R_26	2
R_27	2
R_28	2
R_29	2
R_30	2
R_31	2
R_32	2
R_33	2
R_34	2
R_35	2
R_36	2
R_37	2
R_38	2
R_39	2
R_40	2
R_41	2
R_42	2
R_43	2
R_44	2
R_45	2
R_46	2
R_47	1
R_48	1
R_49	1
R_50	1
R_51	1
R_52	1
R_53	1

Table 9.1 Predicted ground level concentrations for odour – residential receptors

Receptor ID	Predicted 99th percentile 1-second (nose response) odour concentration
Odour goal	**2**
R_54	1
R_55	1
R_56	1
R_57	1
R_58	1
R_59	1
R_60	1
R_61	1
R_62	1
R_63	1
R_64	1
R_65	1

Table 9.2 Predicted ground level concentrations for odour – commercial receptors

Receptor ID	Predicted 99th percentile 1-second (nose response) odour concentration
Odour goal	**7**
CI_12	3
CI_13	4
CI_14	3
CI_15	4
CI_16	4
CI_17	3
CI_18	6
CI_19	3

10 Mitigation and monitoring

10.1 Construction

Activities during construction (material handling and hauling) are consistent with Eastern Creek REP operations and therefore the existing dust controls implemented for site operations are equally relevant to the construction phase. Similarly, the existing Environmental Management Strategy (EMS) and the Air Quality Odour and Greenhouse Gas Management Plan (AQOGHGMP) for the Eastern Creek REP outlines the roles, responsibilities and the tasks to be performed to ensure environmental impacts are minimised. The EMS and AQOGHGMP will continue to be implemented for the construction and operation of the Proposal.

A summary of relevant construction dust mitigation measures is presented in Table 10.1.

Table 10.1 Mitigation measures – construction dust

Impact	Mitigation measure	Responsibility	Timing
Reporting and record keeping	• Implement appropriate communication to potentially impacted residences in accordance with the EMS. • Continue to maintain a complaints register in accordance with the EMS. Where a dust complaint is received, the details of the response actions to the complaint should be detailed in the register. • Record any exceptional incidents that cause dust and/or air emissions, either on or off site, and the action taken to resolve the situation in the register. • Carry out regular site inspections, record inspection results, and make the logbook available for review as requested.	Bingo	Establish communications and register prior to the commencement of construction. Ongoing reporting and record keeping throughout the duration of construction activities.
Dust generation - general	• Erect screens or barriers to site fences around potentially dusty activities and material stockpiles where practicable. • Provide an adequate water supply on the construction site for effective dust/particulate matter suppression/mitigation. • Avoid site runoff of dirty water or mud. • Temporary cessation of non-essential dust generating activities during high winds. • Schedule activities to avoid adverse weather conditions by reviewing weather forecasts	Bingo / Construction contractor	Throughout the duration of construction activities.
Materials handling	• Prevention of truck overloading to reduce spillage during loading/unloading and hauling. • Minimise drop heights from loading, unloading or handling equipment.	Bingo / Construction contractor	Throughout the duration of construction activities.
Exposed areas	• Minimise the disturbance area. • Exposed areas will be stabilised as soon as practicable. • Permanent soil stockpiles will be revegetated.	Bingo / Construction contractor	Throughout the duration of construction activities.
Dust generation from vehicles moving on paved and unpaved roads	• Watering of main haulage routes. • Routes to be clearly marked and speed limits enforced (25km/hr on site). • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Bingo / Construction contractor	Throughout the duration of construction activities.

Table 10.1 Mitigation measures – construction dust

Impact	Mitigation measure	Responsibility	Timing
	• All vehicles will pass through the wheel wash or shaker grid prior to existing the site.		
Vehicle fuel combustion emissions	• Undertake maintenance of equipment. • Switch off vehicles when stationary.	Bingo / Construction contractor	Throughout the duration of construction activities.

10.2 Operation

10.2.1 Best management practice determination

The existing and proposed dust controls for the Eastern Creek REP were incorporated into the emission inventory developed for this assessment and summarised in Section 3.3. To demonstrate that Eastern Creek REP operates in accordance with best practice, a Best Management Practice (BMP) Determination is made with reference to best practice dust measures outlined in:

- Sustainability Victoria's *Guide to Best Practice at Resource Recovery Centres* (Sustainability Victoria 2009); and
- NSW EPA guidance document Environmental Guidelines: Solid Waste Landfills, Second edition 2016 (NSW EPA 2016).

The results of the BMP determination are presented in Table 10.2 and Table 10.3. It can be seen that, wherever applicable, the dust-control methods in place at Eastern Creek REP are consistent with documented best practice dust control measures for the resource recovery and waste industry. Furthermore, the monitoring data presented in Section 4.1 and the modelling results for approved operations (Section 4.4), demonstrate the adequacy of existing dust controls.

It is noted that as part of the ongoing improvements at the Proposal Site, all damaged paved surfaces are to be re-paved and upgraded, which will reduce the propensity to generate dust and make them easier to control. At the time of writing, these upgrades are well progressed, with the road pavement upgraded in front of MPC1, between MPC 1 and MPC2 and along Third Avenue.

In addition, the reconfiguration/optimisation of the Eastern Creek REP acts to re-distribute dust emissions, particularly from trucks, by re-directing truck exit points to the Honeycomb Drive extension and Kangaroo Avenue in the northeast of the Proposal Site, and in turn result in an improvement to air quality for the closest commercial receptors.

Table 10.2 Comparison of site dust-control measures with Sustainability Victoria *Guide to Best Practice at Resource Recovery Centres*

Dust-control method (Sustainability Victoria 2009)	Measure implemented at Eastern Creek REP
Minimise the area of exposed soils	Yes – areas of exposed soils are kept to a minimum.
Stabilise exposed areas (eg through revegetation) and stockpiles of dusty materials as soon as practicable	Yes – all non-active / permanent stockpiles / earth bunds are revegetated.
Revegetate completed areas as soon as practicable	Yes - all permanent stockpiles and earth bunds are revegetated

Table 10.2 Comparison of site dust-control measures with Sustainability Victoria *Guide to Best Practice at Resource Recovery Centres*

Dust-control method (Sustainability Victoria 2009)	Measure implemented at Eastern Creek REP
Water sprinklers at crushing/screening plant	Yes – water sprays operate on the crusher and screens.
Paving of all operating, storage, unloading and loading areas	Yes – all storage and handling occurs within the MPC1 and MPC2 or on paved surfaces at the SMA.
Sealing of roads if dust is considered likely to be an issue	Yes – all internal roads are sealed, except the ramp into the landfill., noting that it is not feasible to pave the access road into the landfill due to the route being subject to change.
Minimising areas of exposed earth through suitable landscaping	Yes – all earth bunds are revegetated.
Utilising dust suppressants (eg light water spray)	Yes – a misting system operates at each exit of the MPC1 and MPC2. MPC2 also operates with a dust collection and extraction system.
Installing windbreaks to prevent particulates becoming airborne	Yes – most material handling activities are sheltered either within a building, within the pit shell or adjacent to earth bunds.
Regular cleaning/sweeping of paved surfaces	Yes – a water cart operates daily on all internal paved surfaces and unpaved roads and surfaces.

Table 10.3 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 Eastern Creek REP
Minimise the area of exposed soils	Yes – areas of exposed soils are kept to a minimum.
Stabilise exposed areas (eg through revegetation) and stockpiles of dusty materials as soon as practicable	Yes – all non-active / permanent stockpiles / earth bunds are revegetated.
Revegetate completed areas as soon as practicable	Yes - all permanent stockpiles and earth bunds are revegetated
Use sealed or gravel roads, particularly from the public roadway to the gatehouse or waste reception section of the landfill	Yes – all internal roads are sealed, except the ramp into the pit.
Reduce drop heights, where applicable	Yes – material drop heights during truck unloading and loading operations will 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 – a misting system operates at each exit of the MPC1 and MPC2. MPC2 also operates with a dust collection system.
Appropriately modify excavation works and operations on dry, windy days or when the wind is blowing towards sensitive receptors	Yes – most material handling activities are sheltered either within a building, within the pit shell or adjacent to earth bunds. Additional watering of the access road will be used on windy days.
Enforce speed limits to minimise wheel-generated dust	Yes – the site enforces a speed limit.
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 – a shaker grid is installed, and a water cart operates daily on all internal paved surfaces and unpaved roads and surfaces.
Install wind barriers and enclosures (where practicable) to deflect wind from erodible areas and to minimise exposure of falling dusty materials to winds	Yes – most erodible areas are sheltered either within a building, within the landfill or adjacent to earth bunds.

The SEARs require details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings. All material receipt handling and sorting associated with the Proposal occurs within enclosed buildings (predominantly MPC2). Both MPC1 and MPC2 are enclosed on all sides and operate fine misting sprays on each opening to control fugitive dust. MPC2, the newer facility and where the majority of the Proposed throughput would be handled, also has an air handling and extraction system, installed to meet Fire Rescue NSW requirements.

The only material handling and processing to occur outside is at the SMA, including loading product stockpiles, loading trucks, material crushing, screening and shredding. All processing, although located outside, is controlled using water sprays. All storage of product materials is also external to buildings, as it is not practical to store this volume of material within an enclosed building. The Proposal would not substantially increase the volume of material directly deposited at the SMA.

10.3 Monitoring

The EMS and the AQOGGMP will be reviewed and updated for the modification, including changes to the air quality monitoring program as required.

The existing boundary dust deposition monitoring sites will need to be reviewed for Stage 2 operations, as the revised site layout will require some of these locations to be moved. The number of dust deposition gauges (four) does not need to be changed.

11 Conclusion

EMM has been commissioned to prepare an Air Quality Impact Assessment to support the preparation of a State Significant Development (SSD) Environmental Impact Statement (EIS) under Part 4, Division 4.7 of the of the *Environmental Planning and Assessment Act 1979* (EP&A Act) the upgrade and construction of supporting infrastructure to optimise the current operation at Eastern Creek REP and facilitate the increased throughput proposed to be received at the Proposal Site.

11.1 Stage 1

There is no construction component for Stage 1, therefore no construction assessment is required.

For Stage 1 operations, there are no additional days above the 24-hour average impact assessment criterion for PM_{10} and no exceedances of the annual average impact assessment criterion for PM_{10} at residential assessment locations. There is one additional day above the 24-hour average impact assessment criterion for $PM_{2.5}$ for Stage 1 operations at residential assessment locations. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria and the contribution from the Stage 1 Proposal to annual average $PM_{2.5}$ is approximately only 4% of the impact assessment criteria at residential receptors.

Modelling results for Stage 1 operations include the dust emission contribution from Stage 2 construction, which is scheduled to occur at the same time as the proposed throughput increase for Stage 1. It is noted that the duration of the Stage 2 construction is approximately 18 months, therefore the modelling predictions for Stage 1 operations plus Stage 2 construction would only occur in the short-term. Modelling predictions for Stage 2 operations represent the longer-term operational conditions.

The maximum number of additional days above the 24-hour average PM_{10} impact assessment criterion at a commercial assessment location is 28 for Stage 1 operations. There are three commercial assessment locations above the annual average impact assessment criterion for Stage 1 operations. The maximum number of additional days above the 24-hour average $PM_{2.5}$ impact assessment criterion at a commercial assessment location is three for Stage 1 operations, however the existing background for annual average $PM_{2.5}$ is already above the impact assessment criterion.

There are no exceedances of the annual average impact assessment criterion for TSP and dust deposition, at either residential or commercial assessment locations.

11.2 Stage 2

Stage 2 construction activities are included with the Stage 1 operations assessment.

For Stage 2 operations, there are no additional days above the 24-hour average impact assessment criterion for PM_{10} and no exceedances of the annual average impact assessment criterion for PM_{10} at residential assessment locations. There is one additional day above the 24-hour average impact assessment criterion for $PM_{2.5}$ at residential assessment locations. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criteria; and the contribution from the Stage 2 Proposal to annual average $PM_{2.5}$ is approximately only 4% of the impact assessment criteria at residential receptors.

The maximum number of additional days above the 24-hour average PM_{10} impact assessment criterion at a commercial assessment location is five for Stage 2 operations and there is one commercial assessment location above the annual average impact assessment criterion for Stage 2 operations

The maximum number of additional days above the 24-hour average $PM_{2.5}$ impact assessment criterion at a commercial assessment location is two for Stage 2 operations. The existing background for annual average $PM_{2.5}$ is already above the impact assessment criterion.

Although Stage 2 operations involve an increase in throughput from Stage 1, modelling results at adjacent commercial assessment locations are reduced compared to Stage 1, as the Stage 2 construction emissions are assumed to occur concurrently with Stage 1 operations only. The peak 24-hour average modelling results at some of the adjacent commercial assessment locations are also reduced compared to approved operations, even though the throughput increases. This is due to the reconfiguration/optimisaiton of the Eastern Creek REP, which acts to re-distribute dust emissions, particularly from trucks, by re-directing truck exit points to the Honeycomb Drive extension and Kangaroo Avenue in the northeast of the Proposal Site.

There are no exceedances of the annual average impact assessment criterion for TSP and dust deposition, at either residential or commercial assessment locations.

11.3 Stage 3

Stage 3 construction involves activities with a low potential for dust emissions, and therefore no assessment of Stage 3 construction is required. There is no throughput increase for Stage 3 operations, therefore no additional modelling is presented.

11.4 Odour

The results of a conservative odour modelling scenario for the Eastern Creek REP, accounting for potential cumulative emissions from the approved Modification 10 and proposed Modification 9 with the Proposal, indicate that odour goals will be met at surrounding residential and commercial/industrial receptor locations.

12 References

Bingo Industries 2021, Landfill Gas Management Plan - Eastern Creek Recycling Ecology Park (& Landfill).

EMM 2019, Genesis Waste Management Facility, Eastern Creek, Modification 6 Response to Submissions, 20 November 2019.

Katestone 2011, NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining, Report compiled on behalf of NSW Department of Environment, Climate Change and Water.

Northstar 2021, *Landfill Gas Collection Network and Flares – Eastern Creek Landfill - Air Quality Impact Assessment* 22.1024.FR1V1, November 2021

NPI 2011, National Pollution Inventory. Emission Estimation Technique Manual for Mining. Version 3.1. January 2011. Australian Government Department of Sustainability, Environment, Water, Population and Communities

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

NSW EPA 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales,* minor revisions, published January 2017.

NSW EPA 2016, Environmental Guidelines: Solid Waste Landfills, Second edition 2016.

NSW DECC 2006, Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW, Air Policy Section, Department of Environment and Conservation, November 2006.

Ramboll 2018, Air Quality Impact Assessment, Genesis Zero Waste Facility Modification 6, August 2018

Sustainability Victoria 2009, Guide to Best Practice at Resource Recovery Centres.

TRC 2011, Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW". Prepared for the Office of Environment and Heritage by TRC, March 2011.

US EPA 1995, AP-42 Fifth Edition Compilation of Air Emission Factors, Volume 1: Stationary Point and Area Source. Office of Air Quality Planning and Standards, Office of Air and Radiation, U.S. United States Environmental Protection Agency, Research Triangle Park, NC 27711, January 1995

Appendix A

Overview of dispersion modelling

A.1 Model settings

Table A2-1: TAPM settings

Parameter	Setting
Model Version	TAPM v.4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	25 x 25
Vertical grids / vertical extent	30 / 8000m (~400mb)
Centre of analysis	Lat 150.824997, long -33.7999992 Easting 298655, Northing 6257892S
Year of analysis	2016
Terrain and landuse	Terrain data using NASA SRTM3 database. Default TAPM values based on land-use and soils data sets from Geoscience Australia and the US Geological Survey, Earth Resources Observation Systems (EROS) Data Center Distributed Active Archive Center (EDC DAAC).
Assimilation sites	NSW OEH - St Marys BoM - Horsley Park Equestrian Centre, Badgerys Creek AWS, Penrith Lakes AWS, Bankstown Airport, Holsworthy Control Range, Sydney Olympic Park, Richmond RAAF and Camden Airport.

Table A2-2: CALMET settings

Parameter	Setting
Grid domain	60 km x 60 km
Grid resolution	0.5 km
Number of grid points	120 x 120
Reference grid coordinate	268.900, 6228.200
Vertical grids / vertical extent	10 cell heights / 4,000m
Upper air meteorology	Prognostic 3D.dat extracted from TAPM at 1 km grid
Surface observations	NSW OEH - St Marys BoM - Horsley Park Equestrian Centre, Badgerys Creek AWS, Penrith Lakes AWS, Bankstown Airport, Holsworthy Control Range, Sydney Olympic Park, Richmond RAAF and Camden Airport.

Table A2-3: CALMET model options

Flag	Description	Recommended setting	Value used
NOOBS	Meteorological data options	0,1,2	1 - combination of surface and prognostic data
ICLOUD	Cloud Data Options – Gridded Cloud Fields	4	4 -Gridded cloud cover from Prognostic relative humidity at all levels (MM5toGrads algorithm)
IEXTRP	Extrapolate surface wind observations to upper layers	-4	-4 - similarity theory used
IFRADJ	Compute Froude number adjustment effects	1	1 - applied

Table A2-3: CALMET model options

Flag	Description	Recommended setting	Value used
IKINE	Compute kinematic effects	0	0 - not computed
BIAS (NZ)	Relative weight given to vertically extrapolated surface observations vs. upper air data	NZ * 0	NZ * 0 - layers in lower levels of model will have stronger weighting towards surface, higher levels will be have stronger weighting to upper air data
TERRAD	Radius of influence of terrain	No default (typically 5-15km)	5 km
RMAX1 and RMAX2	Maximum radius of influence over land for observations in layer 1 and aloft	No Default	10 km, 20km
R1 and R2	Distance from observations in layer 1 and aloft at which observations and Step 1 wind fields are weighted equally	No Default	R1 - 2 km, R2 – 5 km

Table A2-4: CALPUFF model options

Flag	Description	Value used	Description
MCHEM	Chemical Transformation	0	Not modelled
MDRY	Dry Deposition	1	Yes
MWET	Wet Deposition	0	Not modelled
MTRANS	Transitional plume rise allowed?	1	Yes
MTIP	Stack tip downwash?	1	Yes
MRISE	Method to compute plume rise	1	Briggs plume rise
MSHEAR	Vertical wind Shear	0	Vertical wind shear not modelled
MPARTL	Partial plume penetration of elevated inversion?	1	Yes
MSPLIT	Puff Splitting	0	No puff splitting
MSLUG	Near field modelled as slugs	0	Not used
MDISP	Dispersion Coefficients	2	Based on micrometeorology
MPDF	Probability density function used for dispersion under convective conditions	1	Yes
MROUGH	PG sigma y,z adjusted for z	0	No
MCTADJ	Terrain adjustment method	3	Partial Plume Adjustment
MBDW	Method for building downwash	1	ISC Method

A.2 Representative year analysis

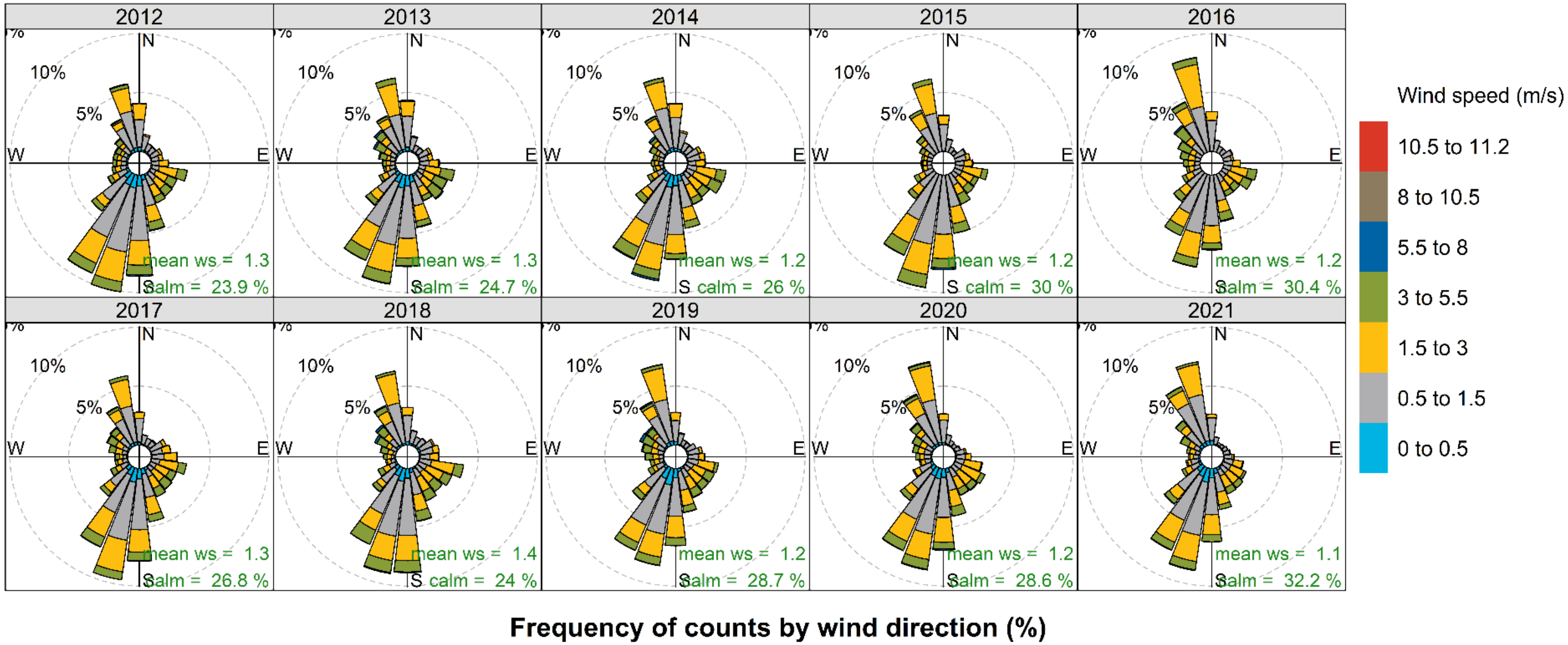

Figure A.1 Multi year wind rose for the DPE St Marys AQMS

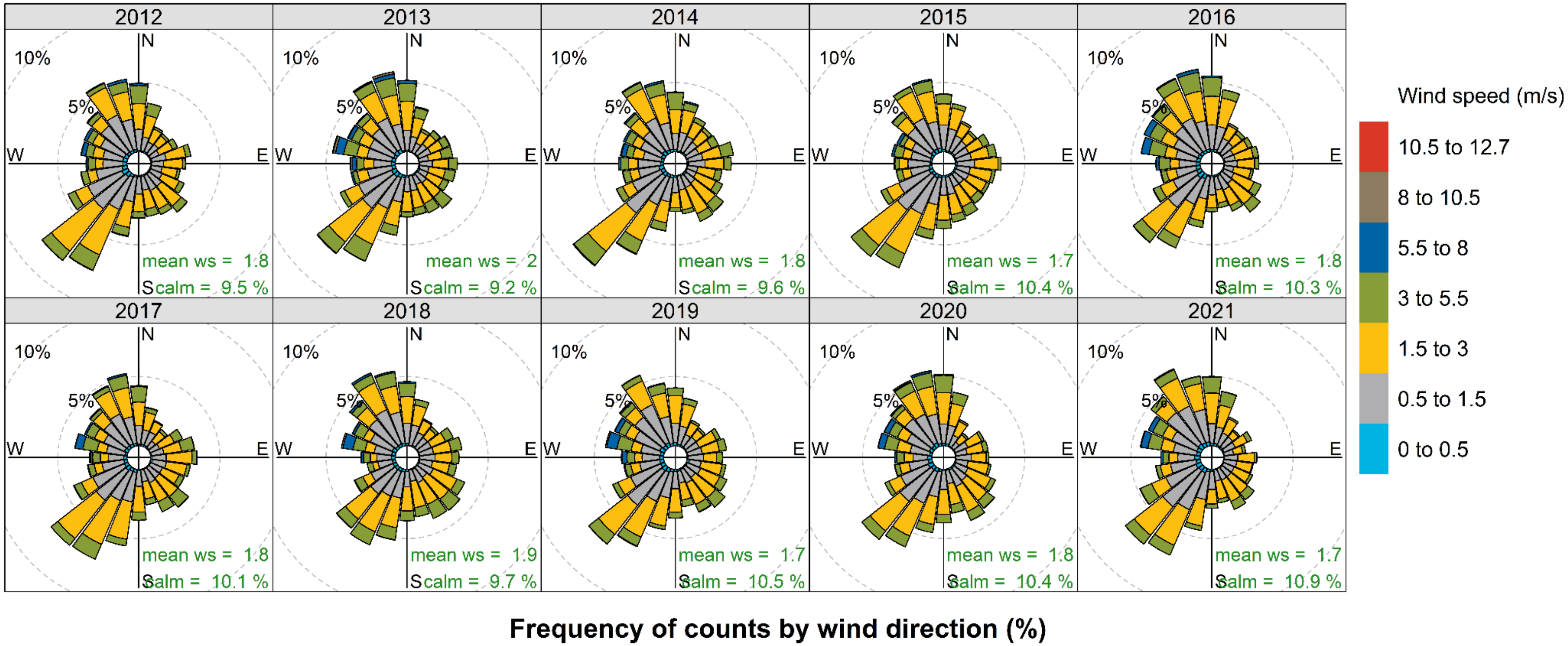

Figure A.2 Multi year wind rose for the DPE Prospect AQM

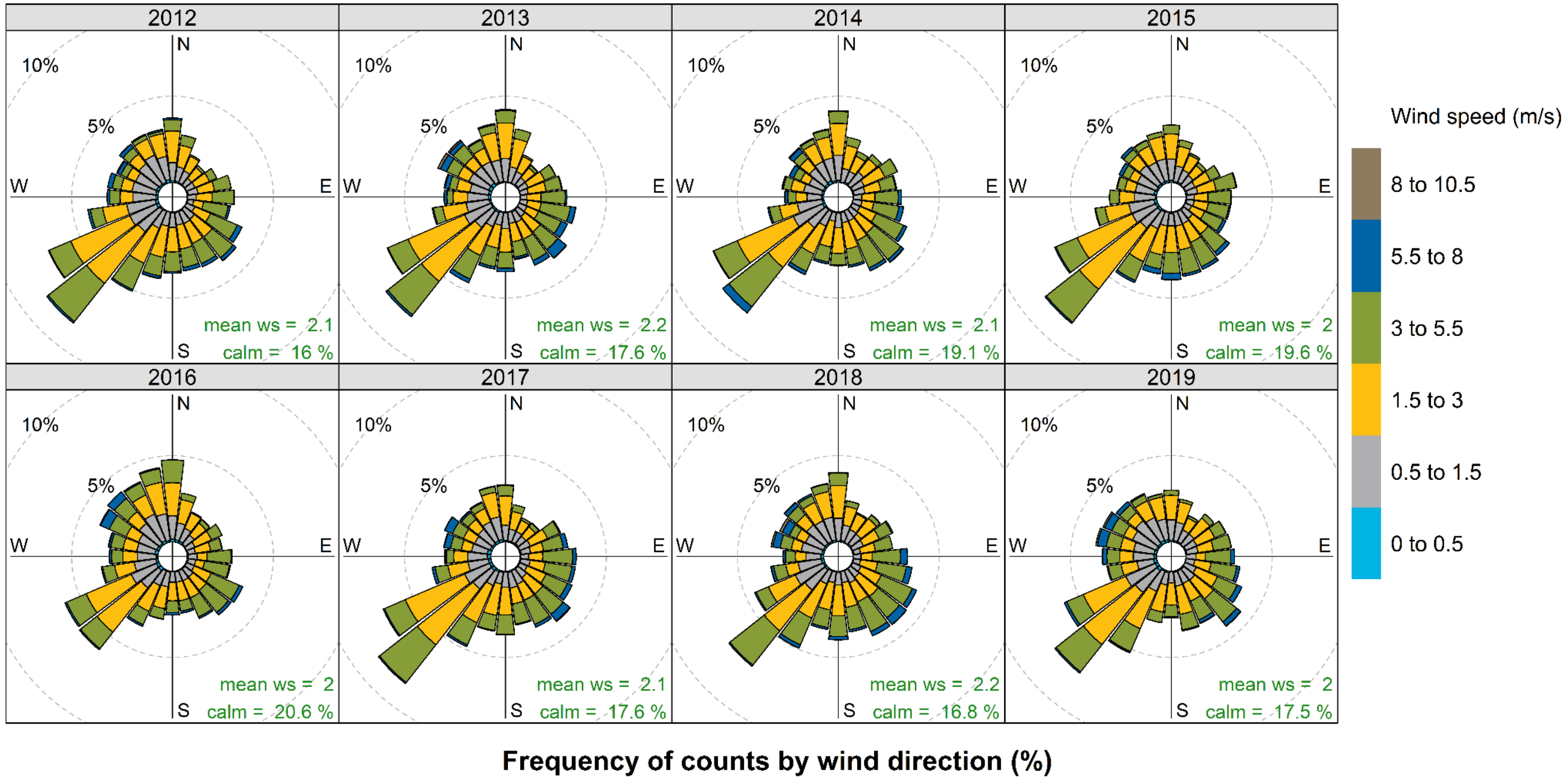

Figure A.3 **Multi year wind rose for the BoM Horsley Park AWS**

Appendix B

Emission inventory

Particulate matter emissions were quantified using accepted published emission estimation factors, collated from United States Environmental Protection Agency (US EPA) AP-42 Air Pollutant Emission Factors (US EPA 1995) as follows:

- AP-42 Chapter 13.2.1 – Paved Roads (US-EPA 2011) emission factor equation for wheel generated dust on internal paved surfaces;
- AP-42 Chapter 13.2.2 Unpaved roads (November 2006) – emission factor equation for wheel generated dust on unsealed section into landfill;
- AP-42 Chapter 13.2.4 Aggregate handling and storage piles (November 2006) – emission factor equation for material handling;
- AP-42 Chapter 11.19.2 – Crushed Stone Processing and Pulverized Mineral Processing (US-EPA 2004) - emission factor for crushing and screening;
- AP-42 Chapter 11.9 Western Surface Coal Mines (October 1998) – emission factor equation wind erosion from exposed areas.

A summary of the critical input assumptions used summarised in Table B.1. Emission summaries by activity are presented in Table B.2, Table B.3, Table B.4 and Table B.5. The derived emission factors for each activity are presented in Table B.6. All other emission inventory inputs are presented in Table B.7, Table B.8, Table B.9 and Table B.10.

Table B.1 Inputs for emission estimation

Material properties	Value	Source of information
Unpaved road silt content (%)	6.0	Consistent with AP-42 Chapter 13.2.2 mean value for municipal solid waste landfills
Paved road silt content (g/m2)	Trucks entering to weighbridge - 2.3 Internal movements around MPC/SMA – 4.0 Trucks exiting from MPC/SMA – 3.5	Site specific measurements
Material moisture contents (%)	Mixed incoming waste – 10% SMA products – 7%	Assumed, based on similar projects Average of site-specific measurements
Diesel consumption	Approved -260 kL/year Stage 1 = 325 kL/year Stage 2 = 384 kL/year	Diesel use for approved operations taken from NGERs data for FY20, and split between landfill (40%) MPC1 (24%), MPC2 (24%) and SMA (12%). Diesel use for Stage 1 and Stage operations are scaled pro-rata for the throughput increase.
Diesel emission factors	TSP – 0.66 kg/kL PM_{10} – 0.66 kg/kL $PM_{2.5}$ – 0.64 kg/kL	Corresponding to a US EPA Tier 2 emission standards for PM of 0.2 g/kWh (US EPA 2016). The PM emission standard is assumed to correspond to TSP and PM_{10}. $PM_{2.5}$ emissions are assumed to comprise 97% of PM_{10} emissions
Average truck load (t)	Waste trucks in - 22 t Product trucks out – 27 t	Based on weighted average of incoming waste as follows: • 20 t loads comprising 50% of incoming waste • 32 t loads comprising 35% of incoming waste • 4 t loads comprising 15% of incoming waste

Table B.1 Inputs for emission estimation

Material properties	Value	Source of information
		• 20 t loads comprising 40% of outgoing product • 32 t loads comprising 60% of outgoing product
Average truck GVM = (t)	Waste trucks in - 37 t Product trucks out –42 t	Based on an average empty weight of 15 t combined with the payload listed above.

Table B.2 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Approved Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Waste trucks in			
Wheel generated dust - landfill trucks in (paved section)	3,733	717	173
Wheel generated dust - landfill trucks in (unpaved section)	9,872	2,631	263
Wheel generated dust – resource recovery trucks into weighbridge	3,733	717	173
Wheel generated dust - resource recovery trucks continue onto SMA	125	24	6
Wheel generated dust - resource recovery trucks continue onto MPC1	NA – included in travel distance to weighbridge		
Wheel generated dust - resource recovery trucks continue onto MPC2	1,129	217	52
Waste trucks out			
Wheel generated dust - landfill trucks out (unpaved section)	6,592	1,757	176
Wheel generated dust - landfill trucks out (paved section)	1,495	287	69
Wheel generated dust - resource recovery trucks exit from SMA	489	94	23
Wheel generated dust - resource recovery trucks exit from MPC1 (empty and non-conforming)	888	171	41
Wheel generated dust - resource recovery trucks exist from MPC2 (empty and non-conforming)	888	171	41
Product trucks in and out			
Wheel generated dust - empty trucks entering site to weighbridge	1,107	212	51
Wheel generated dust - empty trucks entering continue onto SMA	150	29	7
Wheel generated dust - loaded trucks from SMA to exit	4,724	907	219
MPC1			
Trucks unloading	4.9	2.3	0.4
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	4.9	2.3	0.4
Screening	600	206	1.2
Conveyor transfers	3.9	1.9	0.3
Transfer to material storage areas	3.9	1.9	0.3
Loading trucks with non-conforming	0.2	0.1	0.02
Diesel consumption - nonroad equipment	41	41.2	39.9
MPC2			
Trucks unloading	4.9	2.3	0.4
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	4.9	2.3	0.4
Screening	600	206	1.2
Conveyor transfers	3.9	1.9	0.3
Transfer to material storage areas	3.9	1.9	0.3
Loading trucks with non-conforming	0.2	0.1	0.0
Diesel consumption - nonroad equipment	41.2	41.2	39.9
Landfill			

Table B.2 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Approved Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Unloading at tip face	28.8	13.6	2.1
Chute unloading	3.5	1.6	0.2
FEL spreading	32	15	2
Grader (road maintenance)	717	250	22
Diesel consumption - nonroad equipment	68.6	68.6	66.6
Exposed ground wind erosion	1,488	744	112
SMA			
Unloading waste trucks	24	11	2
Unloading MPC material	75.9	35.9	5.4
Crushing	5,250.0	504.0	93.3
Screening	1,806.0	1,806.0	10.5
FEL managing stockpiles	100	47	7
Loading product trucks	100	47	7
Wheel generated dust - truck movements within SMA	557	138	14
Diesel consumption - nonroad equipment	20.6	20.6	20.0
Exposed ground wind erosion	2,267	1,133	170

Table B.3 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Stage 1 Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Waste trucks in			
Wheel generated dust - landfill trucks in (paved section)	3,733	717	173
Wheel generated dust - landfill trucks in (unpaved section)	9,872	2,631	263
Wheel generated dust – resource recovery trucks into weighbridge	5,599	1,075	260
Wheel generated dust - resource recovery trucks continue onto SMA	188	36	9
Wheel generated dust - resource recovery trucks continue onto MPC1	NA – included in travel distance to weighbridge		
Wheel generated dust - resource recovery trucks continue onto MPC2	2,118	406	98
Waste trucks out			
Wheel generated dust - landfill trucks out (unpaved section)	6,592	1,757	176
Wheel generated dust - landfill trucks out (paved section)	1,495	287	69
Wheel generated dust - resource recovery trucks exit from SMA	733	141	34
Wheel generated dust - resource recovery trucks exit from MPC1 (empty and non-conforming)	999	192	46
Wheel generated dust - resource recovery trucks exist from MPC2 (empty and non-conforming)	1,666	320	77
Product trucks in and out			
Wheel generated dust - empty trucks entering site to weighbridge	1,710	328	79
Wheel generated dust - empty trucks entering continue onto SMA	231	44	11
Wheel generated dust - loaded trucks from SMA to exit	7,296	1,401	339
MPC1			
Trucks unloading	5.6	2.6	0.4
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	5.6	2.6	0.4
Screening	675	232	1.4
Conveyor transfers	4.4	2.1	0.3
Transfer to material storage areas	4.4	2.1	0.3
Loading trucks with non-conforming	0.3	0.1	0.02
Diesel consumption - nonroad equipment	58	58.3	56.6
MPC2			
Trucks unloading	9.3	4.4	0.7
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	9.3	4.4	0.7
Screening	1,195	411	2
Conveyor transfers	7.9	3.7	0.6
Transfer to material storage areas	7.9	3.7	0.6
Loading trucks with non-conforming	0.5	0.2	0.03
Diesel consumption - nonroad equipment	58.3	58.3	56.6
Landfill			

Table B.3 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Stage 1 Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Unloading at tip face	28.8	13.6	2.1
Chute unloading	4.1	1.9	0.3
FEL spreading	33	16	2
Grader (road maintenance)	717	250	22
Diesel consumption - nonroad equipment	68.6	68.6	66.6
Exposed ground wind erosion	1,485	742	111
SMA			
Unloading waste trucks	36	17	3
Unloading MPC material	118.3	55.9	8.5
Crushing	8,109.4	778.5	144.2
Screening	2,789.6	2,789.6	16.2
FEL managing stockpiles	154	73	11
Loading product trucks	154	73	11
Wheel generated dust - truck movements within SMA	861	212	21
Diesel consumption - nonroad equipment	29.2	29.2	28.3
Exposed ground wind erosion	2,267	1,133	170

Table B.4 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Stage 2 Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Waste trucks in			
Wheel generated dust - landfill trucks in (paved section)	1,866	358	87
Wheel generated dust - landfill trucks in (unpaved section)	9,255	2,466	247
Wheel generated dust – resource recovery trucks into weighbridge	7,279	1,397	338
Wheel generated dust - resource recovery trucks continue onto SMA	367	70	17
Wheel generated dust - resource recovery trucks continue onto MPC1	NA – included in travel distance to weighbridge		
Wheel generated dust - resource recovery trucks continue onto MPC2			
Waste trucks out			
Wheel generated dust - landfill trucks out (unpaved section)	6,180	1,647	165
Wheel generated dust - landfill trucks out (paved section)	747	143	35
Wheel generated dust - RR trucks exit from SMA	650	125	30
Wheel generated dust - RR trucks exit from MPC1 (empty and non-conforming)	866	166	40
Wheel generated dust - RR trucks exist from MPC2 (empty and non-conforming)	137	26	6
Product trucks in and out			
Wheel generated dust - empty trucks entering site to weighbridge	2,015	387	94
Wheel generated dust - empty trucks entering continue onto SMA	677	130	31
Wheel generated dust - loaded trucks from SMA to exit	8,598	1,650	399
MPC1			
Trucks unloading	4.8	2.3	0.3
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	4.8	2.3	0.3
Screening	585	201	1
Conveyor transfers	3.8	1.8	0.3
Transfer to material storage areas	3.8	1.8	0.3
Loading trucks with non-conforming	0.2	0.1	0.02
Diesel consumption - nonroad equipment	74	73.8	71.6
MPC2			
Trucks unloading	15.6	7.4	1.1
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	15.6	7.4	1.1
Screening	2,020	695	4
Conveyor transfers	13.3	6.3	1.0
Transfer to material storage areas	13.3	6.3	1.0
Loading trucks with non-conforming	0.8	0.4	0.06
Diesel consumption - nonroad equipment	73.8	73.8	71.6
Landfill			
Unloading at tip face	28.8	13.6	2.1
Chute unloading	5.3	2.5	0.4

Table B.4 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Stage 2 Operations

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
FEL spreading	34	16	2
Grader (road maintenance)	717	250	22
Diesel consumption - nonroad equipment	68.6	68.6	66.6
Exposed ground wind erosion	1,485	742	111
SMA			
Unloading waste trucks	35	16	2
Unloading MPC material	164.7	77.9	11.8
Crushing	10,511.7	1,009.1	186.9
Screening	3,616.0	3,616.0	21.0
FEL managing stockpiles	199	94	14
Loading product trucks	199	94	14
Wheel generated dust - truck movements within SMA	1,116	275	28
Diesel consumption - nonroad equipment	36.9	36.9	35.8
Exposed ground wind erosion	2,267	1,133	170

Table B.5 Annual TSP, PM_{10} and $PM_{2.5}$ emissions – Stage 2 Construction

Emission source	Calculated annual emissions (kg/annum) by source		
	TSP	PM_{10}	$PM_{2.5}$
Construction truck movements			
Wheel generated dust - Construction southwest to landfill entrance (unpaved section)	4,665	1,243	124
Wheel generated dust - Construction northeast to landfill entrance (unpaved section)	13,995	3,730	373
Wheel generated dust - construction to landfill (unpaved section)	2,837	756	76
Wheel generated dust - Construction excess to exit (paved)	3,676	706	171
Construction northeast			
Excavator material extraction	11.1	5.2	0.8
Loading to trucks	11.1	5.2	0.8
Unloading for onsite use	1.5	0.7	0.1
Exposed ground wind erosion	1,784	892	134
Construction southwest			
Excavator material extraction	3.7	1.7	0.3
Loading to trucks	3.7	1.7	0.3
Unloading for onsite use	0.5	0.2	0.0
Exposed ground wind erosion	749	375	56
Landfill			
Unloading excavated material at tip face	7.5	3.5	0.5

Table B.6 Emission factors – all scenarios

Activities	Category	TSP	PM_{10}	$PM_{2.5}$	Units
Waste trucks in					
Wheel generated dust - landfill trucks in (paved section)	Hauling	0.27	0.05	0.01	kg/VKT
Wheel generated dust - landfill trucks in (unpaved section)	Hauling	2.74	0.73	0.07	kg/VKT
Wheel generated dust - RR trucks into weighbridge	Hauling	0.27	0.05	0.01	kg/VKT
Wheel generated dust - RR trucks continue onto SMA	Hauling	0.46	0.09	0.02	kg/VKT
Wheel generated dust - RR trucks continue onto MPC1	Hauling	0.46	0.09	0.02	kg/VKT
Wheel generated dust - RR trucks continue onto MPC2	Hauling	0.46	0.09	0.02	kg/VKT
Waste trucks out					
Wheel generated dust - landfill trucks out (unpaved section)	Hauling	1.83	0.49	0.05	kg/VKT
Wheel generated dust - landfill trucks out (paved section)	Hauling	0.11	0.02	0.01	kg/VKT
Wheel generated dust - RR trucks exit from SMA	Hauling	0.16	0.03	0.01	kg/VKT
Wheel generated dust - RR trucks exit from MPC1 (empty and non-conforming)	Hauling	0.16	0.03	0.01	kg/VKT
Wheel generated dust - RR trucks exist from MPC2 (empty and non-conforming)	Hauling	0.16	0.03	0.01	kg/VKT
Product trucks in and out					
Wheel generated dust - empty trucks entering site to weighbridge	Hauling	0.11	0.02	0.01	kg/VKT
Wheel generated dust - empty trucks entering continue onto SMA	Hauling	0.16	0.03	0.01	kg/VKT
Wheel generated dust - loaded trucks from SMA to exit	Hauling	0.46	0.09	0.02	kg/VKT
MPC1					
Trucks unloading	Material handling	0.0001	0.0000	0.00001	kg/t
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	Material handling	0.0001	0.0000	0.00001	kg/t
Screening	Processing	0.0125	0.0043	0.000025	kg/t
Conveyor transfers	Material handling	0.0001	0.0000	0.00001	kg/t

Table B.6 Emission factors – all scenarios

Activities	Category	TSP	PM_{10}	$PM_{2.5}$	Units
Transfer to material storage areas	Material handling	0.0001	0.0000	0.00001	kg/t
Loading trucks with non-conforming	Material handling	0.0001	0.0000	0.00001	kg/t
Diesel consumption - nonroad equipment	Exhaust emissions	0.66	0.66	0.64	kg/kL
MPC2					
Trucks unloading	Material handling	0.0001	0.0000	0.00001	kg/t
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	Material handling	0.0001	0.0000	0.00001	kg/t
Screening	Processing	0.0125	0.0043	0.000025	kg/t
Conveyor transfers	Material handling	0.0001	0.0000	0.00001	kg/t
Transfer to material storage areas	Material handling	0.0001	0.0000	0.00001	kg/t
Loading trucks with non-conforming	Material handling	0.0001	0.0000	0.00001	kg/t
Diesel consumption - nonroad equipment	Exhaust emissions	0.66	0.66	0.64	kg/kL
Landfill					
Unloading at tip face	Material handling	0.0001	0.0000	0.00001	kg/t
Chute unloading	Material handling	0.0001	0.0000	0.00001	kg/t
FEL spreading	Material handling	0.0001	0.0000	0.00001	kg/t
Grader (road maintenance)	Hauling	0.62	0.22	0.02	kg/km
Diesel consumption - nonroad equipment	Exhaust emissions	0.66	0.66	0.64	kg/kL
Exposed ground wind erosion	Wind erosion	850	425	64	kg/ha/y
SMA					
Unloading waste trucks	Material handling	0.0001	0.0001	0.00001	kg/t
Unloading MPC material	Material handling	0.0001	0.0001	0.00001	kg/t
Crushing	Processing	0.0125	0.0012	0.0002	kg/t

Table B.6 Emission factors – all scenarios

Activities	Category	TSP	PM_{10}	$PM_{2.5}$	Units
Screening	Processing	0.0043	0.0043	0.00003	kg/t
FEL managing stockpiles	Material handling	0.0001	0.0001	0.00001	kg/t
Loading product trucks	Material handling	0.0001	0.0001	0.00001	kg/t
Wheel generated dust - truck movements within SMA	Hauling	1.59	0.39	0.04	kg/VKT
Diesel consumption - nonroad equipment	Exhaust emissions	0.66	0.66	0.64	kg/kL
Exposed ground wind erosion	Wind erosion	850	425	64	kg/ha/y
Construction truck movements					
Wheel generated dust - Construction southwest to landfill entrance (unpaved section)	Hauling	2.65	0.71	0.07	kg/VKT
Wheel generated dust - Construction northeast to landfill entrance (unpaved section)	Hauling	2.65	0.71	0.07	kg/VKT
Wheel generated dust - construction to landfill (unpaved section)	Hauling	2.65	0.71	0.07	kg/VKT
Wheel generated dust - Construction excess to exit (paved)	Hauling	0.25	0.05	0.01	kg/VKT
Construction northeast					
Excavator material extraction	Material handling	0.0001	0.00004	0.00001	0.0001
Loading to trucks	Material handling	0.0001	0.00004	0.00001	0.0001
Unloading for onsite use	Material handling	0.0001	0.00004	0.00001	0.0001
Exposed ground wind erosion	Wind erosion	850	425	64	850
Construction northeast					
Excavator material extraction	Material handling	0.0001	0.00004	0.00001	0.0001
Loading to trucks	Material handling	0.0001	0.00004	0.00001	0.0001
Unloading for onsite use	Material handling	0.0001	0.00004	0.00001	0.0001
Exposed ground wind erosion	Wind erosion	850	425	64	850
Landfill					

Table B.6 Emission factors – all scenarios

Activities	Category	TSP	PM_{10}	$PM_{2.5}$	Units
Unloading excavated material at tip face	Material handling	0.0001	0.00004	0.00001	0.0001

Table B.7 Emission inventory inputs – approved operations

	Activity rate	Units	Variables										Control	Control type
Waste trucks in														
Wheel generated dust - landfill trucks in (paved section)	45,872	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - landfill trucks in (unpaved section)	36,697	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - RR trucks into weighbridge	45,872	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto SMA	917	VKT/y	4.0	road surface silt loading (g/m2)	0.1	km	9,174	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC1	0	VKT/y	4.0	road surface silt loading (g/m2)	0.0	km	18,349	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC2	8,257	VKT/y	4.0	road surface silt loading (g/m2)	0.5	km	18,349	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Waste trucks out														
Wheel generated dust - landfill trucks out (unpaved section)	36,697	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.9	water cart 75% + speed limit 44% + wind breaks (30%)
Wheel generated dust - landfill trucks out (paved section)	45,872	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from SMA	10,092	VKT/y	3.5	road surface silt loading (g/m2)	1.1	km	9,174	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from MPC1 (empty and non-conforming)	18,349	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	18,349	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exist from MPC2 (empty and non-conforming)	18,349	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	18,349	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Product trucks in and out														

Table B.7 Emission inventory inputs – approved operations

	Activity rate	Units	Variables										Control	Control type
Wheel generated dust - empty trucks entering site to weighbridge	33,971	VKT/y	2.3	road surface silt loading (g/m2)	1.1	km	30,882	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - empty trucks entering continue onto SMA	3,088	VKT/y	3.5	road surface silt loading (g/m2)	0.1	km	30,882	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - loaded trucks from SMA to exit	33,971	VKT/y	3.5	road surface silt loading (g/m2)	1.1	km	30,882	Loads/y	42	Loaded weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
MPC1														
Trucks unloading	400,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	400,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Screening	320,000	t/y											0.85	70% for enclosure plus 50% for water
Conveyor transfers	320,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Transfer to material storage areas	320,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Loading trucks with non-conforming	20,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Diesel consumption - nonroad equipment	62	kl/y												
MPC2														
Trucks unloading	400,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	400,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water
Screening	320,000	t/y											0.85	70% for enclosure plus 50% for water

Table B.7 Emission inventory inputs – approved operations

	Activity rate	Units	Variables				Control	Control type
Conveyor transfers	320,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water
Transfer to material storage areas	320,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water
Loading trucks with non-conforming	20,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water
Diesel consumption - nonroad equipment	62	kl/y						
Landfill								
Unloading at tip face	1,000,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Chute unloading	120,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
FEL spreading	1,120,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Grader (road maintenance)	3,328	km/y	8	speed of graders in km/h	416	grader hours	0.65	50% for sprinklers + wind breaks (30%)
Diesel consumption - nonroad equipment	104	kl/y						
Exposed ground wind erosion	5.0	Area (ha)					0.65	50% for watering + wind breaks (30%)
SMA								
Unloading waste trucks	200,000	t/y	1.6	wind speed (m/s)	7.7	MC (%)		
Unloading MPC material	640,000	t/y	1.6	wind speed (m/s)	7.7	MC (%)		
Crushing	840,000	t/y					0.5	50% for watering
Screening	840,000	t/y					0.5	50% for watering

Table B.7 Emission inventory inputs – approved operations

	Activity rate	Units	Variables										Control	Control type
FEL managing stockpiles	840,000	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Loading product trucks	840,000	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Wheel generated dust - truck movements within SMA	1,400	VKT/y	4.1	road surface silt loading (g/m2)	0.1	km	28,000	Loads/y	20	Empty weight (t)	30	Truck capacity (t)	0.75	50% for watering
Diesel consumption - nonroad equipment	31	kl/y												
Exposed ground wind erosion	5.3	Area (ha)											0.5	50% for watering

Table B.8 Emission inventory inputs – Stage 1 operations

	Activity rate	Units	Variables										Control	Control type
Waste trucks in														
Wheel generated dust - landfill trucks in (paved section)	45,872	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - landfill trucks in (unpaved section)	36,697	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - RR trucks into weighbridge	68,807	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	68,807	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto SMA	1,376	VKT/y	4.0	road surface silt loading (g/m2)	0.1	km	13,761	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC1	0	VKT/y	4.0	road surface silt loading (g/m2)	0.0	km	20,642	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC2	15,482	VKT/y	4.0	road surface silt loading (g/m2)	0.5	km	34,404	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Waste trucks out														
Wheel generated dust - landfill trucks out (unpaved section)	36,697	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - landfill trucks out (paved section)	45,872	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from SMA	15,138	VKT/y	3.5	road surface silt loading (g/m2)	1.1	km	13,761	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from MPC1 (empty and non-conforming)	20,642	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	20,642	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exist from MPC2 (empty and non-conforming)	34,404	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	34,404	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Product trucks in and out														

Table B.8 Emission inventory inputs – Stage 1 operations

	Activity rate	Units	Variables										Control	Control type
Wheel generated dust - empty trucks entering site to weighbridge	52,472	VKT/y	2.3	road surface silt loading (g/m2)	1.1	km	47,702	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - empty trucks entering continue onto SMA	4,770	VKT/y	3.5	road surface silt loading (g/m2)	0.1	km	47,702	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - loaded trucks from SMA to exit	52,472	VKT/y	3.5	road surface silt loading (g/m2)	1.1	km	47,702	Loads/y	42	Loaded weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
MPC1														
Trucks unloading	450,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	450,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Screening	360,000	t/y											0.85	70% for enclosure plus 50% for water sprays
Conveyor transfers	360,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Transfer to material storage areas	360,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Loading trucks with non-conforming	22,500	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Diesel consumption - nonroad equipment	88	kl/y												
MPC2														
Trucks unloading	750,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	750,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Screening	637,500	t/y											0.85	70% for enclosure plus 50% for water sprays

Table B.8 Emission inventory inputs – Stage 1 operations

	Activity rate	Units	Variables				Control	Control type
Conveyor transfers	637,500	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Transfer to material storage areas	637,500	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Loading trucks with non-conforming	37,500	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Diesel consumption - nonroad equipment	88	kl/y						
Landfill								
Unloading at tip face	1,000,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Chute unloading	142,500	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
FEL spreading	1,142,500	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Grader (road maintenance)	3,328	km/y	8	speed of graders in km/h	416	grader hours	0.65	50% for sprinklers + wind breaks (30%)
Diesel consumption - nonroad equipment	104	kl/y						
Exposed ground wind erosion	5.0	Area (ha)					0.65	50% for watering + wind breaks (30%)
SMA								
Unloading waste trucks	300,000	t/y	1.6	wind speed (m/s)	7.7	MC (%)		
Unloading MPC material	997,500	t/y	1.6	wind speed (m/s)	7.7	MC (%)		
Crushing	1,297,500	t/y					0.5	50% for watering
Screening	1,297,500	t/y					0.5	50% for watering

Table B.8 Emission inventory inputs – Stage 1 operations

	Activity rate	Units	Variables										Control	Control type
FEL managing stockpiles	1,297,500	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Loading product trucks	1,297,500	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Wheel generated dust - truck movements within SMA	2,163	VKT/y	4.1	road surface silt loading (g/m2)	0.1	km	43,250	Loads/y	20	Empty weight (t)	30	Truck capacity (t)	0.75	50% for watering
Diesel consumption - nonroad equipment	44	kl/y												
Exposed ground wind erosion	5.3	Area (ha)											0.5	50% for watering

Table B.9 Emission inventory inputs – Stage 2 operations

	Activity rate	Units	Variables										Control	Control type
Waste trucks in														
Wheel generated dust - landfill trucks in (paved section)	22,936	VKT/y	2.3	road surface silt loading (g/m2)	0.5	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - landfill trucks in (unpaved section)	34,404	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - RR trucks entrance to MPC1/MPC2 - (paved)	89,450	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	89,450	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto SMA	2,683	VKT/y	4.0	road surface silt loading (g/m2)	0.2	km	13,417	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC1	0	VKT/y	4.0	road surface silt loading (g/m2)	0.0	km	17,890	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks continue onto MPC2	0	VKT/y	4.0	road surface silt loading (g/m2)	0.0	km	58,142	Loads/y	37	Loaded weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Waste trucks out														
Wheel generated dust - landfill trucks out (unpaved section)	34,404	VKT/y	6.0	% silt content	0.8	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - landfill trucks out (paved section)	22,936	VKT/y	2.3	road surface silt loading (g/m2)	0.5	km	45,872	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from SMA (NE exit)	13,417	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	13,417	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exit from MPC1 (empty and non-conforming) (NE exit)	17,890	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	17,890	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - RR trucks exist from MPC2 (empty and non-conforming) (SW exit)	11,628	VKT/y	0.8	road surface silt loading (g/m2)	0.2	km	58,142	Loads/y	15	Empty weight (t)	22	Truck capacity (t)	0.7	70% for watering and/or sweeping

Table B.9 Emission inventory inputs – Stage 2 operations

	Activity rate	Units	Variables										Control	Control type
Product trucks in and out														
Wheel generated dust - empty trucks entering site to weighbridge	61,834	VKT/y	2.3	road surface silt loading (g/m2)	1.0	km	61,834	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - empty trucks entering continue onto SMA	12,367	VKT/y	4.0	road surface silt loading (g/m2)	0.2	km	61,834	Loads/y	15	Empty weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
Wheel generated dust - loaded trucks from SMA to exit (NE exit)	61,834	VKT/y	3.5	road surface silt loading (g/m2)	1.0	km	61,834	Loads/y	42	Loaded weight (t)	27	Truck capacity (t)	0.7	70% for watering and/or sweeping
MPC1														
Trucks unloading	390,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	390,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Screening	312,000	t/y											0.85	70% for enclosure plus 50% for water sprays
Conveyor transfers	312,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Transfer to material storage areas	312,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Loading trucks with non-conforming	19,500	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Diesel consumption - nonroad equipment	112	kl/y												
MPC2														
Trucks unloading	1,267,500	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Excavator sorting, loading screen, loading trucks with reject, loading chute with residual	1,267,500	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays

Table B.9 Emission inventory inputs – Stage 2 operations

	Activity rate	Units	Variables				Control	Control type
Screening	1,077,375	t/y					0.85	70% for enclosure plus 50% for water sprays
Conveyor transfers	1,077,375	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Transfer to material storage areas	1,077,375	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Loading trucks with non-conforming	63,375	t/y	1.6	wind speed (m/s)	10	MC (%)	0.85	70% for enclosure plus 50% for water sprays
Diesel consumption - nonroad equipment	112	kl/y						
Landfill								
Unloading at tip face	1,000,000	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Chute unloading	185,250	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
FEL spreading	1,185,250	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)
Grader (road maintenance)	3,328	km/y	8	speed of graders in km/h	416	grader hours	0.65	50% for sprinklers + wind breaks (30%)
Diesel consumption - nonroad equipment	104	kl/y						
Exposed ground wind erosion	5.0	Area (ha)					0.65	50% for watering + wind breaks (30%)
SMA								
Unloading waste trucks	292,500	t/y	1.6	wind speed (m/s)	7.7	MC (%)		
Unloading MPC material	1,389,375	t/y	1.6	wind speed (m/s)	7.7	MC (%)		

Table B.9 Emission inventory inputs – Stage 2 operations

	Activity rate	Units	Variables										Control	Control type
Crushing	1,681,875	t/y											0.5	50% for watering
Screening	1,681,875	t/y											0.5	50% for watering
FEL managing stockpiles	1,681,875	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Loading product trucks	1,681,875	t/y	1.6	wind speed (m/s)	7.7	MC (%)								
Wheel generated dust - truck movements within SMA	2,803	VKT/y	4.1	road surface silt loading (g/m2)	0.1	km	56,063	Loads/y	20	Empty weight (t)	30	Truck capacity (t)	0.75	50% for watering
Diesel consumption - nonroad equipment	56	kl/y												
Exposed ground wind erosion	5.3	Area (ha)											0.5	50% for watering

Table B.10 Emission inventory inputs – Stage 2 construction

	Activity rate	Units	Variables										Control	Control type
Construction truck movements														
Wheel generated dust - Construction southwest to landfill entrance (unpaved section)	12,579	VKT/y	6.0	% silt content	0.8	km	7,862	Loads/y	34	Average weight (t)	38	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44%
Wheel generated dust - Construction northeast to landfill entrance (unpaved section)	37,737	VKT/y	6.0	% silt content	0.8	km	23,586	Loads/y	34	Average weight (t)	38	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44%
Wheel generated dust - construction to landfill (unpaved section)	10,931	VKT/y	6.0	% silt content	0.8	km	6,832	Loads/y	34	Average weight (t)	38	Truck capacity (t)	0.9	water cart 75% + 40km/h speed limit 44% + wind breaks (30%)
Wheel generated dust - Construction excess to exit (paved)	48,973	VKT/y	2.3	road surface silt loading (g/m2)	1.2	km	20,405	Loads/y	34	Average weight (t)	38	Truck capacity (t)	0.7	70% for watering and/or sweeping
Construction northeast														
Excavator material extraction	896,251	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Loading to trucks	896,251	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Unloading for onsite use	120,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Exposed ground wind erosion	4.2	Area (ha)											0.5	50% for watering
Construction southwest														
Excavator material extraction	298,750	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Loading to trucks	298,750	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays
Unloading for onsite use	40,000	t/y	1.6	wind speed (m/s)	10	MC (%)							0.85	70% for enclosure plus 50% for water sprays

Table B.10 Emission inventory inputs – Stage 2 construction

	Activity rate	Units	Variables				Control	Control type
Exposed ground wind erosion	1.8	Area (ha)					0.5	50% for watering
Landfill								
Unloading excavated material at tip face	259,600	t/y	1.6	wind speed (m/s)	10	MC (%)	0.65	50% for sprinklers + wind breaks (30%)

Appendix C

Contour plots

C.1 Incremental ground level concentrations (GLC) – 24-hour average PM_{10}

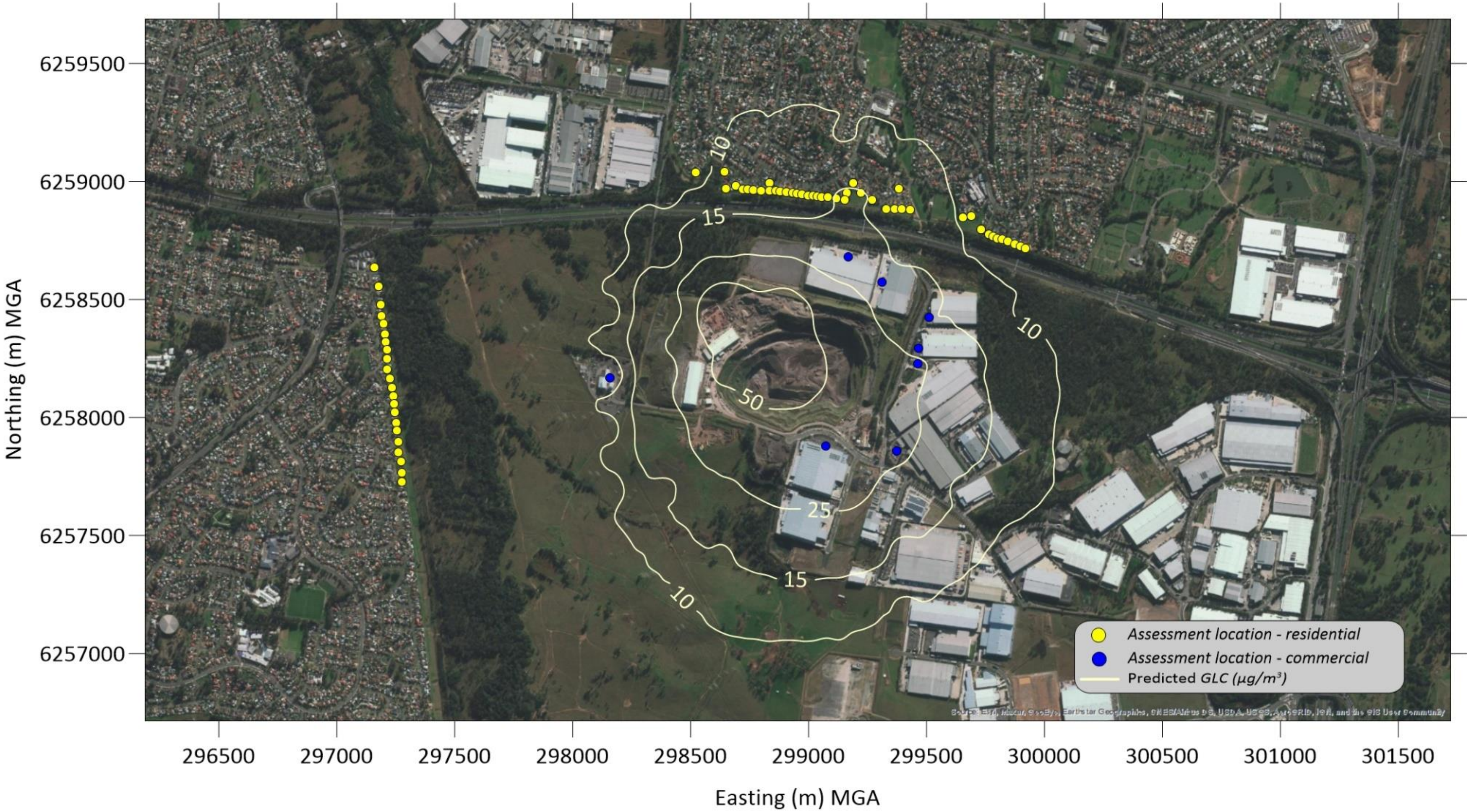

Figure C.1 Predicted ground level concentrations (µg/m³) for 24-hour average PM_{10} – approved operations

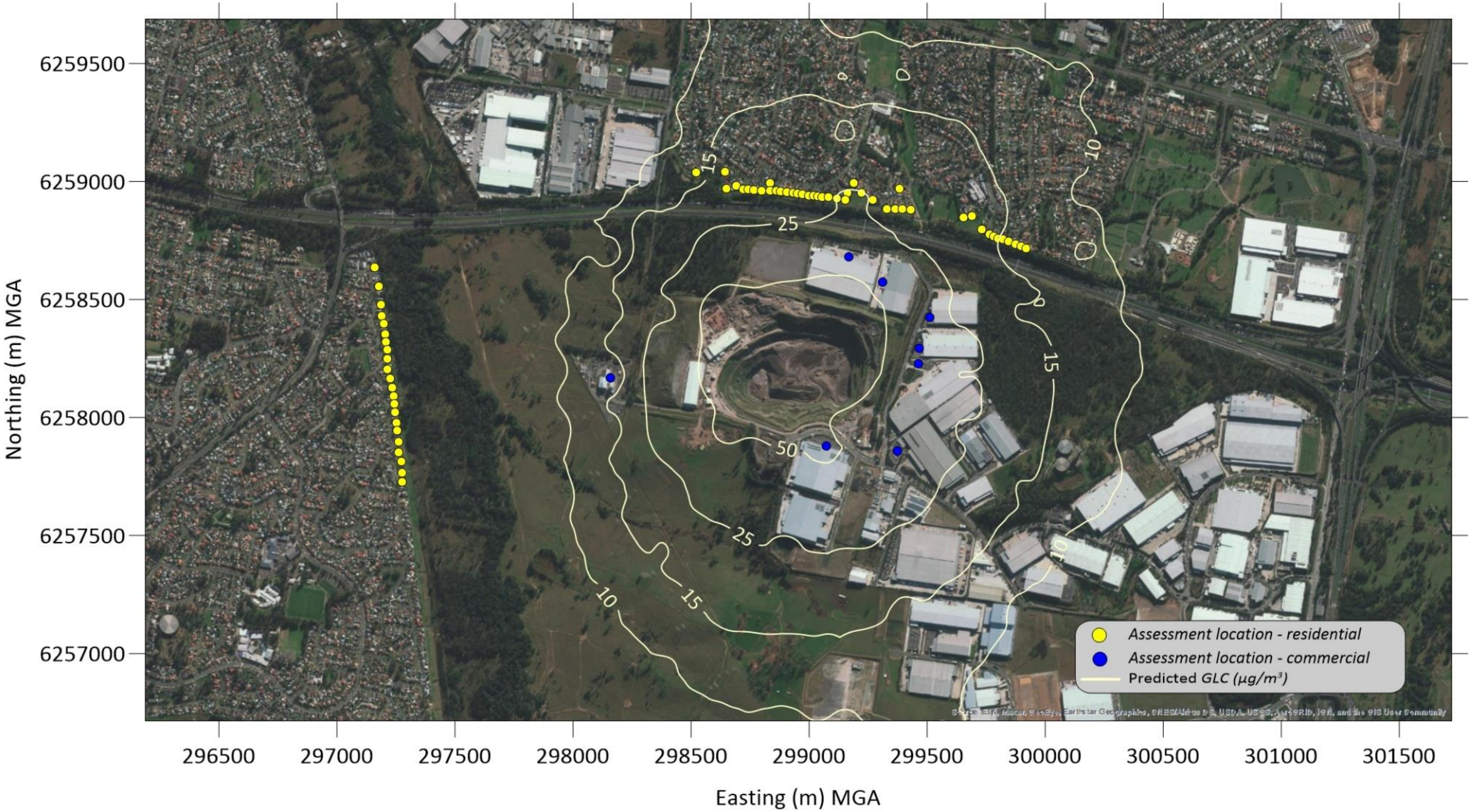

Figure C.2 Predicted ground level concentrations (µg/m³) for 24-hour average PM_{10} – Stage 1 operations (plus Stage 2 construction)

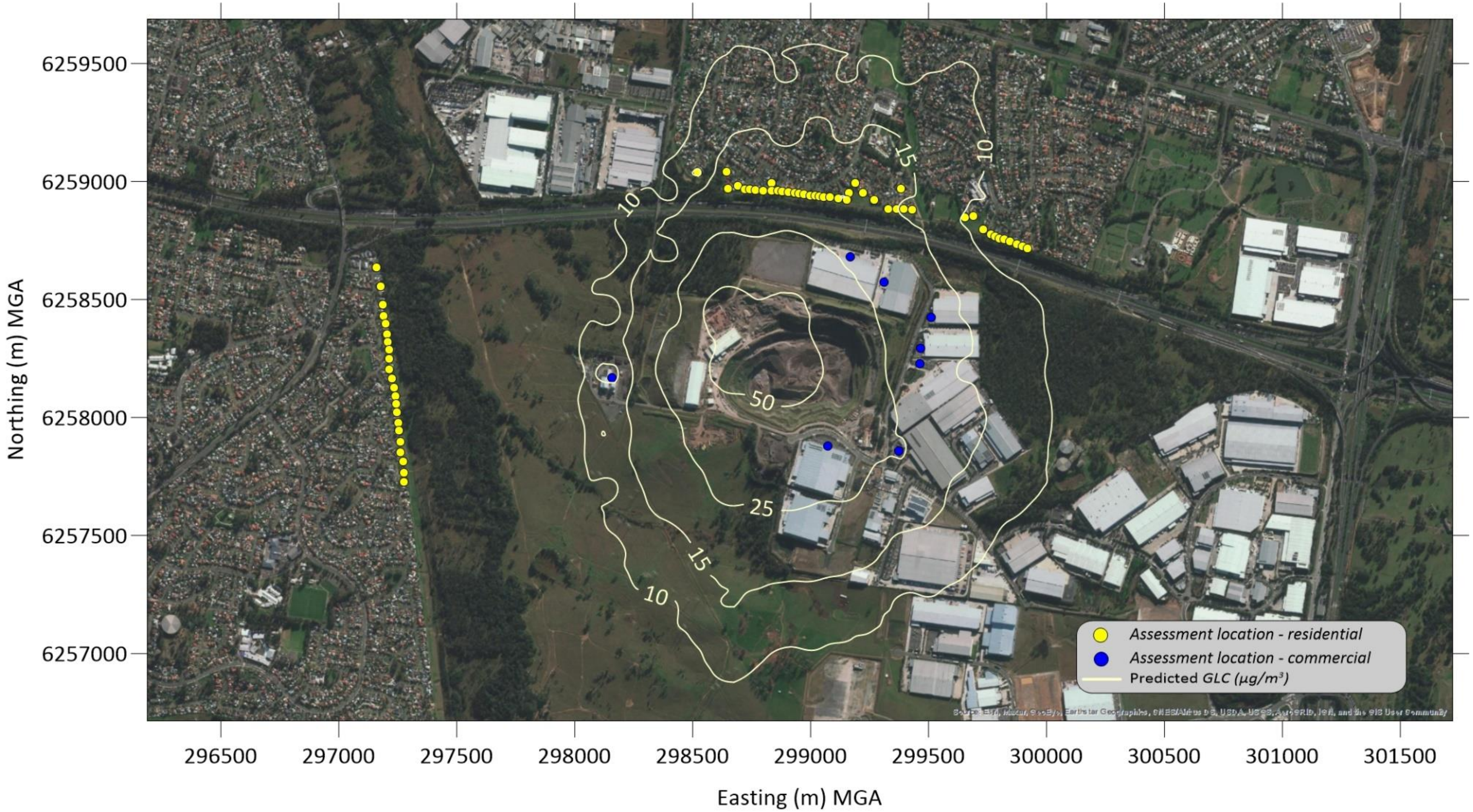

Figure C.3 Predicted ground level concentrations (µg/m³) for 24-hour average PM_{10} – Stage 2 operations

C.2 Incremental ground level concentrations (GLC) – annual average PM_{10}

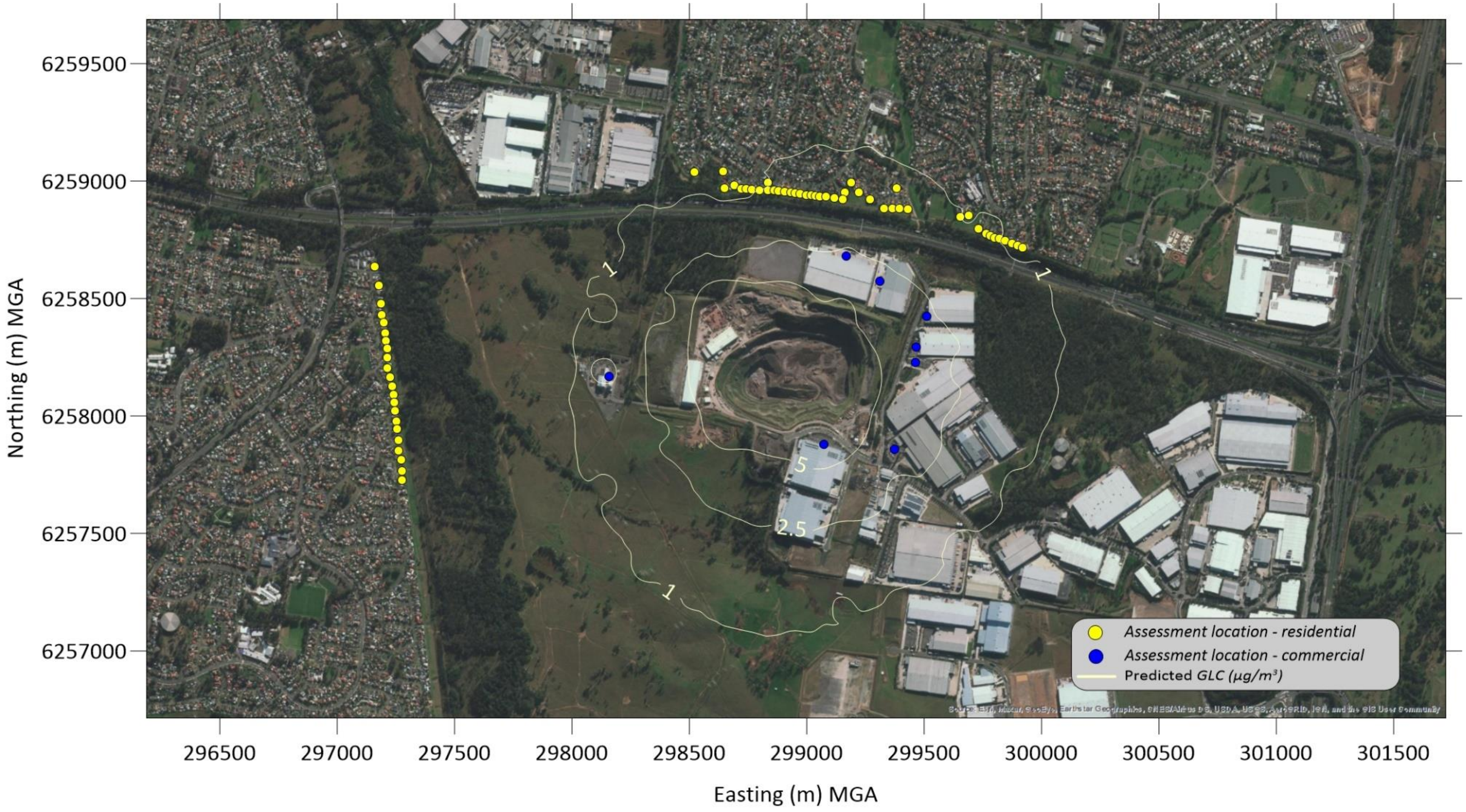

Figure C.4 Predicted ground level concentrations (µg/m³) for annual average PM_{10} – approved operations

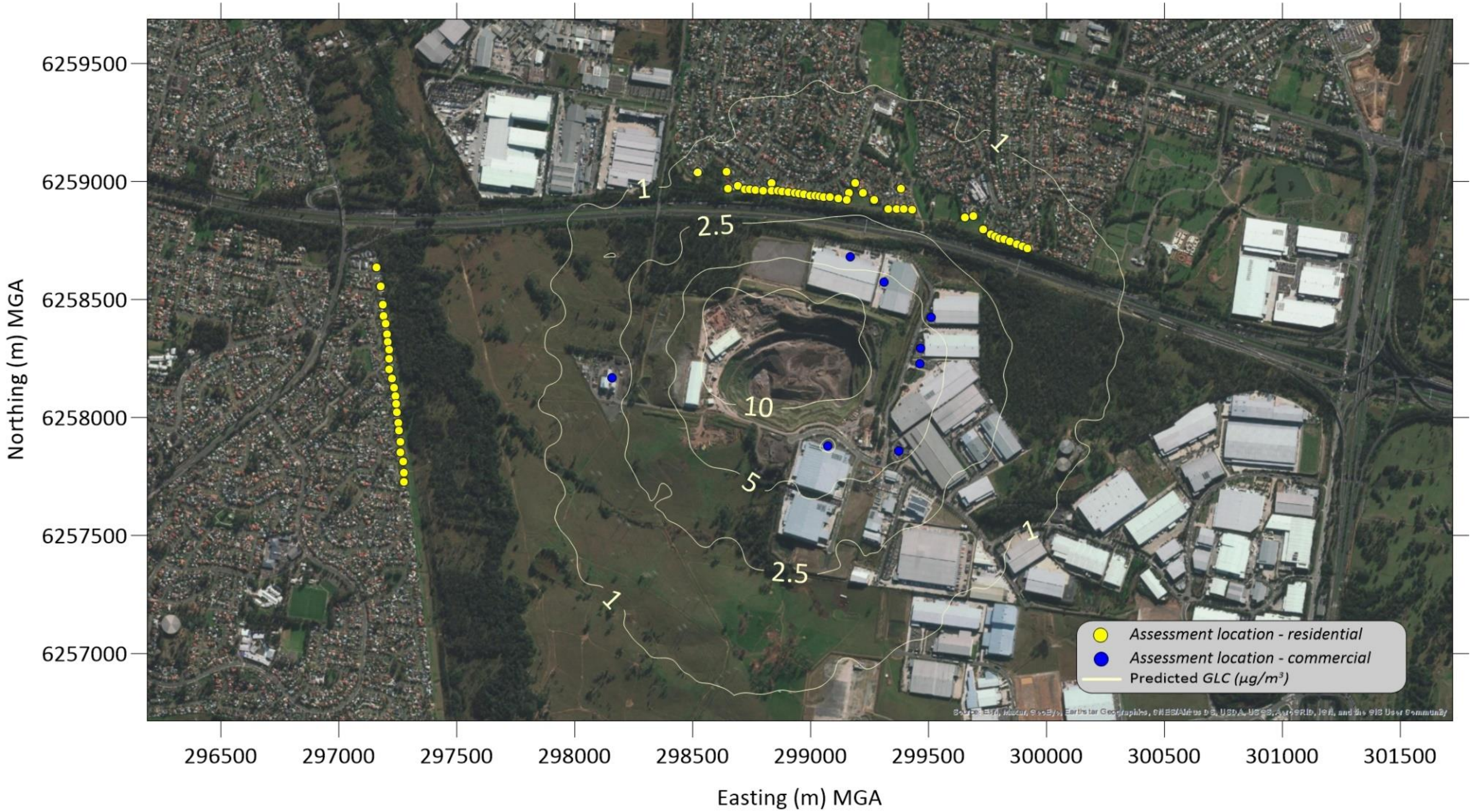

Figure C.5 **Predicted ground level concentrations (µg/m³) for annual average PM_{10} – Stage 1 operations (plus Stage 2 construction)**

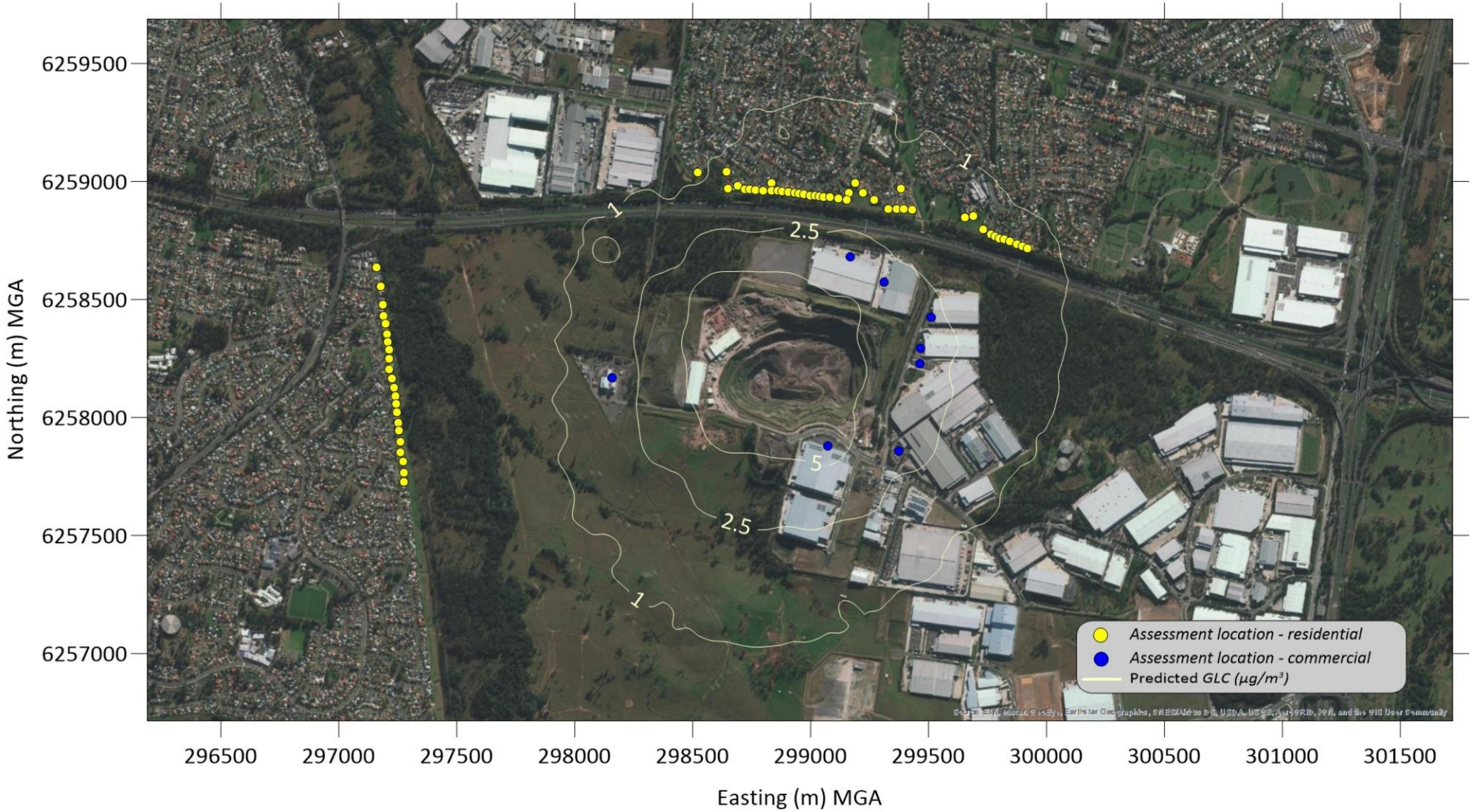

Figure C.6 Predicted ground level concentrations (μg/m^3) for annual average PM_{10} – Stage 2 operations

C.3 Incremental ground level concentrations (GLC) – 24-hour average $PM_{2.5}$

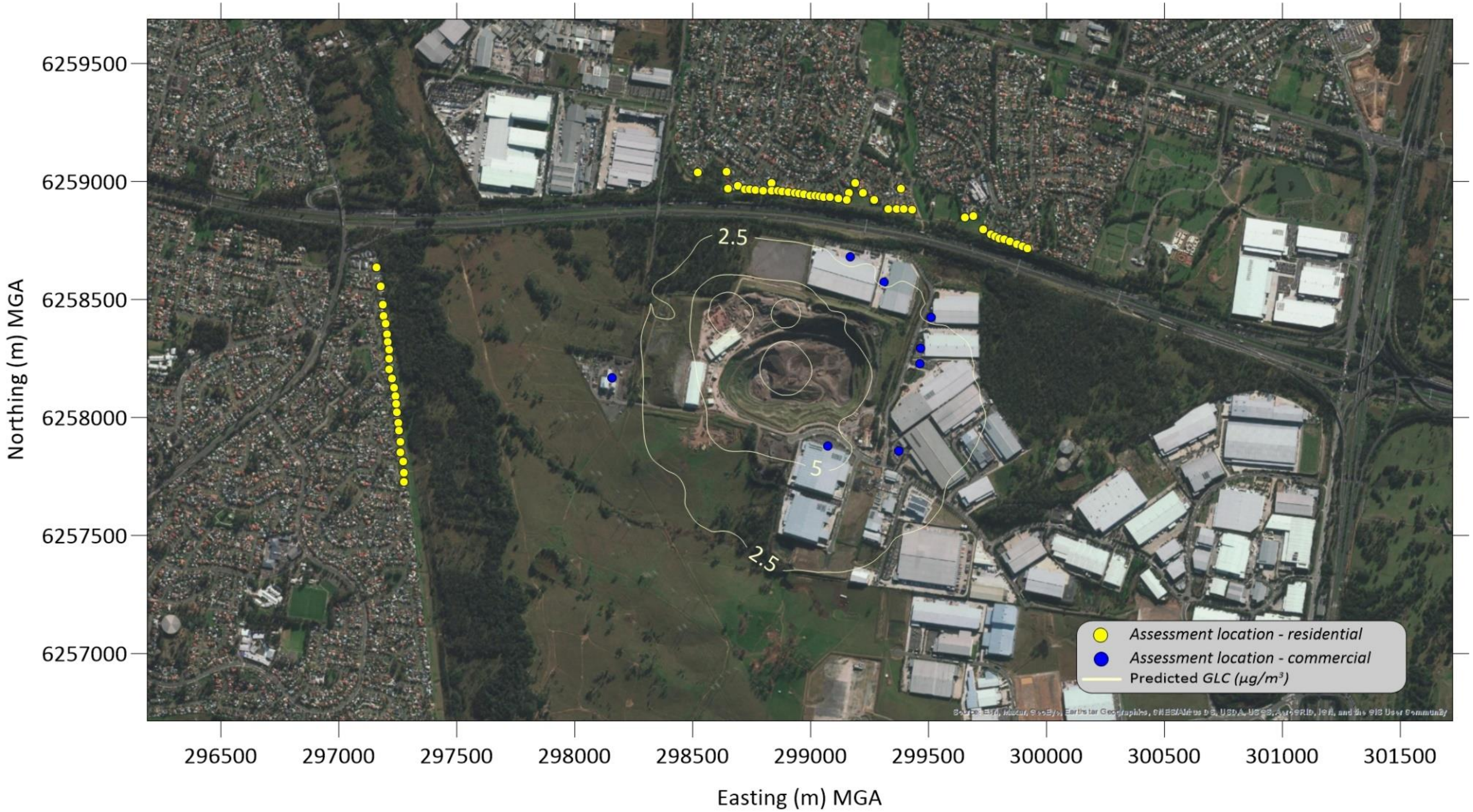

Figure C.7 Predicted ground level concentrations (µg/m³) for 24-hour average $PM_{2.5}$ – approved operations

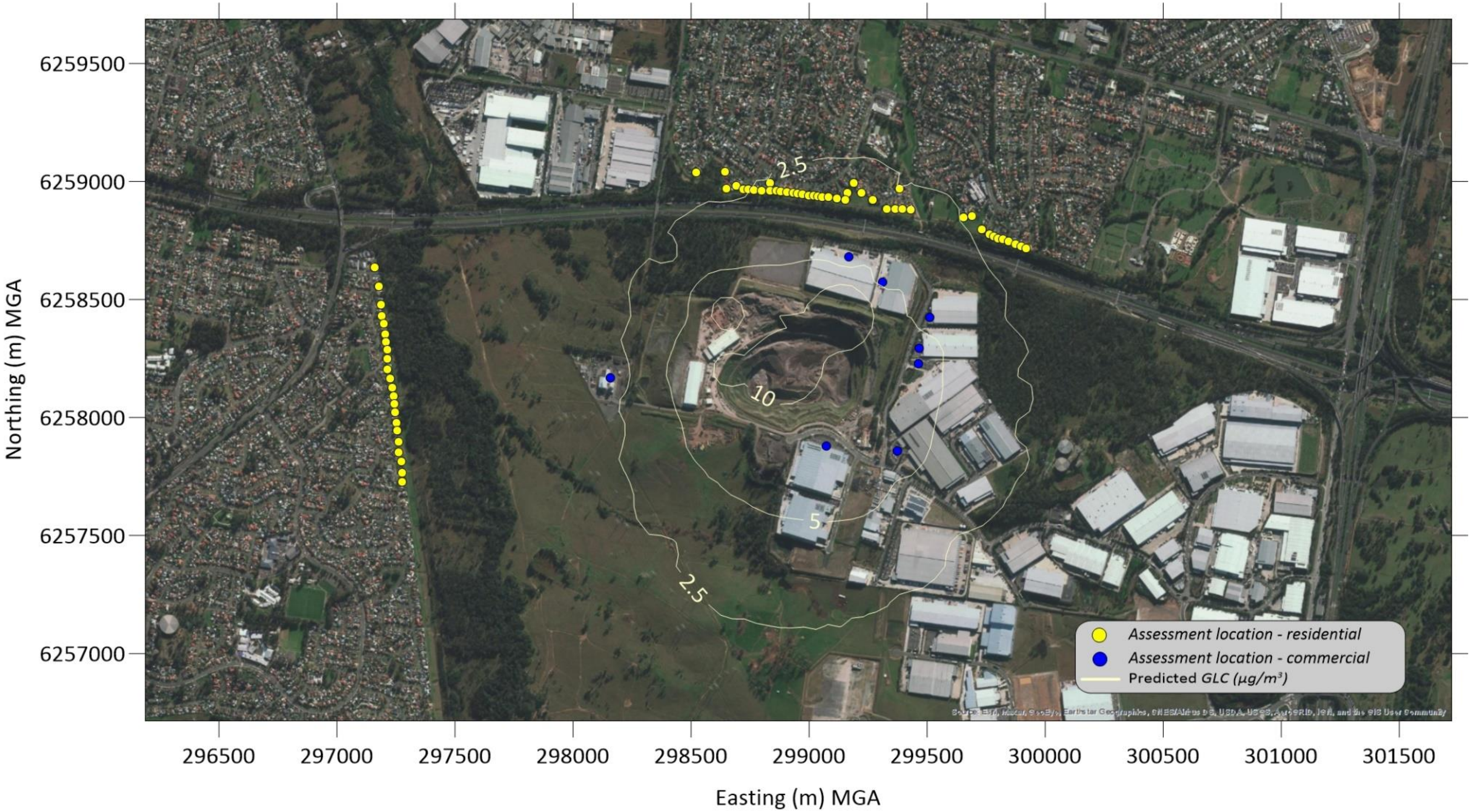

Figure C.8 Predicted ground level concentrations (µg/m³) for 24-hour average $PM_{2.5}$ – Stage 1 operations (plus Stage 2 construction)

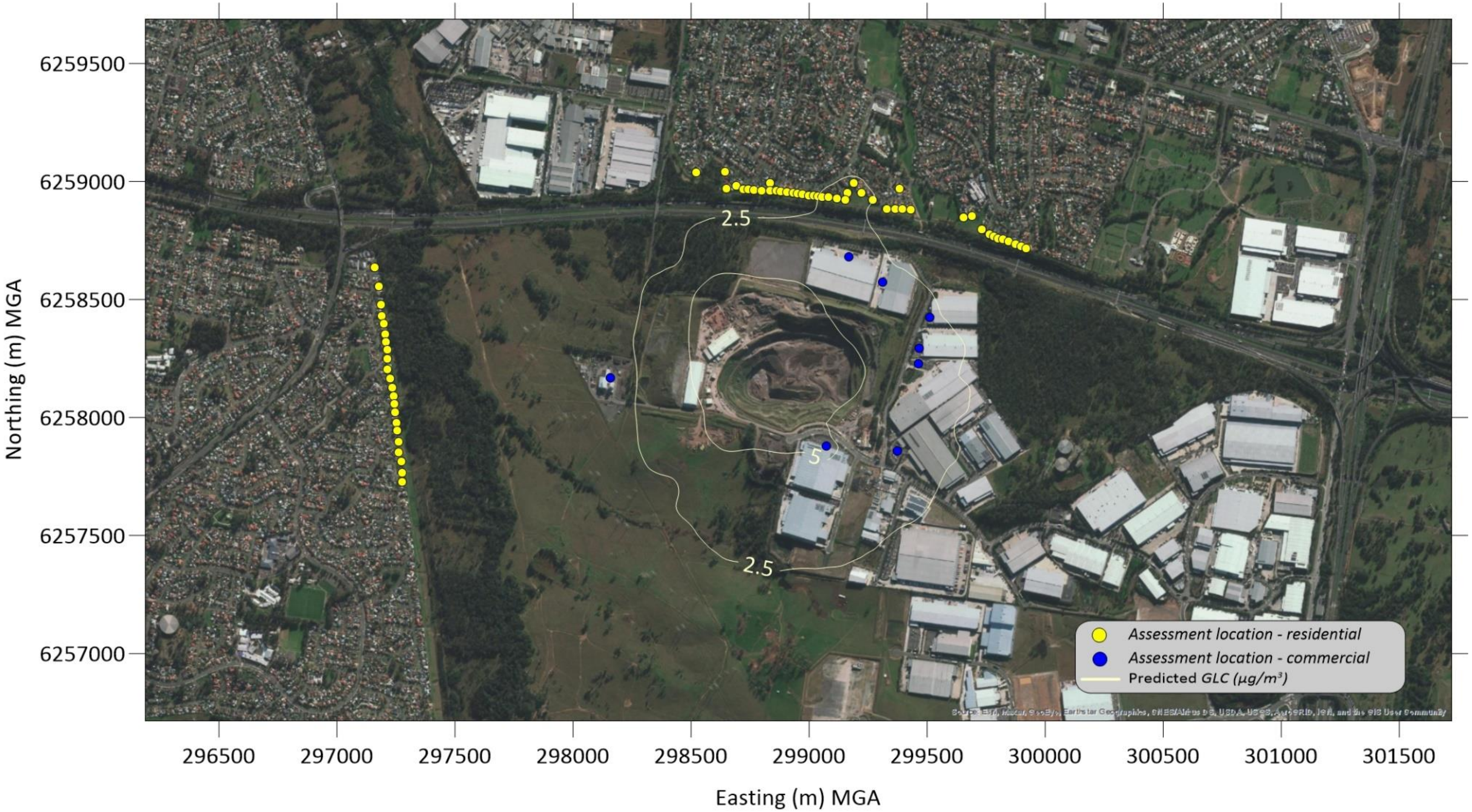

Figure C.9 Predicted ground level concentrations (µg/m³) for 24-hour average $PM_{2.5}$ – Stage 2 operations

C.4 Incremental ground level concentrations (GLC) – annual average $PM_{2.5}$

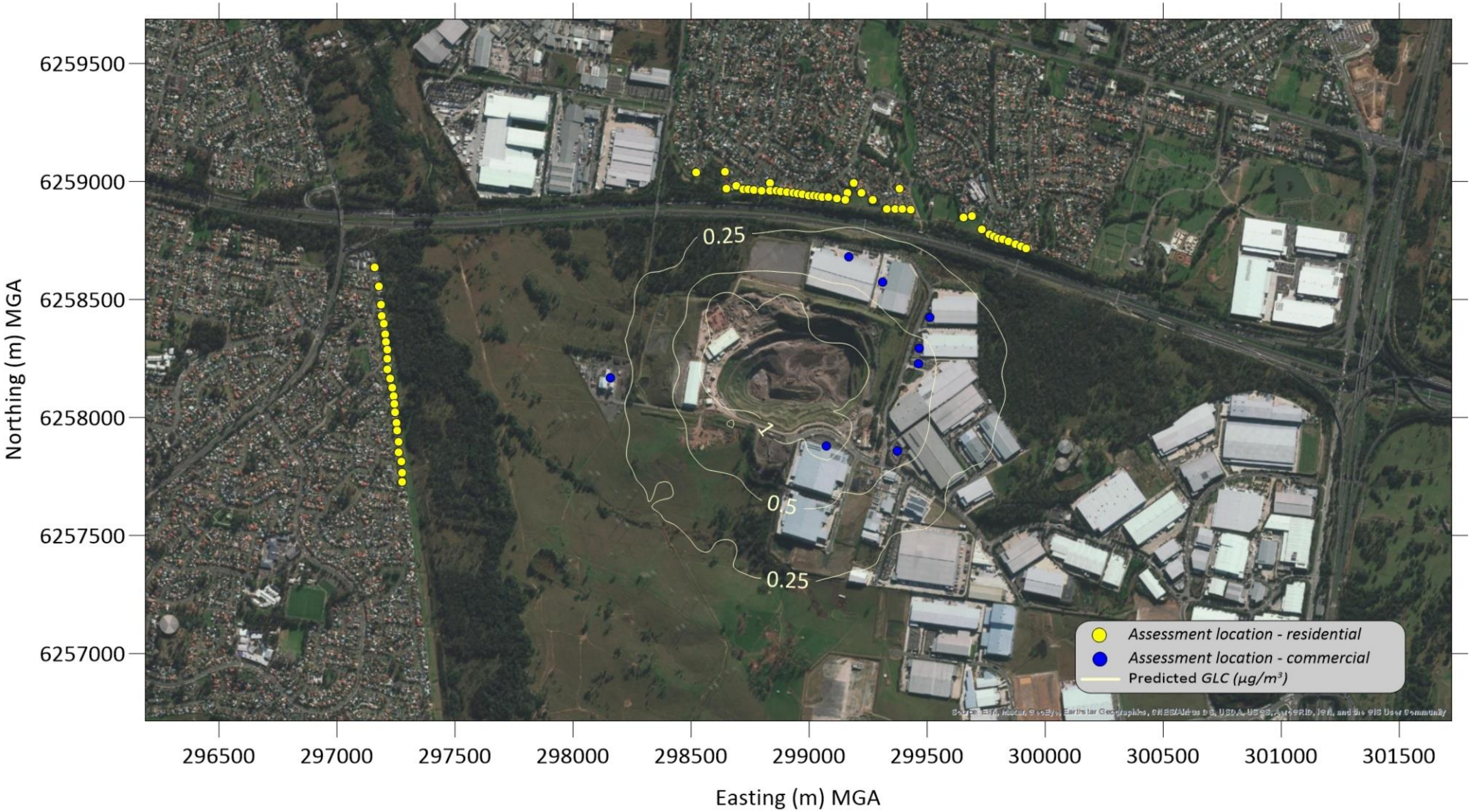

Figure C.10 Predicted ground level concentrations (µg/m³) for annual average $PM_{2.5}$ – approved operations

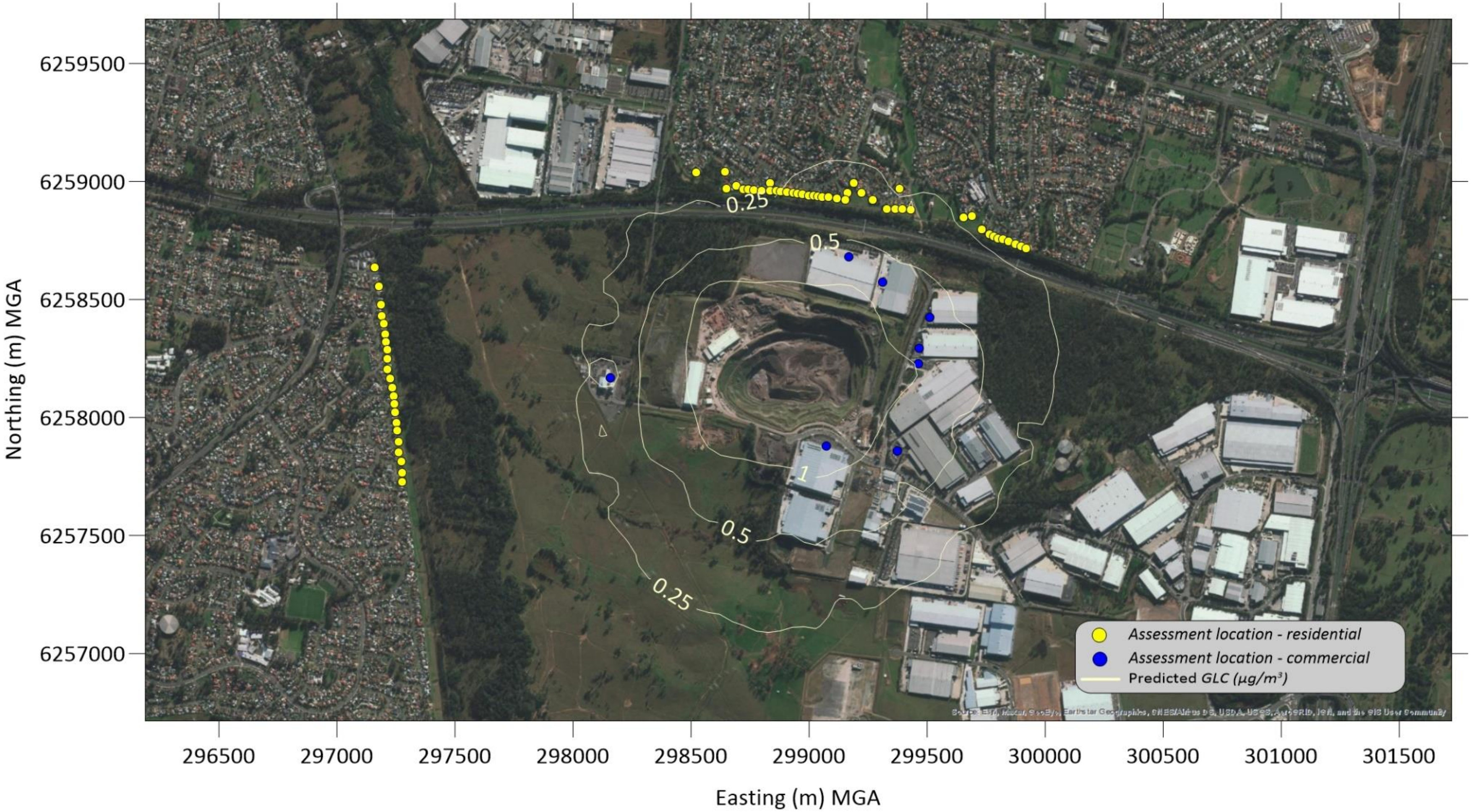

Figure C.11 Predicted ground level concentrations (µg/m³) for annual average $PM_{2.5}$ – Stage 1 operations (plus Stage 2 construction)

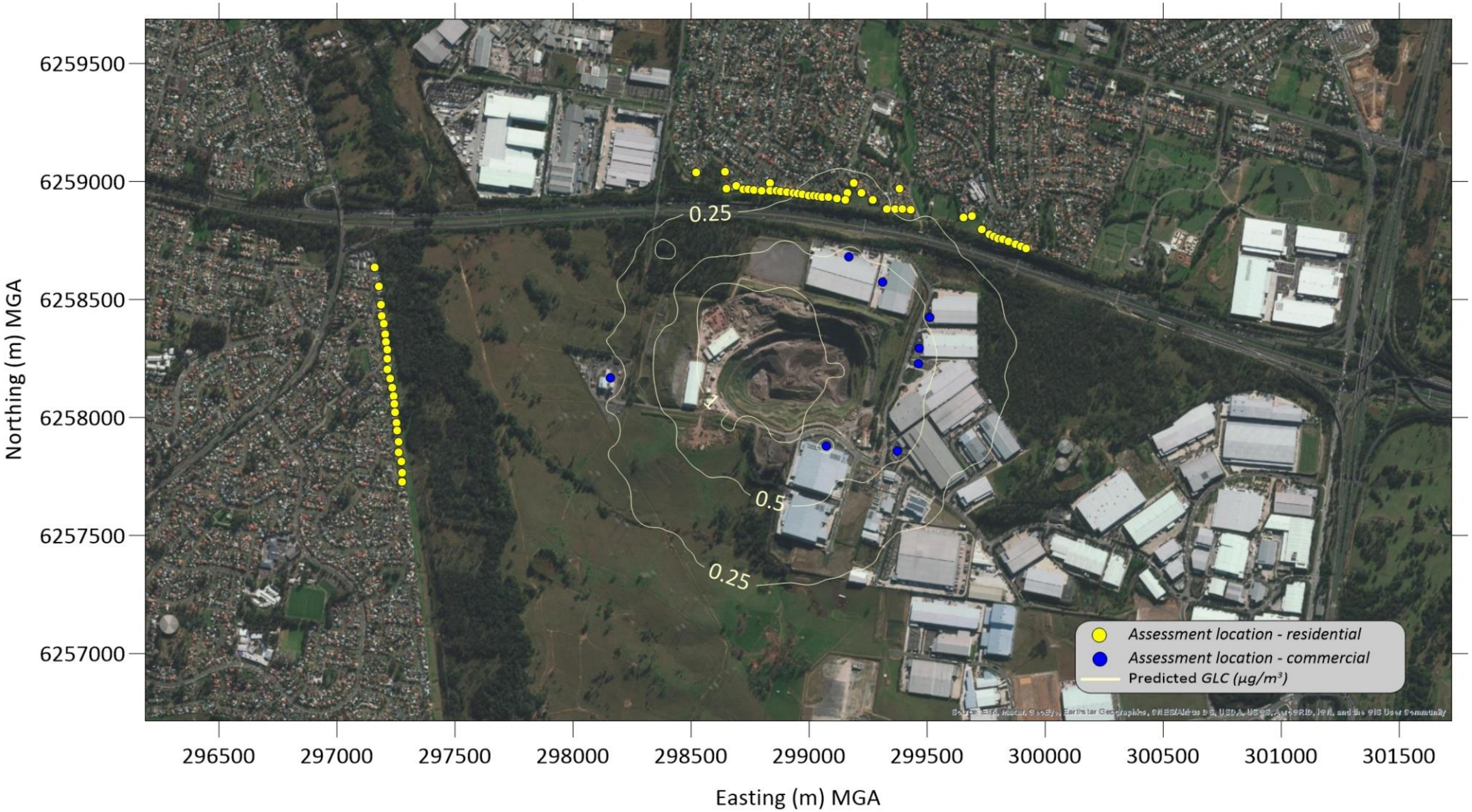

Figure C.12 Predicted ground level concentrations (µg/m³) for annual average $PM_{2.5}$ – Stage 2 operations

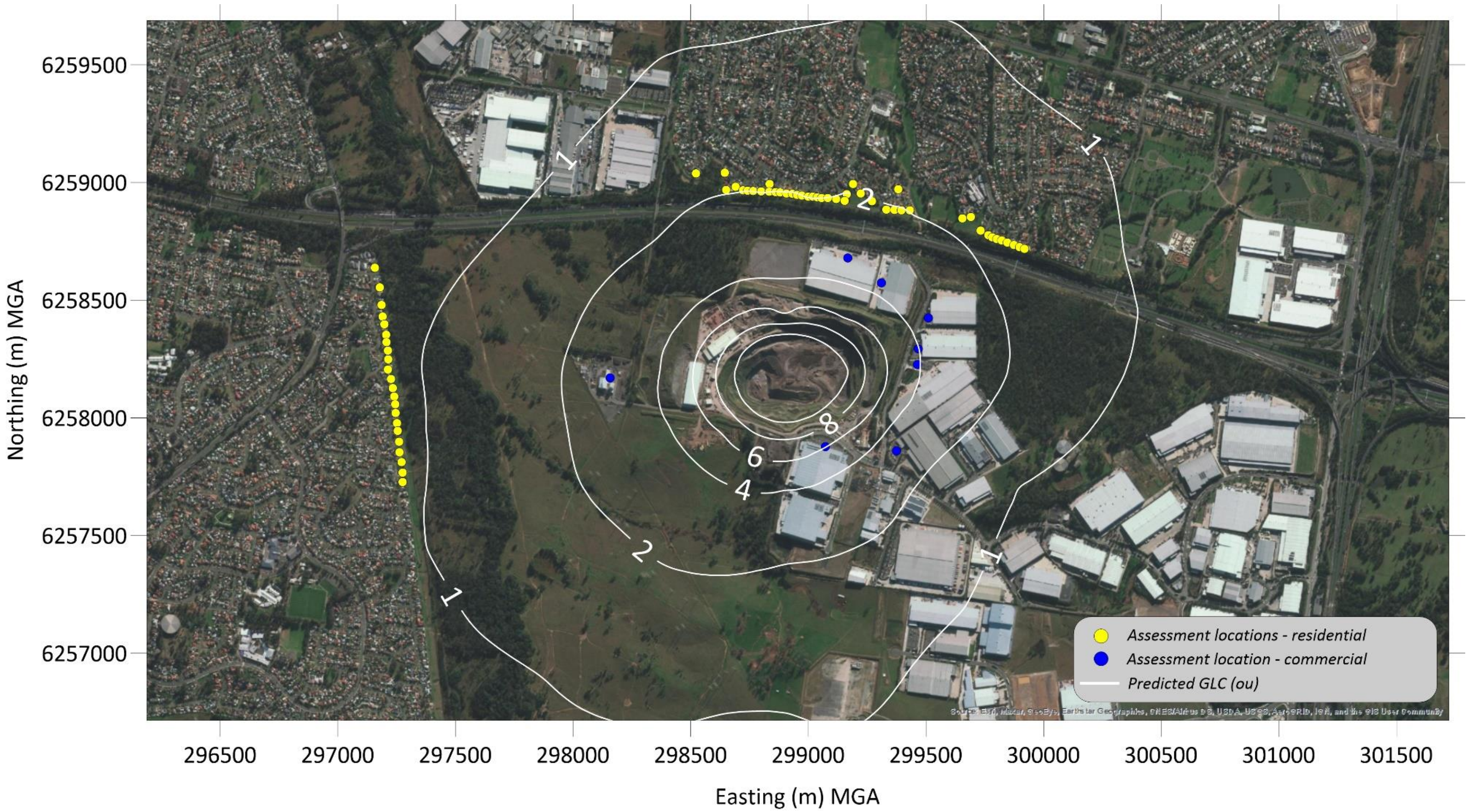

Figure C.13 Predicted ground level concentrations (ou) for 99th percentile 1-second (nose response) odour – future operations