Katanning Gold Mine

Air Quality Assessment

Final Report
Version 2

Prepared for AusGold

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Project Number: 1400

Katanning Gold Mine

Final Report

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Approval for Release

Name	Position	File Reference
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Signature		

Executive Summary

AusGold Limited (AusGold) is an Australian gold exploration and mine development company. Ausgold are seeking to develop the Katanning Gold Project (the Project) located approximately 275 kilometres (km) southeast of Perth and 37 km northeast of Katanning in the Great Southern region of Western Australia (WA).

Overview of assessment

An air dispersion modelling study has been undertaken to inform the assessment of potential air quality impacts of the Project upon the local communities. The air dispersion modelling study incorporated site-specific meteorological data, emissions information, source characteristics, and the location of model receptors. Potential impact was evaluated through comparison to relevant ambient air quality assessment criteria protective of human health and amenity (dust nuisance).

The scope of the modelling assessment is summarised below.

Modelled meteorological period	1 January to 31 December 2019
Model selection	WRF/CALMET/CALPUFF model suite
Key Pollutants	Particulate matter (as TSP, PM_{10}, $PM_{2.5}$ and deposition) from mining operations and gaseous emissions (NO_2, SO_2 and CO) from the power station.
Meteorological data	Three-dimensional prognostic meteorological data developed using the Weather Research and Forecasting (WRF) model.
Background Air Quality	Background air quality was based on DWER monitoring data from Albany and is assumed to be broadly indicative for the Project location and setting.
Project Emissions	Emission estimation was undertaken with reference to the appropriate equations, or factors, from the *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1* for particulates from the mining operations. Gaseous emissions were supplied by AusGold. Operating parameters used to characterise sources were provided by AusGold. The modelling includes fugitive dust emissions (as volume sources) and wind erosion (as area sources), along with point (stack) sources for the proposed power station.
Receptors of Interest including Sensitive Receptors	Multiple set of receptors are included in the model to align with the various model applications: • Nearest receptor locations including residential, buildings, heritage and flora consistent with DWER guidelines for regulatory assessments.
Model Scenarios	The model scenarios included in the assessment consider the proposed operations in isolation of other emission sources (i.e. standalone), as well as cumulatively with the assumed background air quality (based on DWER Albany measured data).

Key Findings

- For TSP:
  - Seven of the receptors are predicted to exceed the nominated assessment criteria (90 µg/m^3) at least once.
  - The two receptors (buildings) with the most exceedances are R52 and R16, which the model predicts exceedances on 13 and 4 days, respectively.
  - At the rifle range, 24-hour TSP concentrations are predicted to exceed the nominated assessment criteria on 50 days.
  - At Woorgabup Nature Reserve, 24-hour TSP concentrations are predicted to exceed the nominated assessment criteria on 85 days.
  - It should be noted that these results are highly conservative including the use of an elevated background concentration.
  - Presentation of the maximum and 6^{th} highest predicted TSP isopleths determined that there is a significant reduction in the predicted concentrations.
- For PM_{10}:
  - For residential receptors R16, R24, and R52, 24-hour PM_{10} concentrations are predicted to exceed the nominated 24-hour assessment criteria (50 µg/m^3) on 3, 2, and 9 days, respectively.
  - Other receptors (building) are not predicted to exceed the criteria.
  - No receptors (building) are predicted to exceed the annual average assessment criteria.
  - At the rifle range, 24-hour PM_{10} concentrations are predicted to exceed the 24-hour assessment criteria on 25 days.
  - It should be noted that these results are highly conservative including the use of an elevated background concentration.
  - There is a significant reduction in the predicted concentrations from the maximum down to the 6^{th} highest.
- For $PM_{2.5}$:
  - None of the receptors (building) are predicted to exceed the nominated 24-hour assessment criteria.
  - None of the receptors are predicted to exceed the annual average assessment criteria.
  - There is a significant reduction in the predicted concentrations from the maximum down to the 6^{th} highest.
- For dust deposition:
  - For the receptors (building) the model is not predicting any excursions of the deposition criteria.
  - For the amenity receptors, the model is predicting potential excursions of the relevant dust deposition criteria at Woorgabup Nature Reserve.
  - For the heritage receptors, the model is predicting potential excursions of the relevant dust deposition criteria at R39.
  - For the ecological receptors, the model is predicting a potential excursion of the relevant dust deposition criteria at R48.

Overall the modelling, for particulates, indicates that elevated concentrations are likely to be isolated events. These elevated levels can be counteracted by additional abatement methods, monitoring, and an operational dust management plan.

The key findings of the assessment, in relation to the potential environmental impact caused by the power generation plant, assessed by comparison to assessment criteria for human health and amenity, are:

- For NO_2:
    - The model is predicting no excursions of the nominated hourly or annual average assessment criteria during normal peak operations at any of the receptors.
    - The model is predicting no excursions of the nominated hourly or annual average assessment criteria during upset operations at any of the receptors.
- For SO_2:
    - None of the sensitive receptors are predicted to exceed the nominated hourly or 24-hour assessment criteria under any operational conditions.
- For CO:
    - None of the sensitive receptors are predicted to exceed the nominated 8-hour assessment criteria under any operational conditions.
- For the $PM_{2.5}$ from generators:
    - $PM_{2.5}$ concentrations from power generation sources are expected to be negligible compared to contributions from mining sources.

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1 Introduction

1.1 Background

AusGold Limited (AusGold) is an Australian gold exploration and mine development company. Ausgold are seeking to develop the Katanning Gold Project (the Project) located approximately 275 kilometres (km) southeast of Perth and 37 km northeast of Katanning in the Great Southern region of Western Australia (WA).

The Project currently comprises open cut pits with a currently proposed mine life of 10 years. Mining will be undertaking using standard mining techniques including:

- Drill/blast,
- Loading of ore and waste onto haul trucks,
- Haulage to either waste stockpiles or run of mine (ROM) pads.

The processing will include the following:

- Single stage crusher with a semi autogenous grinding (SAG) and ball mill configuration,
- Carbon in Leach (CIL) circuit comprising two leach tanks and six CIL adsorption tanks,
- Processing of 3.6 Million tonnes per annum (Mtpa) of ore.

Power generation for the Project will be supplied by a standalone hybrid power station with a forecast of approximately 42% renewable energy. The system will consist of:

- Solar photovoltaic (PV) capacity of 40.8 MWp
- Battery energy storage system (BESS) installed capacity of 20MW (44.2 MWhr),
- Gas reciprocating engines for a capacity of 30.3 MW
- Diesel generators (black start) capacity of 3 MW.

Off-site dust emissions are a potential concern given the proximity of the Project to nearby receptors in the region. An air dispersion modelling study has been undertaken to inform the assessment of potential air quality (dust) from the Project.

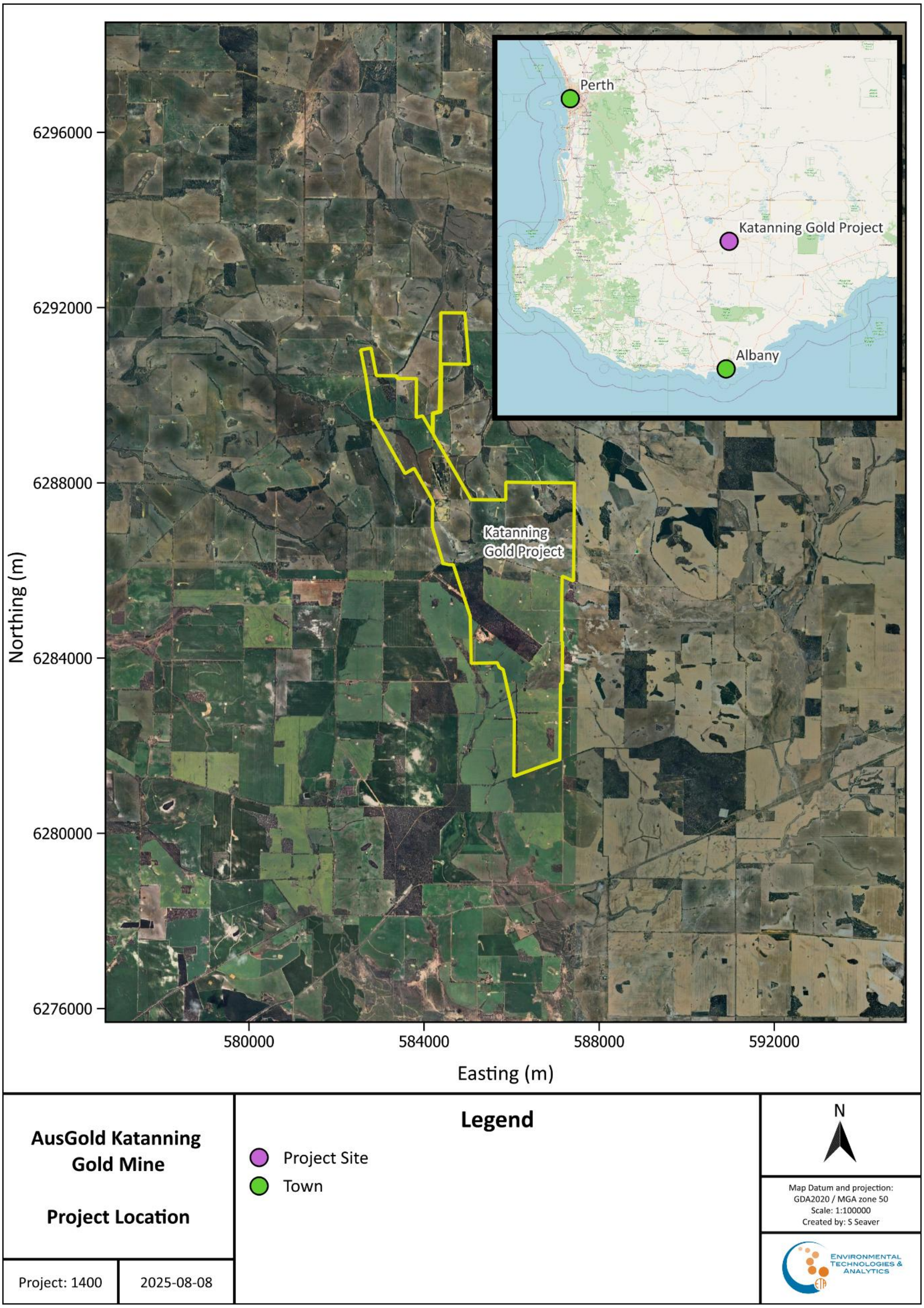

Figure 1-1: Project location and setting.

1.2 Scope of work

Environmental Technologies & Analytics Pty Ltd (ETA) has been engaged by AusGold to undertake an air dispersion modelling study to inform the assessment of potential air quality (dust) impacts from the Project upon the local communities.

The air dispersion modelling study incorporated prognostic meteorological data, emissions information, source characteristics, and the location of model receptors. Potential impacts were evaluated through comparison to relevant ambient air quality assessment criteria.

The emphasis of the emission estimation and modelling is on the potential impact from the operating phase of the Project. Impacts from associated construction activities are excluded from the assessment due to their short-term duration.

For the operations, emissions were determined for:

- Mining
- Haulage
- Processing
- Wind erosion
- Power generation

The ambient air quality and potential impacts are assessed in terms of the following:

- Particulates:
  - Total Suspended Particulates (TSP) (including deposition)
  - PM_{10} (particulate matter with an aerodynamic diameter of 10 micron (µm) or less)
  - $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5 µm or less).
- Gases (power generation only):
  - Oxides of nitrogen
  - Carbon monoxide
  - Oxides of sulfur.

Reference has been made to the following key regulatory policy and guidance:

- Air Quality Modelling Guidance Notes (DoE, 2006)
- Guideline - Air Emissions, draft for external consultation (DWER, 2019)
- Guideline - Dust Emissions, draft for external consultation (DWER, 2021)
- Environmental Factor Guideline – Air Quality (EPA, 2020)
- Environmental Factor Guideline – Social Surroundings (EPA, 2023a)
- Technical Guidance: Environmental Impact Assessment of Social Surroundings – Aboriginal Cultural Heritage (EPA, 2023b).

1.3 Structure of report

This report describes the methods and findings of a dispersion modelling assessment of the potential impacts to the air environment arising from the Project operations. The assessment includes:

- The study approach and methodology, including the regional climate, pollutants of interest and sensitive receptors in the immediate region, in Section 2.

- Impact assessment criteria for human health and amenity, ecological/biological, and heritage (Section 3).
- Atmospheric dispersion modelling of the emissions using CALPUFF (Section 4).
- Project emission estimation and inventory in Section 5.
- Conclusions of the assessment are presented in Section 7.

The appendices contain supporting information, specifically:

- The analysis to determine the representative meteorological year for modelling.
- The detailed configuration for WRF and CALMET.
- Emission parameters and emission rates for each source modelled.

2 Assessment methodology

This section outlines the air quality study and assessment approach. It includes the methodology applied to define the meteorological characteristics of the Project area relevant to the assessment, the emission estimation, the dispersion, and the ambient assessment criteria selected for the purposes of determining the significance of the dispersion model results, and therefore the potential impact.

The study structure is shown in Figure 2-1 and detailed in the following subsections.

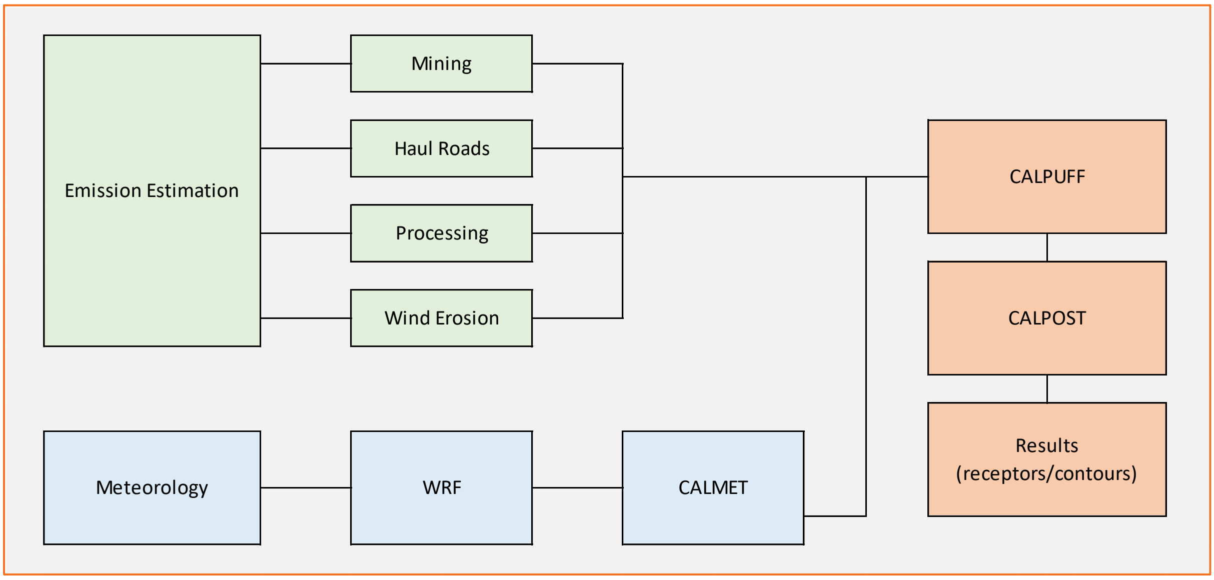

Figure 2-1: Air quality assessment – study approach.

2.1 Climate and Meteorology

This section outlines the key climate and meteorological characteristics of the region important for the dispersion, transformation and removal (or deposition) of pollutants from the atmosphere, and therefore ambient air quality.

The Project area is located approximately 37 km northeast of Katanning, in the Wheatbelt region of Western Australia. This region has a Mediterranean climate (arid), characterised by warm and dry summers, with mild, wet winters. The climate is classified according to the Geiger climate classification system as Csb (Cool dry-summer) (Kottek et al. 2006). Four seasons are used to distinguish the general conditions:

- A hot, dry summer period extending from December to February,
- A warm to mild autumn extending from March to May
- A cool, wet winter extending from June to August
- A return to spring with mild to hot temperatures extending from September to November

The weather in Katanning (along with the Great Southern region of WA) is influenced by variety of drivers including:

- Southern Annular Mode (SAM): Describes the variability of atmospheric pressure and winds pattern surrounding Antarctica (also known as the Antarctic Oscillation (AAO)). The SAM describes the north/south movement of the westerly wind belt circling Antarctica and consists of two phases:
  - A positive SAM results in drier and warmer conditions in the region as westerly winds contract southwards (summer).
  - A negative SAM results in cooler, wetter and windier conditions for the region (winter).
- Subtropical Ridge: A semi-permanent belt of high pressure between 25° and 35° latitude (of both hemispheres). The impact of the ridge is as follows:
  - During summer the ridge is located over southern WA resulting in stable, dry and warm conditions.
  - In winter the ridge shifts north allowing for cold fronts and rain-bearing systems (cold fronts and westerly storm tracks).
- Indian Ocean Dipole (IOD): Refers to the difference in sea surface temperatures (SST) between the western (coast of Africa) and eastern parts (near Indonesia) of the Indian Ocean. Within Western Australia:
  - A positive IOD (cooler waters near Indonesia) results in drier conditions in WA
  - A negative IOD (warmer waters near Indonesia) results in increased rainfall particularly in the winter/spring seasons.
  - A neutral IOD (no difference in the SST) results in average rainfall patterns.

The nearest long term meteorological station is the Bureau of Meteorology (BoM) automatic weather station (AWS) located 2.7 km to the east of Katanning. This station is located approximately 31 km from the Project and the climatic data should be broadly similar. A summary of the long-term meteorological conditions as measured at the BoM Katanning AWS from 1 January 2011 to 31 December 2024 is presented in the following sections.

2.1.1 Temperature

As presented in Figure 2-2 it is evident that the temperature in the Wheatbelt region is characterised by high maxima, and the diurnal difference can be high. At the Katanning AWS the measured mean monthly maximum temperatures range from a high of 29.4 degrees Celsius (ºC) in January to 14.2ºC in July. The mean monthly minimum temperatures range from 13.9ºC in January down to 6.5ºC in July.

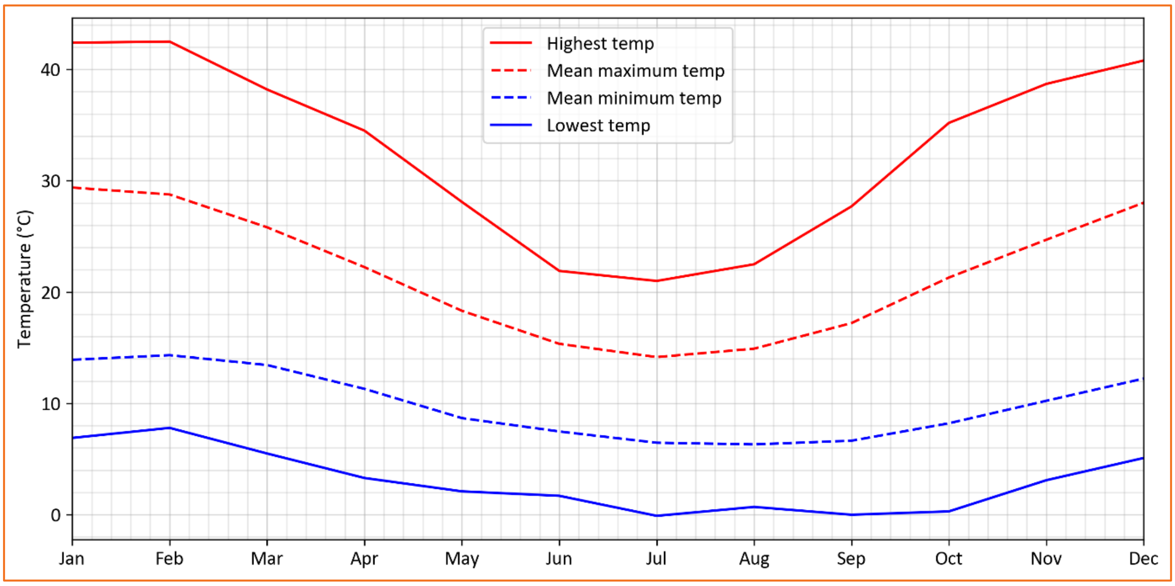

Figure 2-2: Monthly temperature statistics from 2011 to 2024 (BoM Katanning AWS).

2.1.2 Humidity

The mean monthly relative humidity, recorded at 9am and 3pm, at the Katanning AWS is presented in Figure 2-3. The higher mean humidity levels are associated with the winter months, with mean humidity levels falling in the summer months. Across all months the average 9am relative humidity is higher than the 3pm relative humidity.

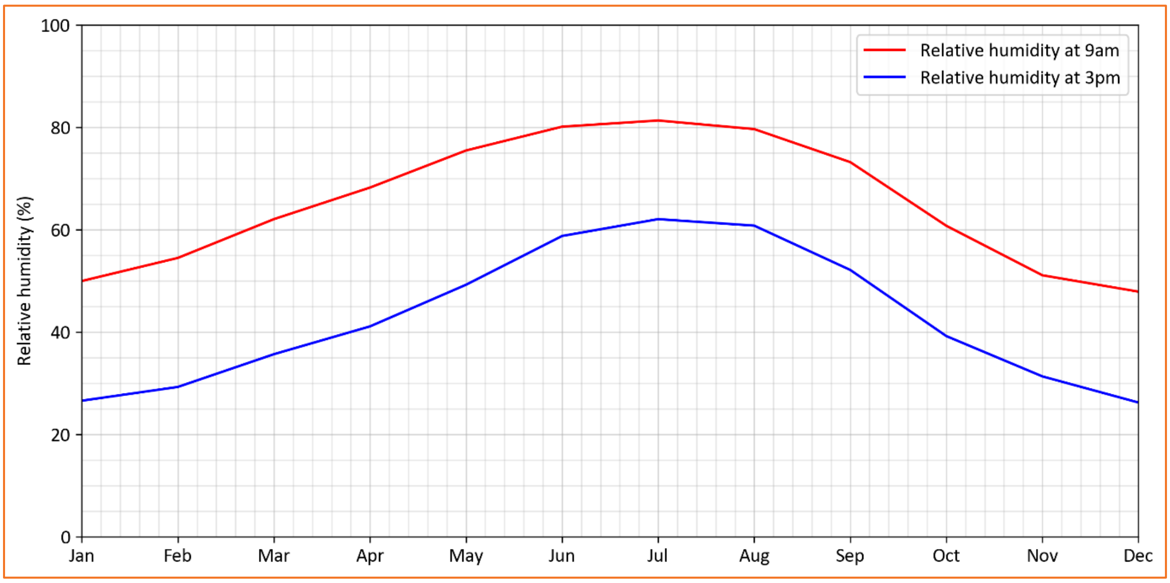

Figure 2-3: Mean Relative Humidity 2011 to 2024 (BoM Katanning).

2.1.3 Rainfall

The long-term rainfall data measured at the BoM Katanning AWS is presented in Figure 2-4. This figure shows that the region experiences distinct seasons with the rainfall varying as follows:

- Summer (December to February): Summers in Katanning are generally dry, with sporadic and occasional thunderstorms. The average monthly rainfall during summer is 20.0 millimetres (mm).
- Autumn (March to May): Autumn in Katanning brings a slight increase in rainfall, with increasing showers and thunderstorms as the season progresses. Rainfall amounts gradually rise during autumn, with average monthly rainfall ranging between 23.1 mm and 47.4 mm.
- Winter (June to August): The region receives the majority of its annual rainfall during this season with average monthly ranging 51.5 mm and 59.0 mm.
- Spring (September to November): Spring in Katanning brings a gradual decrease in rainfall. The region experiences occasional showers and thunderstorms at the beginning of the season, but as spring progresses, rainfall tapers off. Average monthly rainfall during spring ranges between 20.5 mm and 46.4 mm.

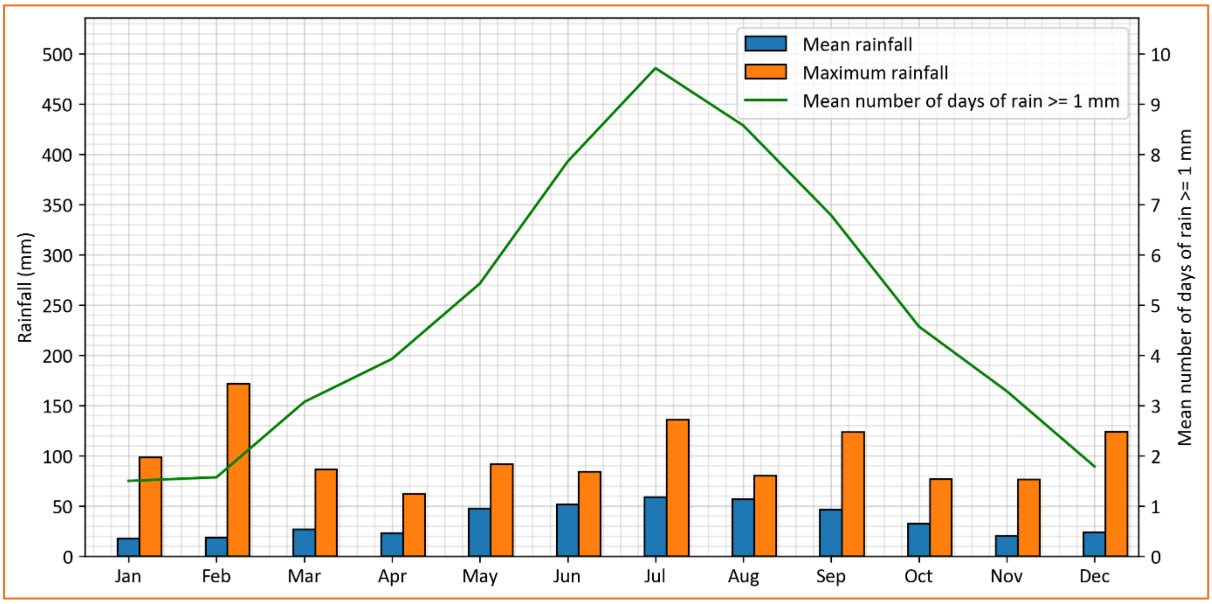

Figure 2-4: Rainfall statistics at Katanning from 2011 to 2024 (BoM Katanning AWS).

2.1.4 Wind speed/direction

The wind characteristics for the Katanning AWS are presented as annual and seasonal wind roses in Figure 2-5. The annual wind direction highlights that the prevailing wind direction is from the east southeast.

On a seasonal basis the wind roses indicate that:

- During summer the prevailing winds are from the east southeast. There is also a higher percentage of stronger wind speeds than other seasons. The mean wind speed is 4.5 m/s.
- During autumn the winds are also primarily from the east southeast, and the wind direction is more distributed than in summer. The mean wind speed is 3.5 m/s
- Winter is dominated by westerly to northly winds. The mean wind speed is 3.6 m/s.
- The spring period has winds from the east to west-northwest. The mean wind speed is 3.9 m/s.

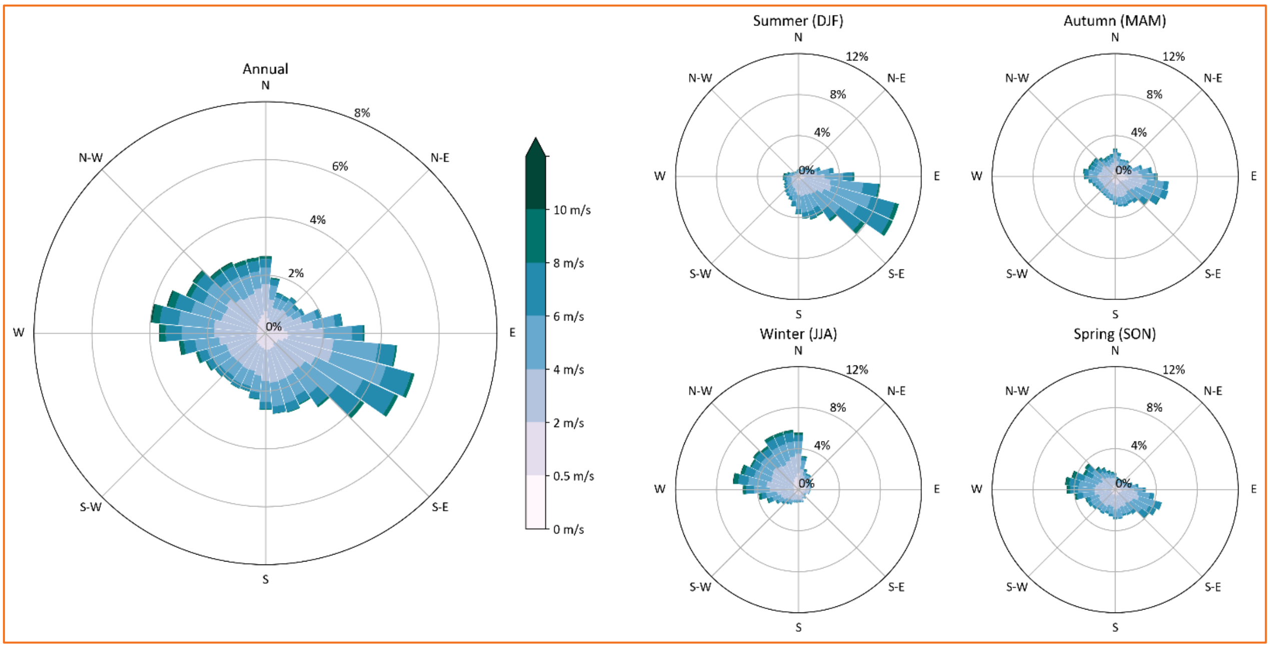

Figure 2-5: Annual and seasonal wind roses from 2011 to 2024 (BoM Katanning AWS).

Understanding the climate and meteorology of a region is critical to understanding periods in which dust emissions, derived from the proposed operations, may increase (or decrease) and potentially impact on the surrounding region. Based on the information presented in the previous sections it is apparent that:

- Dust emissions have the potential to be elevated during the summer months due to a combination of higher temperatures (with increased evaporation) and lower rainfall. The greater potential for increased wind speeds would also increase the potential for windblown dust emissions to occur.
- The relatively high variation between day and night temperatures , coupled with low wind speeds (or calm conditions) increases the potential for low level inversion layers. This would increase the risk of 'hanging' dust over the operations. These conditions have the potential to occur throughout the year though are more likely to occur during the spring/early summer months.
- The winter months have increased rainfall and lower temperatures which would result in lower evaporation rates. The combination of these factors would result in a lower potential for fugitive dust emissions.

2.2 Pollutants of Interest

Based on the description of the Project and key processes considered, the key pollutants of interest to be assessed are summarised in Table 2-1.

Table 2-1: Air pollutants of interest from the Project.

Pollutant to be Assessed	
Particulate Matter	Airborne particles are a broad class of diverse substances that may be solid or liquid (liquid particles are often called aerosols) and are produced by a wide range of natural and human activities. Airborne particles are commonly classified by their size as total suspended particles

Pollutant to be Assessed		
	(TSP), visibility reducing particles (PM_2), and inhalable particles (coarse fraction PM_{10} and fine fraction $PM_{2.5}$). An image of their respective sizes is presented in Figure 2-6. **Project sources are principally from mining, handling of ore/waste, processing and wind generated surface erosion.**	
	PM_{10}	Inhalable particles are grouped into two size categories: those with a diameter of up to 10 µm (PM_{10}) and those with a diameter of up to 2.5 µm ($PM_{2.5}$). Inhalable particles are associated with increases in respiratory illnesses such as asthma, bronchitis and emphysema, with an increase in risk related to their size, chemical composition and concentration. Particles in the PM_{10} size fraction have been strongly associated with increases in the daily prevalence of respiratory symptoms, hospital admissions and mortality.
	$PM_{2.5}$	Particles in the $PM_{2.5}$ size fraction can be inhaled more deeply into the lungs than PM_{10}, and have been associated with health effects similar to those of PM_{10}. There is some evidence to suggest that $PM_{2.5}$ might be more deleterious to health than other size fractions. No lower limit for the onset of adverse health effects has yet been observed.
	TSP	Total suspended particulates (TSP) refers to the total amount of the PM suspended in air, typically up to 50 µm. These larger particles are primarily associated with amenity or visibility issues and are likely to be removed by gravitational settling within a short time of being emitted (i.e. they settle to the ground or other surfaces fairly quickly).
	Deposited Dust	Deposited matter refers to any dust that falls out of suspension in the atmosphere.
Combustion and Process Gases	CO	Carbon monoxide (CO) is a colourless, odourless gas produced by the incomplete combustion of fuels containing carbon. Carbon monoxide is absorbed through the lungs of humans, where it reacts to reduce the blood's oxygen-carrying capacity. Exposure to carbon monoxide can cause carbon monoxide poisoning, which can be attributed to symptoms such as headache, dizziness, weakness, vomiting and confusion. Chronic exposure can cause memory loss, confusion and depression. Acute poisoning may cause cardiac arrhythmia, seizures and death. Excess CO is also indicative of fuel inefficiency within combustion processes, and as such reflects incomplete combustion which if not minimised, can be a costly expense to the operator. **CO assessed only for scenarios involving diesel fuel operations.**[1]
	NO_2	Nitrogen dioxide (NO_2) is a brownish gas with a pungent odour. It exists in the atmosphere in equilibrium with nitric oxide. The mixture of these two gases is commonly referred to as nitrogen oxides (NOx). Nitrogen oxides are a product of combustion processes, and can arise when flame staging is non-ideal and nitrogen present in air is oxidised. Nitrogen dioxide can cause damage to the human respiratory tract, increasing a person's susceptibility to respiratory infections and asthma. Sensitive populations, such as the elderly, children, and people with existing health

[1] Emissions of CO during natural gas fired operations were demonstrated to be relatively insignificant in terms of potential environmental impact in the original assessment (SKM, 2011), and as such are not assessed.

Pollutant to be Assessed		
		conditions are most susceptible to the adverse effects of nitrogen dioxide exposure. Nitrogen dioxide can also cause damage to plants, especially in the presence of other pollutants such as ozone and sulphur dioxide. Nitrogen oxides are also present in the reactions that lead to photochemical smog formation. **NO_2 assessed for scenarios involving natural gas and diesel fuel operations.**
	SO_2	Sulphur dioxide (SO_2) is a strong-smelling, colourless gas that can irritate the lungs, and can be particularly harmful for people with asthma. SO_2 and other sulphur oxides can react with compounds in the atmosphere to form fine particles that reduce visibility (haze formation). **SO_2 assessed only for scenarios involving diesel fuel operations.**[2]

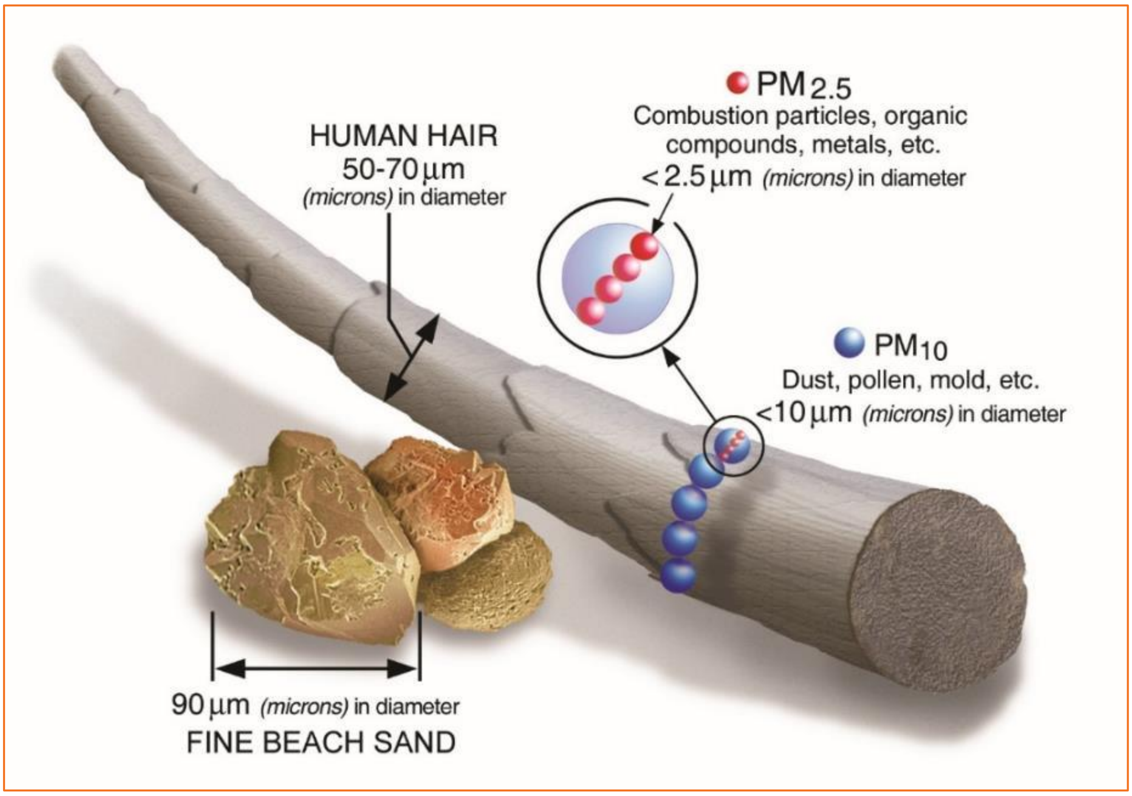

Figure 2-6: Example of particle sizes (USEPA, 2022).

[2] Emissions of SO_2, PM_{10} and $PM_{2.5}$ are insignificant for natural gas fired operations, and as such are not assessed.

2.3 Existing | background air quality

It is a requirement of the Department of Water and Environmental Regulation (DWER) that existing concentrations of each modelled pollutant be accounted for to ensure that potential cumulative impacts are presented (DoE, 2006). AusGold have undertaken ambient monitoring within the immediate region utilising a MetOne E-Sampler fitted with a PM_{10} size selective inlet. This monitoring commencing on 20 November 2024 and ceased on the 7 May 2025. A timeseries view of the hourly averaged data from this monitoring program is presented in Figure 2-7. From this figure it is apparent that:

- Ambient monitoring was undertaken for slightly less than a 6 month period, over the summer period which received below average rainfall[3].
- There was missing data with due to the power supply issues.
- Although the data collected to date is indicative of local background concentrations there is insufficient data to use for background concentrations.

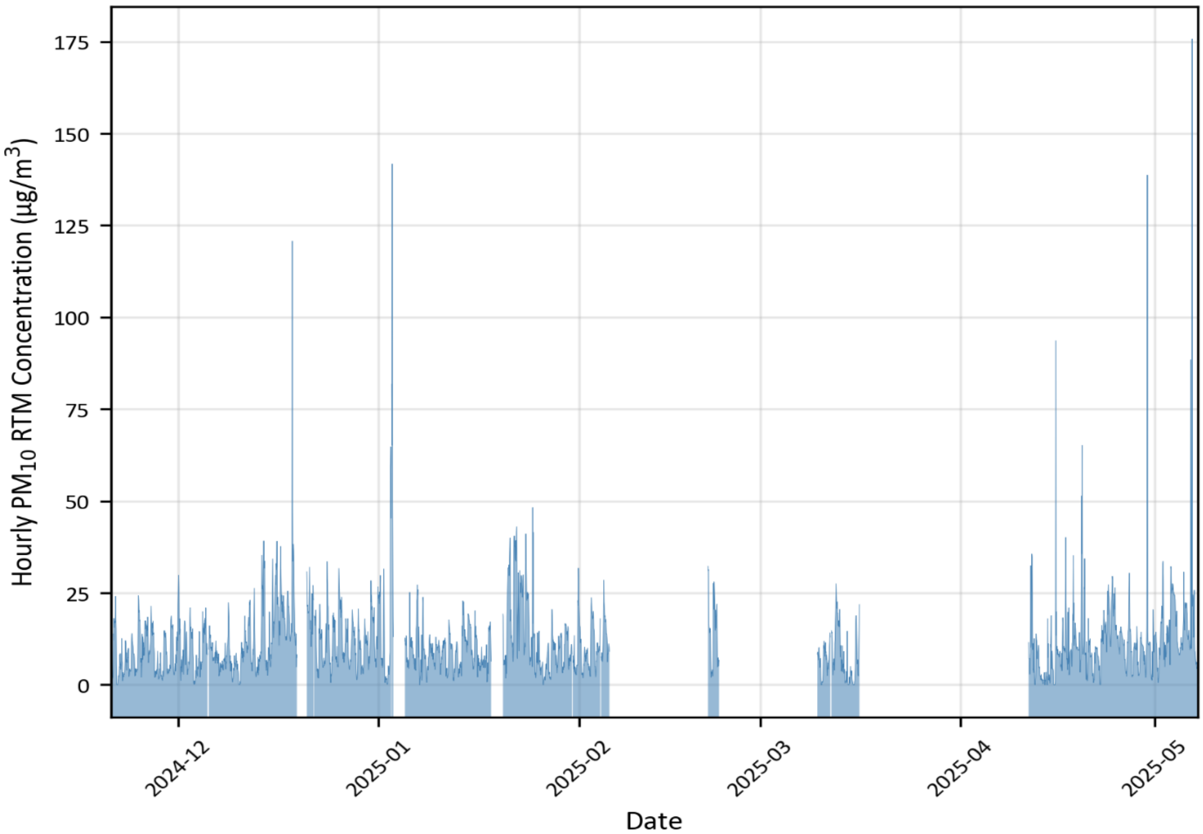

Figure 2-7: Timeseries of hourly averaged PM_{10} E-Sampler monitoring data (μg/m³)

[3] BoM (2025). http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2024&p_c=-23917611&p_stn_num=010916

The statistics of the hourly and 24-hour averaged monitoring data from this monitoring program is presented in Table 2-2.

Table 2-2: PM_{10} monitoring statistics – 21 November 2024 to 6 May 2025 (µg/m³)

Statistic	1-hour	24-hour
Maximum	176.9	28.0
99th Percentile	39.8	27.6
98th Percentile	27.0	23.2
95th Percentile	21.8	17.5
70th Percentile	13.7	12.9
Annual Average	11.5	11.4
Data recovery	63%	61%

To assist in determining background concentrations for the region reference has been made to the Department of Water and Environmental Protection (DWER) annual air quality monitoring reports. DWER operates a network of 16 air quality monitoring stations (AQMS) throughout WA with the nearest station being the Albany monitoring station which is located approximately 170 kilometres (km) to the south of the Project. The published PM_{10} monitoring statistics from the DWER Albany AQMS (DWER, 2024) for the period 2018 to 2022 are presented in Table 2-3.

Table 2-3: DWER Albany PM_{10} monitoring statistics[1] (µg/m³)

Statistics	2018	2019	2020	2021	2022
Maximum	89.6	128.5	37.2	34.3	30.5
99th Percentile	43.9	35.5	32.7	27.9	26.7
98th Percentile	30.1	30.9	29.3	26.1	24
95th Percentile	26.3	27.1	25.9	23.1	21.7
75th Percentile	21.8	22.5	21.3	20.6	17.5
Annual Average	14.6	15.3	14.2	14.3	10.7

Notes:
1 Concentrations referenced to 0°C (excluding reference to dust deposition)

When determining a suitable background concentration it is appropriate to utilise the 70th percentile of one year's observed concentrations (Victorian Government, 2001) however DWER, in their annual monitoring reports, only publish the 75th percentile. For this assessment the 75th percentile concentrations for PM_{10} for 2019 were chosen to represent the 24-hour background concentrations as these represent the highest statistics of the available data. For $PM_{2.5}$ only a single year is available from the Albany AQMS. The nominated constant background concentrations are as follows:

- PM_{10}:
  - 22.5 µg/m³ (24-hour average)
  - 15.3 µg/m³ (annual average)

- $PM_{2.5}$:
  - 4.7 µg/m^3 (24-hour average)
  - 4.0 µg/m^3 (annual average)
- TSP:
  - 45 µg/m^3 (24-hour average) – noting that this value is double the 24-hour averaged PM_{10} concentration.

These concentrations will be utilised in this assessment to represent background concentrations. It should be noted that compared to the ambient monitoring undertaken to date (Table 2-2) it is apparent that the statistics from the Albany monitor are higher. As such, though the Albany monitoring data has been used in this assessment as a background it should be considered to be 'conservative'.

The background contribution of the other key air pollutants (NO_2, SO_2 and CO) to air quality in Katanning, as well as the background deposition rates, are expected to be very minor based on the small population and remote location of the townsite. For deposition, there is no available background deposition rates for the region.

2.4 Sensitive receptors and environmental values

This modelling assessment considers the potential air quality impacts on relevant environmental values and sensitive receptors, consistent with EPA (EPA 2020) and DWER (DWER 2019), noting that the current DWER guidelines excludes the consideration of on-site project related receptors as sensitive receptors. A sensitive receptor, as outlined in the EPA's assessment framework (EPA 2005), is defined as a receptor that is '*potentially sensitive to emissions from industry and infrastructure including residential developments, hospitals…caravan parks, schools, nursing homes…playgrounds and some public buildings*.'.

The definition of environment in the EP Act includes social surroundings, where "*environment, subject to subsection (2) means living things, their physical, biological and social surroundings, and interactions between all of these (Subsection 3(1)).*" (EPA, 2016). Social surroundings, as outlined in the EPA guidelines ((EPA 2023a); (EPA 2023b)) includes Aboriginal heritage and culture, natural and historical heritage, amenity values.

This modelling assessment considers the potential air quality impacts on a range of potential sensitive receptors:

- Residential receptors, specifically at rural residences and farm buildings close to the project.
- Ecologically sensitive areas including nearby reserves which are potential habitat for black cockatoo species.
- Registered and lodged Aboriginal cultural heritage sites.
- Nearby shooting range and public open spaces.

It is noted that the current DWER guidelines excludes the consideration of on-site Project related receptors as sensitive receptors. The location of all the sensitive receptors in the region are presented in Figure 2-8 and are defined in full in Appendix B.

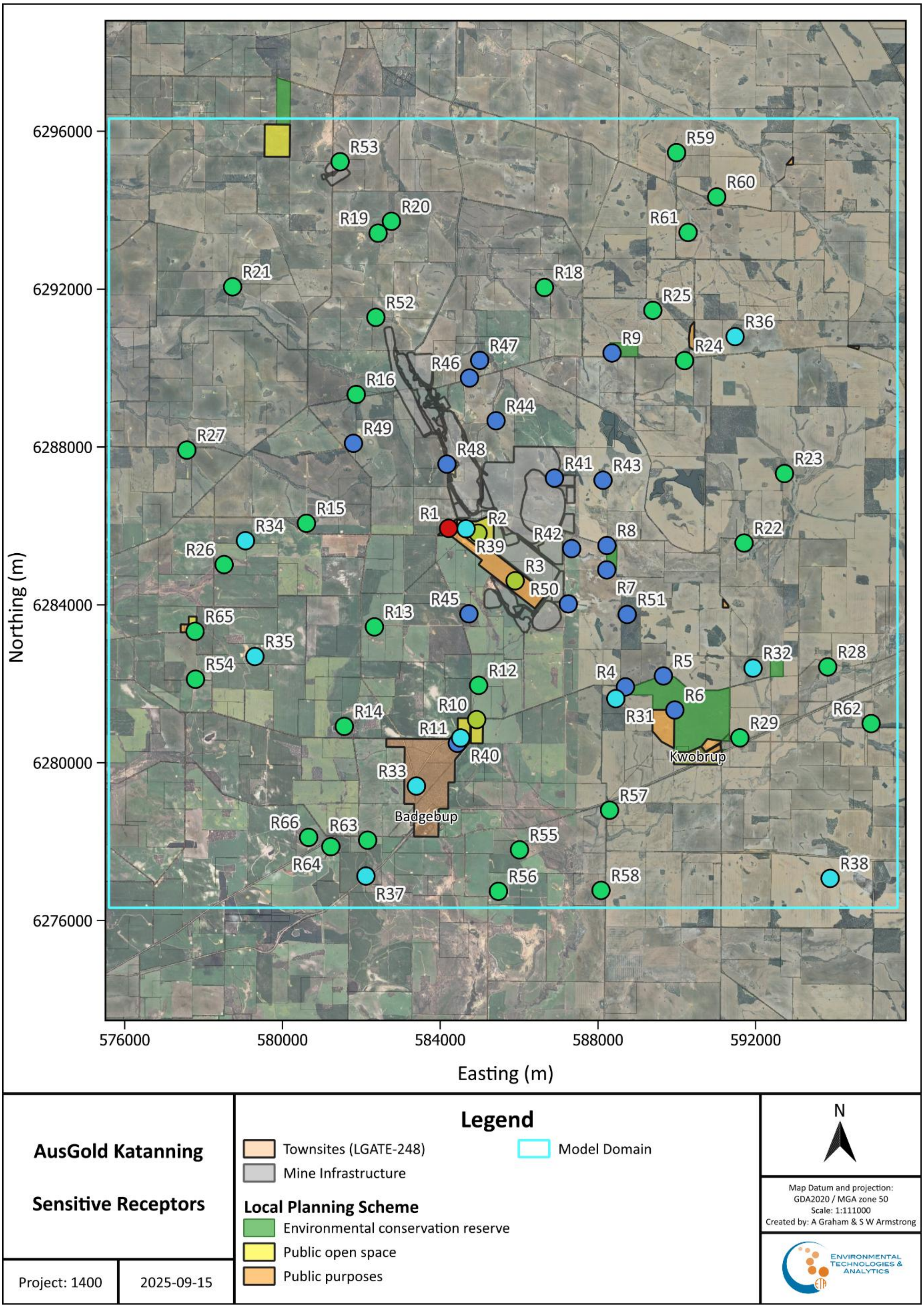

Figure 2-8: Discrete sensitive receptor locations.

3 Impact Assessment Methodology

Ground-level concentrations of particulates (as Total Suspended Particulates (TSP), PM_{10} and $PM_{2.5}$) and dust deposition, predicted at nominated receptors and the surrounding environment were compared with the relevant air quality assessment criteria. This assessment has considered the potential impact attributable to the operations, as well as the cumulative (background) impact (i.e. in conjunction with the existing emission sources in the area).

Modelling results, at nominated receptors, are compared to the numerical value of the criteria, and assessed as being either above or below the numerical value (nominated criteria). It is important to note that, as a risk based assessment approach is normally applied to the assessment of air quality, a modelled result above the numerical value is not an indicator of unacceptable impact, but is an indication that the potential risk for impact requires further consideration.

3.1 Human Health Impact Assessment and Amenity Criteria

Modelled ground level concentrations for particulates have been compared to ambient air quality assessment criteria to determine the potential changes in impact resulting from the Project.

The National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC, 2021) specifies standards that have been derived for the adequate protection of human health and well-being. They cover a range of common air pollutants including (but not limited to) NO_2, SO_2, CO and particulates (as PM_{10} and $PM_{2.5}$).

The Ambient Air Quality NEPM has recently been updated to reflect the latest scientific understanding and to allow for an adequate level of health protection, with more stringent standards adopted for NO_2 and SO_2, amongst other pollutants. As part of a framework for continuous improvement, increasingly more stringent standards for SO_2 (1-hour) and $PM_{2.5}$ apply from 2025. The previous (NEPC, 2016) annual standard for SO_2 has been withdrawn.

The Ambient Air Quality NEPM provides a framework for a nationally consistent approach to monitoring and reporting of ambient air quality in Australia, supporting the formulation of air quality management policies. Whilst the Ambient Air Quality NEPM does not directly regulate the activities of individuals or businesses (NEPC, 2021b), the standards have been widely referenced by State and Territory jurisdictions as regulatory instruments.

The more stringent Ambient Air Quality NEPM standards (as varied 15 April 2021) are not reflected in the Air Emissions Guideline (draft for external consultation) (DWER, 2019) for Western Australia, but nevertheless have been referenced in this assessment to align with the most current Ambient Air Quality NEPM standards and to inform the assessment in regard to regulatory requirements.

In their current form, the draft Air Emissions Guideline would require the assessment criteria for NO_2, SO_2, CO and PM_{10}/$PM_{2.5}$ (defined as *criteria pollutants* under the guideline) to generally be 'met at all existing and future offsite sensitive receptors in the modelling domain'.

3.2 Vegetation Criteria

With respect to vegetation health, research on the effects of dust deposition has been undertaken in Australia by Doley (2006). Doley concluded that "*critical dust loads that result in significant alterations in the most sensitive plant functions vary with the particle size distribution and colour of the dust, from about 1 g/m² for carbon black with a median diameter of about 0.15 µm to about 8 g/m² for coarse road or limestone dusts with* *median diameters greater than about 50 µm. The critical loads vary with the plant function, and it is not possible to predict precisely the nature of one plant response from the knowledge of another*" (Doley 2006). For mineral dust, Farmer (1993) showed that direct physical effects of mineral dusts on vegetation became apparent only at relatively high surface loads (eg. greater than 7 g/m^2).

For this study, 7 g/m^2/month is used as an indicative criteria for potential effects on vegetation. A modelling result that is higher than the assessment criteria is interpreted as an indication that results may need further consideration for the sensitive receptor, and is not necessarily a predicted impact or loss of environmental value.

3.3 Aboriginal Cultural Heritage Criteria

EPA's Technical Guidance for Aboriginal cultural heritage (EPA 2023b) provides the framework for considering potential impacts that may arise due to air quality including dust. To date there are no published air quality ambient guidelines that would guide evaluation of Aboriginal Cultural Heritage (ACH) specifically. In the absence of any documented criteria for assessing air quality impact ACH, the ambient air quality assessment criteria intended to protect human amenity and nuisance values, are assumed to be protective of this environmental value, and are used in this assessment as a "proxy" value. A modelling result that is higher than the assessment criteria should not be interpreted as a predicted impact or loss of environmental value but is an indication that results may need further consideration for the sensitive receptor location, such as monitoring for determining baseline conditions and environmental change.

3.4 Summary of Applied Assessment Criteria

A consolidated summary of the applicable assessment criteria and relevant receptor application is provided in Table 3-1.

Table 3-1: Summary of adopted assessment criteria.

Pollutant	Air quality assessment criteria					Reference
	ppm	µg/m^3 [1]	Averaging Period	Allowable Exceedances	Environmental value protected	
NO_2	0.08	164	1-hour	none	Human health	NEPC (2021)
	0.015	31	Annual			
SO_2	0.075	214	1-hour			
	0.02	57	24-hour			
CO	9.0	11,250	8-hour			
PM_{10}	-	50 µg/m^3	24-hour	exception event		DWER (2019) consistent with NEPM (NEPC, 2021)
	-	25 µg/m^3	annual	none		
$PM_{2.5}$	-	20 µg/m^3	24-hour	exception event		
	-	7 µg/m^3	annual	none		
TSP	-	90 µg/m^3	24-hour	none	Amenity Proxy for protection of ecological values	DWER (2019)

Pollutant	Air quality assessment criteria					Reference
	ppm	µg/m³ [1]	Averaging Period	Allowable Exceedances	Environmental value protected	
Dust deposition	2 g/m²/30 days		30-days	Maximum increase above background	Human Amenity | Nuisance | Heritage (ACH and other)	DWER (2021) referencing (NZ MfE 2016)
	4 g/m²/30 days		30-days	Maximum		DWER (2021) referencing (NSW EPA 2017)
	7 g/m²/30 days		30-days	None	Proxy for protection of ecological values (protected fauna species) Ecological (vegetation/leaf) impact	Doley (2006)

Notes:
1 Concentrations referenced to 0°C (excluding reference to dust deposition)

4 Model Assessment

For this assessment, air dispersion modelling has been conducted using CALPUFF. The model has been used to predict ground level concentrations across the model domain and at identified sensitive receptor locations. The potential air quality impacts associated with the Project have been considered in isolation of other emission sources, as well as cumulatively with existing air quality of the region. The model was configured to predict the ground-level concentrations on a rectangular grid. The model domain was defined with the Southwest corner of the grid cell at 575.671 km Easting and 6276.396 km Northing (UTM Zone 50 S). Specifics for the modelling configuration are described further in this section.

4.1 Meteorological model

The meteorology component of a dispersion model is a key element for the effectiveness or representativeness of the dispersion model outputs. Both upper air and surface information are needed for modelling.

4.1.1 WRF model

In the absence of adequate onsite meteorological data, the Weather Research and Forecast (WRF V3.7) model (http://wrf-model.org/index.php) was used to generate hourly 3-dimensional data for the region. WRF is the next-generation mesoscale numerical weather prediction system. The model was primarily designed to serve both operational forecasting and atmospheric research. WRF features multiple dynamical cores, a 3-dimensional variational data assimilation system and a software architecture allowing for computational parallelism and system extensibility. Further details on WRF are provided in Appendix A.

4.1.2 CALMET

The 3-Dimensional meteorological data generated by WRF was input to CALMET for further processing to the finer resolution used in the dispersion modelling. This procedure will be referred to as the 'WRF-CALMET methodology'. The output from the CALMET meteorological model is then used to drive the pollution dispersion in the CALPUFF model.

CALMET is a three-dimensional meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional, spatially and temporally varying meteorological fields that are utilised in the CALPUFF dispersion model.

CALMET requires several datasets to resolve the surface and upper air meteorology occurring for each hour of the year:

- surface observations and upper air observations or gridded prognostic meteorological model data.
- land use and topographical data.

CALMET was run for a 133 x 133 grid domain at a spatial resolution of 150 m. Vertically, the model consisted of 11 levels extending to 3,000 m. The southwest corner coordinates of the domain were 575.671 km Easting and 6276.396 km Northing (UTM Zone 50 S).

Shuttle Radar Topography Mission (SRTM) data with 90 m resolution was input into the CALMET model to indicate terrain heights within the model domain (Figure 4-1). CALMET also requires geophysical data including gridded fields of land use categories. The default US Geological Survey (USGS) land use classification system

(14 category system) was substituted with a more up to date, finer resolution data (300 m) obtained from the European Space Agency Climate Change Initiative Land cover (ESACCI-LC) dataset.

The CALMET results are provided in Appendix A.

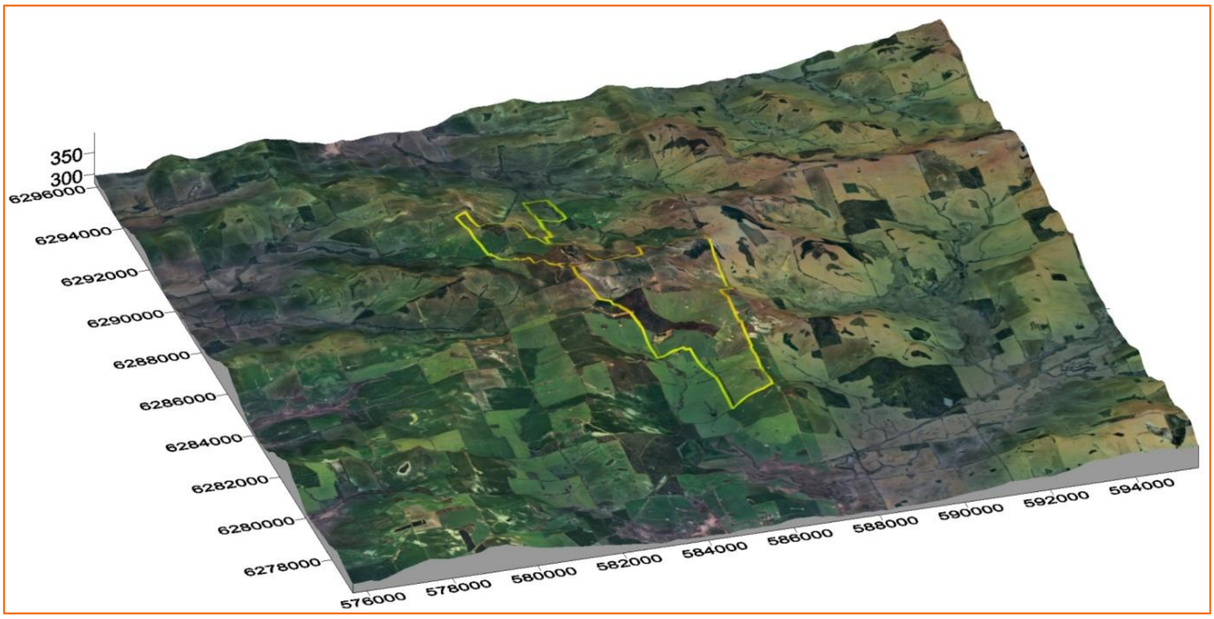

Figure 4-1: Image of SRTM terrain elevation used in CALMET (vertical height is exaggerated).

4.2 CALPUFF

CALPUFF is the dispersion module of the CALMET/CALPUFF suite of models. It is a multi-layer, multi species, non-steady-state puff dispersion model that can simulate the effects of time-varying and space-varying meteorological conditions on pollutant transport, transformation and removal. The model contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer range effects such as pollutant removal, chemical transformation, vertical wind shear and coastal interaction effects. The model employs dispersion equations based on a Gaussian distribution of pollutants across released puffs and considers the complex arrangement of emissions from point, area, volume and line sources (Scire et al. 2000).

The CALPUFF model was set to calculate concentrations both on a set grid (gridded receptors) and at 52 specified locations (discrete receptors). The model domain was defined as 19.8 km in the east–west direction and 19.8 km in the north-south direction at a spacing of 150 m.

4.2.1 Emission sources

Each emission source for the Project was characterised as either area, volume or point sources in the dispersion model. Area sources were assigned to open areas while volume sources were assigned to mining activities in the pits and haul roads following the USEPA recommendations (USEPA, 2012). Point sources were assigned for stacks (power station). The locations of sources are presented in Appendix B as coordinates (GDA94, zone 50).

4.2.2 Particle size distribution

CALPUFF was set up to model depletion of the dust plume concentration through deposition. Since dust is subject to gravitation settling as well as deposition, information on particle size is critical. A particle size distribution for TSP, PM_{10} and $PM_{2.5}$ was estimated using a composite from the USEPA AP-42 manuals for 'aggregated handling and storage piles', 'industrial wind erosion' and 'unpaved roads'. These are shown in Table 4-1.

Table 4-1: Particle size distribution (USEPA, 2006).

Size range (µm)	Representative size	TSP	PM_{10}	$PM_{2.5}$
<2.5	1.3	6	15	100
2.5 – 5.0	3.5	14	36	-
5.0 – 10.0	7.5	19	48	-
10.0 – 15.0	12.5	14	-	-
15.0 – 30.0	22.5	29	-	-
30.0 – 50.0	37.5	18	-	-

4.3 Conversion of NO_X to NO_2

The atmospheric transformation of nitric oxide (NO) must be accounted for in the modelling, and in particular the estimation of NO_2 from modelled NO_x concentrations. The amount of NO_2 in the exhaust stream at the point of release is typically in the order of 10% of total NO_x (expressed as NO_2 equivalents) for combustion sources, although it can range from between 5% to 40% of total NOx dependent on the nature of the source. Following release, the NO is converted to NO_2 through complex photochemical reactions (in the presence of sunlight) involving atmospheric ozone and, to a lesser extent, other reactive pollutants. To simulate the transformation of NO to NO_2 that occurs after the exhaust gases are discharged, modellers have adopted the following methods to estimate nitrogen dioxide concentrations:

- Total Conversion (or US EPA Tier 1) Method:
    - In this conservative screening approach, predicted ground-level concentrations of total NO_x are assumed to exist as 100% NO_2.
- US EPA Tier 2 analysis:
    - Assumes a 75% conversion of NO_x to NO_2 (US EPA, 2005).
- Tier 3 analysis, including:
    - Ozone limited method: - The OLM assumes that approximately 10% of the NO_x emissions are generated as NO_2. If the ozone concentration is greater than 90% of the predicted NO_x concentrations, all the NO_x is assumed to be converted to NO_2 otherwise $NO_2 = O_3 + 0.1* NO_x$.
    - Ambient Ratio Method (ARM): - If there is at least one year of monitoring data available for NOx and NO2 within the airshed, an empirical NO_x /NO_2 relationship can be derived and used as an alternative to the ozone limiting method.

The ozone limited method was selected to estimate NO_x to NO_2 conversion using the following equation (Equation 8.1, NSW EPA, 2022):

$$NO_2 = \{0.1 \times NO_x\} + MIN\left\{0.9 \times NO_x \text{ or } \frac{46}{48} O_3\right\}$$

Where:

NO_x is predicted concentration of NO_x.

O_3 is background ambient ozone concentration.

NO_2 is predicted concentration of NO_2.

The monthly average background ozone concentration for the above calculation was obtained from the closest monitoring station at Mandurah, approximately 67 km to the north (https://www.der.wa.gov.au/your-environment/air/air-quality-data) (Figure 4-2Figure 4-2: Monthly average O3 concentration at Mandurah during 2020.

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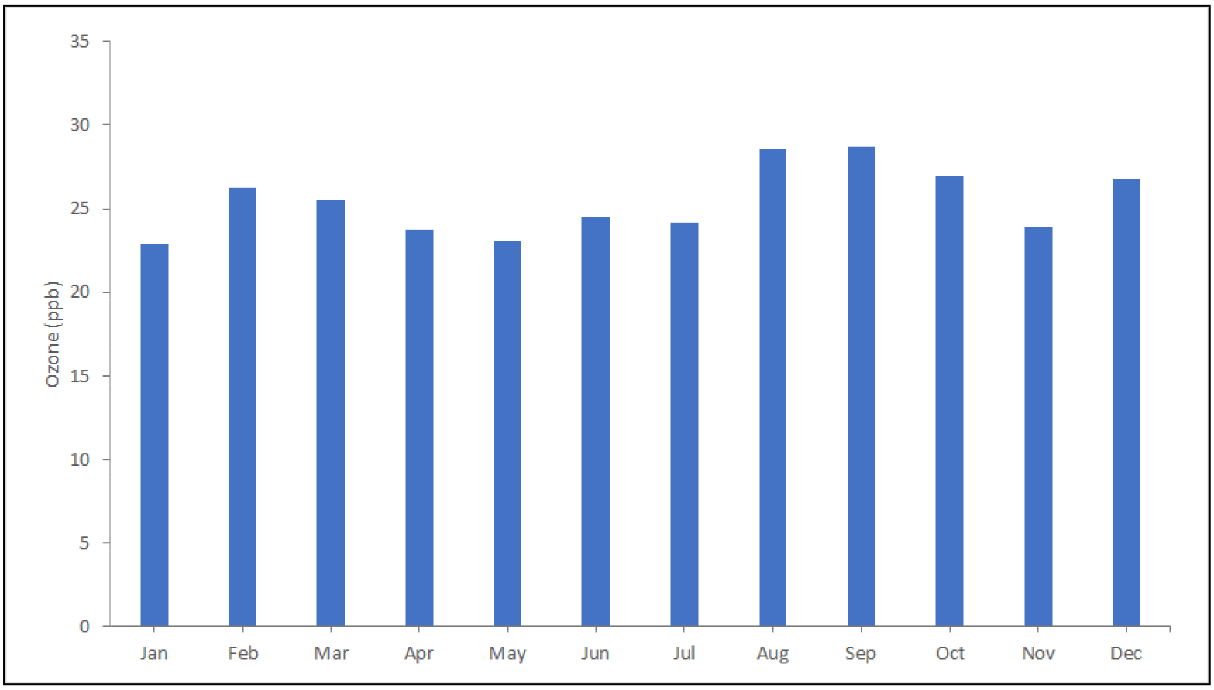

Figure 4-2: Monthly average O_3 concentration at Mandurah during 2020.

5 Emissions to Air Estimation

When determining the potential impact of a facility, either existing or proposed, one of the critical inputs to the dispersion model is the source emission file, based on the project emission inventory. The following sections outline the process whereby potential sources are identified and quantified based on the forecast throughput tonnage of the facility to form the basis of the project emission inventory.

5.1 Emission source inventory | scenarios

For this assessment the proposed mining schedule was obtained from Ausgold and this is presented in Table 5-1. From this table it is apparent that mining is forecast to be undertaken over 10 years across the open cut pits with the maximum tonnage mined occurring in Mining Year 3. For this assessment emission estimation has been conducted using the Mining Year 3 forecast tonnages.

The key emission sources for this scenario are associated with:

- Drilling and blasting
- Material handling from loading and unloading activities involving:
  - loading trucks
  - unloading trucks
  - bulldozing
- Material transport and processing:
  - transfer stations
  - crushing
  - stacking
- Wheel generated dust from roads and haul roads
- Wind erosion from stockpiles and open areas.

Additionally, gaseous emissions from the project will be produced from natural gas and diesel fuel combustion in the various power generation units, consisting of:

- Ten Jenbacher 620 11 kV Generating Sets (J620), natural gas operated,
- Three 415kV Cummins KTA50 G3 engines (KTA50), diesel operated (for startup only).

Table 5-1: Forecast mining tonnages (Mtpa)

Pit	Type	Total	0	1	2	3	4	5	6	7	8	9	10
Total	Waste	242.1	8.7	30.8	31.3	31.0	30.5	32.1	26.4	16.9	12.7	11.3	10.5
	Ore	35.3	1.10	3.72	3.30	4.47	4.62	3.01	4.61	4.71	2.64	1.47	1.67
	Total		**9.80**	**34.55**	**34.65**	**35.44**	**35.11**	**35.11**	**31.02**	**21.58**	**15.30**	**12.76**	**12.16**
Jackson	Waste	34.3	0.0	0.0	0.0	9.5	7.6	0.0	0.0	0.0	8.6	4.5	4.2
	Ore	4.8	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	1.4	0.4	0.4
	Total		0.00	0.00	0.00	10.51	9.08	0.01	0.00	0.00	10.00	4.91	4.60
Jinkas	Waste	183.3	8.7	30.8	31.3	20.5	22.9	32.1	23.1	5.7	0.0	1.7	6.3
	Ore	27.1	1.1	3.72	3.30	3.17	3.09	3.01	4.34	3.89	0.00	0.26	1.24
	Total		9.80	34.55	34.65	23.70	26.03	35.10	27.46	9.60	0.00	1.98	7.56
Olympia	Waste	1.8	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9	0.0
	Ore	0.5	0.0	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.23	0.00
	Total		0.00	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00	1.12	0.00
Dingo	Waste	22.7	0.0	0.0	0.0	0.0	0.0	0.0	3.3	11.2	4.1	4.2	0.0
	Ore	2.9	0.0	0.00	0.00	0.00	0.00	0.00	0.27	0.82	1.21	0.56	0.01
	Total		0.00	0.00	0.00	0.00	0.00	0.00	3.56	11.98	5.29	4.74	0.01

5.2 Emission Estimates (Mining)

This section outlines the emission estimation process for the Project. Emission estimates are sourced from the project emission inventory for inclusion in the dispersion model. It includes the emissions from mine operations, facilities and associated infrastructure including the road network. Emissions from all key sources have been identified according to accepted methods. The emphasis of the emission estimation and modelling is on the potential impact from the operating phase of the various operations within the Project. Emission estimation of construction activities is excluded from the assessment due to their intermittent nature over the life of the Project.

5.2.1 Drilling

Emissions for drilling have been calculated using the default emissions contained within the Emissions Estimation Technique Manual (EETM) for Mining (Environment Australia 2012). The default values are:

- TSP: 0.59 kg/hole
- PM_{10}: 0.31 kg/hole
- $PM_{2.5}$: 28% of PM_{10} emissions

The statistics of the annual emissions from drilling for PM_{10} are contained in Appendix Table 10.

5.2.2 Blasting

Emissions for blasting have been calculated using Equation 19 outlined in Appendix A of the EETM for Mining (Environment Australia 2012). This is represented by Equation 1:

Equation 1: $$EF_{TSP\,(kg/blast)} = 0.00022 \times A^{1.5}$$

Where A = blast area (m^2)

The emission factor for PM_{10} is taken as 52% of the TSP emission and the $PM_{2.5}$ emissions are taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for blasting for PM_{10} are contained in Appendix Table 10.

5.2.3 Loading ore/waste

Emissions for loading ore and waste have been calculated using the default value for excavators and front end loaders on overburden of:

- TSP: 0.025 kg/t
- PM_{10}: 0.012 kg/t

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for loading for PM_{10} are contained in Appendix Table 10.

5.2.4 Unloading ore/waste

Emissions for unloading ore and waste have been calculated using the default values of:

- TSP: 0.012 kg/t
- PM_{10}: 0.0043 kg/t

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for loading for PM_{10} are contained in Appendix Table 10.

5.2.5 Bulldozing

Emissions for the operation of bulldozers on both ore and waste have been determined using Equation 16 and 17 outlined in Appendix A of the EETM for Mining (Environment Australia 2012). The silt and moisture contents used were the defaults listed in the manual (10% moisture, 2% silt).

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual PM_{10} emissions for bulldozing are contained in Appendix Table 10.

5.2.6 Front end loaders

Emissions for the operation of front end loaders, at the Run of Mine (ROM) pad, used the default emission factor listed in Appendix A of the EETM for Mining (Environment Australia 2012) for overburden. These factors are:

- TSP: 0.025 kg/tonne
- PM_{10}: 0.012 kg/tonne

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for loading for PM_{10} are contained in Appendix Table 10.

5.2.7 Crushing (primary/secondary/tertiary)

The emissions for crushing (primary, secondary and tertiary) were determined using the default emission factors for high moisture content ores from Table 3 of the EETM for Mining (Environment Australia 2012).

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for crushing for PM_{10} are contained in Appendix Table 10.

5.2.8 Material handling (transfer stations, stackers)

The emissions for the handling and transferring, including stacking and reclaiming, were determined using the default emission factors for high moisture content ores from Table 3 of the EETM for Mining (Environment Australia 2012).

The emission factor for $PM_{2.5}$ emissions is taken as 15% of the PM_{10} emissions. The statistics of the annual emissions for crushing for PM_{10} are contained in Appendix Table 10.

5.2.9 Haul roads

To determine emissions from wheel generated dust along the haul roads the default equation for 'unpaved roads from wheels' was utilised (Equation 2). The weight of the haul trucks was taken as 185 tonnes – being the average of an empty and fully laden CAT785 haul truck and the default silt content of 10% was utilised.

Equation 2:
$$EF_{(kg/VKT)} = \frac{0.4536}{1.6093} \times k \times \left(\frac{s_{(\%)}}{12}\right)^{a} \times \left(\frac{W_{(t)}}{3}\right)^{b}$$

Where: k = constant (TSP = 4.9, PM_{10} = 1.5)
$s_{(\%)}$ = silt content (%)
$W_{(t)}$ = vehicle mass (t)
a = constant (TSP = 0.7, PM_{10} = 0.9)
b = constant (0.45)

The statistics of the annual emissions for crushing for PM_{10} are contained in Appendix Table 9.

5.2.10 Wind erosion

The default emission factor for wind erosion in the EETM for Mining (Environment Australia 2012) is a constant emission of 0.2 kg/ha/hr which, while potentially suitable for the calculation of annual emissions, is not suitable for inclusion in atmospheric modelling. This assessment used the modified Shao equation outlined in (SKM 2005:200) which is represented as Equation 3:

Equation 3:

$$PM_{10_{(g/m^2/s)}} = k \times \left\{WS^3 \times \left(1 - \left(WS_0{}^2/WS^2\right)\right)\right\} \quad WS > WS_0$$

$$PM_{10_{(g/m^2/s)}} = 0 \quad WS < WS_0$$

Where: WS = wind speed (m/s)
WS_0 = threshold for particulate matter lift off (m/s)
K is a constant

For this assessment the wind speed threshold (WS_0) was set at 5.4 m/s and the k constant at 2.66×10^{-7}. This results in an overall emission rate of 0.4 kg/ha/hr for PM_{10} from open areas, which is higher than the emission rate of 0.2 kg/ha/hr specified in the EETM for Mining (Environment Australia 2012).

The emission factor for TSP is taken as twice that of the PM_{10} emissions while $PM_{2.5}$ emissions are taken as 15% of the PM_{10} emissions (Table 5.1). This is higher than the emission rate of 0.2 kg/ha/hr specified in the EETM for Mining (EA, 2012) which, as outlined in SKM (2005), is derived for the Hunter Valley region of New South Wales (NSW). This increase in wind erosion emissions is based on a range of factors including lower rainfall and higher evaporation rates in the region.

The statistics of the annual emissions for crushing for PM_{10} are contained in Appendix Table 8.

5.3 Emission Controls

Emissions controls (for dust abatement) were included in the emissions estimation and these controls are summarised in Table 5-2, along with the percentage reduction applied to each source type.

Table 5-2: Dust abatement included in the model

Source	Equipment	Dust abatement description	Emission reduction
Mining	Bulldozing	None	0%
	Loading ore and waste	In pit reduction	5% (PM_{10}) 50% (TSP)
	Unloading waste	None	0%
	Unloading ore at ROM pad	None	0%
	Loading ore at ROM pad	None	0%
	Drilling	In pit reduction	5% (PM_{10}) 50% (TSP)
	Blasting	In pit reduction	5% (PM_{10}) 50% (TSP)

Source	Equipment	Dust abatement description	Emission reduction
	Wind erosion (in pit)	In pit	5% (PM_{10}) 50% (TSP)
	Wind erosion (all other)	Watering	50%
Haul road	Hauling	Watering with saline water	85%
Processing Facility	Unloading ore into primary crusher by front end loader	Watering	50%
	Primary crushing of ore	Watering	50%
	Transfer stations	Enclosure	70%
	COS Stacker	Water sprays	50%

5.4 Emission Summary

A summary of the estimated annual emissions from the Project are shown in Table 5-3. The emission sources along with the model parameters are presented in Appendix C while the PM_{10} emission statistics for each source are presented in Appendix D.

Table 5-3: Estimate of TSP and PM_{10} annual particulate emissions (kg/yr).

Source	Model Year		
	TSP	PM_{10}	$PM_{2.5}$
Drilling	19,863	19,830	2,974
Blasting	6,047	5,975	896
Loading ore (pits)	55,927	51,006	7,651
Loading waste (Pits)	375,217	342,198	51,330
Unloading (waste)	360,208	129,075	19,361
Bulldozers (pits)	39,772	18,396	2,759
Bulldozers (waste)	66,021	16,073	2,411
Unload ore (RoM)	11,007	3,944	592
Load ore (ROM)	55,927	26,845	4,027
Unloading (crusher)	45,860	22,013	3,302
Crushing	12,841	5,136	770
Transfer	18,344	7,338	1,101
Stackers	2,752	1,101	165
Haul roads	1,241,505	366,444	91,611
Wind erosion	330,274	227,965	34,195
Total	**2,641,565**	**1,243,339**	**186,500**

Based on the emission estimation presented in Table 5-3 the primary emission sources are associated with:

- Haul road emissions associated with the movement of haul trucks,
- Wind erosion from open areas and within the mining pits, and
- Loading of ore/waste into haul trucks in the mining pits.

The dust generation characteristics and potential abatement strategies for haul roads and wind erosion are outlined in Appendix E. No abatement is recommended for the loading of ore/waste within the mining pits due to spatial and temporal varying nature.

5.5 Emission Estimates (Power Generation)

For the Project to operate, a stand-alone hybrid power station will be constructed. The components of the power station are presented in Table 5-4 and includes:

- Photovoltaic solar farm,
- Battery energy storage system (BESS),
- Ten Jenbacher 620 11 kV Generating Sets (J620), natural gas operated, and
- Three 415kV Cummins KTA50 G3 engines (KTA50), diesel operated,

Table 5-4: Power station capacity

Hybrid Power Station Component		Units	Installed
Solar PV capacity		MWp	40.8
BESS installed capacity		MW/MWhr	20.0 / 44.2
Thermal capacity	Gas	MW	30.3
	Diesel	MW	3.0
Total installation capacity		MW	94.1
Renewable energy percentage		%	42

Two power generation scenarios have been modelled:

- Peak normal operations, which models
  - Eight J620s – noting that this is the maximum operating system as the remaining two units remain as backup units.
- Upset conditions during a black start, which models
  - eight J620s
  - three KTA50.

5.5.1 Normal Operations (Peak)

The J620s are expected to provide 58% of the annual power required for the project, with the solar farm and BESS providing the remaining power, though this number will vary between 44–76% per month as local conditions for solar power generation shift across the year.

During normal operations, peak load requires eight of the ten J620s to be operating. While the power station is not realistically expected to be functioning at this load across the entire day, the model represents the worst case scenario in which the J620s are operating at their peak load across the entire year. Consequently, averaging periods of over an hour are likely to be an overestimation.

5.5.2 Upset Conditions

In contrast to the J620s, the diesel-powered KTA50s are only intended for use in a black start scenario—after a power outage or an emergency shutdown. Consequently, the diesel generator usage is expected to be short-term and intermittent.

During upset conditions, the model assumes that three KTA50s are operating in addition to the previous eight J620s. All generators are assumed to be operating throughout the entire year. This is a highly unrealistic scenario, though one necessary to capture the behaviour of the KTA50s under a wide variety of meteorological conditions. Because of how wildly unrealistic this situation is, assessment criteria with annual averaging periods are not considered applicable.

5.5.3 Model Source Parameters

A summary of the stack parameters and emissions information for the generators used as input to the model is presented in Table 5-5. While this is not an exhaustive list of pollutants, these are the ones relevant to the impact assessment criteria described in Table 3-1.

Table 5-5: Model source parameters for generators

Source Reference No.		STK1–8	DSTK1–3
Generator type		J620	KTA50
Parameter	Units		
Stack parameters			
Stack | Release Height	m (agl)	8.012	6.3
Stack Diameter	m	0.610	0.2
Temperature	°C	364	520
Volumetric Flow	m^3/s	8.4	3.6
Exit Velocity	m/s	28.8	115
Emissions per source			
NO_X (NO_2 equivalent)	g/s	1.468	4.900
CO	g/s	3.083	1.143
$PM_{2.5}$	g/s	0.029	0.033
SO_2	g/s	0.035	0.049

6 Predicted Air Quality Conditions

Comparison of the modelled results to the assessment criteria is intended to provide an objective evaluation of the potential emissions from the operations at the nearest sensitive receptors.

The results of the modelling are presented in two formats:

- Isolated: modelled results for the project scenarios described above, representing the "project only" potential impact.
- Background (cumulative sources): the project emissions inclusive of the background concentrations as referenced in Section 2.3.

6.1 TSP

As outlined in Section 3, the criteria for TSP is primarily designed for the protection of human amenity. In order to model dust deposition in CALPUFF it is first necessary to estimate and model TSP. These results are provided for transparency of the modelling methodology, but are not used in the assessment of dust deposition on flora. The results at the residential receptors, which are presented in Table 6-1, indicate that:

- Seven of the residential receptors are predicted to exceed the nominated assessment criteria (90 µg/m^3) at least once.
    - The two residential receptors with the most exceedances are R52 and R16, which the model predicts exceedances on 13 and 4 days, respectively.
- At the Rifle Range (R1), 24-hour TSP concentrations are predicted to exceed the nominated assessment criteria on 50 days.
- At Woorgabup Nature Reserve (R2 and R3), the criteria is expected to be exceeded on up to 85 days.

While the upper statistics of the dust concentrations are elevated, this must be considered in the context of what the statistics actually represent. The concentrations drop off swiftly at lower statistics, with the project only and cumulative results at the 90th percentile being on average 82% and 53% smaller than the maxima, respectively.

Furthermore, a lack of nearby background monitoring data required the use of monitoring data from the DWER Albany AQMS, which is expected to be a highly conservative estimate due to the additional dust sources from proximity to land use sources.

These results should be interpreted as an indication of which areas are most likely to be affected by dust rather than as a true forecast of future events. Elevated levels predicted by the model can be counteracted by additional abatement methods, monitoring, and an operational dust management plan.

The isopleths for the maximum predicted 24-hour TSP concentrations are presented in isolation in Figure 6-1 and with background concentrations (Section 2.3) in Figure 6-2. The red contour line represents the assessment criteria concentration. The concentration contours show that the maximum 24-hour TSP concentrations are predicted to be elevated around the forecast mining areas.

For reference the isopleths of the 6th highest predicted TSP concentrations are presented in isolation in Figure 6-3 and with background concentrations (Section 2.3) in Figure 6-4. When the results presented in these figures are compared to the corresponding maximum isopleths it is apparent that there is a significant reduction in the predicted concentrations from the maximum down to the 6th highest.

Table 6-1: Statistics of predicted TSP concentrations – Project Only and Cumulative (i.e. Project + Background) (µg/m³)

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90
R1	Amenity	183	131	83	52	28	19.2	16	228	176	128	97	73	64.2	50
R2	Ecological | Amenity	259	172	104	78	42	30.0	31	304	217	149	123	87	75.0	85
R3	Ecological | Amenity	249	104	50	33	9	10.6	6	294	149	95	78	54	55.6	22
R4	Ecological	37	20	11	5	1	1.8	0	82	65	56	50	46	46.8	0
R5	Ecological	37	26	11	5	1	1.8	0	82	71	56	50	46	46.8	0
R6	Ecological	28	21	9	3	1	1.4	0	73	66	54	48	46	46.4	0
R7	Ecological	79	53	31	21	7	5.9	0	124	98	76	66	52	50.9	7
R8	Ecological	70	47	34	24	9	6.8	0	115	92	79	69	54	51.8	6
R9	Ecological	76	36	21	13	5	4.3	0	121	81	66	58	50	49.3	2
R10	Ecological | Amenity	56	22	10	5	1	1.8	0	101	67	55	50	46	46.8	2
R11	Ecological	56	20	9	4	1	1.6	0	101	65	54	49	46	46.6	2
R12	Building	61	25	12	6	1	2.1	0	106	70	57	51	46	47.1	2
R13	Building	36	28	15	9	3	2.7	0	81	73	60	54	48	47.7	0
R14	Building	21	17	8	4	1	1.3	0	66	62	53	49	46	46.3	0
R15	Building	45	34	18	11	5	3.8	0	90	79	63	56	50	48.8	1
R16	Building	68	47	30	22	15	8.9	0	113	92	75	67	60	53.9	4
R18	Building	56	32	18	9	3	3.1	0	101	77	63	54	48	48.1	1
R19	Building	43	30	19	13	3	3.3	0	88	75	64	58	48	48.3	0
R20	Building	43	27	15	11	2	2.7	0	88	72	60	56	47	47.7	0
R21	Building	25	21	12	9	4	2.8	0	70	66	57	54	49	47.8	0
R22	Building	34	24	13	9	3	2.6	0	79	69	58	54	48	47.6	0
R23	Building	34	21	13	6	3	2.2	0	79	66	58	51	48	47.2	0
R24	Building	90	33	17	10	3	3.4	1	135	78	62	55	48	48.4	3
R25	Building	58	31	17	10	3	3.2	0	103	76	62	55	48	48.2	3
R26	Building	25	18	9	5	2	1.8	0	70	63	54	50	47	46.8	0

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90
R27	Building	32	22	9	7	3	2.2	0	77	67	54	52	48	47.2	0
R28	Building	15	13	8	4	1	1.3	0	60	58	53	49	46	46.3	0
R29	Building	21	14	6	3	0	1.0	0	66	59	51	48	45	46.0	0
R31	Heritage	37	19	10	5	1	1.7	0	82	64	55	50	46	46.7	0
R32	Heritage	22	15	8	5	1	1.4	0	67	60	53	50	46	46.4	0
R33	Heritage	40	18	7	3	1	1.3	0	85	63	52	48	46	46.3	0
R34	Heritage	32	24	12	8	3	2.4	0	77	69	57	53	48	47.4	0
R35	Heritage	26	16	9	5	1	1.5	0	71	61	54	50	46	46.5	0
R36	Heritage	69	23	11	7	2	2.3	0	114	68	56	52	47	47.3	1
R37	Heritage	15	8	4	2	0	0.7	0	60	53	49	47	45	45.7	0
R38	Heritage	10	7	3	1	0	0.5	0	55	52	48	46	45	45.5	0
R39	Heritage	288	182	99	73	35	26.2	25	333	227	144	118	80	71.2	71
R40	Heritage	56	20	9	4	1	1.6	0	101	65	54	49	46	46.6	2
R41	Ecological	318	200	100	71	31	24.5	23	363	245	145	116	76	69.5	61
R42	Ecological	148	113	54	39	16	12.4	7	193	158	99	84	61	57.4	29
R43	Ecological	141	90	55	33	13	10.8	4	186	135	100	78	58	55.8	23
R44	Ecological	181	109	60	45	26	18.5	5	226	154	105	90	71	63.5	38
R45	Ecological	136	46	23	15	4	4.8	1	181	91	68	60	49	49.8	4
R46	Ecological	162	76	47	33	19	12.9	2	207	121	92	78	64	57.9	19
R47	Ecological	111	51	30	22	12	8.2	1	156	96	75	67	57	53.2	9
R48	Ecological	508	330	209	138	80	64.9	75	553	375	254	183	125	109.9	191
R49	Ecological	105	69	39	26	15	10.0	2	150	114	84	71	60	55.0	14
R50	Ecological	99	62	32	18	3	5.4	1	144	107	77	63	48	50.4	9
R51	Ecological	91	41	21	12	2	3.8	1	136	86	66	57	47	48.8	3
R52	Building	87	67	39	28	12	8.6	0	132	112	84	73	57	53.6	13
R53	Building	24	21	12	8	2	2.1	0	69	66	57	53	47	47.1	0
R54	Building	18	10	5	3	1	0.9	0	63	55	50	48	46	45.9	0
R55	Building	37	15	5	2	0	0.9	0	82	60	50	47	45	45.9	0

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >90
R56	Building	26	11	3	2	0	0.7	0	71	56	48	47	45	45.7	0
R57	Building	30	17	8	5	0	1.3	0	75	62	53	50	45	46.3	0
R58	Building	13	9	3	2	0	0.6	0	58	54	48	47	45	45.6	0
R59	Building	19	10	6	3	1	0.9	0	64	55	51	48	46	45.9	0
R60	Building	25	14	5	4	1	1.1	0	70	59	50	49	46	46.1	0
R61	Building	25	15	6	4	1	1.3	0	70	60	51	49	46	46.3	0
R62	Building	12	10	5	3	0	0.8	0	57	55	50	48	45	45.8	0
R63	Building	19	11	5	3	0	0.9	0	64	56	50	48	45	45.9	0
R64	Building	16	12	5	2	0	0.8	0	61	57	50	47	45	45.8	0
R65	Building	20	18	6	4	1	1.3	0	65	63	51	49	46	46.3	0
R66	Building	13	11	5	2	0	0.8	0	58	56	50	47	45	45.8	0

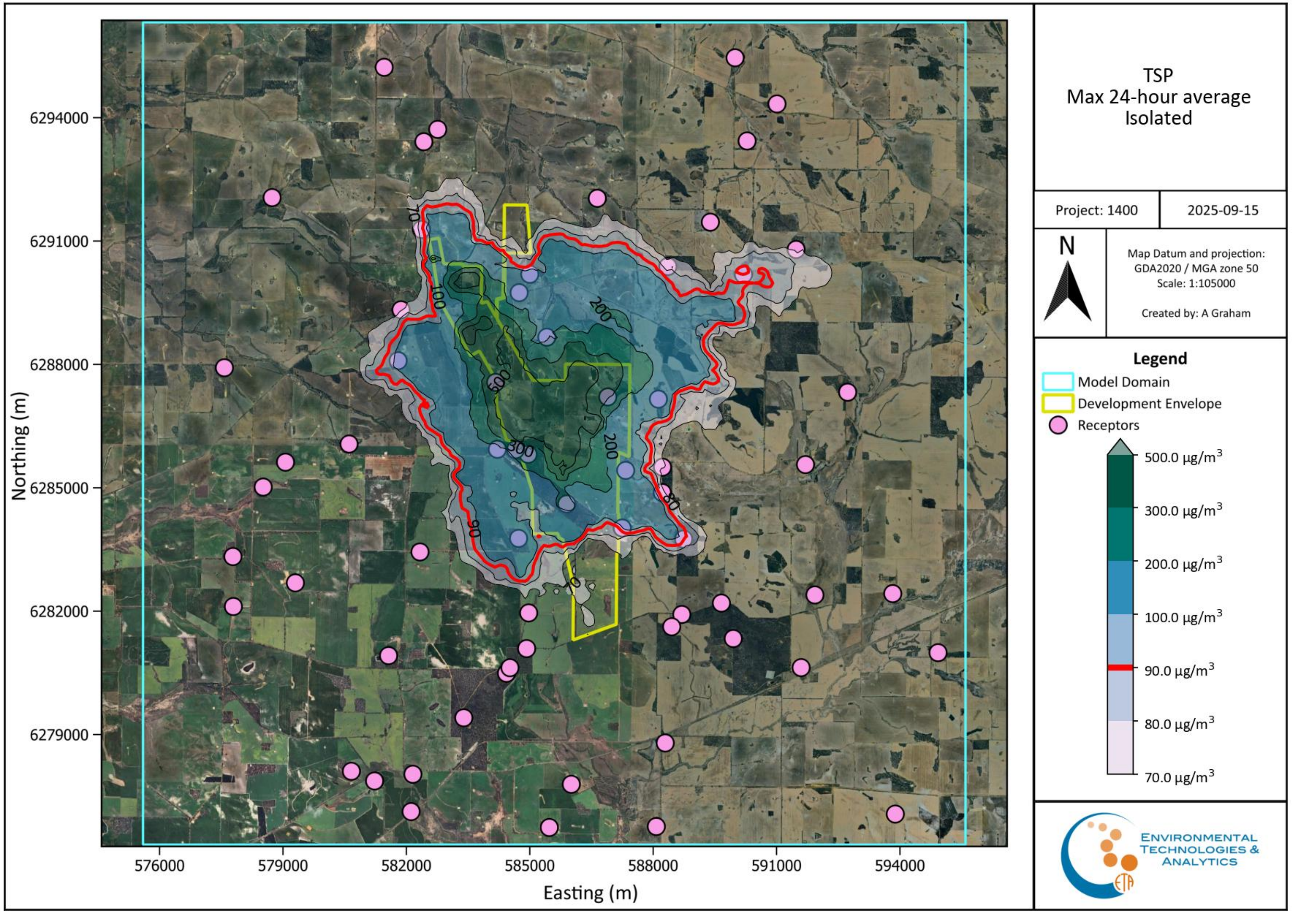

Figure 6-1: Project only TSP emissions – Maximum predicted 24-hour concentrations (μg/m³).

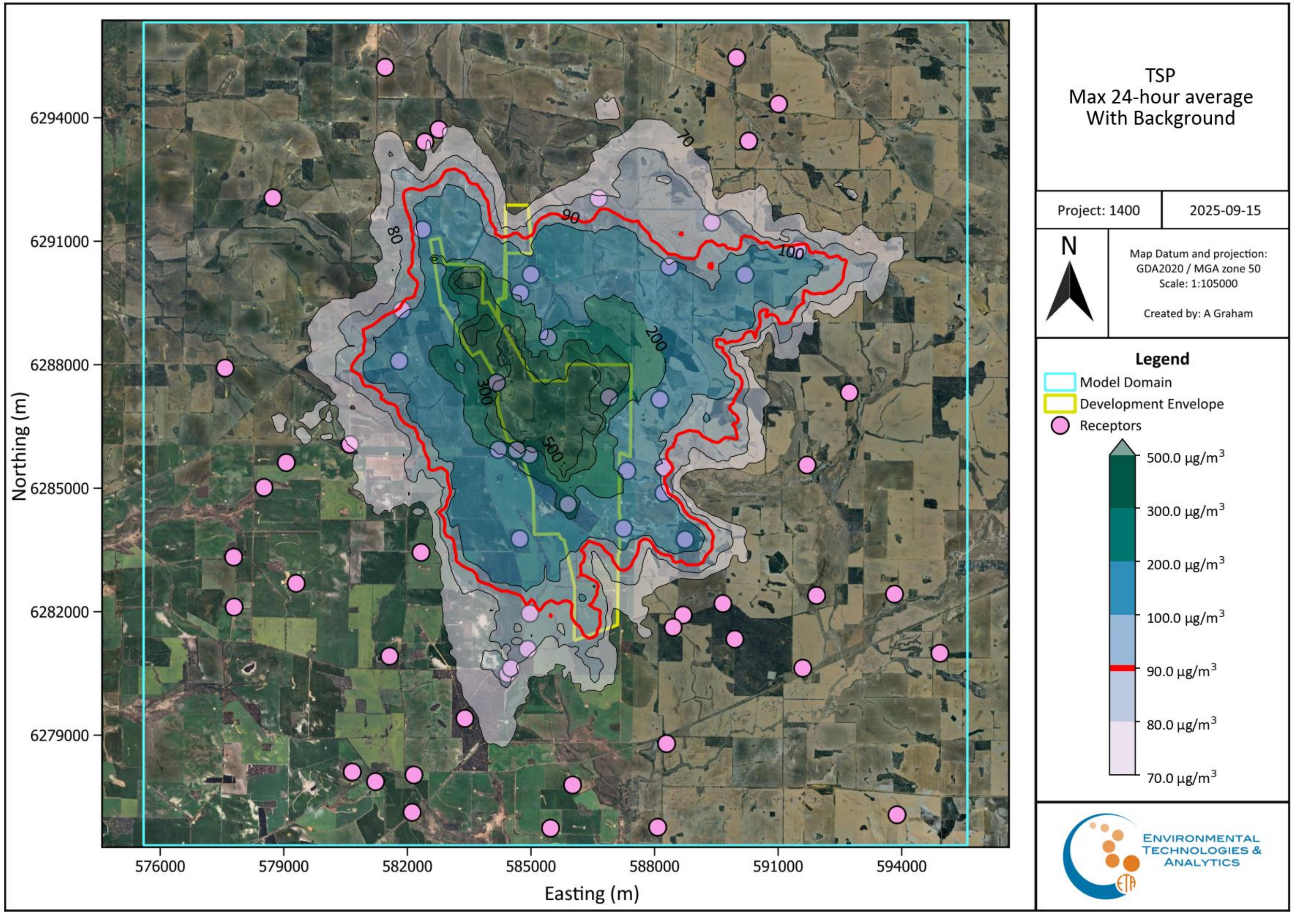

Figure 6-2: Cumulative TSP emissions – Maximum predicted 24-hour concentrations (µg/m^3).

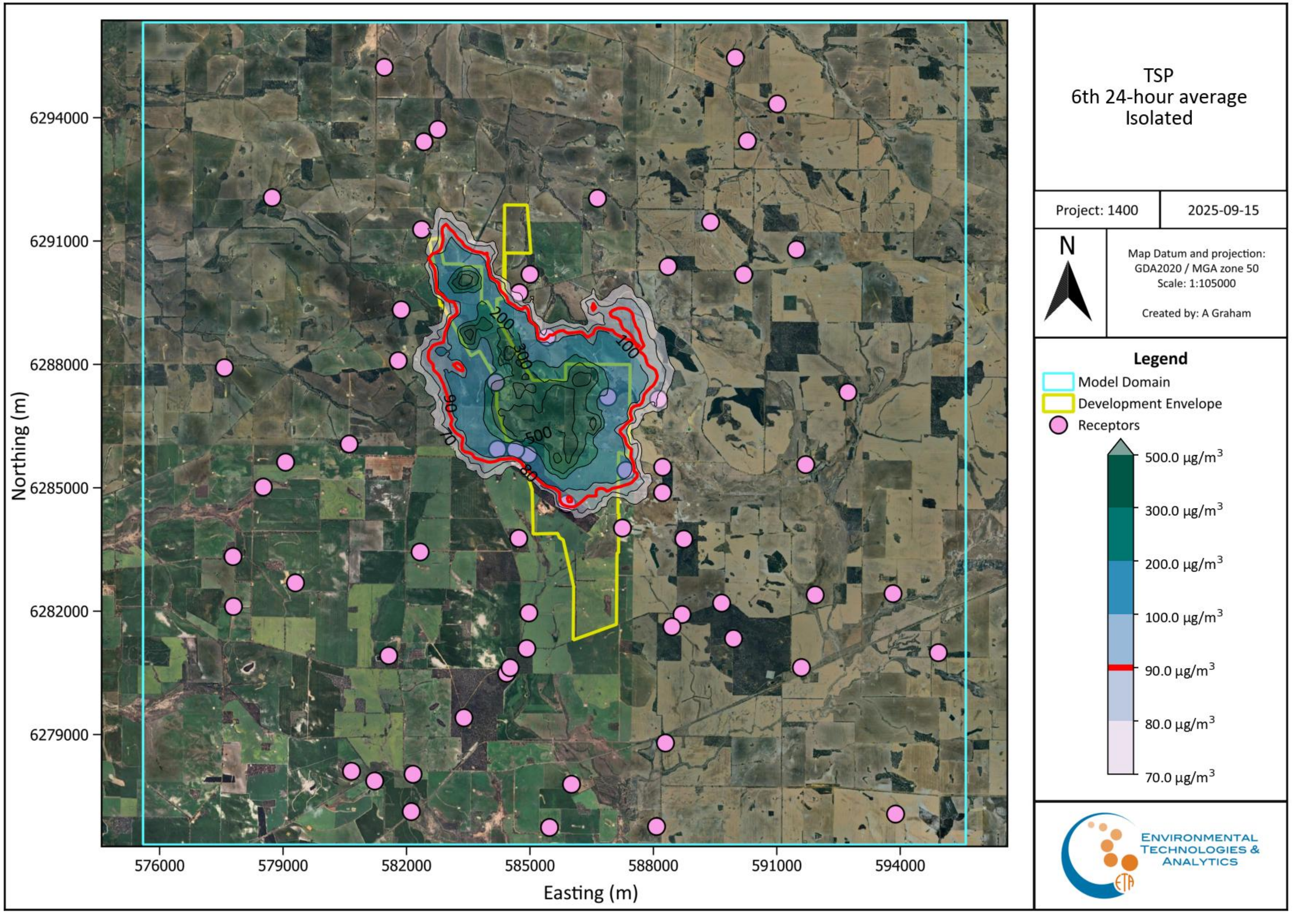

Figure 6-3: Project only TSP emissions – 6th highest predicted 24-hour concentrations (µg/m³).

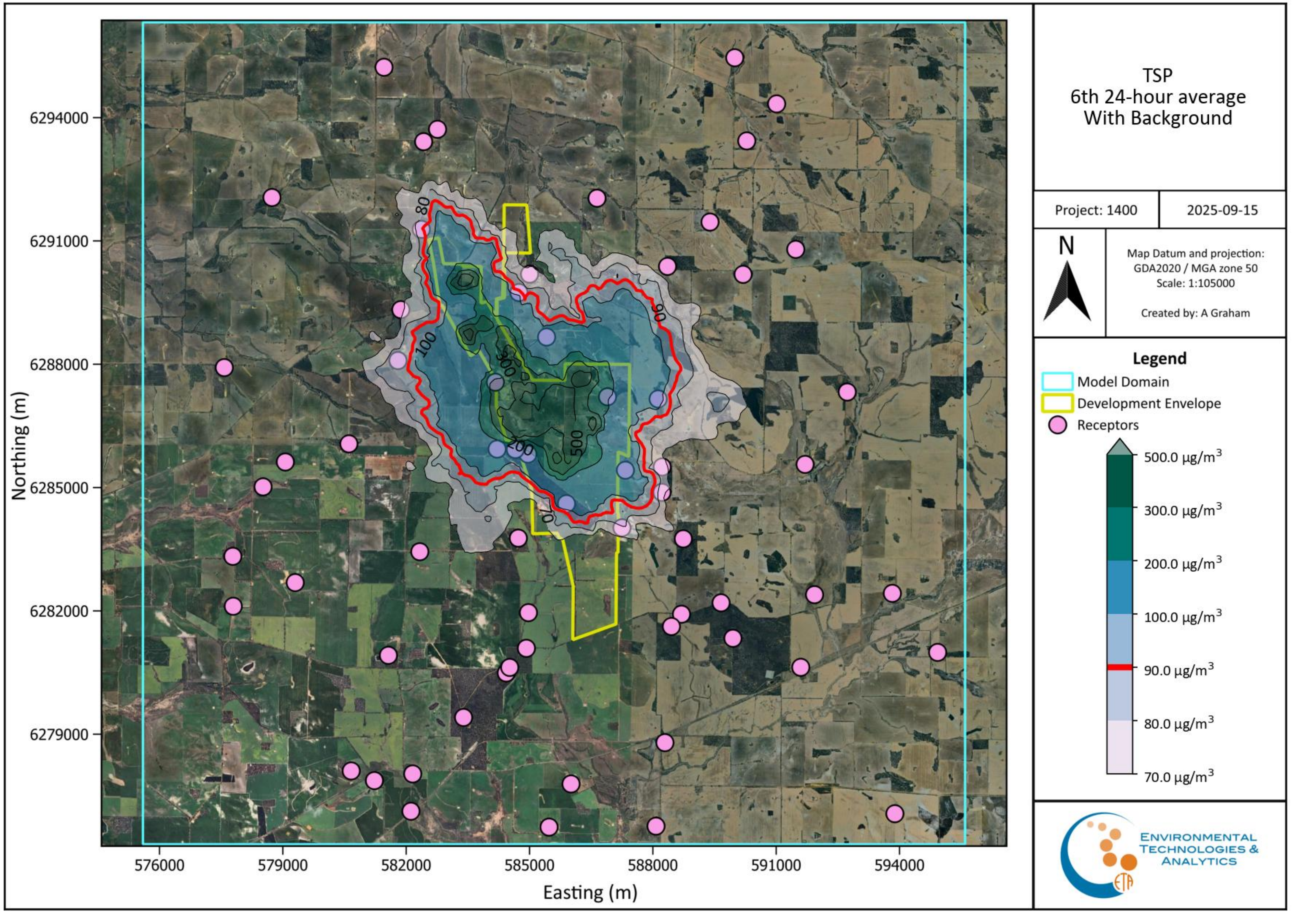

Figure 6-4: Cumulative TSP emissions – 6th highest predicted 24-hour concentrations (µg/m³).

6.2 PM_{10}

As outlined in Section 3, the 24-hour (50 µg/m^3) and annual criteria (25 µg/m^3) for PM_{10} are based on the protection of human health and the criteria used in this assessment it is applicable to community receptors.

The isopleths for the maximum predicted 24-hour PM_{10} concentrations are presented in isolation in Figure 6-5 and with background concentrations (Section 2.3) in Figure 6-6. For reference the isopleths of the 6th highest predicted 24-hour PM_{10} concentrations are presented in isolation in Figure 6-7 and with background concentrations (Section 2.3) in Figure 6-8. The concentration contours show that:

- The maximum 24-hour PM_{10} concentrations are predicted be elevated around the forecast mining areas.
- There is a significant reduction in the predicted concentrations from the maximum down to the 6th highest.

The isopleths for the annual average PM_{10} concentrations are presented in isolation and with background in Figure 6-9 and Figure 6-10, respectively. The red contour line represents the assessment criteria concentration. The annual average PM_{10} concentrations are predicted to be elevated in close proximity and within the forecast mining areas.

The statistics of the predicted 24-hour PM_{10} concentrations, for the applicable sensitive receptors, are presented in Table 6-2. The results indicate that at the sensitive receptors where the primary impact of concern is the impact on human health (i.e. where community is present):

- For residential receptors R16, R24, and R52, 24-hour PM_{10} concentrations are predicted to exceed the nominated 24-hour assessment criteria (50 µg/m^3) on 3, 2, and 9 days, respectively.
    - Other residential receptors are not predicted to exceed the criteria.
- No residential receptors are predicted to exceed the annual average assessment criteria (25 µg/m^3).
- At the rifle range (R1), 24-hour PM_{10} concentrations are predicted to exceed the 24-hour assessment criteria on 25 days.

Compared to the TSP results, the number of predicted PM_{10} exceedances at the residential receptors are limited. With that said, the previous comments about this being a worst-of-the-worst case scenario with an unrealistically high background still apply. Under more realistic conditions, the 24-hour PM_{10} concentrations are expected to be lower.

These results should be interpreted as an indication of which areas are most likely to be affected by dust rather than as a true forecast of future events. Elevated levels predicted by the model can be counteracted by additional abatement methods, monitoring, and an operational dust management plan.

Table 6-2: Statistics of predicted PM_{10} concentrations – Project Only and Cumulative (i.e. Project + Background) (µg/m³)

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >50	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >50
R12	Building	25	10	5	3	0	0.9	0	48	33	28	25	23	16.2	0
R13	Building	16	12	6	4	1	1.2	0	38	35	29	27	23	16.5	0
R14	Building	8	8	3	2	0	0.6	0	31	30	26	24	23	15.9	0
R15	Building	18	15	8	5	2	1.7	0	41	37	30	28	24	17.0	0
R16	Building	32	22	14	11	6	4.4	0	55	45	37	33	29	19.7	3
R18	Building	27	15	8	4	1	1.4	0	49	37	31	27	23	16.7	0
R19	Building	21	13	9	6	1	1.5	0	44	36	31	29	23	16.8	0
R20	Building	21	13	7	5	1	1.3	0	43	35	29	27	23	16.6	0
R21	Building	11	10	6	4	2	1.3	0	34	32	28	27	24	16.6	0
R22	Building	14	10	5	4	1	1.1	0	36	32	28	27	23	16.4	0
R23	Building	14	9	6	3	1	1.0	0	37	32	28	25	23	16.3	0
R24	Building	38	14	7	5	1	1.5	0	60	36	30	27	23	16.8	2
R25	Building	26	13	8	4	1	1.4	0	48	36	30	27	23	16.7	0
R26	Building	11	8	4	3	1	0.8	0	33	31	27	25	23	16.1	0
R27	Building	14	10	4	3	1	1.0	0	37	32	27	26	23	16.3	0
R28	Building	6	5	3	2	0	0.5	0	29	28	26	24	23	15.8	0
R29	Building	9	6	2	1	0	0.4	0	31	29	25	24	23	15.7	0
R52	Building	45	33	20	14	4	4.3	0	67	56	42	36	26	19.6	9
R53	Building	11	10	5	4	0	1.0	0	33	32	28	26	23	16.3	0
R54	Building	8	4	3	1	0	0.4	0	30	27	25	24	23	15.7	0
R55	Building	15	7	3	1	0	0.4	0	38	29	25	24	23	15.7	0
R56	Building	11	5	1	1	0	0.3	0	33	27	24	23	23	15.6	0
R57	Building	13	7	4	2	0	0.6	0	35	30	26	25	23	15.9	0
R58	Building	5	4	2	1	0	0.3	0	28	27	24	23	23	15.6	0
R59	Building	9	5	2	1	0	0.4	0	31	27	25	24	23	15.7	0
R60	Building	12	6	3	2	0	0.5	0	34	29	25	24	23	15.8	0
R61	Building	12	7	2	2	0	0.6	0	34	29	25	25	23	15.9	0

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >50	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >50
R62	Building	5	4	2	1	0	0.4	0	28	27	25	24	23	15.7	0
R63	Building	9	5	2	1	0	0.4	0	31	27	25	24	23	15.7	0
R64	Building	7	5	2	1	0	0.4	0	30	27	25	24	23	15.7	0
R65	Building	8	8	3	2	0	0.6	0	31	30	26	24	23	15.9	0
R66	Building	6	5	2	1	0	0.4	0	29	27	25	24	23	15.7	0

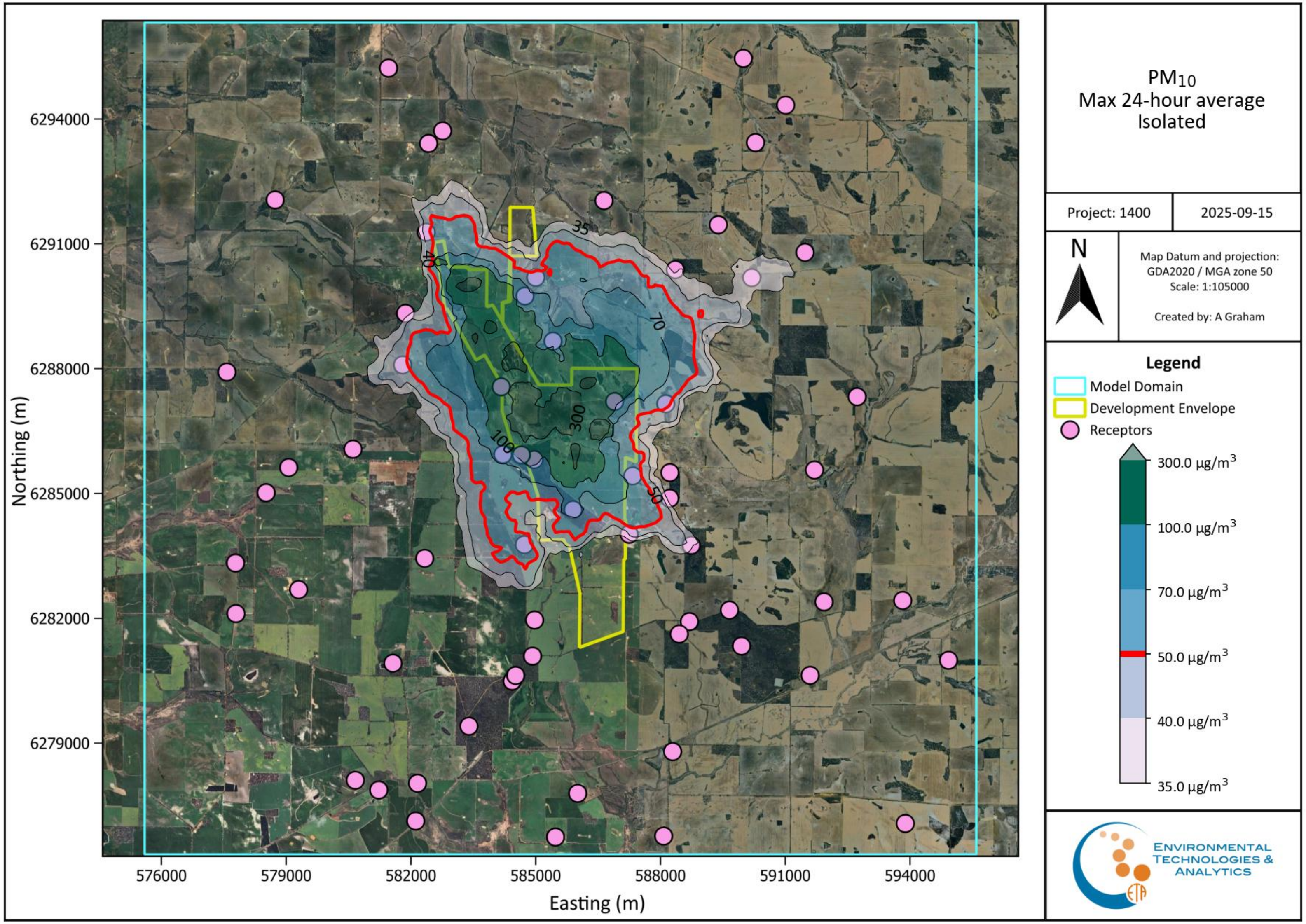

Figure 6-5: Project only PM_{10} emissions – Maximum predicted 24-hour concentrations (μg/m^3).

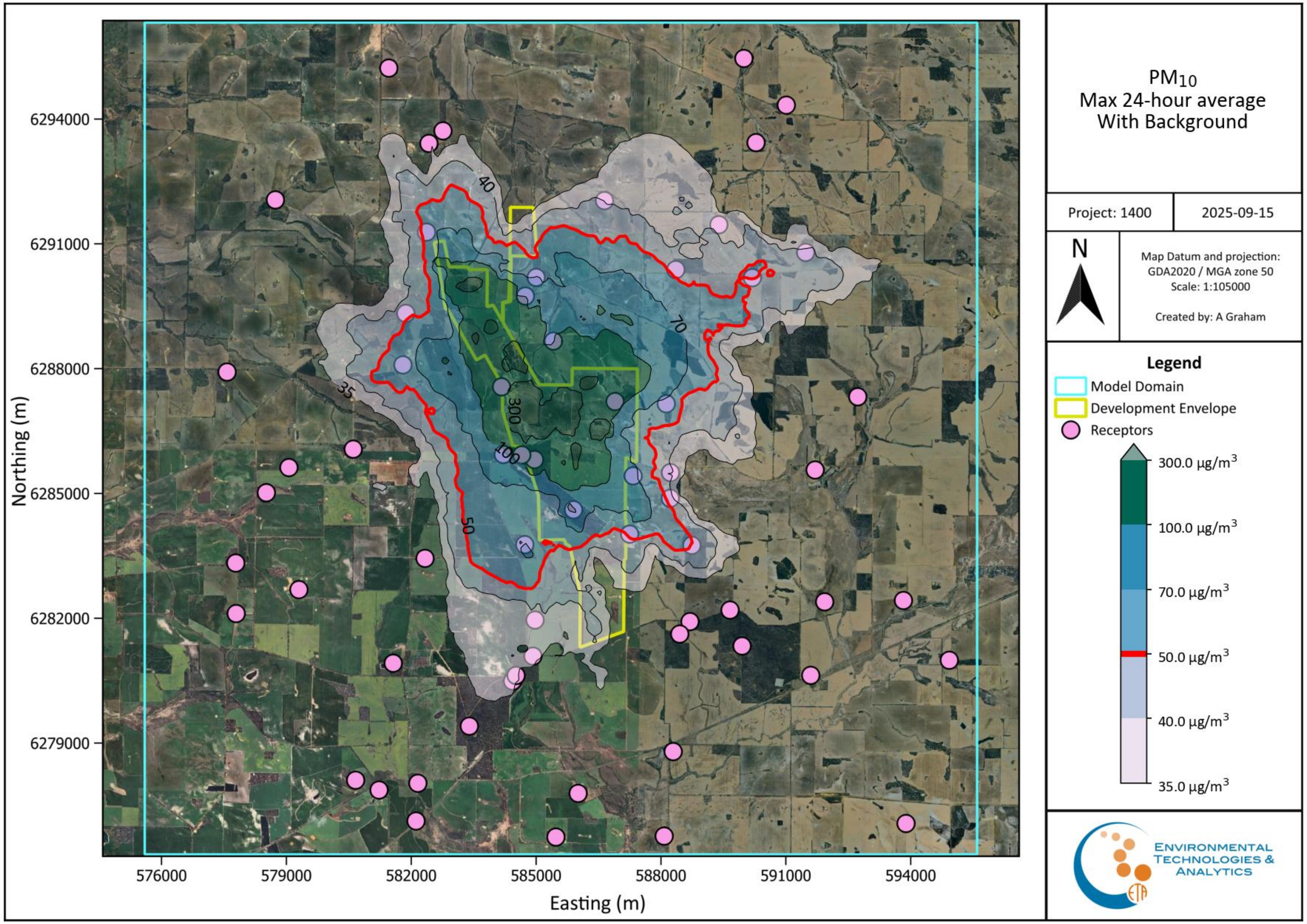

Figure 6-6: Cumulative PM_{10} emissions – Maximum predicted 24-hour concentrations (µg/m^3).

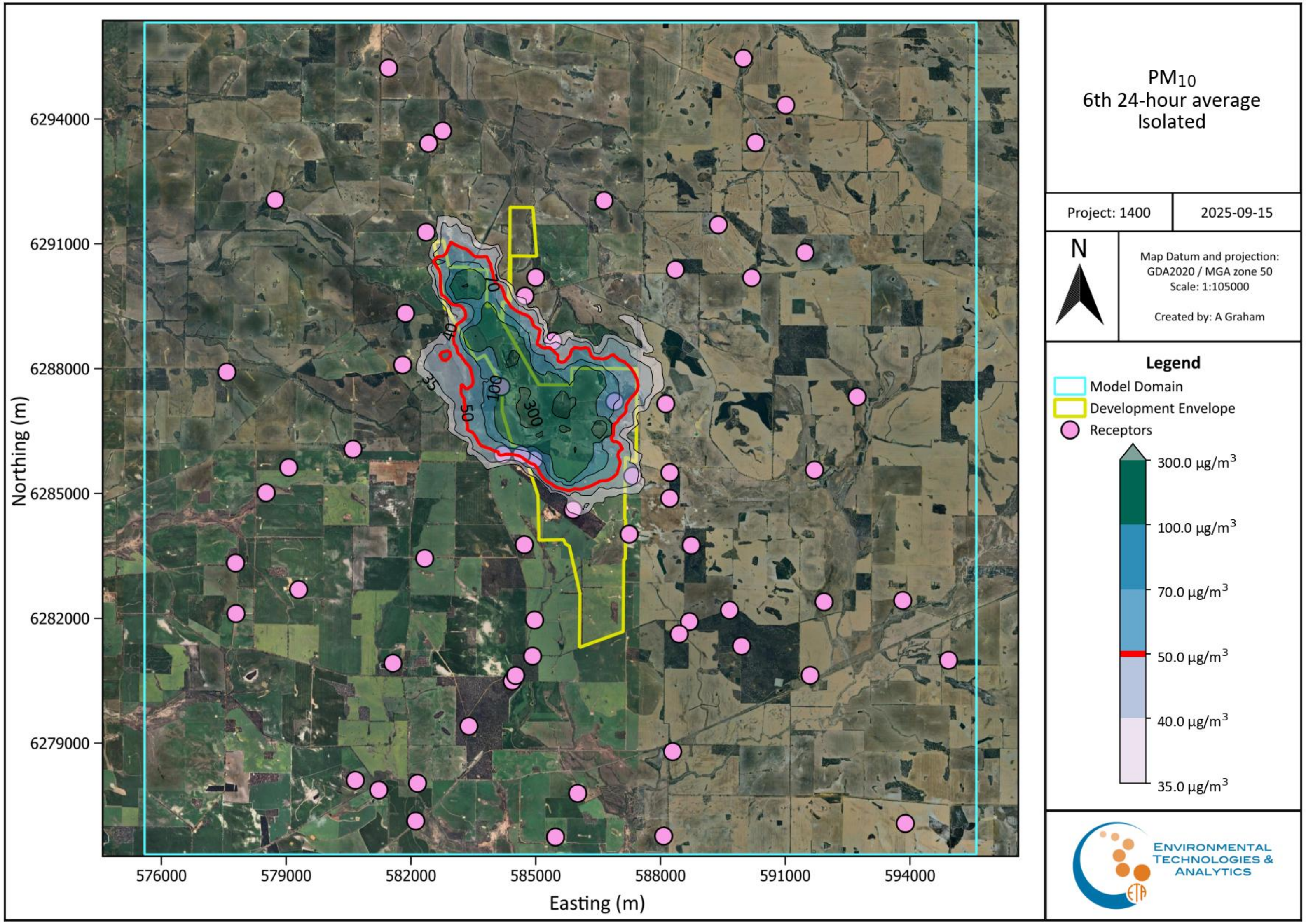

Figure 6-7: Project only PM_{10} emissions – 6th highest predicted 24-hour concentrations (μg/m³).

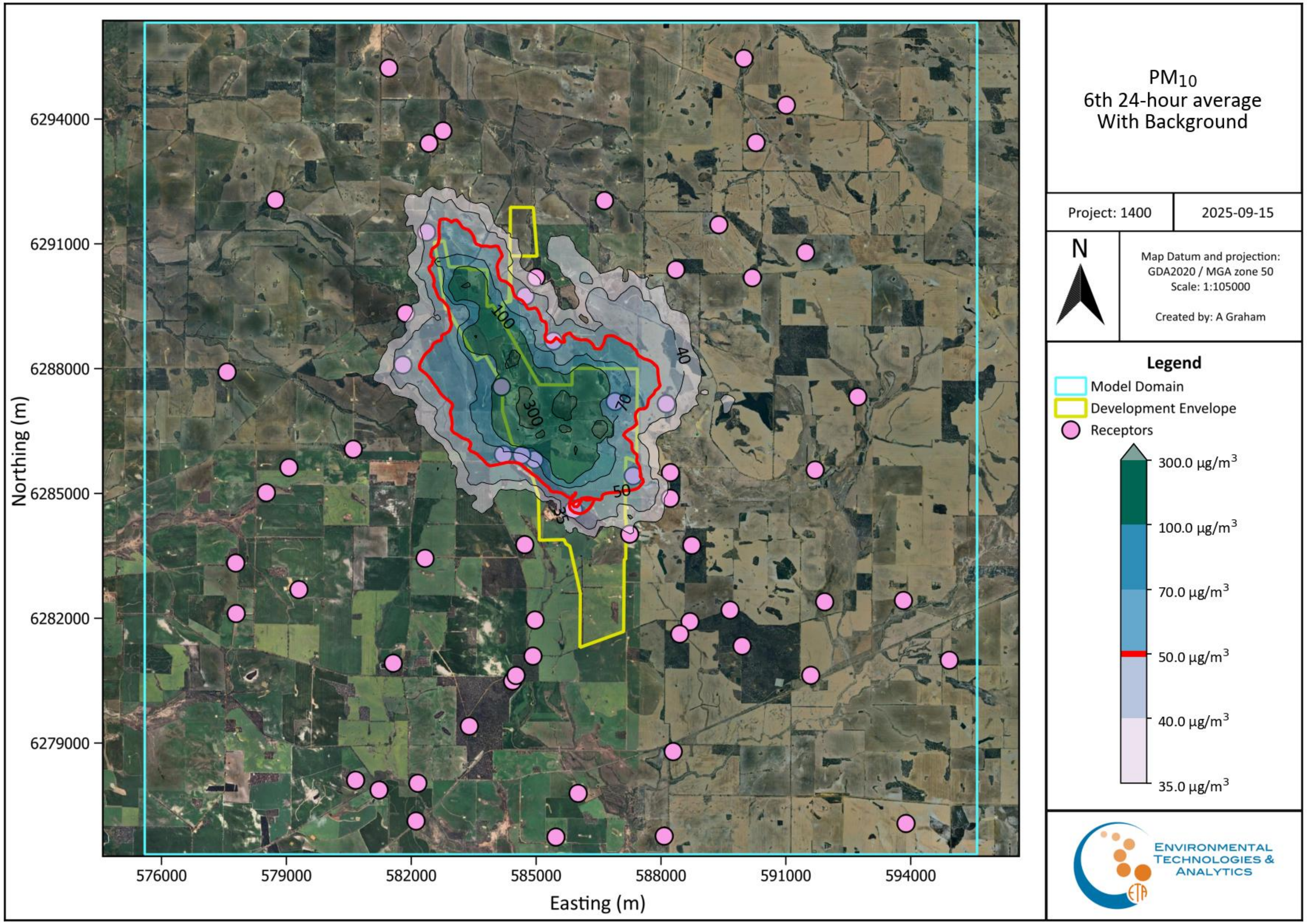

Figure 6-8: Cumulative PM_{10} emissions – 6th highest predicted 24-hour concentrations (μg/m³).

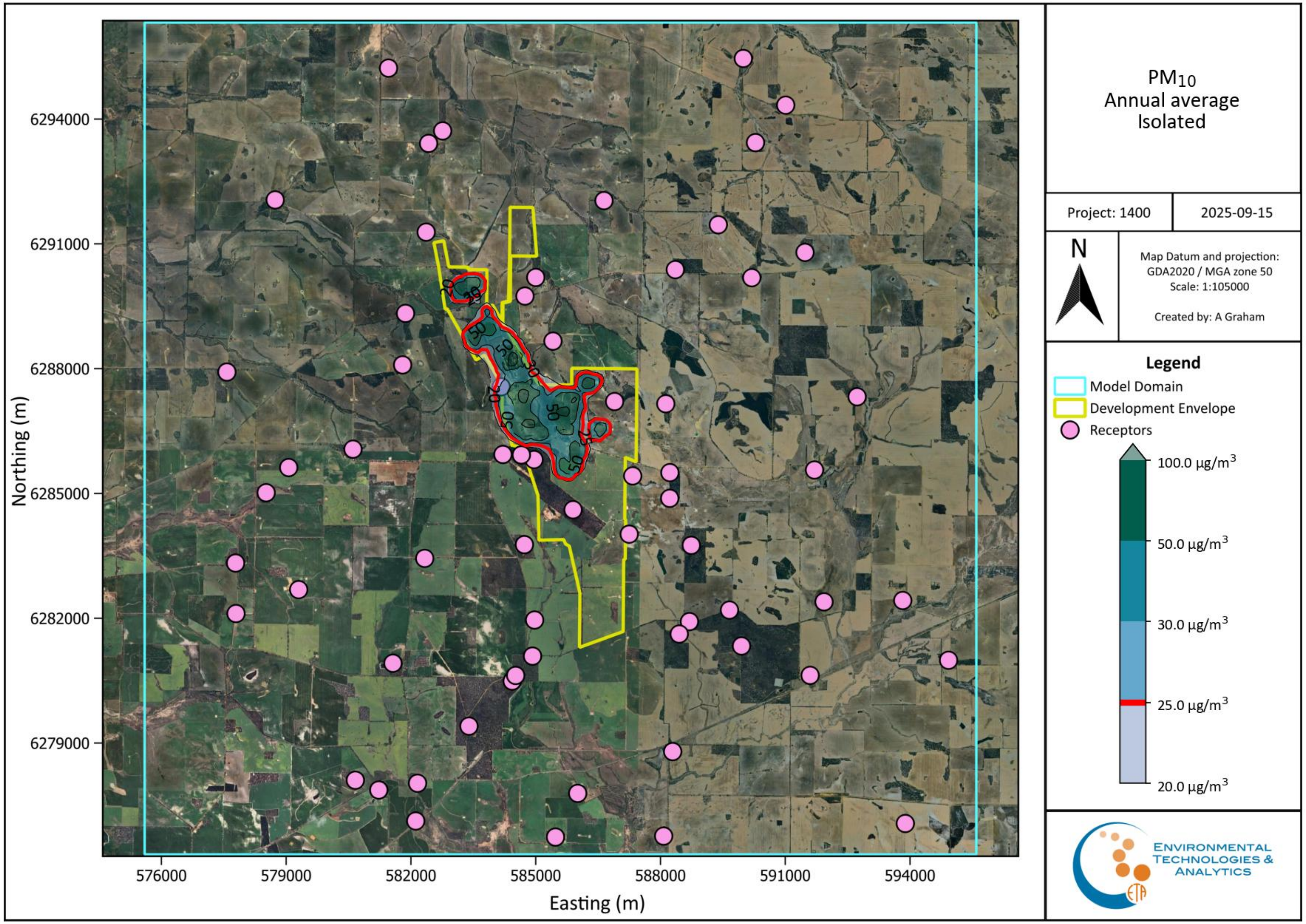

Figure 6-9: Project only PM_{10} emissions – Predicted annual average concentrations (μg/m^3).

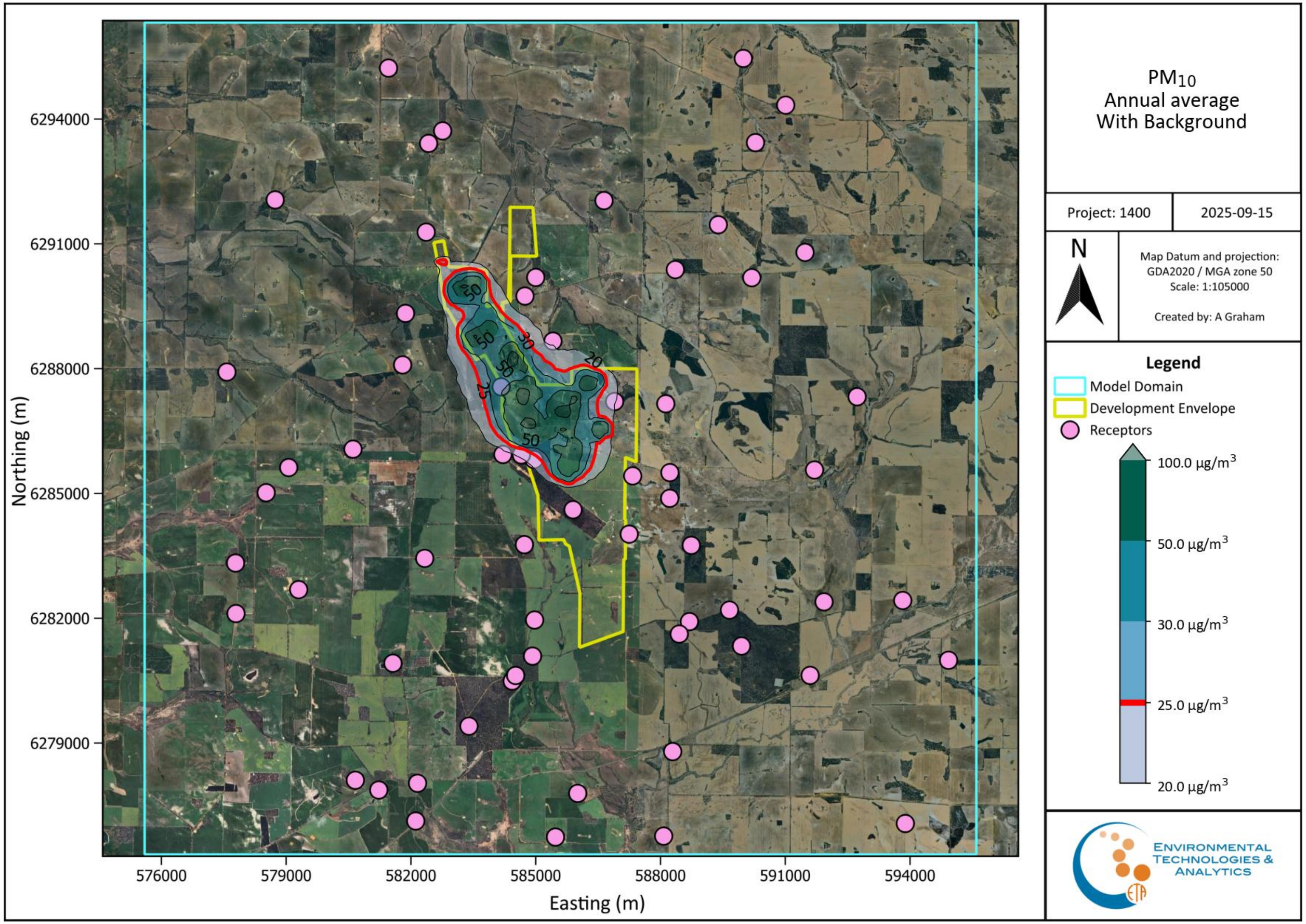

Figure 6-10: Cumulative PM_{10} emissions –Predicted annual average concentrations (µg/m^3).

6.3 $PM_{2.5}$

As outlined in Section 3 the 24-hour (20 µg/m^3) and annual criteria (7 µg/m^3) for $PM_{2.5}$ are based on the protection of human health and the criteria used in this assessment is applicable to community receptors.

The isopleths for the maximum predicted 24-hour $PM_{2.5}$ concentrations are presented in isolation in Figure 6-11 and with background concentrations (Section 2.3) in Figure 6-12. For reference the isopleths of the 6th highest predicted 24-hour $PM_{2.5}$ concentrations are presented in isolation in Figure 6-13 and with background concentrations (Section 2.3) in Figure 6-14. The red contour line represents the assessment criteria concentration. The concentration contours show that:

- The maximum 24-hour $PM_{2.5}$ concentrations are predicted be elevated in close proximity and within the forecast mining areas.
- There is a significant reduction in the predicted concentrations from the maximum down to the 6th highest.

The isopleths for the annual average $PM_{2.5}$ concentrations are presented in isolation and with background in Figure 6-15 and Figure 6-16, respectively. The red contour line represents the assessment criteria concentration. The annual average $PM_{2.5}$ concentrations are predicted to be elevated in close proximity and within the forecast mining areas.

The statistics of the predicted 24-hour $PM_{2.5}$ concentrations, for the applicable sensitive receptors, are presented in Table 6-3. The results indicate that at the sensitive receptors where the primary impact of concern is the impact on human health (i.e. where community is present):

- None of the residential receptors are predicted to exceed the nominated 24-hour assessment criteria (20 µg/m^3).
- None of the receptors are predicted to exceed the annual average assessment criteria (7 µg/m^3).

These results should be interpreted as an indication of which areas are most likely to be affected by dust rather than as a true forecast of future events. Elevated levels predicted by the model can be counteracted by additional abatement methods, monitoring, and an operational dust management plan.

Table 6-3: Statistics of predicted $PM_{2.5}$ concentrations – Project Only and Cumulative (i.e. Project + Background) (µg/m³)

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >20	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >20
R12	Building	4	2	1	0	0	0.1	0	9	6	5	5	5	4.1	0
R13	Building	2	2	1	1	0	0.2	0	7	7	6	5	5	4.2	0
R14	Building	1	1	1	0	0	0.1	0	6	6	5	5	5	4.1	0
R15	Building	3	2	1	1	0	0.3	0	7	7	6	6	5	4.3	0
R16	Building	5	3	2	2	1	0.7	0	10	8	7	6	6	4.7	0
R18	Building	4	2	1	1	0	0.2	0	9	7	6	5	5	4.2	0
R19	Building	3	2	1	1	0	0.2	0	8	7	6	6	5	4.2	0
R20	Building	3	2	1	1	0	0.2	0	8	7	6	5	5	4.2	0
R21	Building	2	1	1	1	0	0.2	0	6	6	6	5	5	4.2	0
R22	Building	2	1	1	1	0	0.2	0	7	6	6	5	5	4.2	0
R23	Building	2	1	1	0	0	0.1	0	7	6	6	5	5	4.1	0
R24	Building	6	2	1	1	0	0.2	0	10	7	6	5	5	4.2	0
R25	Building	4	2	1	1	0	0.2	0	9	7	6	5	5	4.2	0
R26	Building	2	1	1	0	0	0.1	0	6	6	5	5	5	4.1	0
R27	Building	2	1	1	0	0	0.1	0	7	6	5	5	5	4.1	0
R28	Building	1	1	1	0	0	0.1	0	6	6	5	5	5	4.1	0
R29	Building	1	1	0	0	0	0.1	0	6	6	5	5	5	4.1	0
R52	Building	7	5	3	2	1	0.6	0	11	10	8	7	5	4.6	0
R53	Building	2	1	1	1	0	0.1	0	6	6	6	5	5	4.1	0
R54	Building	1	1	0	0	0	0.1	0	6	5	5	5	5	4.1	0
R55	Building	2	1	0	0	0	0.1	0	7	6	5	5	5	4.1	0
R56	Building	2	1	0	0	0	0.0	0	6	5	5	5	5	4.0	0
R57	Building	2	1	1	0	0	0.1	0	7	6	5	5	5	4.1	0
R58	Building	1	1	0	0	0	0.0	0	6	5	5	5	5	4.0	0
R59	Building	1	1	0	0	0	0.1	0	6	5	5	5	5	4.1	0
R60	Building	2	1	0	0	0	0.1	0	6	6	5	5	5	4.1	0
R61	Building	2	1	0	0	0	0.1	0	6	6	5	5	5	4.1	0

ID	Receptor type	Project Only Contribution							Cumulative (Project + Background)						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >20	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >20
R62	Building	1	1	0	0	0	0.1	0	5	5	5	5	5	4.1	0
R63	Building	1	1	0	0	0	0.1	0	6	5	5	5	5	4.1	0
R64	Building	1	1	0	0	0	0.1	0	6	5	5	5	5	4.1	0
R65	Building	1	1	0	0	0	0.1	0	6	6	5	5	5	4.1	0
R66	Building	1	1	0	0	0	0.1	0	6	5	5	5	5	4.1	0

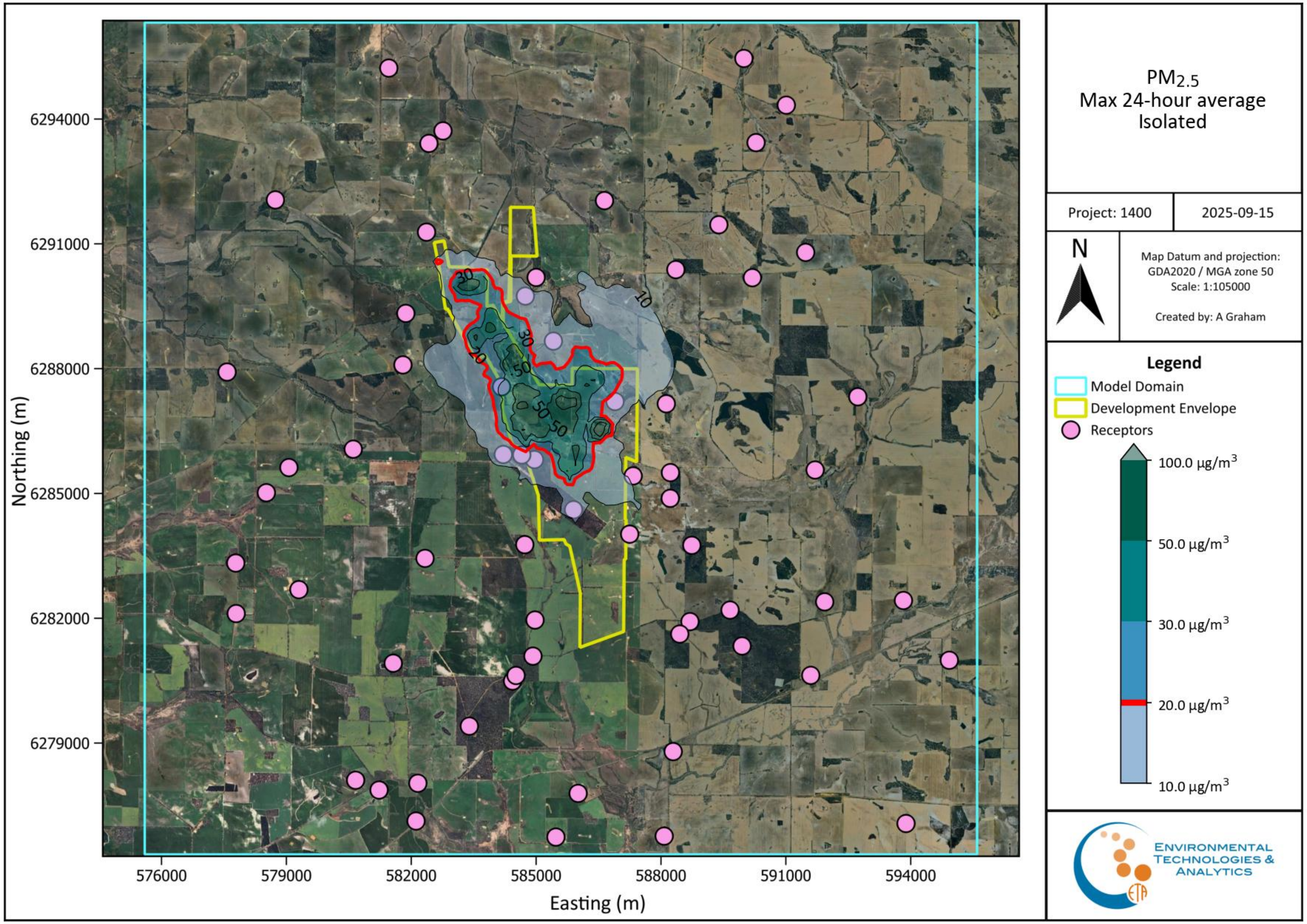

Figure 6-11: Project only $PM_{2.5}$ emissions – Maximum predicted 24-hour concentrations (μg/m^3).

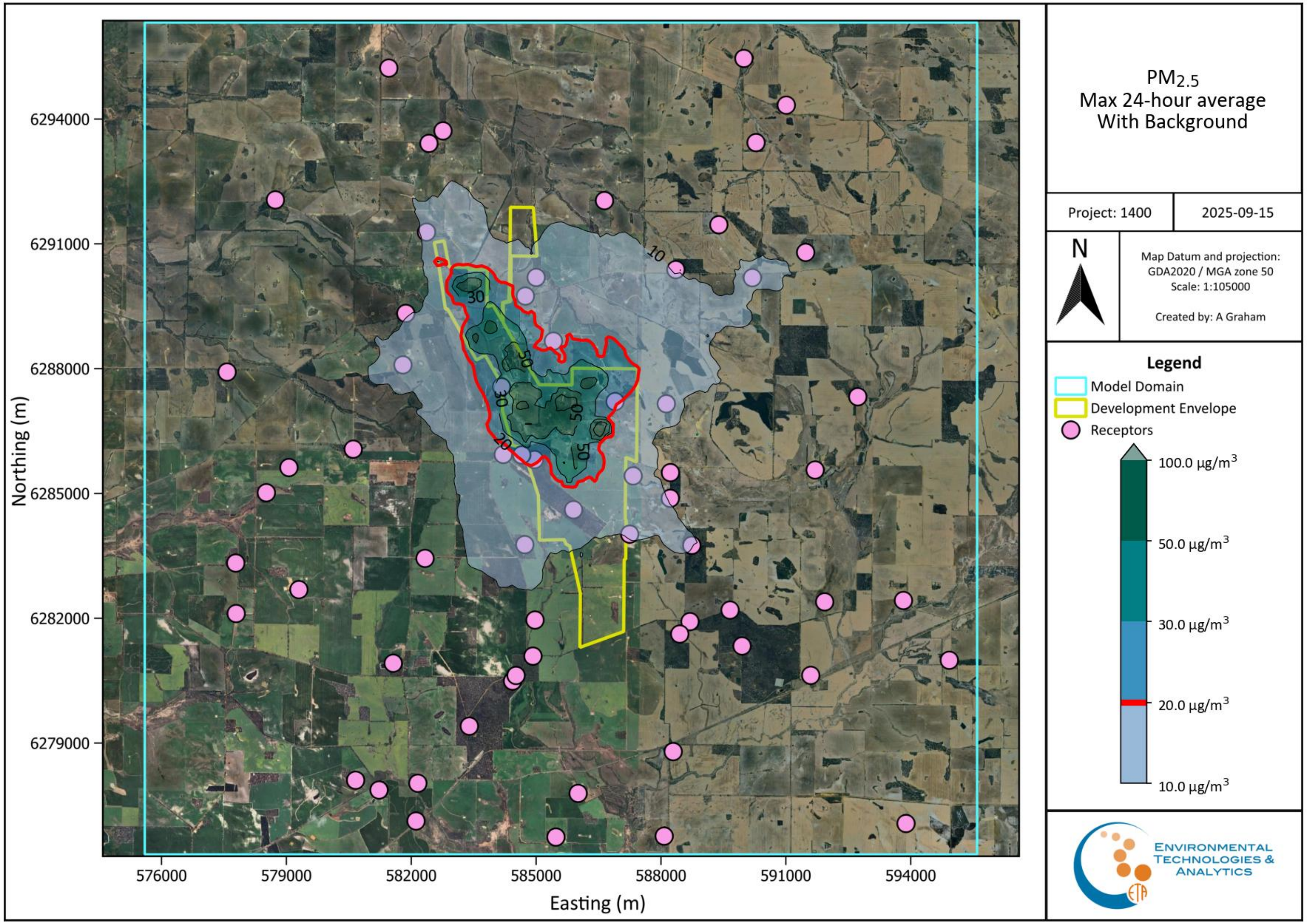

Figure 6-12: Cumulative $PM_{2.5}$ emissions – Maximum predicted 24-hour concentrations (µg/m³).

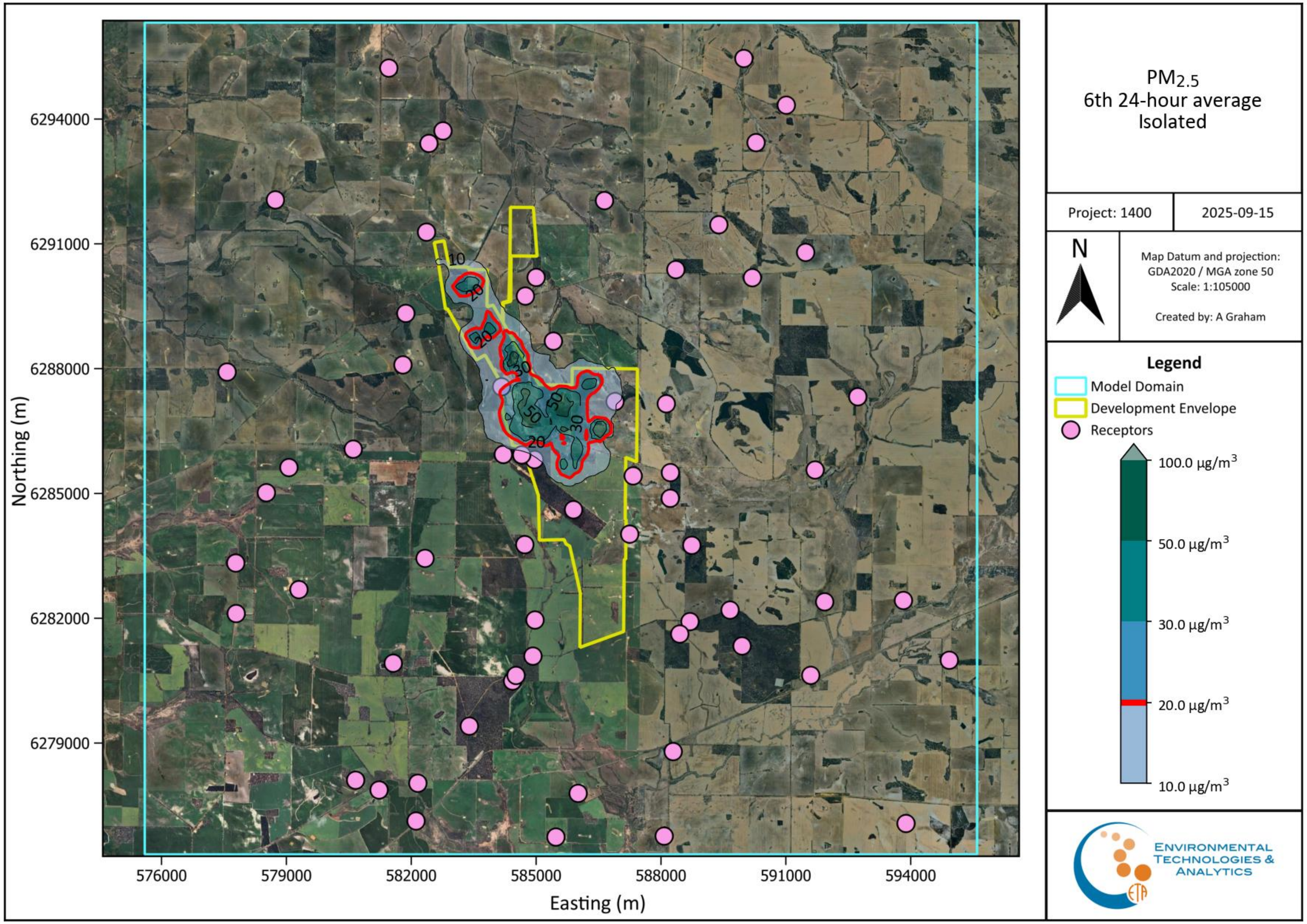

Figure 6-13: Project only $PM_{2.5}$ emissions – 6th highest predicted 24-hour concentrations (µg/m^3).

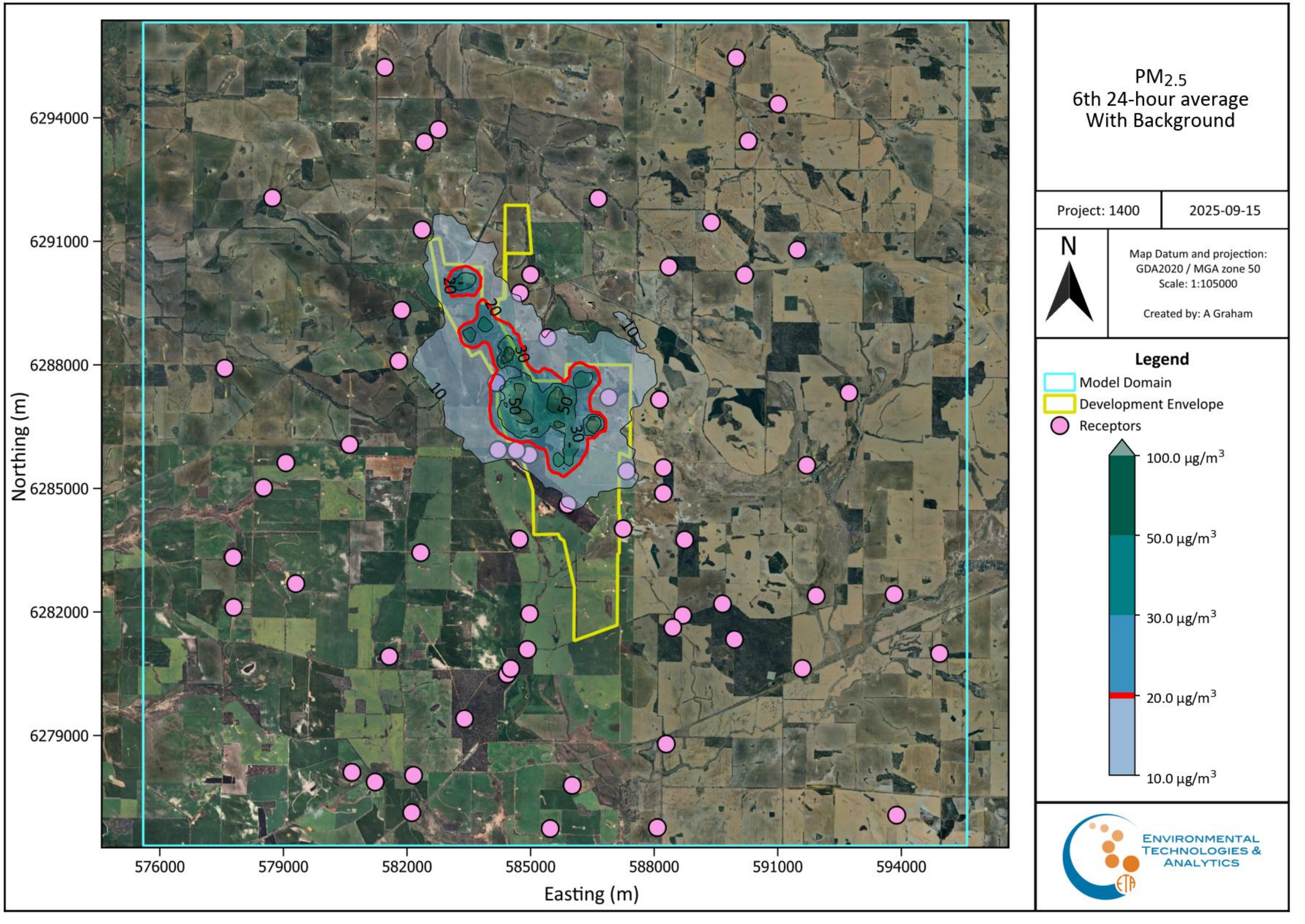

Figure 6-14: Cumulative $PM_{2.5}$ emissions – 6th highest predicted 24-hour concentrations (µg/m³).

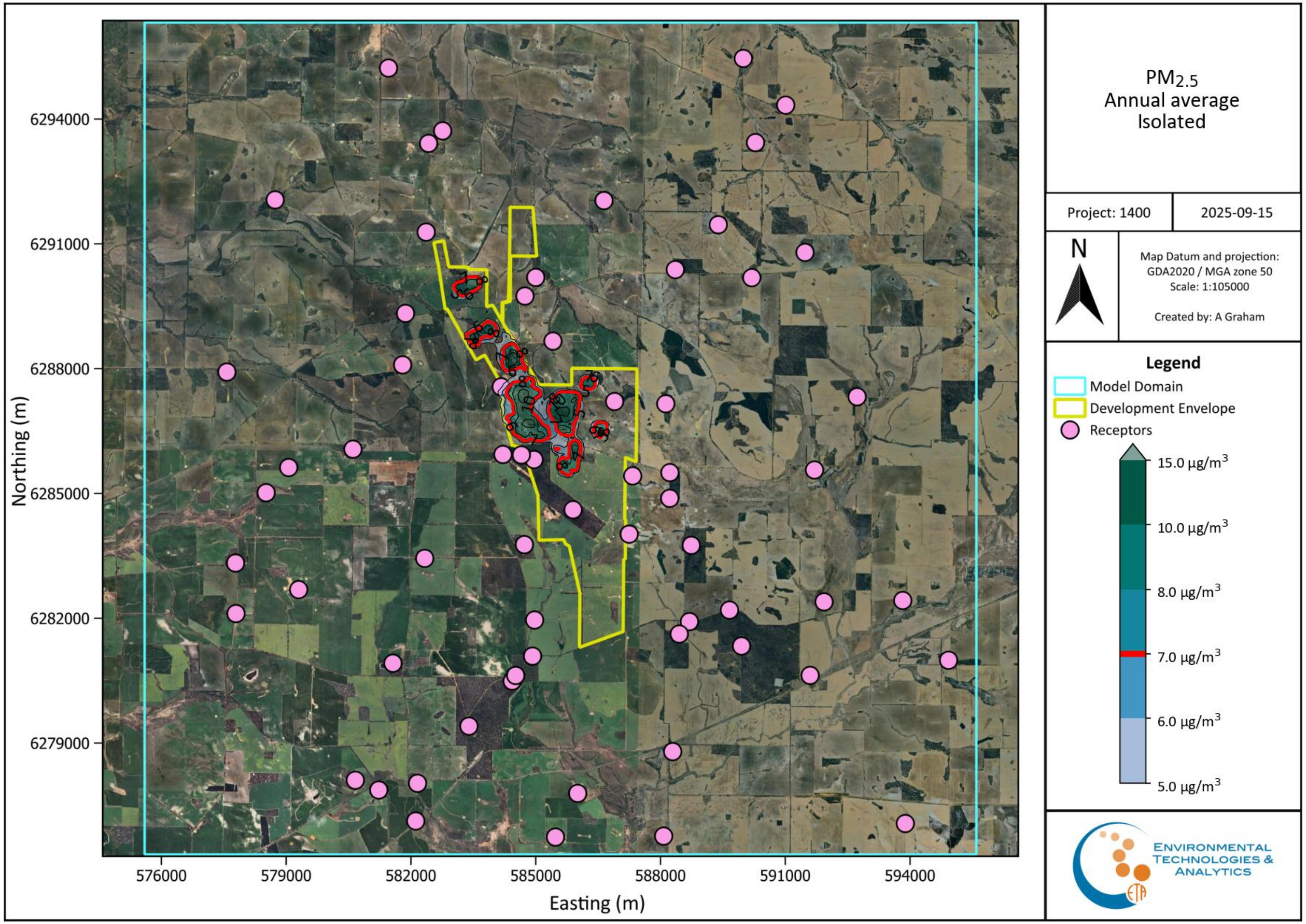

Figure 6-15: Project only $PM_{2.5}$ emissions – Predicted annual average concentrations (µg/m^3).

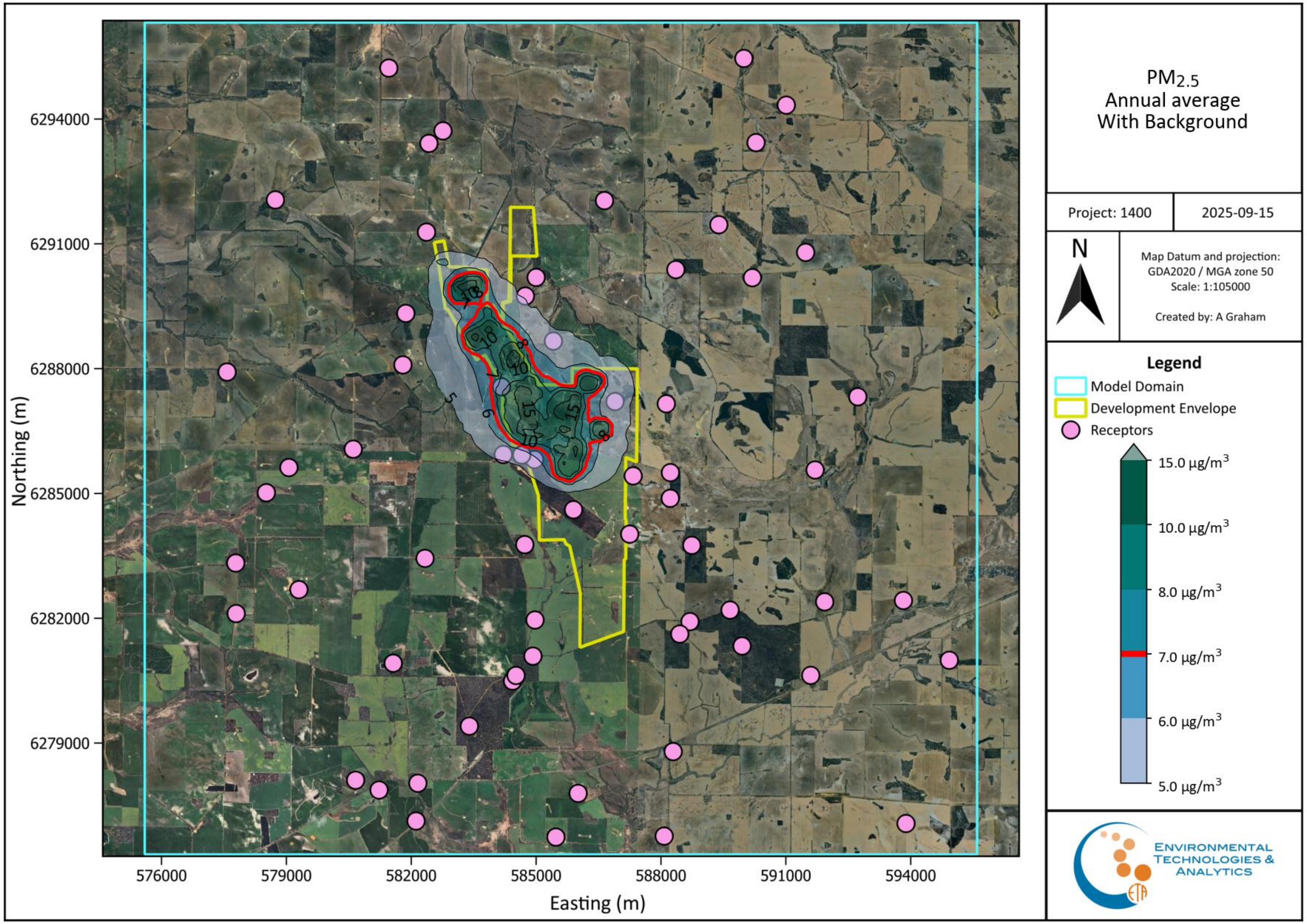

Figure 6-16: Cumulative $PM_{2.5}$ emissions –Predicted annual average concentrations (µg/m³).

6.3.1 Particulate matter from power generation

While the majority of dust is expected to be produced by the mining operations, a small amount of $PM_{2.5}$ will also be emitted from the power station described in Section 5.5.

The isopleths for the maximum predicted 24-hour $PM_{2.5}$ concentrations are presented for normal peak operations in Figure 6-17 and for upset conditions in Figure 6-18 while the isopleths for the predicted annual average $PM_{2.5}$ concentrations are presented for normal peak operations in Figure 6-19. The red contour line represents the assessment criteria concentration. The concentration contours show that:

- The maximum 24-hour and annual average $PM_{2.5}$ concentrations during normal peak operations and upset conditions are predicted to experience a marginal increase around the power generation site.

The cumulative plots with the background and particulates from the mining sources are not presented as the resulting concentrations differ by orders of magnitude, causing the $PM_{2.5}$ contribution from the generators to be lost among those from other sources.

For this reason, any $PM_{2.5}$ contribution from the generators can be safely treated as negligible under all operational conditions.

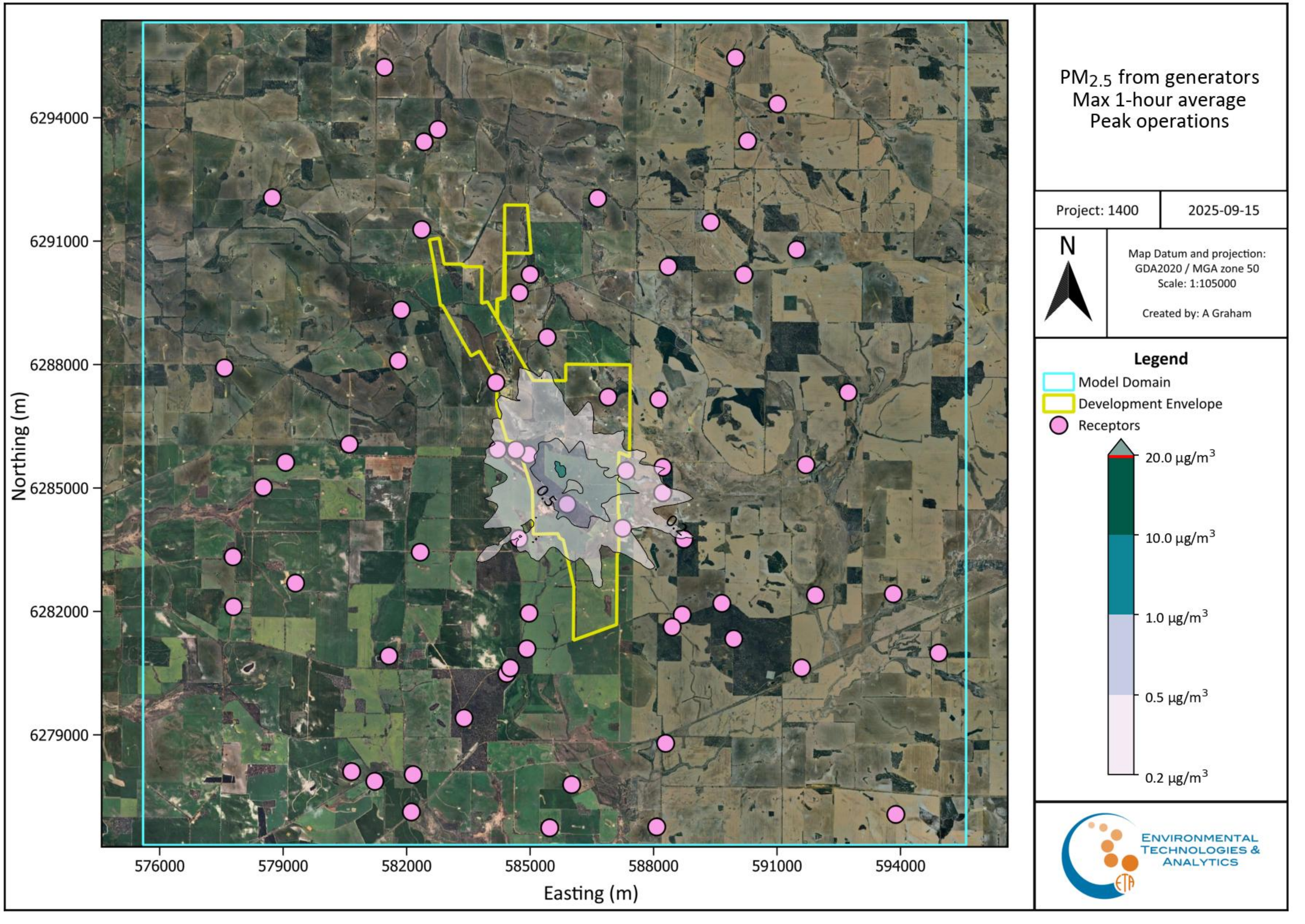

Figure 6-17: Normal peak operation $PM_{2.5}$ emissions from generators – Maximum predicted 24-hour concentrations (µg/m^3).

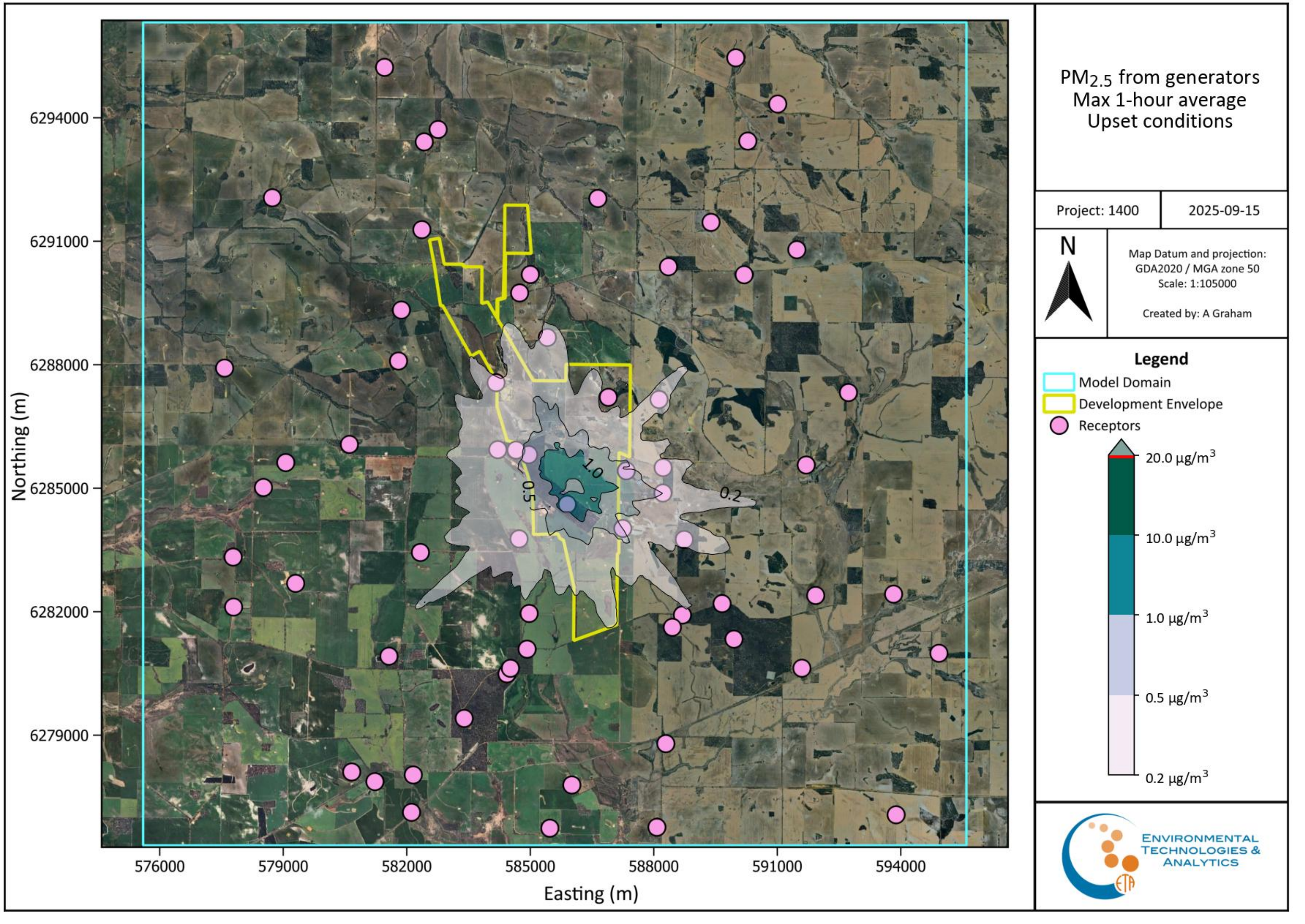

Figure 6-18: Upset condition $PM_{2.5}$ emissions from generators – Maximum predicted 24-hour concentrations (µg/m³).

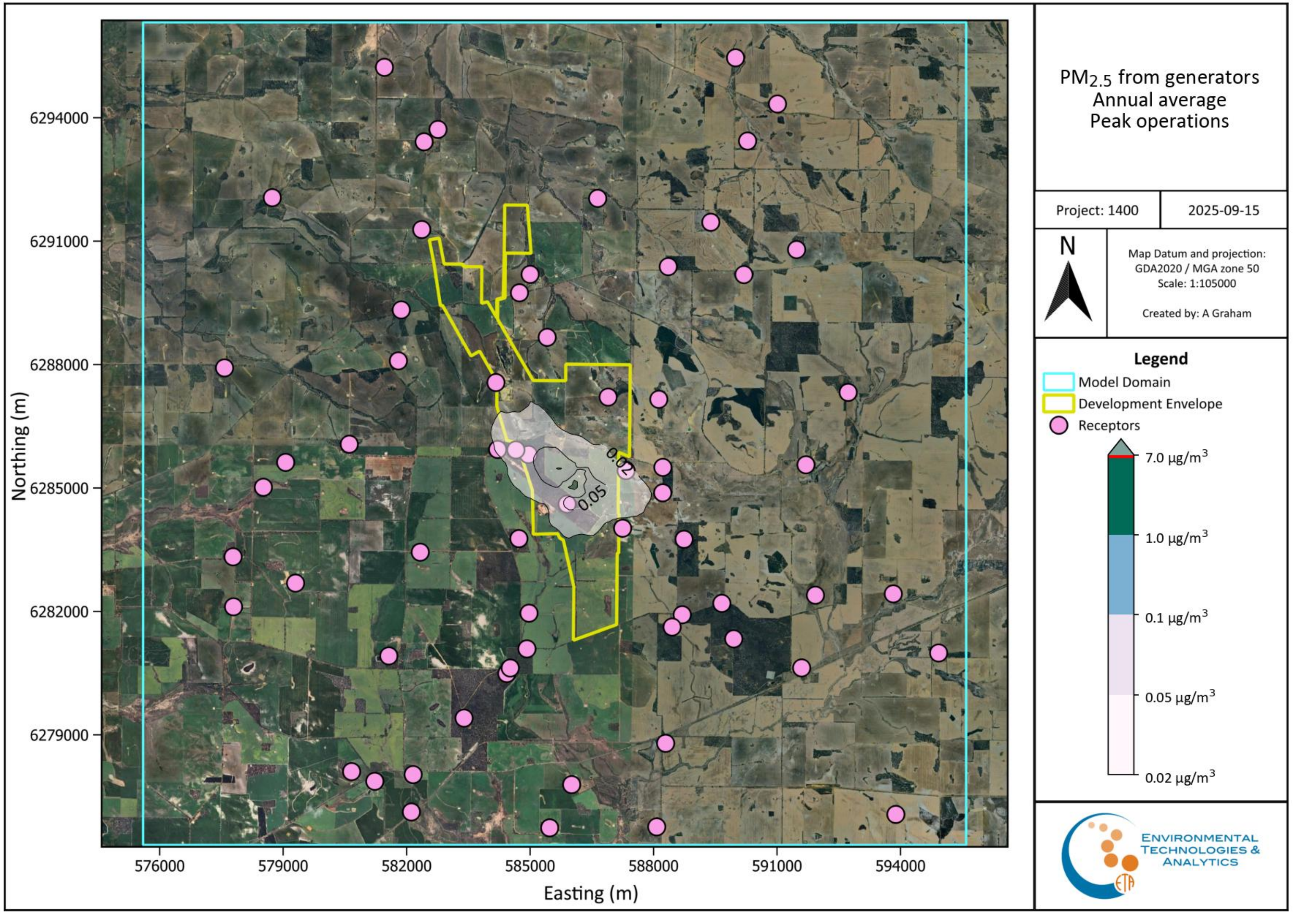

Figure 6-19: Peak operation $PM_{2.5}$ emissions from generators – Annual average concentrations (µg/m³).

6.4 Deposition

As outlined in Section 3 the dust deposition criteria of 2 g/m^2/month from any single source is used in this assessment for amenity and Heritage receptors, while for the protection of ecological values (fauna and flora) a proxy value of 7 g/m^2/month is utilised.

The isopleths for the predicted maximum monthly dust deposition rate are presented in Figure 6-20. The red contour line indicates the predicted 2 g/m^2/month deposition rate, corresponding to the DWER assessment guideline (DWER 2021) for the protection of amenity. The 7 g/m^2/month deposition rate corresponding to the criteria for protection of vegetation health is not shown but lies within the premises boundary.

The deposition contours show that:

- Regions above the criteria (2 g/m^2/month) are only predicted to occur in relatively close proximity to the mining areas.

The statistics of the predicted maximum monthly deposition, for potential receptors, are presented in Table 6-4. The results indicate that at the potential receptors where the primary impact of concern is deposition:

- For the residential receptors the model is not predicting any excursions of the deposition criteria.
- For the amenity receptors, the model is predicting excursions of the relevant dust deposition criteria (2 g/m^2/month) at R2 (Woorgabup Nature Reserve).
- For the heritage receptors, the model is predicting excursions of the relevant dust deposition criteria (2 g/m^2/month) at R39.
- For the ecological receptors, no excursions of the relevant dust deposition criteria (7 g/m^2/month) are predicted from the Project alone. However, as this assessment criteria is for cumulative deposition, the addition of a minor background component is expected to result in an exceedance at R48.

Table 6-4: Maximum deposition rates at sensitive receptors – Project Only (g/m²/month)

ID	Receptor type	Maximum Deposition	ID	Receptor type	Maximum Deposition
R1	Amenity	1.7	R35	Heritage	0.1
R2	Ecological | Amenity	3.2	R36	Heritage	0.1
R3	Ecological | Amenity	1.6	R37	Heritage	0.1
R4	Ecological	0.2	R38	Heritage	0.0
R5	Ecological	0.2	R39	Heritage	3.4
R6	Ecological	0.2	R40	Heritage	0.2
R7	Ecological	0.6	R41	Ecological	1.2
R8	Ecological	0.6	R42	Ecological	1.0
R9	Ecological	0.2	R43	Ecological	0.6
R10	Ecological | Amenity	0.2	R44	Ecological	0.9
R11	Ecological	0.2	R45	Ecological	0.6
R12	Building	0.3	R46	Ecological	0.6
R13	Building	0.2	R47	Ecological	0.4
R14	Building	0.1	R48	Ecological	6.8
R15	Building	0.2	R49	Ecological	0.7
R16	Building	1.0	R50	Ecological	0.5
R18	Building	0.1	R51	Ecological	0.4
R19	Building	0.2	R52	Building	0.7
R20	Building	0.1	R53	Building	0.5
R21	Building	0.3	R54	Building	0.4
R22	Building	0.2	R55	Building	0.7
R23	Building	0.1	R56	Building	0.1
R24	Building	0.1	R57	Building	0.0
R25	Building	0.1	R58	Building	0.1
R26	Building	0.1	R59	Building	0.1
R27	Building	0.1	R60	Building	0.1
R28	Building	0.1	R61	Building	0.1
R29	Building	0.1	R62	Building	0.0
R31	Heritage	0.2	R63	Building	0.0
R32	Heritage	0.1	R64	Building	0.1
R33	Heritage	0.1	R65	Building	0.1
R34	Heritage	0.1	R66	Building	0.1

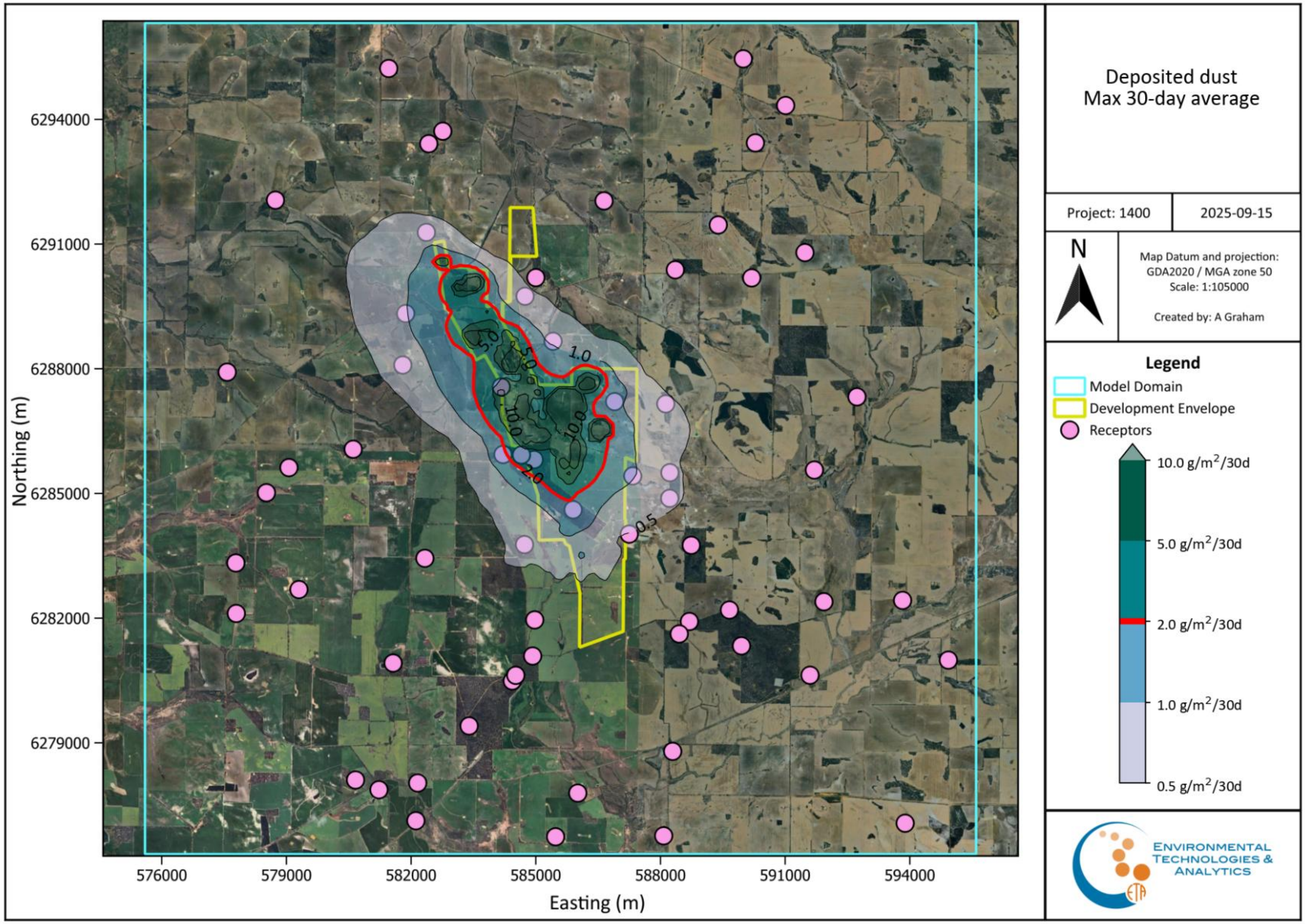

Figure 6-20: Project only dust deposition – Maximum predicted 30-day deposition rate (g/m²/30 days).

6.5 Power Generation

Results for the power generation hub emissions are presented for both normal peak operations (gas generators only) and upset conditions, such as during a black start (gas and diesel generators). Annual averages for the upset (black start) conditions are not presented as the diesel generator operation is expected to be intermittent and short-lived.

Backgrounds for NO_2, CO, and SO_2 are assumed to be negligible due to the distance of the Project location from significant emission sources, industrial or otherwise. For the O_3 background required in the conversion of NO_X to NO_2, we have used the results from monitoring in Mandurah. This is expected to be a conservative estimate as Mandurah has much higher vehicular traffic than Katanning.

6.5.1 Nitrogen dioxide (NO_2)

As outlined in Section 3, the hourly (164 µg/m^3) and annual criteria (31 µg/m^3) for NO_2 are based on the protection of human health and the criteria used in this assessment is applicable to community receptors.

The isopleths for the maximum predicted hourly NO_2 concentrations are presented for normal peak operations in Figure 6-21 and for upset conditions in Figure 6-22 while the isopleths for the predicted annual average NO_2 concentrations are presented for normal peak operations in Figure 6-23. The red contour line represents the assessment criteria concentration. The concentration contours show that:

- The maximum hourly and annual average NO_2 concentrations during normal peak operations are predicted be elevated near the power generation site.
- The maximum hourly NO_2 concentrations during upset conditions are predicted to be elevated around the forecast mining areas.

The statistics of the predicted hourly NO_2 concentrations, for the applicable sensitive receptors, are presented in Table 6-5. The results indicate that at the sensitive receptors where the primary impact of concern is the impact on human health (i.e. where community is present):

- None of the sensitive receptors are predicted to exceed the nominated hourly (164 µg/m^3) or annual average (31 µg/m^3) assessment criteria during normal peak operations.
- While elevated, none of the sensitive receptors are predicted to exceed the nominated hourly assessment criteria during upset conditions.

Table 6-5: Statistics of predicted hourly NO_2 concentrations – Normal peak operations and Upset conditions ($\mu g/m^3$)

ID	Receptor type	Normal peak operations							Upset conditions						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >164	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >164
R1	Amenity	48	22	7	2	0	1.1	0	63	51	18	6	0	2.7	0
R2	Ecological | Amenity	51	12	2	1	0	2.1	0	66	42	4	2	0	5.5	0
R3	Ecological | Amenity	64	50	21	0	0	3.0	0	89	62	49	1	0	8.3	0
R10	Ecological | Amenity	17	6	1	0	0	0.2	0	43	14	1	0	0	0.5	0
R12	Building	27	7	1	0	0	0.2	0	56	16	2	0	0	0.6	0
R13	Building	31	7	1	0	0	0.2	0	50	18	2	0	0	0.6	0
R14	Building	15	4	0	0	0	0.1	0	40	10	0	0	0	0.3	0
R15	Building	16	6	1	0	0	0.2	0	38	16	3	0	0	0.6	0
R16	Building	19	6	1	0	0	0.3	0	42	15	4	1	0	0.7	0
R18	Building	12	2	0	0	0	0.1	0	25	5	0	0	0	0.2	0
R19	Building	13	4	1	0	0	0.1	0	33	10	1	0	0	0.3	0
R20	Building	12	3	1	0	0	0.1	0	29	8	1	0	0	0.3	0
R21	Building	12	3	1	0	0	0.1	0	27	8	2	0	0	0.4	0
R22	Building	15	5	1	0	0	0.2	0	38	14	2	0	0	0.4	0
R23	Building	14	4	0	0	0	0.1	0	28	10	1	0	0	0.3	0
R24	Building	27	4	0	0	0	0.1	0	40	10	1	0	0	0.3	0
R25	Building	15	3	0	0	0	0.1	0	41	7	1	0	0	0.2	0
R26	Building	11	4	1	0	0	0.1	0	27	11	1	0	0	0.4	0
R27	Building	10	4	1	0	0	0.1	0	26	9	2	0	0	0.4	0
R28	Building	17	3	1	0	0	0.1	0	40	9	1	0	0	0.3	0
R29	Building	17	3	0	0	0	0.1	0	45	6	1	0	0	0.2	0
R52	Building	15	6	1	0	0	0.2	0	38	13	2	0	0	0.5	0
R53	Building	12	3	0	0	0	0.1	0	28	8	1	0	0	0.3	0
R54	Building	15	3	0	0	0	0.1	0	31	6	1	0	0	0.2	0
R55	Building	24	3	0	0	0	0.1	0	49	8	1	0	0	0.3	0

ID	Receptor type	Normal peak operations							Upset conditions						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >164	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >164
R56	Building	15	3	0	0	0	0.1	0	34	7	0	0	0	0.2	0
R57	Building	27	4	0	0	0	0.2	0	51	11	1	0	0	0.4	0
R58	Building	15	2	0	0	0	0.1	0	35	5	0	0	0	0.2	0
R59	Building	9	1	0	0	0	0.0	0	19	3	0	0	0	0.1	0
R60	Building	10	1	0	0	0	0.1	0	25	4	0	0	0	0.1	0
R61	Building	8	1	0	0	0	0.1	0	21	4	0	0	0	0.1	0
R62	Building	16	4	0	0	0	0.1	0	36	9	1	0	0	0.3	0
R63	Building	11	3	0	0	0	0.1	0	27	7	0	0	0	0.2	0
R64	Building	19	2	0	0	0	0.1	0	52	5	0	0	0	0.2	0
R65	Building	9	3	0	0	0	0.1	0	24	8	1	0	0	0.3	0
R66	Building	22	2	0	0	0	0.1	0	51	5	0	0	0	0.2	0

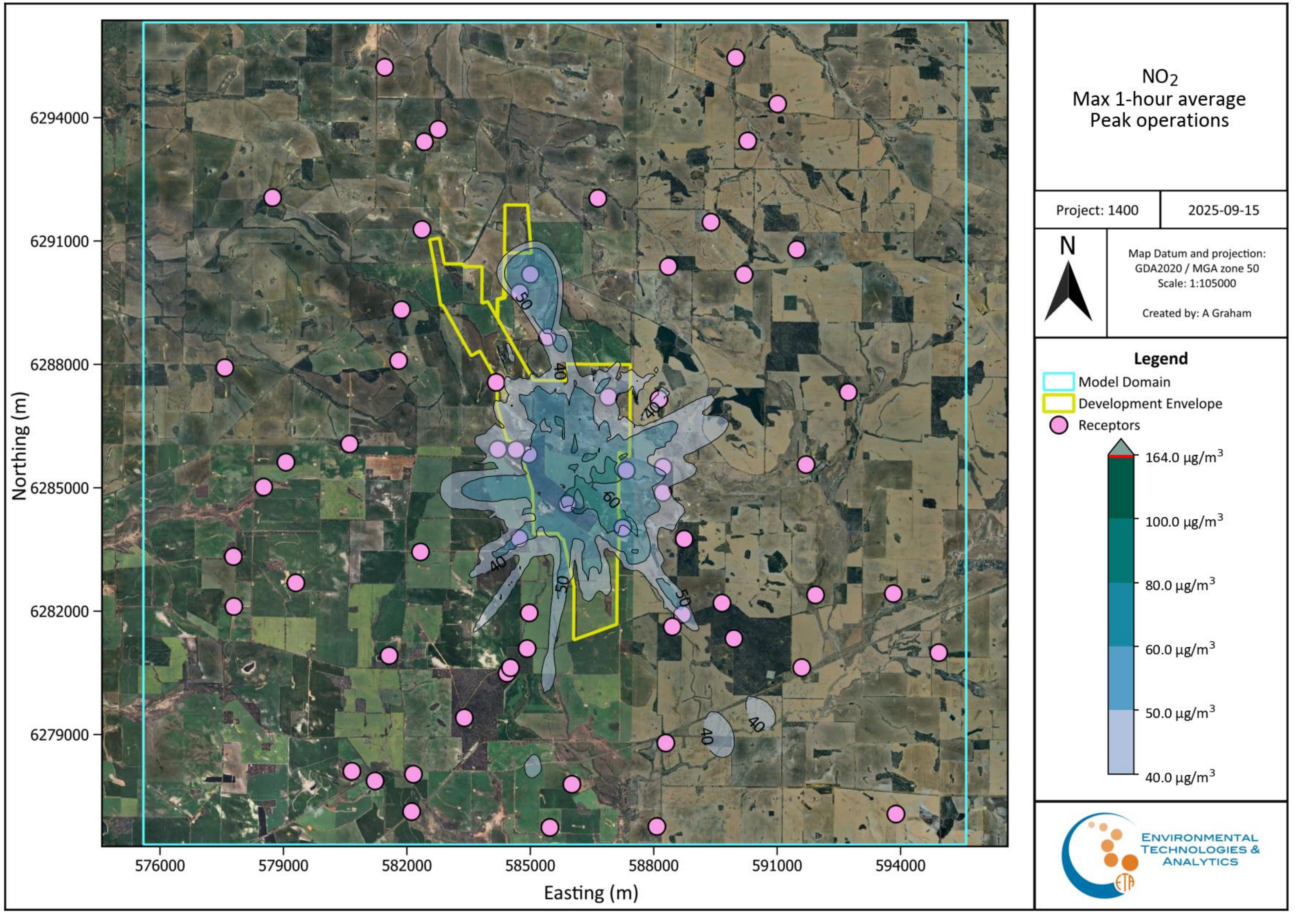

Figure 6-21: Project only NO_2 emissions – Maximum predicted hourly concentrations (µg/m³).

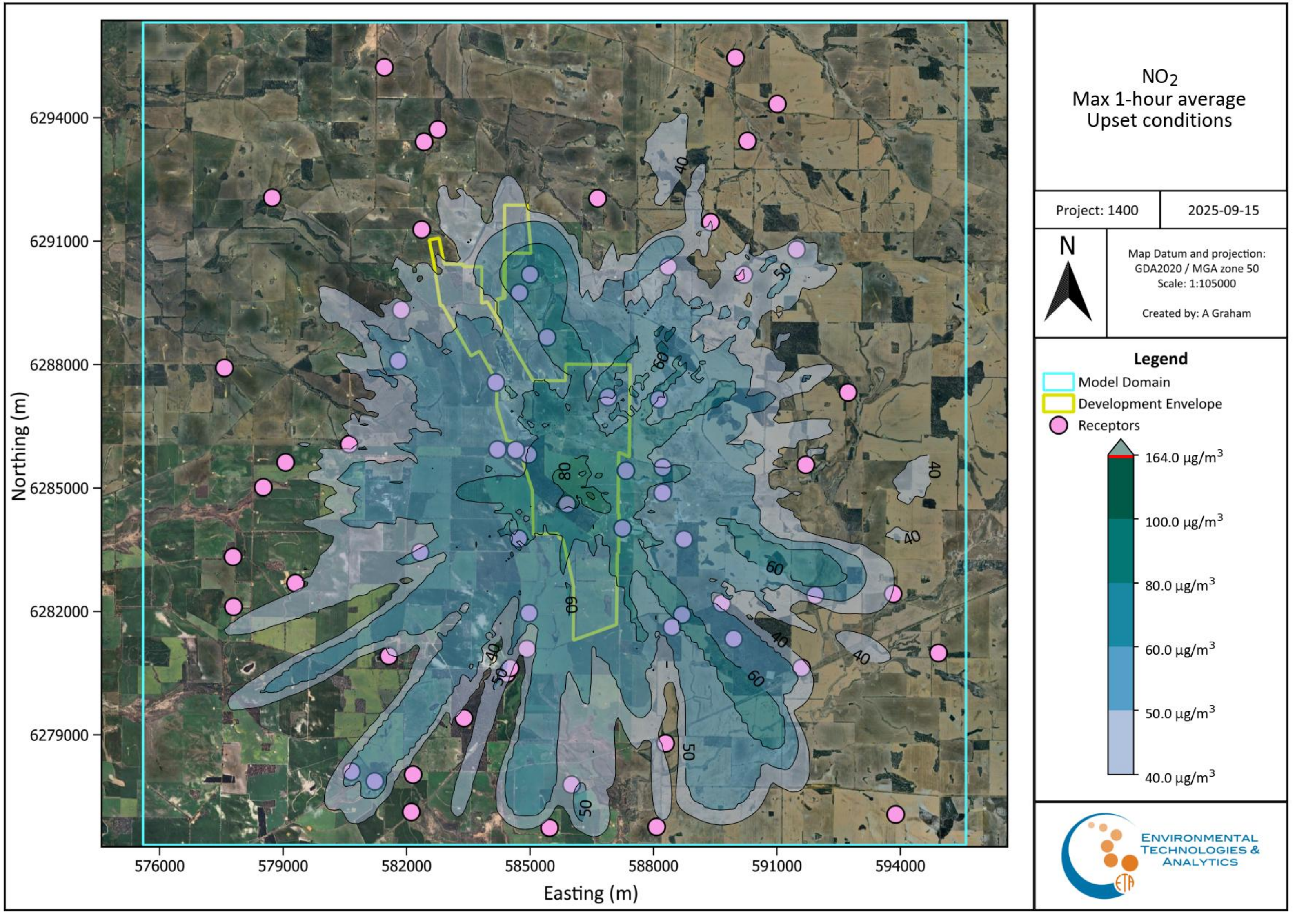

Figure 6-22: Cumulative NO_2 emissions – Maximum predicted hourly concentrations (µg/m³).

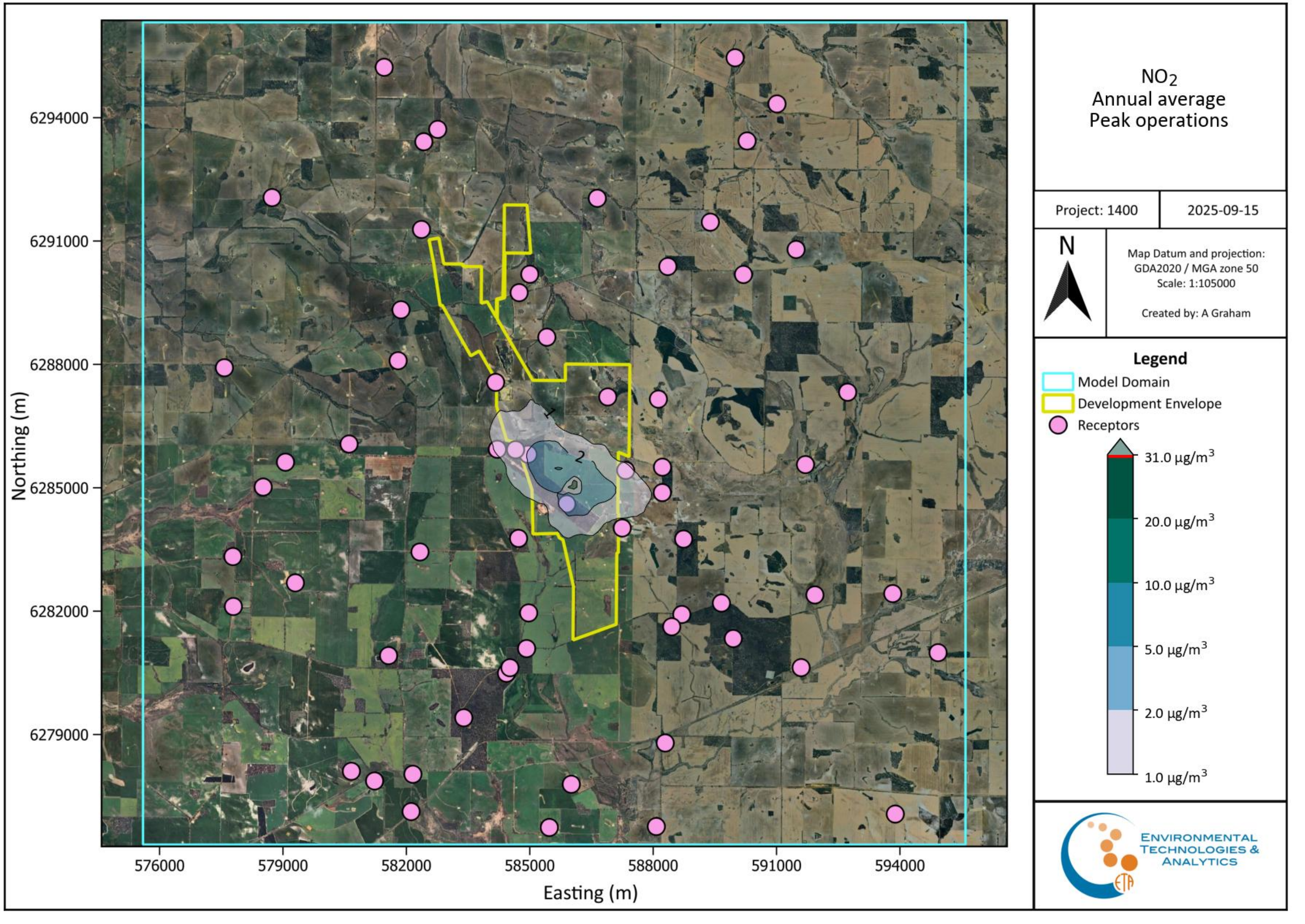

Figure 6-23: Normal peak operation NO_2 emissions – Predicted annual average concentrations (µg/m³).

6.5.2 Sulfur dioxide (SO_2)

As outlined in Section 3, the hourly (214 µg/m^3) and 24-hour criteria (57 µg/m^3) for SO_2 are based on the protection of human health and the criteria used in this assessment is applicable to community receptors.

The isopleths for the maximum predicted hourly SO_2 concentrations are presented for normal peak operations in Figure 6-24 and for upset conditions in Figure 6-25 while the isopleths for the 24-hour SO_2 concentrations are presented for normal peak operations and upset conditions in Figure 6-26 and Figure 6-27, respectively. The red contour line represents the assessment criteria concentration. The concentration contours show that:

- The maximum hourly and 24-hour SO_2 concentrations during normal peak operations and upset conditions are predicted to experience a marginal increase around the power generation site.

The upper statistics of the predicted hourly and 24-hour SO_2 concentrations, for the applicable sensitive receptors, are presented in Table 6-6. The results indicate that at the sensitive receptors where the primary impact of concern is the impact on human health (i.e. where community is present):

- None of the sensitive receptors are predicted to exceed the nominated hourly (214 µg/m^3) or 24-hour (57 µg/m^3) assessment criteria under any operational conditions.

Table 6-6: Statistics of predicted hourly and 24-hour SO_2 concentrations – Normal peak operations and Upset conditions (µg/m^3)

ID	Receptor type	Normal peak operations (1-hour)				Upset conditions (1-hour)				Normal peak operations (24-hr)				Upset conditions (24-hr)			
		Max	99th %ile	Avg	Days >214	Max	99th %ile	Avg	Days >214	Max	99th %ile	Avg	Days >57	Max	99th %ile	Avg	Days >57
R1	Amenity	1	1	0.0	0	2	1	0.0	2	0	0	0.0	0	0	0	0.0	0
R2	Ecological | Amenity	2	1	0.0	0	3	2	0.1	3	0	0	0.0	0	1	1	0.1	0
R3	Ecological | Amenity	5	2	0.1	0	7	3	0.1	7	1	1	0.1	0	2	1	0.1	0
R10	Ecological | Amenity	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R12	Building	1	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R13	Building	1	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R14	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R15	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R16	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R18	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R19	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R20	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R21	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R22	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R23	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R24	Building	1	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R25	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R26	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R27	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R28	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R29	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R52	Building	0	0	0.0	0	1	0	0.0	1	0	0	0.0	0	0	0	0.0	0
R53	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R54	Building	0	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R55	Building	1	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0

ID	Receptor type	Normal peak operations (1-hour)				Upset conditions (1-hour)				Normal peak operations (24-hr)				Upset conditions (24-hr)			
		Max	99th %ile	Avg	Days >214	Max	99th %ile	Avg	Days >214	Max	99th %ile	Avg	Days >57	Max	99th %ile	Avg	Days >57
R56	Building	0	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R57	Building	1	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R58	Building	0	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R59	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R60	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R61	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R62	Building	0	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R63	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R64	Building	0	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R65	Building	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0
R66	Building	1	0	0.0	0	1	0	0.0	0	0	0	0.0	0	0	0	0.0	0

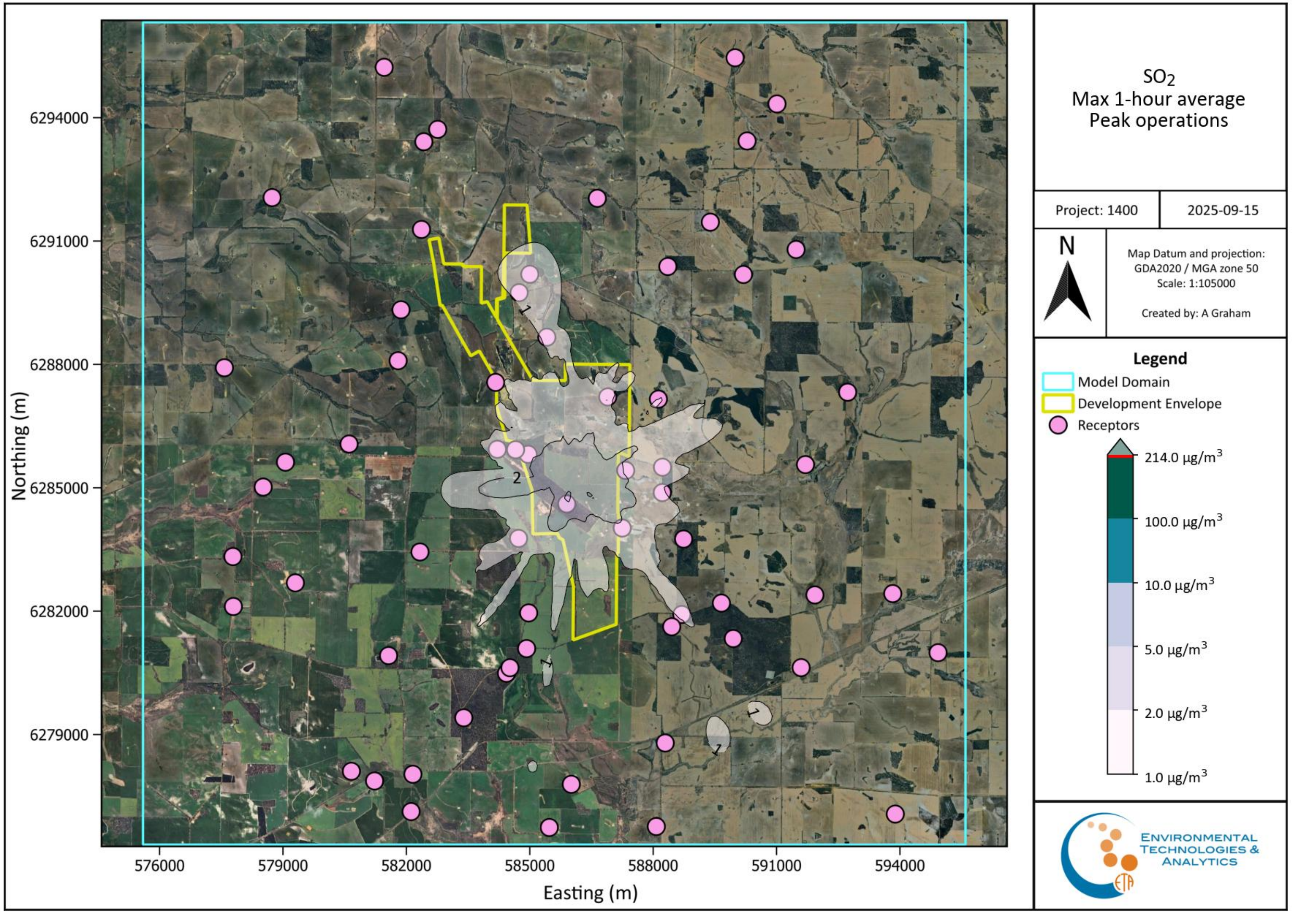

Figure 6-24: Project only SO_2 emissions – Maximum predicted hourly concentrations (µg/m³).

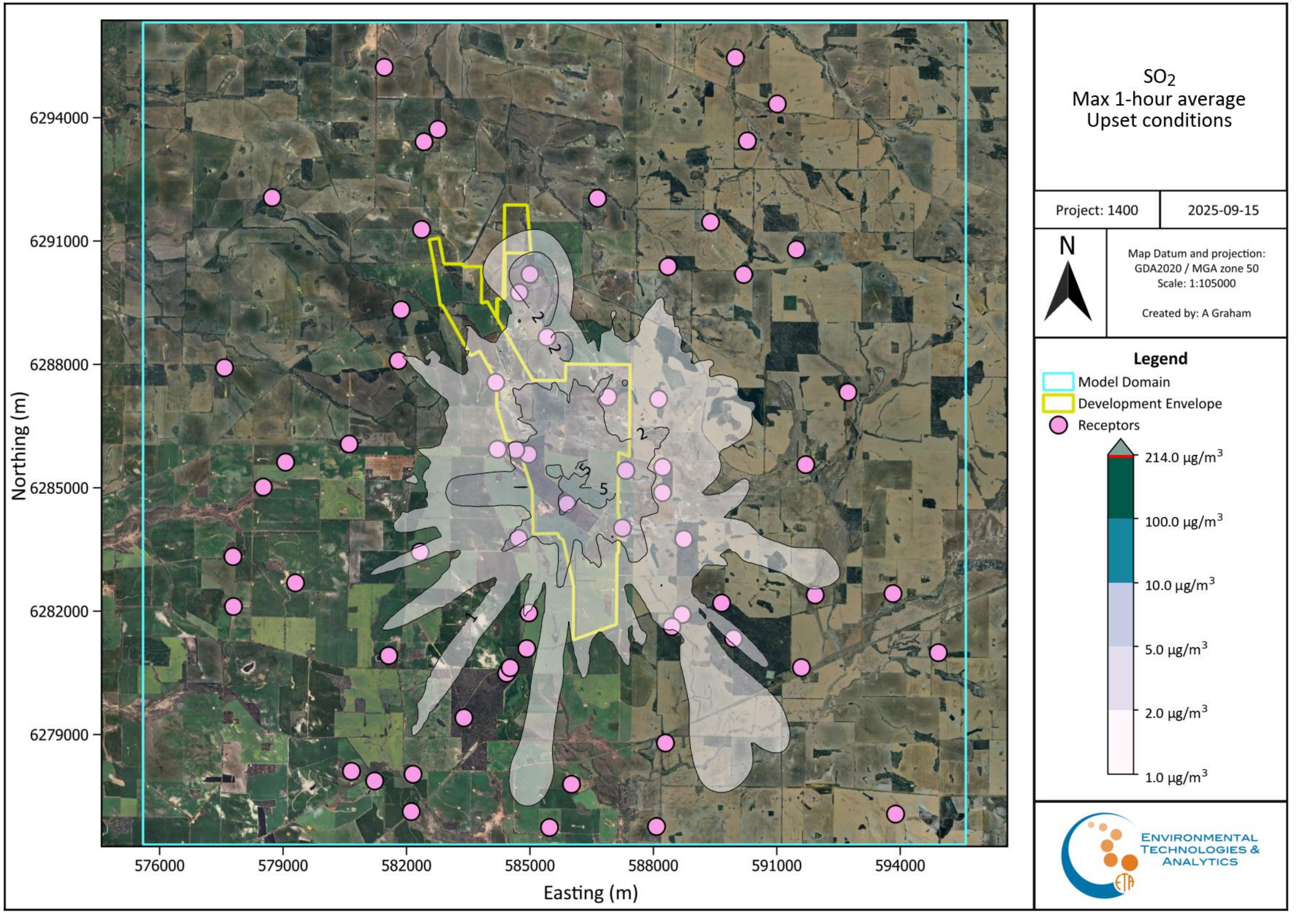

Figure 6-25: Cumulative SO_2 emissions – Maximum predicted hourly concentrations (µg/m³).

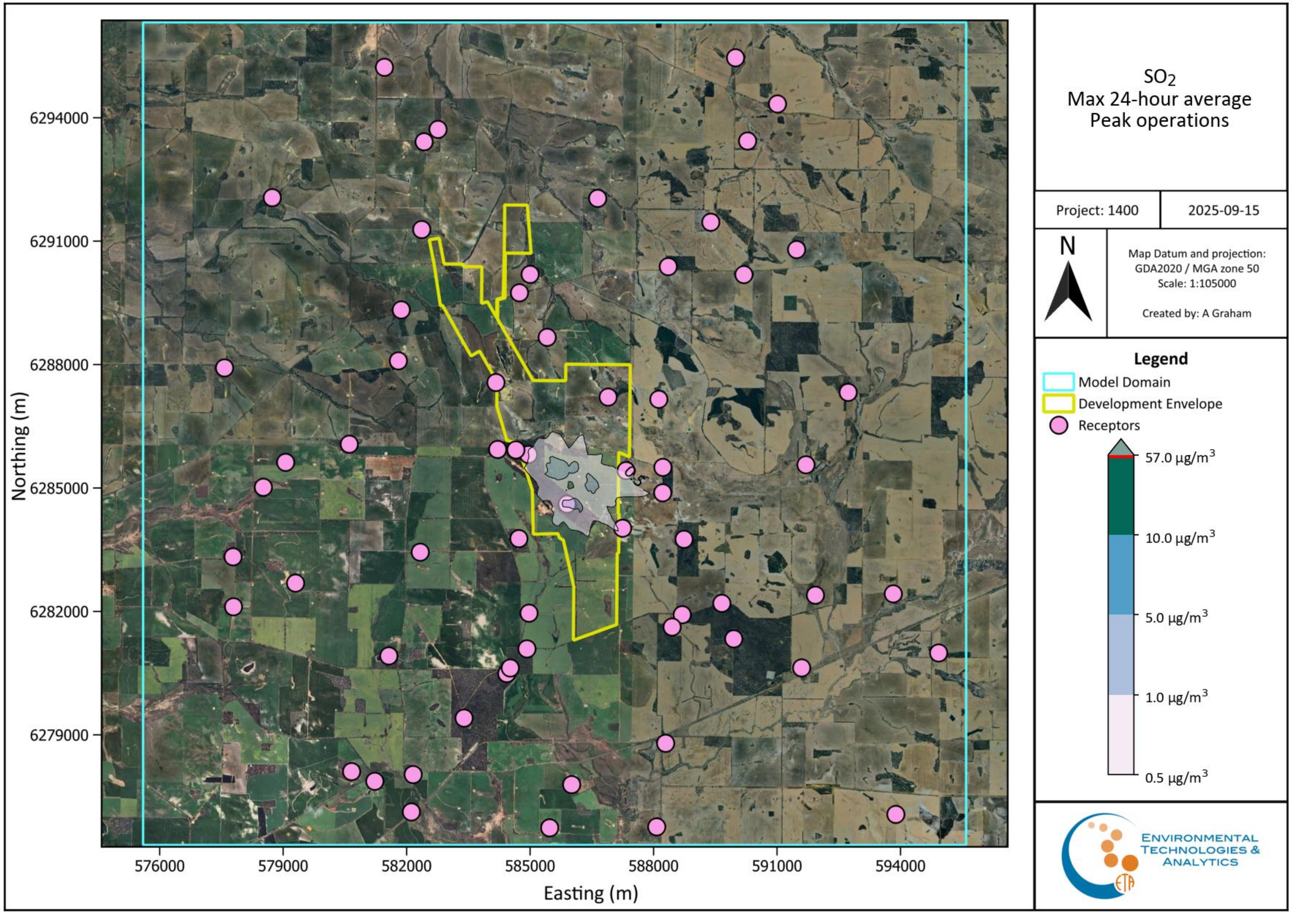

Figure 6-26: Project only SO_2 emissions – Maximum predicted 24-hour concentrations (µg/m³).

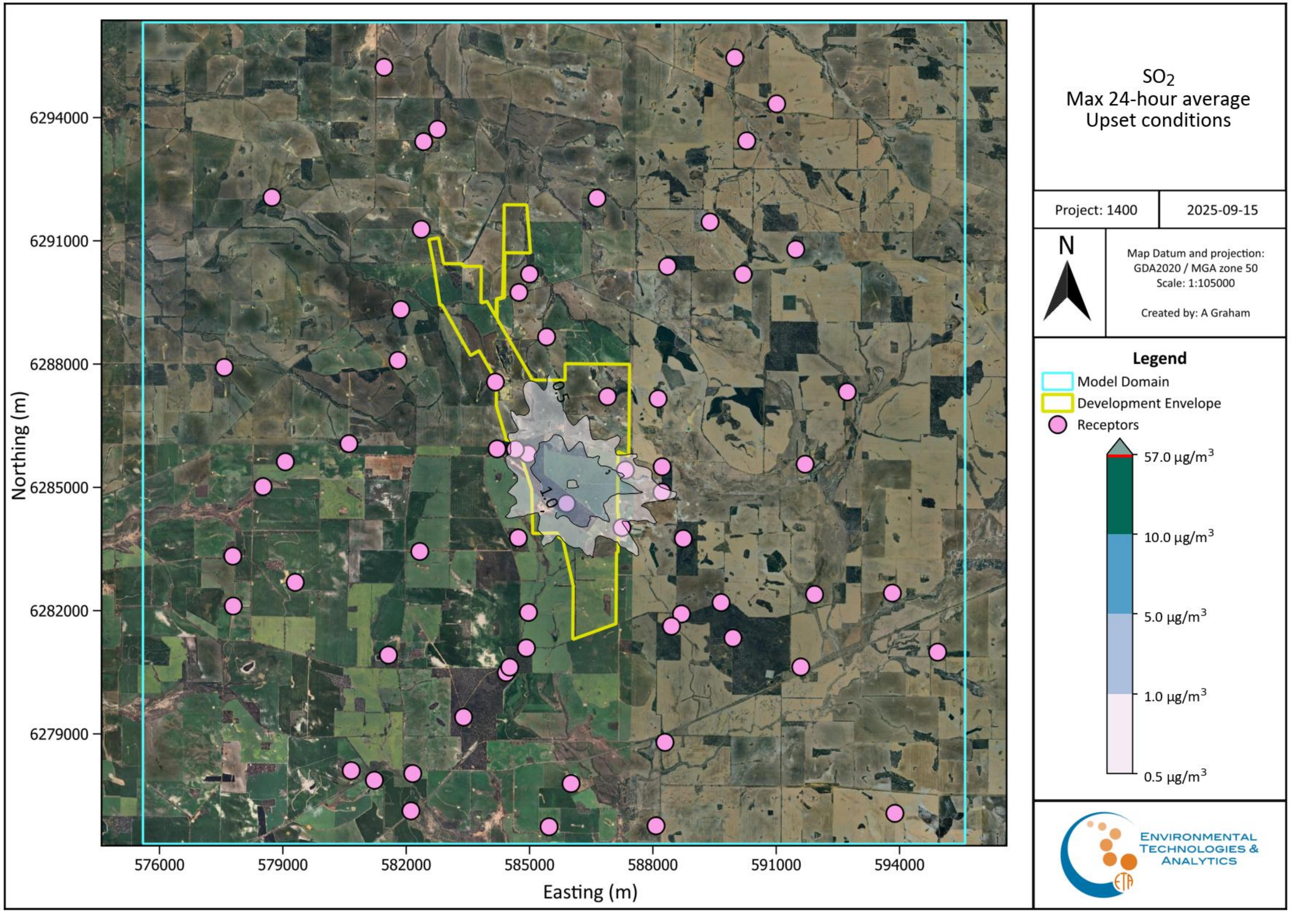

Figure 6-27: Cumulative SO_2 emissions – Maximum predicted 24-hour concentrations (µg/m³).

6.5.3 Carbon monoxide (CO)

As outlined in Section 3, the 8-hour criteria (11,250 µg/m^3) for CO is based on the protection of human health and the criteria used in this assessment is applicable to community receptors.

The isopleths for the maximum predicted 8-hour CO concentrations are presented for normal peak operations in Figure 6-28 and for upset conditions in Figure 6-29. The red contour line represents the assessment criteria concentration. The concentration contours show that:

- The maximum 8-hour CO concentrations during normal peak operations and upset conditions are predicted to be well below the assessment criteria.

The statistics of the predicted 8-hour CO concentrations, for the applicable sensitive receptors, are presented in Table 6-7. The results indicate that at the sensitive receptors where the primary impact of concern is the impact on human health (i.e. where community is present):

- None of the sensitive receptors are predicted to exceed the nominated 8-hour (11,250 µg/m^3) assessment criteria under any operational conditions.

Table 6-7: Statistics of predicted 8-hour CO concentrations – Normal peak operations and Upset conditions (µg/m³)

ID	Receptor type	Normal peak operations							Upset conditions						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >11,250	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >11,250
R1	Amenity	51	27	14	9	0	2.2	0	60	32	16	11	0	2.6	0
R2	Ecological | Amenity	64	45	31	18	1	4	0	76	53	36	20	0	5.2	0
R3	Ecological | Amenity	149	111	41	20	0	6	0	173	130	49	23	0	7.5	0
R10	Ecological | Amenity	15	7	3	1	0	0	0	18	8	3	1	0	0.5	0
R12	Building	14	9	4	1	0	0	0	16	11	4	1	0	0.6	0
R13	Building	25	8	4	1	0	0	0	29	9	4	1	0	0.6	0
R14	Building	12	4	2	0	0	0	0	14	5	2	1	0	0.3	0
R15	Building	14	8	3	2	0	0	0	16	10	4	2	0	0.6	0
R16	Building	12	8	4	2	0	1	0	14	10	4	2	0	0.7	0
R18	Building	7	3	1	0	0	0	0	8	4	1	0	0	0.2	0
R19	Building	12	6	1	1	0	0	0	13	6	2	1	0	0.3	0
R20	Building	12	4	2	1	0	0	0	14	5	2	1	0	0.3	0
R21	Building	6	4	2	1	0	0	0	7	5	2	1	0	0.4	0
R22	Building	15	6	2	1	0	0	0	17	7	3	1	0	0.4	0
R23	Building	12	6	2	0	0	0	0	13	6	2	1	0	0.3	0
R24	Building	12	5	2	0	0	0	0	15	6	2	1	0	0.3	0
R25	Building	9	5	1	0	0	0	0	11	6	1	0	0	0.2	0
R26	Building	12	5	2	1	0	0	0	13	6	2	1	0	0.3	0
R27	Building	6	4	2	1	0	0	0	7	5	2	1	0	0.3	0
R28	Building	7	4	2	1	0	0	0	8	5	2	1	0	0.3	0
R29	Building	11	4	1	0	0	0	0	12	4	1	0	0	0.2	0
R52	Building	17	6	2	1	0	0	0	20	8	3	1	0	0.5	0
R53	Building	9	4	1	0	0	0.2	0	10	5	1	1	0	0.3	0
R54	Building	10	3	1	0	0	0.2	0	11	4	1	0	0	0.2	0
R55	Building	20	6	1	0	0	0.2	0	23	6	1	0	0	0.3	0

ID	Receptor type	Normal peak operations							Upset conditions						
		Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >11,250	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days >11,250
R56	Building	8	5	1	0	0	0.2	0	10	5	1	0	0	0.2	0
R57	Building	24	7	2	1	0	0.3	0	27	9	2	1	0	0.4	0
R58	Building	11	3	1	0	0	0.2	0	13	4	1	0	0	0.2	0
R59	Building	4	2	0	0	0	0.1	0	5	2	1	0	0	0.1	0
R60	Building	6	2	1	0	0	0.1	0	7	2	1	0	0	0.1	0
R61	Building	5	2	1	0	0	0.1	0	6	3	1	0	0	0.1	0
R62	Building	11	5	2	1	0	0.3	0	13	6	2	1	0	0.3	0
R63	Building	14	3	1	0	0	0.2	0	17	4	1	0	0	0.2	0
R64	Building	11	3	1	0	0	0.2	0	13	4	1	0	0	0.2	0
R65	Building	7	3	2	1	0	0.2	0	8	4	2	1	0	0.2	0
R66	Building	12	3	1	0	0	0.2	0	13	3	1	0	0	0.2	0

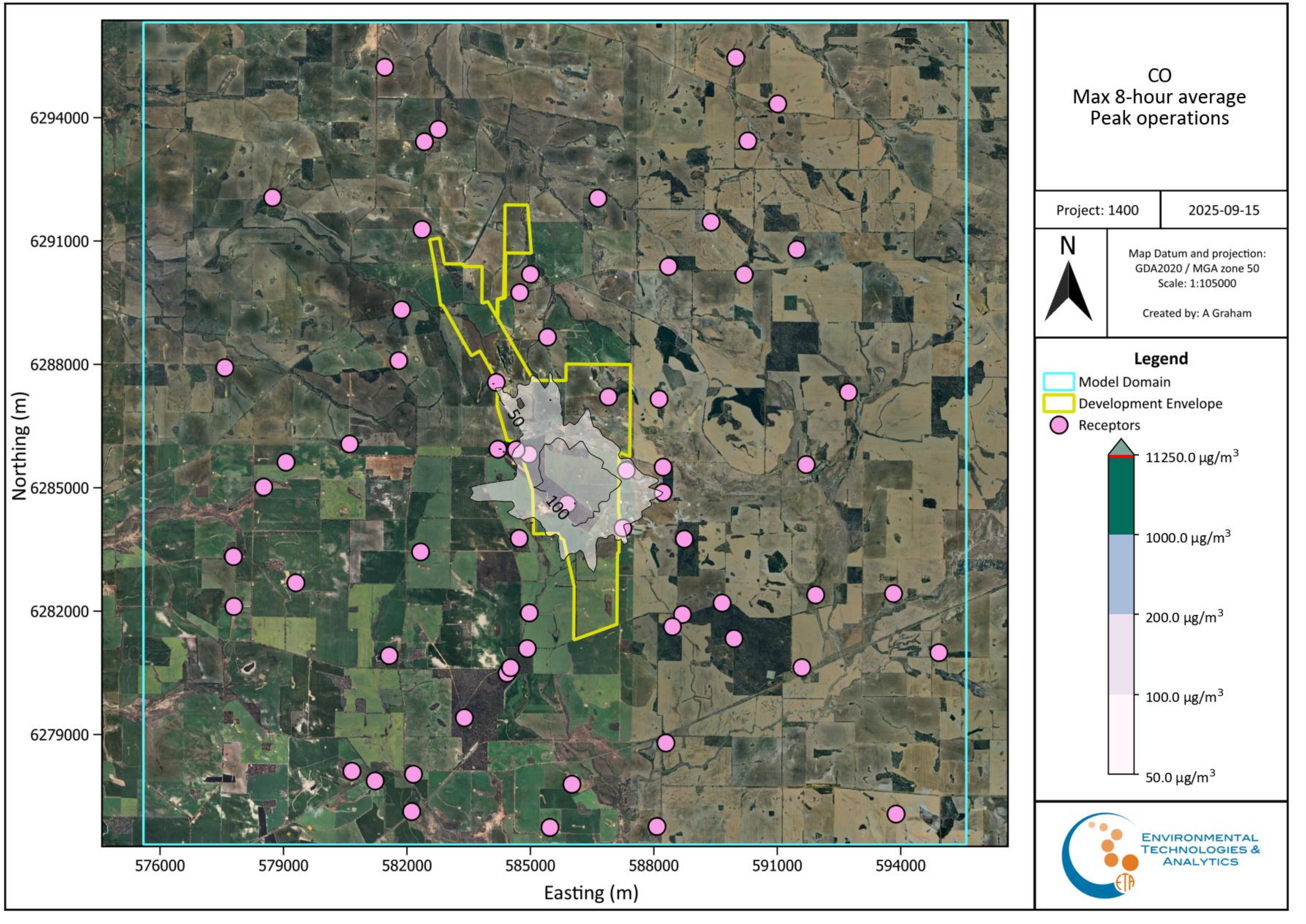

Figure 6-28: Project only CO emissions – Maximum predicted hourly concentrations (μg/m³).

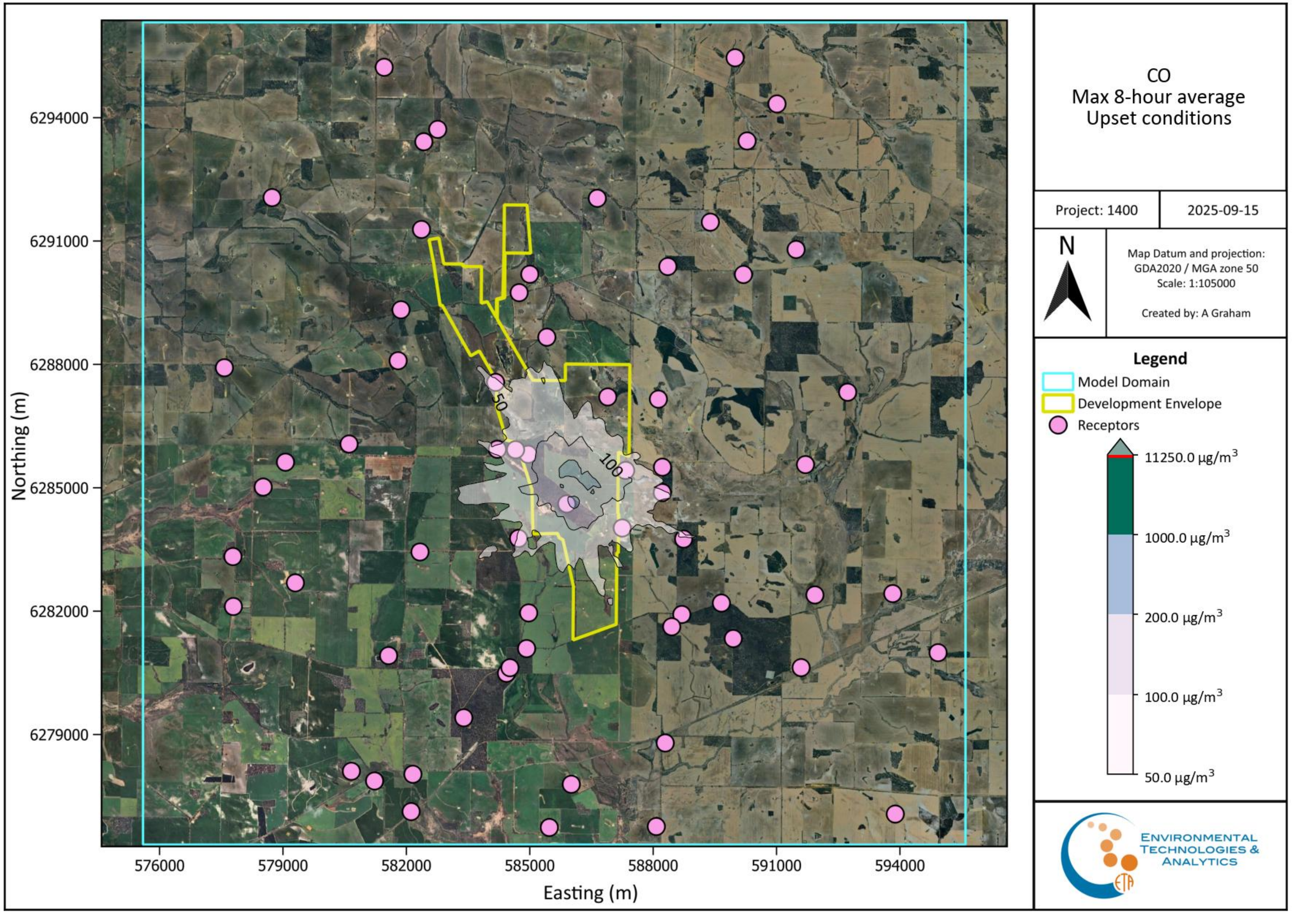

Figure 6-29: Cumulative CO emissions – Maximum predicted hourly concentrations (µg/m^3).

7 Conclusions

AusGold Limited (AusGold) is an Australian gold exploration and mine development company. Ausgold are seeking to develop the Katanning Gold Project (the Project) located approximately 275 kilometres (km) southeast of Perth and 37 km northeast of Katanning in the Great Southern region of Western Australia (WA).

The Project currently comprises open cut pits with a currently proposed mine life of 10 years. Mining will be undertaking using standard mining techniques including:

- Drill/blast,
- Loading of ore and waste onto haul trucks,
- Haulage to either waste stockpiles or run of mine (ROM) pads.

The processing will include the following:

- Single stage crusher with a semi autogenous grinding (SAG) and ball mill configuration,
- Carbon in Leach (CIL) circuit comprising two leach tanks and six CIL adsorption tanks,
- Processing of 3.6 Million tonnes per annum (Mtpa) of ore.

Power generation for the Project will be supplied by a standalone hybrid power station with a forecast of approximately 42% renewable energy. The system will consist of:

- Solar photovoltaic (PV) capacity of 40.8 MWp,
- Battery energy storage system (BESS) installed capacity of 20MW (44.2 MWhr),
- Gas reciprocating engines for a capacity of 30.3 MW,
- Diesel generators (black start) capacity of 3 MW.

Modelled ground level concentrations for the key pollutants (particles as TSP, PM_{10}, $PM_{2.5}$ and dust deposition and gases such as NO_2, SO_2, and CO) have been compared to relevant ambient air quality assessment criteria to determine the potential impact on key sensitive receptors with a particular focus on the Plunge Pool catchment. The sensitive receptors considered in the assessment include human habitation locations and ecological receptor locations.

Modelling impacts was undertaken using the CALMET/CAPUFF modelling suite. In the absence of onsite meteorological measurements, the Weather Research and Forecast (WRF) model was used to simulate the meteorology over the region for a representative year (2018) and was then input to the CALMET model to generate fine-resolution three-dimensional meteorological fields. Fine resolution terrain elevation (SRTM) data with 90 m resolution was used in conjunction with ESACCI-LU land-use data to characterise the geophysical environment.

The emission estimation was calculated utilising emission factors from the EETM for Mining (Environment Australia 2012) and input into the CALPUFF dispersion model as volume sources to simulate mining, haulage and processing, and area sources to simulate wind-blown dust. Background concentrations were also included to provide an indication of the potential cumulative impact from the existing operations.

The key findings of the assessment, in relation to the potential environmental impact caused by mining operations, assessed by comparison to assessment criteria for human health and amenity, are:

- For TSP:
  - Seven of the residential receptors are predicted to exceed the nominated assessment criteria (90 $\mu g/m^3$) at least once.

  - The three residential receptors with the most exceedances are R52 and R16, which the model predicts exceedances on 13 and 4 days, respectively.
  - At the rifle range, 24-hour TSP concentrations are predicted to exceed the nominated assessment criteria on 50 days.
  - At Woorgabup Nature Reserve, 24-hour TSP concentrations are predicted to exceed the nominated assessment criteria on 85 days.
  - It should be noted that these results are highly conservative including the use of an elevated background concentration.
  - Presentation of the maximum and 6th highest predicted TSP isopleths determined that there is a significant reduction in the predicted concentrations.
- For PM_{10}:
  - For residential receptors R16, R24, and R52, 24-hour PM_{10} concentrations are predicted to exceed the nominated 24-hour assessment criteria (50 µg/m^3) on 3, 2 and 9, respectively.
  - No residential receptors are predicted to exceed the annual average assessment criteria.
  - At the rifle range, 24-hour PM_{10} concentrations are predicted to exceed the 24-hour assessment criteria on 25 days.
  - It should be noted that these results are highly conservative including the use of an elevated background concentration.
  - There is a significant reduction in the predicted concentrations from the maximum down to the 6th highest.
- For $PM_{2.5}$:
  - None of the residential receptors are predicted to exceed the nominated 24-hour assessment criteria.
  - None of the receptors are predicted to exceed the annual average assessment criteria.
  - There is a significant reduction in the predicted concentrations from the maximum down to the 6th highest.
- For dust deposition:
  - For the residential receptors the model is not predicting any excursions of the deposition criteria.
  - For the amenity receptors, the model is predicting excursions of the relevant dust deposition criteria at Woorgabup Nature Reserve.
  - For the heritage receptors, the model is predicting excursions of the relevant dust deposition criteria at R39.
  - For the ecological receptors, the model is predicting a potential excursion of the relevant dust deposition criteria at R48.

Overall, the modelling for particulates, indicates that elevated concentrations are likely to be isolated events. These elevated levels can be counteracted by additional abatement methods, monitoring, and an operational dust management plan.

The key findings of the assessment, in relation to the potential environmental impact caused by the power generation plant, assessed by comparison to assessment criteria for human health and amenity, are:

- For NO_2:
  - The model is predicting no excursions of the nominated hourly or annual average assessment criteria during normal peak operations at any of the receptors
  - The model is predicting no excursions of the nominated hourly or annual average assessment criteria during upset operations at any of the receptors
- For SO_2:

    - None of the sensitive receptors are predicted to exceed the nominated hourly or 24-hour assessment criteria under any operational conditions.
- For CO:
    - None of the sensitive receptors are predicted to exceed the nominated 8-hour assessment criteria under any operational conditions.
- For the $PM_{2.5}$ from generators:
    - $PM_{2.5}$ concentrations from power generation sources are expected to be negligible compared to contributions from mining sources.

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9 Acronyms and Glossary

Acronym	Description
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
BWS	Belt wash station
C	Degrees Celsius (temperature)
CV	Conveyor
DWER	Department of Water and Environmental Regulation
EE	Emissions estimation
EET	Emissions Estimation Technique
EETM	Emissions Estimation Technique Manual
EF	Emission factor
EPAV	Environmental Protection Authority Victoria, Australia
ETA	Environmental Technologies& Analytics Pty Ltd
FEL	Front end loader
GLC	Ground Level Concentration
g/m^2/month	Grams per square metre per month
g/s	grams per second
h/yr	Hours per year
kg	kilogram
kg/t	kilogram per tonne
kg/yr	kilograms per year
kPa	kiloPascals
km	kilometre
m	metre
m/s	metres per second

Acronym	Description
mm	millimetre
Mt	Million tonnes
Mtpa	Million tonnes per annum
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
NPI	National Pollutant Inventory
NSW	New South Wales
PM	Particulate matter, small particles and liquid droplets that can remain suspended in air.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 10 µm or less.
PM_{10}	Particulate matter with an aerodynamic diameter of 2.5 µm or less.
t	Tonnes
t/h	Tonnes per hour
tpa	tonnes per annum
tph	tonnes per hour
TS	Transfer station
TSP	Total suspended particulates
$\mu g/m^3$	micro grams (one millionth of a gram) per cubic metre
µm	micrometre
USEPA	United States Environment Protection Agency

10 Appendices

Appendix A – Meteorology

A.1: Selection of Representative Meteorological Year for Modelling

For this assessment, air dispersion modelling has been conducted using the CALMET/CALPUFF suite of models with meteorological data produced from the WRF prognostic model. The CALMET meteorological model has been used to develop the required meteorological inputs, and the CALPUFF model has been used to predict the concentrations at ground-level across the model domain and at nominated discrete sensitive receptor locations. Meteorological measurements representative of the region has been used to verify and refine the meteorological inputs for the modelling.

Generally, a minimum of one year of meteorological data is acceptable for dispersion modelling in Australia. The data must, however, adequately represent worst-case meteorological conditions and the data should be assessed in terms of representativeness against climatic averages. In other words, the meteorology for selected years must be deemed representative of the "normal" range of conditions in the area.

To determine the year of meteorological data to use for the dispersion modelling, 10-years of historical hourly[4] surface observations from the nearest Bureau of Meteorology (BoM) station at Katanning (2012 to 2022 inclusive) were reviewed. The Chi^2 Goodness of Fit test was used to statistically identify the representative modelling year based on recorded meteorological parameters including wind speed, wind direction, temperature, and rainfall.

The statistical analysis shows that 2019 can be considered largely representative of longer-term average conditions. The meteorological variables affecting dust emissions and dispersion, namely wind speed, wind direction, temperature and rainfall compare favourably to the long-term average conditions.

The results of the statistical analysis performed to support selection of the representative year is described in the following sub-sections.

Chi^2 Goodness of Fit test

The Chi^2 goodness of fit test was used to statistically identify the representative modelling year based on recorded meteorological parameters including wind speed, wind direction and temperature. The Chi^2 goodness of fit test is a non-parametric hypothesis test used to determine whether a variable is likely to come from a specified distribution or not. It is often used to evaluate whether sample data (in this case, an individual year) is representative of the full population (e.g. multiple years).

The null hypothesis is that there is no significant difference between hourly values in an individual year and the hourly averages for long term average values. If values fall within the vertical lines (at 5% confidence interval, two tailed), then accept the null hypothesis (Appendix Figure 1).

[4] Calculated from 1-minute data.

Wind Direction

The Chi^2 test results for wind direction for 2012 to 2022 at BoM Katanning are compared in Appendix Figure 4 From this figure it is apparent that the wind direction frequency distribution during 2013, 2015, 2016 and 2022 was significantly different to the long-term wind direction frequency distribution.

Wind Speed

The basic statistics for average wind speed for the 11-year period and individual years are shown in Appendix Table 1. Overall, there is only a small difference between the chosen years though the average and standard deviations during 202020 and 2021 are furthest from the long-term values. With the exception of 2020 and 20219, the frequency of stronger (>20 km/h and lighter (<5 km/h) winds during most years are generally within 1.5% of long-term average values.

Appendix Table 1: Annual wind speed statistics for Katanning (2012-2022).

Year	Mean	Standard Deviation	% <5 hm/h	% >20 km/h
11-year Average	13.8	7.5	10.6	20.6
2012	13.5	7.7	11.2	19.9
2013	13.7	7.5	11.0	19.9
2014	13.6	7.2	10.3	19.0
2015	13.6	7.3	11.3	20.4
2016	14.0	7.3	9.2	21.0
2017	13.8	7.3	10.3	19.0
2018	14.0	7.5	9.9	19.8
2019	13.4	7.4	11.0	18.8
2020	14.6	8.0	9.7	24.6
2021	14.2	8.0	11.4	23.8
2022	13.8	7.4	11.2	20.8

The Chi^2 test results for wind speed are presented in Appendix Figure 3. This figure indicates that the frequency distribution of wind speed during 2020 and 2021 were significantly different to the 11-year average conditions at the 5% confidence interval.

Temperature

The basic statistics for average temperature for the 10-year period and individual years are shown in Appendix Table 2. With the exception of 2016, the average temperature for the years 2011 to 2022 are within 0.5°C of the 11-year average.

Appendix Table 2: Annual temperature statistics for Katanning (2012-2022).

Year	Mean	Standard Deviation	% <5°C	% >35°C
11-yr average	15.3	6.6	2.2	0.7
2012	15.7	6.9	2.3	0.9
2013	15.7	6.5	1.5	0.8
2014	15.7	6.3	1.2	0.4
2015	15.8	6.8	2.2	1.1
2016	14.5	6.7	4.5	0.6
2017	15.2	6.5	1.9	0.6
2018	15.2	6.2	2.1	0.2
2019	15.6	6.8	2.3	1.0
2020	15.5	6.4	1.3	0.6
2021	15.0	6.5	2.3	0.7
2022	14.8	6.5	2.3	0.8

The Chi^2test results for temperature are presented in Appendix Figure 5. From this figure it is apparent that the hourly temperature frequency distribution during 2016 was significantly different to the long-term frequency distribution.

Rainfall

The annual rainfall at Katanning, available for the extended period 1999-2022, is displayed in Appendix Figure 2, noting that there is incomplete data for 2008, 2010, 2013 and 2015 to 2018. There is some variation in rainfall between each year which is to be expected for Western Australia, given the highly variable nature of rainfall in the state. Post 2012, the years 2012, 2014, 2020, 2011 and 2022 have annual rainfall that just fall within the 10th and 90th percentile[5] long-term (25 year) rainfall totals.

Conclusions

It is important to note that it is highly unusual for multiple climatological parameters to all fall within "representative" levels. With that in mind, the following conclusions can be made for the period reviewed:

- All years except 2016 are representative of longer-term (11 year) temperature average frequency distribution at the 99% significance level.

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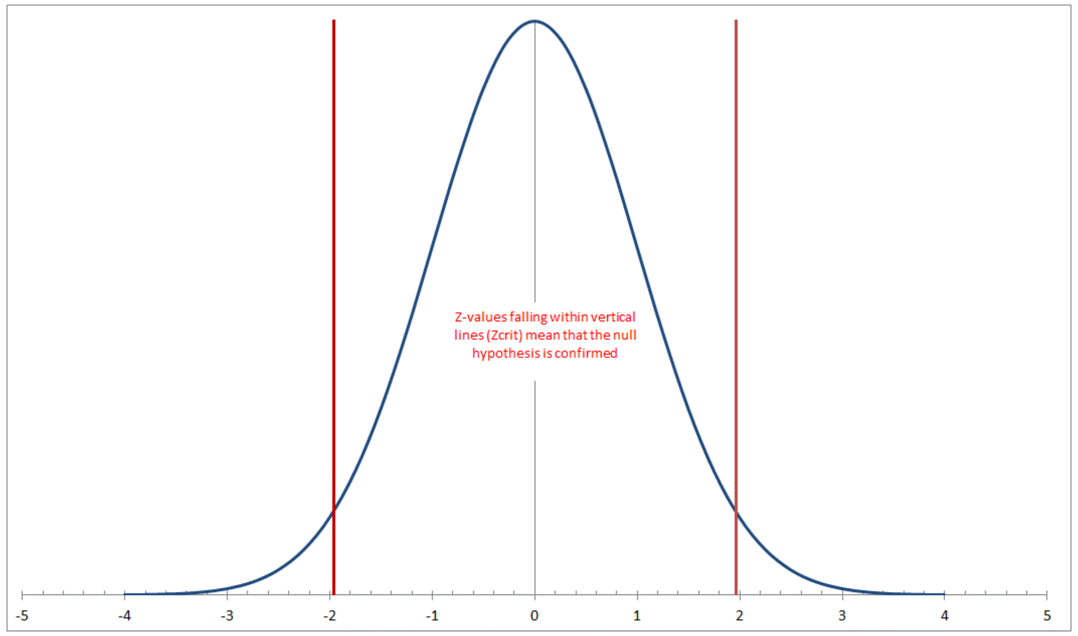
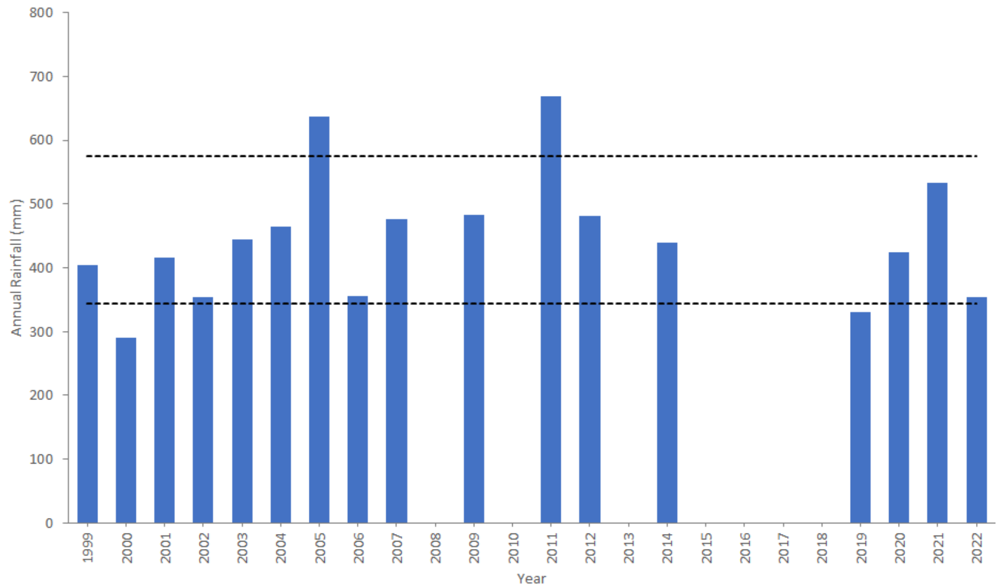
[5] The 10th and 90th percentile values are classed as well below and well above average according to the Bureau of Meteorology

- The years 2012 to 2019 and 2022 are representative of longer-term wind speed average frequency distribution at the 99% significance level.
- For wind direction, frequency distributions during all years except 2013, 2015 and 2022 are representative of longer-term direction frequency distributions at the 99% significance level.
- For annual rainfall, all years (post 2012) except 2019 fall within the longer-term 10^{th} and 90^{th} percentile values.

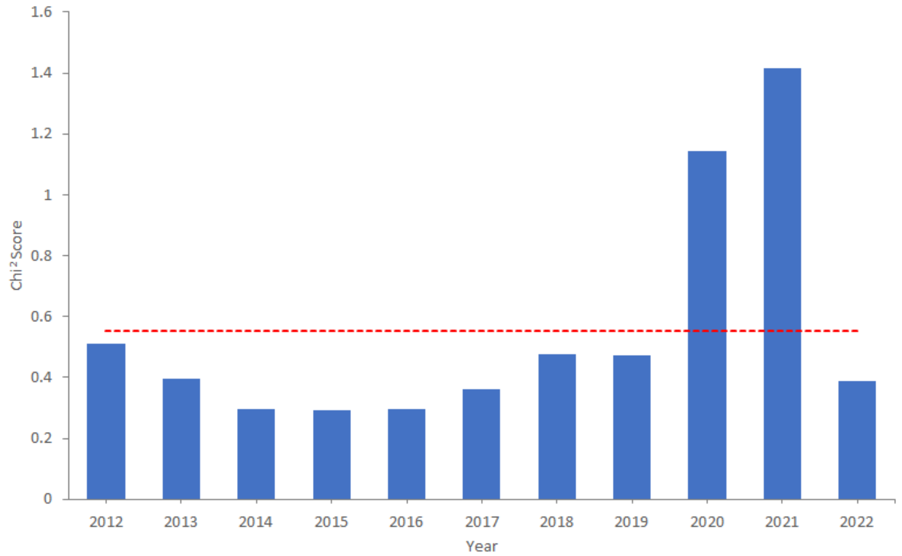
Based on the above analysis, it was decided to use the more recent 2019 as the modelling year as the meteorological variables affecting dispersion, namely wind speed, wind direction, temperature, compare favourably to the long-term average conditions.



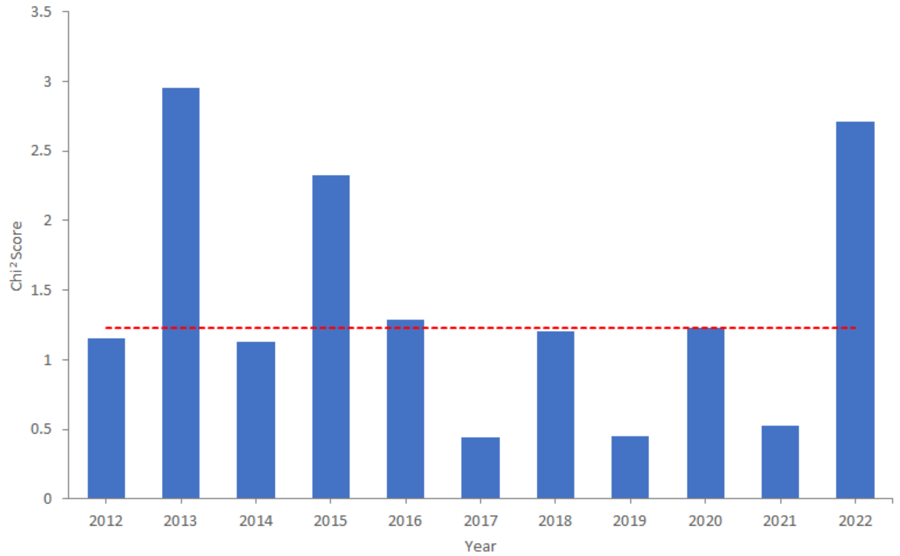
Appendix Figure 1: Null Hypothesis for Chi^2 test.



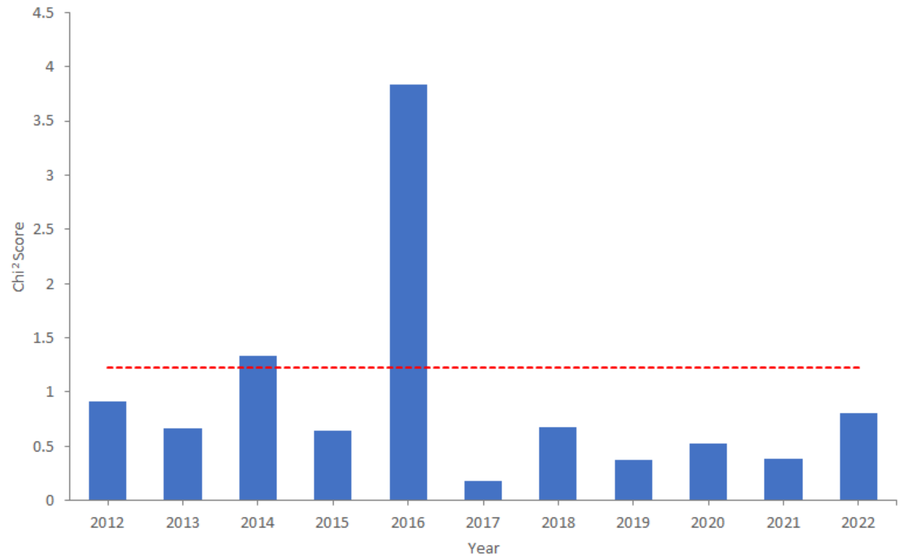
Appendix Figure 2: Chi^2 test result for annual rainfall at Katanning (1999-2022).



Appendix Figure 3: Chi^2 test result for wind speed at Katanning (2012-2022).



Appendix Figure 4: Chi^2 test result for wind direction at Katanning (2012-2022).



Appendix Figure 5: Chi^2 test result for temperature at Katanning (2012-2022).

A.2: WRF

WRF was developed (and continues to be developed) in the United States by a collaborative partnership including the National Center for Atmospheric Research (NCAR), the National Oceanic and Atmospheric Administration (the National Center for Environmental Prediction (NCEP), the Forecast Systems Laboratory (FSL), the Air Force Weather Agency (AFWA), the Naval Research Laboratory, the University of Oklahoma, the Federal Aviation Administration (FAA) and others. (WRF, 2012).

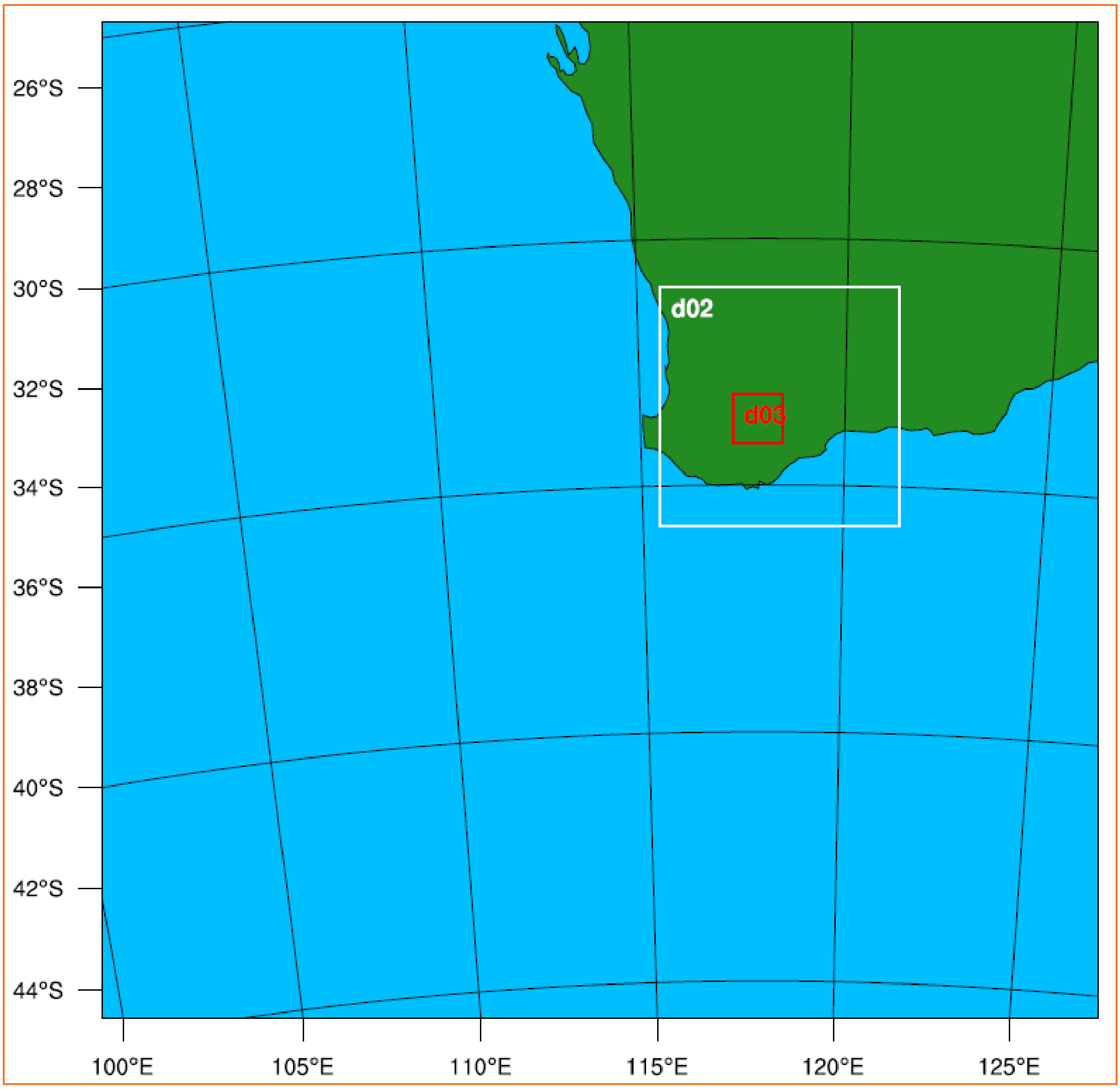
WRF is a fully compressible, Eulerian, non-hydrostatic meso-scale numerical model developed by the National Center for Atmospheric Research (NCAR) and the National Oceanic and Atmospheric Administration (NOAA) in the United States. WRF is suitable for a broad spectrum of applications across scales ranging from metres to thousands of kilometres. The model utilises global reanalysis[6] data to produce fine-scale 3-dimensional meteorological fields that considers local terrain and land-use effects.

WRF was run with a three-nest structure (30 km, 7.5 km and 1.875 km horizontal grid space resolution) centred on 33.541659°S and 117.96896°E. This is shown in Appendix Figure 6. The model vertical resolution consists of 38 hybrid eta levels[7].

Physics options in WRF are to represent atmospheric radiation, surface, and boundary layer as well as cloud and precipitation processes. WRF can be run with a variety of model physics options which can lead to varying results and hence it is crucial for the most appropriate model setup for a particular purpose over a given region/domain. The physics options selected for the modelling are based on the results of a sensitivity study undertaken over southwestern Western Australia, where simulations of 14 combinations of land surface model, longwave radiation scheme, shortwave radiation scheme, cumulus scheme, planetary boundary layer scheme, surface layer scheme and microphysics schemes were compared to observations (Kala et. al., 2015). The combination of physics options found to produce the most accurate results, were used in this study, and are summarised in Appendix Table 3.

[6] Global modelling using observed climate data for temperature, wind speed, and pressure. The observations are analysed; interpolated onto a system of grids and the model initialised with this data.

[7] Terrain-following close to the earth's surface and pressure levels higher in the atmosphere.



Appendix Figure 6: WRF model domains.

Appendix Table 3: WRF Physics Options Selected for the Model.

	Domain 1	Domain 2	Domain 3	Explanatory Notes
mp_physics	4	4	4	WRF Single–moment 5–class Scheme
ra_lw_physics	1	1	1	Rapid radiative transfer model scheme
ra_sw_physics	1	1	1	Dudhia scheme for cloud and clear sky absorption and scattering
Radt	10	10	10	Time step for radiation schemes
sf_sfclay_physics	1	1	1	MM5 based on MOST
sf_surface_physics	2	2	2	Noah land surface model with 6 soil layers
bl_pbl_physics	1	1	1	Non-local K-scheme with entrainment layer

	Domain 1	Domain 2	Domain 3	Explanatory Notes
bldt	0	0	0	Boundary layer time step (0=every time step)
cu_physics	1	1	0	Kain-Fritch scheme using mass flux approach for domain 1 only.
cudt	5	5	5	Cumulus physics time step (minutes)

Six-hourly global final analysis synoptic data (from http://nomads.ncdc.noaa.gov/data/gfsanl/) was used to initialise the model and provide boundary conditions.

Terrain elevation and land-use data were sourced from the United State Geological Services (USGS) and MODIS databases. Inspection of the land-use indicates an acceptable resolution and category for the model area with shrub and cultivated land being the dominant vegetation type.

The selection of an appropriate Land Surface Model (LSM) is critically important to provide the boundary conditions at the land-atmosphere interface because:

- The Planetary Boundary Layer (PBL) schemes are sensitive to surface fluxes.
- The cloud/cumulus schemes are sensitive to the PBL structures.
- There is a need to capture mesoscale circulations forced by surface variability in albedo, soil moisture/temperature and land use.

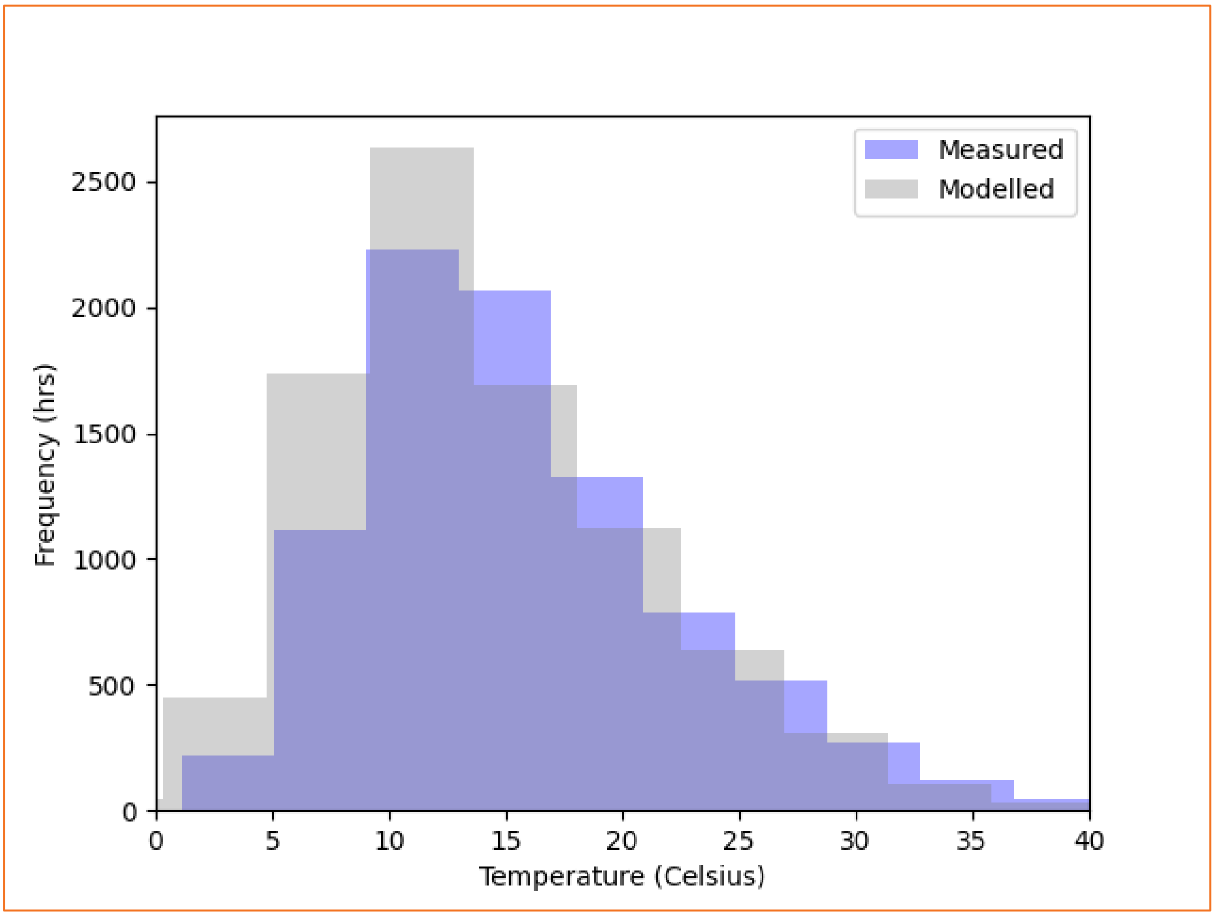
The Noah Land-Surface Model was selected in this case to account for the sub-grid-scale fluxes. This sophisticated scheme provides 4 quantities to the parent atmospheric model (WRF), namely:

- surface sensible heat flux
- surface latent heat flux
- upward longwave radiation
- upward (reflected) shortwave radiation.

A.3: WRF-Validation

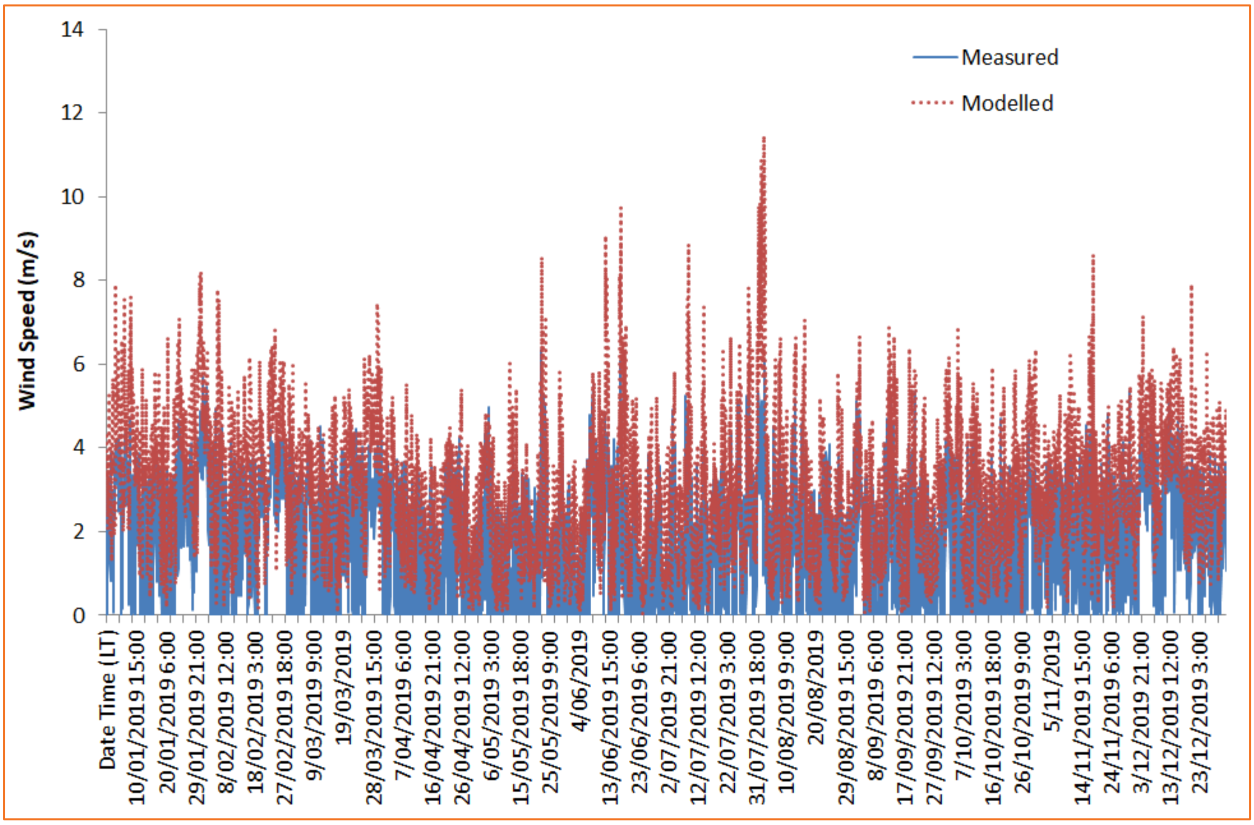
The accuracy of the meteorology generated by WRF was assessed by comparing model output against corresponding measurement data at the Bureau of Meteorology weather station located at Katanning (33.6856°S, 117.6064°E). At an initial level of validation, the model output is visually compared against measured temperature, wind speed and wind direction.

The frequency plot in Appendix Figure 7 shows good correspondence between modelled and measured values, although model slight underprediction is seen at higher and lower temperatures.

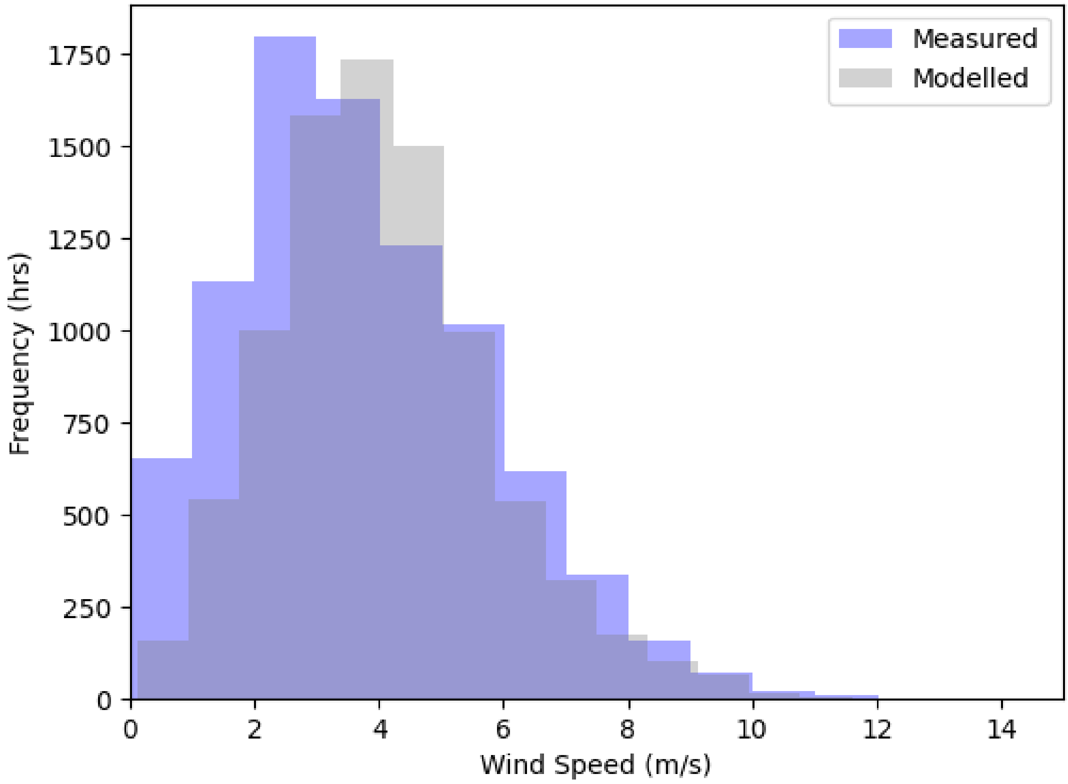


Appendix Figure 7: Frequency of modelled and measured temperature at the Katanning met station

The time series of predicted and measured 10 m wind speed is shown in Appendix Figure 8. The model shows consistent overprediction. The frequency plot of wind speed confirms the model overprediction, especially for light (< 2 m/s) wind speeds (Appendix Figure 9). The very high percentage of measured calm conditions (22%) and wind speeds less than 1 m/s (38%) raise concerns over the measurement data. This may be due to instrumentation erorr or weather station siting issues. Analysis of this issue shows that the station has a sub-optimal (WMO Class 5) siting and wind speed measurements should therefore be treated with a high degree of uncertainty.

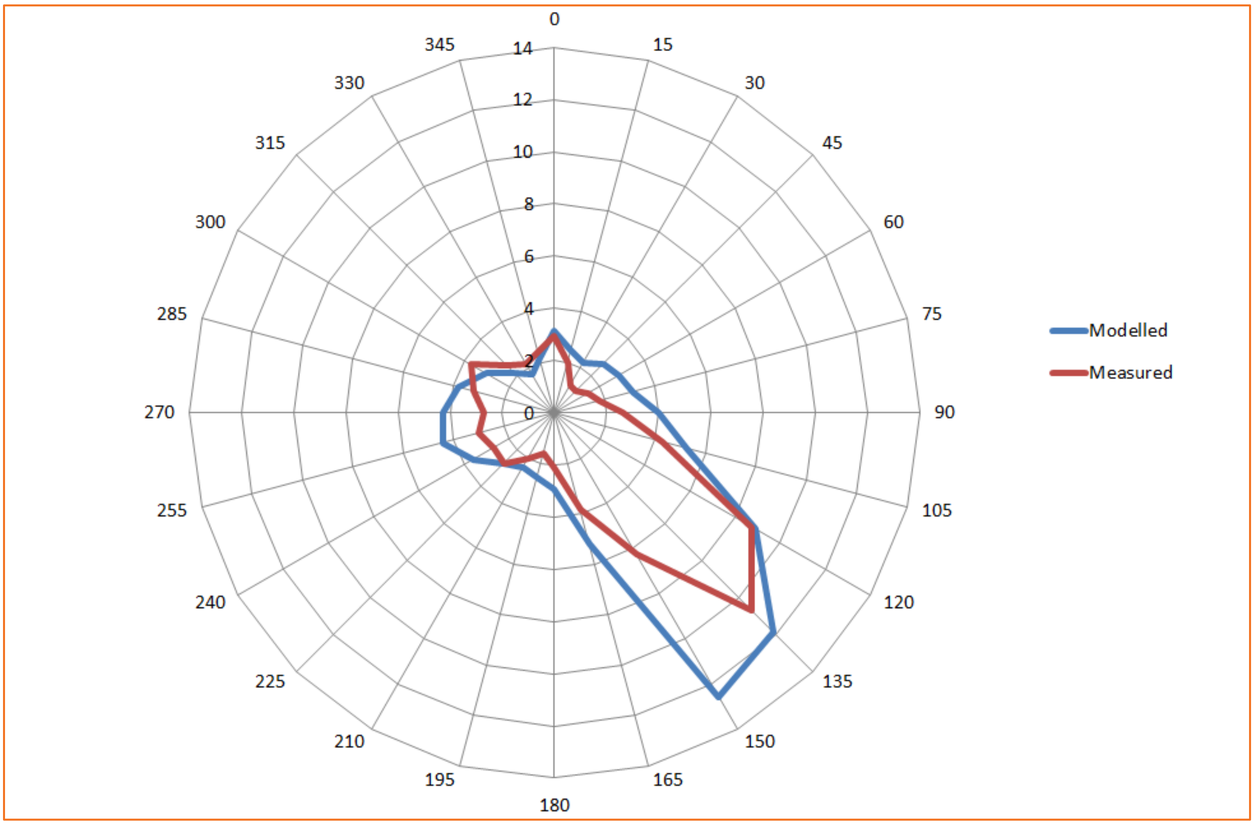


Appendix Figure 8: Time series of modelled at measured wind speed at the Katanning met station.



Appendix Figure 9: Frequency plot of modelled and measured wind speed at the Katanning met station.

The annual wind direction radar plots (Appendix Figure 10) show that while the model predicts the general wind directions well, the model slightly overpredicts the frequency of westerly and south-south-easterly flow.



Appendix Figure 10: Measured and modelled annual wind roses at the Katanning met station.

More objective methods to evaluate model performance are assessed using statistical tests that have been specifically developed for this purpose. These tests used are discussed in detail below.

Model Bias

The model bias (MB) is the mean error and is given by:

$$MB = \frac{1}{n}\sum_{i=1}^{n}(O_i - P_i)$$

Where:

n	=	the number of pairs of observed data
O_i	=	the observed value for the i-th hour
P_i	=	the predicted value for the i-th hour

The ideal value for the bias is zero.

Gross Error

The gross error (GE) is the mean of absolute error and is given by:

$$GE = \frac{1}{n}\sum_{i=1}^{n} | O_i - P_i |$$

where:

n	=	the number of pairs of observed data
O_i	=	the observed value for the i-th hour
P_i	=	the predicted value for the i-th hour

The ideal value for gross error is zero. GE is greater than MB, representing the expected error for each hourly observation.

Root Mean Square Error (RMSE)

The Root Mean Square Error is given by:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(O_i - P_i)^2}$$

where:

N	=	the number of pairs of data
O_i	=	the observed (measured) value for the i-th hour
P_i	=	the predicted (modelled) value for the i-th hour

While the ideal RMSE value is 0, large errors in a small section of the data may produce a large RMSE even though errors may be small elsewhere.

Index of Agreement

The index of agreement (IOA) is the measure of how well the model estimates departure from the observed mean.

$$IOA = 1 - \left[\frac{N(RMSE)^2}{\sum_{i=1}^{n}\left\{ \left| P_i - \bar{O} \right| + \left| O_i - \bar{O} \right| \right\}^2} \right]$$

where:

n	=	the number of pairs of observed data
O_i	=	the observed value for the i-th hour

$\bar{O}_i$ = the mean observed value

The index of agreement has a theoretical range of 0 to 1. The ideal value for IOA is 1.

A set of benchmarks were set for mesoscale model evaluation by Emery *et al.* (2001) and Teschke *et al.* (2001). The purpose of these benchmarks is not necessarily to give a passing or failing grade but to put the results into a proper context (Emery, et al., 2001).

Verification of WRF-CALMET performance has been conducted by comparing hourly predictions at the Collie East weather station against corresponding measurements between January 2022 and December 2022. Temperature, wind speed and wind direction compared (Appendix Table 4).

Appendix Table 4: Results of statistical validation test at the Collie East met station

Variable	Performance Criteria	Benchmark Range	Statistic	
			Score	Benchmark
Wind Speed	RMSE	<±2 m/s	2.2	Outside
	BIAS	<± 0.5 m/s	-1.6	Outside
	IOA	>0.6	0.6	Within
Wind Direction	Gross error	<30 °	27	Within
	BIAS	<10 °	9	Within
Temp	Gross error	<±2 K	2.0	Within
	BIAS	<± 0.5 K	0.8	Outside
	IOA	>0.8	0.9	Within

Based on the results shown in the table, it can be concluded that:

- The model predicts surface temperature with a moderate to high degree of skill. Two of the three benchmark criteria are met with the Bias values falling just outside the benchmark criteria.
- The model predicts wind speed with a low degree of skill. One of the three benchmarks are met. However, assessment of the data and weather station location shows that the station has a sub-optimal (WMO Class 5) siting and should be treated with a high degree of uncertainty.
- The model predicts wind direction with a high degree of accuracy. Both benchmark criteria are met.

Overall, the meteorological model performance can be considered acceptable when compared to measurement data.

Appendix B – Receptor Locations and Description

Appendix Table 4: Receptor locations and description

ID	East	North	Description	Environmental Value Protected	Relevant form of PM to be assessed				
					TSP	PM_{10}	$PM_{2.5}$	Deposition	Other gases
R1	584,213	6,285,938	Wurgabup Rifle Range	Amenity	✓	✓	✓	✓	✓
R2	584,961	6,285,815	Woorgabup Nature Reserve 1	Ecological | Amenity	✓	✓	✓	✓	✓
R3	585,901	6,284,609	Woorgabup Nature Reserve 2	Ecological | Amenity	✓	✓	✓	✓	✓
R4	588,698	6,281,920	Kwobrup 1	Ecological	✓			✓	
R5	589,661	6,282,197	Kwobrup 2	Ecological	✓			✓	
R6	589,950	6,281,334	Kwobrup 3	Ecological	✓			✓	
R7	588,224	6,284,884	Smith Rd Reserve 1	Ecological	✓			✓	
R8	588,228	6,285,502	Smith Rd Reserve 2	Ecological	✓			✓	
R9	588,359	6,290,382	Warren Rd Reserve	Ecological	✓			✓	
R10	584,925	6,281,090	Wolyaming Rd Open Space	Ecological | Amenity	✓	✓	✓	✓	✓
R11	584,436	6,280,490	Badgebup	Ecological	✓			✓	
R12	584,975	6,281,958	Building	Residential	✓	✓	✓	✓	✓
R13	582,332	6,283,440	Building	Residential	✓	✓	✓	✓	✓
R14	581,569	6,280,919	Building	Residential	✓	✓	✓	✓	✓
R15	580,608	6,286,065	Building	Residential	✓	✓	✓	✓	✓
R16	581,870	6,289,330	Building	Residential	✓	✓	✓	✓	✓
R18	586,644	6,292,041	Building	Residential	✓	✓	✓	✓	✓
R19	582,425	6,293,417	Building	Residential	✓	✓	✓	✓	✓
R20	582,763	6,293,718	Building	Residential	✓	✓	✓	✓	✓
R21	578,736	6,292,058	Building	Residential	✓	✓	✓	✓	✓
R22	591,705	6,285,565	Building	Residential	✓	✓	✓	✓	✓
R23	592,731	6,287,325	Building	Residential	✓	✓	✓	✓	✓
R24	590,198	6,290,188	Building	Residential	✓	✓	✓	✓	✓
R25	589,392	6,291,461	Building	Residential	✓	✓	✓	✓	✓
R26	578,520	6,285,019	Building	Residential	✓	✓	✓	✓	✓
R27	577,576	6,287,920	Building	Residential	✓	✓	✓	✓	✓
R28	593,828	6,282,427	Building	Residential	✓	✓	✓	✓	✓
R29	591,600	6,280,627	Building	Residential	✓	✓	✓	✓	✓

ID	East	North	Description	Environmental Value Protected	Relevant form of PM to be assessed				
					TSP	PM_{10}	$PM_{2.5}$	Deposition	Other gases
R31	588,453	6,281,621	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R32	591,935	6,282,395	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R33	583,397	6,279,407	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R34	579,062	6,285,623	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R35	579,302	6,282,688	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R36	591,478	6,290,796	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R37	582,116	6,277,126	Registered Aboriginal Heritage Site	Heritage	✓			✓	
R38	593,889	6,277,066	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R39	584,656	6,285,927	Lodged Aboriginal Heritage Site	Heritage	✓			✓	
R40	584,519	6,280,625	Lodged Aboriginal Heritage	Heritage	✓			✓	
R41	586,898	6,287,210	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R42	587,334	6,285,423	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R43	588,129	6,287,156	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R44	585,417	6,288,663	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R45	584,729	6,283,770	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R46	584,743	6,289,746	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R47	585,002	6,290,194	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R48	584,171	6,287,564	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R49	581,801	6,288,092	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R50	587,250	6,284,023	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R51	588,743	6,283,754	Good quality Black Cockatoo Habitat	Ecological	✓			✓	
R52	582,368	6,291,284	Dyliabing Pty Ltd	Residential	✓	✓	✓	✓	✓
R53	581,462	6,295,227	Building	Residential	✓	✓	✓	✓	✓
R54	577,794	6,282,113	Building	Residential	✓	✓	✓	✓	✓
R55	586,011	6,277,790	Building	Residential	✓	✓	✓	✓	✓
R56	585,477	6,276,740	Building	Residential	✓	✓	✓	✓	✓
R57	588,295	6,278,795	Building	Residential	✓	✓	✓	✓	✓
R58	588,079	6,276,763	Building	Residential	✓	✓	✓	✓	✓
R59	589,994	6,295,459	Building	Residential	✓	✓	✓	✓	✓
R60	591,013	6,294,336	Building	Residential	✓	✓	✓	✓	✓
R61	590,286	6,293,436	Building	Residential	✓	✓	✓	✓	✓

ID	East	North	Description	Environmental Value Protected	Relevant form of PM to be assessed				
					TSP	PM_{10}	$PM_{2.5}$	Deposition	Other gases
R62	594,929	6,280,991	Building	Residential	✓	✓	✓	✓	✓
R63	582,160	6,278,034	Building	Residential	✓	✓	✓	✓	✓
R64	581,228	6,277,871	Building	Residential	✓	✓	✓	✓	✓
R65	577,784	6,283,328	Building	Residential	✓	✓	✓	✓	✓
R66	580,664	6,278,106	Building	Residential	✓	✓	✓	✓	✓

Appendix C – Emission Sources and Parameters

This appendix contains the following:

- Appendix Table 5: Wind erosion sources.
- Appendix Table 6: Haul road sources
- Appendix Table 7: Mining sources

Appendix Table 5: Wind erosion sources.

Source ID	Easting1	Easting2	Easting3	Easting4	Northing1	Northing2	Northing3	Northing4	Effective radius	Effective height	Sigma Z
WE1	583,802	583,862	583,862	583,802	6,289,405	6,289,405	6,289,345	6,289,345	34	1	0.465
WE2	583,714	583,859	583,859	583,714	6,288,931	6,288,931	6,288,786	6,288,786	82	1	0.465
WE3	583,476	583,616	583,616	583,476	6,289,462	6,289,462	6,289,322	6,289,322	79	1	0.465
WE4	583,027	583,172	583,172	583,027	6,290,073	6,290,073	6,289,928	6,289,928	82	1	0.465
WE5	583,308	583,478	583,478	583,308	6,288,922	6,288,922	6,288,752	6,288,752	96	1	0.465
WE6	582,890	583,060	583,060	582,890	6,289,709	6,289,709	6,289,539	6,289,539	96	1	0.465
WE7	582,642	582,812	582,812	582,642	6,290,690	6,290,690	6,290,520	6,290,520	96	1	0.465
WE8	583,445	583,655	583,655	583,445	6,290,154	6,290,154	6,289,944	6,289,944	118	1	0.465
WE9	583,916	583,996	583,996	583,916	6,289,089	6,289,089	6,289,009	6,289,009	45	1	0.465
WE10	584,256	584,506	584,506	584,256	6,288,223	6,288,223	6,287,973	6,287,973	141	1	0.465
WE11	584,522	584,822	584,822	584,522	6,287,248	6,287,248	6,286,948	6,286,948	169	1	0.465
WE12	585,402	586,002	586,002	585,402	6,287,421	6,287,421	6,286,821	6,286,821	339	1	0.465
WE13	586,390	586,790	586,790	586,390	6,286,731	6,286,731	6,286,331	6,286,331	226	1	0.465
WE14	585,754	585,874	585,874	585,754	6,285,726	6,285,726	6,285,606	6,285,606	68	1	0.465
WE15	585,896	586,016	586,016	585,896	6,285,427	6,285,427	6,285,307	6,285,307	68	1	0.465
WE16	585,242	585,372	585,372	585,242	6,284,194	6,284,194	6,284,064	6,284,064	73	1	0.465
WE17	585,624	585,794	585,794	585,624	6,284,296	6,284,296	6,284,126	6,284,126	96	1	0.465
WE18	586,040	586,200	586,200	586,040	6,283,605	6,283,605	6,283,445	6,283,445	90	1	0.465
WE19	586,584	586,834	586,834	586,584	6,283,829	6,283,829	6,283,579	6,283,579	141	1	0.465

Appendix Table 6: Haul road sources

Source	Easting	Northing	Effective Ht	Sigma Y	Sigma Z
HR1	585,268	6,284,236	4.4	16.7	4.1
HR2	585,467	6,284,284	4.4	16.7	4.1
HR3	585,609	6,284,019	4.4	16.7	4.1
HR4	585,763	6,283,767	4.4	16.7	4.1
HR5	585,995	6,283,803	4.4	16.7	4.1
HR6	586,182	6,283,932	4.4	16.7	4.1
HR7	586,409	6,283,870	4.4	16.7	4.1
HR8	586,599	6,284,101	4.4	16.7	4.1
HR9	586,753	6,284,342	4.4	16.7	4.1
HR10	586,008	6,283,635	4.4	16.7	4.1
HR11	585,923	6,283,977	4.4	16.7	4.1
HR12	586,422	6,283,619	4.4	16.7	4.1
HR13	586,453	6,285,160	4.4	16.7	4.1
HR14	586,390	6,285,438	4.4	16.7	4.1
HR15	586,151	6,285,618	4.4	16.7	4.1
HR16	585,903	6,285,779	4.4	16.7	4.1
HR17	585,630	6,285,756	4.4	16.7	4.1
HR18	585,532	6,286,040	4.4	16.7	4.1
HR19	585,434	6,286,323	4.4	16.7	4.1
HR20	585,217	6,286,414	4.4	16.7	4.1
HR21	584,957	6,286,527	4.4	16.7	4.1
HR22	583,165	6,290,058	4.4	16.7	4.1
HR23	583,382	6,289,875	4.4	16.7	4.1
HR24	583,546	6,289,627	4.4	16.7	4.1
HR25	583,721	6,289,405	4.4	16.7	4.1
HR26	583,846	6,289,136	4.4	16.7	4.1
HR27	583,994	6,288,879	4.4	16.7	4.1
HR28	584,081	6,288,591	4.4	16.7	4.1
HR29	584,031	6,288,358	4.4	16.7	4.1
HR30	584,047	6,288,098	4.4	16.7	4.1
HR31	584,134	6,287,811	4.4	16.7	4.1
HR32	584,340	6,287,607	4.4	16.7	4.1
HR33	584,224	6,287,361	4.4	16.7	4.1
HR34	584,243	6,287,065	4.4	16.7	4.1
HR35	584,381	6,286,799	4.4	16.7	4.1
HR36	584,550	6,286,552	4.4	16.7	4.1
HR37	584,733	6,286,316	4.4	16.7	4.1
HR38	584,996	6,286,391	4.4	16.7	4.1
HR39	584,353	6,288,797	4.4	16.7	4.1
HR40	584,508	6,288,540	4.4	16.7	4.1
HR41	584,628	6,288,268	4.4	16.7	4.1

Source	Easting	Northing	Effective Ht	Sigma Y	Sigma Z
HR42	584,722	6,287,983	4.4	16.7	4.1
HR43	584,851	6,287,714	4.4	16.7	4.1
HR44	585,009	6,287,459	4.4	16.7	4.1
HR45	585,034	6,287,216	4.4	16.7	4.1
HR46	585,044	6,286,916	4.4	16.7	4.1
HR47	585,025	6,286,620	4.4	16.7	4.1
HR48	586,132	6,287,518	4.4	16.7	4.1
HR49	585,940	6,287,287	4.4	16.7	4.1
HR50	585,811	6,287,038	4.4	16.7	4.1
HR51	585,850	6,286,741	4.4	16.7	4.1
HR52	585,657	6,286,558	4.4	16.7	4.1
HR53	583,160	6,289,689	4.4	16.7	4.1
HR54	582,985	6,289,767	4.4	16.7	4.1
HR55	583,650	6,288,871	4.4	16.7	4.1
HR56	583,522	6,288,794	4.4	16.7	4.1
HR57	583,372	6,289,950	4.4	16.7	4.1
HR58	585,758	6,286,531	4.4	16.7	4.1
HR59	585,887	6,286,260	4.4	16.7	4.1
HR60	583,951	6,289,333	4.4	16.7	4.1

Appendix Table 7: Mining sources

Source	Easting	Northing	Effective Ht	Sigma Y	Sigma Z
BullPit_3	584,714	6,286,604	2	125	0.93
BullPit_4	584,611	6,287,381	2	125	0.93
BullPit_5	584,316	6,288,208	2	125	0.93
BullPit_6	583,749	6,288,853	2	125	0.93
BullPit_7	583,807	6,289,365	2	125	0.93
BullPit_8	583,164	6,289,797	2	125	0.93
BullWaste_3	585,996	6,285,983	2	125	0.93
BullWaste_4	585,697	6,286,856	2	125	0.93
BullWaste_5	586,371	6,287,675	2	125	0.93
BullWaste_6	583,488	6,288,666	2	125	0.93
BullWaste_8	583,580	6,290,068	2	125	0.93
LoadOre_1	585,750	6,284,224	5	125	2.33
LoadOre_2	586,135	6,283,524	5	125	2.33
LoadOre_3	584,768	6,286,634	5	125	2.33
LoadOre_4	584,664	6,287,412	5	125	2.33
LoadOre_5	584,370	6,288,239	5	125	2.33
LoadOre_6	583,803	6,288,884	5	125	2.33
LoadOre_7	583,860	6,289,396	5	125	2.33

Source	Easting	Northing	Effective Ht	Sigma Y	Sigma Z
LoadOre_8	583,218	6,289,827	5	125	2.33
LoadWaste_1	585,713	6,284,282	5	125	2.33
LoadWaste_2	586,098	6,283,581	5	125	2.33
LoadWaste_3	584,753	6,286,666	5	125	2.33
LoadWaste_4	584,649	6,287,443	5	125	2.33
LoadWaste_5	584,355	6,288,270	5	125	2.33
LoadWaste_6	583,788	6,288,915	5	125	2.33
LoadWaste_7	583,845	6,289,427	5	125	2.33
LoadWaste_8	583,203	6,289,859	5	125	2.33
UnL_1	585,268	6,284,164	2	125	0.93
UnL_2	586,666	6,283,697	2	125	0.93
UnL_3	585,927	6,286,044	2	125	0.93
UnL_4	585,628	6,286,917	2	125	0.93
UnL_5	586,302	6,287,736	2	125	0.93
UnL_6	583,419	6,288,728	2	125	0.93
UnL_7	582,853	6,289,849	2	125	0.93
UnL_8	583,511	6,290,129	2	125	0.93
Blast_3	586,087	6,283,540	20	22.5	9.30
Blast_4	584,720	6,286,651	20	22.5	9.30
Blast_5	584,617	6,287,428	20	22.5	9.30
Blast_8	583,812	6,289,412	20	22.5	9.30
Drill_3	584,774	6,286,589	1.5	125	0.70
Drill_4	584,670	6,287,366	1.5	125	0.70
Drill_5	584,375	6,288,193	1.5	125	0.70
Drill_7	583,866	6,289,350	1.5	125	0.70
LoadROM_1	585,816	6,285,648	5	125	2.33
UnloadROM_1	585,839	6,285,611	2	125	0.93
LoadPC1_1	585,714	6,285,508	5	125	2.33
PC1	585,739	6,285,474	6	5	2.79
TS1	585,812	6,285,403	3	2	1.40
COS_Stacker1	585,722	6,285,282	8	57.5	3.72

Appendix D – PM_{10} Emission Rates

This appendix contains the following:

- Appendix Table 8: Wind erosion emissions
- Appendix Table 9: Haul road emissions
- Appendix Table 10: Mining emissions

Appendix Table 8: Wind erosion emissions

ID	Maximum	99%	95%	90%	70%	Mean	Total (kg/yr)
WE1	1.58	0.48	0.20	0.11	-	0.03	1089
WE2	9.21	2.79	1.16	0.64	-	0.20	6357
WE3	8.59	2.60	1.08	0.60	-	0.19	5927
WE4	9.21	2.79	1.16	0.64	-	0.20	6357
WE5	6.66	2.02	0.84	0.47	-	0.15	4599
WE6	6.66	2.02	0.84	0.47	-	0.15	4599
WE7	6.66	2.02	0.84	0.47	-	0.15	4599
WE8	10.17	3.08	1.28	0.71	-	0.22	7018
WE9	2.80	0.85	0.35	0.20	-	0.06	1935
WE10	27.38	8.30	3.44	1.92	-	0.60	18898
WE11	39.42	11.95	4.96	2.76	-	0.86	27214
WE12	83.00	25.15	10.44	5.81	-	1.82	57292
WE13	70.09	21.24	8.81	4.91	-	1.53	48380
WE14	3.32	1.01	0.42	0.23	-	0.07	2292
WE15	3.32	1.01	0.42	0.23	-	0.07	2292
WE16	3.90	1.18	0.49	0.27	-	0.09	2690
WE17	12.66	3.84	1.59	0.89	-	0.28	8739
WE18	11.21	3.40	1.41	0.78	-	0.25	7741
WE19	14.41	4.37	1.81	1.01	-	0.32	9947

Appendix Table 9: Haul road emissions

ID	Maximum	99%	95%	90%	70%	mean	Total (kg/yr)
HR1	-	-	-	-	-	-	-
HR2	-	-	-	-	-	-	-
HR3	-	-	-	-	-	-	-
HR4	-	-	-	-	-	-	-
HR5	-	-	-	-	-	-	-
HR6	-	-	-	-	-	-	-
HR7	-	-	-	-	-	-	-
HR8	-	-	-	-	-	-	-
HR9	-	-	-	-	-	-	-

ID	Maximum	99%	95%	90%	70%	mean	Total (kg/yr)
HR10	-	-	-	-	-	-	-
HR11	-	-	-	-	-	-	-
HR12	-	-	-	-	-	-	-
HR13	-	-	-	-	-	-	-
HR14	-	-	-	-	-	-	-
HR15	-	-	-	-	-	-	-
HR16	0.25	0.25	0.25	0.25	0.24	0.20	-
HR17	0.25	0.25	0.25	0.25	0.24	0.20	-
HR18	0.25	0.25	0.25	0.25	0.24	0.20	-
HR19	0.25	0.25	0.25	0.25	0.24	0.20	-
HR20	1.02	1.02	1.02	1.02	1.01	0.82	-
HR21	-	-	-	-	-	-	-
HR22	-	-	-	-	-	-	-
HR23	0.03	0.03	0.03	0.03	0.03	0.02	-
HR24	0.03	0.03	0.03	0.03	0.03	0.02	-
HR25	0.03	0.03	0.03	0.03	0.03	0.02	-
HR26	0.04	0.04	0.04	0.04	0.04	0.04	-
HR27	0.07	0.07	0.07	0.07	0.07	0.06	-
HR28	0.07	0.07	0.07	0.07	0.07	0.06	-
HR29	0.07	0.07	0.07	0.07	0.07	0.06	-
HR30	0.07	0.07	0.07	0.07	0.07	0.06	-
HR31	0.07	0.07	0.07	0.07	0.07	0.06	-
HR32	0.07	0.07	0.07	0.07	0.07	0.06	-
HR33	0.51	0.51	0.51	0.51	0.51	0.41	-
HR34	0.51	0.51	0.51	0.51	0.51	0.41	-
HR35	0.51	0.51	0.51	0.51	0.51	0.41	-
HR36	0.96	0.96	0.96	0.96	0.96	0.77	-
HR37	0.96	0.96	0.96	0.96	0.96	0.77	-
HR38	0.96	0.96	0.96	0.96	0.96	0.77	-
HR39	0.45	0.45	0.45	0.45	0.45	0.35	-
HR40	0.45	0.45	0.45	0.45	0.45	0.35	-
HR41	0.45	0.45	0.45	0.45	0.45	0.35	-
HR42	0.45	0.45	0.45	0.45	0.45	0.35	-
HR43	0.45	0.45	0.45	0.45	0.45	0.35	-
HR44	0.45	0.45	0.45	0.45	0.45	0.35	-
HR45	0.06	0.06	0.06	0.06	0.06	0.05	-
HR46	0.06	0.06	0.06	0.06	0.06	0.05	-
HR47	0.06	0.06	0.06	0.06	0.06	0.05	-
HR48	0.39	0.39	0.39	0.39	0.39	0.31	-
HR49	0.39	0.39	0.39	0.39	0.39	0.31	-
HR50	0.39	0.39	0.39	0.39	0.39	0.31	-
HR51	0.77	0.77	0.77	0.77	0.77	0.61	-

ID	Maximum	99%	95%	90%	70%	mean	Total (kg/yr)
HR52	1.16	1.16	1.16	1.16	1.16	0.92	-
HR53	-	-	-	-	-	-	-
HR54	-	-	-	-	-	-	-
HR55	0.27	0.27	0.27	0.27	0.27	0.21	-
HR56	0.27	0.27	0.27	0.27	0.27	0.21	-
HR57	0.27	0.27	0.27	0.27	0.27	0.21	-
HR58	0.39	0.39	0.39	0.39	0.39	0.31	-
HR59	0.39	0.39	0.39	0.39	0.39	0.31	-
HR60	0.02	0.02	0.02	0.02	0.02	0.01	-

Appendix Table 10: Mining emissions

ID	Maximum	99%	95%	90%	70%	mean	Total (kg/yr)
BullPit_3	1.59	1.59	-	-	-	0.06	1,790
BullPit_4	1.59	1.59	-	-	-	0.07	2,070
BullPit_5	1.59	1.59	-	-	-	0.06	1,932
BullPit_6	1.59	-	-	-	-	0.01	183
BullPit_7	1.08	1.08	1.08	-	-	0.10	3,069
BullPit_8	1.08	1.08	1.08	-	-	0.10	3,147
BullWaste_3	1.08	1.08	1.08	-	-	0.09	2,860
BullWaste_4	1.08	1.08	1.08	-	-	0.10	3,065
BullWaste_5	1.08	1.08	1.08	-	-	0.10	3,127
BullWaste_6	1.08	1.08	1.08	-	-	0.10	3,127
BullWaste_8	1.13	1.13	1.13	-	-	0.10	3,231
LoadOre_1	1.13	1.13	1.13	-	-	0.11	3,312
LoadOre_2	1.13	1.13	1.13	-	-	0.10	3,011
LoadOre_3	1.13	1.13	1.13	-	-	0.10	3,227
LoadOre_4	1.13	1.13	1.13	-	-	0.10	3,292
LoadOre_5	0.37	0.37	0.37	-	-	0.03	1,101
LoadOre_6	0.35	0.35	0.35	0.35	0.35	0.21	6,565
LoadOre_7	0.35	0.35	0.35	0.35	0.35	0.21	6,548
LoadOre_8	0.35	0.35	0.35	0.35	0.35	0.20	6,438
LoadWaste_1	0.17	0.17	0.17	-	-	0.01	278
LoadWaste_2	-	-	-	-	-	-	-
LoadWaste_3	-	-	-	-	-	-	-
LoadWaste_4	0.48	0.48	0.48	0.48	0.48	0.38	12,040
LoadWaste_5	0.47	0.47	0.47	0.47	0.47	0.38	12,040
LoadWaste_6	0.48	0.48	0.48	0.48	0.48	0.38	12,040
LoadWaste_7	0.23	0.23	0.23	0.23	0.23	0.19	5,883
LoadWaste_8	0.12	0.12	0.12	0.12	0.12	0.10	3,119
UnL_1	0.23	0.23	0.23	0.23	0.23	0.19	5,883

ID	Maximum	99%	95%	90%	70%	mean	Total (kg/yr)
UnL_2	0.87	0.87	0.87	0.87	0.87	0.70	22,013
UnL_3	2.12	2.12	2.12	2.12	2.12	0.85	26,845
UnL_4	-	-	-	-	-	-	-
UnL_5	-	-	-	-	-	-	-
UnL_6	3.12	3.12	3.12	3.12	3.12	2.47	78,035
UnL_7	3.07	3.07	3.07	3.07	3.07	2.47	78,035
UnL_8	3.12	3.12	3.12	3.12	3.12	2.47	78,035
Blast_3	2.16	2.16	2.16	2.16	2.16	1.71	54,047
Blast_4	-	-	-	-	-	-	-
Blast_5	2.14	2.14	2.14	2.14	2.14	1.71	54,047
Blast_8	0.20	0.20	0.20	0.20	0.20	0.16	5,136
Drill_3	0.29	0.29	0.29	0.29	0.29	0.23	7,338
Drill_4	-	-	-	-	-	-	-
Drill_5	-	-	-	-	-	-	-
Drill_7	1.18	1.18	1.18	1.18	1.18	0.93	29,434
LoadROM_1	1.16	1.16	1.16	1.16	1.16	0.93	29,434
UnloadROM_1	1.18	1.18	1.18	1.18	1.18	0.93	29,434
LoadPC1_1	0.81	0.81	0.81	0.81	0.81	0.65	20,386
PC1	-	-	-	-	-	-	-
TS1	0.81	0.81	0.81	0.81	0.81	0.65	20,386
COS_Stacker1	0.32	0.32	0.32	0.32	0.32	0.13	3,944

Appendix E – Dust Generation

Ore mining, handling, processing and transport activities give rise to dust generation through wind action or the physical movement of ore through mechanical processes.

- Wind generated dust occurs when the wind speed exceeds a "threshold" velocity (nominally in the 5 – 10 metres per second (m/s) range)) for erosion of the underlying surface. Under these conditions, particles greater than 100 µm in diameter that protrude above the surface are dislodged by shear forces and bounce and creep across the surface. These particles (through their bouncing or skipping motion) commonly known as saltating particles, can dislodge smaller particles, which then remain suspended in the air. The amount of particulate matter generated is highly dependent upon the wind speed: below the wind speed threshold, no particulate matter is generated, whilst above the threshold, particulate matter generation tends to increase with the cube of the wind speed.

  The amount of particulate matter generated by wind is also dependent on the surface properties; including whether the material is crusted, the amount of non-erodible particles present (particles greater than several millimetres that tend to protect the smaller particles) and the size distribution of the material.

- Mechanical processes that generate and potentially release particulate matter include material movement (such as grinding operations, dropping at conveyor transfer points, stacking, reclaiming and ship loading), blasting and vehicular movement over unsealed or dust laden surfaces. The amount of particulate matter generated from these processes does not have as high a wind speed dependency as that from wind erosion, but is more dependent on the moisture properties of the material being transferred, the particle size distribution of the material, drop heights and the dust management measures and emission controls in place for the sources.

Meteorology

As outlined above one of the critical dust generation mechanisms is wind speeds exceeding a threshold velocity resulting in wind erosion. There are additional meteorological parameters that, while not directly responsible for causing emissions, can assist in propagating dust concentrations from existing sources. The meteorological parameters that are of importance include:

- Ground inversion: This type of inversion occurs when the ground begins to cool in the late evening which in turns cools the layer of air directly above the ground resulting a layer of cool air overlain by a layer of warm air. These conditions occur during calm conditions, as even moderate wind speeds will negate the formation of a ground inversion, however it is important to note that once formed they 'disconnect' the surface from the upper air ensuring that calm conditions, during the night, continue.

  Inversions prevent the vertical dispersion of pollutants resulting in any pollutant released becoming 'trapped'. An example of this is presented in Appendix Figure 11 where a layer of dust can be seen near the surface whilst the air above is clear. Inversions tend to dissipate relatively quickly in the morning once the surface is warmed by the sun.

- Katabatic Drainage: This is simply the flow of cool air downhill – hot air rises and cool air sinks. This occurs primarily at night and at the Mt Marion operations will result in dust laden air from sources at the mining operations (haul roads and waste rock landforms (WRL) and the ROM pad flowing downhill. This may result in higher concentrations of dust, including dust deposition, within the immediate region.

Appendix Figure 11: Dust trapped underneath an inversion layer (ETA, 2024).

Haul Roads

Haul roads, or unpaved roads, can collectively be one of the largest sources of particulate emissions from an open cut mine. It is not the purpose of this report to detail, in full, all the requirements to reduce emissions from unpaved haul roads, rather to provide a general outline of the main generation mechanisms and potential mitigation options.

For emissions from unsealed haul roads there are three main generation mechanisms:

- Vortex entrainment – This occurs when air is compressed under a vehicle and then expands forcing particulates from the road into the atmosphere. This mechanism is only responsible for a minor fraction of the overall particulate emissions from unpaved roads (Succariech 1992).
- Slippage Entrainment – Occurs when the fine material of a road is pulverised and is forced upwards into the atmosphere as particulates by the action of the wheels. This mechanism is responsible for the majority of the overall particulate emissions from unpaved roads (Succariech 1992).
- Saltation and creep – This mechanism, which is explained above as wind generated particulates, occurs when there are sufficient fines on the surface of the road. It will only occur once the wind speed has exceeded a certain 'threshold' velocity.

There are also numerous factors that influence the quantity of particulate emissions from unpaved roads including:

- Surface moisture – Ideally for an unpaved road the fines and moisture act as an adhesive to bind the coarser material together to create a firm, smooth surface (Addo *et al*, 2004). As the road surface loses moisture then the adhesive strength is reduced resulting in the generation of particulate matter.
- Road composition – The material that an unpaved road is constructed from will greatly influence its susceptibility to emit particles. This also includes the particle size distribution of the construction material.
- Vehicle speed – The faster a vehicle travels, the greater the particulate emissions generated.
- Number of wheels – In general the greater the number of wheels the greater the particulate emissions, particularly with respect to wheel slippage entrainment of dust.

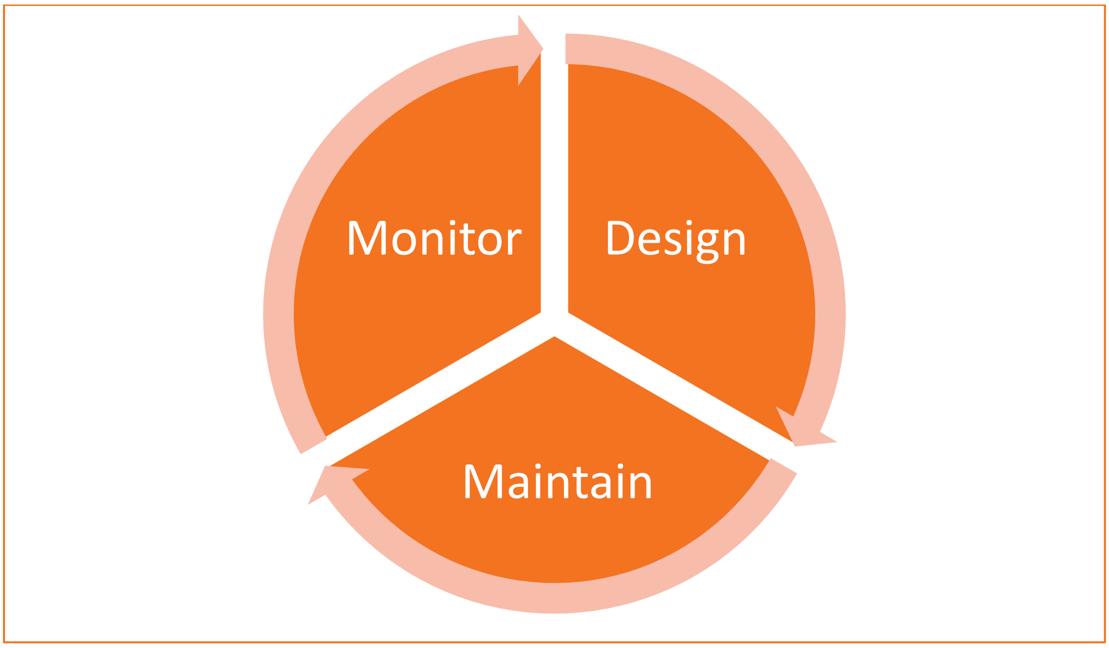
- Volume – As the traffic volume on an unpaved road increase then an increase in the quantity of particulate emissions can be expected.
- Length of unpaved roads – The greater the length of unpaved roads at a facility then the greater the contribution of fugitive particulate matter will be from this source.
- Climate – In Australia a large proportion of the mining facilities are located in semi-arid environments which are characterised by high temperatures with a corresponding high evaporation rate as well as low annual average rainfalls. This results in the surface moisture being easily lost which leads to an increase in fugitive particulate emissions.

A well designed, constructed and properly maintained haul road has significant benefits for a mine including:

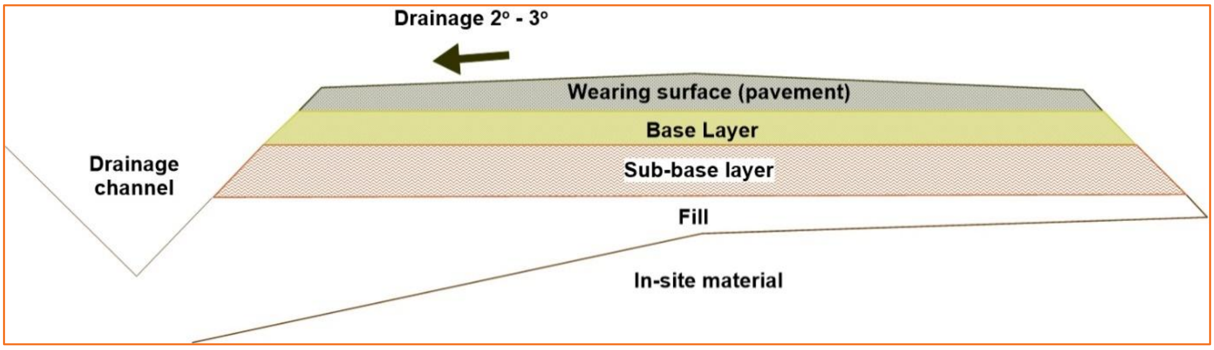
- Lower operating costs through a range of factors including:
    - Reduced rolling resistance (lower fuel usage)
    - Increased tyre life
    - Reduced maintenance
- Reduced safety incidences, particularly 'soft' tissue injuries to operators
- Reduced dust emissions.

As outlined in Appendix Figure 12 there are three basic steps in operating a haul road:

- Design:
    - Geometric: Includes determining line of sight, grade, width, stopping distances, safety berms and drainage.
    - Structural: This is the carrying capacity of the haul road and requires that the vertical structure of the haul road be constructed to support both the forecast weight and volume of haul trucks. An example of a cross section of a road is presented in Appendix Figure 13. It is critical that the base layers are constructed using suitable material to continually support vehicles.
    - Functional: This concerns the top, or wearing, surface of the road and it is critical that suitable material is utilised to reduce; rolling resistance, dust emissions and wearing.
- Maintain:
    - It is critical that haul roads be maintained, particularly the wearing surface, to ensure that the benefits of a correctly designed road continue.
    - No amount of maintenance can correct a poorly designed haul road.
- Monitor:
    - The formation of potholes, corrugations, rutting or loose material are indicative of issues with either the design or maintenance.
    - Investigations should be undertaken to determine the base cause of the issue and remediation be implemented.



Appendix Figure 12: Steps in operating a haul road.



Appendix Figure 13: Generic cross section of a haul road (not to scale).

As noted by (Thompson and Visser 2007) good construction and maintenance practices (including the selection of optimal materials for road wearing courses), together with mechanical stabilisation of the road, reduces the dust-generating potential of unsealed roads. However, this does not entirely eliminate fugitive dust generation on unsealed roads. To further reduce dust emissions from haul roads a commonly used mitigation practice is the use of dust suppression products. These products can be classified into seven broad generic classes namely:

- Water – This includes both fresh and salt water and can only be considered a short-term dust suppression method, especially in locations experiencing high evaporation.
- Chlorides – Including both calcium and magnesium chlorides. Chlorides are especially effective when the humidity is above 30-40% as they are hygroscopic which means they can absorb moisture from the atmosphere and reduce evaporation. Unfortunately, they are corrosive and as they are water soluble the chlorides will be washed out during rainfall events (Addo et al. 2004).

- Petroleum Products (Organic) – Cover a range of products including waste oil, bituminous emulsion and tar. Although these products are highly effective at reducing dust, particularly in drier climates, their potential adverse environmental impacts constrain their usage (i.e. potential impact on natural waterways and water quality).
- Non-Petroleum Products (Organic) – These include lignin derivatives, molasses and vegetable oils. They are normally derived as a by-product of other industries (i.e. lignin derivatives from the paper industry, molasses from sugar cane or sugar beet) and generally work by binding the surface particles. There can be limited availability of these products and as with the chlorides these products are water soluble and will be washed out during rainfall events.
- Electrochemical – Includes sulfonated oils and enzymes. These products work by expelling the adsorbed water from soil which increases compaction due to the decrease in air voids (USEPA 2002). The performance of these products is dependent on the clay mineralogy and, as such, they only work on certain types of road construction material.
- Polymer – Includes both polyvinyl acrylic and vinyl acetate. These products work by binding the soil particles to form a semi rigid film on the road surface (Sierra Research 2006).It is noted in ARRB (2002) that polymers are very effective at reducing dust in sandy soils in dry climates (ARRB 2022) while USEPA (2002) states that results of testing show that polymers increased the tensile strength of clays by up to ten times.
- Clay Additives – These products, which include bentonite, reduce dust emissions by agglomerating the fine particles and increasing the strength of the road. They are most effective in warm, dry conditions. It should be noted that if the road has a high fines content, then there is the potential for the road to become slippery when wet (USDA 1999).

When selecting the product that will be most beneficial to a facility there are a number of factors that must be considered including economics, quality of the road, climate and environmental. It is highly recommended that a series of trials be conducted to determine which product will achieve the most effective emission reduction based on the factors listed above.

Wind Erosion

As outlined previously wind erosion occurs when the wind speed exceeds a threshold velocity, a process known as saltation and creep can occur which results in fine particles becoming airborne. The amount of particulate matter is dependent on a number of factors including:

- Wind speed: Above the wind speed threshold particulate matter generation tends to increase with the cube of the wind speed.
- Surface properties: Is the surface crusted preventing material becoming dislodged?
- Size distribution: For wind erosion to occur, via saltation and creep, it requires the presence of a range of particle sizes – a surface with a uniform particulate size has a reduced erodibility potential.

The impact of high emissions due to wind erosion can be significant and includes increased deposition of particulates within the region. When aiming to reduce particulate emissions associated with wind erosion there are two main focuses:

- Reducing the wind speed: By reducing the wind speed to either below, or just above, the threshold velocity will ensure that emissions are minimised. This can be accomplished by:

  - directly reducing the wind speed via a wind fence (e.g. structure / vegetation with a 50% porosity), noting that a wind fence is effective, at ground level, for approximately 10 times the height of the structure downwind.
  - reducing the fetch length: The fetch length is the distance that the wind has blown without obstruction. Basically the longer the fetch length the higher the wind speed, and the greater the wind erosion potential. Methodologies for reducing the fetch length include:
    - Revegetation
    - Small wind fences (approximately 1 m in height)
    - Adding obstructions throughout the area, such as small rocks around 20 – 30 cm in diameter.
- Reducing the wind erosion potential: Within active open areas it is not practical to install a wind fence or obstructions to reduce the fetch length. In these situations the focus should be on reducing the wind erosion potential of the surface material, which can be achieved by:
  - Wetting open surfaces via a water truck (short term solution).
  - Using a chemical surfactant to crust the surface material. This can be a short term to long term solution depending on the product used. Hydro mulch, which is basically blended paper, is a long term solution while polymers are a short term solution.

To determine when to apply the products, particularly the polymers, requires an understanding of the forecast wind speed. With forewarning, operational personnel can apply the polymer suppressant to the water truck and selectively target open areas to minimise the wind erosion potential.

Appendix F – Model Results

F.1: Dust emissions – TSP

Table 10-1: Statistics of 24-hour TSP concentration – Standalone (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 90
R1	Amenity	183	131	83	52	28	19.2	16
R2	Ecological | Amenity	259	172	104	78	42	30.0	31
R3	Ecological | Amenity	249	104	50	33	9	10.6	6
R4	Ecological	37	20	11	5	1	1.8	0
R5	Ecological	37	26	11	5	1	1.8	0
R6	Ecological	28	21	9	3	1	1.4	0
R7	Ecological	79	53	31	21	7	5.9	0
R8	Ecological	70	47	34	24	9	6.8	0
R9	Ecological	76	36	21	13	5	4.3	0
R10	Ecological | Amenity	56	22	10	5	1	1.8	0
R11	Ecological	56	20	9	4	1	1.6	0
R12	Residential	61	25	12	6	1	2.1	0
R13	Residential	36	28	15	9	3	2.7	0
R14	Residential	21	17	8	4	1	1.3	0
R15	Residential	45	34	18	11	5	3.8	0
R16	Residential	68	47	30	22	15	8.9	0
R18	Residential	56	32	18	9	3	3.1	0
R19	Residential	43	30	19	13	3	3.3	0
R20	Residential	43	27	15	11	2	2.7	0
R21	Residential	25	21	12	9	4	2.8	0
R22	Residential	34	24	13	9	3	2.6	0
R23	Residential	34	21	13	6	3	2.2	0
R24	Residential	90	33	17	10	3	3.4	1
R25	Residential	58	31	17	10	3	3.2	0
R26	Residential	25	18	9	5	2	1.8	0
R27	Residential	32	22	9	7	3	2.2	0
R28	Residential	15	13	8	4	1	1.3	0
R29	Residential	21	14	6	3	0	1.0	0
R31	Heritage	37	19	10	5	1	1.7	0
R32	Heritage	22	15	8	5	1	1.4	0
R33	Heritage	40	18	7	3	1	1.3	0
R34	Heritage	32	24	12	8	3	2.4	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 90
R35	Heritage	26	16	9	5	1	1.5	0
R36	Heritage	69	23	11	7	2	2.3	0
R37	Heritage	15	8	4	2	0	0.7	0
R38	Heritage	10	7	3	1	0	0.5	0
R39	Heritage	288	182	99	73	35	26.2	25
R40	Heritage	56	20	9	4	1	1.6	0
R41	Ecological	318	200	100	71	31	24.5	23
R42	Ecological	148	113	54	39	16	12.4	7
R43	Ecological	141	90	55	33	13	10.8	4
R44	Ecological	181	109	60	45	26	18.5	5
R45	Ecological	136	46	23	15	4	4.8	1
R46	Ecological	162	76	47	33	19	12.9	2
R47	Ecological	111	51	30	22	12	8.2	1
R48	Ecological	508	330	209	138	80	64.9	75
R49	Ecological	105	69	39	26	15	10.0	2
R50	Ecological	99	62	32	18	3	5.4	1
R51	Ecological	91	41	21	12	2	3.8	1
R52	Residential	87	67	39	28	12	8.6	0
R53	Residential	24	21	12	8	2	2.1	0
R54	Residential	18	10	5	3	1	0.9	0
R55	Residential	37	15	5	2	0	0.9	0
R56	Residential	26	11	3	2	0	0.7	0
R57	Residential	30	17	8	5	0	1.3	0
R58	Residential	13	9	3	2	0	0.6	0
R59	Residential	19	10	6	3	1	0.9	0
R60	Residential	25	14	5	4	1	1.1	0
R61	Residential	25	15	6	4	1	1.3	0
R62	Residential	12	10	5	3	0	0.8	0
R63	Residential	19	11	5	3	0	0.9	0
R64	Residential	16	12	5	2	0	0.8	0
R65	Residential	20	18	6	4	1	1.3	0
R66	Residential	13	11	5	2	0	0.8	0

Table 10-2: Statistics of 24-hour TSP concentration – Cumulative (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 90
R1	Amenity	227	176	128	97	73	64.2	50
R2	Ecological | Amenity	304	217	149	123	87	75.0	85

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 90
R3	Ecological | Amenity	294	149	95	78	54	55.5	22
R4	Ecological	82	65	56	50	46	46.8	0
R5	Ecological	82	71	56	50	46	46.8	0
R6	Ecological	73	66	54	48	46	46.4	0
R7	Ecological	124	98	76	66	52	50.9	7
R8	Ecological	115	92	79	69	54	51.8	6
R9	Ecological	121	81	66	58	50	49.3	2
R10	Ecological | Amenity	101	67	55	50	46	46.8	2
R11	Ecological	101	65	54	49	46	46.6	2
R12	Residential	106	70	57	51	46	47.1	2
R13	Residential	81	73	60	54	48	47.7	0
R14	Residential	66	62	53	49	46	46.3	0
R15	Residential	90	79	63	56	50	48.8	1
R16	Residential	113	92	75	67	60	53.9	4
R18	Residential	101	77	63	54	48	48.1	1
R19	Residential	88	75	64	58	48	48.3	0
R20	Residential	88	72	60	56	47	47.7	0
R21	Residential	70	66	57	54	49	47.8	0
R22	Residential	79	69	58	54	48	47.6	0
R23	Residential	79	66	58	51	48	47.2	0
R24	Residential	135	78	62	55	48	48.4	3
R25	Residential	103	76	62	55	48	48.2	3
R26	Residential	70	63	54	50	47	46.8	0
R27	Residential	77	67	54	52	48	47.2	0
R28	Residential	60	58	53	49	46	46.3	0
R29	Residential	66	59	51	48	45	46.0	0
R31	Heritage	82	64	55	50	46	46.7	0
R32	Heritage	67	60	53	50	46	46.4	0
R33	Heritage	85	63	52	48	46	46.3	0
R34	Heritage	77	69	57	53	48	47.4	0
R35	Heritage	71	61	54	50	46	46.5	0
R36	Heritage	114	68	56	52	47	47.3	1
R37	Heritage	60	53	49	47	45	45.7	0
R38	Heritage	55	52	48	46	45	45.5	0
R39	Heritage	333	227	144	118	80	71.2	72
R40	Heritage	101	65	54	49	46	46.6	2
R41	Ecological	362	245	145	116	76	69.5	61

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 90
R42	Ecological	193	158	99	84	61	57.3	29
R43	Ecological	186	134	100	78	58	55.8	23
R44	Ecological	227	154	105	90	71	63.5	38
R45	Ecological	181	91	68	60	49	49.8	4
R46	Ecological	207	121	92	78	64	57.9	19
R47	Ecological	156	96	75	67	57	53.2	9
R48	Ecological	551	374	253	183	125	109.8	191
R49	Ecological	150	114	84	71	60	55.0	14
R50	Ecological	144	107	77	63	48	50.4	9
R51	Ecological	136	86	66	57	47	48.8	3
R52	Residential	132	112	84	73	57	53.6	13
R53	Residential	69	66	57	53	47	47.1	0
R54	Residential	63	55	50	48	46	45.9	0
R55	Residential	82	60	50	47	45	45.9	0
R56	Residential	71	56	48	47	45	45.7	0
R57	Residential	75	62	53	50	45	46.3	0
R58	Residential	58	54	48	47	45	45.6	0
R59	Residential	64	55	51	48	46	45.9	0
R60	Residential	70	59	50	49	46	46.1	0
R61	Residential	70	60	51	49	46	46.3	0
R62	Residential	57	55	50	48	45	45.8	0
R63	Residential	64	56	50	48	45	45.9	0
R64	Residential	61	57	50	47	45	45.8	0
R65	Residential	65	63	51	49	46	46.3	0
R66	Residential	58	56	50	47	45	45.8	0

F.2: Dust emissions – PM_{10}

Table 10-3: Statistics of 24-hour PM_{10} concentration – Standalone (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R1	Amenity	82	54	31	22	8	8.0	7
R2	Ecological | Amenity	112	64	41	33	13	12.0	10
R3	Ecological | Amenity	91	41	20	14	2	4.4	2
R4	Ecological	16	8	5	2	0	0.8	0
R5	Ecological	15	11	4	2	0	0.8	0
R6	Ecological	12	9	4	2	0	0.6	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R7	Ecological	31	22	13	9	1	2.4	0
R8	Ecological	27	20	14	10	2	2.8	0
R9	Ecological	33	15	9	6	2	1.9	0
R10	Ecological | Amenity	23	10	4	2	0	0.8	0
R11	Ecological	23	9	4	2	0	0.7	0
R12	Residential	25	10	5	3	0	0.9	0
R13	Residential	16	12	6	4	1	1.2	0
R14	Residential	8	8	3	2	0	0.6	0
R15	Residential	18	15	8	5	2	1.7	0
R16	Residential	32	22	14	11	6	4.4	0
R18	Residential	27	15	8	4	1	1.4	0
R19	Residential	21	13	9	6	1	1.5	0
R20	Residential	21	13	7	5	1	1.3	0
R21	Residential	11	10	6	4	2	1.3	0
R22	Residential	14	10	5	4	1	1.1	0
R23	Residential	14	9	6	3	1	1.0	0
R24	Residential	38	14	7	5	1	1.5	0
R25	Residential	26	13	8	4	1	1.4	0
R26	Residential	11	8	4	3	1	0.8	0
R27	Residential	14	10	4	3	1	1.0	0
R28	Residential	6	5	3	2	0	0.5	0
R29	Residential	9	6	2	1	0	0.4	0
R31	Heritage	15	8	4	2	0	0.7	0
R32	Heritage	9	6	4	2	0	0.6	0
R33	Heritage	18	8	3	1	0	0.6	0
R34	Heritage	14	11	5	4	1	1.1	0
R35	Heritage	11	7	4	3	0	0.7	0
R36	Heritage	28	10	5	3	0	1.0	0
R37	Heritage	6	4	2	1	0	0.3	0
R38	Heritage	4	3	1	1	0	0.2	0
R39	Heritage	124	62	37	30	11	10.5	10
R40	Heritage	23	9	4	2	0	0.7	0
R41	Ecological	116	77	40	27	10	9.6	13
R42	Ecological	60	46	21	16	4	5.0	2
R43	Ecological	53	36	22	13	4	4.4	1
R44	Ecological	85	46	28	21	10	8.4	4
R45	Ecological	59	19	11	6	1	2.1	1

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R46	Ecological	86	36	22	16	7	6.2	1
R47	Ecological	58	25	15	11	4	3.9	1
R48	Ecological	218	133	89	61	35	30.9	57
R49	Ecological	47	33	17	12	6	4.7	0
R50	Ecological	41	25	13	7	1	2.3	0
R51	Ecological	36	17	9	5	1	1.6	0
R52	Residential	45	33	20	14	4	4.3	0
R53	Residential	11	10	5	4	0	1.0	0
R54	Residential	8	4	3	1	0	0.4	0
R55	Residential	15	7	3	1	0	0.4	0
R56	Residential	11	5	1	1	0	0.3	0
R57	Residential	13	7	4	2	0	0.6	0
R58	Residential	5	4	22	1	0	0.3	0
R59	Residential	9	5	2	1	0	0.4	0
R60	Residential	12	6	3	2	0	0.5	0
R61	Residential	12	7	2	2	0	0.6	0
R62	Residential	5	4	2	1	0	0.4	0
R63	Residential	9	5	2	1	0	0.4	0
R64	Residential	7	5	2	1	0	0.4	0
R65	Residential	8	8	3	2	0	0.6	0
R66	Residential	6	5	2	1	0	0.4	0

Table 10-4: Statistics of 24-hour PM_{10} concentration – Cumulative (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R1	Amenity	104	77	53	44	30	23.3	25
R2	Ecological | Amenity	134	86	63	56	36	27.3	50
R3	Ecological | Amenity	113	64	43	37	25	19.7	14
R4	Ecological	38	31	27	25	23	16.1	0
R5	Ecological	38	33	27	25	23	16.1	0
R6	Ecological	35	31	27	24	23	15.9	0
R7	Ecological	54	44	35	31	24	17.7	1
R8	Ecological	50	42	36	32	25	18.1	0
R9	Ecological	56	37	31	29	24	17.2	2
R10	Ecological | Amenity	46	32	27	25	23	16.1	0
R11	Ecological	45	31	27	24	23	16.0	0
R12	Residential	48	33	28	25	23	16.2	0
R13	Residential	38	35	29	27	23	16.5	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R14	Residential	31	30	26	24	23	15.9	0
R15	Residential	41	37	30	28	24	17.0	0
R16	Residential	55	45	37	33	29	19.7	3
R18	Residential	49	37	31	27	23	16.7	0
R19	Residential	44	36	31	29	23	16.8	0
R20	Residential	43	35	29	27	23	16.6	0
R21	Residential	34	32	28	27	24	16.6	0
R22	Residential	36	32	28	27	23	16.4	0
R23	Residential	37	32	28	25	23	16.3	0
R24	Residential	60	36	30	27	23	16.8	2
R25	Residential	48	36	30	27	23	16.7	0
R26	Residential	33	31	27	25	23	16.1	0
R27	Residential	37	32	27	26	23	16.3	0
R28	Residential	29	28	26	24	23	15.8	0
R29	Residential	31	29	25	24	23	15.7	0
R31	Heritage	38	30	27	25	23	16.0	0
R32	Heritage	31	29	26	25	23	15.9	0
R33	Heritage	41	30	26	24	23	15.9	0
R34	Heritage	36	33	27	26	23	16.4	0
R35	Heritage	33	29	26	25	23	16.0	0
R36	Heritage	51	32	27	26	23	16.3	1
R37	Heritage	29	26	24	24	23	15.6	0
R38	Heritage	27	26	24	23	23	15.5	0
R39	Heritage	146	84	60	52	34	25.8	41
R40	Heritage	45	31	27	24	23	16.0	0
R41	Ecological	138	99	62	49	33	24.9	36
R42	Ecological	83	69	44	38	26	20.3	10
R43	Ecological	76	59	45	35	27	19.7	12
R44	Ecological	107	69	50	44	32	23.7	19
R45	Ecological	81	41	33	29	24	17.4	1
R46	Ecological	108	59	45	38	30	21.5	11
R47	Ecological	81	47	38	34	27	19.2	3
R48	Ecological	241	156	112	83	57	46.2	172
R49	Ecological	69	56	40	34	28	20.0	6
R50	Ecological	63	48	35	30	24	17.6	2
R51	Ecological	59	39	32	28	23	16.9	2
R52	Residential	67	56	42	36	26	19.6	9

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 50
R53	Residential	33	32	28	26	23	16.3	0
R54	Residential	30	27	25	24	23	15.7	0
R55	Residential	38	29	25	24	23	15.7	0
R56	Residential	33	27	24	23	23	15.6	0
R57	Residential	35	30	26	25	23	15.9	0
R58	Residential	28	27	24	23	23	15.6	0
R59	Residential	31	27	25	24	23	15.7	0
R60	Residential	34	29	25	24	23	15.8	0
R61	Residential	34	29	25	25	23	15.9	0
R62	Residential	28	27	25	24	23	15.7	0
R63	Residential	31	27	25	24	23	15.7	0
R64	Residential	30	27	25	24	23	15.7	0
R65	Residential	31	30	26	24	23	15.9	0
R66	Residential	29	27	25	24	23	15.7	0

F.3: Dust emissions – $PM_{2.5}$

Table 10-5: Statistics of 24-hour $PM_{2.5}$ concentration – Standalone (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R1	Amenity	12	8	5	3	2	1.2	0
R2	Ecological | Amenity	17	10	6	5	2	1.8	0
R3	Ecological | Amenity	14	6	3	2	1	0.7	0
R4	Ecological	2	1	1	0	0	0.1	0
R5	Ecological	2	2	1	0	0	0.1	0
R6	Ecological	2	1	1	0	0	0.1	0
R7	Ecological	5	3	2	1	0	0.4	0
R8	Ecological	4	3	2	1	1	0.4	0
R9	Ecological	5	2	1	1	0	0.3	0
R10	Ecological | Amenity	3	1	1	0	0	0.1	0
R11	Ecological	3	1	1	0	0	0.1	0
R12	Residential	4	2	1	0	0	0.1	0
R13	Residential	2	2	1	1	0	0.2	0
R14	Residential	1	1	1	0	0	0.1	0
R15	Residential	3	2	1	1	0	0.3	0
R16	Residential	5	3	2	2	1	0.7	0
R18	Residential	4	2	1	1	0	0.2	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R19	Residential	3	2	1	1	0	0.2	0
R20	Residential	3	2	1	1	0	0.2	0
R21	Residential	2	1	1	1	0	0.2	0
R22	Residential	2	1	1	1	0	0.2	0
R23	Residential	2	1	1	0	0	0.1	0
R24	Residential	6	2	1	1	0	0.2	0
R25	Residential	4	2	1	1	0	0.2	0
R26	Residential	2	1	1	0	0	0.1	0
R27	Residential	2	1	1	0	0	0.1	0
R28	Residential	1	1	1	0	0	0.1	0
R29	Residential	1	1	0	0	0	0.1	0
R31	Heritage	2	1	1	0	0	0.1	0
R32	Heritage	1	1	1	0	0	0.1	0
R33	Heritage	3	1	0	0	0	0.1	0
R34	Heritage	2	2	1	1	0	0.2	0
R35	Heritage	2	1	1	0	0	0.1	0
R36	Heritage	4	1	1	0	0	0.2	0
R37	Heritage	1	1	0	0	0	0.0	0
R38	Heritage	1	0	0	0	0	0.0	0
R39	Heritage	19	9	6	4	2	1.6	0
R40	Heritage	3	1	1	0	0	0.1	0
R41	Ecological	17	12	6	4	2	1.4	0
R42	Ecological	9	7	3	2	1	0.8	0
R43	Ecological	8	5	3	2	1	0.7	0
R44	Ecological	13	7	4	3	2	1.3	0
R45	Ecological	9	3	2	1	0	0.3	0
R46	Ecological	13	5	3	2	1	0.9	0
R47	Ecological	9	4	2	2	1	0.6	0
R48	Ecological	33	20	13	9	6	4.6	4
R49	Ecological	7	5	3	2	1	0.7	0
R50	Ecological	6	4	2	1	0	0.3	0
R51	Ecological	5	3	1	1	0	0.2	0
R52	Residential	7	5	3	2	1	0.6	0
R53	Residential	2	1	1	1	0	0.1	0
R54	Residential	1	1	0	0	0	0.1	0
R55	Residential	2	1	0	0	0	0.1	0
R56	Residential	2	1	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R57	Residential	2	1	1	0	0	0.1	0
R58	Residential	1	1	0	0	0	0.0	0
R59	Residential	1	1	0	0	0	0.1	0
R60	Residential	2	1	0	0	0	0.1	0
R61	Residential	2	1	0	0	0	0.1	0
R62	Residential	1	1	0	0	0	0.1	0
R63	Residential	1	1	0	0	0	0.1	0
R64	Residential	1	1	0	0	0	0.1	0
R65	Residential	1	1	0	0	0	0.1	0
R66	Residential	1	1	0	0	0	0.1	0

Table 10-6: Statistics of 24-hour $PM_{2.5}$ concentration – Cumulative (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R1	Amenity	17	13	9	8	6	5.2	0
R2	Ecological | Amenity	21	14	11	10	7	5.8	1
R3	Ecological | Amenity	18	11	8	7	5	4.7	0
R4	Ecological	7	6	5	5	5	4.1	0
R5	Ecological	7	6	5	5	5	4.1	0
R6	Ecological	7	6	5	5	5	4.1	0
R7	Ecological	9	8	7	6	5	4.4	0
R8	Ecological	9	8	7	6	5	4.4	0
R9	Ecological	10	7	6	6	5	4.3	0
R10	Ecological | Amenity	8	6	5	5	5	4.1	0
R11	Ecological	8	6	5	5	5	4.1	0
R12	Residential	9	6	5	5	5	4.1	0
R13	Residential	7	7	6	5	5	4.2	0
R14	Residential	6	6	5	5	5	4.1	0
R15	Residential	7	7	6	6	5	4.3	0
R16	Residential	10	8	7	6	6	4.7	0
R18	Residential	9	7	6	5	5	4.2	0
R19	Residential	8	7	6	6	5	4.2	0
R20	Residential	8	7	6	5	5	4.2	0
R21	Residential	6	6	6	5	5	4.2	0
R22	Residential	7	6	6	5	5	4.2	0
R23	Residential	7	6	6	5	5	4.1	0
R24	Residential	10	7	6	5	5	4.2	0
R25	Residential	9	7	6	5	5	4.2	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R26	Residential	6	6	5	5	5	4.1	0
R27	Residential	7	6	5	5	5	4.1	0
R28	Residential	6	6	5	5	5	4.1	0
R29	Residential	6	6	5	5	5	4.1	0
R31	Heritage	7	6	5	5	5	4.1	0
R32	Heritage	6	6	5	5	5	4.1	0
R33	Heritage	7	6	5	5	5	4.1	0
R34	Heritage	7	6	5	5	5	4.2	0
R35	Heritage	6	6	5	5	5	4.1	0
R36	Heritage	9	6	5	5	5	4.2	0
R37	Heritage	6	5	5	5	5	4.0	0
R38	Heritage	5	5	5	5	5	4.0	0
R39	Heritage	23	14	10	9	6	5.6	1
R40	Heritage	8	6	5	5	5	4.1	0
R41	Ecological	22	16	11	9	6	5.4	2
R42	Ecological	14	12	8	7	5	4.8	0
R43	Ecological	13	10	8	7	5	4.7	0
R44	Ecological	17	12	9	8	6	5.3	0
R45	Ecological	14	8	6	6	5	4.3	0
R46	Ecological	18	10	8	7	6	4.9	0
R47	Ecological	13	8	7	6	5	4.6	0
R48	Ecological	37	25	18	14	10	8.6	11
R49	Ecological	12	10	7	6	6	4.7	0
R50	Ecological	11	8	7	6	5	4.3	0
R51	Ecological	10	7	6	5	5	4.2	0
R52	Residential	11	10	8	7	5	4.6	0
R53	Residential	6	6	6	5	5	4.1	0
R54	Residential	6	5	5	5	5	4.1	0
R55	Residential	7	6	5	5	5	4.1	0
R56	Residential	6	5	5	5	5	4.0	0
R57	Residential	7	6	5	5	5	4.1	0
R58	Residential	6	5	5	5	5	4.0	0
R59	Residential	6	5	5	5	5	4.1	0
R60	Residential	6	6	5	5	5	4.1	0
R61	Residential	6	6	5	5	5	4.1	0
R62	Residential	5	5	5	5	5	4.1	0
R63	Residential	6	5	5	5	5	4.1	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R64	Residential	6	5	5	5	5	4.1	0
R65	Residential	6	6	5	5	5	4.1	0
R66	Residential	6	5	5	5	5	4.1	0

F.4: Dust emissions – Deposition

Appendix Table 11: Maximum deposition rates at sensitive receptors – Project Only (g/m²/month)

ID	Receptor type	Maximum Deposition	ID	Receptor type	Maximum Deposition
R1	Amenity	1.7	R35	Heritage	0.1
R2	Ecological | Amenity	3.2	R36	Heritage	0.1
R3	Ecological | Amenity	1.6	R37	Heritage	0.1
R4	Ecological	0.2	R38	Heritage	0.0
R5	Ecological	0.2	R39	Heritage	3.4
R6	Ecological	0.2	R40	Heritage	0.2
R7	Ecological	0.6	R41	Ecological	1.2
R8	Ecological	0.6	R42	Ecological	1.0
R9	Ecological	0.2	R43	Ecological	0.6
R10	Ecological | Amenity	0.2	R44	Ecological	0.9
R11	Ecological	0.2	R45	Ecological	0.6
R12	Building	0.3	R46	Ecological	0.6
R13	Building	0.2	R47	Ecological	0.4
R14	Building	0.1	R48	Ecological	6.8
R15	Building	0.2	R49	Ecological	0.7
R16	Building	1.0	R50	Ecological	0.5
R18	Building	0.1	R51	Ecological	0.4
R19	Building	0.2	R52	Building	0.7
R20	Building	0.1	R53	Building	0.5
R21	Building	0.3	R54	Building	0.4
R22	Building	0.2	R55	Building	0.7
R23	Building	0.1	R56	Building	0.1
R24	Building	0.1	R57	Building	0.0
R25	Building	0.1	R58	Building	0.1
R26	Building	0.1	R59	Building	0.1
R27	Building	0.1	R60	Building	0.1
R28	Building	0.1	R61	Building	0.1
R29	Building	0.1	R62	Building	0.0
R31	Heritage	0.2	R63	Building	0.0
R32	Heritage	0.1	R64	Building	0.1
R33	Heritage	0.1	R65	Building	0.1
R34	Heritage	0.1	R66	Building	0.1

F.5: Gas emissions – NO_2

Table 10-7: Statistics of 1-hour NO_2 concentration – Normal peak operations (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 164
R1	Amenity	48	22	7	2	0	1.1	0
R2	Ecological | Amenity	51	12	2	1	0	2.1	0
R3	Ecological | Amenity	64	50	21	0	0	3.0	0
R4	Ecological	48	5	1	0	0	0.2	0
R5	Ecological	19	5	1	0	0	0.2	0
R6	Ecological	29	4	0	0	0	0.1	0
R7	Ecological	44	19	5	1	0	0.8	0
R8	Ecological	47	15	3	0	0	0.5	0
R9	Ecological	17	2	0	0	0	0.1	0
R10	Ecological | Amenity	17	6	1	0	0	0.2	0
R11	Ecological	19	4	0	0	0	0.2	0
R12	Residential	27	7	1	0	0	0.2	0
R13	Residential	31	7	1	0	0	0.2	0
R14	Residential	15	4	0	0	0	0.1	0
R15	Residential	16	6	1	0	0	0.2	0
R16	Residential	19	6	1	0	0	0.3	0
R18	Residential	12	2	0	0	0	0.1	0
R19	Residential	13	4	1	0	0	0.1	0
R20	Residential	12	3	1	0	0	0.1	0
R21	Residential	12	3	1	0	0	0.1	0
R22	Residential	15	5	1	0	0	0.2	0
R23	Residential	14	4	0	0	0	0.1	0
R24	Residential	27	4	0	0	0	0.1	0
R25	Residential	15	3	0	0	0	0.1	0
R26	Residential	11	4	1	0	0	0.1	0
R27	Residential	10	4	1	0	0	0.1	0
R28	Residential	17	3	1	0	0	0.1	0
R29	Residential	17	3	0	0	0	0.1	0
R31	Heritage	29	4	1	0	0	0.2	0
R32	Heritage	24	5	1	0	0	0.2	0
R33	Heritage	15	4	0	0	0	0.1	0
R34	Heritage	16	5	1	0	0	0.2	0
R35	Heritage	14	4	0	0	0	0.1	0
R36	Heritage	19	3	0	0	0	0.1	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 164
R37	Heritage	10	2	0	0	0	0.1	0
R38	Heritage	14	2	0	0	0	0.1	0
R39	Heritage	49	28	10	4	0	1.5	0
R40	Heritage	18	5	0	0	0	0.2	0
R41	Ecological	41	10	1	0	0	0.4	0
R42	Ecological	51	30	6	0	0	1.2	0
R43	Ecological	43	9	1	0	0	0.3	0
R44	Ecological	48	6	1	0	0	0.2	0
R45	Ecological	51	18	1	0	0	0.5	0
R46	Ecological	55	6	1	0	0	0.2	0
R47	Ecological	51	4	0	0	0	0.2	0
R48	Ecological	32	16	4	1	0	0.6	0
R49	Ecological	23	9	2	1	0	0.4	0
R50	Ecological	51	20	4	0	0	0.8	0
R51	Ecological	33	15	2	0	0	0.5	0
R52	Residential	15	6	1	0	0	0.2	0
R53	Residential	12	3	0	0	0	0.1	0
R54	Residential	15	3	0	0	0	0.1	0
R55	Residential	24	3	0	0	0	0.1	0
R56	Residential	15	3	0	0	0	0.1	0
R57	Residential	27	4	0	0	0	0.2	0
R58	Residential	15	2	0	0	0	0.1	0
R59	Residential	9	1	0	0	0	0.0	0
R60	Residential	10	1	0	0	0	0.1	0
R61	Residential	8	1	0	0	0	0.1	0
R62	Residential	16	4	0	0	0	0.1	0
R63	Residential	11	3	0	0	0	0.1	0
R64	Residential	19	2	0	0	0	0.1	0
R65	Residential	9	3	0	0	0	0.1	0
R66	Residential	22	2	0	0	0	0.1	0

Table 10-8: Statistics of 1-hour NO_2 concentration – Upset conditions (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 164
R1	Amenity	63	51	18	6	0	2.7	0
R2	Ecological | Amenity	66	42	4	2	0	5.5	0
R3	Ecological | Amenity	89	62	49	1	0	8.3	0
R4	Ecological	53	13	2	0	0	0.5	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 164
R5	Ecological	45	13	2	0	0	0.4	0
R6	Ecological	50	11	1	0	0	0.4	0
R7	Ecological	54	48	13	2	0	2.1	0
R8	Ecological	54	41	7	0	0	1.5	0
R9	Ecological	44	6	1	0	0	0.3	0
R10	Ecological | Amenity	43	14	1	0	0	0.5	0
R11	Ecological	48	11	1	0	0	0.4	0
R12	Residential	56	16	2	0	0	0.6	0
R13	Residential	50	18	2	0	0	0.6	0
R14	Residential	40	10	0	0	0	0.3	0
R15	Residential	38	16	3	0	0	0.6	0
R16	Residential	42	15	4	1	0	0.7	0
R18	Residential	25	5	0	0	0	0.2	0
R19	Residential	33	10	1	0	0	0.3	0
R20	Residential	29	8	1	0	0	0.3	0
R21	Residential	27	8	2	0	0	0.4	0
R22	Residential	38	14	2	0	0	0.4	0
R23	Residential	28	10	1	0	0	0.3	0
R24	Residential	40	10	1	0	0	0.3	0
R25	Residential	41	7	1	0	0	0.2	0
R26	Residential	27	11	1	0	0	0.4	0
R27	Residential	26	9	2	0	0	0.4	0
R28	Residential	40	9	1	0	0	0.3	0
R29	Residential	45	6	1	0	0	0.2	0
R31	Heritage	51	11	2	0	0	0.4	0
R32	Heritage	48	12	2	0	0	0.4	0
R33	Heritage	35	9	1	0	0	0.3	0
R34	Heritage	37	13	2	0	0	0.4	0
R35	Heritage	37	11	1	0	0	0.3	0
R36	Heritage	42	8	1	0	0	0.3	0
R37	Heritage	24	6	0	0	0	0.2	0
R38	Heritage	31	5	0	0	0	0.2	0
R39	Heritage	57	50	26	10	0	3.8	0
R40	Heritage	46	11	1	0	0	0.4	0
R41	Ecological	55	24	3	0	0	0.9	0
R42	Ecological	64	52	18	1	0	3.2	0
R43	Ecological	52	25	3	0	0	0.9	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 164
R44	Ecological	55	18	2	0	0	0.6	0
R45	Ecological	59	46	3	0	0	1.3	0
R46	Ecological	62	17	2	0	0	0.5	0
R47	Ecological	61	11	1	0	0	0.4	0
R48	Ecological	53	40	9	3	0	1.7	0
R49	Ecological	49	23	6	2	0	1.0	0
R50	Ecological	62	49	11	0	0	2.0	0
R51	Ecological	54	39	6	0	0	1.3	0
R52	Residential	38	13	2	0	0	0.5	0
R53	Residential	8	1	0	0	0.3	0	8
R54	Residential	6	1	0	0	0.2	0	6
R55	Residential	8	1	0	0	0.3	0	8
R56	Residential	7	0	0	0	0.2	0	7
R57	Residential	11	1	0	0	0.4	0	11
R58	Residential	5	0	0	0	0.2	0	5
R59	Residential	3	0	0	0	0.1	0	3
R60	Residential	4	0	0	0	0.1	0	4
R61	Residential	4	0	0	0	0.1	0	4
R62	Residential	9	1	0	0	0.3	0	9
R63	Residential	7	0	0	0	0.2	0	7
R64	Residential	5	0	0	0	0.2	0	5
R65	Residential	8	1	0	0	0.3	0	8
R66	Residential	5	0	0	0	0.2	0	5

F.6: Gas emissions – SO_2

Table 10-9: Statistics of 1-hour SO_2 concentration – Normal peak operations (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R1	Amenity	1	1	0	0	0	0.0	0
R2	Ecological | Amenity	2	1	0	0	0	0.0	0
R3	Ecological | Amenity	5	2	0	0	0	0.1	0
R4	Ecological	1	0	0	0	0	0.0	0
R5	Ecological	0	0	0	0	0	0.0	0
R6	Ecological	1	0	0	0	0	0.0	0
R7	Ecological	1	0	0	0	0	0.0	0
R8	Ecological	1	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R9	Ecological	0	0	0	0	0	0.0	0
R10	Ecological | Amenity	0	0	0	0	0	0.0	0
R11	Ecological	0	0	0	0	0	0.0	0
R12	Residential	1	0	0	0	0	0.0	0
R13	Residential	1	0	0	0	0	0.0	0
R14	Residential	0	0	0	0	0	0.0	0
R15	Residential	0	0	0	0	0	0.0	0
R16	Residential	0	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	0	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0
R22	Residential	0	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	1	0	0	0	0	0.0	0
R25	Residential	0	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	0	0	0	0	0	0.0	0
R29	Residential	0	0	0	0	0	0.0	0
R31	Heritage	1	0	0	0	0	0.0	0
R32	Heritage	1	0	0	0	0	0.0	0
R33	Heritage	0	0	0	0	0	0.0	0
R34	Heritage	0	0	0	0	0	0.0	0
R35	Heritage	0	0	0	0	0	0.0	0
R36	Heritage	0	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	0	0	0	0	0	0.0	0
R39	Heritage	1	1	0	0	0	0.0	0
R40	Heritage	0	0	0	0	0	0.0	0
R41	Ecological	1	0	0	0	0	0.0	0
R42	Ecological	2	1	0	0	0	0.0	0
R43	Ecological	1	0	0	0	0	0.0	0
R44	Ecological	1	0	0	0	0	0.0	0
R45	Ecological	2	0	0	0	0	0.0	0
R46	Ecological	1	0	0	0	0	0.0	0
R47	Ecological	2	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R48	Ecological	1	0	0	0	0	0.0	0
R49	Ecological	1	0	0	0	0	0.0	0
R50	Ecological	2	0	0	0	0	0.0	0
R51	Ecological	1	0	0	0	0	0.0	0
R52	Residential	0	0	0	0	0	0.0	0
R53	Residential	0	0	0	0	0	0.0	0
R54	Residential	0	0	0	0	0	0.0	0
R55	Residential	1	0	0	0	0	0.0	0
R56	Residential	0	0	0	0	0	0.0	0
R57	Residential	1	0	0	0	0	0.0	0
R58	Residential	0	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	0	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	0	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	1	0	0	0	0	0.0	0

Table 10-10: Statistics of 1-hour SO_2 concentration – Upset conditions (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R1	Amenity	2	1	0	0	0	0.0	0
R2	Ecological | Amenity	3	2	1	0	0	0.1	0
R3	Ecological | Amenity	7	3	1	0	0	0.1	0
R4	Ecological	2	0	0	0	0	0.0	0
R5	Ecological	1	0	0	0	0	0.0	0
R6	Ecological	1	0	0	0	0	0.0	0
R7	Ecological	2	1	0	0	0	0.0	0
R8	Ecological	2	1	0	0	0	0.0	0
R9	Ecological	1	0	0	0	0	0.0	0
R10	Ecological | Amenity	1	0	0	0	0	0.0	0
R11	Ecological	1	0	0	0	0	0.0	0
R12	Residential	1	0	0	0	0	0.0	0
R13	Residential	1	0	0	0	0	0.0	0
R14	Residential	1	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R15	Residential	1	0	0	0	0	0.0	0
R16	Residential	1	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	1	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0
R22	Residential	1	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	1	0	0	0	0	0.0	0
R25	Residential	1	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	1	0	0	0	0	0.0	0
R29	Residential	1	0	0	0	0	0.0	0
R31	Heritage	1	0	0	0	0	0.0	0
R32	Heritage	1	0	0	0	0	0.0	0
R33	Heritage	1	0	0	0	0	0.0	0
R34	Heritage	1	0	0	0	0	0.0	0
R35	Heritage	1	0	0	0	0	0.0	0
R36	Heritage	1	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	1	0	0	0	0	0.0	0
R39	Heritage	2	1	0	0	0	0.1	0
R40	Heritage	1	0	0	0	0	0.0	0
R41	Ecological	2	0	0	0	0	0.0	0
R42	Ecological	3	1	0	0	0	0.0	0
R43	Ecological	1	0	0	0	0	0.0	0
R44	Ecological	2	0	0	0	0	0.0	0
R45	Ecological	3	1	0	0	0	0.0	0
R46	Ecological	2	0	0	0	0	0.0	0
R47	Ecological	3	0	0	0	0	0.0	0
R48	Ecological	1	1	0	0	0	0.0	0
R49	Ecological	1	0	0	0	0	0.0	0
R50	Ecological	3	1	0	0	0	0.0	0
R51	Ecological	1	1	0	0	0	0.0	0
R52	Residential	1	0	0	0	0	0.0	0
R53	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 214
R54	Residential	1	0	0	0	0	0.0	0
R55	Residential	1	0	0	0	0	0.0	0
R56	Residential	1	0	0	0	0	0.0	0
R57	Residential	1	0	0	0	0	0.0	0
R58	Residential	1	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	1	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	1	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	1	0	0	0	0	0.0	0

Table 10-11: Statistics of 24-hour SO_2 concentration – Normal peak operations (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 57
R1	Amenity	0	0	0	0	0	0.0	0
R2	Ecological | Amenity	0	0	0	0	0	0.0	0
R3	Ecological | Amenity	1	1	0	0	0	0.1	0
R4	Ecological	0	0	0	0	0	0.0	0
R5	Ecological	0	0	0	0	0	0.0	0
R6	Ecological	0	0	0	0	0	0.0	0
R7	Ecological	0	0	0	0	0	0.0	0
R8	Ecological	0	0	0	0	0	0.0	0
R9	Ecological	0	0	0	0	0	0.0	0
R10	Ecological | Amenity	0	0	0	0	0	0.0	0
R11	Ecological	0	0	0	0	0	0.0	0
R12	Residential	0	0	0	0	0	0.0	0
R13	Residential	0	0	0	0	0	0.0	0
R14	Residential	0	0	0	0	0	0.0	0
R15	Residential	0	0	0	0	0	0.0	0
R16	Residential	0	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	0	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 57
R22	Residential	0	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	0	0	0	0	0	0.0	0
R25	Residential	0	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	0	0	0	0	0	0.0	0
R29	Residential	0	0	0	0	0	0.0	0
R31	Heritage	0	0	0	0	0	0.0	0
R32	Heritage	0	0	0	0	0	0.0	0
R33	Heritage	0	0	0	0	0	0.0	0
R34	Heritage	0	0	0	0	0	0.0	0
R35	Heritage	0	0	0	0	0	0.0	0
R36	Heritage	0	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	0	0	0	0	0	0.0	0
R39	Heritage	0	0	0	0	0	0.0	0
R40	Heritage	0	0	0	0	0	0.0	0
R41	Ecological	0	0	0	0	0	0.0	0
R42	Ecological	0	0	0	0	0	0.0	0
R43	Ecological	0	0	0	0	0	0.0	0
R44	Ecological	0	0	0	0	0	0.0	0
R45	Ecological	0	0	0	0	0	0.0	0
R46	Ecological	0	0	0	0	0	0.0	0
R47	Ecological	0	0	0	0	0	0.0	0
R48	Ecological	0	0	0	0	0	0.0	0
R49	Ecological	0	0	0	0	0	0.0	0
R50	Ecological	0	0	0	0	0	0.0	0
R51	Ecological	0	0	0	0	0	0.0	0
R52	Residential	0	0	0	0	0	0.0	0
R53	Residential	0	0	0	0	0	0.0	0
R54	Residential	0	0	0	0	0	0.0	0
R55	Residential	0	0	0	0	0	0.0	0
R56	Residential	0	0	0	0	0	0.0	0
R57	Residential	0	0	0	0	0	0.0	0
R58	Residential	0	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 57
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	0	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	0	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	0	0	0	0	0	0.0	0

Table 10-12: Statistics of 24-hour SO_2 concentration – Upset conditions (μg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 57
R1	Amenity	0	0	0	0	0	0.0	0
R2	Ecological | Amenity	1	1	0	0	0	0.1	0
R3	Ecological | Amenity	2	1	1	0	0	0.1	0
R4	Ecological	0	0	0	0	0	0.0	0
R5	Ecological	0	0	0	0	0	0.0	0
R6	Ecological	0	0	0	0	0	0.0	0
R7	Ecological	1	0	0	0	0	0.0	0
R8	Ecological	0	0	0	0	0	0.0	0
R9	Ecological	0	0	0	0	0	0.0	0
R10	Ecological | Amenity	0	0	0	0	0	0.0	0
R11	Ecological	0	0	0	0	0	0.0	0
R12	Residential	0	0	0	0	0	0.0	0
R13	Residential	0	0	0	0	0	0.0	0
R14	Residential	0	0	0	0	0	0.0	0
R15	Residential	0	0	0	0	0	0.0	0
R16	Residential	0	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	0	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0
R22	Residential	0	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	0	0	0	0	0	0.0	0
R25	Residential	0	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 57
R29	Residential	0	0	0	0	0	0.0	0
R31	Heritage	0	0	0	0	0	0.0	0
R32	Heritage	0	0	0	0	0	0.0	0
R33	Heritage	0	0	0	0	0	0.0	0
R34	Heritage	0	0	0	0	0	0.0	0
R35	Heritage	0	0	0	0	0	0.0	0
R36	Heritage	0	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	0	0	0	0	0	0.0	0
R39	Heritage	1	0	0	0	0	0.1	0
R40	Heritage	0	0	0	0	0	0.0	0
R41	Ecological	0	0	0	0	0	0.0	0
R42	Ecological	1	0	0	0	0	0.0	0
R43	Ecological	0	0	0	0	0	0.0	0
R44	Ecological	0	0	0	0	0	0.0	0
R45	Ecological	0	0	0	0	0	0.0	0
R46	Ecological	0	0	0	0	0	0.0	0
R47	Ecological	0	0	0	0	0	0.0	0
R48	Ecological	0	0	0	0	0	0.0	0
R49	Ecological	0	0	0	0	0	0.0	0
R50	Ecological	1	0	0	0	0	0.0	0
R51	Ecological	0	0	0	0	0	0.0	0
R52	Residential	0	0	0	0	0	0.0	0
R53	Residential	0	0	0	0	0	0.0	0
R54	Residential	0	0	0	0	0	0.0	0
R55	Residential	0	0	0	0	0	0.0	0
R56	Residential	0	0	0	0	0	0.0	0
R57	Residential	0	0	0	0	0	0.0	0
R58	Residential	0	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	0	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	0	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	0	0	0	0	0	0.0	0

F.7: Gas emissions – CO

Table 10-13: Statistics of 8-hour CO concentration – Normal peak operations (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 11,250
R1	Amenity	51	27	14	9	0	2.2	0
R2	Ecological | Amenity	64	45	31	18	1	4	0
R3	Ecological | Amenity	149	111	41	20	0	6	0
R4	Ecological	19	8	2	1	0	0	0
R5	Ecological	14	7	2	1	0	0	0
R6	Ecological	12	5	2	1	0	0	0
R7	Ecological	49	29	10	5	0	2	0
R8	Ecological	37	20	7	3	0	1	0
R9	Ecological	9	4	1	0	0	0	0
R10	Ecological | Amenity	15	7	3	1	0	0	0
R11	Ecological	10	6	2	1	0	0	0
R12	Residential	14	9	4	1	0	0	0
R13	Residential	25	8	4	1	0	0	0
R14	Residential	12	4	2	0	0	0	0
R15	Residential	14	8	3	2	0	0	0
R16	Residential	12	8	4	2	0	1	0
R18	Residential	7	3	1	0	0	0	0
R19	Residential	12	6	1	1	0	0	0
R20	Residential	12	4	2	1	0	0	0
R21	Residential	6	4	2	1	0	0	0
R22	Residential	15	6	2	1	0	0	0
R23	Residential	12	6	2	0	0	0	0
R24	Residential	12	5	2	0	0	0	0
R25	Residential	9	5	1	0	0	0	0
R26	Residential	12	5	2	1	0	0	0
R27	Residential	6	4	2	1	0	0	0
R28	Residential	7	4	2	1	0	0	0
R29	Residential	11	4	1	0	0	0	0
R31	Heritage	13	6	2	1	0	0	0
R32	Heritage	12	6	2	1	0	0	0
R33	Heritage	11	6	2	0	0	0	0
R34	Heritage	12	6	2	1	0	0	0
R35	Heritage	13	5	2	1	0	0	0
R36	Heritage	15	5	1	0	0	0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 11,250
R37	Heritage	8	3	1	0	0	0	0
R38	Heritage	7	4	1	0	0	0	0
R39	Heritage	52	31	21	12	1	3	0
R40	Heritage	11	6	2	1	0	0	0
R41	Ecological	29	12	6	2	0	1	0
R42	Ecological	66	38	18	7	0	2	0
R43	Ecological	41	12	5	2	0	1	0
R44	Ecological	28	9	3	1	0	0	0
R45	Ecological	45	21	8	3	0	1	0
R46	Ecological	23	8	3	1	0	0	0
R47	Ecological	28	6	2	1	0	0	0
R48	Ecological	50	21	8	4	0	1	0
R49	Ecological	23	12	6	3	0	1	0
R50	Ecological	51	28	9	5	0	2	0
R51	Ecological	37	18	7	3	0	1	0
R52	Residential	17	6	2	1	0	0	0
R53	Residential	9	4	1	0	0	0.2	0
R54	Residential	10	3	1	0	0	0.2	0
R55	Residential	20	6	1	0	0	0.2	0
R56	Residential	8	5	1	0	0	0.2	0
R57	Residential	24	7	2	1	0	0.3	0
R58	Residential	11	3	1	0	0	0.2	0
R59	Residential	4	2	0	0	0	0.1	0
R60	Residential	6	2	1	0	0	0.1	0
R61	Residential	5	2	1	0	0	0.1	0
R62	Residential	11	5	2	1	0	0.3	0
R63	Residential	14	3	1	0	0	0.2	0
R64	Residential	11	3	1	0	0	0.2	0
R65	Residential	7	3	2	1	0	0.2	0
R66	Residential	12	3	1	0	0	0.2	0

Table 10-14: Statistics of 8-hour CO concentration – Upset conditions (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 11,250
R1	Amenity	60	32	16	11	0	2.6	0
R2	Ecological | Amenity	76	53	36	20	0	5.2	0
R3	Ecological | Amenity	173	130	49	23	0	7.5	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 11,250
R4	Ecological	22	9	3	1	0	0.5	0
R5	Ecological	15	8	3	1	0	0.4	0
R6	Ecological	14	7	2	1	0	0.3	0
R7	Ecological	58	33	12	6	0	1.9	0
R8	Ecological	44	22	9	4	0	1.3	0
R9	Ecological	11	5	1	0	0	0.2	0
R10	Ecological | Amenity	18	8	3	1	0	0.5	0
R11	Ecological	13	7	3	1	0	0.4	0
R12	Residential	16	11	4	1	0	0.6	0
R13	Residential	29	9	4	1	0	0.6	0
R14	Residential	14	5	2	1	0	0.3	0
R15	Residential	16	10	4	2	0	0.6	0
R16	Residential	14	10	4	2	0	0.7	0
R18	Residential	8	4	1	0	0	0.2	0
R19	Residential	13	6	2	1	0	0.3	0
R20	Residential	14	5	2	1	0	0.3	0
R21	Residential	7	5	2	1	0	0.4	0
R22	Residential	17	7	3	1	0	0.4	0
R23	Residential	13	6	2	1	0	0.3	0
R24	Residential	15	6	2	1	0	0.3	0
R25	Residential	11	6	1	0	0	0.2	0
R26	Residential	13	6	2	1	0	0.3	0
R27	Residential	7	5	2	1	0	0.3	0
R28	Residential	8	5	2	1	0	0.3	0
R29	Residential	12	4	1	0	0	0.2	0
R31	Heritage	15	7	3	1	0	0.4	0
R32	Heritage	14	7	3	1	0	0.4	0
R33	Heritage	14	6	2	0	0	0.3	0
R34	Heritage	15	7	3	1	0	0.4	0
R35	Heritage	15	6	2	1	0	0.3	0
R36	Heritage	18	6	2	0	0	0.3	0
R37	Heritage	10	4	1	0	0	0.2	0
R38	Heritage	8	4	1	0	0	0.2	0
R39	Heritage	61	37	24	15	0	3.6	0
R40	Heritage	13	7	3	1	0	0.4	0
R41	Ecological	37	14	7	2	0	0.9	0
R42	Ecological	81	47	22	9	0	2.9	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 11,250
R43	Ecological	49	14	6	2	0	0.8	0
R44	Ecological	33	10	4	1	0	0.6	0
R45	Ecological	50	24	10	3	0	1.3	0
R46	Ecological	26	10	3	1	0	0.5	0
R47	Ecological	32	7	2	1	0	0.4	0
R48	Ecological	61	23	9	5	0	1.6	0
R49	Ecological	27	14	7	3	0	1.0	0
R50	Ecological	57	32	11	6	0	1.9	0
R51	Ecological	44	20	8	4	0	1.3	0
R52	Residential	20	8	3	1	0	0.5	0
R53	Residential	10	5	1	1	0	0.3	0
R54	Residential	11	4	1	0	0	0.2	0
R55	Residential	23	6	1	0	0	0.3	0
R56	Residential	10	5	1	0	0	0.2	0
R57	Residential	27	9	2	1	0	0.4	0
R58	Residential	13	4	1	0	0	0.2	0
R59	Residential	5	2	1	0	0	0.1	0
R60	Residential	7	2	1	0	0	0.1	0
R61	Residential	6	3	1	0	0	0.1	0
R62	Residential	13	6	2	1	0	0.3	0
R63	Residential	17	4	1	0	0	0.2	0
R64	Residential	13	4	1	0	0	0.2	0
R65	Residential	8	4	2	1	0	0.2	0
R66	Residential	13	3	1	0	0	0.2	0

F.8: Gas emissions – $PM_{2.5}$ from generators

Table 10-15: Statistics of 24-hour $PM_{2.5}$ concentration from gensets – Normal peak operations (µg/m^3).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R1	Amenity	0	0	0	0	0	0.0	0
R2	Ecological | Amenity	0	0	0	0	0	0.0	0
R3	Ecological | Amenity	1	1	0	0	0	0.1	0
R4	Ecological	0	0	0	0	0	0.0	0
R5	Ecological	0	0	0	0	0	0.0	0
R6	Ecological	0	0	0	0	0	0.0	0
R7	Ecological	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R8	Ecological	0	0	0	0	0	0.0	0
R9	Ecological	0	0	0	0	0	0.0	0
R10	Ecological | Amenity	0	0	0	0	0	0.0	0
R11	Ecological	0	0	0	0	0	0.0	0
R12	Residential	0	0	0	0	0	0.0	0
R13	Residential	0	0	0	0	0	0.0	0
R14	Residential	0	0	0	0	0	0.0	0
R15	Residential	0	0	0	0	0	0.0	0
R16	Residential	0	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	0	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0
R22	Residential	0	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	0	0	0	0	0	0.0	0
R25	Residential	0	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	0	0	0	0	0	0.0	0
R29	Residential	0	0	0	0	0	0.0	0
R31	Heritage	0	0	0	0	0	0.0	0
R32	Heritage	0	0	0	0	0	0.0	0
R33	Heritage	0	0	0	0	0	0.0	0
R34	Heritage	0	0	0	0	0	0.0	0
R35	Heritage	0	0	0	0	0	0.0	0
R36	Heritage	0	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	0	0	0	0	0	0.0	0
R39	Heritage	0	0	0	0	0	0.0	0
R40	Heritage	0	0	0	0	0	0.0	0
R41	Ecological	0	0	0	0	0	0.0	0
R42	Ecological	0	0	0	0	0	0.0	0
R43	Ecological	0	0	0	0	0	0.0	0
R44	Ecological	0	0	0	0	0	0.0	0
R45	Ecological	0	0	0	0	0	0.0	0
R46	Ecological	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R47	Ecological	0	0	0	0	0	0.0	0
R48	Ecological	0	0	0	0	0	0.0	0
R49	Ecological	0	0	0	0	0	0.0	0
R50	Ecological	0	0	0	0	0	0.0	0
R51	Ecological	0	0	0	0	0	0.0	0
R52	Residential	0	0	0	0	0	0.0	0
R53	Residential	0	0	0	0	0	0.0	0
R54	Residential	0	0	0	0	0	0.0	0
R55	Residential	0	0	0	0	0	0.0	0
R56	Residential	0	0	0	0	0	0.0	0
R57	Residential	0	0	0	0	0	0.0	0
R58	Residential	0	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	0	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	0	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	0	0	0	0	0	0.0	0

Table 10-16: Statistics of 24-hour $PM_{2.5}$ concentration from gensets – Upset conditions (µg/m³).

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R1	Amenity	0	0	0	0	0	0.0	0
R2	Ecological | Amenity	1	1	0	0	0	0.1	1
R3	Ecological | Amenity	1	1	1	0	0	0.1	1
R4	Ecological	0	0	0	0	0	0.0	0
R5	Ecological	0	0	0	0	0	0.0	0
R6	Ecological	0	0	0	0	0	0.0	0
R7	Ecological	0	0	0	0	0	0.0	0
R8	Ecological	0	0	0	0	0	0.0	0
R9	Ecological	0	0	0	0	0	0.0	0
R10	Ecological | Amenity	0	0	0	0	0	0.0	0
R11	Ecological	0	0	0	0	0	0.0	0
R12	Residential	0	0	0	0	0	0.0	0
R13	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R14	Residential	0	0	0	0	0	0.0	0
R15	Residential	0	0	0	0	0	0.0	0
R16	Residential	0	0	0	0	0	0.0	0
R18	Residential	0	0	0	0	0	0.0	0
R19	Residential	0	0	0	0	0	0.0	0
R20	Residential	0	0	0	0	0	0.0	0
R21	Residential	0	0	0	0	0	0.0	0
R22	Residential	0	0	0	0	0	0.0	0
R23	Residential	0	0	0	0	0	0.0	0
R24	Residential	0	0	0	0	0	0.0	0
R25	Residential	0	0	0	0	0	0.0	0
R26	Residential	0	0	0	0	0	0.0	0
R27	Residential	0	0	0	0	0	0.0	0
R28	Residential	0	0	0	0	0	0.0	0
R29	Residential	0	0	0	0	0	0.0	0
R31	Heritage	0	0	0	0	0	0.0	0
R32	Heritage	0	0	0	0	0	0.0	0
R33	Heritage	0	0	0	0	0	0.0	0
R34	Heritage	0	0	0	0	0	0.0	0
R35	Heritage	0	0	0	0	0	0.0	0
R36	Heritage	0	0	0	0	0	0.0	0
R37	Heritage	0	0	0	0	0	0.0	0
R38	Heritage	0	0	0	0	0	0.0	0
R39	Heritage	0	0	0	0	0	0.0	0
R40	Heritage	0	0	0	0	0	0.0	0
R41	Ecological	0	0	0	0	0	0.0	0
R42	Ecological	1	0	0	0	0	0.0	1
R43	Ecological	0	0	0	0	0	0.0	0
R44	Ecological	0	0	0	0	0	0.0	0
R45	Ecological	0	0	0	0	0	0.0	0
R46	Ecological	0	0	0	0	0	0.0	0
R47	Ecological	0	0	0	0	0	0.0	0
R48	Ecological	0	0	0	0	0	0.0	0
R49	Ecological	0	0	0	0	0	0.0	0
R50	Ecological	0	0	0	0	0	0.0	0
R51	Ecological	0	0	0	0	0	0.0	0
R52	Residential	0	0	0	0	0	0.0	0

ID	Receptor type	Maximum	99th percentile	95th percentile	90th percentile	75th percentile	Average	Days > 20
R53	Residential	0	0	0	0	0	0.0	0
R54	Residential	0	0	0	0	0	0.0	0
R55	Residential	0	0	0	0	0	0.0	0
R56	Residential	0	0	0	0	0	0.0	0
R57	Residential	0	0	0	0	0	0.0	0
R58	Residential	0	0	0	0	0	0.0	0
R59	Residential	0	0	0	0	0	0.0	0
R60	Residential	0	0	0	0	0	0.0	0
R61	Residential	0	0	0	0	0	0.0	0
R62	Residential	0	0	0	0	0	0.0	0
R63	Residential	0	0	0	0	0	0.0	0
R64	Residential	0	0	0	0	0	0.0	0
R65	Residential	0	0	0	0	0	0.0	0
R66	Residential	0	0	0	0	0	0.0	0

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